# Fish & Wildlife Benefits of Farm Bill Conservation Programs

## 2000-2005 Update




Technical Review
05-2, 2005

# Fish and Wildlife Benefits of Farm Bill Conservation Programs: 2000-2005 Update

Edited by
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## Technical Review 05-2
**October 2005**

The Wildlife Society
Bethesda, Maryland



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Funding provided by the USDA Natural Resources Conservation Service and Farm Service Agency through a partnership with The Wildlife Society in support of the Conservation Effects Assessment Project.

Suggested citation:
Haufler, J. B., editor. 2005. Fish and wildlife benefits of Farm Bill conservation programs: 2000-2005 update. The Wildlife Society Technical Review 05-2.

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# Executive Summary

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Heard et al. (2000) summarized information concerning wildlife benefits derived from Farm Bill conservation programs documented in the literature from 1985 to 2000. This publication updates that report with new information and broadens the scope of the report to include fish as well as wildlife.

There is clear evidence of the multitude of benefits produced by the conservation programs of Farm Bill legislation enacted and implemented since 1985. The best researched and documented has been the Conservation Reserve Program (CRP). This program has converted millions of acres of cropland to grass cover across the prairies, and to grass or forest cover in the Southeast.

Farrand and Ryan (*this volume*) summarized the benefits accrued from CRP in the Midwest. Bird populations have been shown to utilize CRP, with some studies reporting increases in reproductive rates and population gains attributable to CRP. Information on other species including mammals, reptiles, and amphibians is not as extensive, but increased occurrences associated with CRP have been reported. Farrand and Ryan (*this volume*) discussed how wildlife responses to CRP are multiscale and that wildlife responses can vary depending on a number of factors. Similarly, Johnson (*this volume*) reported on bird responses to CRP in the northern Great Plains. He found numerous examples of benefits to birds associated with CRP when compared to croplands. He noted the complexity of bird responses and stated that response can vary not only by species but by region, year, vegetation composition, and treatments of CRP fields. Reynolds (*this volume*) reported on the benefits of CRP to waterfowl, and reported that CRP in the Prairie Pothole Region was estimated to produce 2.2 million ducks per year.

Burger (*this volume*) discussed the benefits of CRP to fish and wildlife in the southeastern U.S. He stated that "wildlife populations at a given point in time will be a function of the conservation practice, age of the stand, establishment methods, and mid-contract management regimes". CRP conditions and corresponding wildlife use change rapidly in the Southeast because of the good growing conditions. Numerous wildlife species have been documented to utilize CRP or similar habitat conditions in the Southeast (Burger, *this volume*).

Clark and Reeder (*this volume*) discussed wildlife benefits associated with Continuous CRP. The conservation practices in this program are typically linear strips. Clark and Reeder (*this volume*) reported on various studies that documented the use of habitat created by this program by a variety of wildlife species. They did note, however, that because of their linear nature, "[c]areful planning and management are keys to gaining the desired wildlife benefits from these plantings...". They also noted that information on the reproductive success of wildlife associated with these areas is very limited.

Allen (*this volume*) reported on the benefits to fish and wildlife associated with the Conservation Reserve Enhancement Program, which addresses conservation needs at a larger landscape scale. Most contracts under this program, currently implemented in 25 states, have occurred in the past 4 years. While monitoring of benefits has begun, the limited amount of time since implementation of most projects has restricted the quantification and reporting of benefits. Benefits to fish through enhanced water quality and to wildlife through the establishment of habitat are expected.

That CRP is a tremendous benefit to wildlife populations is well substantiated. However, cautions were raised by all of the authors that CRP is not a panacea. Responses to CRP by wildlife vary, as pointed out above. Landscape relationships are poorly understood. CRP may occur in small patches, or as reported by Clark and Reeder (*this volume*), in linear strips. Such areas may be impacted by edge effects, and many species may have low reproductive rates, creating the potential for ecological sinks. Responses by many wildlife species remain unknown, and most studies that have been conducted have been short term and confined to small areas (Johnson, *this volume*). A concern is that CRP should not be viewed as a replacement to native prairies. Also, CRP should not encourage any conversion of native prairies. While CRP has benefits to many species of wildlife, these benefits have been shown to differ significantly in use and reproductive success by many species when compared to native prairies.

A survey conducted of CRP participants (Allen, *this volume*) indicated strong support for this program, with a majority (75%) of respondents indicating that they felt the benefits to wildlife were important. Most respondents also thought that CRP provided a number of other conservation benefits.

The Wetlands Reserve Program (WRP) has enrolled 1.6 million acres of wetland and associated upland habitats (Rewa, *this volume*). Numerous beneficial responses by wildlife to wetland maintenance and restoration have been documented. However, little research has been conducted directly on WRP areas. Additional research is needed to document direct benefits of WRP to fish and wildlife and to determine influences of factors such as landscape differences on these benefits.

The Grasslands Reserve Program (Wood and Williams, *this volume*) is a new program created by the 2002 Farm Bill. Since 2003, 524,000 acres have been enrolled in this program through easements and long-term rental agreements. While direct benefits to fish and wildlife from this program are expected, they have not been documented to date.

The Environmental Quality Incentives Program (EQIP) (Berkland and Rewa, *this volume*) has substantial allocations, increasing to a proposed authorization of $1.3 billion by 2007. This program covers a wide variety of practices. Most practices are not specifically directed at fish and wildlife, but are expected to produce secondary benefits to fish and wildlife species. Some practices under EQIP are directed at fish and wildlife. Recently, EQIP has been used to directly focus practices on the needs of listed species or species of concern. Benefits to fish and wildlife from these practices have not been documented to date.

The Wildlife Habitat Incentives Program (Gray et al., *this volume*) is a program directly focused on fish and wildlife. This has been a popular program with agricultural producers and has been applied on 2.8 million acres under 18,000 different contracts. While benefits to fish and wildlife are expected, little data exist on the actual benefits of the program. Additional research is recommended.

The Conservation Security Program (CSP) (Henry, *this volume*) is a new program that rewards agricultural producers who demonstrate a commitment to application of conservation practices. It has 3 tiers, with increasing benefits associated each level. Tiers 1 and 2 focus on soil and water quality, and producers must meet identified standards to gain the added incentives of CSP. To be eligible for Tier 3 benefits, producers must include wildlife habitat practices. The program is too new to have documented benefits, but it appears to offer great potential.

Brady (*this volume*) discussed the benefits of the highly erodible lands and Swampbuster provisions of the Farm Bill. While these programs do not directly provide for wildlife habitat, they do provide substantial indirect benefits. For example, the program has identified a reduction in soil erosion of 1.3 billion tons/year from cropland as well as a reduction in wetland conversion that is highlighted by a net gain in wetland acres in agricultural lands between 1997 and 2002.

This report documents that Farm Bill conservation programs are widely utilized by agricultural producers and are producing numerous and substantial conservation benefits. Benefits to fish and wildlife accrue directly from practices targeted towards these species as well as through indirect benefits such as reductions in sediments in streams, establishment of habitat through practices not specifically targeting wildlife, and similar effects. Many benefits to wildlife have been documented, especially those associated with CRP. Many other benefits are suspected, but have not been documented. In addition, benefits to fish and wildlife are complex and influenced by many factors, so additional information is needed in order to understand this complexity. Finally, some programs utilize practices that may produce mixed responses from wildlife. Understanding all of these relationships and developing recommendations for maximizing conservation benefits will require additional monitoring and investigations.

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# Highly Erodible Land and Swampbuster Provisions of the 2002 Farm Act

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## Abstract

*The Farm Security and Rural Investment Act of 2002 continued provisions for the conservation of highly erodible land and wetlands that had been enacted by the omnibus farm acts of 1985, 1990, and 1996. The effects these provisions have on wildlife conservation are reviewed in light of recent data and reports published about those programs. Strong evidence supporting the conservation benefits of these programs includes the significant reduction in cropland soil-erosion rates of 1.3 billion tons per year and the significant reduction in wetland losses due to agriculture in recent periods. The latter is highlighted by net wetland gains on agricultural lands during the period 1997–2002. While these 2 provisions generally do not create wildlife habitat directly, they play a very substantial role in supporting the conservation gains made by other U.S. Department of Agriculture (USDA) conservation provisions. Additionally they provide strong motivation for producers to apply conservation systems on their highly erodible lands, to protect wetlands from conversion to cropland, and to apply for enrollment in the other USDA conservation programs, especially the Conservation Reserve and Wetlands Reserve programs.*

## Introduction

The Highly Erodible Land (HEL) and "Swampbuster" (or Wetlands Conservation) provisions of federal farm acts were both initiated with the Food Security Act of 1985 (FSA, 16 U.S.C. 3801 et seq.). Subsequent farm acts (in 1990 and 1996) retained those provisions essentially intact. The HEL provisions are also referred to as "Conservation Compliance" and "Sodbuster". The effects of these provisions on wildlife conservation were summarized for the period 1985–2000 (Brady 2000) as part of a comprehensive review of Farm Bill contributions to wildlife conservation (Heard et al. 2000). This paper updates this information to include the Farm Security and Rural Investment Act of 2002.

Wetland and cropland interspersed in South Dakota (D. Poggensee, USDA-NRCS).

The Food Security Act of 1985 introduced a new era of agricultural conservation provisions that required an environmental standard to be achieved on certain classes of land for producers to maintain eligibility for many farm program benefits. The greatest direct environmental effects of the HEL and Swampbuster provisions were the following:

- reduction of soil erosion and associated sediments from highly erodible cropland,
- reduction in the conversion of other HEL to cropland, and
- the reduction in the conversion of wetlands to cropland.

These provisions generally did not create wildlife habitat directly but collectively supported the conservation gains made by other USDA programs, especially the Conservation Reserve and the Wetlands Reserve programs. There were substantial habitat gains made by other programs that would not have been achieved without the interaction of these compliance provisions with those other USDA programs (Brady 2000). The report by Zinn (2004) provided an excellent description of this legislation.

The definition of HEL is based on soil, climate, and topographic properties that when combined into a standardized "erodibility index" results in a value ≥8 (Brady 2000). This index does not include the effect of management practices, but represents an index of potential erosion based upon natural conditions. The HEL provisions consist of 2 parts, Conservation Compliance and "Sodbuster." Conservation Compliance applies to land that has been in use as cropland and that meets the definition of highly erodible. Sodbuster applies to HEL that is newly converted to cropland from permanent native vegetative cover such as rangeland or forest. Under both parts of this provision, producers who annually till HEL for the production of commodity crops are required to follow an approved conservation plan that would allow no substantial increase in soil erosion (<*T*, the tolerable or maximum level that maintains productivity). Failure to do so would result in the loss of eligibility for certain farm program benefits. When site-specific management practices (e.g., conservation tillage, terraces, contour farming, crop rotations, etc.) are applied, it is often possible to produce commodity crops on HEL and maintain soil erosion rates specified for the major HEL soil type in the field. The authors of this legislation recognized that there were numerous farmers who had participated in and abided by the rules of the programs but would not be able to farm their land and receive a reasonable return under the HEL provision. Therefore, they offered the Conservation Reserve Program (CRP) as a means to adapt their operations to the new program environment.

The 2002 Farm Act continued the Conservation Compliance and Sodbuster provisions; however, the law added the requirement that the Secretary of Agriculture cannot delegate authority to make a compliance determination to a private party or entity.

The Swampbuster provision applies to wetlands that may be converted to produce commodity crops. Such a conversion would also result in the loss of certain farm program benefits. However, there is a provision for conditions when minimal effects can be documented by USDA. The 2002 Farm Act also added the requirement that the Secretary of Agriculture cannot delegate authority to make a wetland compliance determination to a private person or entity.

## Program Effects

*Highly Erodible Lands*

Declines in acreages of both cropland and grazing lands have been observed during the last 20 years (Table 1). Concomitant to the implementation of the Conservation Provisions of the recent Farm Acts have been shifts in the kind and management of land used for crop production. These changes are the net result of increased awareness on the part of agricultural producers, successful delivery of technical assistance, and the conservation provisions of the recent Farm Acts. Because of the confounding effect of these independent forces, it is not possible to single out specific cause-and-effect relationships, but it is evident that the "carrot and stick" approach to farm program benefits of the recent Farm Acts got the immediate attention of the agricultural community, particularly those producing commodity crops on HEL.

Table 1. Total surface area of the 48 contiguous states by land cover/use and year. Margins of error defining the 95% confidence intervals are in parentheses. The total surface area of the contiguous United States is 1,937.7 million acres (NRCS 2004).

| | Major land cover/use (millions of acres) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Crop | Conservation Reserve Program | Pasture | Range | Forest | Other | Developed | Water | Federal |
| 1982 | 419.6 (± 1.2) | 0.0 (± 0.0) | 131.0 (± 0.7) | 415.5 (± 1.9) | 403.0 (± 1.5) | 48.0 (± 0.7) | 72.8 (± 0.4) | 48.6 (± 0.1) | 399.1 (± 0.0) |
| 1992 | 381.2 (± 1.1) | 34.0 (± 0.1) | 125.1 (± 0.7) | 406.6 (± 1.7) | 404.0 (± 1.4) | 49.3 (± 0.7) | 86.5 (± 0.5) | 49.4 (± 0.1) | 401.5 (± 0.0) |
| 2002 | 368.4 (± 1.2) | 31.6 (± 0.2) | 117.3 (± 0.9) | 405.3 (± 1.8) | 404.9 (± 1.5) | 50.6 (± 0.8) | 107.3 (± 0.7) | 50.4 (± 0.1) | 401.9 (± 0.0) |

Evidence of the positive effect of linking land stewardship with farm program benefits can be observed from reviewing results from the National Resources Inventory (NRI; NRCS 2003, 2004) and as reported by Flather et al. (1999). Soil erosion on all cropland declined from 3.1 billion tons per year in 1982 to 1.8 billion tons per year in 2001 (Figure 1), a net reduction of 1.3 billion tons/year or 42%. Sheet and rill erosion (i.e., rainfall induced) dropped by almost 41% during this period, while wind erosion dropped by 43%. Erosion rates per acre also declined. Sheet and rill erosion rates dropped from 4.0 to 2.7 tons per acre per year, and wind erosion rates dropped from 3.3 to 2.1 tons per acre per year (Table 2). Likewise cropland acreage eroding at excessive rates (>T, the tolerable or presumably the sustainable limit) dropped 39% from 170 million acres in 1982 to 103.8 million acres in 2001 (NRCS 2003).

Table 2. Soil erosion on cropland in the United States by year (NRCS 2003). Margins of error defining the 95% confidence interval are in parentheses.

| | Sheet and rill erosion | | Wind erosion | |
|---|---|---|---|---|
| Year | Millions of tons/year | Tons/acre/year | Millions of tons/year | Tons/acre/year |
| 1982 | 1,680.1 (± 13.8) | 4.0 (± 0.1) | 1,389.2 (± 22.0) | 3.3 (± 0.1) |
| 1987 | 1,486.4 (± 12.8) | 3.7 (± 0.1) | 1,307.9 (± 22.0) | 3.2 (± 0.1) |
| 1992 | 1,182.0 (± 10.9) | 3.1 (± 0.1) | 919.6 (± 20.4) | 2.4 (± 0.1) |
| 1997 | 1,048.5 (± 9.3) | 2.8 (± 0.1) | 812.6 (± 18.2) | 2.2 (± 0.1) |
| 2001 | 997.2 (± 13.7) | 2.7 (± 0.1) | 789.8 (± 28.5) | 2.1 (± 0.2) |

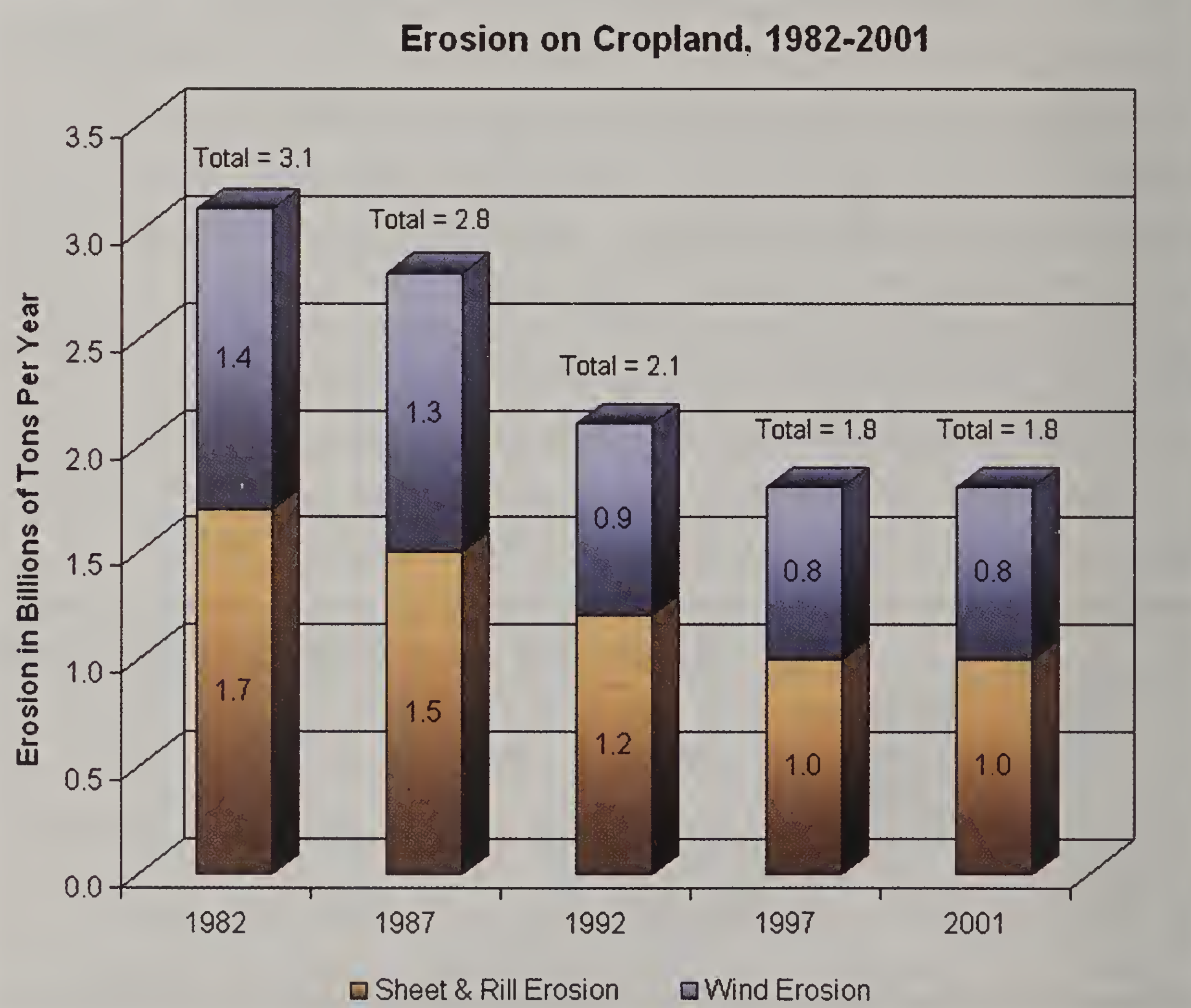



Figure 1. Sheet and rill– and wind-erosion rates on cropland from 1982 to 2001 (NRCS 2003).

Highly erodible cropland represents about 27% of the total cropland and is interspersed throughout that part of the country where cropland is a dominant land use (Figures 2–3). Erosion rates also declined substantially on HEL cropland. Only one-third of the HEL cropland exhibited erosion rates <*T* in 1982, but by 2001 nearly 46% of it met that goal (Table 3). Highly erodible cropland acreage declined from 123.9 million acres in 1982 to 101.1 million acres in 2001, most of which was eroding at excessive rates. Management of the non–highly erodible majority of cropland improved also as the proportion of cropland exhibiting tolerable erosion rates grew from 71% to 82% of the acreage from 1982 to 2001 (Table 3). These improvements stem from improved technology applied on the land (e.g., conservation tillage systems), technical assistance, and the conservation provisions of USDA Farm Acts since 1985, including the removal of 34 million acres of eroding cropland that was enrolled in the CRP. The CRP removed eroding cropland from cultivation and protected it with perennial vegetation for 10–15-year contracts, beginning in 1986. Conservation tillage in various forms has been applied extensively on both

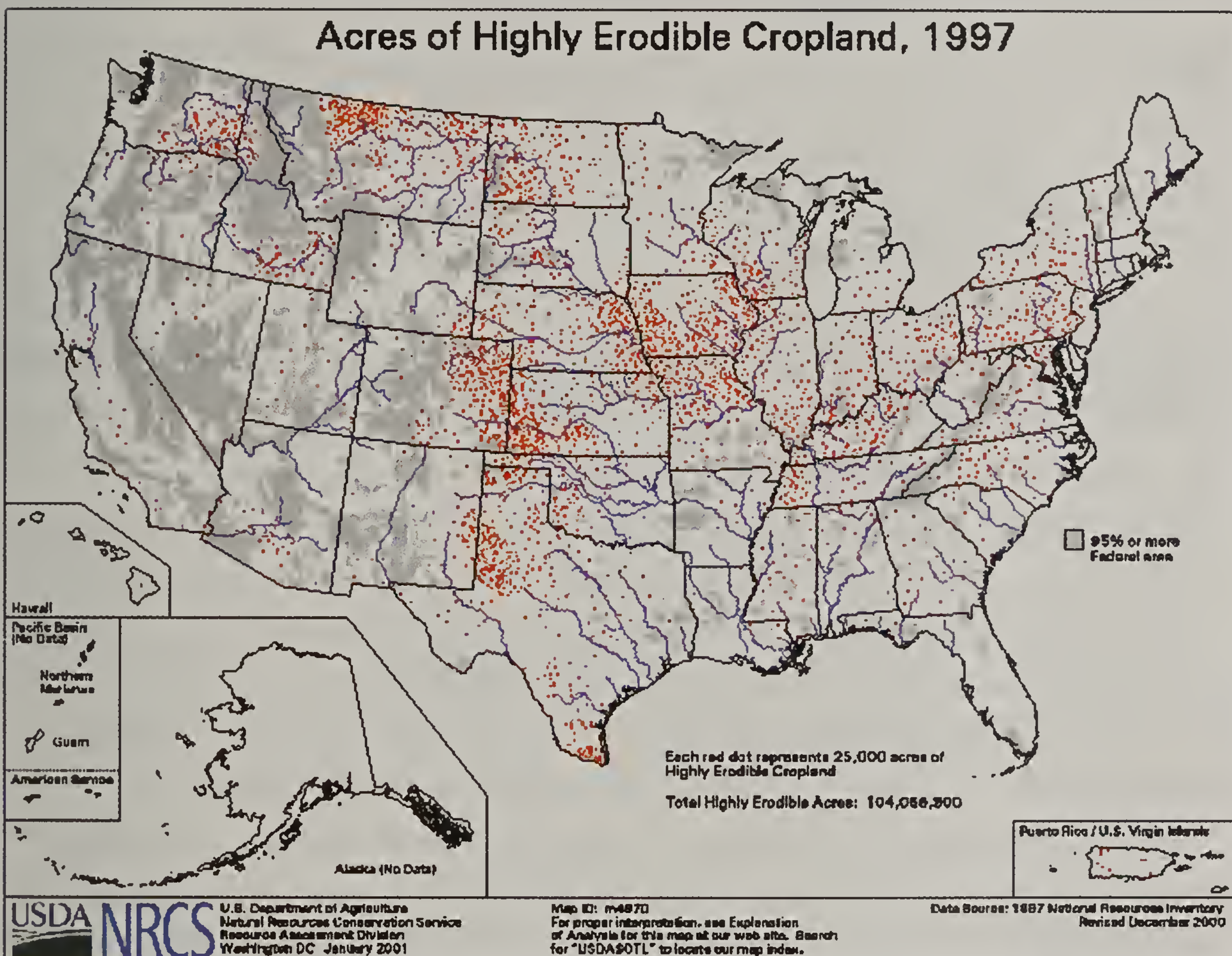



Figure 2. Distribution of highly erodible cropland in 1997 (NRCS 2000). Dots are aggregated by and placed randomly within 8-digit hydrologic units. Each red dot represents 25,000 acres.

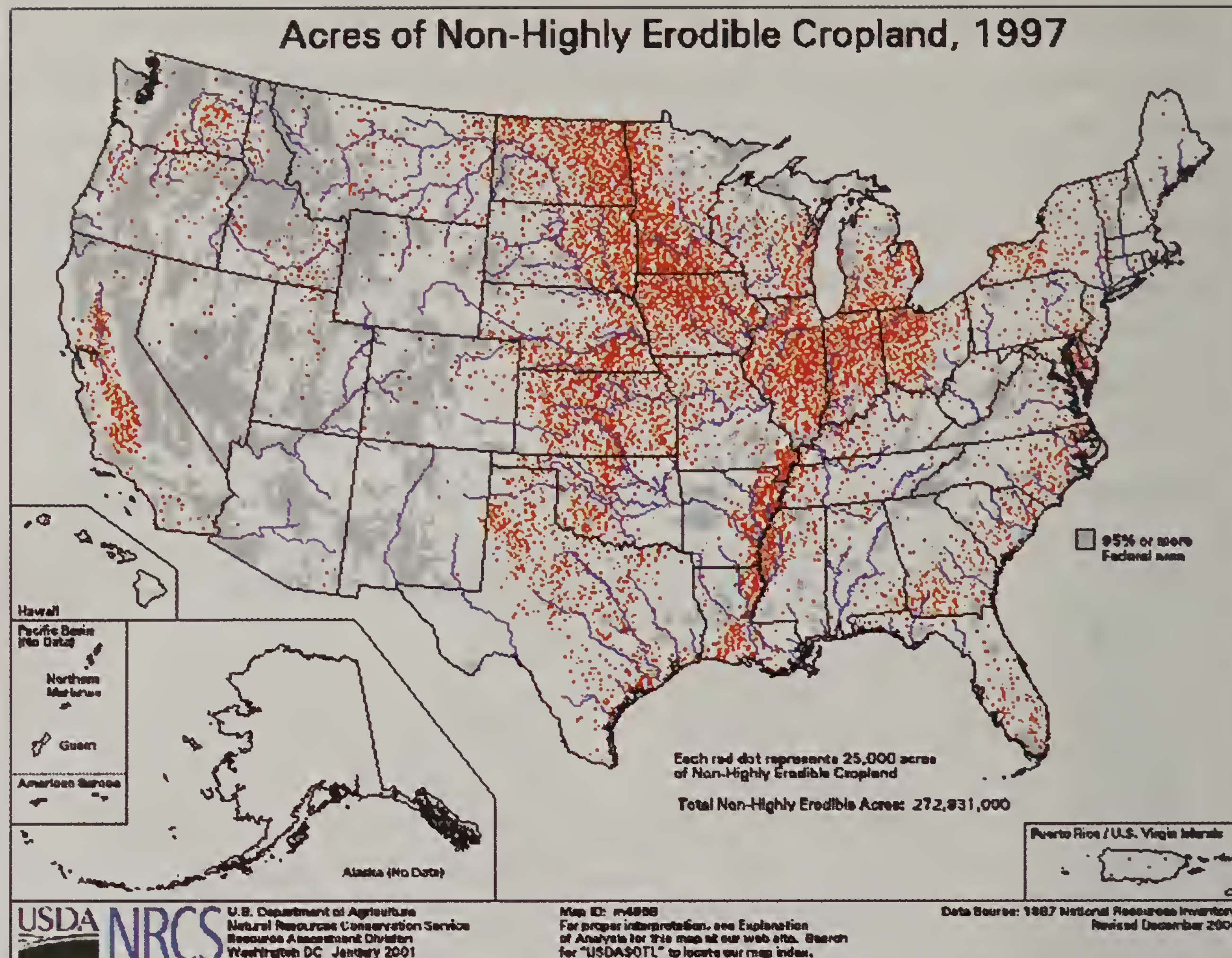
**Cropland (millions of acres)**

| | Highly erodible | | | | Non–highly erodible | | | | All cropland | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | <*T* | >*T* | <*T* (%) | Total | <*T* | >*T* | <*T* (%) | Total | HEL (%) | <*T* (%) |
| 1982 | 41.0 (± 1.7) | 82.9 (± 1.9) | 33.1 | 123.9 (± 2.5) | 209.5 (± 3.4) | 87.1 (± 2.0) | 70.6 | 296.6 (± 3.9) | 29.5 | 59.6 |
| 1987 | 38.1 (± 1.6) | 78.0 (± 1.9) | 32.8 | 116.1 (± 2.6) | 209.2 (± 3.4) | 80.8 (± 1.9) | 72.1 | 290.0 (± 3.9) | 28.6 | 60.9 |
| 1992 | 41.6 (± 1.8) | 63.1 (± 1.8) | 39.7 | 104.7 (± 2.5) | 221.0 (± 3.6) | 56.0 (± 1.6) | 79.8 | 277.0 (± 3.9) | 27.4 | 68.8 |
| 1997 | 45.9 (± 1.8) | 57.2 (± 1.6) | 44.5 | 103.1 (± 2.5) | 222.8 (± 3.6) | 50.4 (± 1.5) | 81.6 | 273.2 (± 3.9) | 27.4 | 71.4 |
| 2001 | 46.0 (± 1.8) | 55.1 (± 1.7) | 45.5 | 101.1 (± 2.5) | 219.9 (± 3.6) | 48.7 (± 1.5) | 81.9 | 268.6 (± 3.9) | 27.3 | 71.9 |

Table 3. Highly erodible (HEL) and non–highly erodible cropland eroding at less than and greater than *T*, by year (NRCS 2003). *T* represents the maximum soil loss limit determined to be sustainable. Margins of error defining the 95% confidence interval are in parentheses.

HEL and non-HEL cropland to reduce erosion, conserve soil moisture and nutrients, and reduce trips across the field with large equipment. Modern applications of both conservation tillage and conventional tillage on croplands generally utilize chemical pesticides to control weeds, diseases, and insects. The biggest difference in these 2 systems is the frequency and timing of disturbances in the field and the retention of crop residues on

Figure 3. Distribution of non-highly erodible cropland in 1997 (NRCS 2000). Dots are aggregated by and placed randomly within 8-digit hydrologic units. Each red dot represents 25,000 acres.




the surface. While croplands and haylands are generally unsuitable for grassland nesting birds (Johnson 2000), there is evidence that conservation tillage is better than conventional tillage for some birds. Wildlife benefits from conservation tillage over conventional tillage have been summarized previously (Brady 2000). However, a recent addition to the literature (Martin and Forsyth 2003) adds support for the concept that minimum tillage appears to confer benefits in productivity to birds that nest in farmland over conventionally tilled cropland. Martin and Forsyth (2003) studied songbird productivity in prairie farmlands under conventional versus minimum tillage regimes in southern Alberta, Canada. They found that Savannah sparrows (*Passerculus sandwichensis*) in spring cereal and winter wheat and chestnut-collared longspurs (*Calcarius ornatus*) in summer fallow tended to prefer minimum tillage. McCown's longspurs (*Calcarius mccownii*) and horned larks (*Eremophila alpestris*) occurred more frequently on conventional- than on minimum-till spring cereal plots in at least 1 of the 2 years. For Savannah sparrows, minimum-till spring cereal and winter wheat were more productive than conventional-till habitat. Summer fallow of either tillage regime did not appear to be as productive as minimum-till cereal fields for this species. Chestnut-collared longspurs occurred predominantly in minimum-till summer fallow and spring cereal habitat and showed almost no productivity in conventionally managed plots. McCown's longspurs tended to have higher productivity in minimum-till plots. These represent comparisons between different tillage techniques on cropland, not between cropland and native grasslands. While some doubt about the effectiveness and enforcement of the HEL

Divided slope farming to reduce soil erosion in Washington. (T. McCabe, USDA-NRCS)

provisions has been expressed (GAO 2003), it is clear from the preceding discussion and data that these provisions made a substantial difference in reducing cropland erosion. The reduction of 1.3 billion tons per year of eroding cropland soils has effects both on- and off-site. On-site, fertility and soil quality are retained, and the long-term sustainability of the productive soil resource base is protected. Off-site, there are substantially less sediment and attached pollutants moving into wetlands and water bodies, thereby improving water quality, extending the lifespan of reservoirs, and reducing sediment damage, maintenance, and dredging costs. The net effect on aquatic habitat has not been quantified, but it can be inferred from the previous discussion that substantial improvement in aquatic habitat quality is also expected.

The national estimates presented above indicate that resource-management decisions are moving favorably towards more sustainable use of those HEL croplands. However "sodbusting" still continues in some forms, although not necessarily on HEL. Concurrent advances in technology have made it possible to produce row crops on lands previously thought to be unsuitable for that use. Higgins et al. (2002) reported that development of drought-resistant, genetically modified soybeans has been responsible for the conversion of native grasslands and extended the western expansion of soybeans into 48 counties in South Dakota that previously had been considered too dry to grow soybeans. Land area devoted to soybean production now exceeds land area used for corn production in South Dakota. Since 1987 in eastern South Dakota alone, about 68,000 ha (~168,000 acres) of native rangeland have been converted to cropland in the 21 counties most heavily impacted by the western expansion of soybeans (Higgins et al. 2002:46). They express concern that while the current westward expansion of cropland has obvious impacts on prairie ecology, it also has the direct effect of moving wetland drainage interest into formerly secure (i.e., rangeland) habitats (Higgins et al. 2002:48).

### *Swampbuster*

Wetland losses due to agriculture have been declining in recent decades because of many factors, including Swampbuster, greater public awareness of wetland values, economic factors, and other federal, state, and local laws (Brady and Flather 1994, Flather et al. 1999, NRCS 2000, NRCS 2004; Figure 4). Recent studies reveal that the annual rate of wetland loss has continued to decline. Gross wetland losses from 1992 to 1997 were 506,000 (±43,600) acres (NRCS 2000), but declined by 44% to 281,600 (±79,000) acres during the subsequent period 1997–2002 (NRCS 2004). Gross wetland losses due to agriculture declined by 62% between the intervals 1992–1997 and 1997–2002. Swampbuster's effect has been significant since agriculture's role in gross wetland loss during the 1992–1997 period had declined to about 26% (NRCS 2000), then to about 18% during 1997–2002 (NRCS 2004). The synergistic effect of Swampbuster's deterrence of wetland losses and the gains derived from other wetland conservation programs, especially the Wetlands Reserve Program (WRP), resulted in a net wetland gain on agricultural lands of 131,400 (±70,000) acres from 1997 to 2002 (NRCS 2004). Most recent estimates for the 2001–2003 interval indicate a net wetland gain of 66,000 acres per year on agricultural lands (NRCS 2005), representing a major reversal of patterns observed prior to Swampbuster nearly 20 years ago. While Swampbuster's main impact has been to reduce agriculturally induced wetland conversions, it has also served to motivate landowners to submit bids for the CRP and for the WRP.

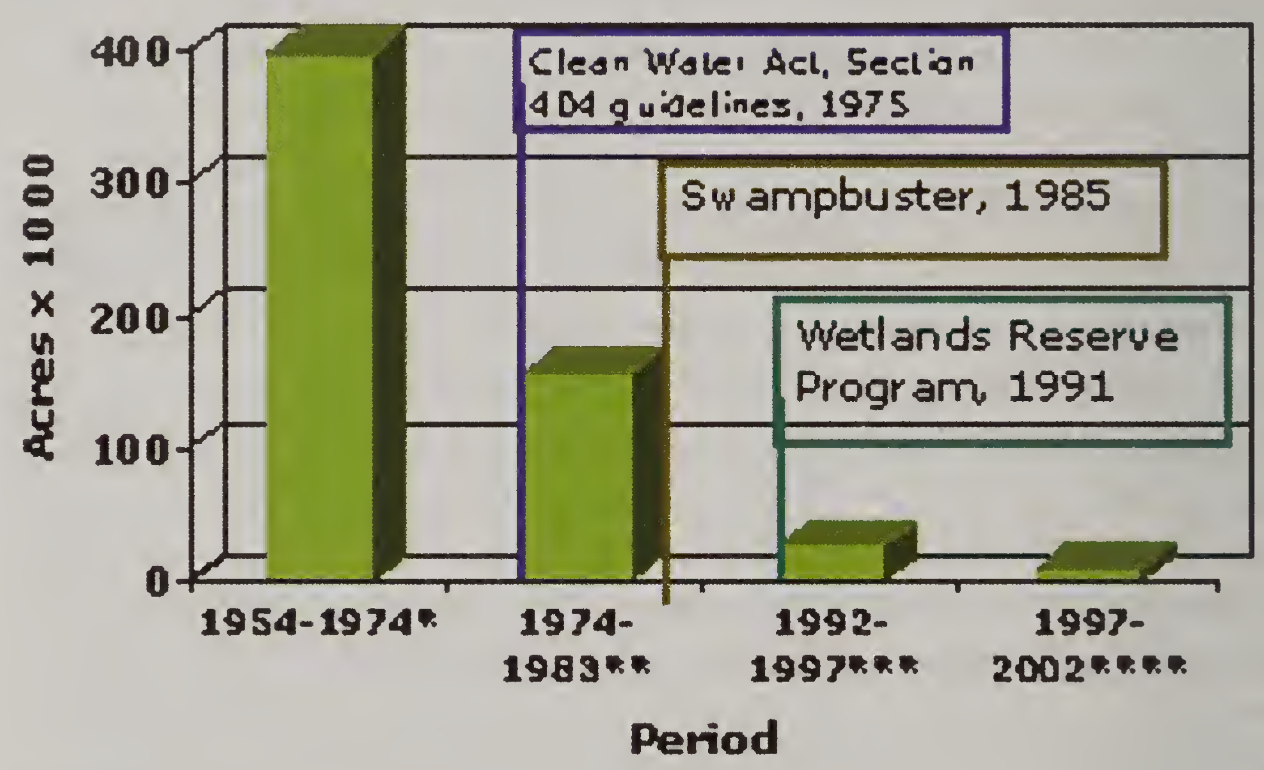
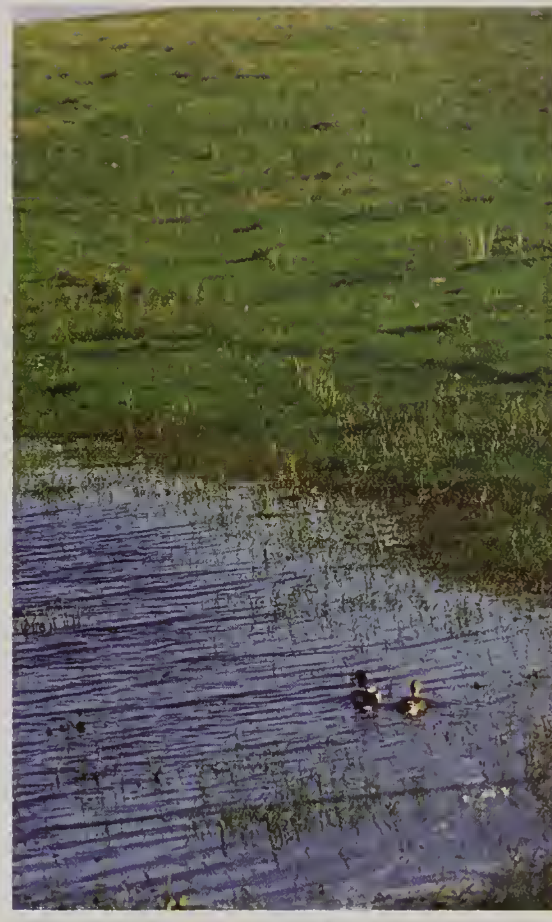



Figure 4. Average annual wetland loss due to agriculture, 1954–2002, and significant federal legislation (*Frayer et al. 1983, **Dahl and Johnson 1991, ***NRCS 2000, ****NRCS 2004).

The direct effect of Swampbuster is to reduce the rate of wetland loss, but it also has both synergistic and indirect benefits to wildlife. Reynolds (2005) studied the CRP and duck production in the Prairie Pothole Region (PPR) of the U.S. His results suggest that CRP cover planted around wetlands and the curtailment of disturbance associated with tilling and planting crops has improved the function of wetlands relative to breeding duck use. There were about 230,000 acres of small, shallow (temporary and seasonal) wetlands in CRP fields in the PPR. They attracted 492,000 duck pairs annually during the years 2000–2003, which was 210,000 more pairs per year than in the absence of the CRP. These small, shallow wetlands in the PPR are critical to brood survival by providing security from predators (Krapu et al. 2000) and food requirements for developing ducklings. Swampbuster has been effective in reducing wetland loss, but some question the need to protect small, shallow wetlands that interfere with tilling and planting. Reynolds (*this volume*) found that the types of wetlands in all land uses that showed the highest use by breeding ducks were temporary and seasonal classes (see Figure 2 in Reynolds [*this volume*]) that averaged only 0.6 and 1.46 acres in area, respectively. He also found that 63% of all dabbling ducks in the area depend on temporary and seasonal wetlands that were less than 1 acre in area and the majority of those wetlands occurred in crop fields. Reynolds (*this volume*) concluded: "Swampbuster provisions of the Farm Bill must be continued to protect wetlands habitat critical to breeding waterfowl and broods".

## Conclusions

Reduced erosion rates of 1.3 billion tons/year and net wetland gains on agricultural lands provide clear evidence that recent USDA farm program provisions are providing significant conservation benefits. The combined effect of these documented erosion reductions and greatly reduced wetland conversions in association with the Conservation Reserve Program (Farrand and Ryan, *this volume*; Johnson, *this volume*; Reynolds, *this volume*), Continuous Conservation Reserve Program (Clark and Reeder, *this volume*), the Conservation Reserve Enhancement Program (Allen, *this volume*), the Wildlife Habitat Incentives Program (Gray et al., *this volume*), the Wetlands Reserve Program (Rewa, *this volume*), Environmental Quality Incentives Program (Berkland and Rewa, *this volume*), and the Grassland Reserve Program (Wood and Williams, *this volume*) have very large synergistic benefits to the conservation of habitats for wildlife. While conservation tillage is not a panacea for wildlife management on highly erodible croplands, it does represent one additional increment improving cropland habitats over conventional tillage systems. Although the HEL and Swampbuster provisions generally do not create additional wildlife habitat, they collectively support the conservation gains obtained in the other programs and motivate producers to apply for enrollment in those programs. The net effect of the interaction of all these Farm Act Provisions results in substantial wildlife habitat improvements under existing patterns of land use that otherwise would not be possible if the various provisions were implemented independently of one another.



Mallard ducks in a prairie pothole in South Dakota. (D. Poggensee, USDA-NRCS)

## Acknowledgments

Appreciation is extended to Beth Schuler, Skip Hyberg, Jon Haufler, and Billy Teels for helpful comments on an early draft of this manuscript.

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# Grassland Bird Use of Conservation Reserve Program Fields in the Great Plains

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## Abstract

*An enormous area in the Great Plains is currently enrolled in the Conservation Reserve Program (CRP): 19.5 million acres (nearly 8 million ha) in Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, and Texas. This change in land use from cropland to grassland since 1985 has markedly influenced grassland bird populations. Many, but certainly not all, grassland species do well in CRP fields. The responses by birds to the program differ not only by species but also by region, year, the vegetation composition in a field, and whether or not a field has been hayed or grazed. The large scale and extent of the program has allowed researchers to address important conservation questions, such as the effect of the size of habitat patch and the influence of landscape features on bird use. However, most studies on nongame bird use of CRP in or near the Great Plains have been short-lived; 83% lasted only 1–3 years. Further, attention to the topic seems to have waned in recent years; the number of active studies peaked in the early 1990s and dramatically declined after 1995. Because breeding-bird use of CRP fields varies dramatically in response both to vegetational succession and to climatic variation, long-term studies are important. What was learned about CRP in its early stages may no longer be applicable. Finally, although the CRP provisions of the Farm Bill have been beneficial to many grassland birds, it is critical that gains in grassland habitat produced by the program not be offset by losses of native prairie.*

## Introduction

Grasslands are among the nation's most threatened ecosystems (Samson and Knopf 1994, Noss et al. 1995). Their declines have been dramatic, with losses of native grasslands reaching 99.9% for tallgrass prairie in many states, and 70–80% for mixed-grass prairies. Grassland communities and the wildlife that depend on them have suffered from these declines, as well as from

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fragmentation of remaining patches, invasion by exotic species, planting of woody vegetation, and disruption of disturbance processes (Johnson 1996).

The Conservation Reserve Program (CRP) was established under the Farm Bill to encourage agricultural producers to plant highly erodible croplands to grasses. The result has been a vast conversion of cropland to perennial grassland (Johnson et al. 1993). The Great Plains has been a priority area for the CRP because of its plentiful winds and highly erodible soils. As of September 2003, the enrollment in CRP in Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, and Texas totaled 19.5 million acres (nearly 8 million ha). The majority of those lands were planted with introduced or native grasses, the former typically mixed with legumes. Grasslands established under the program offer the potential to mitigate some of the detrimental effects to fish and wildlife associated with the loss of native grassland. Johnson (2000) summarized research findings related to bird responses to CRP. This paper updates the information summarized in Johnson (2000) with new research conducted since that report.

Male lark bunting. (G. Kramer, USDA-NRCS)

## Status of Grassland Birds

Johnson (2000) discussed the effects of grassland conversion to croplands. The historical prairies were reported to have rich abundances of wildlife (Dinsmore 1994). Surveys of bird populations over the past 35 years have documented the decline of more prairie bird species than in any other guild of birds (Peterjohn and Sauer 1999). As examples, declines during 1966–1979 were 3.4% per year for lark buntings (*Calamospiza melanocorys*), 4.3% per year for grasshopper sparrows (*Ammodramus savannarum*), and 5.5% for dickcissels (*Spiza americana*) (Sauer et al. 2004). Those numbers appear small, but they translate to declines of 34–52% for that short period of time. Projected for, say, 40 years, those trends would leave only 10–25% of the populations remaining.

Declines of grassland birds associated with the loss of prairies are due to a number of causes. Reduction in availability of habitat through conversion of prairies to croplands or other land uses is a primary cause. While some birds have been found to nest in croplands (e.g., horned lark [*Eremophila alpestris*], vesper sparrow [*Pooecetes gramineus*]) and in hayfields (e.g., waterfowl and vesper sparrow), their nests have high rates of failure because of the frequency of agricultural operations (Rodenhouse and Best 1983, Bollinger et al. 1990, Frawley and Best 1991, Dale et al. 1997, McMaster et al. 2005), producing conditions that can lead to population "sinks" (sensu Pulliam 1988). An additional cause of decline in many areas is the habitat fragmentation resulting from the high levels of habitat loss, producing patches that lack sufficient size to support many bird species (Johnson 2001), or that have reduced reproductive rates due to edge effects that can increase the densities of predators (Clark and Reeder, *this volume*) or the brood parasite brown-headed cowbirds (*Molothrus ater*) (Koford et al. 2000). These influences are discussed in more detail below.

The value of grasslands to many bird species (e.g., Sprague's pipit [*Anthus spragueii*] and Baird's sparrow [*Ammodramus bairdii*]) has been found to be reduced by the invasion or planting of woody vegetation (Johnson 2000), even though areas supporting woody vegetation may contain more bird species than those without (Arnold and Higgins 1986). This increase in species tends to be due to the presence of edge or generalist species, such as brown thrasher (*Toxostoma rufum*), gray catbird (*Dumetella carolinensis*), song sparrow (*Melospiza melodia*), American robin (*Turdus migratorius*), and common grackle (*Quiscalus quiscula*). Woody vegetation has been found to influence grassland birds in several ways. First, the presence of trees and shrubs reduces the total area of grassland and fragments it. Second, it precludes some species from using the remaining grassland areas (Wiens 1969, Whitmore 1981, Kahl et al. 1985, Bollinger and Gavin 2004). Third, woody plants provide perches for raptors, other avian predators, and brown-headed cowbirds, as well as travel lanes for mammalian predators (Winter et al. 2000), which can result in reduced nest success near trees and shrubs (Johnson and Temple 1990, Bollinger and Gavin 2004). Fourth, species attracted to the woody vegetation may forage in nearby grasslands and potentially compete with prairie species.

## CRP as Habitat for Grassland Birds

Evaluations of bird use of CRP fields in the Great Plains, summarized by Johnson (2000), have demonstrated that many species of birds utilize CRP, including lark bunting, western meadowlark (*Sturnella neglecta*), horned lark, Savannah sparrow (*Passerculus sandwichensis*), clay-colored sparrow (*Spizella pallida*), bobolink (*Dolichonyx oryzivorus*), common yellowthroat (*Geothlypis trichas*), sedge wren (*Cistothorus platensis*), and grasshopper sparrow, with different species occurring at different densities in different locations (Johnson and Schwartz 1993a,b; Hanowski 1995, Johnson and Igl 1995, Delisle and Savidge 1997, Horn 2000). Table 1 lists the primary species reported to occur in CRP in these studies.

| Species | Great Plains Roughlands Johnson and Schwartz 1993a | Missouri Coteau Johnson and Schwartz 1993a | Drift Prairie Johnson and Schwartz 1993a | Black Prairie Johnson and Schwartz 1993a | Minnesota Hanowski 1995 | Nebraska Delisle and Savidge 1997 | North Dakota Horn 2000 |
|---|---|---|---|---|---|---|---|
| Lark bunting | 1 | 1 | | | | | |
| Grasshopper sparrow | 2 | 2 | 1.5 | 6 | 11 | 2 | 11 |
| Red-winged blackbird | 5 | 3 | 1.5 | 1 | 2 | 4 | 8 |
| Western meadowlark | 4 | 6 | 10 | 9.5 | 15 | 9 | 12 |
| Horned lark | 3 | 5 | 11 | | | | |
| Savannah sparrow | 7 | 8 | 4 | 5 | 4 | | 5 |
| Brown-headed cowbird | 6 | 4 | 8 | 9.5 | 11 | 3 | 1 |
| Clay-colored sparrow | 10.5 | 10 | 3 | 7 | 3 | | 2 |
| Bobolink | 8 | 11 | 5.5 | 3 | 1 | 7 | 7 |
| Common yellowthroat | | 12 | 5.5 | 4 | 8 | 5 | 6 |
| Sedge wren | | | 8 | 2 | 5 | 6 | 3 |
| Chestnut-collared longspur | 9 | 7 | | | | | |
| Dickcissel | | 13 | 8 | 8 | | 1 | |
| Baird's sparrow | 10.5 | 9 | 12 | | | | |
| American goldfinch[a] | | | | | 6 | | 9 |
| Brewer's blackbird[b] | | | | | 7 | | |
| Common grackle | | | | | 9 | | |
| Tree swallow[c] | | | | | 10 | | |
| Vesper sparrow | | | | | 13 | | |
| Song sparrow | | | | | 14 | | 10 |
| Mourning dove | | | | | 16 | 9 | |
| Northern bobwhite | | | | | | 9 | |
| Ring-necked pheasant | | | | | | 11 | |
| Le Conte's sparrow | | | | | | | 4 |

a *Carduelis tristis* b *Euphagus cyanocephalus* c *Tachycineta bicolor*.

Table 1. Reported densities of breeding birds (by ranking) in Conservation Reserve Program fields in the northern Great Plains.

Johnson (2000) also reported that, in general, CRP fields supported larger populations of grassland birds than croplands, citing studies by Kimmel et al. (1992), Johnson and Igl (1995), and Wachob (1997). Johnson (2000) did note that the species composition of birds using CRP fields can vary dramatically from one year to the next, depending on climatic variation, succession of vegetation communities within CRP fields, and fluctuations in the numbers and distributions of birds. Johnson et al. (1997) surveyed breeding birds annually in several hundred CRP fields in 4 northern Great Plains states during 1990–1996. Ecological succession had taken place in these grasslands during that time as the plantings matured. In addition, the region experienced drought conditions early in the study but received above-average precipitation in the latter years. Bird populations responded to these changes in a variety of ways (Table 2). Many species had similar densities in 1990–1991 and 1995–1996, but several species increased in number fairly steadily throughout that period. They included common yellowthroat, bobolink, and clay-colored sparrow, all of which favor tall or dense vegetation. After the drought ended in mid-1993, several species increased, including northern harrier (*Circus cyaneus*), Wilson's phalarope

(*Phalaropus tricolor*), and Savannah sparrow, and some populations mushroomed, such as sedge wren and Le Conte's sparrow (*Ammodramus leconteii*) (Igl and Johnson 1999). Horned larks, chestnut-collared longspurs (*Calcarius ornatus*), and lark buntings typically declined in number (Table 2). These latter species prefer sparser, more open vegetation.

| Species | Average density (pairs/100 ha) | |
|---|---|---|
| | 1990–1991 | 1995–1996 |
| Savannah sparrow | 6 | 20 |
| Clay-colored sparrow | 5 | 12 |
| Bobolink | 5 | 9 |
| Common yellowthroat | 4 | 6 |
| Sedge wren | 3 | 11 |
| Le Conte's sparrow | 0 | 16 |
| Lark bunting | 21 | 4 |
| Horned lark | 7 | 1 |
| Chestnut-collared longspur | 2 | 0 |

Table 2. Average density of breeding birds in CRP fields in the northern Great Plains during 1990–1991 versus 1995–1996 (Johnson et al. 1997). Several species increased dramatically, while others declined.

Delisle and Savidge (1997) noted that grasshopper sparrow densities declined with time in CRP fields (1991–1994), a change they attributed to a buildup of litter and dead vegetation. Winter et al. (2005) noted that responses of densities and nesting successes of grassland birds to vegetation parameters varied by regions, years, and species.

Conservation Reserve Program fields have been found to support higher reproductive rates of grassland birds than croplands. Johnson (2000) noted work conducted by Berthelsen and Smith (1995), Clawson and Rotella (1998), and Koford (1999) that supported this relationship. However, because of the difficulty of finding nests (Winter et al. 2003), reproductive success has not been well studied in CRP fields in the Great Plains. Winter et al. (2005) emphasized the variability in nesting success that can occur due to the factors mentioned above for densities, and suggested that more research is needed before the relationships of many factors to nesting success will be understood. Further, some studies on nesting success in CRP fields have used artificial nests for their research focus, and extrapolation of the results of these studies to actual nests must be viewed with some caution (e.g., Major and Kendal 1996, Davison and Bollinger 2000).

## Effects of Patch Size and Landscape Features on Bird Use

As identified above, and discussed by Johnson (2000, 2001) and Johnson and Winter (1999), habitat fragmentation can affect bird use of CRP. Habitat-fragmentation effects involve the size, shape, and distribution of patches as well as surrounding landscape conditions. Some patches may be too small to be used by certain species, or birds that do use smaller patches may suffer more from competition, brood parasitism, or predation than birds in larger patches, resulting in lower nesting success. Smaller patches have a relatively greater proportion of their area near an edge, so edge effects (Faaborg et al. 1993, Clawson and Rotella 1998, Winter and Faaborg 1999, Winter et al. 2000) may be more pronounced, causing lower densities or reduced nesting success. Distribution of patches may also have an effect on bird use, as isolation from other grassland patches can affect occupancy by birds. Finally, arrangement of patches and presence of other vegetation types in the surrounding landscape can provide habitat conditions favorable to competing species, which in turn can reduce densities or nesting success of grassland birds.

These features have been found to operate among several species of grassland birds, in several regions, and in different types of grasslands (e.g., Herkert et al. 2003, Winter et al. 2005). In CRP fields specifically, Johnson and Igl (2001) related the occurrence of species and their densities to the patch size of each field. They conducted 699 fixed-radius point counts of 15 bird species in 303 CRP fields in 9 counties in 4 northern Great Plains states (Figure 1). They found that northern harriers, sedge wrens, clay-colored sparrows, grasshopper sparrows, Baird's sparrows, Le Conte's sparrows, and bobolinks favored larger grassland patches in 1 or more counties. In contrast, 2 edge species, mourning doves (*Zenaida macroura*) and brown-headed cowbirds, tended to prefer smaller grassland patches. Horn (2000) reported that bobolinks, grasshopper sparrows, and red-winged blackbirds (*Agelaius phoeniceus*) were more common in larger CRP fields, while brown-headed cowbirds preferred smaller fields. Wachob (1997) investigated sharp-tailed grouse (*Tympanuchus phasianellus*) and found that it favored larger CRP patches for nesting but not for brood-rearing. He also reported that leks were more common closer to CRP fields and in areas with extensive CRP grassland within 0.6 mile (1 km).

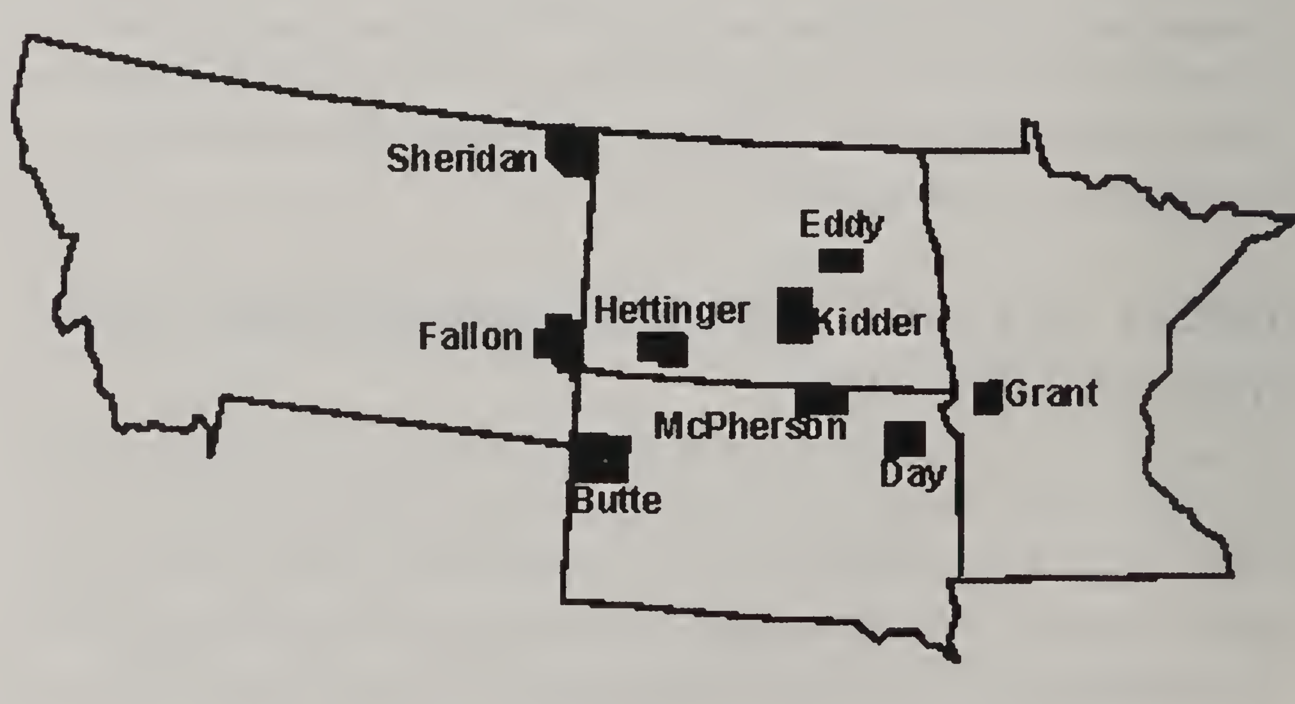


Figure 1. Counties containing study areas used in the Northern Prairie Wildlife Research Center long-term study of breeding-bird use of Conservation Reserve Program fields. Fallon (Montana), Butte (South Dakota), and Hettinger (North Dakota) counties are in the Great Plains Roughland geologic landform; Sheridan (Montana), Kidder (North Dakota), and McPherson (South Dakota) counties are in the Missouri Coteau; Eddy (North Dakota) and Day (South Dakota) counties are in the Drift Prairie; and Grant County (Minnesota) is in the Black Prairie.

## Effects of Haying of CRP

In many counties, in certain years, CRP fields have been released for haying or, less frequently, grazing, due either to drought or to excessive precipitation, often in combination with landowner and political pressure. Johnson et al. (1998) assessed densities of breeding birds in hayed versus idled CRP, the year after the disturbance occurred. Because the authors used the same fields in all years, they had essentially a before-and-after, treatment-and-control design. They had data from nearly 300 fields that had been hayed and more than 2,600 fields that had been left idle in a year. A few species responded positively the year following haying; these were horned lark, chestnut-collared longspur, and lark bunting, all of which favor short and sparse vegetation. Many more species, in contrast, had reduced densities the year following haying, including vesper sparrow, sedge wren, common yellowthroat, bobolink, clay-colored sparrow, dickcissel, and Le Conte's sparrow.

Horn and Koford (2000) reported fewer sedge wrens and, possibly, clay-colored sparrows, Le Conte's sparrows, red-winged blackbirds, common yellowthroats, and grasshopper sparrows in mowed than in uncut CRP fields in the year after mowing. Savannah sparrows showed the opposite tendency, being more common in mowed CRP.

McCoy et al. (2001) noted that mowing of cool-season CRP plantings in Missouri in late summer and early fall permitted sufficient regrowth to provide habitat for wintering birds. In contrast, the value of mowed warm-season planting was reduced for at least 2 years. McMaster et al. (2005) investigated bird use of croplands converted to hayfields in Saskatchewan. They found nests of 26 species using the hayfields, and also found high levels of nest success compared to other related studies, but they noted that haying of the fields they investigated was delayed in the years of their study because of high precipitation. They acknowledged that mowing earlier in the season could have significantly reduced nesting success.

## Use of CRP Habitat During the Nonbreeding Season

Johnson (2000) summarized studies of bird use of CRP during the nonbreeding season. King and Savidge (1995), Delisle and Savidge (1997), and Best et al. (1998) investigated winter use of CRP fields. Species noted to utilize CRP during this season included American tree sparrow (*Spizella arborea*), ring-necked pheasant (*Phasianus colchicus*), meadowlark, northern bobwhite (*Colinus virginianus*), dark-eyed junco (*Junco hyemalis*), red-winged blackbird, and horned lark. Johnson (2000) noted the lack of studies that have investigated nonbreeding-season bird use of CRP. No new information has been identified relative to this subject since that report.

## Research Needs and Status

As Johnson (2000) noted, much has been learned about CRP and its value to grassland birds, but a number of issues deserved further investigation, particularly landscape and patch-size effects (Johnson 2001, Johnson and Igl 2001). Johnson (2000) also noted that more information was needed about the influences of specific vegetation conditions on use of CRP by grassland birds.

Few studies have been conducted in the interim to address these questions. McCoy et al. (2001) reported greater use of CRP fields planted to cool-season species than to fields dominated by switchgrass (*Panicum virgatum*), a warm-season species. In CRP fields in eastern South Dakota, Eggebo (2001) observed higher densities of sedge wrens, Savannah sparrows, and bobolinks in cool-season than in warm-season plantings. The reverse pattern held for killdeer (*Charadrius vociferus*), mourning dove, song sparrow, and brown-headed cowbird, species less tightly dependent on grassland. Johnson and Schwartz (1993b) reported on the response of several species to differences in vegetation composition. More recent CRP guidelines have encouraged mixtures of more species in the plantings, which should develop into more diverse grasslands. A study recently concluded by the Northern Prairie Wildlife Research Center, with support from the U.S. Fish and Wildlife Service, is addressing some issues relating to planting mixtures in the northern Great Plains. Preliminary results indicate that plantings of either introduced or native grasses, along with legumes, support populations of breeding birds, although the species composition sometimes differs between the 2 types. Winter et al. (2005) emphasized the need for studies that included larger spatial and temporal scales to address many of the complexities of grassland bird abundances and nesting success.

Hay bales in Missouri CRP fields. (N. Klopfenstein, USDA-NRCS)

The effects of haying on the reproductive success of birds nesting in CRP fields, discussed above, also needs further study. While this need was noted by Johnson (2000), little remains known about the total immediate and long-term effects on reproduction during the year of mowing. In conventionally managed hayfields, mowing can be detrimental to birds that are still nesting, so the actual effect depends on the date of mowing (McMaster et al. 2005). Political and economic pressures continue to mount for earlier mowing dates, before the forage value of CRP vegetation diminishes, but earlier mowing is much more detrimental to breeding birds than is mowing after most of the nesting activities have been completed.

The advent of the Conservation Reserve Program, with the major changes it wrought on the Great Plains landscape, led to a large number of research studies. These projects, many of which were conducted by graduate students, sought to understand how CRP fields were used by birds. Other than the long-term study by Northern Prairie Wildlife Research Center (continuously from 1990 to the present), most of the studies on nongame bird use of CRP in or near the Great Plains were short-lived; 83% had durations of only 1 to 3 years.

Further, attention to the topic seems to have waned in recent years. The number of active studies (excluding those of Northern Prairie Wildlife Research Center) peaked in the early 1990s and has dramatically declined since 1995 (Figure 2). This pattern would pose no problem if the phenomenon under study were unchanging. But, as discussed by Igl and Johnson (1999) and Johnson (2000), breeding bird populations in CRP fields can vary dramatically in response both to vegetational succession and to climatic variation. What was learned about CRP in its early stages may no longer be applicable.

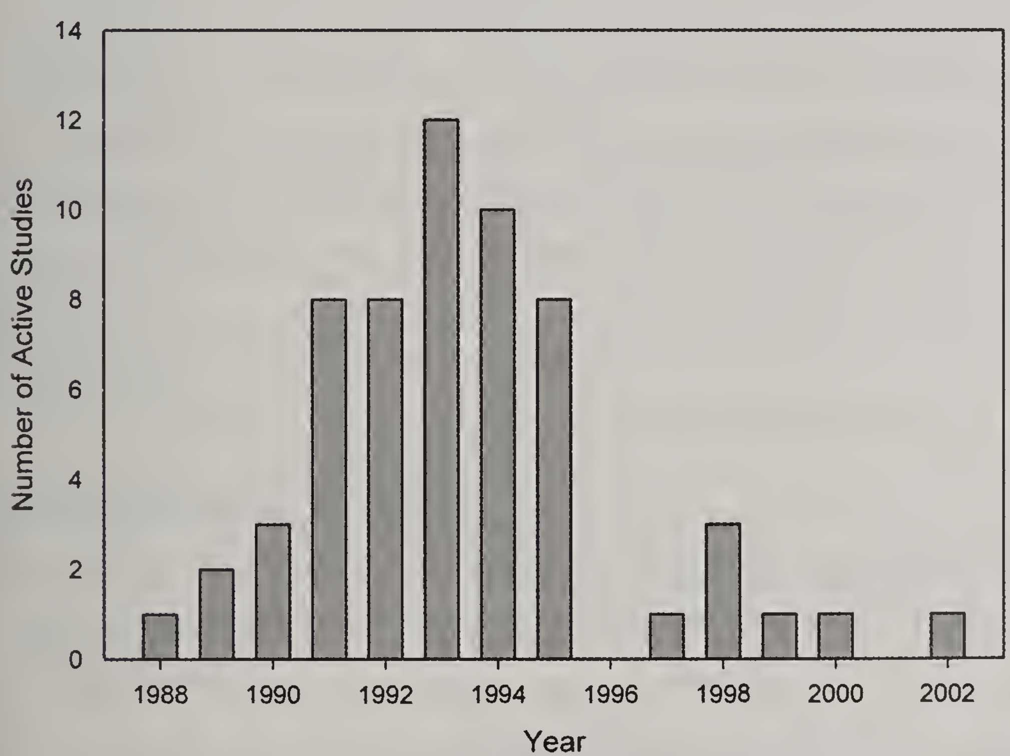


Figure 2. Number of studies involving bird use of Conservation Reserve Program fields in or near the Great Plains, by year, based on a review by the author of theses and published articles.

## Conclusions

Conservation Reserve Program fields are clearly much more beneficial to a wide variety of breeding birds than are the cropland fields that they replaced. Tracts of untilled native prairie, however, are tremendously important to grassland birds; they support many species that rarely if ever use cropland or even CRP fields, such as burrowing owl (*Athene cunicularia*), Sprague's pipit, Baird's sparrow, and chestnut-collared longspur (D. H. Johnson and L. D. Igl, unpublished data). Likewise, Klute et al. (1997) found greater densities of several grassland species in grazed native prairie than in CRP fields in Kansas. Maintaining extant

Yellow-rumped warbler in a South Dakota prairie pothole. (D. Larson, USDA-NRCS)

native prairie should be a high priority for the conservation of birds (as well as many other animal and plant species). It is critical that farm programs do not directly or indirectly encourage conversion of native prairie to cultivation while seeking to restore perennial grassland to existing areas of cropland.

As reported by Johnson (2000), evidence indicates that native grasslands are being lost at the same time as CRP is reestablishing grassland. Johnson (2000) reported on information compiled by C. Madsen (U.S. Fish and Wildlife Service , personal communication). In South Dakota, 1,776,383 acres (718,884 ha) were enrolled in CRP by 1995. However, during the period (1985–1995), 707,896 acres (286,478 ha) of grassland were converted to cropland. Recent summaries of U.S. Department of Agriculture data indicate that sodbusting continues. Analyses by Ducks Unlimited show that 74,470 acres (30,137 ha) in North Dakota and 191,813 acres (77,625 ha) in South Dakota were broken for crops during 2002–2004 (J. K. Ringelman, Ducks Unlimited, personal communication). Analysis of Landsat satellite imagery of selected counties in North Dakota and South Dakota during 1982–2002 conducted by Ducks Unlimited likewise shows conversion of native grassland continues at an appalling rate (S. Stephens, Ducks Unlimited, personal communication). Tillage of rangeland is being encouraged by new varieties of crops, many of them genetically modified, such as Roundup®-ready (use of trade names does not imply endorsement by the U.S. government) corn and soybeans.

Natural Resources Inventory data tell similar stories of losses of grassland. In North Dakota, rangeland diminished by 791,100 acres (320,000 ha) between 1982 and 1997; pastureland declined by 160,900 acres (65,100 ha) during the same period (USDA 2000). Those losses definitely offset many of the gains in wildlife habitat provided by the 2,802,300 acres (1,133,700 ha) enrolled in CRP in North Dakota by 1997. Similarly, losses of rangeland between 1982 and 1997 totaled 1,089,300 acres (440,800 ha) in South Dakota, 1,076,300 acres (435,600 ha) in Montana, and 506,500 acres (205,000 ha) in Nebraska. More recent Natural Resources Inventory results are not yet available by state, but nationwide values show a continuing decline in the area of land used for grazing (USDA 2004). These changes in land use undoubtedly have had a negative influence on the populations of many grassland bird species.

Although Conservation Reserve Program fields are much more beneficial to breeding birds in the northern Great Plains than in the croplands that they replaced, the continuing loss of native grasslands is a critical concern. Those native grasslands provide habitat for a wide variety of breeding birds, including many species that make little if any use of cropland or even CRP fields. Further, native rangeland often occurs in large patches and thus is less susceptible to many of the problems associated with fragmentation that were previously described. Conversion of cropland to CRP grasslands may be only temporary, but the conversion of native prairie to cropland is virtually permanent; prairie restoration is a costly process that does not fully restore the integrity of native prairie ecosystems. Recent Farm Bills have made positive contributions to wildlife habitat though the Conservation Reserve Program. Those contributions would be greatly enhanced if they also discouraged further cultivation of existing native grassland and fostered the preservation of these threatened ecosystems. A more balanced and comprehensive program is needed.

## Acknowledgments

I am grateful to my CRP colleagues, Lawrence D. Igl and Michael D. Schwartz, for their valuable efforts, to the numerous landowners who allowed access to their CRP fields for studies reviewed here, and to Farm Service Agency personnel for their assistance. The bibliographies developed by Arthur Allen (U.S. Geological Survey, unpublished data) and the Grasslands Ecosystem Initiative at Northern Prairie Wildlife Research Center (<http://www.npwrc.usgs.gov/resource/literatr/grasbird/grasbird.htm>) were invaluable to this effort. Carl R. Madsen, Kurt Forman, James K. Ringelman, and Scott Stephens generously provided information that they had compiled. Lawrence D. Igl provided a review of an earlier draft of this manuscript, and Jonathan Haufler offered extensive editorial assistance.

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# The Conservation Reserve Program and Duck Production in the U.S. Prairie Pothole Region[1]

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## Introduction

The Prairie Pothole Region (PPR) of North America has historically been considered the most important area of the continent for many species of waterfowl, particularly upland nesting ducks (Bellrose 1976). However, during the time since settlement of this area by Europeans, productivity by species such as mallard, gadwall, blue-winged teal, northern shoveler, and northern pintail has apparently declined. Beauchamp and others (1996) reported a system-wide decline in nest success of upland nesting duck species in the PPR between 1935 and 1992. Nest success has been identified as the single most important factor influencing population change of mallards breeding in the PPR (Hoekman and others 2002) and predation has been identified as the primary reason for nest failure of upland nesting duck species in the PPR of the U.S. (Klett and others 1988, Reynolds and others 2001). Declines in nest success in the PPR have coincided with the conversion of large areas of perennial grasslands to cropland that has presumably altered predator/prey relationships in ways unfavorable to upland nesting birds (Cowardin and others 1983). In 1985, Congress authorized the Conservation Reserve Program (CRP) as part of the Food Security Act (Public Law 99-198). Under this Act, landowners enroll cropland to be converted to perennial cover for a specified period (e.g., 10–15 years) in exchange for annual payments. The CRP has been part of all subsequent Farm Bills since the 1985 Act and resulted in approximately 4.7 million acres of cropland converted to undisturbed grass cover in the PPR of the Dakotas and northeast Montana during the period 1992–present. Conservationists have heralded the CRP as the most significant conservation program benefiting wildlife populations ever implemented by the U.S. Department of Agriculture (USDA). During the period 1992–1997, Reynolds and others (2001) conducted a study to assess the impact of CRP on duck productivity in the PPR of North Dakota, South

[1]This chapter is a reprint from Allen, A. W., and M. W. Vandever, editors. 2005. The Conservation Reserve Program- Planting for the future: Proceedings of a national conference, Fort Collins, Colorado, June 6-9, 2004. U.S. Geological Survey, Biological Resources Discipline, Scientific Investigation Report 2005-5145.

Wetlands in the prairie pothole region in South Dakota. (D. Poggensee, USDA-NRCS)

Dakota, and northeast Montana. This paper presents results from that study and other data to demonstrate the benefits of CRP to waterfowl beyond 1997.

## Impacts of CRP on Waterfowl in the PPR

### *Duck Production 1992–1997*

For nesting cover to provide meaningful benefits to duck populations, certain criteria need to be met: (1) the cover must be characterized by nest success that is higher than other major cover types, (2) it should be more attractive to nesting hens than less secure competing cover, and (3) it should be accessible to a large number of nesting hens. In addition nest success should exceed 15–20% in order for productivity to balance annual mortality (Klett and others 1988). During the period 1992–1997, Reynolds and others (2001) studied use and success by five duck species (mallards, gadwall, blue-winged teal, northern shoveler, and northern pintail) nesting in CRP cover in the U.S. PPR. These investigators searched over 30,000 acres of CRP cover in the Dakotas and Northeast Montana and collected information on over 10,000 duck nests. Results from that study showed that nest success in CRP, averaged among years and species, was 23%, and was higher than any other major cover type used by ducks. They found that CRP cover was preferred over all other major cover types on the landscape by all duck species studied, and that 30% of all successful nests across the study area were initiated in CRP fields that accounted for 7% of the total land area. They also found that nest success in CRP fields was positively related to the percent of total perennial cover on the study sites and that nest success in other cover types was higher during the CRP period than that observed prior to the CRP. They concluded that CRP was having a positive impact on the entire landscape. Overall, these investigators estimated that duck productivity in the PPR increased by 30% compared to that expected in the absence of CRP and that an additional 12.4 million ducks (2.1 million per year) were produced in the U.S. PPR during the study period over what would have occurred in the absence of the CRP. This is equivalent to approximately 33% of the entire U.S. harvest of those species studied during the 6-year period.

### *Duck Production 1998–2002*

Models developed from the 1992–1997 study can be used to estimate the impact of CRP on duck production beyond 1997 if certain information is available and/or assumptions made as follows: (1) estimates of duck breeding pair numbers and distribution are available annually, (2) the distribution of CRP since the 1996 Farm Bill is available in the digital/spatial database, and (3) nest success estimates were updated or assumed to be unchanged since the 1992–1997 period. The U.S. Fish and Wildlife Service continued to annually survey duck breeding populations since

1997 and therefore this critical component of evaluation exists. Because broad-scale temporal variation in nest success was not observed during the 1992–1997 period (Reynolds and others 2001), the assumption that nest success has remained similar in subsequent years seems to be reasonable. The most important change that has occurred since 1997 has been the amount and distribution of CRP throughout the PPR. There have been large shifts among counties and states in the region that will need to be incorporated into any serious attempt to quantify CRP benefits to waterfowl production beyond 1997. However, a rather crude examination can be made if we assume the current CRP is equivalent to that which was in place during1992–1997. Under those conditions, model projections predict that during the 1998–2003 period (period for which breeding populations have been summarized) an additional 13.3 million (2.2 million/year) puddle ducks have been produced as a result of the CRP. The slightly greater average annual incremental increase during the 1998–2002 period compared to the 1992–1997 period is due to the larger average breeding population size during the later period. This brings the total incremental increased production of ducks to 25.7 million for the period 1992–2003.

Mallard ducks in a prairie pothole wetland. (D. Poggensee, USDA-NRCS)

### *Breeding Duck Pairs and Wetlands in CRP Fields*

In addition to providing relatively secure nesting cover for upland nesting ducks, the CRP has the potential to impact the number of breeding ducks settling in the U.S. PPR. There is speculation that homing by adult and young females due to increased productivity from CRP has resulted in greater than expected densities of breeding duck pairs using much of the U.S. PPR. However, wetland habitat has also been positively affected by CRP cover. Wetlands that occur in grasslands tend to attract higher densities of ducks and are considered superior in biological function to those that occur in cropland (Kantrud and Newton 1996, Krapu and others 1997). I examined breeding duck data from over 2,400 wetland observations collected by the U.S. Fish and Wildlife Service (USFWS, Habitat and Population Evaluation Team, Bismarck, ND, unpublished data) for the period 2000–2003 to compare the density of 13 combined duck species using three classes (Cowardin and others 1979) of wetlands occurring in CRP fields ($n$ = 466) and crop fields ($n$ = 1957). Wetlands in both CRP and crop fields showed frequent use by breeding ducks, but greater densities were recorded for wetlands in CRP fields compared to those in crop fields (Figure 1). These results suggest that CRP cover planted around wetlands and the curtailment of disturbance associated with tilling and planting crops has improved the function of wetlands relative to breeding duck use. This impact is not trivial as evidenced by estimates from landscape samples that indicate there are about

230,000 acres of small-shallow (temporary and seasonal) wetlands in CRP fields throughout the PPR. These wetlands attracted 492,000 duck pairs annually during years 2000–2003, which was 210,000 more pairs per year than if they had been in cropland instead of the CRP.

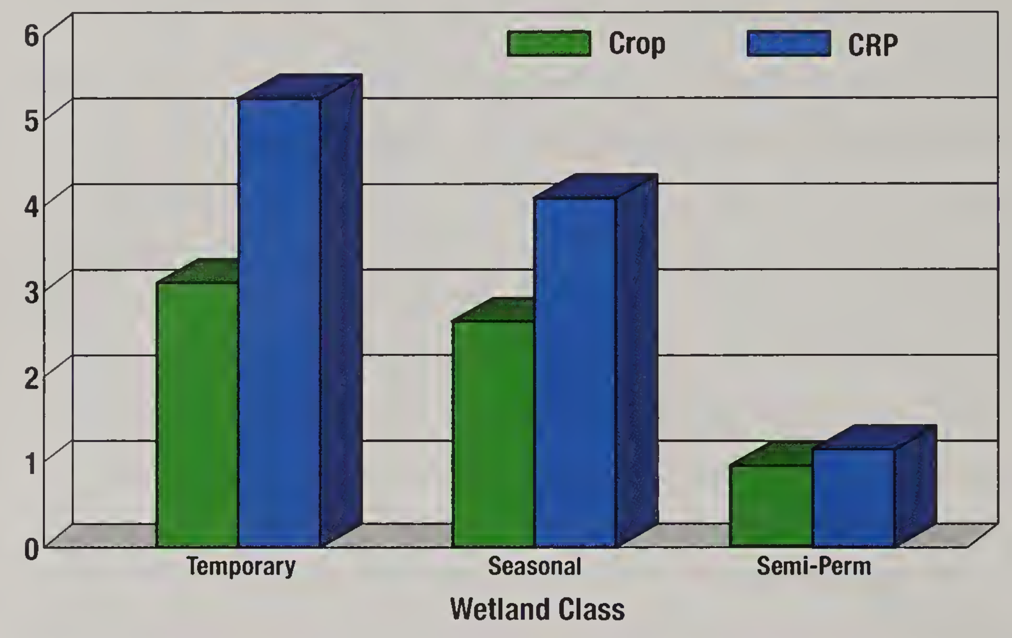


Figure 1. Duck pairs/wet acre (13 species combined) on wetlands occurring in crop fields versus those in CRP fields in the U.S. Prairie Pothole Region during spring 2000–2003.

## *Wetland Conservation*

CRP cover provides benefit to duck production only when this cover occurs in proximity to wetlands that attract numerous breeding hens. Some nesting hens will travel as much as 2 miles or more from core wetlands to access suitable nesting cover (Derrickson 1975, Dwyer and others 1979, Cowardin and others 1985). Loss of wetlands due to drainage can have a significant effect by reducing the capability of an area to attract ducks. Tiner (1984) reported that over half of the original 7 million acres of pothole wetlands in the Dakotas have already been lost, mostly due to agriculture. In addition, small shallow wetlands in the PPR are critical to brood survival by providing security from predators (Krapu and others 2000) and food requirements for developing ducklings. Since 1985, all Farm Bills have included conservation compliance (Swampbuster) provisions that restrict wetlands from being drained and converted to cropland. Swampbuster has been effective in reducing wetland loss, but

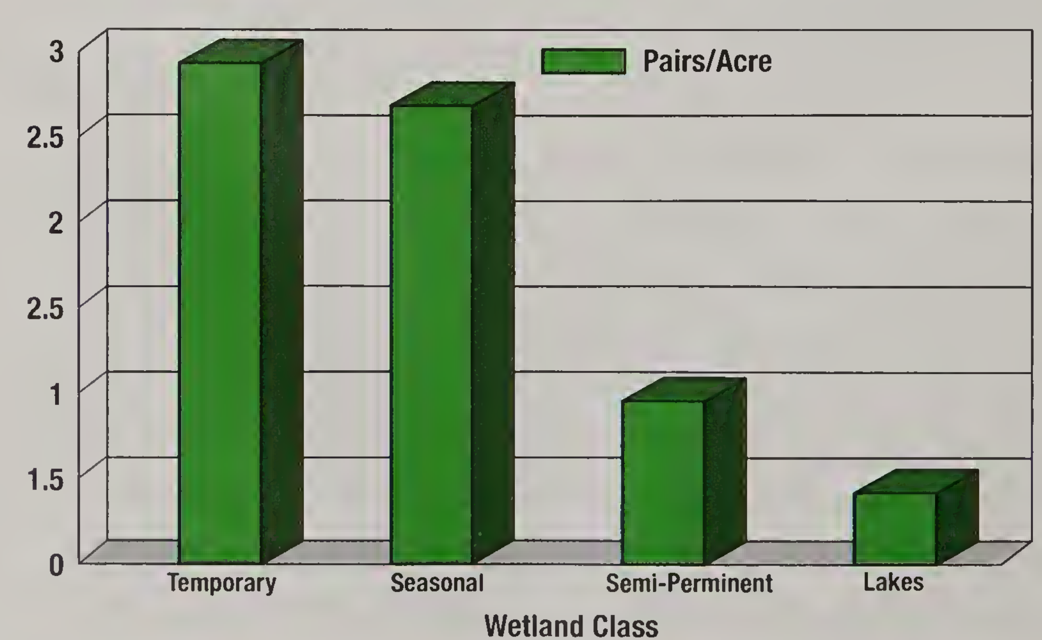


Figure 2. Duck pairs/wet acre (13 species combined) observed on four classes of wetlands in the U.S. Prairie Pothole Region during May 2000–2003.

some farm groups question the need to protect small-shallow wetlands that interfere with tilling and planting. I examined data collected by the U.S. Fish and Wildlife Service (USFWS, Habitat and Population Evaluation Team, Bismarck, ND, unpublished data) during the period 1987–2003 to determine which wetland types attracted the highest amount of use by breeding ducks in the U.S. PPR. The types of wetlands in all land uses that showed the highest use by breeding ducks were temporary and seasonal classes (Figure 2) that averaged only 0.60 and 1.46 acres in area, respectively. Further examination of this data revealed that 63% of all dabbling ducks in the area depend on temporary and seasonal wetlands that are less than 1 acre in area and the majority of these wetlands occur in crop fields.

## Discussion

The PPR of the U.S. is the most important breeding area in the nation for many duck species. The PPR area of the Dakotas makes up about 7% of the traditional waterfowl survey area (Cowardin and Blohm 1992) that is considered the principal breeding range for ducks in North America (Reynolds 1987). During the period 1994–2002, 21% of all breeding ducks from the traditional continental survey area occurred in the PPR of the Dakotas (U.S. Fish and Wildlife Service Administrative Reports 1994–2002). The CRP has been popular with landowners in this area who have enrolled and maintained nearly 5 million acres of land in the program since 1992. Reynolds and others (2001) documented the importance of CRP to duck production and concluded the program has provided widespread landscape level affects. In addition, CRP cover appears to have improved the attractiveness of certain wetlands and increased the carrying capacity of breeding ducks in the region.

Notwithstanding the demonstrated benefits CRP has provided for waterfowl in the PPR, there is concern about the future continuation of these benefits. Nearly 2.5 million acres (>1/2 of the total) of CRP in the PPR is due to expire in 2007 and by 2010 only about 20% of the current CRP acres will remain in active contracts. The CRP will need to be reauthorized prior to contract expiration if benefits to waterfowl are to continue. However, even with reauthorization of the CRP, changes need to be made in the current Environmental Benefit Index (EBI) (used to determine which CRP contracts are accepted by USDA) if waterfowl are considered a conservation priority. The EBI has changed considerably since sign-ups in 1997–2000 when most of the CRP in the PPR was contracted. EBI criteria for earlier sign-ups included points for offers in the PPR National Conservation Priority Area, proximity to wetlands, proximity to protected areas such as National Wildlife Refuge System Waterfowl Production Areas, and upland to wetland ratios that allowed enrollment of entire fields with numerous pothole wetlands. The most recent sign-ups emphasized criteria such as riparian buffers, shelterbelts, grass waterways, contour grass strips, wetland buffers, and filter strips (USDA, Farm Service Agency 2004). While these later criteria may result in plantings that provide certain conservation benefits, they are unlikely to be compatible with the habitat needs of prairie ducks. Idle grass plantings with these configurations are similar to road rights-of-way and other fragmented habitats described by Cowardin and others (1988) that are attractive to nesting ducks, but have been characterized by low nest success due to excessive predation (Klett and others 1988, Reynolds and others 2001). Conversely, landscapes that have been shown to be associated with high duck productivity include large blocks (e.g., ≥32 ha) of CRP associated with other CRP or perennial grasslands in close proximity to wetland complexes that support moderate to high densities of breeding duck pairs. Whole field enrollments in CRP cover will be needed to meet the nesting habitat requirements of upland nesting ducks.

As a result of EBI changes in later sign-ups, only 12% (50,954 acres) of 428,470 acres of CRP offered from the Dakotas were accepted during the most recent general sign-up (signup 26) (USDA, Farm Services Agency news release (2004). This is in contrast to the national CRP acceptance rate of 48%. If waterfowl are intended to be a priority wildlife group for a future CRP, practices popular with landowners in the PPR will need to be emphasized (Table 1). Also, the USDA should consider using available biological data to maximize the waterfowl benefits from the program. The USFWS Habitat and Population Evaluation Teams in Bismarck, North Dakota, and Fergus Falls, Minnesota, have developed spatially explicit models and used Geographic Information System technology to create maps that can be used to target programs such as CRP to achieve the greatest waterfowl production results (e.g., Reynolds and others 1996). Maps developed from these models can be made available for the entire PPR.

Table 1. Percent distribution of Conservation Reserve Program (CRP) by practice category for states that make up the majority of the U.S. Prairie Pothole Region[a].

| CRP practice | Percentage of total CRP in the north-central Plains |
|---|---|
| CP-1: Introduced grasses | 16.5% |
| CP-2: Native grasses | 12.6% |
| CP-4: Wildlife habitat | 10.4% |
| CP-10: Established grasses | 35.1% |
| CP-23: Wetland restoration | 15.0% |
| All other practices combined | 8.4% |

[a] Includes North Dakota, South Dakota, Montana, and Minnesota.

## Conclusions

In summary, the CRP has resulted in significantly increased duck productivity from the most important duck breeding area in North America. Ducks produced in the PPR migrate to virtually every state, province, and territory in North America, Mexico, and several countries in South America. Waterfowl hunters and observers nationwide have been the beneficiaries of the CRP. In order to maintain duck production levels in the PPR, at least 5 million acres of CRP will need to be targeted toward areas of moderate to high duck density. To maximize duck production and meet other migratory bird and upland bird population goals in the region, a total of 8 million acres of CRP cover is recommended (Wildlife Management Institute 2001). Finally, Swampbuster provisions of the Farm Bill must be continued to protect wetlands habitat critical to breeding waterfowl and broods. Waterfowl enthusiasts nationwide will be looking forward to continuing the benefits of these landmark conservation initiatives.

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# Impact of the Conservation Reserve Program on Wildlife Conservation in the Midwest

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## Abstract

*Evidence that the Conservation Reserve Program (CRP) created habitat used by grassland birds in the Midwest is unquestionable. Evidence also is accumulating that suggests CRP is used by a variety of other terrestrial wildlife species. Reproductive and population-level benefits have been demonstrated for some, but not all, avian species; evidence for other terrestrial wildlife is lacking. Wildlife response to CRP is a multiscale phenomenon dependent upon vegetation structure and composition within the planting, practice-level factors such as size and shape, and its landscape context, as well as temporal factors. Thus, the benefits of CRP and the impacts of recent programmatic changes are location- and species-specific. Overall, CRP habitat in the Midwest likely contributes to the population stability and growth of many, but not all, grassland wildlife species.*

## Introduction

Since its inception in 1985, the Conservation Reserve Program has influenced wildlife conservation in the United States. With each reauthorization of farm policy legislation (in 1990, 1996, 2002), CRP has expanded in terms of acreage and the emphasis given to providing wildlife habitat. The 2002 Farm Bill added additional practices (e.g., CP29 wildlife habitat buffer) and management options for landowners, including managed haying and grazing, managed harvesting of biomass, and installation of wind turbines on CRP fields (USDA 2003). These changes will affect the potential of CRP to provide wildlife habitat.

As of January 2005, nearly 7.7 million acres were enrolled in the CRP in 8 midwestern states (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin). The majority of these acres (80%) were enrolled through the competitive general signup, and 4.4 million acres (58%) are whole fields planted to grass. Although new land is expected to be brought into the CRP between 2003 and 2007, many new contracts are likely to be focused on forests, wetlands, and linear buffers, thereby altering the benefits for some species (Riley 2004). Many of the existing contracts are set to expire between 2007 and 2009. Contracts on 34% of existing acreage in the Midwest will expire by the end of 2007, with another 30% expiring over the following 2 years (USDA 2005). The future of these acres and the wildlife benefits they provide is uncertain.

Ryan (2000) reviewed existing knowledge on avian response to grassland CRP plantings (CP1, CP2, CP10) in the Midwest. We build upon that knowledge by emphasizing recently published information on birds (since 1999), as well as presenting available information on other terrestrial wildlife (i.e., mammals, reptiles, amphibians, and invertebrates). Discussion is focused on whole field grass plantings in the tallgrass prairie region (states mentioned above), but studies undertaken outside the Midwest are reviewed when the species of concern occur there.

## Wildlife and the CRP in the Midwest

Among the intended objectives of the CRP was an increase in total habitat available for wildlife, especially grassland birds. The implicit assumption underlying this objective was that availability of grasslands was limiting populations of many species of birds. By establishing new grass plantings, it was expected that birds would occupy those fields and successfully reproduce, thereby augmenting their populations. The decline of grassland bird populations over the last half of the 20th century has been well documented by the efforts of the Breeding Bird Survey (BBS) (Sauer et al. 1996). Unfortunately, no other continent-wide survey exists to maintain data on other vertebrate groups. Still, it was widely assumed that the establishment of CRP plantings would positively affect grassland wildlife populations (e.g., Berner 1988). However, wildlife response to changes in land use is species-specific, depending on life-history requirements. Also, wildlife habitat selection and use is a multiscale phenomenon (e.g., Best et al. 2001, Gehring and Swihart 2004). Response to implementation of a particular CRP practice is dependent upon vegetation structure and composition within the planting, practice-level factors (e.g., size, shape), and its landscape context, as well as temporal factors (e.g., succession).

Ryan (2000) identified 6 levels of evidence of a positive impact on conservation of wildlife in the Midwest, from weakest to strongest, that should be investigated:

1) Evidence of use (occupancy) of CRP fields;
2) Evidence of high abundance in CRP relative to alternative vegetation types, especially cropfields that were replaced by CRP;
3) Evidence of nesting in CRP and comparison with alternative vegetation types;
4) Evidence of high reproductive success relative to alternative vegetation types;
5) Evidence of reproductive success and survival in CRP fields sufficient for positive population growth (i.e., $\lambda > 1.0$); and
6) Evidence of positive population growth (or reduced decline) after initiation of the CRP.

## Evidence of Wildlife Use of CRP Fields

*Birds*

There is overwhelming evidence that CRP plantings were used by a variety of bird species. In their review of the literature, Ryan et al. (1998) listed 92 species of birds, including 53 songbirds (Order Passeriformes), that had been observed using CRP plantings in the central U.S. Recent research has added only 1 species to that list; Evrard (2000) noted 3 rough-legged hawks (*Buteo lagopus*) hunting CRP fields in Wisconsin. In the most extensive study of songbird use of CRP in the Midwest, Best et al. (1997) observed over 60 species of birds using CRP habitats during the breeding season. Similarly, Best et al. (1998) recorded over 40 bird species using CRP grasslands as winter-feeding or roosting habitat. Interestingly, the total number of bird species observed in CRP plantings by Best et al. (1997, 1998) did not differ markedly from the number of species they observed in nearby row-crop fields.

Pheasant in a CRP field in Iowa. (USDA-NRCS)

Several studies have investigated the impact of field-level (e.g., age, field size) and within-field (e.g., planting mix) factors on avian use of CRP. Eggebo et al. (2003) observed more crowing ring-necked pheasants (*Phasianus colchicus*) in old cool-season CRP fields than in any other age or cover type in South Dakota. Horn et al. (2002) found field size to be an important factor influencing the occurrence and/or abundance of grassland songbirds in switchgrass (*Panicum virgatum*) plantings in Iowa. Swanson et al. (1999) evaluated avian use of CRP (CP1, CP2, and CP10) fields in Ohio as a function of vegetation, physical, and disturbance characteristics. Age and field size were not related to species richness, but the grassland area of the field plus surrounding areas was related to use by several grassland-dependent species. All species were more abundant in CRP fields contiguous with other grassland.

In Missouri, species richness, abundance, and nesting success of grassland birds during the breeding season and total bird use in the winter did not differ between introduced grasses with legumes (CP1) and native grasses (CP2) (McCoy et al. 2001). In contrast, Morris (2000) observed grassland birds using CP2 fields, but not CP1, in winter in southern Wisconsin. Hull et al. (1996) examined the relationship between avian abundance and forb abundance in native-grass CRP fields in Northeast Kansas. The expected significant relationship was not found, but no field had >24% forbs, which the authors surmised was too low to produce a response. Murray and Best (2003) found that species richness did not differ between harvest treatments in Iowa switchgrass fields; species preferring taller vegetation were replaced by species preferring shorter vegetation in the harvested treatments. The abundances of 16 of 18 species did not differ with treatment. Sedge wrens (*Cistothorus platensis*) were more abundant in non-harvested than totally harvested fields, while grasshopper sparrow (*Ammodramus savannarum)* abundances differed in all treatments (total > strip > non-harvested). Svedarsky et al. (2000) noted the potential of CRP to provide greater prairie-chicken (*Tympanuchus cupido pinnatus*) habitat if it was managed to maintain grass vigor and reduce woody invasion and litter buildup.

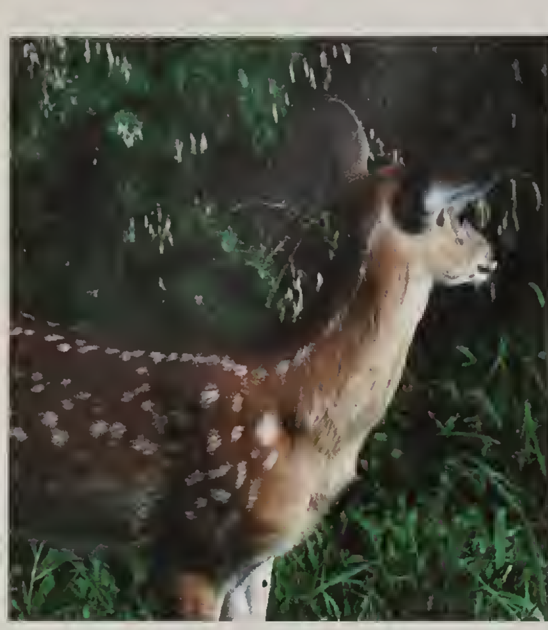
Recent studies also have examined the effect of a CRP field's landscape context on avian use. Merrill et al. (1999) compared landscapes (1.6-km radius) surrounding greater prairie-chicken leks to random non-lek points and found greater amounts of CRP in the landscape for leks. Toepfer (1988) documented nesting in Minnesota CRP, but success was lower in CRP than in native grasslands (J. Toepfer, unpublished data [in Merrill et al. 1999]). The shape of grassland and woodland patches was significant but had low predictive power for comparisons between temporary and traditional leks. Merrill et al. (1999) believed CRP might be important, especially near temporary lek sites. Svedarsky et al. (2000) recommended that 30% of the grassland surrounding greater prairie-chicken leks be managed to provide spring nesting cover and be in close proximity to brood cover to maintain populations.

Best et al. (2001) investigated the effect of landscape context, including proportion in CRP, on avian use of row-crop fields in Iowa. Some species showed a strong response to landscape composition (including dickcissel [*Spiza americana*] and indigo bunting [*Passerina cyanea*]), while others did not (e.g., American robin [*Turdus migratorius*], American goldfinch [*Carduelis tristis*], and killdeer [*Charadrius vociferus*]). Seven species differed significantly between landscapes—for these the lowest numbers in crop fields occurred in areas of intensive agriculture. Species with different habitat affinities (grass or wood) showed similar aversion to row crop. Grassland birds occurred more often in landscapes with more grass (block or strip). Generalists, crop specialists, and aerial foragers were not affected by landscape composition.

In contrast to these studies, Hughes et al. (2000) found that mourning dove (*Zenaida macroura*) daily survival rate was influenced by vegetation structure within the field, but not field edge or landscape (800-m) factors. Landscape effects were thought to be lacking due to the generalist nature of doves. For ring-necked pheasants in northwestern Kansas, the amount of CRP in areas where home ranges were located had no detectable effect on size of home ranges (Applegate et al. 2002). Females tended to have smaller home ranges (average of 127 ha) in high-density (25%) CRP sites than in low-density (8% to 11%) CRP sites (average 155 ha), but males showed the reverse trend. Horn et al. (2002) also found no effect of landscape on the relations between avian occurrence, abundance, and field size. They noted that the literature is contradictory concerning landscape effects on area sensitivity. Horn et al. (2002) reported that the amount of woodland cover, ranges in field sizes among landscapes, and amounts of shrub and forb cover within CRP fields may have confounded any relationship with landscape composition.

### *Mammals*

Information on mammalian use of CRP fields is scarce. The majority of available evidence comes from surveys of small mammals, either to assess wildlife habitat quality or estimate the potential to contribute to crop depredation. Eight species of small mammals were captured on CRP fields planted to exotic grasses (CP1) in Michigan (L. T. Furrow, H. Campa, III , S. R. Winterstein, K. F. Millenbah, R. B. Minnis, and A. J. Pearks, unpublished data). Deer mice and white-footed mice (*Peromyscus spp.*) dominated younger fields, and meadow voles (*Microtus pennsylvanicus*) dominated older (≥2 years) fields. *Peromyscus* numbers were positively correlated with bare ground and forb canopy cover, and voles were positively correlated with litter depth. Fields ≤2 years old had a greater diversity of small mammalian species than older fields, while relative abundance increased with age. Millenbah (1993) reported greater insect abundance on 1–2-year-old fields, which may have contributed to greater small mammal diversity on these age classes. Hall and Willig (1994) captured 10 rodent species on CRP in Northwest Texas, including deer mice and white-footed mice. No significant differences in mammalian diversity were detected among sites, and diversity was not correlated with heterogeneity of vegetation or site age. However, species composition was significantly different among all sites in each season. In a crop-depredation study in Nebraska, Hygnstrom et al. (1996) trapped small mammals in a 9-year-old, 64-ha field planted to brome. Trapped species included (in decreasing order) deer mouse (*Peromyscus maniculatus*), short-tailed shrew (*Blarina brevicauda*), least shrew (*Cryptotis parva*), and meadow jumping mouse (*Zapus hudsonicus*). No voles were captured, although they were observed the preceding season. Meadow voles constituted 95% of captures in Wisconsin (Evrard 2000).



White-tailed deer fawn in Iowa. (L. Betts, USDA-NRCS)

Few studies have directly measured use of CRP by midsized and large mammals. Furrow (1994) noted a decreasing trend in mammal detections at scent stations with increasing age of the CRP field. The decreasing trend was attributed to decreases in ease of movement and prey diversity. From most to least abundant, the 6 species were recorded were raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), marmot (*Marmota monax*), domestic cat, domestic dog, and Virginia opossum (*Didelphis virginiana*). Raccoons were the most abundant detections across field ages in most months sampled, and skunks also were recorded in almost every month. In Northwest Texas, Kamler et al. (2003) reported that both adult and juvenile swift fox (*Vulpes velox*) strongly avoided CRP fields. Whereas CRP comprised 13% and 15% of the available habitat for each age class, respectively, only 1 of 1,204 locations was recorded in a CRP field. Kamler et al. (2003) believed this was due to the taller, denser vegetation of introduced warm-season grass plantings compared to the native shortgrass prairie preferred by swift foxes. A study of white-tailed deer (*Odocoileus virginianus*) habitat use in South Dakota revealed that CRP fields were used proportionately greater than habitat availability during periods of deer activity in the spring, and during evening and midnight periods during summer (Gould and Jenkins 1993). Increased use of CRP between spring and summer corresponded with rapid vegetation growth and fawning.

Other, more anecdotal information exists for mammalian use of CRP. Hughes et al. (2000) listed potential nest predators at their sites in Kansas including coyotes (*Canis latrans*), raccoons, striped skunks, opossums, feral cats, and badgers (*Taxidea taxus*). Evrard (2000) attributed duck nest predation to mammalian predators, including red fox (*Vulpes vulpes*), striped skunk, and raccoon, though hard evidence was lacking. Other mammalian species incidentally noted in CRP included white-tailed jackrabbits (*Lepus townsendii*), white-tailed deer fawns, and a coyote den with 3 pups (Evrard 2000).

### *Other Wildlife*

Other terrestrial wildlife studied or observed in CRP plantings included invertebrates and snakes. Most studies of invertebrates in CRP have been conducted relative to crop pests or avian food supplies. Carroll et al. (1993) assessed CRP grasses (native and exotic) to be marginal overwintering habitat for boll weevils (*Coleoptera: Curculionidae*) in Texas.

Alternatively, Phillips et al. (1991) detected a low incidence of cotton pests and found beneficial predator species in Texas CRP. Also in Northwest Texas, McIntyre and Thompson (2003) reported that CRP supported avian prey and that CRP types were similar in abundances (i.e., no support that different types of CRP possess different prey availabilities for grassland birds). Millenbah (1993) measured greater insect abundance on 1–2-year-old CRP fields than fields ≥3 years old in Michigan. In Northeast Kansas, data collected by Hull et al. (1996) did not support the hypothesis that invertebrate biomass was correlated positively with forb abundance (but see Burger et al. 1993). McIntyre (2003) surveyed 4 planting types and 1 native prairie in the Texas panhandle for endangered Texas horned lizards (*Phrynosoma cornutum*) and their food supply, harvester ants (*Pogonomyrmex spp.*). Ant nest densities varied within the classes but not between, suggesting that planting type (exotic vs. native) did not affect habitat value. Lizards also were seen on all types of CRP, but only at sites with ant nests. Davison and Bollinger (2000) identified 4 species of snakes common on their study sites in east-central Illinois, including prairie kingsnake (*Lampropeltis calligaster*), common garter snake (*Thamnophis sirtalis*), black rat snake (*Elaphe obsoleta obsoleta*), and blue racer (*Coluber constrictor*). Hughes et al. (2000) listed bullsnakes (*Pituophis melanoleucus*) as a potential nest predator in Kansas CRP fields.

## Evidence of High Wildlife Abundance in CRP Fields

### *Birds*

Best et al. (1997) compared avian abundance in paired CRP and row-crop fields in 6 midwestern states (Indiana, Michigan, Iowa, Missouri, Nebraska, and Kansas) in the early 1990s. Best et al. (1997) detected from 1.4 to 10.5 times more birds in CRP grasslands than in row-crop fields during the breeding season. Similarly, King and Savidge (1995) reported avian abundance to be 4 times greater in CRP fields than in cropfields in Nebraska. Best et al. (1997) further reported 16 species of birds that were unique or substantially more abundant in CRP fields than in nearby row-crop fields. Three of the 4 bird species they frequently observed in CRP (dickcissels, grasshopper sparrows, and bobolinks [*Dolichonyx oryzivorus*]) have been undergoing significant population declines. Additionally, Henslow's sparrow (*Ammodramus henslowii*) and sedge wren, species of high conservation concern in the Midwest (Herkert et al. 1996), occurred only in CRP fields. Of the 5 species unique or substantially more abundant in row crops than in CRP fields (Best et al. 1997), only the lark sparrow (*Chondestes grammacus*) is of moderate conservation concern (Herkert et al. 1996).

Direct comparisons of avian abundance in CRP and alternative grassland vegetation have been rare. Klute and Robel (1997) documented higher abundances of dickcissels, grasshopper sparrows, meadowlarks (*Sturnella spp.*), and upland sandpipers (*Bartramia longicauda*) in grazed pastures versus CRP plantings in Kansas. Summer observations of pheasants in western Kansas analyzed by Rodgers (1999) showed that pheasants used CRP fields more than their availability in northwestern Kansas, but not in southwestern Kansas where shorter grass plantings may not provide better habitat than cropland. Pheasant indices in Wisconsin CRP fields were 10-fold higher than in surrounding private farmland (Evrard 2000). Morris (2000) compared winter use by grassland birds of CRP, crop fields, pastures, and restored and native prairies. In this study, species diversity was highest in crop fields, followed by restored prairie, CP2 fields (a mixture of native warm-season grasses and 2 forbs), native prairie remnants, and pastures, while avian abundance was highest in pastures, followed by restored prairie, CP2, crop fields, and native prairie. No species were observed using CP1 fields (a mixture of introduced grasses and legumes) in this study. Avian abundance in crop fields and native prairie was higher during periods of incomplete snow cover than during periods with 100% snow cover, while the reverse was true for restored prairie and CP2 sites.

During the winter months, ring-necked pheasants, northern bobwhites (*Colinus virginianus*), American tree sparrows (*Spizella arborea*), dark-eyed juncoes (*Junco hyemalis*), and American goldfinches were the most abundant or widely distributed species observed in CRP fields (Best et al. 1998). All species but the goldfinch have been undergoing long-term population declines (Sauer et al. 1996). In a separate study, Burger et al. (1994) provided evidence that CRP plantings in Missouri provided important winter cover for northern bobwhites. They documented that 69% of nighttime roosts occurred in CRP fields in an area where CRP made up only 15% of the landscape. Rodgers (1999) used dropping counts to compare winter pheasant use of weedy wheat stubble and CRP in north-central Kansas. Despite offering comparable concealment, dropping density was 2.75 times greater in wheat stubble than CRP. Dropping data suggested that pheasants were using CRP for nighttime roosting. CRP may be less valuable to pheasants in winter due to fewer food sources, excessive litter, and less rigid stems.

### *Mammals*

Comparison of mammal use of CRP relative to other vegetation types has been rare. A 3-phase, winter wheat (*Triticum aestivum*) rotation in southeastern Wyoming had higher rodent abundance and diversity than CRP at both sites in both years (Olsen and Brewer 2003). Evrard (2000) reported a catch/effort ratio for small mammals in Wisconsin of 19.37, much higher than Evrard (1993 [in Evrard 2000]) reported for Waterfowl Production Area (WPA) grasslands (6.8). Hall and Willig (1994) found that CRP grasslands simulated shortgrass prairies of Northwest Texas in species diversity but not in species composition, suggesting that CRP was not mimicking natural conditions. Of the 11 species captured in the study, only the southern plains woodrat (*Neotoma micropus*) was not captured on CRP. White-tailed deer in southeastern Montana used CRP in greater proportion than its availability in all seasons except fall (Selting and Irby 1997).

### *Other Wildlife*

Direct comparisons of other wildlife abundance in CRP and alternative vegetation types have been extremely rare. McIntyre and Thompson (2003) sampled invertebrates with pitfall traps in 4 CRP field types in Northwest Texas and compared trap results with those of a shortgrass prairie. CRP field types had less vegetative diversity and lower arthropod diversity than prairie, but CRP fields did support avian prey groups. McIntyre (2003) found fewer harvester ant mounds on CRP plantings than on indigenous grasslands, but no significant differences between exotic and native CRP plantings.

## Evidence of Nesting or Other Reproductive Behaviors in CRP Fields

### *Birds*

CRP plantings have been extensively used for nesting by grassland birds in the Midwest. Murray and Best (2003) found 20 species nesting in switchgrass CRP fields in 1999 and 2000 in Iowa; red-winged blackbirds (*Agelaius phoeniceus*) comprised 56% of the sample. Best et al. (1997) located 1,638 nests of 33 bird species in CRP fields versus only 114 nests of 10 species in a similar area of row crops. In row-crop areas, they most frequently detected red-winged blackbird, vesper sparrow (*Pooecetes gramineus*), and horned lark (*Eremophila alpestris*) nests. Nests of red-winged blackbirds, dickcissels, and grasshopper sparrows were the most frequently located in CRP fields by Best et al. (1997). Similar lists of species nesting in CRP have been produced by recent studies (Davison and Bollinger 2000, McCoy et al. 2001). House sparrow (*Passer domesticus*) was the most common avian species nesting in CRP fields in Northeast Kansas (Hughes et al. 1999). CRP also appears to be important nesting habitat for mourning doves in Kansas (Hughes et al. 2000). In Wisconsin, ring-necked pheasant, gray partridge (*Perdix perdix*), northern harrier (*Circus cyaneus*), short-eared owl (*Asio flammeus*), and duck nests have been reported (Evrard 2000). In Northwest Texas, Berthelsen et al. (1990) found approximately 6 pheasant nests per 10 acres of CRP land, but no nests in cornfields. In Missouri, 55% of northern bobwhite nests and 46% of brood foraging locations occurred in CRP fields that constituted only 15% of the largely agricultural landscape (Burger et al. 1994).

### *Mammals*

Evidence of reproductive activity by mammals is rare. Some of this is likely due to incomplete reporting as none of the small mammal papers reviewed mentioned the incidence of pregnant female mice, though this has been recorded in grass filter strips (CP21) in Missouri (D. T. Farrand, unpublished data). The only direct reproductive evidence found was reported by Evrard (2000), who observed a coyote den with 3 pups at 1 site. Indirectly, Gould and Jenkins (1993) concluded that CRP fields were important in South Dakota for female white-tailed deer during fawn-rearing, particularly at night.

### *Other Wildlife*

None of the papers reviewed reported reproductive activity of other terrestrial wildlife species. Although it can be assumed that most semi-aquatic species (e.g., toads) do not use grasslands for reproduction, some reptiles and many invertebrates likely do.

## Evidence of High Reproductive Success Relative to Alternative Vegetation Types

### *Birds*

Nest success of birds breeding in CRP fields has been equal to or greater than that reported for alternative agricultural types. Apparent nest success for 1,526 nests monitored in CRP fields by Best et al. (1997) was 40% versus 36% for 113 nests monitored in row-crop fields. Using a subset of the data from Best et al. (1997), Patterson and Best (1996) reported apparent nest success of 38% in CRP fields and 32% in row-crop fields in Iowa. McCoy (1996), using the Missouri subset of the Best et al. (1997) data, reported significantly higher Mayfield nest success in CRP fields versus row-crop fields in 2 of 3 years (1993: CRP = 45%, row crop = 12%; 1995: CRP = 46%, row crop = 9%; 1994: CRP = 43%, row crop = 53%).

Pheasant population indices and Mayfield estimates for blue-winged teal (*Anas discors*) and mallards (*A. platyrhynchos*) in CRP did not differ from fields in WPA in Wisconsin (Evrard 2000). McCoy et al. (1999) noted that reproductive success of grasshopper sparrows, field sparrows (*Spizella pusilla*), dickcissels, American goldfinches, and common yellowthroats (*Geothlypis trichas*) breeding in CRP fields in Missouri was similar to or higher than that reported from alternative grasslands in a variety of prior studies. Klute et al. (1997) compared Mayfield nest success of 7 species breeding in CRP fields and pastures in Kansas. They detected no differences; however, sample sizes of nests were very small. Granfors et al. (1996) reported Mayfield nest survival for eastern meadowlarks (*Sturnella magna*) in CRP and grazed grasslands in Kansas. Nest success in CRP and grazed grass did not differ (1990: CRP = 17%, grazed = 25%; 1991: CRP = 10%, grazed = 20%), but they noted the low power of their statistical tests. Gransfors et al. (1996) also reported no difference in the mean number of nestlings fledged, for radiomarked females occupying CRP and grazed fields (CRP = 1.9 fledged/female, grazed = 0.7).

Recently published studies have compared reproductive success among CRP planting types and management regimes. McCoy et al. (2001) found that species-specific Mayfield nest success often differed between CP1 and CP2 within years, and the better type switched between years in several cases. However, means differed only for red-winged blackbirds. Parasitism rates did not differ between conservation practices (CPs) for any species, but varied with host species (mean = 18%, range = 0–40%). More pheasant broods were recorded in old cool-season than in warm-season CRP fields in South Dakota (Eggebo et al. 2003). Murray and Best (2003) found that non-harvested switchgrass fields had higher nest success and lower predation than strip-harvested or total-harvested fields. Failure due to brood parasitism did not differ between treatments. Grasshopper sparrow nest success in total-harvested fields (48%) was similar to that reported for Missouri by McCoy et al. (2001) (49% in warm-season and 42% in cool-season plantings). However it was higher than that reported for cool-season grass plantings in Iowa (Patterson and Best 1996). Common yellowthroat daily survival rate did not differ between treatments, and nest success was higher (41%) than reported in Missouri (McCoy et al. 2001; 32% in warm-season and 21% in cool-season plantings).

### *Mammals and Other Wildlife*

We found no published data on reproductive success of mammals, reptiles, amphibians, or invertebrates relative to other vegetation types.

## Evidence of Reproductive Success or Survival Adequate for Positive Population Growth

### *Birds*

We found no published data on survival of adult or post-fledging juvenile birds in CRP. Few studies have examined fecundity in CRP; most research examined nest success (defined as ≥1 nestling fledged per nest) and implicitly assumed nest survival is the limiting factor in population growth. Duck species are the best studied in terms of reproduction. In Wisconsin, Mayfield nest success for blue-winged teal and mallards in CRP fields was above the level needed for population stability, but duck production was lower in CRP fields due to lower estimated nest densities (Evrard 2000).

McCoy et al. (1999) quantified seasonal fecundity for 8 grassland bird species breeding in CRP fields in Missouri and assessed whether it was adequate to offset annual mortality (i.e., achieve $\lambda > 1.0$). They concluded that CRP fields were of sufficient quality for 4 species (grasshopper sparrow, field sparrow, eastern meadowlark, and American goldfinch) to produce young in excess of that needed to maintain stable populations. Common yellowthroat reproductive success in CRP fields varied substantially among years, with output being in excess of that needed for maintenance of a stable population in only 1 of 3 years (McCoy et al. 1999). Fecundity of dickcissels and nesting success and fecundity of red-winged blackbirds were higher on CP2 than on CP1 habitat, but both CPs were likely sinks ($\lambda < 1$) for these species. Both CPs were likely source (>1) habitat for grasshopper sparrows, whereas only CP1 fields were likely a source for eastern meadowlarks and American goldfinches (McCoy et al. 2001).

Murray and Best (2003) found that nest success rates of grasshopper sparrows in total-harvested fields and common yellowthroats in all management treatments were similar to those reported for switchgrass fields by other studies, and thought they might be sufficient to maintain stable populations. Mourning dove apparent nest success averaged 56% ($n = 90$) in CRP fields in Kansas (Hughes et al. 2000), among the highest estimates they found in the literature. Although Hughes et al. (2000) postulated that CRP may be a source habitat for increasing populations of doves in the Great Plains, they made no attempt to calculate the source–sink status of CRP fields they studied.

Recently published studies of dickcissels nesting in CRP found nest success rates within the range of those summarized by McCoy et al. (1999). On 11 CRP fields in Northeast Kansas, Hughes et al. (1999) located 186 dickcissel nests, of which 13.2% were successful in 1994 and 14.9% were successful in 1995. Davison and Bollinger (2000) reported apparent nesting success in east-central Illinois averaging 39% over the entire nesting cycle and 59% during approximately 12 days of incubation. Robel et al. (2003) observed natural dickcissel nests in 5–6-year-old CRP fields in northeastern Kansas planted to native warm-season grasses. Of 97 nests, 68 (70%) were lost to predation or abandonment. A daily survival rate of 0.92 was calculated using the Mayfield method. Maddox and Bollinger (2000) observed male dickcissels feeding nestlings in Illinois CRP fields in 1997 but not in 1998. This extremely rare behavior was postulated to be a response to low food supplies.

Patterson and Best (1996) reported apparent nest success of ring-necked pheasants breeding in Iowa CRP fields as 34%, considerably higher than that reported for alternative agricultural fields studied previously in Iowa (see Ryan et al. 1998 for review). The 34% rate reported by Patterson and Best (1996) exceeded the level of nest success predicted by Hill and Robertson (1988) as necessary to maintain stable populations. However, Warner et al. (1999) reported that chick survival on their study area in Illinois remained low from 1982 to 1996 despite increases in brood habitat provided by CRP.

No direct measures of survival of grassland birds occupying CRP fields for all or significant portions of the annual cycle are available. However, Burger et al. (1995) did not detect a difference in annual survival of northern bobwhites occupying a landscape comprised of 15% CRP fields (5.4%) versus an agricultural area without CRP (5.1%).

### *Mammals and Other Wildlife*

We found no published data on survival or reproductive success of mammals, reptiles, amphibians, or invertebrates relative to other habitats.

## Evidence of Population Growth Related to CRP Fields

### *Birds*

Murphy (2003) examined the impact of changes in agricultural land-use variables on population indices of grassland and shrubland bird species in the eastern and central U.S. from 1980 to 1998. Both groups experienced declines (15 of 25 and 13 of 33 species, respectively), but only the grassland bird group had an average rate significantly less than zero. Declines in grassland bird populations were independent of migratory behavior or nesting ecology. Changes in landscape variables accounted for more of the variation in grassland than shrubland bird population trends. Most of the trends significantly correlated to CRP acreage were negative (7 of 8); only the loggerhead shrike (*Lanius ludovicianus*) was positively correlated with increases in CRP acreage. Of the species negatively correlated with CRP, most (5 of 7) were shrubland species and the others nest in sparse grasslands—a condition CRP does not continually provide without management (e.g., Greenfield et al. 2002, 2003). Lack of positive relationships may be due to the fact that recent areas of CRP expansion tended to be in the eastern U.S. (outside most grassland bird ranges) or the relatively small land area in CRP. CRP comprises only 3.6% of the eastern and central U.S. and may be overwhelmed by other factors (Peterjohn 2003).

Based on Breeding Bird Survey data from Illinois, Herkert (1997) demonstrated a significant positive relationship between the population trend for Henslow's sparrow and the percentage of CRP in a county. Five of 8 counties with ≥3% of the area in CRP had positive population trends for Henslow's sparrow, whereas 8 of 11 counties with <3% CRP had negative trends. Unfortunately, the effect of CRP establishment was not sufficient to reverse the long-term declining trend in Henslow's sparrows in Illinois (Herkert 1997). However, recent reanalysis by Herkert (2004), using BBS data from the last 8 years (1995–2003), has shown that population trends are still positively correlated with CRP enrollments and that Illinois' populations of Henslow's sparrow are now at a 30-year-high level. Herkert (1998) reported a significant change in the slope of the population trend for grasshopper sparrows after the initiation of the CRP. In the 8 years prior to the CRP, 179 (64%) of 278 Breeding Bird Survey routes had negative trends. In the 8 years after, only 149 (54%) of the routes had negative trends. The overall trend prior to CRP initiation was strongly negative, but was essentially level during the CRP years. Herkert (1998) also showed a greater increase in trend slopes in areas with higher CRP acreages (>3.8% of the landscape). However, in the last 8 years (1995–2003) population trends again have become negative and are declining at a rate comparable to pre-CRP conditions (Herkert 2004).

Hughes et al. (2000) reported that mourning dove numbers have increased in the Great Plains region since the mid-1980s when the CRP was initiated. Mueller et al. (2000) quantified the relative effects of Minnesota CRP on abundance and distribution of mourning doves and found dove indices were positively related to CRP abundance.

Haroldson et al. (2004) quantified the relationships between amount of CRP fields in 15 agricultural landscapes in Minnesota and relative abundance of ring-necked pheasants, gray partridge, and meadowlarks in south-central Minnesota over a 10-year CRP enrollment cycle. For each 10% increase of grass in the landscape, pheasant indices averaged 12.4 birds/route higher in spring and 32.9 birds/route higher in summer, and meadowlark indices averaged 11.7 birds/route higher in summer. Partridge indices declined dramatically regardless of amount of grass habitat available. Pheasant populations in Nebraska increased from <2 birds/100 miles of survey route during 1983–1985 to >10 birds/100 miles in 1994 as CRP was established. King and Savidge (1995) reported significantly more pheasant observations in study areas with 18–21% CRP landscape coverage versus areas with 2–3% CRP. In Iowa, Riley (1995) compared pheasant populations in the 5 years immediately prior to CRP initiation with those in the first 5 years after establishment. He recorded a significant increase in mean detections from 37/survey route to 48/route.

Most of the change occurred where CRP was established in landscapes initially comprised of >70% cropland.

Rodgers (1999) used long-term survey data to show that pheasant populations have not responded to increased grassland acreages due to CRP, and deduced that deterioration of abundant wheat stubble fields represented an overwhelming habitat loss in western Kansas for which CRP could not compensate. Additionally, the author postulated that anticipated pheasant benefits from CRP were not fully realized because of inadequate plant diversity, poor stand maintenance, and large field size. Warner et al. (1999) found that ring-necked pheasant chick survival remained low despite increases in grassland and food supplies in central Illinois since the early 1980s. Similarly, Roseberry and David (1994) detected no relationship between northern bobwhite population indices and amounts of CRP in the landscape in Illinois.

### *Mammals and Other Wildlife*

Mueller et al. (2000) quantified the relative effects of Minnesota CRP on abundance and distribution of white-tailed jackrabbits, eastern cottontail rabbits (*Sylvilagus floridanus*), and white-tailed deer. In the 32 counties analyzed, CRP accounted for 91% of the increase in grassland acreage in the post-CRP period (1986–1997) over the pre-CRP period (1974–1985). Cottontail indices were positively related to CRP abundance, whereas jackrabbit indices were negatively related, and deer indices were not influenced. Gould and Jenkins (1993) concluded that CRP enhanced habitat options (improved forage and cover) for white-tailed deer, but would have little population consequences other than influencing harvest mortality by providing escape cover.

Respondents to a survey of landowners in Riley County, Kansas, by Hughes and Gipson (1996) felt that several wildlife species causing damage on their property had become more common due to CRP. White-tailed deer accounted for 64.3% of these observations, followed by wild turkey (*Meleagris gallopavo*), eastern cottontail, striped skunk, and opossum, which accounted for 14.3%, 7.1%, 7.1%, and 7.1% of the damage observations, respectively.

## Conclusions

Significant new information has accumulated on wildlife response to the CRP, especially in terms of terrestrial wildlife use and the population response of grassland and shrubland birds. This information reveals the complex nature of wildlife response to changes in land use; research has come to conflicting conclusions regarding the benefits of CRP across and within species. Some of this is due to differences in methodology (especially true of invertebrate sampling), while some is due to differences in species' response by landscape (e.g., Best et al. 2001) or region (e.g., Morris 2000 vs. McCoy et al. 2001). Much more work needs to be done to understand the causes of this complexity and to fill holes in our understanding of CRP effects, especially in relation to effects on populations of non-avian wildlife.

Wildlife response to CRP is a multiscale phenomenon dependent upon vegetation structure and composition within the planting, practice-level factors (e.g., size, shape), and its landscape context, as well as temporal factors. Thus, changes in the CRP resulting from the 2002 re-authorization (e.g., managed haying and grazing) will impact each species uniquely. We know enough to predict the response of some avian species in some landscapes (e.g., Murray et al. 2003), and as information on additional wildlife species accumulates we will be better able to tailor the program. However, several studies have shown that vegetation conditions outside the CRP may have a bigger impact than CRP on avian populations (e.g., Rodgers 1999, Warner et al. 1999, Murphy 2003), and this may well be true for other wildlife (e.g., Kamler et al. 2003). CRP grasslands are only a small proportion of U.S. land area (Peterjohn 2003), constitute a small amount of total grassland (Herkert 2004), and tend to be implemented in landscapes already characterized by greater diversity (Weber et al. 2002). Thus, CRP's vital importance to wildlife conservation in intensive agricultural areas may need to be augmented by other changes in land management if we are to reach desired conservation goals.

## Remaining Questions

To better evaluate the impact of the CRP on wildlife conservation and to improve the efficiency (i.e., increased conservation benefits per dollar expended) several lines of additional research are needed:

- Direct comparisons of abundance and reproductive success of species breeding in native prairie and CRP grasslands;
- Further evidence of population-level change attributable to the availability of CRP grasslands at regional levels;
- The effects of distribution of CRP plantings in different landscape contexts on avian use and reproductive success in CRP fields (e.g., should CRP contracts be clumped or dispersed in landscapes with high or low amounts of existing grassland?);
- Comprehensive analyses of the impacts of types, frequency, and extent of disturbances (e.g., mowing, burning, grazing) of CRP vegetation on avian abundance and reproductive success; and
- Greater focus on non-avian wildlife response to CRP fields, including nest-predator species.

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# The Conservation Reserve Program in the Southeast: Issues Affecting Wildlife Habitat Value

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## Abstract

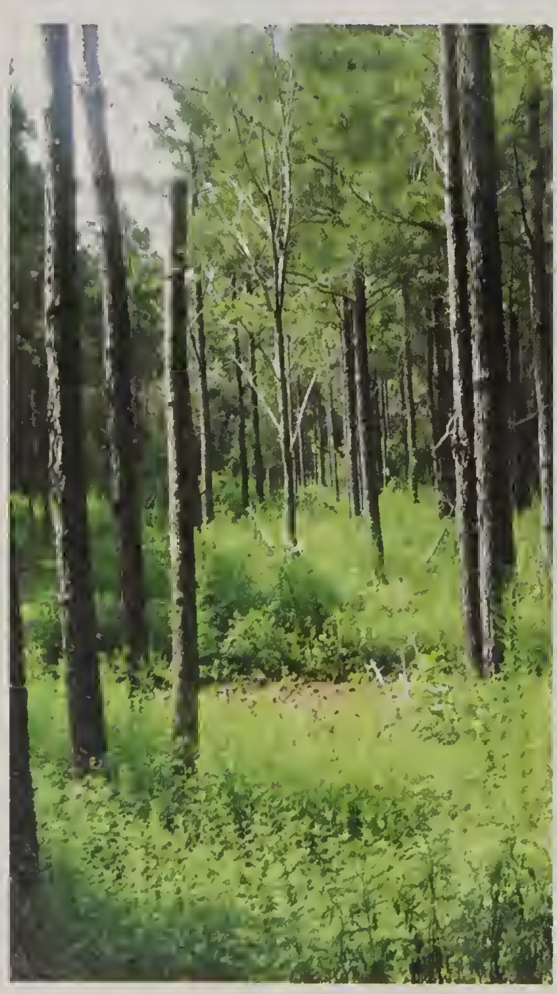
*Provision of wildlife habitat is one of the statuary objectives of the Conservation Preserve Program (CRP); however, the realized wildlife habitat benefits vary regionally in relation to specific cover crop, age, and management regimes. As of February 2005, 1,324,066 ha were enrolled in the CRP in 12 southeastern states. Approximately 57% of southeastern CRP was in 1 of 3 tree cover practices (CP3 new pine, CP3a new hardwood, or CP11 existing trees); 19% as CP10 existing grass (much of which was reenrolled CP1); 4% as CP1 cool-season grass; 3% in CP2 native warm-season grasses; and 12% in continuous-signup buffer practices. Targeted conservation practices resulted in enrollment of 75,014 ha of longleaf pine within the longleaf practice and 2,850 ha of hardwoods in the continuous bottomland hardwood practice. Plant communities on CRP fields are not static, but change over time. In the southeastern United States, natural succession progresses rapidly because of fertile soils, long growing seasons, and substantial rainfall. As such, the specific wildlife species that occur on CRP stands will vary over the life of the contract. Wildlife populations at a given point in time will be a function of conservation practice, age of the stand, establishment methods, and mid-contract management regimes. Provision and maintenance of wildlife habitat on CRP fields in the South requires active management. Planned disturbance (disking or fire) should be incorporated into the conservation plan of operation for all grass plantings in the Southeast. Exotic forage grasses may need to be eradicated to accrue substantive wildlife benefits. Tree plantings also require active management. Most pine CP11 plantings are now 15–17 years old and are characterized by closed canopies with dense litter accumulation and little herbaceous ground cover. Thinning, selective herbicide, and prescribed fire would enhance the habitat value of these stands. The CRP has had substantial impact on land use and landscape composition in the Southeast. However, the wildlife habitat value of fields enrolled in the CRP*

*in the Southeast has been diminished by selection of cover practices with short duration or minimal habitat value (i.e., CP1, CP1 reenrolled as CP10, CP3, CP11). Proactive management of extant CRP acreage and selective enrollment of high-value cover practices (e.g. longleaf pine) will be required to achieve the types of wildlife habitat benefits associated with the CRP in other regions.*

## Introduction

The Conservation Reserve Program (CRP) was established under the Food Security Act of 1985 with the purpose of assisting owners and operators of agricultural land in conserving and improving soil, water, and wildlife resources. In 1996, Congress reauthorized the CRP with an acreage limit of 36.4 million acres. The 2002 Farm Act increased the enrollment limit to 39 million acres. Environmental goals of the CRP were expanded under the 1990 and 1996 Farm Bills, and the 2002 Farm Act included wildlife habitat as a CRP objective, explicitly requiring an equitable balance among conservation purposes of soil erosion control, water-quality protection, and wildlife habitat. Several specific programmatic changes designed to promote targeted enrollment have occurred since 2000 (USDA 2004a). In 2000, starting with continuous signup 22, signup enhancements including an up-front signup incentive payment, a 40% practice incentive payment, increased maintenance payments, and updated marginal pastureland rental rates were added to some Continuous CRP (CCRP) practices. In 2003, new marginal pastureland eligibility provisions were implemented under CCRP that allowed non-tree covers to be established under the wetland buffers (CP30) and wildlife habitat (CP29) practices (USDA 2003a). Additionally, in 2003 the bottomland hardwood tree initiative was adopted under CCRP CP31. In 2004, cost-share was permitted for selected mid-contract management practices (USDA 2003a). State technical committees were responsible for recommending a list of contract management activities that would enhance the CRP cover for the duration of the contract period (USDA 2003b). Also in 2004, a pilot program was established to allow enrollment of herbaceous crop land buffers under CCRP CP33 Habitat Buffers for Upland Wildlife. Under this practice, 250,000 acres were allocated for establishment of 30–120-foot field borders in 35 states within the range of the northern bobwhite (*Colinus virginianus*) (USDA 2004b). Starting with general CRP signup 15 in 1997, wildlife habitat was given co-equal status with water quality and soil erosion (USDA 2004a). The Environmental Benefits Index (EBI) for signup 15 was modified to selectively encourage practices with greater wildlife value. From 1998 to 2005, EBIs for subsequent general signups (16, 18, 20, 26, 29) were modified to reflect knowledge gained in previous signups and enhance ease of application.

CP11 stand, thinned, herbicided with Arsenal, and prescribe burned. Use of mid-contract management practices can produce a pine-grassland structure in CP11 stands, substantially enhancing wildlife habitat. (Wes Burger)



Insofar as provision of wildlife habitat is one of the statuary objectives of CRP, broad benefits through creation and enhancement of wildlife habitat might be an expected outcome of this program. However, the realized wildlife habitat benefits of the CRP vary considerably regionally and within region in relation to specific cover crop established, time since enrollment, and management regimes. In the southeastern United States, unlike in the Great Plains (Johnson 2000, Reynolds 2000) and the Midwest (Ryan et al. 1998, Ryan 2000), the wildlife habitat value and resulting population responses to CRP have been more equivocal and less thoroughly documented. Within the Southeast, the implementation of the program and practices established vary considerably among states and differ substantially from other regions. In the southeastern states, the wildlife benefits are less obvious and in some cases potentially negative. Burger (2000) reviewed wildlife responses to CRP in the Southeast and suggested that wildlife habitat benefits of the CRP had been limited by extensive enrollment in loblolly pine tree (*Pinus taeda*) plantings and exotic forage grasses. However, Burger (2000) reported that substantive conservation benefits had likely been achieved through hardwood restoration in floodplain regions and longleaf pine (*Pinus palustris*) restoration under the longleaf CPA. Furthermore, he observed that conservation benefits could be substantially enhanced with greater emphasis on selection of appropriate herbaceous cover crops, expanded longleaf restoration, broader implementation of herbaceous buffer practices, and active management of existing acres (thinning, prescribed burning, selective herbicide, and conversion of exotic to native species). Between 2000 and 2005, programmatic changes have facilitated many of these recommendations, and additional research has been conducted to evaluate wildlife benefits of select practices. This chapter characterizes the current CRP in the Southeast and reviews relevant new research documenting expected benefits.

## CRP Enrollment in the Southeast

As of February 2005, 1,324,066 ha were enrolled in the CRP in 12 southeastern states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia) (USDA 2005). Enrollment in the CRP was not equitably distributed among states, with Mississippi (29%) and Alabama (15%) having the highest enrollment. Georgia (9%), Kentucky (10%), Tennessee (8%), Louisiana (7%), and South Carolina (6%) had moderate enrollments, and the remaining 5 states collectively accounted for 16% of total enrollment. As of February 2005, more than 756,314 ha, or 57% of CRP in the Southeast was enrolled in 1 of 4 tree cover practices, including CP3 pine plantings (12% of total enrollment), CP3a longleaf (6% of total enrollment), CP3a hardwood plantings (10% of total enrollment), and CP11 existing trees (30% of total enrollment) (USDA 2005). Most of the 75,014 ha enrolled in CP3a longleaf pine was established as part of the national longleaf Conservation Priority Area (USDA 2005). In addition to the 129,737 ha planted to hardwoods under CP3a, 2,850 ha of floodplain hardwoods were established under the bottomland hardwood initiative, CP31. Approximately 19% (252,201 ha) of the total acreage was enrolled as CP10 existing grass, 4% (57,517 ha) in CP1 cool-season grass, 3% (38,088 ha) in CP2 native warm-season grasses, and 12% (153,546 ha) was enrolled in various buffer practices, principally CP21 filter strips and CP22 riparian forest buffer. Given the preponderance of enrollment in CP3, CP11, CP1, and CP10 (much of which was reenrolled CP1) more than 68% of total enrollment in the Southeast was in practices that have limited or short-duration wildlife benefits.

Within the Southeast, the distribution of enrollment among various cover practices differed substantially among states. Kentucky (79% of state enrollment) and Tennessee (81% of state enrollment) enrolled principally grass practices (CP1, CP2, CP4, CP10), whereas Alabama (66% of state enrollment), Mississippi (68% of state enrollment), Louisiana (72% of state enrollment), South Carolina (72% of state enrollment), Florida (93% of state enrollment), and Georgia (94% of state enrollment) enrolled primarily tree practices (CP3, CP3a, CP11). Only Kentucky (15,433 ha) and Tennessee (16,726 ha) enrolled substantive amounts of CP2, native warm-season grasses. However, Kentucky and Tennessee continued to enroll substantial acreage of CP1, cool-season exotic grass (35,837 ha and 12,786 ha, respectively). Existing grass (CP10) totaled 252,201 ha, with most occurring in Alabama (46,968 ha), Kentucky (56,642 ha), Mississippi (52,822 ha), and Tennessee (56,076 ha). Additional incentives associated with national priorities areas and continuous signup were seemingly effective in some states in increasing enrollment in practices with higher perceived environmental benefits. Enrollment in the CP3a longleaf practice was substantive in Georgia (48,682 ha) and Alabama (17,888 ha), but only moderate in Florida (4,640 ha) and North Carolina (3,020 ha). Enrollment in various continuous signup buffer practices was high in Mississippi (56,607 ha), Kentucky (20,453 ha), Arkansas (18,018 ha), North Carolina (14,106 ha), and South Carolina (13,719 ha).

## Wildlife Benefits

Burger (2000) reported that the evaluation of wildlife responses to the CRP in the SE has been neither as extensive nor as thorough as in the Midwest (Best et al. 1997, 1998; Ryan et al. 1998; Ryan 2000), that few studies had directly monitored wildlife populations on CRP fields, and even fewer have documented population performance. However, numerous studies throughout the region had characterized wildlife populations on non-CRP lands established with management practices similar to those implemented under the CRP (e.g., pine plantations, hardwood afforestation). From these accounts, Burger (2000) inferred likely wildlife benefits of the principal CRP practices in the Southeast. This update summarizes general conclusions from Burger (2000) and expands upon recent research findings, where available.

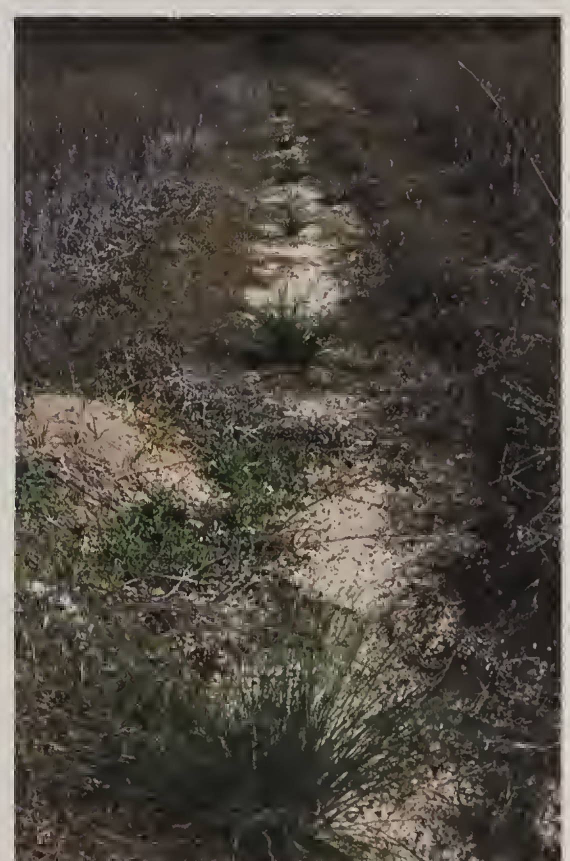
## Wildlife and Tree Planting Practices

### *Pine Plantations*

Avian community composition in regenerating pine stands is influenced by stand age, site-preparation methods, competition control methods, and landscape context. Burger (2000), summarizing the extant literature, concluded that in southern pine plantations, overall avian diversity and species richness tend to increase with age (Johnson and Landers 1982, Repenning and Labisky 1985, Dickson et al. 1993, Wilson and Watts 2000), but may decline during the pole stage, finally peaking during the sawtimber stage. In general, avian abundance increases with age until canopy closure at 7–9 years (Johnson and Landers 1982, Dickson et al. 1993), then declines and remains low through the early pole stage (Darden et al. 1990, Dickson et al. 1993, Wilson and Watts 2000), then increases as the stand approaches sawtimber size (Darden et al. 1990).

### *Effects of Stand Age*

Of the extant CP3 acres in the Southeast, 81% were enrolled between 1998 and 2001 and, as such, are currently 3–6 years old (Burger 2006). No studies were identified in the extant literature that specifically monitored birds on young pine plantations established under CRP; however, plant and bird communities on recently established pine plantations have been characterized (Johnson and Landers 1982, Dickson et al. 1993, Wilson and Watts 2000). Young pine plantings are characterized by low-growing grasses and forbs and, as such, are occupied by grassland and early successional bird species (Wilson and Watts 2000). Wilson and Watts (2000) studied bird communities on pine plantations 1–35 years of age in North Carolina. Over all age classes, they reported 68 different species of birds using pine plantations. They documented 30 bird species using pine plantations during the first 2 years after planting. Wilson and Watts (2000) observed 33 species using pine plantations 3–4 years old, 28 species in stands 5–6 years old, and 33 species in stands 9–11 years old.



Longleaf pine planting as part of a CRP contract. (J. Vanuga, USDA-NRCS)

During the establishment period, bird communities in pine plantings are dominated by grassland and early successional species, such as eastern meadowlark (*Sturnella magna*), eastern bluebird (*Sialia sialis*), Bachman's sparrow (*Aimophila aestivalis*), northern bobwhite, and mourning dove (*Zenaida macroura*) (Dickson et al. 1993). As the stand ages, herbaceous plants are replaced by shrubby species, and height and structural complexity increase. In response to these vegetational changes, grassland and early successional bird species such as eastern meadowlark and northern bobwhite decline, and shrub-successional species such as indigo bunting (*Passerina cyanea*), yellow-breasted chat (*Icteria virens*), common yellowthroat (*Geothlypis trichas*), and prairie warbler (*Dendroica discolor*) increase, peaking 3–10 years following establishment (Dickson et al. 1993).

Wilson and Watts (2000) reported that some generalist species, such as the common yellowthroat, gray catbird (*Dumetella carolinensis*), white-eyed vireo (*Vireo griseus*) and eastern towhee (*Pipilo erythrophthalmus*) occurred throughout much of the 30–35-year rotation, whereas other species tended to occur only within a given successional window. For example, killdeer (*Charadrius vociferus*) and eastern meadowlark were principally associated with stands during the first 2 years. Eastern bluebird, eastern kingbird (*Tyrannus tyrannus*), blue grosbeak (*Passerina caerulea*), indigo bunting, and field sparrow (*Spizella pusilla*) were associated with stands during the first 4 years after planting. American goldfinch (*Carduelis tristis*) was associated with stands 1–6 years old, prairie warblers were associated with stands 1–11 years old, and yellow-breasted chats occurred in stands that were 3–6 years old (Wilson and Watts 2000). As the stand matures, grassland birds disappear, shrub-successional species decline, and forest birds such as red-eyed vireos (*Vireo olivaceus*), white-eyed vireos, pine warblers (*Dendroica pinus*), Carolina wrens (*Thryothorus ludovicianus*), and hooded warblers (*Wilsonia citrina*) begin to permanently occupy the site (Dickson et al. 1993).

When pine stands reach 7–10 years after planting, the young pine trees form a dense, closed canopy and light penetration to the forest floor is reduced. During this period, herbaceous and shrub ground cover declines. Consequently, closed-canopy mid-rotation pine plantings provide relatively poor wildlife habitat and support a relatively simple faunal community between the time of canopy closure and the first thinning. The majority (91.5%) of CP11 acreage in the Southeast was enrolled between 1998 and 2000. Presuming most of these contracts were reenrolled following an initial 10-year contract, these stands are currently 15–17 years old and in the middle of this closed-canopy window unless recently thinned. Thinning opens the canopy, allows sunlight to penetrate to the forest floor, and stimulates development of herbaceous and shrub ground cover. Wilson and Watts (2000) reported that during the latter portion of the rotation, following thinning, species typical of second-growth and mature forest habitats predominated, including downy woodpecker (*Picoides pubescens*), Carolina wren, blue-gray gnatcatcher (*Polioptila caerulea*), Acadian flycatcher (*Empidonax virescens*), ovenbird

(*Seiurus aurocapilla*), Carolina chickadee (*Poecile carolinensis*), eastern wood-peewee (*Contopus virens*), great crested flycatcher (*Myiarchus crinitus*), tufted titmouse (*Baeolophus bicolor*), worm-eating warbler (*Helmitheros vermivorum*), pine warbler, summer tanager (*Piranga rubra*), and northern cardinal (*Cardinalis cardinalis*). 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 closed canopy, low plant species diversity, and 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.

Some species, such as yellow-breasted chat and indigo bunting, occur during early successional stages and again 1–2 years after first and second thinnings (Wilson and Watts 2000). Other early successional species, such as northern 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 1–3-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.

### *Mid-contract Management*

Starting with CRP signup 15, participants that wished to re-enroll CP3 pine tree plantings (as CP11) had the opportunity to increase their Environmental Benefits Index (EBI), and hence their probabilities of having their bids accepted, by agreeing to thin the pine planting within the first 3 years of the second contract period. Prospective program participants could further increase the EBI of their offer by agreeing to convert 15–20% of the stand to early successional habitat. Although avian diversity in pine plantations tends to decline during the mid-rotation period, thinning may enhance habitat quality for many regionally declining species. Wilson and Watts (2000) reported that thinned pine plantations had greater species richness than unthinned plantations of similar age. They reported that of the 68 species documented using pine plantations during the study, 7 species (10%) were detected exclusively in stands before thinning and 11 species (16%) were detected exclusively in thinned stands. Several species (e.g., indigo bunting and yellow-breasted chat) occurred in young stands and again 1–2 years after the first and second thin. One species, brown-headed nuthatch (*Sitta pusilla*), occurred in greater density in stands 1–2 years following thins (Wilson and Watts (2000).

In one of the few southeastern studies in which bird communities were surveyed in pine plantations enrolled in CRP, Schaefbauer (2000) documented 30 bird species using mid-rotation stands in Georgia. During 1998–1999, breeding bird communities were sampled using point counts in 6 CRP stands, 2 of which were third row-thinned, 2 of which were strip-thinned plus row-thinned, and 2 controls. Species richness, diversity, and total abundance were generally similar among thinning treatments in both years. Schaefbauer (2000) anticipated increased species richness following thinning. The lack of evidence for increased richness was attributed to a lag time in response between thinning implementation and colonization by early successional and grassland species. The most abundant species included northern cardinal, indigo bunting, eastern towhee, great crested flycatcher, gray catbird, pine warbler, tufted titmouse, and mourning dove. The number of species detected per year and treatment varied from 5 to 25. 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. Only indigo bunting abundance differed among treatments and was higher in strip + row-thinned stands than in control during the second year of the study (Schaefbauer 2000).

Parnell et al. (2002) monitored habitat use of radiomarked bobwhite in a forest–agricultural matrix in Georgia. They observed that northern bobwhite selectively used fallow fields and thinned pine forests, including those enrolled in the CRP. They reported an avoidance of agricultural fields and closed-canopy pine plantations. Parnell et al. (2002) concluded that thinning regimes that open the canopy and encourage herbaceous ground cover would create habitats preferred by bobwhites. In the context of this study, an EBI that provides incentive to simultaneously thin CP11 stands to an open structure and convert portions to fallow herbaceous vegetation would provide preferred bobwhite habitat and increase usable space in a forest–agricultural matrix.

In pine CRP stands in Georgia, Schaefbauer (2000) documented nesting by 8 bird species in a first year and 12 species in a second year. In the first year of the study, more species were documented nesting in the row-thinned stands (8.5) than in either strip-thinned plus row-thinned (5), or control stands (4). Nesting activity increased the second year following thinning. Nests of eastern towhee, mourning dove, brown thrasher, northern cardinal, and summer tanager were located in all thinning treatments (row-thinned, strip-thinned plus row-thinned, control). Indigo bunting, pine warbler, and blue grosbeak nests were located in both row-thinned and strip-thinned plus row-thinned stands. American crow (*Corvus brachyrhychos*) and white-eyed vireo nests were found in control stands and stands strip- plus row-thinned. Field sparrow and Carolina wren nests were located only in stands strip- plus row-thinned, and gray catbird nests were found only in unthinned control stands. Blue grosbeak, field sparrows, indigo buntings, pine warblers, and summer tanagers apparently benefited from thinning in that these species did not nest in unthinned control stands. Overall apparent nest success was 6.2% in the first year and 24.2% in the second year (Schaefbauer (2000). Apparent nest success of individual species ranged from 0.0% to 66.7%. Only for northern cardinals was a sufficient number of nests located to estimate Mayfield success (32%).

Effective 2004, FSA approved cost-share for mid-contract management activities, including prescribed fire, disking, and herbicidal control of invasive species. In thinned mid-rotation pine plantations, recolonization by early successional species may be accelerated by thinning and burning, thereby enhancing the herbaceous and shrub ground cover. 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 (17–28-year-old) slash pine (*Pinus elliottii*) 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-year-old) loblolly pine plantations under 4 different management regimes (thin only, thin/burn, thin/Imazapyr herbicide, thin/Imazapyr herbicide/burn). During the first breeding season following treatment application, 34–39 breeding bird species were observed in these stands, including 14 shrub-successional species (Thompson 2002). Total breeding bird abundance, bird species diversity, and total avian conservation value (TACV; Nuttle et al. 2003) were highest in control (thin only) plots and lowest in herbicide treatments during the first year following treatment. However, as the herbaceous community recovered following herbicide and fire treatments, more high-priority early successional bird species colonized treated stands, and by the second growing season following treatments, total bird abundance and TACV were highest in stands that were thinned, herbicided, and burned. In the second growing season following treatment, species associated with the midstory (white-eyed vireo and Kentucky warbler [*Oporornis formosus*]) were most abundant in control stands, whereas early successional, shrub, and open forest birds (northern bobwhite, eastern wood-pewee, gray catbird, common yellowthroat, and indigo bunting) were most abundant in herbicide/burned stands (Thompson 2002). Two pine–grassland species (Bachman's sparrow and brown-headed nuthatch) were detected only in herbicide/burned stands. By the third and fourth growing seasons following treatments, total bird abundance, TACV, bird species richness, and diversity were highest in herbicide/burned stands and lowest in control stands (Woodall 2005). Black-and-white warbler (*Mniotilta varia*) and hooded warbler (*Wilsoni citrina*) were most abundant in control stands, whereas common yellowthroat, eastern towhee, indigo bunting, northern bobwhite, red-headed woodpecker (*Melanerpes erythrocephalus*), tufted titmouse, and eastern wood-peewee were most abundant in herbicide/burned stands (Woodall 2005). In this study, the herbicide/prescribed burn treatment combination created an open forest structure that mimicked regionally scarce pine–grasslands and resulted in colonization by regionally declining early successional and pine–grassland bird species. Although some species declined following mid-rotation management (i.e., Kentucky warbler), the net effect was a more diverse bird community characterized by regionally declining species with high conservation value. Similar conservation benefits might be accrued by broadly implementing mid-contract management practices on extant CP11 CRP stands.

To specifically address bird response to mid-contract management on CRP CP11, an ongoing study in central Mississippi is characterizing bird abundance and community structure on 24 pine stands enrolled in CRP CP11 (L. W. Burger, unpublished data). This study, in its third year, compares breeding bird communities in thinned CP11 stands treated with Imazapyr and prescribed fire to those in CP11 stands thinned, but not herbicided or burned. Half of the stands are in the upper coastal plain and half are in the lower coastal plain. During the first year post-treatment, 31 bird species were detected using control stands in the upper coastal plain, whereas 36 species were detected using treated stands. In the lower coastal plain, 29 species were detected using control stands, whereas 33 species were detected using treated stands. During the second year post-treatment, 33 bird species were detected using control stands in the upper coastal plain, whereas 38 species were detected using treated stands. In the lower coastal plain, 31 species were detected using control stands, whereas 30 species were detected using treated stands. The most abundant species in control stands included eastern towhee, northern cardinal, indigo bunting, hooded warbler, yellow-breasted chat, pine warbler, Carolina chickadee, and Carolina wren. The most abundant species in herbicided and prescribe-burned stands included indigo bunting, eastern towhee, yellow-breasted chat, northern cardinal, pine warbler, Carolina wren, and northern bobwhite. During the first 2 growing seasons following treatment, community metrics were similar between treated and control stands. However, during the second year following treatment, brown-headed nuthatch, Bachman's sparrow, eastern bluebird, and northern bobwhite were detected in treated stands, but not in untreated stands. If CP11 pine stands exhibit similar patterns to those reported in Thompson (2002) and Woodall (2005), plant and bird communities on sites treated with Imazapyr and prescribed fire will continue to diverge from those in untreated stands, and treated sites will be characterized by a pine overstory with a rich herbaceous understory occupied by early successional, shrub, and pine–grassland bird species.

### *Mammals and Herpetofauna in Pine Plantations*

No studies were identified that specifically documented mammal or herpetofaunal populations in pine stands enrolled in CRP. However, Hood (2001) sampled both small mammals and herpetofauna in 24 mid-rotation pine plantations under 4 management regimes (thin only, thin/burn, thin/Imazapyr herbicide, thin/Imazapyr herbicide/burn) in east-central Mississippi. Small mammal and herpetofaunal abundance was largely independent of mid-rotation management practice. She documented 21 mammalian species using mid-rotation pine plantations: white-tailed deer (*Odocoileus virginianus*), armadillo (*Dasypus novemcinctus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), eastern cottontail (*Sylvilagus floridanus*), swamp rabbit (*Sylvilagus aquaticus*), eastern gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), cotton mouse (*Peromyscus gossypinus*), eastern harvest mouse (*Reithrodontomys humulis*), golden mouse (*Peromyscus nuttalli*), house mouse (*Mus musculus*), white-footed mouse (*Peromyscus leucopus*), pine vole (*Pitymys pinetorum*), rice rat (*Oryzomys palustris*), hispid cotton rat (*Sigmodon hispidus*), eastern mole (*Scalopus aquaticus*), least shrew (*Cryptotis parva*), and shorttailed shrew (*Blarina brevicauda*). In the same stands, Hood (2001) documented 12 amphibian and 15 reptile species. Amphibians included American toad (*Bufo americanus*), eastern narrowmouth toad (*Gastrophryne carolinensis*), Fowler's toad (*Bufo woodhousii fowleri*), gray treefrog (*Hyla chrysoscelis*), green treefrog (*Hyla cinerea*), southern cricket frog (*Acris gryllus gryllus*), southern leopard frog (*Rana utricularia*), spring peeper (*Pseudacris crucifer*), upland chorus frog (*Pseudacris feriarum*), Mississippi slimy salamander (*Plethodon mississippi*), smallmouth salamander (*Ambystoma texanum*), and central newt (*Notophthalmus viridescens louisianensis*). Reptiles included corn snake (*Elaphe guttata*), eastern hognose snake (*Heterodon platirhinos*), speckled kingsnake (*Lampropeltis getula holbrooki*), midland brown snake (*Storeria dekayi wrightorum*), Mississippi ringneck snake (*Diadophis punctatus stictogenys*), rough green snake (*Opheodrys aestivus*), southern black racer (*Coluber constrictor priapus*), cottonmouth (*Agkistrodon piscivorus*), southern copperhead (*Agkistrodon contortrix contortrix*), timber rattlesnake (*Crotalus horridus*), western pygmy rattlesnake (*Sistrurus miliarius streckeri*), five-lined skink (*Eumeces fasciatus*), green anole (*Anolis carolinensis*), ground skink (*Scincella lateralis*), and northern fence lizard (*Sceloporus undulatus hyacinthinus*). Similar aged pine plantations in a similar landscape context might be expected to support many of these species.

### *Pine Summary*

In summary, pine plantations created under the CRP will provide habitat that will be used by a variety of bird, mammal, and herpetofaunal species. As the stand structure and composition changes over the life of the contract, the specific assemblage of bird species occupying pine plantations will change. Grassland and early successional species will occupy the stand during the first 1–3 years, then will be replaced by bird species associated with shrub-successional and young forest communities. Avian diversity and abundance may decline during the mid-rotation period. Much of the mid-rotation pine plantations enrolled in the 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. Although an understanding of bird responses to management in pine plantations is still incomplete, thinning, prescribed fire, and in some cases selective herbicide can enhance the conservation value of these stands by creating a stand structure that mimics regionally scarce pine–grassland communities. When mid-contract management practices are applied to create this open pine structure, regionally declining bird species of high conservation concern, such as Bachman's sparrow, brown-headed nuthatch, and northern bobwhite, will benefit. Pine plantations managed for an open structure will support a bird community with greater total avian conservation value than unmanaged stands. As such, thinning, prescribed burning, and selective herbicide practices should be encouraged through the use of incentives and regulations. The longleaf pine ecosystem has been identified as critically endangered and of highest conservation priority in the region. The CRP longleaf conservation priority area provides a programmatic opportunity to facilitate longleaf restoration in the Southeast to help achieve regional conservation objectives. (It should be noted that the restoration of longleaf pine, an important management objective in the Southeast that CRP can help to accomplish, is not specifically addressed in this paper.)

### *Hardwood Plantations*

Conservation of the bottomland hardwood ecosystem in the Southeast has been identified as requiring highest priority for avian conservation (Hunter et al. 1993). Bottomland hardwoods are regionally scarce forest communities in the Southeast and support a particularly diverse avian community (>70 species), including numerous Neotropical migrants of international conservation concern. As such, restoration of hardwood bottomland has been established as a conservation priority by numerous public, private, and interagency groups (Myers 1994). The CRP provides an important programmatic vehicle for restoring bottomland hardwoods. Collectively, more than 253,041 ha of hardwoods, most in bottomlands, have been established under CP3a, CP22, and CP31. Additionally, some unknown portion of CP11 contracts are hardwoods initially established under CP3a. Although no studies have directly assessed avian response to bottomland afforestation under the CRP, numerous recent studies have evaluated avian use, abundance, and productivity on hardwood afforestation sites and provide a very good approximation to expected benefits of CRP plantings.

### *Effects of Stand Age*

Agricultural lands afforested with hardwoods undergo successional processes similar to pine stands; however, the rate of succesional changes and attainment of canopy closure is slower in hardwoods. During the first 4 years after establishment, hardwood plantings support high densities of grassland birds, such as red-winged blackbird (*Agelaius phoeniceus*) and dickcissel (*Spiza americana*), and may also be occupied by northern bobwhite, eastern meadowlark, and northern mockingbird (*Mimus polyglottos*) (Nuttle and Burger 1996). Peak abundance of shrub-successional species, such as yellow-breasted chat, indigo bunting, and common yellowthroat, occurs 7–15 years after planting. However, with the exception of indigo bunting, none of the previously identified species persist in older plantations (>20 years of age) (Nuttle and Burger 1996). Thus, hardwood plantings established for bottomland hardwood conservation will provide temporary habitat for some regionally declining grassland and shrub-successional species, particularly during winter (Hamel et al. 2002). In a study of wintering bird communities, Hamel et al. (in press) detected 36 bird species on recently afforested sites (still in grassland/herbaceous stage) in the Mississippi Alluvial Valley (MAV). They reported a mean density of 13.0 birds/ha as measured by Project Prairie Bird survey methods or 3.0 birds/ha as estimated by Winter Bird

Population Study surveys. The most commonly detected species included northern harrier (*Circus cyaneus*; 9.5/100 ha), red-tailed hawk (*Buteo jamaicensis*; 6.0/100 ha), loggerhead shrike (*Lanius ludovicianus*; 3.1/100 ha), Carolina wren (0.6/100 ha), sedge wren (*Cistothorus platensis*; 5.3/100 ha), northern mockingbird (1.0/100 ha), eastern towhee (1.2/100 ha), field sparrow (0.8/100 ha), Savannah sparrow (*Passerculus sandwichensis*; 56.6/100 ha), fox sparrow (*Passerella iliaca*; 1.0/100 ha), song sparrow (*Melospiza melodia*; 25.6/100 ha), swamp sparrow (*Melospiza georgiana*; 96.8/100 ha), red-winged blackbird (57.6/100 ha), and eastern meadowlark (21.0/100 ha). The duration of grassland habitat in hardwood afforestation sites will vary from 4 to 15 years depending on the specific requirements of the species and the establishment practices.

The long-term objective of hardwood bottomland afforestation is to produce a forest that is similar in structure and function to mature hardwood bottomlands. Nuttle (1997) characterized breeding bird communities in afforested sites in the MAV. When compared to bird communities in mature hardwood bottomland hardwood forests, Morisita's index of similarity was 2.6–4.6% for plantations 0–4 years of age, 35–42% for plantations 7–15 years of age, and 74–85% for plantations 21–27 years of age (Nuttle 1997). Thus, within 20 years after planting, hardwood plantations are supporting many bird 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).

The benefits of afforestation to forest birds are positively associated with the speed at which afforestation and succession occur. As such, rapid afforestation has been assumed to be beneficial to wildlife (Hamel et al. 2002). This assumption is based on the premise that many bird species of highest conservation concern in the MAV are late-successional species (Ribbeck and Hunter 1994). Toward this end, Twedt and Portwood (1997) suggested that the addition of fast-growing, early successional species, such as cottonwood (*Populus deltoides*), willow (*Salix sp.*), sycamore (*Platanus occidentalis*), and green ash (*Fraxinus pennsylvanica*) to oak (*Quercus sp.*) plantings, would accelerate the development of a 3-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 (*Coccyzus americanus*), Acadian flycatcher, yellow-breasted chat, warbling vireo (*Vireo gilvus*), indigo bunting, orchard oriole (*Icterus spurius*), and Baltimore oriole (*Icterus galbula*). Conversely, 6-year-old oak plantings only supported 9 species, which 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. 2002).

The intent of rapid afforestation is to accelerate the development of vertical wooded structure to more quickly attain a plant and bird community that resembles mature bottomland hardwood forests. The rate of vegetation development in bottomland afforestation sites varies among establishment methods. Hamel et al. (2002) characterized vegetation structure on afforestation sites in the MAV. These sites were afforested using 1 of 4 techniques: natural regeneration, sown Nuttall oak (*Quercus texana*) acorns, planted Nuttall oak seedlings, and planted cottonwood stem cuttings. Five years after establishment, cottonwood trees on the site established with cottonwood cuttings were >10 m in height. Nuttall oak saplings were 3–4 m in height on the site planted to Nuttall oak seedlings, and 1–3 m in height on the site sown with Nuttall acorns. On the naturally regenerated site few woody stems exceeded 1–3 m. Vegetation structure in afforested sites is a function of the intensity of management at establishment, age of the propagules at planting, and growth rates of the species planted (Hamel et al. 2002). Not surprisingly, vegetation structure develops more rapidly when more intense effort is applied to establishing vegetation (Hamel et al. 2002).

During rapid afforestation, the early successional window is shorter than under natural succession. Wintering birds, in particular, use the early successional herbaceous communities in recently afforested hardwood sites. Hamel et al. (2002) characterized wintering bird communities on sites afforested using different establishment methods. The mean number of bird species detected was greatest in sites afforested with cottonwood cuttings (30), followed by sites planted to oak seedlings (13). A similar mean number of species (11) were detected in sites naturally regenerated or sown with acorns (Hamel et al. 2002). A total of 47 species were detected in cottonwood cutting stands, 19 in oak seedling stands, 14 in oak acorn stands, and 17 in naturally regenerated stands. As woody vegetation develops, some high conservation–priority bird species associated with herbaceous ground cover disappear. Although bird species richness increased with vegetation structure (rapid afforestation), the average conservation priority score does not because of loss of several high-priority species. Hamel et al. (2002) concluded that "… rapid afforestation provides winter habitat for a number of species quickly, at the expense of a few high-priority species found in early successional habitats." Given that the rate of structural development is a function of afforestation efforts and will subsequently determine bird community structure, management goals should seek to provide bird habitat through the whole successional continuum. This may require using a variety of afforestation methods to achieve various management objectives and intentionally maintaining some early successional communities through planed disturbance.

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, during the breeding season hardwood plantings 0–4 years of age provide 34% the conservation value of mature natural hardwood bottomlands. Plantings 7–15 years of age have 46% the conservation value of mature natural bottomlands, and plantings 21–27 years 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. During the breeding season, newly established hardwood plantings are relatively species-poor, and the species present in this age class are relatively common species such as 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 (*Passerina ciris*), and high-priority grassland bird species such as dickcissel, and consequently will have intermediate conservation value. As restoration stands reach 22 to 27 years old, they will be populated by high-priority forest species, such as prothonotary warbler (*Prothonotaria citria*) and yellow-billed cuckoo, contributing to their increased conservation value (Nuttle 1997.) Similarly, Twedt et al. (2002) 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 5–9-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. (2001) reported that in the Lower Mississippi Alluvial Valley, nest success of blue-gray gnatcatcher (18%), eastern towhee (28%), indigo bunting (18%), northern cardinal (22%), and yellow-bellied cuckoo (18%) did not differ between mature bottomland hardwood forests and cottonwood plantations. However, nest success of open cup nests of 19 bird species in natural bottomland hardwoods (27%) was greater than that of 18 species in cottonwood plantations (15%). Differences in nest success were attributed to differences in predator community and species composition of bird communities. Rates of parasitism by brown-headed cowbirds (*Molothrus ater*) were greater in cottonwood plantations than in bottomland hardwood forests (Twedt et al. 2001).

### *Hardwood Summary*

In summary, hardwood bottomlands are a regionally scarce resource of high priority for conservation of avian diversity. The CRP provides a programmatic vehicle for creating long-term conservation benefits on bottomland hardwood sites. The availability of continuous enrollment and automatic acceptance of eligible offers under the bottomland hardwood initiative (CP31) increases the opportunities for hardwood restoration. However, participation in this practice to date has been relatively small. During the first 5 years after establishment, and particularly during winter, hardwood plantings provide ephemeral habitats for regionally declining early successional grassland and shrub-successional species, thus contributing to regional avian conservation. 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. However, management goals that include a variety of establishment methods and management regimes will provide long-term conservation for a broader avian community.

## Wildlife and Grassland Plantings

In the Great Plains (Johnson 2000, Reynolds 2000) and Midwest (Ryan et al. 1998, Ryan 2000), grasslands created through the CRP have undoubtedly provided habitat for many grassland bird species and in some case altered population trajectories. However, in the Southeast, avian communities on CRP grasslands have received less research attention and consequently the conservation benefits are less clear. 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 (*Lolium* *arundinaceum*), Bermuda grass (*Cynodon dactylon*), or bahia grass (*Paspalum notatum*). CRP fields planted to tall fescue have dense vegetation with little bare ground and low plant species diversity (Barnes et al. 1995; Greenfield et al. 2001, 2002, 2003). Fescue stands typically provide few food resources for granivorous birds (Barnes et al. 1995; Greenfield et al. 2001, 2003). Although tall fescue may support abundant and diverse insect communities, these food resources may be unavailable to ground-foraging birds because of the dense vegetation structure. It is generally acknowledged that exotic forage grasses, including tall fescue, provide poor habitat for bobwhites and other ground foraging granivores because it lacks 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 (Washburn et al. 2000).

Native warm-season grasses are generally presumed to have greater wildlife benefits than exotic forage grasses (Washburn et al. 2000). Despite consistent promotion of native warm-season grasses (NWSG) by southeastern state fish and wildlife agencies, enrollment in CP2–native warm-season grasses amounted to only 3% of the total CRP enrollment in the Southeast. Only Kentucky and Tennessee enrolled substantial amounts of native grass cover, yet even within these states, CP2 enrollment accounted for only 11% and 15% of the respective total state enrollment.

In Tennessee, Dykes (2005) documented breeding bird use of 45 NWSG plantings established under the CRP. Bird communities on CRP CP2 fields were compared to those in remnant native grasslands at Fort Campbell Military Reservation. Dykes (2005) documented 85 species of birds using restored NWSG CRP fields. Although vegetation communities in planted NWSG fields and remnant native grasslands were both predominantly native grasses and forbs, planted fields had taller vegetation. Field size was the best predictor of bird species richness, with larger fields supporting a richer bird community. Most grassland bird species were positively associated with field size. Additionally, many species exhibited a negative relationship with vegetation height and NWSG cover, and a positive relationship with bare ground. Planted NWSG fields were occupied by regionally declining, high conservation–priority species such as Henslow sparrow (*Ammodramus henslowii*), eastern meadowlark, dickcissel, and northern bobwhite.

Program participants interested in re-enrollment of grass CRP contracts could increase their Environmental Benefits Index (EBI) 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 1 year post-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.

From 1997 to 2001, Smith (2001) and Szukaitus (2001) used radiotelemetry to monitor bobwhite habitat use, survival and reproduction on a 2,370-ha public wildlife management area in east-central Mississippi. This property included 781 ha of fields enrolled in CRP CP1 from 1987 to 1997. CRP fields were initially planted to fescue and at the start of the study comprised solid stands of fescue or a broomsedge (*Andropogon sp.*) overstory with a dense fescue understory. Annual mowing from 1987 to 1996 had produced low plant diversity and dense litter layers in all CRP fields (Greenfield et al. 2001). In 1997, annual mowing was ceased, a 3-year rotation prescribed fire regime was introduced, and a systematic program of herbicidal fescue eradication was implemented. From 1997 to 2001, an average of 259 ha were burned annually. Additionally, between 1997 and 2002, 314 ha were herbicidally treated to eradicate fescue. Fields were recolonized by native *Andropogon sp.*, legumes, and broad-leaved forbs. During 1997–2001, second-order habitat selection (habitat selection in establishment of seasonal ranges) varied somewhat among years; however, bobwhite consistently demonstrated selection of managed grasslands over other available habitats (woods, row crop, old fields, odd). Mean breeding season survival of bobwhite during 1997–2001 was 35% (range 20–48%; Smith 2001, Szukaitus 2001). From 1997 to 2001, mean apparent nest success of incubated nests was 52%. Twenty-four percent of nests were in managed grasslands (previously CRP fields) that had been burned the previous spring, 60% of nests were in managed grasslands burned ≥1 year prior, and 19% of nests were in other habitats (Smith 2001, Szukaitus 2001). From 1996 to 1998, breeding season relative abundance doubled and fall density increased by a factor of 4. Populations remained approximately stable from 1998 to 2000, then declined from 2000 to 2002 in response to prolonged drought, poor ground cover conditions, and associated high nest and adult predation (L. W. Burger, unpublished data).

### *Effects of Stand Age*

Plant communities on CRP grasslands are not static, but rather change in species composition and structure over the 10-year lifespan of the contract. McCoy et al. (2001) studied vegetation changes on 154 CRP grasslands in northern Missouri and reported that during the first 2 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. (2001) 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. Dykes (2005) characterized vegetation structure on 45 CP2 fields in Tennessee and reported that litter cover and depth were greater on fields that had been mowed than those that had been burned. Litter cover and depth were intermediate on unmanaged fields. Conversely, forb coverage was greatest on burned fields, followed by unmanaged and mowed fields (Dykes 2005).

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 et al. (2001, 2003), 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 improved vegetation structure for bobwhite broods during the first growing season after treatment. However, the benefits were short-lived (1 growing season). Herbicide treatment in combination with prescribed fire enhanced quality of bobwhite brood habitat for the longest duration (Greenfield et al. 2001).

*Winter Bird Communities in Grasslands*

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

*Mammals in CRP Grasslands*

Bond et al. (2002) estimated movements and habitat use of radiomarked cottontails on the same managed CRP grasslands studied by Smith (2001) and Szukaitus (2001). Although cottontails used a diversity of habitats, they exhibited consistent selection for managed CRP grasslands across multiple spatial scales, sexes, seasons, and diel periods (Bond et al. 2002). Additionally, movement rates of cottontails in managed CRP grasslands were less than those observed in hayfields or croplands (Bond et al. 2001).

*Grassland Summary*

Relative to the Midwest there is little information on responses of grassland-dependent birds to CRP in the Southeast. However, CP2 fields in Mid-South states are clearly used by a diversity of bird species, including high-priority, regionally declining grassland species. Larger NWSG CRP fields seemingly support greater bird diversity and fields managed with prescribed fire instead of mowing have more desirable plant species composition and structure (Dykes 2005). Several studies (Barnes et al. 1995; Madison et al. 1995; Greenfield et al. 2001, 2002, 2003; 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, (2) periodic disturbance is necessary to enhance or maintain quality early successional habitats, (3) disking and prescribed fire produce short-lived habitat enhancement, whereas herbicidal eradication of exotic forage grasses produces longer-lived benefits. In addition to birds, managed CRP fields can provide high-quality habitat for cottontails (Bond et al. 2001, 2002).

## Wildlife and Upland Habitat Buffers

Conservation buffer practices (field borders, filter strips, and riparian corridors) constituted a relatively small (12%) component of CRP in the Southeast, but may provide substantial benefits for wildlife in intensive agricultural systems. In 2004, USDA announced the availability of a new

Herbaceous field border around a crop field in Georgia. (D. Paul, USDA-NRCS)

upland buffer practice under the continuous CRP. The CP33–Habitat Buffers for Upland Wildlife practice allows creation of 30–120-feet herbaceous field borders around the entire perimeter of crop fields that meet program eligibility criteria. This practice is designed to provide habitat for northern bobwhite and other grassland bird species. Although the practice was only recently approved, a number of recent studies had evaluated wildlife response to herbaceous idle field borders.

Although no study has directly evaluated wildlife population response to CP21, CP22, or CP33, several studies in North Carolina have evaluated use of fallow field borders by northern bobwhite and passerines. Results of these studies have application to field margin, non-crop vegetation created under CP21, CP22, or CP33.

Puckett et al. (1995) examined habitat use and reproductive success of radiomarked bobwhites on 4 farms in Dare County, North Carolina. On 2 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 non-filter strip sites exhibited greater movement from capture to first nest location. Filter strips increased use of row-crop fields by bobwhite throughout the breeding season. In a related study of 24 farms in North Carolina, farms with filter strips (n = 12) supported higher bobwhite density in fall than farms without filter strips (W. Palmer, Tall Timbers Research Station, personal communication). Filter strips apparently benefited bobwhite populations by increasing usable space during the early breeding season, holding bobwhites on the landscape until cover in crop fields developed, increasing access and use of crop fields by bobwhites, and providing nesting and brood-rearing habitat.

Field borders may also 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. 2000). Marcus et al. (2000) reported that, during winter, herbaceous field borders support nearly 3 times more wintering sparrows than mowed field edges. Most (93%) birds detected using field margins were sparrows, although northern cardinals, American robins (*Turdus migratorius*), and yellow-rumped warblers (*Dendroica coronata*) were also observed. In one study area, the most commonly observed sparrows (in rank order) were dark-eyed juncos, song sparrows, white-throated sparrows (*Zonotrichia albicollis*), Savannah sparrows, field sparrows, and chipping sparrows (*Spizella passerina*). Song sparrows, Savannah sparrows, and swamp sparrows were most abundant on a second study area. Field, chipping, and white-throated sparrows were observed only in field borders and not in mowed edges. Field borders may also 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.

Conover et al. (2005) estimated density of grassland birds on narrow (7–10-m) and wide (20–40-m) NWSG field borders during winter and summer in an intensive agricultural landscape in the MAV. During winter, Conover et al. (2005) observed 59 bird species using managed NWSG field margins and associated cropland and wooded edges. The most abundant birds detected were mourning dove (18%), European starling (*Sturnus vulgaris*; 16%), red-winged blackbird (7%), common grackle (6%), and northern cardinal (6%). The most abundant sparrows were song sparrow (5%), white-throated sparrow (4%), and swamp sparrow (3%). Winter sparrows were more than 2 times as abundant along narrow field borders (8.1/ha) and more than 7 times more abundant along wide field borders (21.3/ha) as unbordered field margins (3.3/ha). In adjacent crop fields, sparrow densities were similar between non-bordered (1.2/ha) and narrow-bordered margins (1.8/ha). However, sparrow density in crop fields were much higher adjacent to wide-bordered margins (10.6/ha) (Conover et al. 2005).

During the breeding season, 73 species were observed using field margins and associated croplands and wooded edges. The most abundant species were red-winged blackbird (30%), northern cardinal (10%), common grackle (8%), mourning dove (5%), blue jay (5%), indigo bunting (5%), and dickcissel (5%) (Conover et al. 2005). Indigo buntings and northern cardinals were 3 times more abundant in bordered margins. Despite being forest birds, these 2 species exploited field borders for cover, nesting, and foraging. Dickcissel was completely absent from field margins without field borders. Over 3 breeding seasons, 434 total nests of 8 bird species were located in field borders. Red-winged blackbird (78%) and dickcissel (19%) represented the majority of nesting occurrences. Other birds that nested in field borders included northern cardinal, blue grosbeak, yellow-billed cuckoo, indigo bunting, mallard (*Anas platyrhynchos*), northern mockingbird, and northern bobwhite. Birds nested in both narrow and wide field borders, but had disproportionately higher nest densities in wide-bordered margins. The exceedingly low nest density of narrow-bordered field margins implies that increased border width substantially enhanced the attractiveness of field borders as nesting habitat. Overall, apparent nest success in all field borders was low at 22.4% (all years combined). Birds nesting in narrow borders experienced greater nesting success (29.2%) than wide borders (21.6%)(Conover et al. 2005).

Stripdisking in established grass CRP reduces litter, stimulates germination of annual forbs and legumes, and enhances wildlife habitat value. (Wes Burger)

Smith (2004) evaluated grassland songbird and northern bobwhite response to fallow herbaceous field borders in the Black Prairie Physiographic Region of east-central Mississippi. In his study, bordered and non-bordered field margins adjacent to large blocks of grass, grass strips, large blocks of woods, and wood strip habitats were sampled. During the breeding season, 53 species were observed using field borders and associated crop and edge habitats. The 6 most abundant species were mourning dove (8%), northern cardinal (7%), indigo bunting (15%), dickcissel (13%), red-winged blackbird (20%), and common grackle (6%). Dickcissel and indigo bunting were nearly twice as abundant where field borders were established, regardless of adjacent plant community type or width. Although indigo buntings are primarily a forest bird, the field borders provided an herbaceous plant community along existing wooded areas, edges making these areas more favorable for foraging, loafing, and nesting sites. Species richness was greater along bordered than non-bordered edges; however, diversity did not differ. Overall bird abundance was greater along bordered linear habitats than along unbordered similar edges. However, addition of field borders along larger patches of grasslands or woodlands did not alter the number of birds using these edges (Smith 2004).

During winter, 71 bird species were observed in field borders and associated croplands and field margins (Smith et al. in press). The 5 most abundant species were red-winged blackbird (45%), American pipit (*Anthus rubescens*; 11%), song sparrow (7%), Savannah sparrow (6%), and American robin (5%). Across most adjacent plant communities, song, field, and swamp sparrows occurred in higher density on bordered field margins than on unbordered. Song sparrow and swamp sparrow densities were greater where field borders were established along existing grasslands. Song sparrow densities were also greater along field borders adjacent to wooded strip habitats than comparable wooded strips without a field border. All other sparrows (pooled) were 4 times more abundant along bordered edges than along non-bordered (Smith et al. in press).

### *Upland Habitat Buffer Summary*

In intensive agricultural ecosystems of the Southeast, field margins provide some of the only available idle herbaceous plant communities. Herbaceous conservation buffers, such as CP33, can provide important breeding and wintering habitats for grassland and early successional birds. Field borders may provide nesting, foraging, roosting, loafing, and escape cover. During winter, field borders may provide important habitat in southern agricultural systems where most short distance migrants overwinter. The availability of field borders may increase local abundance and species richness. Bird density, species richness, and nest survival may be influenced by border width. Wider borders are more likely to make substantive contributions to avian conservation in agricultural systems.

## Conclusions

Although systematic evaluations of wildlife benefits of the CRP in the Southeast are lacking, probable patterns of wildlife occupancy and use may be inferred from studies of similar management practices on non-CRP lands. In contrast to the Midwest where grass establishment practices dominated CRP enrollment, in the Southeast 57% of CRP acres were enrolled in tree planting practices, primarily loblolly pine. 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 the developing pines. 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, prescribed fire, and selective herbicide may increase herbaceous ground cover, thereby enhancing habitat quality for regionally declining grassland, shrub, and pine–grassland birds. Bottomland hardwood plantings established under the CRP should be expected to support high densities of grassland birds during the first 5 years after establishment. Peak abundance of shrub-successional species will occur 7–15 years after planting. Stands over 20 years of age 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. Grassland CRP in the Southeast is predominantly enrolled in CP1 or CP10 practices and is primarily established in exotic forage grasses. The wildlife conservation value of these fields has not been evaluated. However, CRP fields planted to native warm-season grasses in the Mid-South support diverse communities that include grassland species of regional conservation priority. Upland conservation buffers provide an important programmatic tool for adding idle herbaceous habitats to intensive agricultural landscapes. Recent studies have demonstrated that upland habitat buffers can support diverse and abundant bird communities on working landscapes during both winter and summer. In the Southeast, plant communities change rapidly through natural succession. Proactive management of extant CRP acreage and selective enrollment of high value cover practices will be required to achieve the types of wildlife habitat benefits associated with the CRP in other regions.

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# Continuous Conservation Reserve Program: Factors Influencing the Value of Agricultural Buffers to Wildlife Conservation

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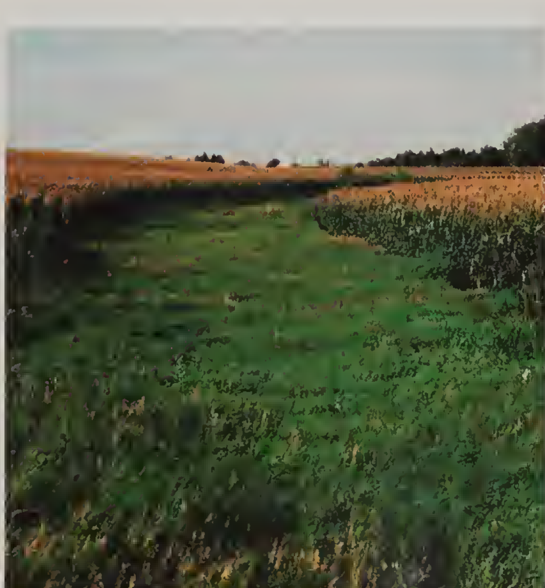
## Abstract

*The Continuous Conservation Reserve Program (CCRP) principally consists of linear buffer conservation practices designed to remove highly erodible land from production and to improve water quality. The extent of projects differentiates CCRP from the general signup CRP, which focuses on whole-field enrollments. Small sizes and high edge to area ratios have the potential to limit the usefulness of these practices for wildlife. Careful planning and management are keys to gaining the desired wildlife benefits from these plantings, particularly with regard to the role of buffers in the landscape. Evidence that the practices enrolled in the CCRP are used by wildlife is mounting, although studies are still most heavily focused on the avian community. Further study on reproductive success and survival is needed on all species of wildlife using these plantings to determine how the CCRP can best serve wildlife habitat functions.*

## Introduction

The Continuous Conservation Reserve Program (CCRP), authorized by the 1996 Farm Bill, made certain high-priority agricultural conservation practices eligible for enrollment in the Conservation Reserve Program (CRP) on a continuous basis, rather than through the general CRP signup process. Practices eligible under this program include riparian buffers, wildlife habitat buffers, wetland buffers, herbaceous filter strips, wetland restoration, grassed waterways, shelterbelts, living snow fences, contour grass strips, salt-tolerant vegetation, and shallow-water areas for wildlife (FSA 2003). Riparian buffers, herbaceous filter strips, and grassed waterways account for 61% of the acres currently enrolled in the CCRP (FSA 2004). CCRP plantings are generally small in area (often <5.0 ha [12.5 acres]), concentrated along waterways on highly erodible lands or other high-priority areas, and are generally linear because they are associated with field edges. Contracts in this program are 10–15 years in duration (FSA 2003). In this paper, we use the term "buffer" in reference to these collective CCRP practices, because the majority of them are designed to either buffer natural features such as wetlands or streams from adjacent agricultural areas or to provide a wind barrier. The objectives of the program are to improve water quality and control soil erosion, improve air quality, enhance aesthetics, and create wildlife habitat (FSA 2003)



Example of a sod waterway.
NRCS, Lynn Betts

The 2002 Farm Bill resulted in no major modifications of the CCRP, which remains available to producers. CCRP currently enrolls 1,143,892 ha (2,826,608 acres) in conservation practices (Tables 1 and 2) (including Conservation Reserve Enhancement Program acres authorized under continuous signup) (FSA 2004). The 2002 Bill also authorized implementation of the Conservation Security Program (CSP) (see Henry, *this volume*), which was designed to work in conjunction with pre-existing programs such as the CRP and CCRP, but not to replace them (CCC & NRCS 2004). Enrollment of acres in CCRP can earn producers points toward qualification for Tiers II and III CSP, providing additional incentive for conservation.

This paper updates and expands the previous review that summarized CCRP based on similar strip-cover practices (Best 2000). That review focused on avian responses. Since that time, interest in documented use of strip-cover by invertebrates, amphibians and reptiles (herpetofauna), and small mammals has emerged. Furthermore, in the intervening years there has been opportunity to study birds and other taxa directly on areas enrolled in CCRP rather than infer CCRP effects from research on similar strip-cover habitats such as roadsides or field borders. We have incorporated those newer findings as well as repeated some of the important findings of research focused on areas functionally similar to CCRP. We first review the evidence that addresses how CCRP differs as potential habitat from the annual crops that it is designed to replace. Then we review the available information that documents benefits of CCRP to wildlife, including how buffers function as edges and corridors and how predators respond to buffers. We address the state of our understanding of the importance of landscape context on the conservation value of buffers. Finally, we conclude with an assessment of information gaps that should be addressed in future monitoring or research programs. We have organized the review according to the functional aspects of CCRP practices for wildlife rather than following a taxonomic chapter organization. We focused on CCRP as applied in agricultural/grassland regions of the Midwest and Great Plains rather than the wooded riparian systems of the East and Southeast, largely because the available research has primarily addressed grassland systems. We did not address any information on CCRP benefits to fish, although our review of information on CCRP benefits revealed a paucity of information on this subject.

## Wildlife Abundance and Species Composition in CCRP Buffers

In the Midwest and Great Plains, the major benefit of CCRP, like that of CRP and other farm conservation programs, is that they replace annual row crops with perennial vegetation cover, thus providing substantial improvement for wildlife (Best 2000, Johnson 2000, Reynolds 2000, Ryan 2000). Even though some bird species such as vesper sparrows (*Pooecetes gramineus*), dickcissels (*Spiza americana*), and red-winged blackbirds (*Agelaius phoeniceus*) are known to nest in row-crop fields, abundances in vegetation buffers are an order of magnitude greater than in row crops (Best 2000). All recent studies confirmed that generalist species comprise the largest part of the abundance of birds using buffers. For example, red-winged blackbirds accounted for 54% of total bird abundance sampled in Iowa filter strips (Henningsen 2003) and 50% of the total bird abundance in Iowa grassed waterways (Knoot 2004).

Game birds such as ring-necked pheasants (*Phasianus colchicus*), gray partridge (*Perdix perdix*), and mallards (*Anas platyrhynchos*) have been documented using strip cover (Best 2000). Ring-necked pheasants and, more rarely, mallards have nested in CCRP plantings (Henningsen 2003, Kammin 2003, Knoot 2004), although these species exhibit a preference for large blocks of cover (Clark et al. 1999, Reynolds 2000). CCRP may provide winter cover for resident game birds, but unfortunately little data have been collected on winter use of CCRP by wildlife. Kammin (2003) documented 11 species of birds, including ring-necked pheasants, present in filter strips in winter in Illinois, but abundance was low for all species. When snow is deep, buffers often act as drift fences that catch snow, thereby reducing their value as winter habitat. Presence of shrubs and trees provides additional structure and may ameliorate this effect somewhat. Some resource managers recommend seeding plans for buffers based upon winter cover considerations, choosing switchgrass (*Panicum*

Table 1. Conservation practices on continuous signup CRP acres as of December 2004 (excludes general signup acres). Adapted from NRCS (2004).

| | | Continuous (CREP) | | Continuous (non-CREP) | | Total | |
|---|---|---|---|---|---|---|---|
| Code | Practice | Acres | % | Acres | % | Acres | % |
| CP1 | New introduced grasses and legumes | 100,065 | 16 | 72,303 | 3 | 172,368 | 6 |
| CP2 | New native grasses | 60,392 | 10 | 19,361 | 1 | 79,753 | 3 |
| CP3 | New softwood trees (not longleaf) | 375 | 0 | 320 | 0 | 695 | 0 |
| CP3A | New hardwood trees | 8,092 | 1 | 877 | 0 | 8,969 | 0 |
| CP4 | Permanent wildlife habitat | 38,314 | 6 | 3,053 | 0 | 41,367 | 1 |
| CP5 | Field windbreaks | 2,633 | 0 | 68,750 | 3 | 71,383 | 2 |
| CP7 | Erosion control structures | 1 | 0 | 0 | 0 | 1 | 0 |
| CP8 | Grass waterways | 559 | 0 | 105,025 | 5 | 105,584 | 4 |
| CP9 | Shallow water areas for wildlife | 2,282 | 0 | 45,732 | 2 | 48,014 | 2 |
| CP10 | Existing grasses and legumes | 11,033 | 2 | 37,385 | 2 | 48,418 | 2 |
| CP11 | Existing trees | 357 | 0 | 0 | 0 | 357 | 0 |
| CP12 | Wildlife food plots | 1,662 | 0 | 0 | 0 | 1,662 | 0 |
| CP15 | Contour grass strips | 111 | 0 | 76,620 | 3 | 76,731 | 3 |
| CP16 | Shelterbelts | 385 | 0 | 28,147 | 1 | 28,532 | 1 |
| CP17 | Living snow fences | 0 | 0 | 3,968 | 0 | 3,968 | 0 |
| CP18 | Salinity reducing vegetation | 9 | 0 | 292,964 | 13 | 292,973 | 10 |
| CP21 | Filter strips (grass) | 126,244 | 20 | 835,773 | 37 | 962,017 | 34 |
| CP22 | Riparian buffers | 142,204 | 23 | 552,562 | 25 | 694,766 | 24 |
| CP23 | Wetland restoration | 91,216 | 15 | 0 | 0 | 91,216 | 3 |
| CP23 | Wetland restoration (floodplain) | 0 | 0 | 62,630 | 3 | 62,630 | 2 |
| CP23A | Wetland restoration (non-floodplain) | 0 | 0 | 1,670 | 0 | 1,670 | 0 |
| CP24 | Cross wind trap strips | 38 | 0 | 643 | 0 | 681 | 0 |
| CP25 | Rare and declining habitat | 38,165 | 6 | 0 | 0 | 38,165 | 1 |
| CP26 | Sediment retention | 6 | 0 | 0 | 0 | 6 | 0 |
| CP29 | Wildlife habitat buffer (marginal pasture) | 1,520 | 0 | 13,694 | 1 | 15,214 | 1 |
| CP30 | Wetland buffer (marginal pasture) | 188 | 0 | 9,939 | 0 | 10,127 | 0 |
| CP31 | Bottomland hardwood | 55 | 0 | 7,198 | 0 | 7,253 | 0 |
| CP33 | Upland bird habitat buffers | 0 | 0 | 3,697 | 0 | 3,697 | 0 |
| | Unknown | 410 | 0 | 904 | 0 | 1,314 | 0 |
| Total | | 626,315 | 100 | 2,243,217 | 100 | 2,869,532 | 100 |

Table 2. Continuous CRP enrollment as of December 2004, not including CREP. Adapted from NRCS (2004).

| State | Acres | Annual Rental (× $1000) | Payments ($/acre) |
|---|---|---|---|
| Alabama | 29,059 | 1,460 | 50.25 |
| Alaska | 482 | 28 | 57.12 |
| Arkansas | 43,759 | 2,842 | 64.95 |
| California | 5,973 | 405 | 67.78 |
| Colorado | 8,073 | 326 | 40.62 |
| Connecticut | 83 | 7 | 82.32 |
| Delaware | 858 | 68 | 78.95 |
| Florida | 68 | 3 | 39.88 |
| Georgia | 1,983 | 99 | 50.12 |
| Idaho | 9,024 | 488 | 54.05 |
| Illinois | 251,599 | 33,354 | 132.57 |
| Indiana | 78,897 | 9,941 | 126.00 |
| Iowa | 409,688 | 58,054 | 141.70 |
| Kansas | 52,672 | 3,335 | 63.31 |
| Kentucky | 47,646 | 4,681 | 98.24 |
| Louisiana | 20,607 | 1,247 | 60.52 |
| Maine | 368 | 24 | 65.09 |
| Maryland | 3,157 | 268 | 84.83 |
| Massachusetts | 27 | 3 | 105.06 |
| Michigan | 20,384 | 2,006 | 98.41 |
| Minnesota | 229,925 | 18,923 | 82.30 |
| Mississippi | 139,820 | 8,403 | 60.10 |
| Missouri | 75,389 | 6,690 | 88.75 |
| Montana | 152,578 | 5,732 | 37.56 |
| Nebraska | 58,392 | 4,593 | 78.66 |
| New Hampshire | 185 | 10 | 52.75 |
| New Jersey | 182 | 14 | 75.50 |
| New Mexico | 6,662 | 292 | 43.77 |
| New York | 8,423 | 447 | 53.08 |
| North Carolina | 12,579 | 914 | 72.67 |
| North Dakota | 138,600 | 5,635 | 40.65 |
| Ohio | 42,900 | 4,692 | 109.37 |
| Oklahoma | 12,973 | 567 | 43.71 |
| Oregon | 12,191 | 724 | 59.42 |
| Pennsylvania | 1,075 | 55 | 50.77 |
| Puerto Rico | 436 | 28 | 65.00 |
| South Carolina | 34,392 | 1,837 | 53.42 |
| South Dakota | 148,342 | 9,162 | 61.76 |
| Tennessee | 15,630 | 1,536 | 87.88 |
| Texas | 39,599 | 10 | 38.78 |
| Utah | 216 | 19 | 46.39 |
| Vermont | 358 | 78 | 53.96 |
| Virginia | 1,603 | 6,555 | 48.68 |
| Washington | 93,024 | 12 | 70.46 |
| West Virginia | 266 | 2,663 | 46.43 |
| Wisconsin | 27,865 | 232 | 95.56 |
| Wyoming | 5,199 | 1,536 | 44.71 |
| Total U.S. | 2,243,217 | 199,837 | 89.08 |

RIng-necked pheasants.
NRCS, Roger Hill

*virgatum*) because it maintains more vertical structure than the most commonly planted species, smooth brome (*Bromus inermis*). However, we could find no research on what types of factors influence wildlife use of CCRP in winter.

Grassland specialist bird species use buffer strips in comparatively small numbers. Knoot (2004) observed grasshopper sparrows (*Ammodramus savannarum*), Savannah sparrows (*Passerculus sandwichensis*), and vesper sparrows in fewer than 5 of 33 grassed waterways surveyed. Kammin (2003) reported that grassland species such as grasshopper sparrows, Henslow's sparrows (*Ammodramus henslowii*), and vesper sparrows were absent from filter strips surveyed in Illinois. Buffers with shrubs and small trees have greater species richness than herbaceous buffers due to the increased heterogeneity of vegetation structure, but such plantings also chiefly host generalist species such as red-winged blackbirds, song sparrows (*Melospiza melodia*), and brown-headed cowbirds (*Molothrus ater*) (Kammin 2003).

Small mammals, including mice (*Peromyscus* spp.), voles (*Microtus* spp.), shrews (*Sorex* spp. and *Blarina* spp.), and ground squirrels (*Spermophilus* spp.) are common residents in perennial vegetation that comprises buffers (Snyder and Best 1988, Wiewel 2003). Voles are restricted to areas with substantial vegetation and litter cover (Getz 1961, Birney et al. 1976) and would be rare in row-crop fields. In contrast, deer mice densities of 15–50/ha (Clark and Young 1986, Wiewel 2003) have been observed in both perennial vegetation and row-crop fields. Specialist mammals like meadow jumping mice (*Zapus hudsonius*) and least weasels (*Mustela nivalis*) would be uncommon in buffers.

Buffers with their perennial vegetation provide habitat for invertebrates to aggregate. In soybean fields in Ohio, researchers found that above-ground arthropod predator numbers were higher in grassy corridors than in adjacent soybean fields; the corridors may have even drawn in predators from the planted fields (Kemp and Barrett 1989). Uncultivated land adjacent to crop fields harbors natural enemies that annually colonize fields to exploit pests (Price 1976). The practice of strip intercropping was developed as a method of managing insect crop pests because uncut strips in alfalfa fields attract pest populations into small areas and provide refuge for parasites and predators of insect pests (Weiser et al. 2003).

The presence of invertebrate, bird, and small mammal prey within the perennial vegetation in buffers has been shown to attract larger predators. In a radiotelemetry study of striped skunks (*Mephitis mephitis*) and red foxes (*Vulpes vulpes*) in North Dakota, Phillips et al. (2003) found that skunks selected perennial cover along wetland edges over other habitat types, probably because of abundant food resources (Greenwood et al. 1999). Red foxes selected planted perennial cover over cropland, especially where perennial vegetation was <20% of the landscape. Such selection of agricultural–wetland edges indicates the potential for enhanced predator–prey interactions within buffers (see sections below).

CCRP buffers. NRCS, Lynn Betts

## Vegetation Structure

In general, diverse vegetation structure and composition benefits a greater variety of wildlife, but for CCRP there is not a nationwide planting mixture that is required. The CCRP filter strip practice standard says "species selected shall have stiff stems and a high stem density near the ground surface…[and] be such that the stem spacing does not exceed 1 inch." The standard further states that if the goal is to create wildlife habitat, then "plant species selected for this purpose shall be for permanent vegetation adapted to the wildlife or beneficial insect population(s) targeted" (NRCS 2003). Brome and brome-alfalfa (*Medicago sativa*) is still commonly planted in CCRP buffers, although individual resource managers may recommend mixtures of native species as are effectively required for general enrollment CRP.

Diverse buffers may provide habitat for beneficial (and detrimental) arthropods that have importance to agriculture, are prey for wildlife, and have intrinsic esthetic value. Integrated pest managers and ecologists have suggested that integration of uncultivated corridors in agricultural fields could have positive economic impacts with regards to pest management (Kemp and Barrett 1989). In a study of filter strips in Minnesota, butterfly abundance and diversity were associated with the quantity of broad-leaved forbs within the strips that provide nectar sources and host plants for larvae (Reeder 2004).

McIntyre and Thompson (2003) studied prey items of breeding grassland birds and reported that arthropod abundance and diversity were highest at sites with highest vegetative diversity. Benson (2003) found similar patterns in his study of riparian floodplain restoration in Iowa. Pheasant chicks depend on adequate populations of arthropods for normal growth and development (Woodward et al. 1977, Nelson et al. 1990) and landscapes dominated by row crops have insufficient arthropod biomass to support pheasant broods (Whitmore 1982). In fact in Europe, conservation headlands with diverse plantings of wildflowers are often incorporated into small grain production specifically to the benefit of game birds (Potts 1986).

Plant species diversity and associated structural heterogeneity provides a variety of perching and nesting sites for birds, and leads to a greater variety of microhabitats for invertebrates and small mammals. Grassland birds are influenced by structural diversity of native and restored plant communities (Johnson and Schwartz 1993). Within grassed waterways in Iowa, vegetation vertical density was positively associated with the presence of dickcissels, common yellowthroats (*Geothlypis trichas*), and red-winged blackbirds (Knoot 2004). Population density of small mammals varied greatly with habitat characteristics, but was generally greater in denser vegetation (Birney et al. 1976). Most explanations of the effects of plant cover on wildlife emphasize food availability and protection from predation (Birney et al. 1976, Grant et al. 1977). Prairie voles (*Microtus ochrogaster*) actually have lower density in habitat with the greatest cover such as tallgrass prairie but which have less diverse availability of high-quality forbs for food (Cole and Batzli 1979), whereas meadow voles (*Microtus pennsylvanicus*) are abundant in areas with dense grass and litter.

There is very little information on responses of herpetofauna to vegetation structure within CCRP buffers, but like other taxa the individual species' habitat requirements would dictate the expected response. For example, Knoot (2004) found that occurrences of smooth green snakes (*Lioclonorophis vernalis*) in grassed waterways in Iowa were positively associated with litter cover, but eastern garter snake (*Thamnophis sirtalis*) occurrence was negatively correlated with litter.

## Wildlife Reproduction in Buffers

Best (2000) provided a very comprehensive review of the factors contributing to low nest success in strip buffers in agricultural landscapes. Recent studies of nesting birds in CCRP confirm that success is far lower than in block habitat, but comparable to success in other types of strip-cover. Nest success reported in 3 recent studies in filter strips in Iowa, in filter strips in Illinois, and in grassed waterways in Iowa was 27%, 13%, and 27%, respectively (Henningsen 2003, Kammin 2003, Knoot 2004). The dominant cause of nest failure was predation. Best et al. (1997) reported nest success in CRP fields to be 40%, and Patterson and Best (1996) reported a 38% nest success rate in CRP. Similarly, duck nests have exhibited higher survival in large blocks than in strip-cover (Pasitschniak-Arts and Messier 1996). Pheasant nest success is highest in areas consisting of several grassland blocks of at least 16 ha (40 acres) (Clark et al. 1999). Data on mammals and herpetofauna have not been organized in such a way that we can draw any conclusions about reproductive performance in buffers.

## Patch Area

Most CCRP projects would be only minimally sufficient in size for some area-sensitive bird species and are insufficient for others. For example, consider a buffer 0.8 km (0.5 mile) long and 61 m (200 feet) wide, which would be 4.9 ha (12 acres) in area—a representative CCRP planting. Such a patch would be adequate for species with a small home range like that of many small mammals (Gaines et al. 1992), invertebrates, and many snakes, but for more mobile taxa such as birds, such small patches are often insufficient. Several species of grassland birds have minimum area requirements (Herkert 1994, Vickery et al. 1994, Walk and Warner 1999, Winter and Faaborg 1999). These requirements are manifested on a distributional level (reduced density or absence in smaller patches) and on a demographic level (reduced reproductive success in smaller patches) (Winter and Faaborg 1999). Herkert (1994) found minimal area requirements for 5 grassland bird species ranging from 5 to 55 ha (12.4–136 acres), and Walk and Warner (1999) reported similar area requirements ranging from 12 to 75 ha (29.7–185.3 acres).

Patterns of area sensitivity can differ depending on the surrounding landscape (Donovan et al. 1997), suggesting that the effectiveness of small CCRP patches might vary regionally. However, Johnson and Igl (2001) studied density and occurrence of grassland bird species in relation to patch size across the northern Great Plains and found fairly consistent area sensitivity across this geographical region, including bird species ranging from northern harriers (*Circus cyaneus*) to sedge wrens (*Cistothorus platensis*).

## Buffer Width

The linear characteristic of buffers potentially makes width more relevant to wildlife habitat value than patch area per se, but researchers are just beginning to collect data on the effects of width. With regard to birds, the results of recent studies are quite mixed. For example, Knoot (2004) found a predictive relationship of grassed waterway width in Iowa for only 2 of 7 species of songbirds, and the direction of the relationship contrasted. In filter strips, Kammin (2003) found no relationship, and Henningsen (2003) found that only the abundance of the eastern meadowlark (*Sturnella magna*) was associated with width. Henningsen (2003) found nest success of only 1 species, the red-winged blackbird, was positively associated with width of the filter strip. Perhaps these results reflect the fact that the strips studied in these cases ranged only between 8 and 40 m (26–131 feet), making it difficult to detect an effect on vagile species like birds.

Studies conducted in wider strips and with less vagile species than birds provide more consistent support for the positive effects of width. Knoot (2004) also reported that presence of plains garter (*Thamnophis radix*), eastern garter, and brown (*Storeria dekayi*) snakes was positively correlated with width of grassed waterways. Reeder (2004) found that the diversity of butterflies, and also the abundance of certain larger or habitat-sensitive butterflies was positively correlated with widths ranging between 18 and 167 m (59–548 feet) in Minnesota buffers. Semlitsch and Brodie (2003) integrated biological criteria of both amphibians and reptiles when they considered guidelines for buffers around wetlands and riparian habitats.

## Disturbance

A large part of the value of CCRP and other set-aside programs is that the habitat created is undisturbed relative to the surrounding agricultural lands. Although vegetation management is required periodically for maintenance of healthy plantings, substantial or frequent disturbance often negatively affects wildlife communities. Different CCRP practices have different management scenarios; filter strips are supposed to be mowed or sprayed for noxious weed control as needed, whereas grassed waterways are supposed to be mowed yearly to facilitate water flow. Grassed waterways embedded in crop fields are routinely driven across with tractors. For example, farm equipment caused 9% of nest failures in grassed waterways in Iowa (Knoot 2004), and Kammin (2003) reported that 3.6% of nest failures in filter strips in Illinois were caused by human disturbance. But the anthropogenically caused nest failure rates above are small in comparison to the 80% and 88% of failures caused by predation in those studies, respectively (Kammin 2003, Knoot 2004).

The change in vegetation structure after mowing or burning is reflected in the wildlife community. Mowing or burning that is done before the nesting cycle of birds has been completed caused nest failure and adult mortality (Bryan and Best 1991, Delisle and Savidge 1997, Johnson 2000, Horn and Koford 2000, Murray 2002). Mowing and burning can also impact less mobile species or immature, sedentary life stages of species such as flying insects (Swengel 1996). However, these negative effects are usually short-lived (Panzer 2002, Benson 2003). The habitat improvement gained through prudent use of mowing and burning confers long-term benefits to most species (Panzer 2002).

The CCRP does not generally allow grazing except under certain situations such as drought, although there has been discussion of liberalizing the regulations. The effect of grazing on wildlife has received considerable attention in the literature, reflecting primarily negative effects among ground-nesting birds, especially waterfowl (Kirsch 1969, Hertel and Barker 1987, Kruse and Bowen 1996). This is particularly true when grazing is focused on small patches, as opposed to extensive rangelands. In buffer habitats the results are highly variable and some studies suggest that intermediate disturbance may be beneficial. For example, Walk and Warner (2000) found that light grazing favored abundances of 5 grassland bird species. Chapman and Ribic (2002) compared the small mammal community in buffer strips to that found in intensively managed rotationally grazed plots and continuously grazed plots. They found 6–7 times more species and 3–5 times more individual small mammals in the buffer sites than in the pastures, and speculated that this was likely due to the fact that the buffer sites receive relatively little disturbance from haying, grazing, or herbicide application.

## Linear Habitats as Movement Corridors

The potential for linear landscape features to connect otherwise isolated habitat fragments is often cited as a possible conservation strategy (Bunce and Hallam 1993, Rosenberg et al. 1997, Beier and Noss 1998, Haddad et al. 2000, Tewksbury et al. 2002). If CCRP projects served this function, they could mitigate some of the negative consequences of habitat fragmentation by increasing the effective population sizes of plants and wildlife occupying isolated fragments of grassland.

Experimental evidence confirming the benefits of corridors like those of a typical CCRP project is lacking, although some studies provide guidance with regard to important issues like width, structure, and landscape context (Rosenberg et al. 1997, Haddad et al. 2000). Corridors can potentially serve 3 beneficial roles: they can simply provide additional habitat; they can connect otherwise isolated habitat patches; and they can act as drift fences, intercepting animals moving across the landscape and directing them into the patches that they connect (Rosenberg et al. 1997). Corridors may have population and ecosystem function effects because they enhance movement of organisms in the landscape (Tewksbury et al. 2002). Although it is tempting to view CCRP as wildlife corridors, buffers do not necessarily connect larger patches of habitat, and there is very little information on whether CCRP plantings increase movement of organisms between patches.

## Edge Effects

Another important factor related to CCRP practices is that they are essentially all edge habitats, so that the potential for edge effects must be considered. Edges have both positive and negative effects on wildlife depending on the species (Lidicker and Koenig 1996). With regard to more vagile species like birds, the small extent of CCRP projects makes it likely that area is probably more relevant than edge effect per se. Nonetheless, bird ecologists have frequently studied edge effects in buffers, particularly in forested systems, but also to determine effects on grassland songbirds. Fletcher and Koford (2003) reported that bobolink (*Dolichonyx oryzivorus*; a declining, area-sensitive grassland songbird) territory densities in grassland

Agricultural field borders, a CCRP practice. NRCS, Lynn Betts

habitat were lower near edges of all types (forest, road, and agriculture). Winter et al. (2000) studied the effect of forested, shrubby, road, and agricultural field edges on artificial nests, and on real nests of dickcissels and Henslow's sparrows. The forested edges were associated with the most pronounced effects on artificial nests, artificial nest survival was depressed within 30 m (98 feet) of woodland edges, and real nests suffered greater predation within 50 m (164 feet) of shrubby edges.

The effects of proximity to multiple edges are particularly relevant to CCRP because they are specifically designed as buffers along edges of other vegetation types and they are often in a dendritic pattern. Henningsen (2003) noted that some birds, including common yellowthroats and song sparrows, showed an aversion to placing nests near both the wooded edges and the crop field edges. Fletcher (2003) showed that nesting grassland passerines avoided corners of fields where there were 2 edges until they were at least 100 m from either edge. Edge avoidance and nesting success data for game birds including ducks and pheasants have come primarily from studies conducted in large blocks of cover. It is difficult to generalize from the literature because an edge effect on nest success has been found in some studies (Horn et al., in press) but not in others (Pasitschniak-Arts et al. 1998). It is also hard to establish that there is edge-averse nest-placement behavior that is related to avoidance of predation because relatively few studies quantify use of edges by nest predators. Kuehl and Clark (2002) showed that raccoon (*Procyon lotor*), skunk, and red fox preferred vegetation edges near large blocks of grassland cover and that these predators more frequently entered patches at corners than along sides. Edges along streams and wetlands are particularly preferred by these generalist predators (Phillips et al. 2003).

CCRP buffers are described by wildlife ecologists as "hard" edges, in contrast to more natural edges that are gradual or "feathered" to which wildlife species are better adapted (Ratti and Reese 1988). Studies of butterflies illustrate how many animals respond to these hard edges. Ries and Debinski (2001) found that 2 species of butterflies, a habitat specialist (*Speyeria idalia*) and a habitat generalist (*Danaus plexippus*) both avoided or turned back from tree-line boundaries of prairie patches. The specialist butterfly exhibited the same behavior with regard to edges with roads and crop fields. Such behavior might serve to hold butterflies in CCRP plantings once they have entered them, when a particular project provides diverse, quality habitat for butterflies.

## Landscape Context

Landscape context influences local distribution patterns, and, on a larger scale, the long-term population dynamics of wildlife. Landscape variables, such as the amount of cover in the landscape or the proximity of a habitat patch to other landscape features, affect avian abundance and reproductive success (Clark et al. 1999, Bergin et al. 2000, Ribic and Sample 2001), carabid beetle assemblages (Jeanneret et al. 2003), butterfly diversity and abundance (Jeanneret et al. 2003, Luoto et al. 2001), and anuran abundance and richness (Knutson et al. 1999, Pope et al. 2000). Knoot (2004) observed that the characteristics of the surrounding landscape explained variation in occurrence of 6 of 8 bird species and 3 out of 5 snake species studied in grassed waterways in Iowa. In the case of aquatic species, the cumulative effects of watershed-level conservation efforts and disturbance patterns often have more influence on habitat suitability than amount of buffers in the immediate area (Willson and Dorcas 2003).

These effects can be visualized easily when the perspective is at a township extent rather than the level of an individual buffer project. Understanding the value of buffers created by CCRP depends importantly on distinguishing the effects on local distribution (i.e., much of the wildlife count data cited above) from the influence that buffers might have on long-term, large-scale changes in population dynamics. Observing large numbers of individuals in buffers may be misleading because such observations reveal little about the reproduction and survival in these strip covers (Pulliam and Danielson 1991). Given the effects of small patch size, linear shape, and large edge ratio, buffers often could be ecological traps (Gates and Gysel 1978, Anderson and Danielson 1997).

There is evidence that sometimes success of ground-nesting birds is actually as high in small, isolated strips of habitat as it is in large blocks (Clark et al. 1999, Horn et al. in press). In fact, Horn et al. (in press) observed that nest success of waterfowl was lowest in intermediate-sized patches of CRP. Evidence from studies of pheasants suggests that success is especially low where intermediate-sized patches are clustered so that there is a relatively large amount of edge per unit of landscape area (Clark et al. 1999). The mechanism influencing these patterns is that generalist predators like skunks, raccoons, and foxes spend a disproportionately large part of their activity in intermediate-sized patches and along edges (Kuehl and Clark 2002, Phillips et al. 2003, Phillips et al. 2004).

To a very large degree the landscape composition, that is the amount of perennial habitat in the landscape, has a much larger effect on the persistence of populations than the configuration and fragmentation of that habitats (Fahrig 1997). Nonetheless Clark et al. (2001) demonstrated that predicted response of pheasant abundance in typical Iowa townships could differ between conditions where CRP was allocated in general

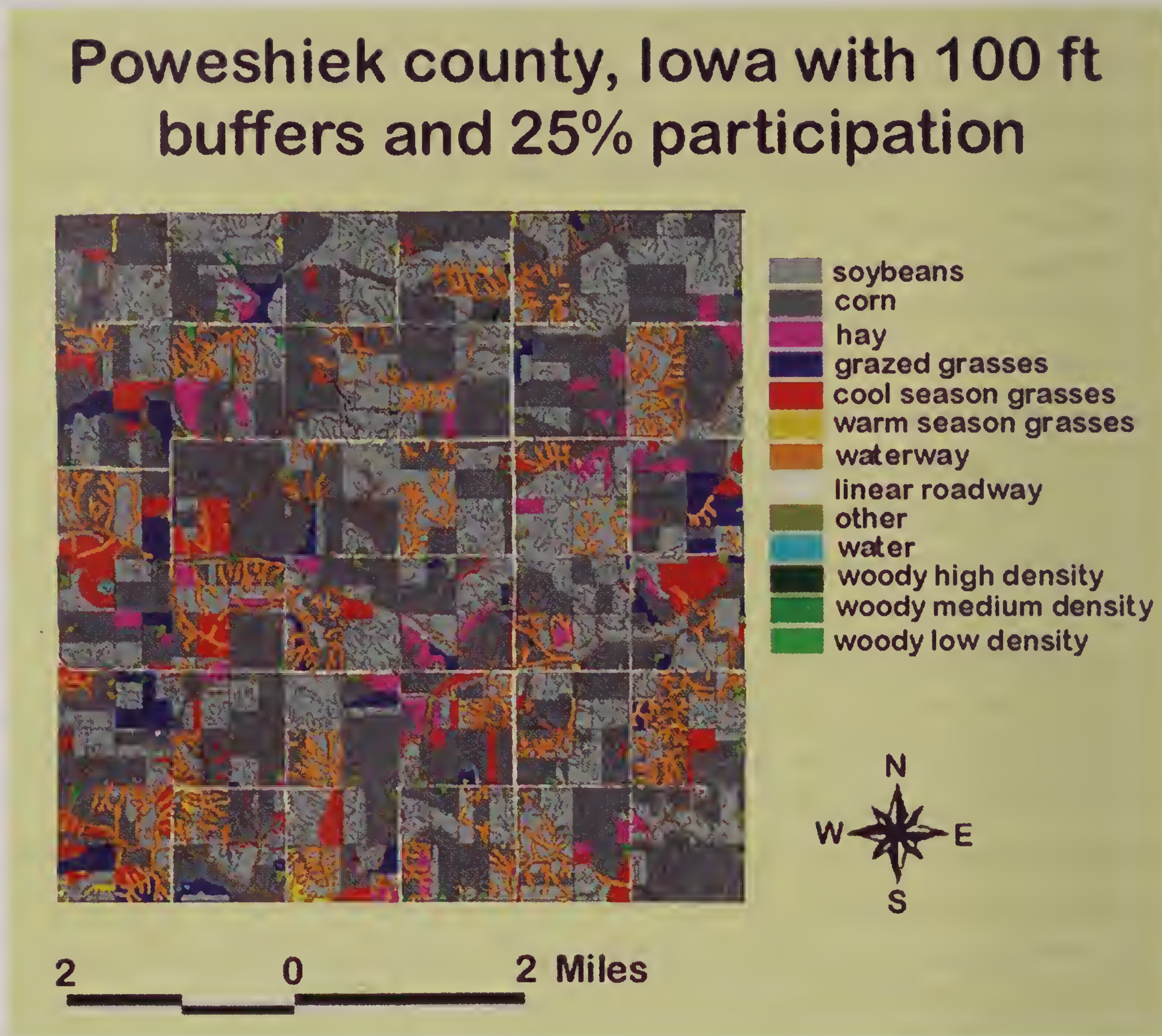



Figure. 1. A township in Poweshiek County, Iowa, with hypothetical CCRP projects, assuming that 25% of all landowners participated and were able to enroll all eligible areas into 100-foot riparian filter strips planted to grasses.
William Clark

enrollment of fields in blocks versus buffers (Figure 1). They estimated that if 10–15% of the landscape was configured in grassland conservation buffers, pheasant populations would be predicted to be only about one-third of the density predicted when the same area of grassland is configured in blocks. Under either scenario, pheasant abundance would be expected to increase most rapidly over the range of 10–20% increase in perennial grassland and would not be expected to reach peak abundance until nearly 50% of the landscape was in perennial grassland.

## Conclusions and Directions for Future Research

In the Midwest and Great Plains, the major benefit of buffers, like that of CCRP and other farm conservation programs, is that they replace annual row crops with perennial wildlife habitat. Most of the major limitations of buffers are related to the small area of individual projects and the associated edge and width effects. Many of the assessments of wildlife using buffers are based only on counts of animals, and information on the functional effects of these buffers on reproduction and survival is lacking for a broad array of taxa. Further study is needed on the arrangement of buffers and their potential to act as drift fences and migratory corridors. It would be particularly useful to better understand the landscape-level influence of buffers on wildlife population dynamics. Modeling outcomes under an array of landscape configuration scenarios could help managers to understand the tradeoffs between an allocation of CRP into blocks or into buffers, or to suggest goals for establishing buffers that could be translated into farm policy. Long-term research on a large (multi-state) level is necessary to provide an assessment of how CCRP is affecting regional wildlife populations. Furthermore, a comparative approach across watersheds would identify what factors drive large-scale patterns of wildlife use of CCRP.

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# The Conservation Reserve Enhancement Program

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## Abstract

*The Conservation Reserve Enhancement Program (CREP) reflects advancement in U.S. Department of Agriculture agricultural policy by addressing agriculturally related conservation on a multi-farm, landscape scale and establishing funding support and partnerships with state and non-governmental organizations. Underway in 25 states, with more being planned, the CREP addresses environmental issues on the farmed landscape with implications for environmental quality potentially reaching thousands of miles away from where program conservation practices are established. Most CREPs have been initiated only within the last 4 years. Monitoring programs to evaluate CREP performance have been established, but because of time needed to establish vegetative covers, growing participation in the programs over time, and the complexities of landscape-level analysis, quantifiable results are limited. Environmental data related to CREP effects on water quality and wildlife habitats are being collected for future assessments and refinement of the program. By addressing state-identified priorities, landowner needs, and social issues, the CREP offers substantial promise to fully integrate economically viable agricultural production and effective conservation.*

## Introduction

The Conservation Reserve Enhancement Program (CREP) is a refinement of the Conservation Reserve Program (CRP) intended to address environmental issues on landscape scales. The CREP encourages eligible producers to adopt specific conservation practices through shared financial responsibilities and partnerships established among the U.S. Department of Agriculture (USDA), tribal, state, municipal governments, and private non-governmental organizations. The primary goals are improvements of drinking and surface water quality as well as wildlife habitats, but the CREP focus differs based largely on state-identified priorities. Administered by the Farm Service Agency (FSA), the CREP reflects a vitally needed approach to conservation with a deliberate evolution toward addressing environmental issues on a multi-farm, landscape scale.

Table 1. Summary of Conservation Reserve Enhancement Program enrollment by state as of December 2004. Adapted from data provided at <http://www.fsa.usda.gov/dafp/cepd/crpinfo.htm>.

| State | Year initiated[a] | Number of contracts | Number of farms | Acres | Annual rental (× $1,000) | Payments[b] ($/acre) |
|---|---|---|---|---|---|---|
| Arkansas | 2001 | 223 | 142 | 6,447 | 647 | 100.41 |
| California | 2001 | 43 | 40 | 4,051 | 497 | 122.75 |
| Delaware | 1999 | 428 | 248 | 4,934 | 576 | 116.76 |
| Florida[c] | 2002 | | | | | |
| Illinois | 1998 | 5,403 | 3,955 | 109,764 | 17,508 | 159.51 |
| Iowa | 2001 | 17 | 13 | 314 | 67 | 213.72 |
| Kentucky | 2001 | 343 | 201 | 7,818 | 933 | 119.39 |
| Maryland | 1997 | 4,986 | 3,005 | 69,035 | 9,103 | 131.87 |
| Michigan | 2000 | 4,096 | 2,177 | 47,897 | 5,878 | 122.71 |
| Minnesota | 1998 | 2,618 | 2,107 | 83,649 | 9,314 | 111.35 |
| Missouri | 2000 | 249 | 188 | 13,564 | 1,173 | 86.50 |
| Montana | 2002 | 92 | 33 | 7,962 | 751 | 94.31 |
| Nebraska | 2004 | 1,914 | 1,374 | 20,223 | 1,945 | 96.18 |
| New York | 1998, 2004, 2004 | 265 | 207 | 3,489 | 505 | 144.86 |
| North Carolina | 1999 | 1,871 | 1,187 | 26,538 | 2,861 | 107.81 |
| North Dakota | 2001 | 75 | 56 | 1,500 | 53 | 35.53 |
| Ohio | 2000, 2002, 2004 | 4,233 | 2,901 | 21,777 | 3,316 | 152.28 |
| Oregon | 1998 | 556 | 402 | 14,663 | 1,330 | 90.71 |
| Pennsylvania | 2000, 2004 | 6,164 | 3,809 | 118,240 | 11,946 | 101.04 |
| Vermont | 2001 | 101 | 81 | 1,072 | 96 | 89.14 |
| Virginia | 2000 | 2,376 | 1,908 | 20,159 | 1,575 | 78.12 |
| Washington | 1998 | 567 | 451 | 9,408 | 1,545 | 164.24 |
| West Virginia | 2002 | 126 | 103 | 1,519 | 115 | 75.44 |
| Wisconsin | 2001 | 3,013 | 1,980 | 32,292 | 3,656 | 113.22 |
| National | | 39,759 | 26,568 | 626,315 | 75,393 | 120.37 |

[a] Multiple years of initiation represent individual CREPs started within the state.

[b] Payments scheduled to be made October 2005. Payments include annual incentives and maintenance allowance payments, but do not include one-time signing incentive payments, practice incentive payments, or payment reductions, such as for lands enrolled for less than 1 year and payment reductions as a consequence of lands hayed or grazed under emergency conditions.

[c] CREP enrollment has not been initiated at the time of this writing.

As of January 2005, the CREP is underway in 25 states with commitment to sign up 1.7 million acres in the program (USDA 2004). A summary of current CREP enrollment is furnished in Table 1. Appendix 1 provides a state-by-state summary of CREP funding, geographic applicability, and objectives. Expansions and establishment of CREPs in additional states are in progress.

## CREP Offers a Landscape Approach to Conservation

Trying to solve large-scale environmental problems one field or farm at a time without consideration of adjacent land use offers limited ability for finding long-term solutions. Resolution of ecological problems associated with agriculture will be found only when addressed across larger and contiguous landscapes (Rabalais et al. 2002, Pimentel et al. 2004). Similarly, multiple initiatives and programs individually focused on solving specific environmental problems (e.g., erosion vs. wildlife habitat) will have limited success in maintaining public, political, and financial support over the long term (Kleiman et al. 2000, Keeney and Kemp 2003).

Grassed waterways carry runoff from crop fields, preventing erosion. (L. Betts, USDA-NRCS)

The CREP is designed to simultaneously address multiple resource issues by involving various government agencies, private groups, and landowners across an assortment of legal and physical dimensions. The program represents a deliberate effort on the part of the USDA to address various environmental issues by establishing conservation practices best believed to meet environmental problems stemming from agricultural production on individual, as well as multi-farm and ownership scales. Although the amount of habitat physically created by establishment of conservation practices can be comparatively small when viewed from the prospect of the entire landscape, benefits to wildlife can be substantial (Nusser et al. 2004).

### *Enrollment Criteria*

The CRP has operated under 2 approaches to enrollment. Participation in the General Signup CRP is determined during periodic signup periods using the Environmental Benefits Index (EBI). Scores from the EBI reflect a balance of environmental and economic priorities used to determine the potential benefits of each parcel of land offered for enrollment (Feather et al. 1999). Signup periods are typically held no more than once a year and are of limited duration. Under the Continuous CRP, participants enroll environmentally desirable land to establish high-priority conservation practices (e.g., riparian buffers, wetland restorations) and may offer land for inclusion in the program at any time. If the land and producer meet certain eligibility criteria, typically the land is accepted into the program. As with continuous enrollment, CREP participation is accepted on an uninterrupted basis with eligible participants able to enroll land satisfying their state's CREP criteria. Smith (2000) described land enrolled in CREPs prior to 2000 as being smaller than lands enrolled through the General CRP signup. The average CREP contract size was slightly greater than those in the Continuous CRP but smaller than those in the General CRP. Contracts established under the CREP are on average of longer duration than the usual 10-year CRP contract, with 15 years often desired by participating states. States also may acquire additional agreements with landowners to assure the CRP cover remains in place long after the CREP agreement expires. Lands enrolled in CREP generally are of higher economic value than those enrolled in the General CRP, justifying higher rental rates. Within each state, CREP enrollment usually is limited to 100,000 acres.

### *Funding*

The Commodity Credit Corporation provides funding for the CREP with partnerships established through state, tribal, local government, and non-government organizations. Non-governmental contributions to CREPs may be substantial. Ducks Unlimited and the Chesapeake Bay Foundation, for example, furnished 40% of non-federal contributions to the Maryland CREP (C. Chadwell, USDA, Conservation and Environmental Programs Division, personal communication). Owners of land enrolled in the CREP receive annual rental payments and usually are offered additional monetary incentives for establishing approved conservation practices. Cost-share for establishing conservation practices and technical support are also furnished.

### *Special Incentives for Enrollment*

Solutions to natural resource issues often rely on human motivations and responses. Some farm operators hesitate to make long-term commitments to conservation programs because of concerns about lost income, uncertainty about market changes, and unease about future environmental regulations (Lant et al. 1995). Based on analysis of prospective participants in the Oregon CREP, Kingsbury and Boggess (1999) suggested some concerns could be diminished by clearly defining how regulations may affect use of enrolled lands at the end of the contract period. Raising or adjusting rental rates to account for inflation and property taxes, increasing flexibility in contract periods and terms, and making enrollment procedures simpler have all been identified as options to decrease producer hesitation about participating in conservation programs (Lant et al. 1995).

Adoption of conservation policies and practices by producers can be expected as long as their agricultural enterprise remains profitable (Santelmann et al. 2004) and program requirements do not conflict with efficient management of their operations (Lamont 2005). The CREP has been successful in addressing economic issues by minimizing or eliminating costs to participants. In addition to annual rental payments and cost-sharing for establishing conservation covers or practices, supplementary financial incentives are offered for CREP enrollments. One time, up-front signing incentive payments (SIP) and practice incentive payments (PIP) are often used to encourage adoption of high-priority conservation practices and increase enrollment. The availability of SIP and PIP incentives substantially increased participation in the New York City Watershed CREP (Lamont 2005). Incentive payment rates vary between CREPs and may be complemented by additional incentives furnished by states and non-governmental organizations.

Economic incentives may be uniquely focused on regional priorities. For example, the CoverLock aspect of the North Dakota CREP offers additional funds for 20-year easements to establish a combination of tree, shrub, and grass cover for long-term wildlife habitat. The Oregon CREP, which targets establishment of buffers along designated stream reaches, had an inventive approach to increasing enrollment by offering a substantial one-time payment if more than 50% of landowners along a 5-mile stream reach were enrolled within a specific time period.

## Evaluation of CREP Performance

Of 30 active CREPs, 27% were established prior to 2000. The Maryland CREP is the oldest, having been started in 1997. There has not been sufficient time to quantify long-term benefits of these programs as to how they affect environmental conditions. Monitoring and evaluation of CREP performance is in progress and required as part of more recent CREP agreements. Establishment of monitoring programs is only in the initial stages of staffing, coordination between agencies, definition of sampling protocols, and collection of data (e.g., Commonwealth of Kentucky 2003, West Virginia Conservation Agency 2003, State of North Carolina 2004b). Consequently, long-term data describing environmental effects of the CREP are not available.

In some instances, advantage is being taken of infrastructure and baseline data already in place. For example, the Ohio Upper Big Walnut Creek CREP where the City of Columbus Water Quality Lab will provide water-quality monitoring services (Ohio Department of Natural Resources 2003). The majority of CREPs do not have such an advantageous position. Differing priorities for agencies potentially involved in CREP monitoring (Commonwealth of Kentucky 2003), insufficient funds specifically dedicated to long-term monitoring (Wisconsin Department of Agriculture, Trade and Consumer Protection 2004), and inadequate time for planted covers to become established (Wentworth and Brittingham 2003) have, in some cases, constrained evaluation of the program.

Grassed filter strip on a farm in Iowa. (L. Betts, USDA-NRCS)

Annual CREP reports to date have focused predominantly on numbers of contracts established, acres enrolled in specific conservation practices, and application of Natural Resource Conservation Service best management practices (e.g., Illinois Department of Natural Resources 2003, Ronaldson 2003, State of New York 2004). Consequently, little documentation of CREP effects exists in published literature. Much of the following information has been gathered from annual CREP reports; therefore, conclusions drawn are preliminary. Quantifiable results will be available as studies progress.

### *Wildlife and Conservation Practices*

The nearly 20-year existence of the CRP has allowed moderate assessment of its effects on vegetation response, wildlife, environmental quality, and rural economies (Dunn et al. 1993, Bangsund et al. 2002, Allen and Vandever 2003, Adam et al. 2004, Fleming 2004, Sullivan et al. 2004). Conservation practices used in CREPs across all states are those employed in the standard CRP. Establishment of introduced and native grasses, grassed filter strips, and forested riparian buffers are leading conservation practices used in CREPs (Table 2). It seems rational to assume environmental and wildlife effects described for individual conservation practices such as riparian buffers (Whitworth and Martin 1990, Peak et. al 2004) establishment of vegetative covers (Moulton et al. 1991, Best et al. 1997, Carmichael 1997, Reynolds et al. 2001) and long-term management of vegetation (Renner et al. 1995, Nuttle and Burger 1996, Allen et al. 2001) have comparable benefits and consequences when enveloped in a CREP. Arguments might be made that the landscape approach used by CREP enhances the per unit effectiveness of conservation practices established under the program. Spatial relations between conservation practices and their combined effects on wildlife need further investigation.

Roadside bird surveys completed in 2001 and 2002 associated with the Wisconsin CREP indicate grassland avian species of management concern tended to be more abundant on management (i.e., CREP) routes than on control routes (Wisconsin Department of Agriculture, Trade and Consumer Protection 2004). Rather than an accurate documentation of CREP effects on avian populations this information is viewed as baseline data upon which future assessments of program effects can be made. In an analysis of the Pennsylvania CREP, Wentworth and Brittingham (2003) reported greater numbers of avian species in fields planted to tame and native grasses than recorded in nearby non-program hayfields. Larger (≥40 acres) CREP fields were more likely to contain obligate grassland birds than smaller fields. There was no significant difference, however, in bird density, nest density, or nest success by field size, even for obligate grassland species.

Table 2. Conservation covers and practices on Conservation Reserve Enhancement Program (CREP) acreage by state as of December 2004. Source: USDA, Farm Service Agency.

| State | Introduced CP1 | Native CP2 | Existing grass CP10 | Wildlife habitat[1] CP4 | Rare and declining habitat CP25 | Wildlife food plots CP12 | Grass filter-strips CP21 | Riparian buffers CP22 | New and existing trees CP3&11 | Wetland practice[2] | Wind buffers[3] | Other[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arkansas | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6,447 | 0 | 0 | 0 | 0 |
| California | 2,821 | 677 | 372 | 8 | 0 | 15 | 0 | 6 | 0 | 0 | 0 | 152 |
| Delaware | 0 | 0 | 0 | 652 | 0 | 0 | 957 | 142 | 2,889 | 293 | 0 | 1 |
| Illinois | 2 | 2,588 | 0 | 30,519 | 1,605 | 559 | 16,348 | 19,727 | 3,683 | 34,038 | 21 | 673 |
| Iowa | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 314 | 0 | 0 |
| Kentucky | 215 | 3,294 | 0 | 0 | 0 | 0 | 1 | 4,262 | 46 | 0 | 0 | 10 |
| Maryland | 9,334 | 1,485 | 154 | 368 | 0 | 0 | 37,660 | 16,662 | 635 | 2,151 | 0 | 584 |
| Michigan | 4,061 | 4,185 | 0 | 0 | 0 | 0 | 25,909 | 1,826 | 0 | 10,205 | 949 | 762 |
| Minnesota | 0 | 0 | 0 | 0 | 31,507 | 0 | 8,690 | 5,900 | 0 | 37,527 | 3 | 22 |
| Missouri | 12,533 | 805 | 0 | 50 | 0 | 3 | 85 | 60 | 7 | 0 | 0 | 20 |
| Montana | 0 | 6,439 | 0 | 1,088 | 367 | 0 | 0 | 4 | 0 | 0 | 0 | 64 |
| Nebraska | 1,404 | 15,235 | 0 | 2,220 | 0 | 0 | 971 | 109 | 0 | 261 | 17 | 8 |
| New York | 201 | 11 | 160 | 0 | 0 | 0 | 50 | 2,124 | 0 | 74 | 0 | 869 |
| North Carolina | 0 | 0 | 0 | 0 | 0 | 0 | 2,004 | 22,521 | 473 | 1,530 | 0 | 10 |
| North Dakota | 0 | 0 | 0 | 1,115 | 0 | 0 | 0 | 0 | 0 | 0 | 385 | 0 |
| Ohio | 1 | 0 | 0 | 106 | 0 | 0 | 16,270 | 1,599 | 150 | 1,976 | 1,643 | 31 |
| Oregon | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 14,144 | 0 | 270 | 0 | 169 |
| Pennsylvania | 67,633 | 25,071 | 7,886 | 2,187 | 0 | 1,084 | 1,646 | 10,469 | 932 | 586 | 0 | 745 |
| Vermont | 0 | 0 | 0 | 0 | 0 | 0 | 132 | 940 | 0 | 0 | 0 | 0 |
| Virginia | 0 | 0 | 0 | 0 | 0 | 0 | 3,644 | 16,174 | 0 | 296 | 38 | 7 |
| Washington | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9,408 | 0 | 0 | 0 | 0 |
| West Virginia | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 1,475 | 8 | 0 | 0 | 0 |
| Wisconsin | 1,861 | 612 | 2,461 | 0 | 4,686 | 0 | 11,760 | 8,204 | 0 | 1,939 | 0 | 768 |
| Total | 100,065 | 60,392 | 11,033 | 38,314 | 38,165 | 1,662 | 126,244 | 142,204 | 8,823 | 91,459 | 3,056 | 4,897 |

[1]Plantings that generally meet multiple seasonal (e.g., nesting cover, winter cover) requirements for wildlife of local or regional concern.
[2]Includes CP23, CP30, and CP31.
[3]Includes CP5, CP16, and CP24.
[4]Includes CP8, CP9, CP15, CP18, CP26, and CP29.

A floristic quality index (FQI) is being used in Illinois as a habitat-based approach to indirectly measure wildlife habitat potential of CREP sites (Illinois Department of Natural Resources 2003). The FQI ratings for all CREP sites evaluated were described as lower than expected as a consequence of weeds dominating sites for the first 1 to 2 years after establishment of conservation practices. Desirable seeded and native plants, however, began to increase during the second and third years of monitoring, contributing to higher FQI values. The Illinois CREP is believed to have created critical habitat for many wildlife species, but surveys were not completed to measure vertebrate species usage or numbers. Physical attributes of changes in aquatic habitats, fish community structure, and benthic macroinvertebrates, in response to the Illinois CREP, have been collected on the sub-watershed and watershed scale. Results of these assessments were not described in the 2003 Illinois Annual Report. Conservation practices established under the Illinois CREP are being included in the Illinois Conservation Practices Tracking System used to document spatial relations between conservation practices and land use in the Illinois River basin. Availability of spatial data and characteristics of conservation practices will be essential for describing extent and cumulative effects of various conservation programs on wildlife and water-quality response (Das et al. 2004, Nusser et al. 2004).

### *Water Quality*

While conservation practice effects on wildlife populations are not always immediately evident or easily quantified (Brady and Flather 2001), documentation of effects on water quality are even more problematic. Soil and sediment characteristics, variability in hydrologic and weather events, as well as vegetative characteristics, spatial distribution, and quality of conservation practices influence both short- and long-term effectiveness (Davie and Lant 1994, Lee et al. 1999, Mersie et al. 2003). Land use by producers using less effective approaches to conservation may dampen benefits seen from successful conservation practices on adjacent lands. Annual variability in agrochemical use and ensuing nutrient loading in sediments and runoff can result in variation in monitoring results and estimates of CREP effectiveness in the short term. Consequently, the time lag between establishment of conservation practices and detection of measurable changes in water quality can be long and require intensive collection of data (Rabalais et al. 2002, Richards and Grabow 2003). The Ohio Department of Natural Resources (2003) projected that at least 10 years, perhaps 20 years, may be required before CREP success in improvements of water quality can be reliably measured over the long term.

Within the Minnesota River Watershed estimates are that CREP has reduced sediments by 9.6 tons/acre/year, soil loss has been diminished by

4.2 tons/acre/year, and phosphorous input to aquatic systems has been reduced by 5.3 lbs/year for every acre enrolled in a conservation easement (Lines 2003). Approximations of environmental benefits of the North Carolina CREP include sediment reduction of 26,510 tons/year (State of North Carolina 2004a). As of October 1, 2004 about 30% of the land eligible for inclusion in the Wisconsin CREP had been enrolled (Wisconsin Department of Agriculture, Trade and Consumer Protection 2005). As a consequence of establishing 1,015 miles of buffers on Wisconsin streams and shorelines, annual phosphorus input into surface waters are estimated to have declined by more than 106,000 lbs, nitrogen input has been reduced by over 55,000 lbs, and sediments in runoff have been reduced by more than 49,000 tons. Application of conservation practices focused on distribution of pastured dairy cattle in the New York City CREP is estimated to have decreased phosphorus loading into city reservoirs by nearly one-third since the program was initiated (Lamont 2005). Based on characteristics of lands currently enrolled, simulation analysis of effects of the Illinois CREP in the Lower Sangamon watershed suggest sediment loading resulting from a 5-year storm event has been reduced by 12% (from 38,642 tons to 33,966 tons) (Wanhong et al. 2005). The authors conclude performance and cost-effectiveness of the Illinois CREP in this watershed could be improved if more attention was given to enrollment of lands with greatest potential to reduce sediment input within the area of eligibility. Among their suggestions were greater emphases on enrollment of highly sloping lands, lands closer to water, inclusion of acres receiving higher upland sediment flow, and increased inclusion of lands with lower rental costs.

## Conclusions

The CREP advances agricultural conservation policy by employing a multi-farm approach to solving environmental, economic, and social consequences of agricultural production. To succeed, conservation practices cannot present an economic burden on producers. Based on shared economic responsibilities between federal, state, and private interests, the CREP minimizes costs to producers while addressing regional, state, and local environmental issues of greatest priority.

With much of the land under production for generations, the environmental effects of agriculture have been cumulative and reach far beyond farm boundaries (Trenbath et al. 1990, Krapu et al. 2004). The diminished diversity of crops produced, less frequent and varied rotations between crops, an enduring dependence on agrochemicals, and physical concentration of livestock production have negatively affected surface and ground water quality within and beyond agriculturally dominated landscapes. The consequences have an effect on drinking water quality on farms, nearby towns, cities far downstream, and biological conditions in marine ecosystems thousands of miles away. The decline in amount and diversity of non-farmed vegetative covers across intensively farmed regions continues to influence availability and quality of terrestrial and aquatic habitats for obscure, as well as economically and socially important wildlife species. Solutions to these issues will not occur by addressing individual problems in isolation. Nor will reversal in the negative consequences of decades of land use occur quickly.

Design of acceptable evaluation programs under financial and time constraints presents a fundamental obstacle to those who formulate and administer agricultural legislation (Büchs 2003). Years of research to furnish answers to specific environmental issues may be tolerable in an academic setting but is a liability rather than an asset in a political arena. Performance criteria must be clear and must support lucid communication of results and implications. This is a difficult, rarely attained goal, particularly for long-term programs like the CREP.

Assessments of CREP performance can be expected to take years from time of program authorization and initiation simply because enrollment appears take several years to pick up momentum. Additionally, many vegetative covers will take years to become sufficiently mature to have an influence on resource conditions they were designed to address. Most CREPs have been active for only a small number of years with evaluation of performance just beginning. In many cases, data being gathered now on program effectiveness can only be used as baseline information because previously collected data specific to CREP applications do not exist.

Refinements in the CREP and other USDA conservation programs cannot be made without quantifiable information. Acres enrolled in specific conservation practices offer only incomplete answers. Answers related to CREP effectiveness in improving water quality, wildlife response to enhancement of habitats, and the ability of economically viable agricultural production to thrive without undue environmental harm will require a long-term commitment to evaluation of program performance. An effectual long-term monitoring plan must extend beyond basic collection of data to account for recurrent training needed in response to changes in personnel, effective analysis, and reporting of results over years. Based upon information in annual reports, collection of environmentally related data is now providing a foundation upon which future assessments CREP performance can be made.

## Acknowledgments

Appreciation is extended to Mike Linsenbigler and Chad Chadwell, FSA, Conservation and Environmental Programs Division (CEPD) for their help and burying me in annual reports and other CREP data and information. I thank Skip Hyberg, FSA, Economic and Policy Analysis Staff (EPAS), and Sally Benjamin, CEPD, for their review and beneficial comments on this document and Alex Barbarika, EPAS, for contributing Table 2.

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# Appendix 1. Overview of existing Conservation Reserve Enhancement Programs (CREP).

A summary of key aspects of established Conservation Reserve Enhancement Programs (CREP) by state. Proposals for establishment of CREPs are underway for additional states. Additional information on individual CREPs can be obtained from USDA Farm Service Agency web sites http://www.fsa.usda.gov/dafp/cepd/state_updates.htm or http://www.fsa.usda.gov/dafp/cepd/epb/assessments.htm.

| State | Year initiated | Funding federal (F) and nonfederal (nf) (millions)[1] | Acres committed | Primary area of applicability | Key environmental objectives[2] | Primary conservation practices[3] |
|---|---|---|---|---|---|---|
| Arkansas | 2001 | F 8.5<br>nf 1.7 | 4,700 | Bayou Metro Watershed | Drinking, surface water quality, wildlife habitat | Riparian buffers |
| California | 2001 | F 19.0<br>nf 5.0 | 12,000 | North Central Valley | Surface and groundwater quality, soil erosion, air quality, wildlife habitat | Introduced and native grasses, wetland restoration, wildlife food plots, habitat improvement, riparian buffers and filter strips |
| Delaware | 1999 | F 10.0<br>nf 2.0 | 6,000 | Chesapeake Bay, Delaware Bay and Inland Bay watersheds | Lower surface water nutrient loading, water and aquatic habitat quality, upland wildlife habitat | Hardwood trees, filter strips, riparian buffers, wetland restoration |
| Florida | 2002 | F 96.0<br>nf 57.0 | 30,000 | Everglades watershed | Increase water quality and storage capabilities, enhance wildlife habitat and biodiversity | Filter strips and riparian buffers, wetland restoration, hardwood trees |
| Illinois | 1998, Expanded in 2001 | F 60.0<br>nf 12.0 | 232,000 | Illinois River watersheds | Reduce sediment and nutrient loading, enhance terrestrial and aquatic wildlife habitats | Riparian buffers and filter strips |
| Iowa | 2001 | F 31.0<br>nf 7.0 | 9,000 | North-central Iowa | Drinking and surface water quality, wildlife habitat | Wetland restoration, riparian buffers and filter strips |
| Kentucky | 2001 | F 88.0<br>nf 17.0 | 100,000 | Green River watershed | Recreation, water quality, restoration of ecosystems in Mammoth Cave National Park | Wetland restoration, riparian buffers and filter strips hardwood trees |
| Maryland | 1997 | F 170.0<br>nf 25.0 | 100,000 | Chesapeake Bay and tributaries | Water quality and aquatic habitat quality | Riparian buffers and filter strips |
| Michigan | 2000 | F 142.0<br>nf 35.0 | 80,000 | Macatawa, Raisin rivers and Saginaw Bay watersheds | Improvement in surface water and drinking water supplies and quality, improve wildlife habitat | Riparian buffers and filter strips, wetland restoration, windbreaks |
| Minnesota | 1998 | F 187.0<br>nf 81.4 | 190,000 | Minnesota river and floodplain | Improve water quality and wildlife habitat | Wetland restoration, riparian easements, buffers and filter strips |

| State | Year initiated | Funding federal (F) and nonfederal (nf) (millions)[1] | Acres committed | Primary area of applicability | Key environmental objectives[2] | Primary conservation practices[3] |
|---|---|---|---|---|---|---|
| Missouri | 2000 | F 70.0<br>nf 15.0 | 50,000 | 83 reservoir watersheds across 36 counties | Improve drinking water quality, lower sediment input into water supply reservoirs, elevate natural diversity | Contour grass strips, hardwood trees, filter and riparian buffer strips |
| Montana | 2002 | F 41.0<br>nf 16.0 | 26,000 | Missouri and Madison River systems | Improve water quality by reduction of nutrients and sediments in runoff | Wetland restoration, filter strips and riparian buffers |
| Nebraska | 2002 | F 143.0<br>nf 66.0 | 100,000 | Nebraska Central Basin | Reduce sediment and nutrient loading in lakes and streams, improve wildlife habitat in 37 counties | Grassland establishment, wetland restoration, filter strips, riparian buffers |
| New Jersey | 2004 | F 77.0<br>nf 23.0 | 30,000 | Watersheds draining into Atlantic Ocean | Enhance biological and aquatic habitat quality in Atlantic estuaries, increase open space | Grassed waterways, filter strips, and riparian buffers |
| New York | 1998 | F 7.3<br>nf 3.2 | 40,000 | Catskill/Delaware (New York City watersheds) | Improve quality of New York City drinking water, improve wildlife and aquatic habitats | Filter strips and riparian buffers, fencing, wetland restoration, tree planting |
| | 2004 | F 0.65<br>nf 0.25 | 1,000 | Skaneateles Lake watershed | Improve drinking water quality for Syracuse | Tree planting, contour grass strips, diversions, filter strips, riparian buffers |
| | 2004 | F 52.0<br>nf 10.4 | 40,000 | 12 watersheds across state | Reduce nutrient and pathogen content in sediments and runoff | Tree planting, filter strips, riparian buffers, wetland restoration |
| North Carolina | 1999 | F 221.0<br>nf 54.0 | 100,000 | Albemarle-Pamlico Estuary | Improve estuarine fisheries, enhance municipal drinking waters | Hardwood tree planting, filter strips, riparian buffers |
| North Dakota | 2001 | F 20.0<br>nf 23.0 | 160,000 | Six watersheds across southwestern and southern regions of the state | Critical winter habitats for wildlife, water quality, recreation, enhancement of rural economies | Shelterbelts, permanent wildlife habitat, food plots |
| Ohio | 2000 | F 167.0<br>nf 34.0 | Protection of 5,000 linear miles of streams | Lake Erie and tributaries | Reduce sediment and nutrient loading, enhance wildlife habitat | Wetland restoration, field windbreaks, filter strips, riparian buffers |
| | 2002 | F 8.4<br>nf 4.8 | 3,500 | Upper Big Walnut Creek Watershed | Improvement in drinking water quality | Filter strips, riparian buffers, hardwood trees |
| | 2004 | F 160.0<br>nf 32.0 | 70,000 | Scioto Watershed | Improvement in drinking water quality, wildlife habitat | Filter strips, riparian buffers, hardwood trees |

| State | Year initiated | Funding federal (F) and nonfederal (nf) (millions)[1] | Acres committed | Primary area of applicability | Key environmental objectives[2] | Primary conservation practices[3] |
|---|---|---|---|---|---|---|
| Oregon | 1998 | F 200.0<br>nf 50.0 | 100,000 | 4,000 miles of streams throughout Oregon | Improvement in habitat quality for endangered salmon and trout | Filter strips and riparian buffers, wetland restoration |
| Pennsylvania | 2000 | F 129.0<br>nf 77.0 | 200,000 | Susquehanna and Potomac River watersheds | Improvement in water quality entering Chesapeake Bay | Filter strips, riparian buffers, wetland restoration, contour grass strips |
| | 2004 | F 98.9<br>nf 46.7 | 65,000 | Ohio River watersheds | Improvement in water quality entering Gulf of Mexico | Filter strips, riparian buffers, wetland restoration, contour grass strips |
| Vermont | 2001 | F 1.5<br>nf 3.7 | 7,500 | Statewide | Reduction of nutrient loading in Lake Champlain and Hudson-Saint Lawrence waterway | Filter strips, grassed waterways, wetland restoration |
| Virginia | 2000 | F 68.0<br>nf 23.0 | 25,000 | Chesapeake Bay watersheds | Improvement in water quality entering Chesapeake Bay | Filter strips, riparian buffers, wetland restoration |
| | | | 10,000 | Southern Virginia Rivers (exclusive of Chesapeake Bay watersheds) | Water quality, wildlife habitat | Filter strips, riparian buffers, wetland restoration |
| Washington | 1998 | F 200.0<br>nf 50.0 | 100,000 | All streams crossing agricultural lands providing salmon spawning habitat | Restoration of salmon habitats in 3,000 miles of streams | Tree- dominated riparian buffers |
| West Virginia | 2002 | F 8.2<br>nf 3.2 | 9,160 | Potomac, New Greenbrier, and Little Kanawha river watersheds | Enhancement of water quality and wildlife habitats | Riparian buffers and filter strips, hardwood tree planting |
| Wisconsin | 2001 | F 198.0<br>nf 45.0 | 100,000 | All or portions of 47 counties across state | Enhancement of water quality and wildlife habitats | Grassed waterways, filter strips, riparian buffers, wetland restoration |

1 Base funding for CREPs includes allocation for annual rental payments, establishment of conservation practices, annual maintenance of covers established, technical assistance and support. Special Incentive Payments (SIP) and Practice Incentive Payments (PIP) may be available as well as additional financial incentives from non-government partners. For the purposes of this paper contributions from state and non-federal organizations (nf) are combined. Costs are estimated over a 10-15 year period.

2 Each CREP has numerous environmental objectives identified, not all are listed in this table. Control of soil erosion is an underlying objective of all CREPs

3 Only a generalization of key conservation practices is provided. Specific, eligible conservation practices are defined for each CREP and typically include more practices than listed. Virtually all CREPs permit establishment of tame or native grasses as partial or whole-field enrollment.

# Wildlife Benefits of the Wetlands Reserve Program

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## Abstract

*Since its initial authorization in 1990, more than 1.6 million acres of primarily drained or degraded wetlands on agricultural lands have been enrolled in the U.S. Department of Agriculture's (USDA) Wetlands Reserve Program (WRP). The Natural Resources Conservation Service (NRCS) and its partners are working with landowners to restore these lands to ecologically productive wetland and upland buffer habitats. Numerous studies have documented the value of restored and created wetlands to fish and wildlife resources. However, few objective studies have been completed that document fish and wildlife response to wetlands enrolled in and restored through WRP. Preliminary results of some studies underway indicate that wildlife use of WRP sites is comparable to or exceeds that of non-program restored wetland habitats. In addition, anecdotal reports on some WRP restored wetland complexes indicate that wildlife response has been greater than expected. Additional studies are needed to enable WRP program managers and participants to better understand how lands enrolled in the program affect local fish and wildlife use and the landscape factors that affect wildlife community dynamics and population trends influenced by the lands enrolled. Elements of USDA's Conservation Effects Assessment Project are intended to begin addressing this need.*

## Introduction

The Conservation Title of the 1985 Food Security Act represented a major shift in U.S. Department of Agriculture (USDA) agricultural policy toward emphasis on conservation of soil, water, and wildlife resources in agricultural landscapes (Myers 1988, Heimlich et al. 1998). The 1990 Farm Bill's amendments to the 1985 conservation provisions included establishment of the Wetlands Reserve Program (WRP), which provides incentives for restoration of wetlands previously impacted by agricultural development. A detailed description of the program is available on-line at <http://www.nrcs.usda.gov/programs/wrp/>.

Wetlands have long been recognized for their value as productive wildlife

Mechanical excavation increases microtopographic complexity that benefits a diversity of wetland wildlife on WRP sites in the Arkansas River valley. (Kiah Gardner, Arkansas Game and Fish Commission)

habitats (Greeson et al. 1978). As part of a comprehensive review of Farm Bill contributions to wildlife conservation (Heard et al. 2000), Rewa (2000a) summarized the literature documenting wildlife response to wetland restoration and made inferences on the contribution of WRP to wildlife habitat potential. That report concluded that while actual wildlife use of WRP sites had not been well documented, the literature on wildlife use of other restored wetlands implies that many species are likely benefiting from WRP wetland habitats. While the lack of program-specific wildlife response data prevented the quantification of species population responses to the program at that time, the variety of wetland habitats established and the predicted wildlife response to these habitats based on studies in the literature implied that the program was providing tangible benefits to individuals and likely benefiting at least some wildlife populations.

This paper provides an update on WRP accomplishments and, while still quite limited, summarizes the available literature documenting the benefits of wetland restoration and management specific to WRP sites. Since the 2000 report was completed, a number of additional studies have been published that document fish and wildlife response to wetland restoration not associated with WRP sites.

## Program Enrollment

Enrollment in WRP has expanded substantially since the 2000 report was produced. Under the 2002 Farm Bill's expanded enrollment cap of 2,275,000 acres, over 1,627,000 acres in 8,396 separate projects had been enrolled through September 2004. The majority of acres (80%) and projects (75%) in the program are enrolled under permanent easements, 14% of both acres and projects are enrolled under 30-year easements, and 10% of the projects encompassing 6% of the acres are enrolled under 10-year cost-share agreements. The average size of projects enrolled is approximately 194 acres. Landowners continue to show great interest in the program; 3,173 applications covering over 535,932 acres in fiscal year 2004 were not accepted due to funding limitations. Landowner interest in the program stems from a range of factors, including use of wetlands for hunting and their general interest in wildlife and natural beauty (Despain 1995, Blumenfeld 2003). Projects range in size from 2-acre prairie pothole sites to floodplain wetlands exceeding 10,000 acres. Assemblages of individual projects remain commonplace, especially in marginal flood-prone areas where clusters of projects have restored wetland complexes; 1 wetland complex in Arkansas exceeds 18,000 acres in area. Although projects are located in all 50 states and Puerto Rico, 8 states have enrollments of greater than 60,000 acres (Arkansas, California, Florida, Iowa, Louisiana, Mississippi, Missouri, Texas) and 16 states have more than 200 separate contracts (Arkansas, California, Illinois, Indiana, Iowa, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New York, Ohio, Oklahoma, South Dakota, Wisconsin) (Figure 1).

As stated in the 2000 report, a wide variety of wetland types are being restored under the program, ranging from southeastern bottomland hardwood forests to herbaceous prairie marshes to expansive floodplain wetlands to coastal tidal salt marshes. Physical restoration of wetland characteristics remains a high priority of the program. In addition, greater emphasis is being placed on establishing a diversity of surface features through mechanical treatment to mimic natural micro- and macro-topography and encourage development of a diversity of fish and wildlife habitat conditions.

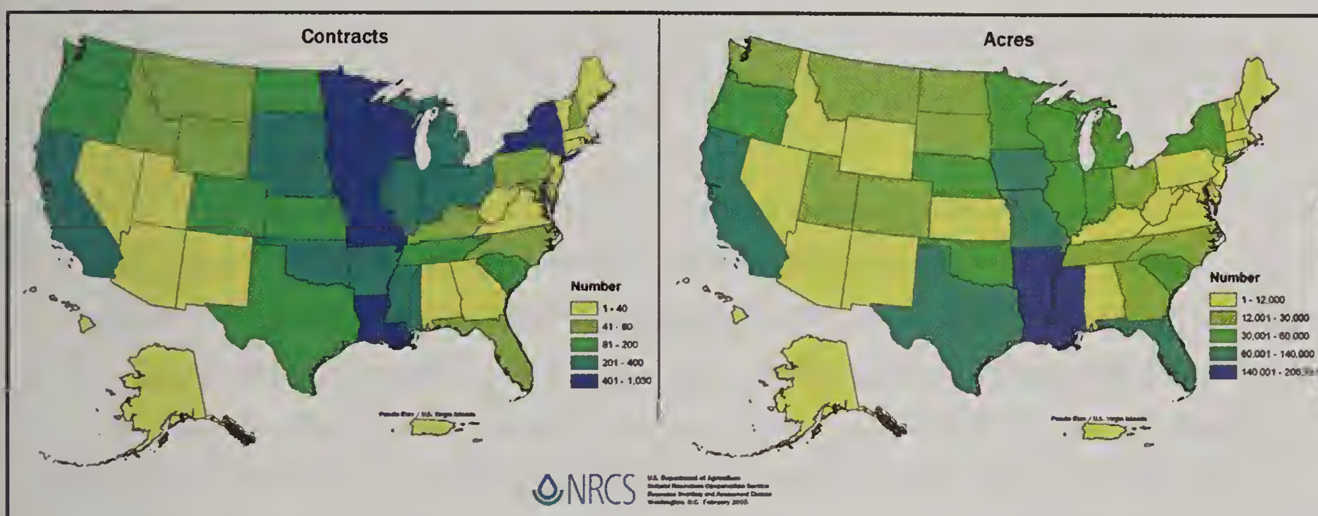


Figure 1. Distribution of total Wetlands Reserve Program contracts and acres enrolled through fiscal year (FY) 2004.

Actions taken to restore wetland conditions (e.g., plugging ditches, breaking tiles, installing water control structures, excavating meander swales, planting trees, etc.) are aimed at setting in place the natural processes that allow recovery of many wetland functions previously lost. While it may be many years or decades for most wetland functions to be restored, valuable habitat and other wetland functions can appear shortly after restoration actions are taken. Initial restored wetland condition may provide functions that are substantially different from the planned condition (NRC 2001). In documenting wildlife benefits resulting from WRP, it may take many years for studies to document the responses of wildlife species typically associated with mature forests to WRP-initiated bottomland hardwood restoration (Kolka et al. 2000). However, it is possible to document in a relatively short timeframe such wildlife responses as habitat created in early stages of wetland succession following restoration actions. In the case of bottomland hardwood forest restoration, studies have shown that birds associated with grasslands and scrub–shrub communities readily use these sites as they transition from open field to forested habitats (Twedt et al. 2002, Twedt and Best 2004). While there are still very few empirical studies that document wildlife response to WRP wetlands, this paper compiles existing data and identifies gaps in our understanding in this area.

Through WRP, Hay Lake in Arizona was restored to functional wetlands that filled with water during heavy rains in February 2005. (Rick Miller, Arizona Game and Fish Department)

## Documented Wildlife Response to WRP Enrollments

Studies have shown how restoring wetlands results in recovery of wetland vegetation (Galatowitsch and van der Valk 1996, Sleggs 1997, Brown 1999); colonization by aquatic invertebrates (Reaves and Croteau-Hartman 1994, Dodson and Lillie 2001), fish (Langston and Kent 1997), and amphibians (Lehtinen and Galatowitsch 2001, Petranka et al. 2003); and use of restored habitats by wetland birds (Guggisberg 1996, Brown and Smith 1998, Brown 1999, Stevens et al. 2003, Brasher and Gates 2004) and other wildlife (see Rewa 2000a). While a number of investigations have been initiated to quantitatively document fish and wildlife use of WRP sites, few have been completed and published. Results from studies that are available indicate that wildlife response to WRP wetland sites is similar to wetlands restored through other programs.

Early unpublished reports also imply that in some instances, largely due to specific measures taken during the restoration process to maximize wildlife habitat values, wildlife response to wetlands restored through WRP has been greater than expected. Reports of significant wildlife response in areas where large wetland complexes are enrolled and restored are of particular note. Following are a few examples of informal reports of wildlife response to WRP sites from NRCS WRP contacts (L. Deavers, NRCS, personal communication):

- Restoration work on 1,500 acres of a 7,100-acre wetland complex enrolled in Indiana has attracted thousands of migrating sandhill cranes (*Grus canadensis*), large numbers of migrating ducks, and several species that are on Indiana's threatened and endangered species lists including the crawfish frog (*Rana areolata*), king rail (*Rallus elegans*), bald eagle (*Haliaeetus leucocephalus*), and Wilson's phalarope (*Phalaropus tricolor*).
- At a WRP site in northwestern Indiana, bird species have been sighted that have not been known to nest in Indiana for many years. Eighteen species that are on state threatened or endangered species lists have been sighted at this site.
- In 1998, a 2,800-acre area in South Florida was enrolled in WRP; the row crops that occupied the site have since been replaced by marsh vegetation. The resulting mosaic of vegetation types provides high-quality habitat for a diversity of wetland-dependent species including many listed species. The deep marsh habitat is being used by migratory waterfowl, including northern pintails (*Anas acuta*), mottled ducks (*Anas fulvigula*), ring-necked ducks (*Aythya collaris*), northern shovelers (*Anas clypeata*), American wigeon

(*Anas americana*), and blue-winged teal (*Anas discors*). These deep marsh areas also provide feeding opportunities for the federally listed Everglades snail kite (*Rostrhamus sociabilis*) and bald eagle. Shallow marsh areas provide habitat for many wading bird species, including the wood stork (*Mycteria americana*), a federally listed species, and the snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), white ibis (*Eudocimus albus*), and limpkin (*Aramus guarauna*), all species of special concern in Florida.

- A 4,000-acre WRP wetland complex in Minnesota recently restored through the involvement of 12 separate landowners has induced the return of a tremendous amount of migratory and resident wildlife species. Dozens of wetland wildlife and upland species have been noted, including sandhill crane, ducks and geese, greater prairie-chicken (*Tympanuchus cupido*), numerous songbirds, moose (*Alces alces*), butterflies, and the federally threatened western fringed prairie orchid (*Platanthera praeclara*).
- WRP easements at Raft Creek in Arkansas have been noted for substantial wildlife response. These restored wetlands have been used by many ducks, shorebirds, and other birds that are indigenous to Arkansas as well as many species seldom seen in the state. As many as 50 brown pelicans (*Pelecanus occidentalis*) were observed to have spent part of the summer months at this site. This site has also been known to be host to an estimated 20% of all ducks that pass through Arkansas during some period of the migration season, and rare species have been sighted.
- Through WRP, a group of landowners in southeastern Oklahoma have restored a nearly 7,500-acre wetland complex adjacent to the Red River known as Red Slough. Red Slough is now recognized within the state and region as a birdwatcher's paradise. Within 2 years of restoration, 254 species of birds were recorded at the site. Birds only rarely seen in the state are becoming common during seasonal visits to Red Slough. Unusual or first-time records of birds nesting in Oklahoma, such as wood storks, white ibis, willow flycatchers (*Empidonax traillii*), roseate spoonbills (*Ajaia ajaja*), and black-necked stilts (*Himantopus mexicanus*) have been documented. Migratory and wintering waterfowl numbers at Red Slough and nearby wetlands have exceeded 100,000 birds. Other examples of use of this wetland complex by rare species include the first nesting record of common moorhens (*Gallinula chloropus*) in the county (Heck and Arbour 2001a), as many as 350 wood storks at the site at one time, the highest number ever recorded in Oklahoma (Heck and Arbour 2001b), and estimates of hundreds of yellow rails (*Coturnicops noveboracensis*) (P. Dickson, Louisiana Ornithological Society, personal communication).

Hicks (2003) studied wildlife use of early successional habitats provided by bottomland hardwood wetlands restored through WRP in the Cache River watershed in southern Illinois. Surveys conducted in 2002 and 2003 documented use of WRP wetlands by 18 species of waterfowl, 9 shorebird groups, 5 marsh bird species, and 8 wading bird species. Mean densities within each taxa were at least comparable between WRP and reference wetlands; mean waterfowl density on WRP sites in 2003 exceeded mean waterfowl density on reference sites. Species richness for shorebirds, wading birds, and marsh birds on WRP sites did not differ from reference sites (Hicks 2003). These data indicate that early successional wetland habitats provided by WRP enrollments following restoration are providing tangible benefits to local wildlife communities.

Documented waterfowl use of restored WRP wetland sites in the Oneida Lake Plain of central New York show similar results (M. R. Kaminski and G. A. Baldassarre, State University of New York, unpublished data). A 2-year field study (2003–2004) examining waterfowl production in these wetlands showed that mallard (*Anas platyrhynchos*) productivity in WRP wetland and upland sites was greater than on comparable non-WRP nesting sites. Although sample sizes were small, hen success rate on WRP restored wetlands (3 of 3 nests succeeded) and grasslands (3 of 6 nests succeeded) appeared to exceed hen success rate on non-WRP wetlands (2 of 4 nests succeeded) and grasslands (2 of 8 nests succeeded).

WRP has been a major tool for restoring wetlands for migratory birds in California's Central Valley. A diversity of microtopographic conditions provides both open water and emergent vegetation. (Alan Forkey, NRCS)

Harris (2001) studied bird use of 21 semi-permanent and spring-seasonal restored wetlands in California's Sacramento Valley, 5 of which were sites enrolled in WRP (P. A. Morrison, U.S. Fish and Wildlife Service, personal communication). This study found that these restored wetlands attracted diverse bird communities, with species richness greater on semi-permanent restored wetlands than on spring-seasonal sites. Wetland obligate bird species were associated with greater water depths and wetland size (Harris 2001).

Preliminary data from work investigating anuran amphibian use of WRP sites in Arkansas and Louisiana illustrate the potential value of these restored wetlands to amphibians. Sampling of 21 WRP sites in Avoylles Parish, Louisiana, in 2004 detected 11 of 12 species expected to occur in the region, with 12 of the sites each supporting at least 3 species. Likewise, anuran call surveys in 2004 in Mississippi detected amphibians using 15 of 20 WRP newly restored sites sampled, detecting 12 of 14 potential species for the region (S. L. King, U.S. Geological Survey Louisiana Cooperative Fish and Wildlife Research Unit, unpublished data).

Uyehara (2005) investigated use of WRP wetlands and other wetlands by the endangered Hawaiian duck (*Anas wyvilliana*), or Koloa, in Hawaii. Among the 48 total wetlands examined, Koloa were observed more frequently at WRP wetlands than on non-WRP wetland sites (81% vs. 41%). Uyehara (2005) concluded that WRP wetlands served as functional habitat patches for Hawaiian ducks within a matrix of uplands and stream habitats. She also concluded that clustering WRP wetlands around existing wetlands used by Koloa provides additional habitat value.

While wetlands restored through WRP appear comparable to other wetlands in their use by a variety of wildlife, greater habitat value for some wildlife species or groups has been documented where active wetland habitat management is involved. For example, waterfowl densities were 2–4 times greater on managed than non-managed wetlands studied in New York (M. R. Kaminski and G. A. Baldassarre, State University of New York, unpublished data), implying the potential value of periodic draw-down to improve habitat quality for migrating and breeding waterbirds. This finding, as well as that of Hicks (2003), demonstrates the importance of proper management of restored wetlands to achieving maximum wildlife benefits.

## Knowledge Gaps

Many studies have been conducted that document local fish and wildlife response to various restored and created wetlands, primarily through documentation of habitat use (Rewa 2000b). Few of these studies document the effects of wetland restoration on species populations or how local restoration actions affect overall landscape functions. At the same time, threats to remaining wetlands are expected to increase in the coming century, presenting greater challenges for waterbirds and other wetland-dependent wildlife (O'Connell 2000, Higgins et al. 2002).

Wetland-restoration programs such as WRP are being looked upon as a means to help restore previously lost habitats for fish (Hussey 1994), waterfowl (Baxter et al. 1996), Neotropical migratory birds (Twedt and Uihlein 2005), and even some endangered species, such as the Louisiana black bear (*Ursus americanus luteolus*) (Guglielmino 2000). More than 1.6 million acres are currently enrolled in WRP. While the literature engenders confidence in the assumption that these acres are providing functional habitats, quantitative measures of how these enrollments are affecting fish and wildlife populations beyond local observations of habitat use are lacking.

Wetland restoration actions begin the time-dependent process of recovering previously lost wetland function (Mitsch and Wilson 1996). Most wetlands enrolled in WRP are relatively young in their development

Ephemeral wetlands at the Lake Valley WRP site in New Mexico provide breeding habitat for amphibians and other wildlife during summer monsoons and habitat for waterfowl during the winter.
(Matilde Holzworth)

of the full suite of wetland habitat values expected to be realized over time. Little is known on how the additional habitat being provided by new WRP enrollments and successional progression of existing enrollments offsets ongoing loss and degradation of remaining wetland and upland habitats in agricultural landscapes.

As noted above, WRP has the unique potential to establish large complexes of restored wetlands in agricultural landscapes, in some cases, changing the local habitat matrix from agricultural cropland to wetland habitat. This has great potential to positively affect amphibians, area-sensitive forest birds, and other species that are vulnerable to fragmentation of natural habitats (Lehtinen et al. 1999; Twedt et al., in press). Large wetland complexes located strategically along migratory pathways may also directly affect survival, distribution, and reproduction capability of waterbirds, waterfowl, and other migratory birds (Beyersbergen et al. 2004). Better measures of how WRP wetland complexes affect these species and groups are needed.

The need for effective monitoring to evaluate the effectiveness of ecological restoration has been the topic of interest in recent years (Block et al. 2001). Integration of effective ecological monitoring measures into WRP program implementation would facilitate compilation of fish and wildlife use data on a broader scale. Combining these data with landscape variables and wildlife population trend data from other sources may present an opportunity to more effectively quantify the effects of WRP enrollments on population dynamics for some species.

## Efforts to Document Wildlife Benefits

The USDA is currently engaged in an effort to quantify the environmental benefits of its conservation program practices (Mausbach and Dedrick 2004). This effort, known as the Conservation Effects Assessment Project (CEAP), relies on the use of existing physical effects process models applied to a sample of cropland and Conservation Reserve Program field sites throughout the country to estimate soil- and water-related benefits nationwide. Work plans to address fish and wildlife benefits of conservation programs and practices and to address other land uses (e.g., wetlands and grazing lands) are also being developed to complement the national CEAP assessment.

The approach under development to quantify the environmental benefits of wetland practices has the potential to improve our understanding of the wildlife benefits derived from WRP in the future. Much of the WRP enrollment occurs in several geographic regions—the Mississippi Alluvial Valley, the upper Midwest, and California's Central Valley

(Figure 1). In recognition of the distribution of WRP and other wetland restoration efforts, a series of regional data collection and modeling efforts are planned to estimate the wildlife habitat and other benefits obtained through wetland restoration (S. D. Eckles, NRCS, personal communication). These efforts are expected to produce quantitative estimates of conservation effects including response of some wildlife groups (e.g., amphibians and waterbirds) resulting from wetland restoration in various regions around the country. Output from this CEAP wetlands component is expected to produce predictive models capable of quantifying the contribution of WRP enrollments to sustaining select wildlife species populations in agricultural landscapes.

## Conclusions

In some areas with significant enrollments, WRP is contributing to shifts in land-use patterns toward functional wetland ecosystems that occurred prior to conversion to agricultural use in the 20th century. Wetlands enrolled in WRP have great potential to provide valuable habitats to wetland-dependent and other fish and wildlife species on agricultural landscapes and beyond. While studies underway and recently completed are beginning to reveal the magnitude of this potential, most of the fish and wildlife–related benefits being generated by the more than 1.6 million acres enrolled in the program have yet to be quantified. Additional work is needed to better understand how wetlands restored through the program contribute to fish and wildlife habitat use patterns and population trends.

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# The Grassland Reserve Program: New Opportunities to Benefit Grassland Wildlife


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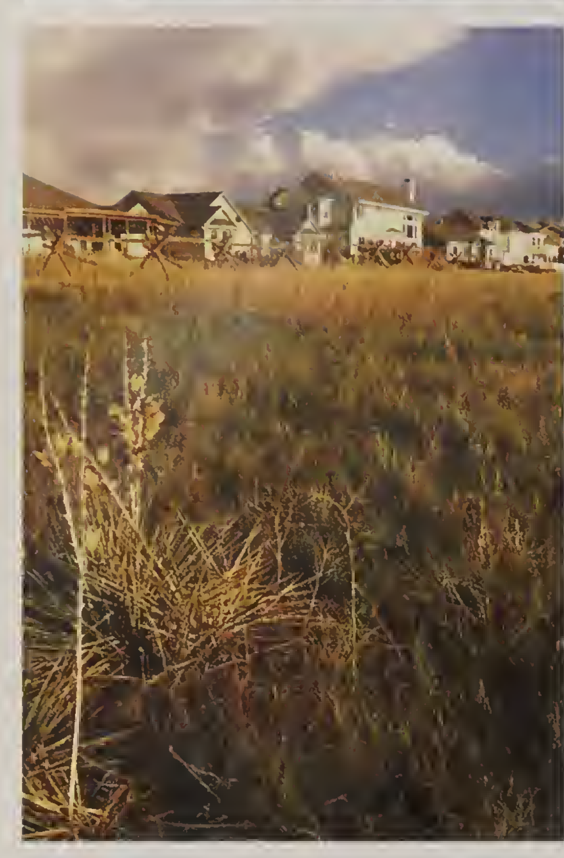
## Abstract

*The Grassland Reserve Program (GRP) was established by the 2002 Farm Bill to provide assistance to landowners in conserving and enhancing ecological value of grasslands while maintaining their suitability for grazing and other compatible uses. In response to long-term declines in grassland acreage and their associated benefits, approximately 524,000 acres have been enrolled since fiscal year 2003 in a variety of long-term rental agreements and easements. The program has proven popular with landowners. Whereas wildlife benefits have likely accrued by protection, enhancement, and restoration of grasslands enrolled, little effort has been made to quantify wildlife response during the first 2 years of program operation. Additional studies are needed to document wildlife benefits achieved.*


## Introduction

Historically, grasslands and shrublands occupied approximately 1 billion acres of the contiguous United States—about half the landmass. Roughly half of these lands have been converted to cropland, urban land, and other land uses. Non–federally owned grasslands in the U.S. (pastureland and rangeland) currently cover approximately 522 million acres (Natural Resources Conservation Service, 2002 National Resources Inventory). Grasslands provide both ecological and economic benefits to



Urban sprawl threatens shortgrass prairie in Colorado. (J. Vanuga, USDA-NRCS)

local residents and society in general (Licht 1997). Grassland importance lies not only in the immense area covered, but also in the diversity of benefits they produce. These lands provide water for urban and rural uses, livestock products, flood protection, wildlife habitat, and carbon sequestration services. These lands also provide aesthetic value in the form of open space and are vital links in the enhancement of rural social stability and economic vigor, as well as being part of the nation's history.

Grassland loss through conversion to other land uses such as cropland, parcels for home sites, invasion of woody or nonnative species, and urban and exurban development threatens grassland resources (Knight et al. 2002). Between 1982 and 2002, non-federal acreage devoted to grazing uses (rangeland, pastureland, and grazed forest land) declined from 611 million acres in 1982 to 578 million acres in 2002, a decrease of over 5%. Between 1992 and 2002, the net decline in grazing land acreage was about 3% (Natural Resources Conservation Service, 2002 National Resources Inventory). Today, grasslands are considered North America's most endangered ecosystem (Noss et al. 1995, Samson and Knopf 1996).

## Program Description

In recognition of the importance of grasslands and the threats they face, the Grassland Reserve Program (GRP) was created by the Farm Security and Rural Investment Act of 2002 (i.e., 2002 Farm Bill). The GRP is a voluntary program that helps landowners and operators restore and protect grassland, including rangeland, pastureland, and certain other lands, while maintaining the lands' suitability for grazing. The GRP is a voluntary program with the goal of conserving, enhancing, and restoring eligible land through easement purchases and rental agreements with landowners. As required by statute, emphasis is on supporting grazing operations, plant and animal biodiversity, and grassland and land containing shrubs or forbs under the greatest threat of conversion. The following privately owned or tribal lands are eligible for enrollment:

- Grasslands (including lands on which the vegetation is dominated by grasses, grass-like plants, shrubs, and forbs, encompassing rangeland and pastureland).
- Land located in an area historically dominated by grassland, forbs, or shrubland, with potential to serve as habitat for ecologically significant animal or plant populations, if retained in its current use or restored to a natural condition.
- Incidental land contributing to properly configuring boundaries, allowing efficient management of the area for easement purposes and otherwise promoting and enhancing GRP objectives. Parcels of less than 40 contiguous acres are generally ineligible, but may be accepted

where program objectives are met and there are opportunities to protect sites with unique grassland attributes.

Participants have the opportunity to enroll acreage in rental agreements with durations of 10, 15, 20, or 30 years, or long-term or permanent easements. Under both easements and rental agreements, participants have the opportunity to utilize common grazing-management practices to maintain the viability of the grassland acreage. Landowners retain ownership and associated responsibilities, including property taxes, and are required to follow a conservation plan on all acres enrolled in the program.

Technical and financial assistance is provided to restore the natural grassland functions and values. No acreage limit is placed on total enrollment, but a maximum of 2 million acres may be enrolled for the purpose of grassland restoration. Program payments are determined as follows:

- For permanent easements, the fair market value of the land less the grazing value of the land encumbered by the easement.
- For 30-year easements or easements for the maximum duration allowed under applicable state law, 30% of the fair market value of the land less the grazing value of the land.
- For rental agreements, annual payments not to exceed 75% of the annual grazing value.
- For previously cultivated land, cost-share payments of up to 75% of the cost of grassland restoration is provided. For land that has never been cultivated, restoration cost-share rate may be up to 90%.

The program is jointly administered by the Natural Resources Conservation Service (NRCS) and the Farm Service Agency (FSA). The NRCS has lead responsibility on technical issues and easement administration, and the FSA has lead responsibility for rental agreement administration and financial activities. The program operates under a continuous signup process. The NRCS and FSA, working in consultation with state technical committees, use state-developed ranking criteria to ensure GRP funds are directed toward the most appropriate projects for the local area. Additional information on the specifics of program operation is provided at <http://www.nrcs.usda.gov/programs/GRP/>.

## Program Funding and Enrollment

The 2002 Farm Bill authorized $254 million to be spent on GRP over fiscal years 2003–2007. Under this authorization, approximately $169 million of financial assistance has been made available for GRP during fiscal year (FY) 2003, FY 2004, and FY 2005. These funds have supported enrollment of approximately 524,000 acres during the first 2 years of program operation (Table 1). The program is operational in all 50 states. However, much of the acreage enrolled is encompassed by large contracts on central and western rangelands, whereas a large number of smaller contracts are scattered throughout the country (Figure 1). Contrasting FY 2004 enrollment activity in Georgia and Montana illustrates this point, where 8,966 acres in 57 contracts were enrolled in Georgia and 10,353 acres in just 3 contracts were enrolled in Montana.

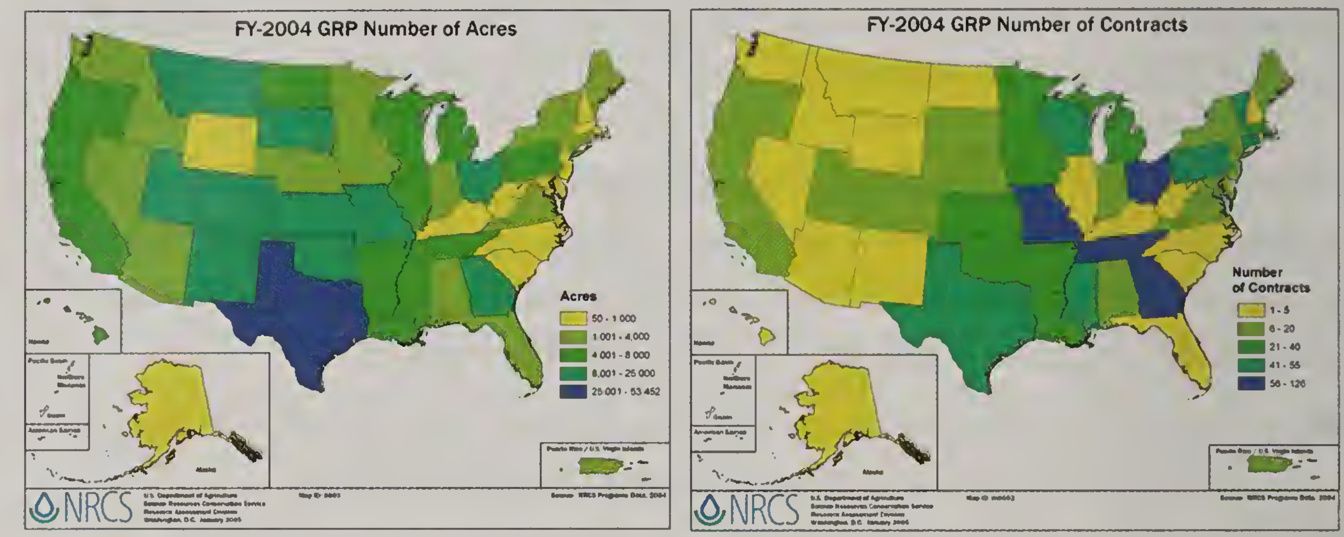



Figure 1. Distribution of number of acres and contracts enrolled in the Grassland Reserve Program during fiscal year (FY) 2004.

Table 1. Grassland Reserve Program (GRP) enrollment activity during fiscal year (FY) 2003–2004.

| Enrollment activity | FY 2003 | FY 2004 | Total |
|---|---|---|---|
| Number of participants enrolled | 794 | 1,055 | 1,849 |
| Acres enrolled | 240,965 | 283,338 | 524,303 |
| Acres enrolled consisting of native grassland, rangeland, and shrubland permanently protected through GRP conservation easements | 60,341 | 78,218 | 138,559 |
| Acres protected to benefit declining species | 134,098 | 255,000 | 389,098 |
| Number of unfunded applications | | 9,091 | |
| Acres associated with unfunded applications | | 6,241,587 | |
| Unmet funding need associated with unfunded applications | | $1,498 million | |

Interest in the program has far outpaced the funding available—the number of applications received in FY 2004 was approximately 10 times the number accepted (Table 1). The vast number of applications received has enabled the agencies to select high-quality applications, resulting in nearly 75% of acres enrolled targeted toward benefiting declining species (Table 1).

## Wildlife Benefits

Because FY 2003 was the first year of GRP implementation, efforts to evaluate wildlife response to program enrollments since then have been minimal. We found no published wildlife studies specifically related to lands enrolled in the GRP. However, observations can be made regarding the potential for GRP to provide significant benefits to some species and species groups being targeted by program implementation.

By prioritizing enrollment acceptance to lands with the greatest biodiversity and where the threat of conversion to other land uses is greatest, GRP is maximizing the benefits to wildlife species that depend on these lands for survival. The program is being implemented to target declining species and has made substantial progress in protecting existing native grassland communities. Through FY 2004, over 138,000 acres of natural grassland systems have been protected by permanent easements. With proper management, these lands are ensured of providing long-term wildlife habitat and other ecological benefits. Although GRP enrollments potentially benefit a wide array of grassland-associated wildlife, several examples of species benefited are worth noting here.

### *Sage-grouse*

The greater sage-grouse (*Centrocercus urophasianus*) is a native upland game bird that is considered a sagebrush ecosystem–obligate species of the Intermountain West. Sage-grouse populations have declined steadily across much of its range since European settlement (Connelly et al. 2000). Habitat degradation through altered fire regimes, fragmentation, land-use conversion, and introduction of exotic invasive species has contributed to this decline (Connelly et al. 2004). In FY 2004, USDA provided $2 million in additional GRP financial assistance to 4 western states for greater sage-grouse conservation and recovery on lands identified by state wildlife agencies as containing critical sage-grouse habitat. The funds are being used for enrollment of GRP easements on private lands in Colorado, Idaho, Utah, and Washington, with technical assistance and additional financial assistance provided through state and local partnerships. Improving the habitat quality through manipulating vegetation to increase the amount of forbs available for brood habitat (Wirth and Pyke 2003) and reducing the amount of separation between summer and winter habitats are important elements of GRP activity to benefit sage-grouse.

### *Grassland Birds*

As a group, North American grassland breeding bird populations have declined significantly in recent decades (Sauer et al. 2004). Loss of grasslands on the breeding grounds and habitat fragmentation are considered among the causes most responsible for these declines (Burger et al. 1994, Vickery at al. 1999, Herkert et al. 2003). Efforts to restore degraded grassland habitats and reestablish previously converted grasslands have been shown to benefit grassland birds and may have

Pronghorn antelope in shortgrass prairie. (G. Kramer, USDA-NRCS)

the potential to help stem population declines. For example, Fletcher and Koford (2002) found bird communities in restored grasslands in Iowa to be similar to those in natural grassland habitats. Grassland Reserve Program enrollments have the potential to benefit grassland birds by restoring local habitat quality and reducing the effects of habitat fragmentation on prairie landscapes. Species benefited include Neotropical migratory song birds as well and non-migrating birds such as prairie-chickens (*Tympanuchus* spp.) and northern bobwhites (*Colinus virginianus*).

### *Big Game Corridors*

Lands enrolled in GRP are also preventing fragmentation of critical migration habitat corridors for elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), and pronghorn antelope (*Antilocapra americana*).

## Knowledge Gaps

Native grasslands vary widely in their quality and characteristics. Grasslands can range from virgin prairie to heavily grazed native rangeland to pasture lands dominated by introduced forage species. Identifying and selecting ecologically significant and unique grasslands would maximize the GRP's ability to secure many of the environmental benefits grasslands provide. At this point, the vegetation composition and wildlife populations of GRP lands have not been adequately studied to characterize wildlife benefits realized.

Additional questions remain regarding how GRP enrollments influence overall land use at landscape scales. Specifically, we do not know whether the benefits obtained by GRP enrollments are offset by conversion of other grasslands to other uses.

## Conclusions

The GRP offers the opportunity to protect and restore up to 2 million acres of grasslands, many of which will be on existing native grasslands. While quantitative data that describe wildlife response are lacking, GRP has the potential to provide substantial benefits to declining species associated with grassland ecosystems in the United States. Additional studies are needed to enable program managers and participants to understand and maximize wildlife benefits derived from GRP enrollments.

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# Fish and Wildlife Benefits of the Wildlife Habitat Incentives Program

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## Abstract
*The Wildlife Habitat Incentives Program (WHIP) is a voluntary program that encourages the establishment and enhancement of a wide variety of fish and wildlife habitats of national, state, tribal, or local significance. Through voluntary agreements, the Natural Resources Conservation Service (NRCS) provides financial and technical assistance to participants who installed habitat restoration and management practices. Since 1998, nearly $150 million has been dedicated to the program and over 2.8 million acres involving over 18,000 contracts have been enrolled. A wide range of habitat-enhancement actions are cost-shared through the program, affecting hundreds of target and non-target species. While few quantitative data exist describing how fish and wildlife have responded to terrestrial and aquatic habitats enrolled in the program, the popularity of WHIP among participants and funding partners and anecdotal evidence imply that tangible benefits to target species are being realized. Additional studies are needed to better understand how WHIP projects affect local habitat use by and population response of target and non-target species.*

## Introduction
The Wildlife Habitat Incentives Program (WHIP) was established by the 1996 amendments to the 1985 Food Security Act and reauthorized by the Farm

Security and Rural Investment Act of 2002. Whereas other U.S. Department of Agriculture (USDA) conservation programs include wildlife conservation as a program purpose, WHIP is the only conservation program principally focused on addressing fish and wildlife habitat needs. Through WHIP, the Natural Resources Conservation Service (NRCS) provides technical and financial assistance to landowners and others to develop upland, wetland, riparian, and aquatic habitat areas on their property.

Through 5- to 10-year voluntary contracts, WHIP provides technical assistance and up to 75% of the cost of installing terrestrial and aquatic fish and wildlife habitat practices recommended in a wildlife habitat development plan. A provision in the 2002 Farm Bill enables cost-share to exceed 75% for contracts that are 15 years in duration.

Since implementation of WHIP began in 1998, over 2.8 million acres have been enrolled for a variety of fish and wildlife habitat objectives. While enrollment is substantial, little effort has been placed on quantifying benefits to the fish and wildlife resources targeted by WHIP projects. Hackett (2000) reviewed the literature that was available concerning the first 2 years of program operation. Few additional quantitative fish and wildlife studies to document response specifically related to WHIP have been conducted since. Therefore, this paper focuses on updating readers on WHIP implementation since 2000 and provides some examples of the types of projects the program is supporting to benefit fish and wildlife resources. Information presented on principle practices and program focus will help set the stage for the program-neutral, practice-based literature synthesis currently under development by The Wildlife Society and others.

Table 1. General enrollment information for the Wildlife Habitat Incentives Program (WHIP).

| Heading | Fiscal year (FY) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1998 | 1999 | 2000[a] | 2001 | 2002 | 2003 | 2004 |
| No. contracts enrolled | 4,340 | 3,800 | 519 | 2,477 | 1,946 | 2,123 | 3,012 |
| Cumulative no. contracts | 4,340 | 8,140 | 8,659 | 11,136 | 13,082 | 15,205 | 18,217 |
| Acres (× 1,000) | 672 | 721 | 92 | 212 | 368 | 299 | 432 |
| Cumulative acres (× 1,000) | 672 | 1,393 | 1,485 | 1,697 | 2,065 | 2,364 | 2,876 |
| Funding (× $1,000) | 30,000 | 20,000 | 0 | 12,500 | 15,000 | 30,000 | 42,000 |
| Average contract size (acres) | 146 | 187 | 176 | 92 | 189 | 141 | 140 |
| Average cost-share ($/acre) | 44 | 28 | 110 | 59 | 34 | 55 | 63 |
| Unfunded applications (number and total cost-share requested [× $1,000]) | | | | | | 3,660 40,393 | 3,033 10,704 |

[a] Although no funds were allocated for WHIP in FY 2000, additional lands were enrolled using carry-over funds from previous years.

## Program Funding and Enrollment

Although the program was authorized in 1996, it was first implemented through a $30 million allocation in fiscal year (FY) 1998. An additional $20 million was allocated in FY 1999; the program was not funded in FY 2000. While funding has varied over the years, a total of $149.5 million had been appropriated to WHIP through FY 2004 (Table 1). By the end of FY 2004, over 2.8 million acres involving over 18,000 contracts had been enrolled (Table 1).

WHIP is a popular program, generating far more applications than it has been able to fund. In recent years, the number of contracts funded has been approximately half the number of applications received (Table 1). This tendency has remained through the life of the program, illustrated by signup activity during early enrollment periods. For example, while 428 applications were received in Oklahoma in 1999, only 74 were funded (Wildlife Management Institute 2002).

Management of the program is viewed positively by program participants. A recent customer satisfaction survey found that the American Customer Satisfaction Index (ASCI) score for WHIP of 77 to be rated significantly above the private sector services score of 74.7 and well above the aggregate federal government ASCI score of 70.9 (Federal Consulting Group 2004). Satisfaction with NRCS customer service (courtesy and professionalism) was the primary factor responsible for the high score, whereas the application process was seen less favorably.

Partnership with other organizations has remained a key aspect of WHIP implementation. The NRCS cooperates with other federal agencies, state and local partners, and the private sector to address local and national conservation issues. The NRCS State Technical Committees provide a forum to establish state wildlife priorities and for working with other fish and wildlife interests in the state to encourage the leveraging of other public and private funding. Links to state web pages with program descriptions and priorities can be viewed on the NRCS web site at <www.nrcs.usda.gov/programs/whip/WHIP_signup/WHIP_Stateprograms.html>.

Whereas WHIP participants contribute to the cost of habitat projects, conservation groups and other organizations also play a major role in many instances. In FY 2004, partners contributed over $8 million in cost-share or in-kind services to help participants establish wildlife habitat practices on enrolled lands. Partners also bring technical expertise to the collaboration and may create wildlife habitat development plans, monitor progress, and assist in communication with stakeholders. In addition, partners bring other resources into the WHIP program through cost-share, by supplying equipment, or providing staff or volunteers who install practices. Emphasis on partnership has strengthened WHIP and is an essential facet of the program's success.

## Targeted Habitats and Practices

The WHIP Program Manual describes the emphasis of the program as follows:

- Wildlife and fisheries habitats of national and state significance.
- Habitats of fish and wildlife species experiencing declining or significantly reduced populations, including rare, threatened, and endangered species.
- Practices beneficial to fish and wildlife that may not otherwise be funded.

States generally select 2 to 6 priority habitat types, including 1 or more upland and riparian habitats. Wetlands, aquatic in-stream habitat and other unique wildlife habitat such as caves and salt marshes are also priorities in a number of states (Table 2).

Specific multi-state initiatives have also been established. For example, the WHIP Salmon Habitat Restoration Initiative helps landowners in Alaska, California, Idaho, Maine, Oregon, and Washington develop projects that restore habitat for Pacific and Atlantic salmon. Projects may include providing shade along streams, restoring gravel spawning beds, removing barriers to fish passages and reducing agricultural runoff. Funding for this initiative has been substantial—$3.5 million was allocated in FY 2004, and $2.8 million is being dedicated to this initiative in FY 2005.

Over 90% (388,454 acres) of the acres enrolled in WHIP in FY 2004 addressed upland wildlife habitats such as grasslands, shrub–scrub, and forests, whereas less than 5% (21,500 acres) of WHIP lands enrolled were wetland habitats. Riparian habitat made up less than 5% of the acres enrolled in FY 2004 as well. In FY 2004, 131 contracts involving $2.9 million in cost-share funding and covering 21,000 acres were enrolled in 25 states to address habitat needs of threatened or endangered species.

A wide variety of lands and habitat types are eligible for enrollment in the program, enabling many clients to participate in USDA programs for the first time. Although many enrolled lands do involve agricultural production, this is not a requirement of the program. For example, 30 schools and environmental education centers have developed "WILD School Sites" with WHIP technical and financial assistance. Many types of practices are cost-shared to provide the planned habitat in WHIP

Table 2. Examples of habitat types, species targeted, and practices cost-shared under Wildlife Habitat Incentives Program (WHIP) to achieve fish and wildlife habitat objectives.

| Habitat type | Examples of species or groups targeted | Practices and/or habitat-management actions |
|---|---|---|
| Upland<br>Early successional/ grasslands<br>Range lands<br>Forest lands<br>Shrub/scrub<br>Cropland | Karner blue butterfly, gopher tortoise, Gunnison sage-grouse, short-eared owl and other grassland nesting birds, northern bobwhite, western harvest mouse, swift fox | Seeding and plantings<br>Fencing<br>Livestock management<br>Prescribed burning<br>Shrub thickets and shelterbelts<br>Creation of forest openings<br>Disking or mowing (meander disking through woodlands)<br>Woody cover control<br>Brush management<br>Aspen stand regeneration<br>Exclusion of feral animals<br>Winter flooding of crop fields |
| Wetland<br>Tidal flushing areas<br>Salt marshes<br>Wetland hardwood hammocks<br>Mangrove forests<br>Wild-rice beds<br>Freshwater marshes<br>Estuaries<br>Vernal pools | Fairy shrimp, short-nosed sturgeon, amphibians, Santa Cruz long-toed salamander, black-crowned night heron, snowy egret, ibis, osprey, piping plover, California clapper rail, canvasback, Koloa duck, Nene goose | Installation of culverts or water-control structures<br>Invasive plant control<br>Fencing<br>Creation of green-tree reservoirs<br>Moist soil unit management<br>Creation of shallow water area |
| Riparian and in-stream<br>Riparian areas along streams, rivers, lakes, sloughs and coastal areas<br>In-stream habitats | Higgin's eye pearly mussel, Ouachita rock pocketbook mussel, California freshwater shrimp, valley elderberry longhorn beetle, Puritan tiger beetle, short-nosed sturgeon, arctic grayling, American shad, Bonneville cutthroat trout, Oregon chub, bull trout, westslope cutthroat trout, brook trout, pallid shiner, leopard darter, Arkansas darter, hellbender, Pacific giant salamander, ornate box turtle, alligator snapping turtle, painted turtle, woodcock, Columbia sharp-tailed grouse, least tern, belted kingfisher, yellow-billed cuckoo, southwest willow flycatcher, Le Conte's sparrow, Preble's meadow jumping mouse, river otter | Tree plantings<br>Fencing with livestock management and off-stream watering<br>In-stream structures, including installation of large wood<br>Seeding<br>Streambank protection and stabilization<br>Stream deflectors<br>Creation of small pools<br>Installation of buffers<br>Removal of dams<br>Fencing<br>Creation of fish passage<br>Gravel bed creation |
| Threatened and endangered, and other rare or declining species<br>Various | American burying beetle, Neosho madtom, Topeka shiner, Snake River Chinook salmon, Umpqua River cutthroat trout, Lahontan cutthroat trout, coho salmon, steelhead, bulltrout, dusky gopher frog, bog turtle, gopher tortoise, southern hognose snake, eastern indigo snake, black pine snake, Florida sandhill crane, Mississippi sandhill crane, wood stork, Yuma clapper rail, snail kite, caracara, red-cockaded woodpecker, grasshopper sparrow, gray bat, lesser long-nosed bat, black-tailed prairie dog, Sonoran pronghorn, kit fox, Mexican wolf, Louisiana black bear, Florida panther | Species habitat requirement–specific actions |

Table 3. Practices reported as planned and applied under the Wildlife Habitat Incentives Program WHIP during fiscal year (FY) 2004 that are generally recognized for providing benefits to fish and wildlife. (Data provided by the Natural Resources Conservation Service [NRCS] National Conservation Planning Database. Acres planned or installed do not directly correspond to acres enrolled in FY 2004 due to overlap in enrolling lands and planning and installing conservation practices.)

| | | Units | |
|---|---|---|---|
| **Conservation practice** | **NCRS code** | **Planned**[a] | **Installed**[b] |
| **Wildlife-specific practices** | | | |
| Early successional habitat development/management (acres) | 647 | 16,600 | 3,878 |
| Hedgerow planting (feet) | 422 | 363,118 | 88,293 |
| Restoration and management of declining habitats (acres) | 643 | 4,174 | 1,517 |
| Riparian herbaceous cover (acres) | 390 | 3,226 | 41 |
| Shallow water management for wildlife (acres) | 646 | 4,922 | 934 |
| Upland wildlife habitat management (acres) | 645 | 659,735 | 177,667 |
| Wetland wildlife habitat management (acres) | 644 | 36,769 | 8,553 |
| Wildlife watering facility (no.) | 648 | 164 | 32 |
| **Buffer practices** | | | |
| Field border (feet) | 386 | 754,205 | 139,198 |
| Riparian forest buffer (acres) | 391 | 2,572 | 263 |
| Windbreak/shelterbelt establishment (feet) | 380 | 984,667 | 374,085 |
| Windbreak/shelterbelt renovation (feet) | 650 | 83,036 | 24,579 |
| **Grazing lands practices** | | | |
| Brush management (acres) | 314 | 57,974 | 11,639 |
| Fence (feet) | 382 | 1,579,539 | 421,812 |
| Prescribed burning (acres) | 338 | 137,017 | 33,382 |
| Prescribed grazing (acres) | 528a | 239,888 | 113,698 |
| **Forestland practices** | | | |
| Forest stand improvement (acres) | 666 | 22,506 | 12,368 |
| Tree/shrub establishment (acres) | 612 | 9,606 | 1,994 |
| **Wetland and stream practices** | | | |
| Dike (feet) | 356 | 69,430 | 13,188 |
| Fish passage (no.) | 396 | 106 | 3 |
| Pond (no.) | 378 | 315 | 79 |
| Stream habitat improvement and management (acres) | 395 | 9,367 | 4,855 |
| Streambank and shoreline protection (feet) | 580 | 101,025 | 25,686 |
| Structure for water control (no.) | 587 | 110 | 45 |
| Wetland enhancement (acres) | 659 | 601 | 460 |
| Wetland restoration (acres) | 657 | 9,316 | 3,208 |

[a] Practices planned during FY 2004 that were approved for cost-share under WHIP contracts.

[b] Practices approved for cost-share under WHIP contracts established in FY 2004 or prior years and installed during FY 2004.

habitat plans. A number of these practices are widely recognized for their potential to improve fish and wildlife habitat quality. Table 3 provides a list of these practices planned and installed during FY 2004. Table 4 provides a list of other practices that, while not generally recognized as practices designed to address fish and wildlife habitat needs, were planned and installed for WHIP projects during FY 2004. This information provides a window into the relative amount of effort placed on each of the various NRCS conservation practices in WHIP implementation. The Upland Wildlife Habitat Management (645) practice stands out with nearly 660,000 acres planned during FY 2004 (Table 3). This practice is an umbrella practice for many activities undertaken for the purpose of creating, restoring, maintaining, or enhancing areas for food, cover, and water for upland wildlife and species that use upland habitat for a portion of their life cycle (NRCS 645 Practice Standard, Field Office Technical Guide). Many types of projects are carried out under this practice, making it difficult to determine specific habitat-manipulation actions performed without inspection of individual wildlife habitat plans. Specific habitat manipulation is easier to visualize for other practices.

Table 4. Practices reported planned and applied under Wildlife Habitat Incentives Program (WHIP) during fiscal year (FY) 2004 that are not generally recognized as wildlife practices. (Data provided by the Natural Resources Conservation Service [NRCS] National Conservation Planning Database.)

| | | Units | |
|---|---|---|---|
| **Conservation practice** | **NCRS code** | **Planned[a]** | **Installed[b]** |
| Access road (feet) | 560 | 34,653 | 850 |
| Agroforestry planting (acres) | 704 | 12 | 12 |
| Animal trails and walkways (feet) | 575 | 1,084 | |
| Channel bank vegetation (acres) | 322 | 5 | 1 |
| Channel stabilization (feet) | 584 | 1,556 | |
| Clearing and snagging (feet) | 326 | 230 | |
| Composting facility (no.) | 317 | 1 | |
| Conservation cover (acres) | 327 | 6,352 | 2,771 |
| Conservation crop rotation (acres) | 328 | 5,177 | 1,867 |
| Constructed wetland (no.) | 656 | 3 | 3 |
| Contour buffer strips (acres) | 332 | 30 | 8 |
| Contour farming (acres) | 330 | 393 | 393 |
| Controlled stream access for livestock watering (no.) | 730 | 2 | 2 |
| Cover crop (acres) | 340 | 1,211 | 244 |
| Critical area planting (acres) | 342 | 885 | 63 |
| Cross wind trap strips (acres) | 589c | 66 | |
| Dam, diversion (no.) | 348 | 1 | |
| Diversion (feet) | 362 | 6,690 | 1,599 |
| Filter strip (acres) | 393 | 134 | 22 |
| Firebreak (feet) | 394 | 4,442,070 | 1,727,153 |
| Forage harvest management (acres) | 511 | 2,348 | 1,832 |

| Conservation practice | NCRS code | Units | |
|---|---|---|---|
| | | Planned[a] | Installed[b] |
| Forest site preparation (acres) | 490 | 4,414 | 1,261 |
| Forest trails and landings (acres) | 655 | 229 | 32 |
| Grade stabilization structure (no.) | 410 | 95 | 16 |
| Grassed waterway (acres) | 412 | 10 | 5 |
| Grazing land mechanical treatment (acres) | 548 | 60 | |
| Heavy use area protection (acres) | 561 | 1,178 | 53 |
| Irrigation canal or lateral (feet) | 320 | 1,200 | 1,200 |
| Irrigation field ditch (feet) | 388 | 769 | |
| Irrigation or regulating reservoir (no.) | 552 | 6 | |
| Irrigation system, micro-irrigation (no.) | 441 | 9,091 | 138 |
| Irrigation system, sprinkler (no.) | 442 | 33 | |
| Irrigation system, surface and subsurface (no.) | 443 | 1 | |
| Irrigation water conveyance, ditch and canal lining, nonreinforced concrete (feet) | 428a | 125 | |
| Irrigation water conveyance, pipeline, high-pressure, underground, plastic (feet) | 430dd | 31,389 | 1,300 |
| Irrigation water conveyance, pipeline, low-pressure, underground, plastic (feet) | 430ee | 9,545 | |
| Irrigation water conveyance, pipeline, rigid gated pipeline (feet) | 430hh | 2,845 | 3,500 |
| Irrigation water management (acres) | 449 | 401 | 86 |
| Land clearing (acres) | 460 | 550 | 199 |
| Land grading (acres) | 744 | 520 | 520 |
| Land smoothing (acres) | 466 | 4 | 5 |
| Mine shaft and adit closing (no.) | 457 | 1 | 1 |
| Mulching (acres) | 484 | 75 | 45 |
| Nutrient management (acres) | 590 | 11,060 | 4,797 |
| Obstruction removal (acres) | 500 | 40 | |
| Pasture and hay planting (acres) | 512 | 2,336 | 1,067 |
| Pest management (acres) | 595 | 20,959 | 14,352 |
| Pipeline (feet) | 516 | 371,511 | 73,560 |
| Planned grazing system (acres) | 762 | 783 | 813 |
| Pond sealing or lining, bentonite sealant (no.) | 521c | 4 | |
| Pond sealing or lining, flexible membrane (no.) | 521a | 5 | |
| Pumping plant (no.) | 533 | 24 | 2 |
| Range planting (acres) | 550 | 12,238 | 2,811 |
| Recreation area improvement (acres) | 562 | 15 | 11 |
| Recreation land grading and shaping (acres) | 566 | 1 | 1 |
| Recreation trail and walkway (feet) | 568 | 13,600 | 2,900 |
| Residue management, mulch till (acres) | 329b | 524 | 399 |
| Residue management, no-till/strip till (acres) | 329a | 815 | 335 |
| Residue management, seasonal (acres) | 344 | 3,938 | 1,165 |
| Row arrangement (acres) | 557 | 12 | 12 |
| Snow fence (feet) | 770 | 1,420 | |

| Conservation practice | NCRS code | Units | |
|---|---|---|---|
| | | Planned[a] | Installed[b] |
| Spoil spreading (feet) | 572 | 4,000 | |
| Spring development (no.) | 574 | 39 | 6 |
| Stream crossing (no.) | 728 | 22 | |
| Subsurface drain (feet) | 606 | 1,839 | 89 |
| Terrace (feet) | 600 | 57,000 | |
| Tree/shrub pruning (acres) | 660 | 376 | 19 |
| Underground outlet (feet) | 620 | 345 | 435 |
| Use exclusion (acres) | 472 | 13,376 | 5,231 |
| Waste storage facility (no.) | 313 | 1 | |
| Water and sediment control basin (no.) | 638 | 2 | |
| Water well (no.) | 642 | 45 | 17 |
| Watering facility (no.) | 614 | 238 | 71 |
| Well decommissioning (no.) | 351 | 6 | |
| Wetland creation (acres) | 658 | 119 | 458 |
| Woodland pruning (acres) | 763 | 6 | 6 |

[a] Practices planned during FY 2004 that were approved for cost-share under WHIP contracts.
[b] Practices approved for cost-share under WHIP contracts established in FY 2004 or prior years and installed during FY 2004.

## Fish and Wildlife Response to WHIP

Hackett (2000) reported that state-level WHIP priorities are intended to benefit a wide breadth of species and native habitats considered culturally and ecologically important. Few studies have been conducted to quantify the fish and wildlife benefits derived from WHIP implementation to date. However, many have recognized the potential importance of WHIP in meeting the needs of declining species and other important fish and wildlife resources. Casey et al. (2004) acknowledged the existence of indirect evidence of WHIP projects benefiting threatened and endangered or other at-risk species. Most states include at-risk species as a priority for the program.

Although WHIP does address problems believed to limit wildlife and their habitats, with few exceptions a direct cause-and-effect relationship between WHIP projects and improvements in wildlife populations has not been documented in the peer-reviewed literature. One reason is a lack of standardized monitoring protocols to establish such a relationship. However, a considerable amount of anecdotal information is available from states and others that demonstrates the value of WHIP projects for fish and wildlife. We list here just a few examples of the types of activities supported by WHIP.

### *Sage-grouse Habitat Improvement*

The Western Governors Association (2004) credits WHIP as the means of securing funding to implement sage-grouse conservation actions on

Installation of fencing and adoption of grazing management allows for controlled, short-duration intensive grazing (far side of fence) followed by extended rest periods to improve habitat quality for sage-grouse and other wildlife species on Parker Mountain in Utah.
Ron Francis, NRCS

WHIP is being used to restore riparian areas along streams used by salmon and other aquatic species. On this stream in northern California, WHIP provided support for bioengineered bank stabilization and tree planting in the riparian area. The site has been used to demonstrate salmon habitat-restoration techniques.
Charlie Rewa, NRCS

private lands and to fund a private lands coordinator position. Specifically, $350,000 of WHIP funds have recently been dedicated to improving privately owned sagebrush (*Artemisia* spp.) habitat on over 104,000 acres on Parker Mountain in Utah. This project is aimed at improving habitat quality for sage-grouse (*Centrocercus urophasianus*) and other species, such as pygmy rabbits (*Sylvilagus idahoensis*) and mule deer (*Odocoileus hemionus*). Funds will contribute to a partnership effort involving 15 federal and state agencies to restore the shrub–steppe ecosystem in the area. Habitat restoration work consists of planting forbs, excluding livestock with fencing, prescribed grazing, and installation of livestock water facilities. The effort is intended to help stem the decline in sage-grouse populations and to prevent it from becoming listed as an endangered species. An understanding of sage-grouse habitat requirements and how management practices can be installed to benefit this species is a key element of this effort (see Connelly et al. 2004). A total of $2 million is being allocated in FY 2005 for projects designed to improve sage-grouse habitat in 5 western states.

### *Fish Passage on Streams*

WHIP is supporting projects that remove impediments to fish passage on streams, ranging from removal of both large and small dams to replacing culverts to building fish ladders and other structures on obstructions that cannot be removed (106 fish passage projects were planned in FY 2004). These projects are opening hundreds of miles of streams to access by anadromous fish and other migratory aquatic organisms that have been blocked for many years by a variety of structures built during the 19th and 20th centuries. For example, removal of the Madison Electric Works Dam near Madison, Maine, is opening access of the Sandy River, a major tributary to the Kennebec River, to Atlantic salmon (Salmo salar) for the first time in over 160 years.

In 2004, $74,000 in WHIP funds was contributed to a partnership effort among federal, state, and local governments, conservation groups, and James Madison University to remove the McGaheysville Dam on the South Fork of the Shenandoah River in Virginia. The work opened the South Fork to fish that had been previously precluded from access. Fish passage benefits of this type of project are usually quickly realized. In a similar project nearby, more than 5,000 juvenile eels were reported upstream of where a structure was removed just 1 week earlier (J. Hawkins, NRCS, personal communication).

### *Zebra Mussel Control*

In August of 2002, the zebra mussel (*Dreissena polymorpha*), a nonnative species that can cause severe damage to ecological systems and local economies, was documented for the first time in Virginia. This single population occurs in an abandoned quarry that is used for scuba training and recreational diving. This quarry lies just 300 feet from a natural stream. In an effort to prevent potential ecological damage to nearby native aquatic communities (an individual zebra mussel filters up to 1 gallon of water per day, removing microscopic organisms that serve as the food base of native fish and aquatic invertebrates), a multi-agency partnership was formed to eradicate this population of zebra mussels. In 2005, WHIP is contributing $250,000 to this effort.

With the assistance of WHIP, removal of the McGaheysville Dam has reopened the South Fork of the Shenandoah River in Virginia to access by American eels (*Anguilla rostrata*) and other migratory fish.
Mike Collins, City of Harrisonburg, Virginia

### *Eelgrass Restoration*

NRCS has been using WHIP to support the efforts of an interagency partnership in Rhode Island to restore eelgrass (*Zostera marina*) beds in Narragansett Bay since 1998. Since 2001, tens of thousands of eelgrass plants have been transplanted, and hundreds of acres once again support eelgrass habitat. This submerged aquatic vegetation provides a vital habitat element for fish, shellfish (bay scallops [*Aequipecten irradians*], blue crabs [*Callinectes sapidus*], lobsters [*Homarus americanus*]), waterfowl such as Atlantic brant (*Branta bernicla*), and other wildlife.

### *Hawaiian Forest Restoration*

The Honouliuli Preserve on Oahu, Hawaii, is 3,692 acres of globally rare lowland mesic forest. This preserve harbors a species of native land snail that is found nowhere else. The forest contains some of the last remaining habitat for native forest birds and the Hawaiian owl (Asio flammeus sandwichensis), revered as a guardian spirit by ancient Hawaiians. Also present is the O'ahu 'elepaio (*Chasiempis sandwichensis ibidis*), an endangered land bird. In partnership with The Nature Conservancy, NRCS has used WHIP funds to plant 3,900 plants listed as endangered and install catchment tanks and irrigation systems. WHIP funds were also used to install various kinds of traps for the purpose of controlling rodents to protect the rare snail, the plants, and the O'ahu 'elepaio during the nesting season.

WHIP is assisting a multi-agency partnership restore eelgrass beds in Rhode Island's Narragansett Bay, reestablishing productive habitat for benthic infauna, fish, and other aquatic species.

### *Gating Abandoned Mines*

Having lost many of their natural cave hibernation sites, bats now rely heavily on abandoned mines for shelter. Through partnerships with other agencies and organizations such as Bat Conservation International, NRCS is using WHIP to assist owners of these abandoned mines preserve important bat hibernation sites. Instead of sealing mine entrances to eliminate safety hazards, landowners are now working to install gates on inactive mines that preclude human access but allow bats to enter and exit. By protecting abandoned iron and copper mines in this way in Michigan's Upper Peninsula, these activities have preserved the hibernation habitat of an estimated 400,000 bats in Michigan, and as many as 1.5 million bats in the Upper Great Lakes region.

In Texas, WHIP is being used to help ranchers install grazing-management systems that allow areas previously over-grazed by cattle, sheep, and goats to recover. Grazing management under the WHIP contract site featured here consists of grazing cattle only during the dormant season and complete rest during the growing season. Restoration of native habitat diversity is the goal on this ranch.
Steve Nelle, NRCS

### *Enhancing Habitat with Improved Grazing Systems*

Nearly 300 miles of fencing and 240,000 acres of prescribed grazing practices were planned under WHIP in 2004 (Table 3). These practices are used in many instances to improve wildlife habitat quality while allowing producers to maintain productive livestock operations. For example, WHIP is assisting producers in Sheridan County, Montana, to adopt rest–rotation and other planned grazing systems that help support the area's high-value waterfowl and shorebird habitat. Practices allow ranchers to minimize impacts to nesting piping plovers (*Charadrius melodus*) and waterfowl by restricting livestock access to the alkali wetlands that are scattered on the landscape.

### *Bog Turtle Habitat Enhancement*

In eastern states from the Carolinas to New York, WHIP has provided funding to assist private landowners manage habitat for the federally threatened bog turtle (*Clemmys muhlenbergii*). Bog turtles inhabit limestone fens, sphagnum bogs, and wet, grassy pastures that are characterized by soft, muddy bottoms and perennial groundwater seepage. Bog turtle habitat projects have included brush management, fencing, prescribed grazing by goats and other livestock, and biological control of purple loosestrife (*Lythrum salicaria*) and other invasive exotic plants. Controlled grazing by livestock maintains an earlier successional stage and softens the ground, creating favorable conditions for bog turtles. However, overgrazing can result in habitat degradation. WHIP funds have been used for fencing to facilitate controlled grazing to maintain optimal habitat conditions for bog turtles.

### *Early Successional Habitat Development*

Early successional habitats in forested and agricultural landscapes in the eastern U.S. have declined substantially in recent decades (Daley et al. 2004). Grassland birds and other wildlife species associated with these habitats have also experienced population declines (Sauer et al. 2004). WHIP is being used to help landowners restore and manage habitats in native herbaceous and scrub–shrub vegetation to benefit these declining species. Common species benefited include grassland nesting birds such as eastern meadowlark (*Sturnella magna*), bobolink (*Dolichonyx oryzivorus*), upland sandpiper (*Bartramia longicauda*), grasshopper sparrow (*Ammodramus savannarum*) vesper sparrow (*Pooecetes gramineus*), northern bobwhite (*Colinus virginianus*), small mammals, and other species.

### *Invasive Species Management*

Habitat degradation by invasive species (plant, animal, and microbe) has become a major threat to many fish and wildlife species throughout North America and elsewhere (Pimentel et al. 2001). Many states are using

WHIP to reduce the impact of invasive species on target fish and wildlife. In states such as Nebraska and Texas, WHIP is being used to control invasive species such as mesquite (*Prosopis* sp.) and saltcedar (*Tamarix ramosissima*). The absence of fire within previous grassland systems has allowed woody species to dominate and change the wildlife species composition. WHIP projects are intended to remove these exotic woody plants and restore more natural grassland conditions that support native wildlife communities.

## Knowledge Gaps

There is a general sense among program managers and participants that WHIP is supporting projects that greatly enhance fish and wildlife habitat quality and quantity. However, few objective studies have been published that quantify the response of fish and wildlife to these projects. We recognize several categories of knowledge gaps that need to be addressed to adequately assess how effective WHIP has been at meeting program objectives. These gaps, in the form of questions to be answered, are as follows:

1) Can the wide variety of habitat manipulation actions taken under umbrella practices such as the Upland Wildlife Habitat Management (645) practice be categorized to enable evaluation?
2) How does installation of WHIP practices influence local habitat use by target (and non-target) species?
3) How does installation of WHIP practices influence population dynamics of target (and non-target) species?
4) How do local and regional landscape characteristics affect fish and wildlife response to WHIP projects?
5) Once practices are planned and installed, how does habitat quality change over the life of the contract, with and without maintenance or active management?
6) The goal of WHIP is to improve habitat quality and quantity. Using standard habitat evaluation procedures, is it acceptable to assume WHIP has met this goal by increasing habitat units available for target species, whether or not the species actually responds to the habitat provided?
7) What is the success rate of projects that depend on active management (e.g., prescribed grazing) to produce the desired wildlife benefits?

In the Loess Hills region of central Nebraska, WHIP has been used to improve range condition and habitat quality for greater prairie-chickens (*Tympanuchus cupido*) and other wildlife with prescribed fire. Herbaceous vegetation responds quickly shortly after the removal of saltcedar encroachment.
Ritch Nelson, NRCS

The Conservation Effects Assessment Project (CEAP) is an interagency effort to document the environmental effects of Farm Bill conservation programs and practices (Mausbach and Dedrick 2004). As part of this effort, NRCS is working with state fish and wildlife agencies and others to develop an approach to assessing fish and wildlife benefits derived from conservation programs. Although we expect the CEAP effort to begin to address these questions identified for WHIP, it may be some time before the full impact of the wide range of WHIP activities on fish and wildlife resources throughout the country are understood.

## Conclusions

The WHIP program has made great strides in organizing stakeholders, setting priorities for wildlife projects at the state and national level, and delivering services in collaboration with partners. A wide variety of projects are being implemented to address the habitat needs of hundreds of fish and wildlife species throughout the country, with an emphasis on species and habitats that are rare or declining. The WHIP program provides a means for NRCS and its partners to provide assistance to traditional USDA clients (e.g., farmers and ranchers enrolled in other conservation or commodity programs) as well as those that have not been involved with USDA programs. Whereas quantitative studies documenting fish and wildlife response to WHIP projects are lacking, benefits have been implied through anecdotal evidence and informal feedback from program participants and partners. Efforts to quantify fish and wildlife response to the program are needed. By attempting to assess the environmental benefits of conservation practices, including fish and wildlife benefits, CEAP is intended to begin to provide the information needed by program managers and partners to maximize fish and wildlife benefits achieved through WHIP and other conservation programs.

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# Environmental Quality Incentives Program Contributions to Fish and Wildlife Conservation

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## Abstract

*The Environmental Quality Incentives Program (EQIP) is a voluntary program whereby the U.S. Department of Agriculture provides technical and financial assistance to active farmers and ranchers to address natural resource concerns such as soil conservation, water quality and quantity, nutrient management, and fish and wildlife habitat. The Natural Resources Conservation Service (NRCS) is working with these landowners to maximize the environmental benefits gained for the expenditures made in the program. Funding has expanded significantly under the 2002 Farm Bill, with the amount of annual funding authorized reaching $1.3 billion by fiscal year 2007. The EQIP has been used to implement a wide variety of practices that are considered beneficial to many species of fish and wildlife. The NRCS is also beginning to use EQIP to address the needs of declining and other at-risk fish and wildlife species. Few data are available that document fish and wildlife response to EQIP. Program implementation to date is summarized, and recent information on planning of practices with the potential to benefit fish and wildlife resources is examined.*

## Introduction

Since the 1940s, agricultural production has transformed landscapes in North America and elsewhere (National Research Council 1989). Production systems and advancing technology have enabled greater commodity outputs necessary to feed a growing global population. These changes have also generated concern regarding environmental and ecological degradation associated with modern agriculture (Freemark

Fire and livestock grazing are used to create structural heterogeneity in tallgrass prairie. (S. Fuhlendorf, Oklahoma State University)

1995). Beginning with the Conservation Title of the 1985 Food Security Act, U.S. Department of Agriculture (USDA) conservation programs have been largely targeted toward addressing these concerns.

Set-aside programs that remove parcels of land from crop production have been an effective means of providing wildlife habitat on agricultural landscapes (Van Buskirk and Willi 2004). Farm Bill conservation programs that involve set-aside or land retirement, such as the Conservation Reserve Program (CRP) and Wetlands Reserve Program (WRP), are recognized for providing fish and wildlife habitat benefits (see papers on these programs elsewhere in this volume).

Sustainable farming measures and practices applied within and around active croplands such as grassed waterways, field borders, hedgerows and other conservation buffers, and certain cultural practices have been recognized for providing wildlife habitat on agricultural landscapes (Carlson 1985, Jahn and Schenck 1991). Similarly, integrating grazing practices based on ecological principles on rangelands can be an effective means of supporting fish and wildlife populations on grazing lands used for livestock production (Fuhlendorf and Engle 2001).

The Environmental Quality Incentives Program is USDA's primary cost-share program for assisting farmers and ranchers to address natural resource issues on working croplands and rangelands they own and manage. All land-management actions have the potential to affect fish and wildlife resources in some way. Targeted toward America's production-oriented cropland, rangelands, and forests, EQIP has the potential to provide significant benefits to fish and wildlife associated with these largely private lands. Esser et al. (2000) recognized this potential in their description of the program during the first few years of operation. This paper updates program implementation information and summarizes literature describing EQIP benefits to fish and wildlife resources.

## Program Description

The Natural Resources Conservation Service works cooperatively with agricultural producers to deliver EQIP. Established in the 1996 Farm Bill, the program provides cost-share and technical assistance to farmers and ranchers through voluntary contracts to address threats to soil, water, and related natural resources, including grazing lands, wetlands, and wildlife habitat. Appendix 1 contains the program purposes as defined by the 2002 Farm Bill.

Structural and management practices included in conservation plans developed by NRCS or qualified technical service providers are eligible for up to 75% cost-share (up to 90% for beginning and limited resource producers). General descriptions of various program elements, along with key program changes made by the 2002 Farm Bill, are provided in Table 1. Additional information on the specifics of program operation is provided at <http://www.nrcs.usda.gov/programs/eqip>.

Table 1. Comparison of Environmental Quality Incentives Program elements between the 1996 and 2002 Farm Bills.

| Program element | 1996 Farm Bill | 2002 Farm Bill |
|---|---|---|
| Authorized funding level | $200 million/year | Fiscal Year (FY) 2003: $700 million<br>FY 2004: $1 billion<br>FY 2005: $1.2 billion<br>FY 2006: $1.2 billion<br>FY 2007: $1.3 billion |
| Cost-share level | Up to 75% of client cost | Up to 75% of client cost; up to 90% cost-share for limited resource and beginning farmers and ranchers |
| Program targeting | Funding targeted to geographic priority areas | No required geographic targeting |
| Contract duration | 5 to 10 years | 1–10 years after practice installation |
| Payment limits to participants | $10,000 per year<br>$50,000 per contract | $450,000 per individual or entity |
| Program funds targeted to livestock operations | At least 50% | 60% target |
| Eligibility of large confined animal-feeding operations | Ineligible for cost-share on animal waste storage and treatment | Eligible for cost-share on animal waste storage and treatment when part of a comprehensive nutrient-management plan |

## Program Funding and Enrollment

Authorized funding levels for EQIP have increased substantially under the 2002 Farm Bill. However, there remains far greater demand for the program than it can address (Table 2). As directed by statute, greater than 50% of funds are being directed to address natural resource concerns related to livestock operations. Approximately 75% of cost-share payments made during fiscal year (FY) 2004 were in support of practices relating to animal waste practices and fencing, soil erosion and sediment control, and irrigation (Table 3).

Table 2. Contract and fund obligation information for Environmental Quality Incentives Program during fiscal years 2002–2004.

| Program activity | Fiscal year | | |
|---|---|---|---|
| | 2002 | 2003 | 2004 |
| No. of contracts established | 19,817 | 30,251 | 46,413 |
| Cost-share funds obligated | $322,193,226 | $483,483,746 | $718,150,476 |
| Livestock-related cost-share obligated | no data | $323,053,083 | $449,558,698 |
| No. of unfunded applications | 70,495 | 174,062 | 135,394 |
| Unfunded cost-share | $1,486,944,435 | $3,070,533,611 | $2,204,438,291 |

Source: USDA System 36 database.

Table 3. Payments made during fiscal year (FY) 2004 for practices approved in contracts accepted into the program during FY 1997–2004.

| Practices related to: | Amount disbursed |
|---|---|
| Animal waste practices, plus fencing | $68,130,224 |
| Soil erosion and sediment control | $58,292,173 |
| Irrigation practices | $76,220,632 |
| Grazing lands practices | $44,057,740 |
| Total[a] | $269,225,386 |

Source: USDA System 36 database.

[a] Approximately $22 million was provided for practices in other categories.

A wide variety of structural and cultural conservation practices are cost-shared through EQIP to address a broad range of natural resource issues on active agricultural operations. Appendix 2 provides a list of practices planned and applied during FY 2004. While the information provided in Appendix 2 applies to just 1 year of program activity, it provides an illustration of the diversity of practices supported by the program. For further illustration, practices generally recognized as providing substantial potential to directly benefit fish and wildlife are highlighted.

The majority of EQIP planning activity during FY 2004 centered on addressing soil and water resource concerns in dry-land and irrigated cropping operations and grazing systems. Livestock production facility practices planned during FY 2004 include 14,487 barnyard runoff management systems, 3,805 composting facilities, 101,184 manure transfer facilities, 22,999 roof runoff structures, 235,909 waste storage facilities, and 241,572 livestock watering facilities (Appendix 2). Cropland system practices planned in FY 2004 include 258,048 irrigation systems, over 2,631 miles of irrigation water conveyance ditches and pipelines, nutrient management plans on nearly 3.9 million acres, over 6,789 miles of pipeline, residue management plans on over 2.8 million acres, nearly 558 miles of subsurface drains, 4,739 miles of terraces, over 642 miles of underground outlets, and over 934 miles of windbreak/shelterbelts to be established. Practices planned on grazing lands include over 13,788 miles of fence and prescribed grazing on over 9 million acres (Appendix 2).

Rangeland watering trough for livestock. (G. Wilson, USDA-NRCS)

## Fish and Wildlife Benefits

Esser et al. (2000) found no specific assessments documenting fish and wildlife response to EQIP. Our review of the literature did not identify any significant assessments conducted since 2000 specifically related to EQIP. However, our appreciation for the potential of EQIP-funded practices to support a wide variety of fish and wildlife continues to emerge. We present several examples of habitat improvements and other practices where EQIP is being used to the benefit of fish and wildlife resources.

### *Invasive Species*

Invasion of native ecosystems by non-indigenous species has become a major issue influencing the integrity of natural ecosystems and the welfare of native plants and animals they support (Westbrooks 1998). In an effort to address the growing problem of invasive species control and management, EQIP is beginning to support projects that control invasive species as a primary concern (Figure 1). Although the number of contracts affected is still a small percentage of contracts established in FY 2004 (<0.5%), the potential for the use of EQIP to address invasive species issues is apparent. In some instances, the impact of invasive species is the primary limiting factor for fish and wildlife populations.

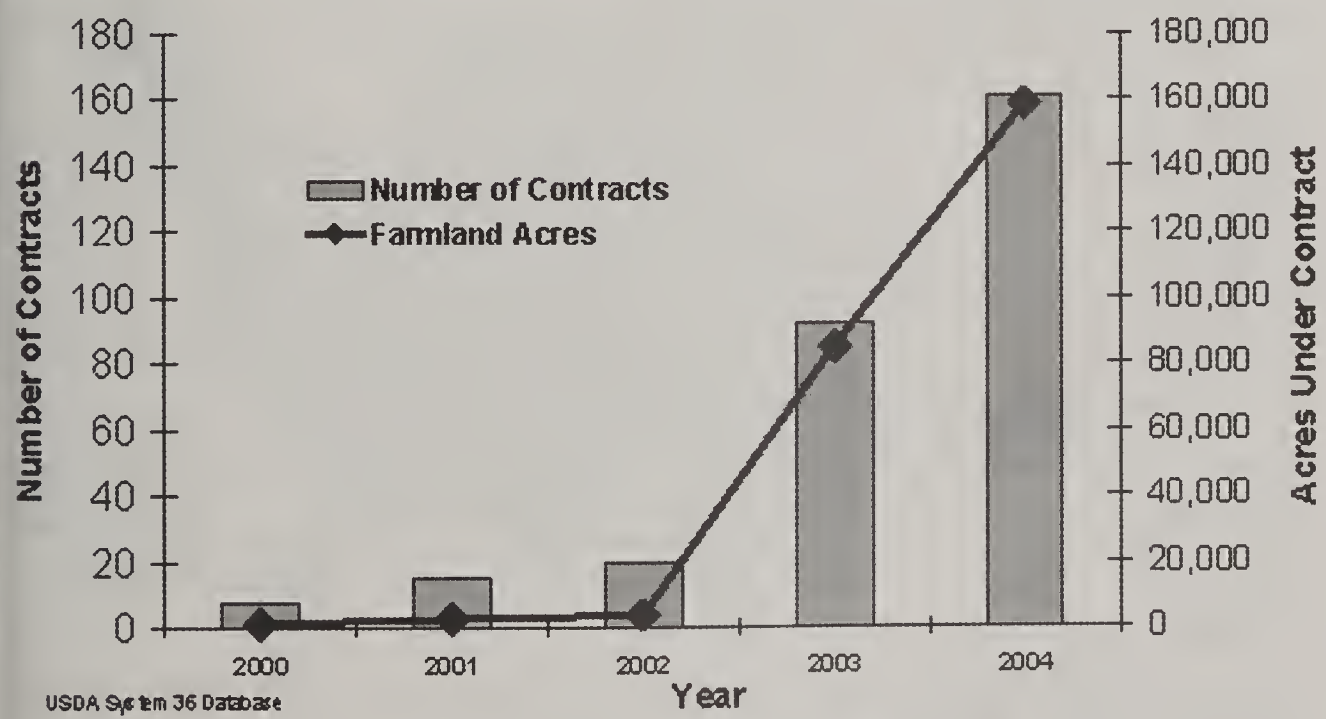



Figure 1. Number of EQIP contracts and acres under contract. Primary resource concern: invasion of non-indigenous species, 2000–2004.

### *Threatened and Endangered Species*

Whereas the majority of EQIP practices address other resource concerns as described above, EQIP is also being used to address habitat needs of threatened, endangered, and other at-risk plant and animal species. Figure 2 illustrates the growth of the use of EQIP in recent years to address threatened and endangered species needs. The acres under contract reflect the total acreage of farm or ranch lands associated with contracts enrolled under this objective; an unknown percentage of acres under contract were actually treated to address listed species needs. The increase in use of EQIP to address listed species reflects the increasing focus NRCS is placing on targeting at-risk and declining species. A variety of practices are being applied to benefit a diversity of listed species across the country, and the geographic distribution of these practices aligns with where opportunities to affect listed species exist (Figure 3).

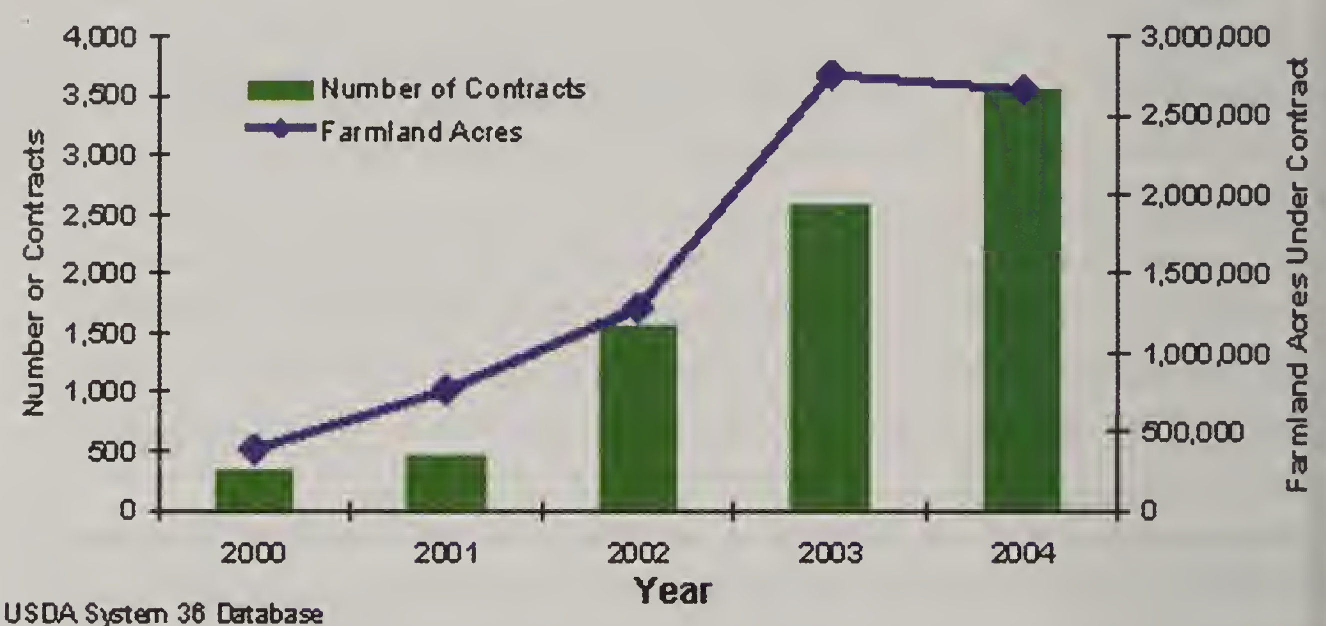



Figure 2. Number of EQIP contracts and acres under contract. Primary resource concern: threatened and endangered species, 2000–2004.

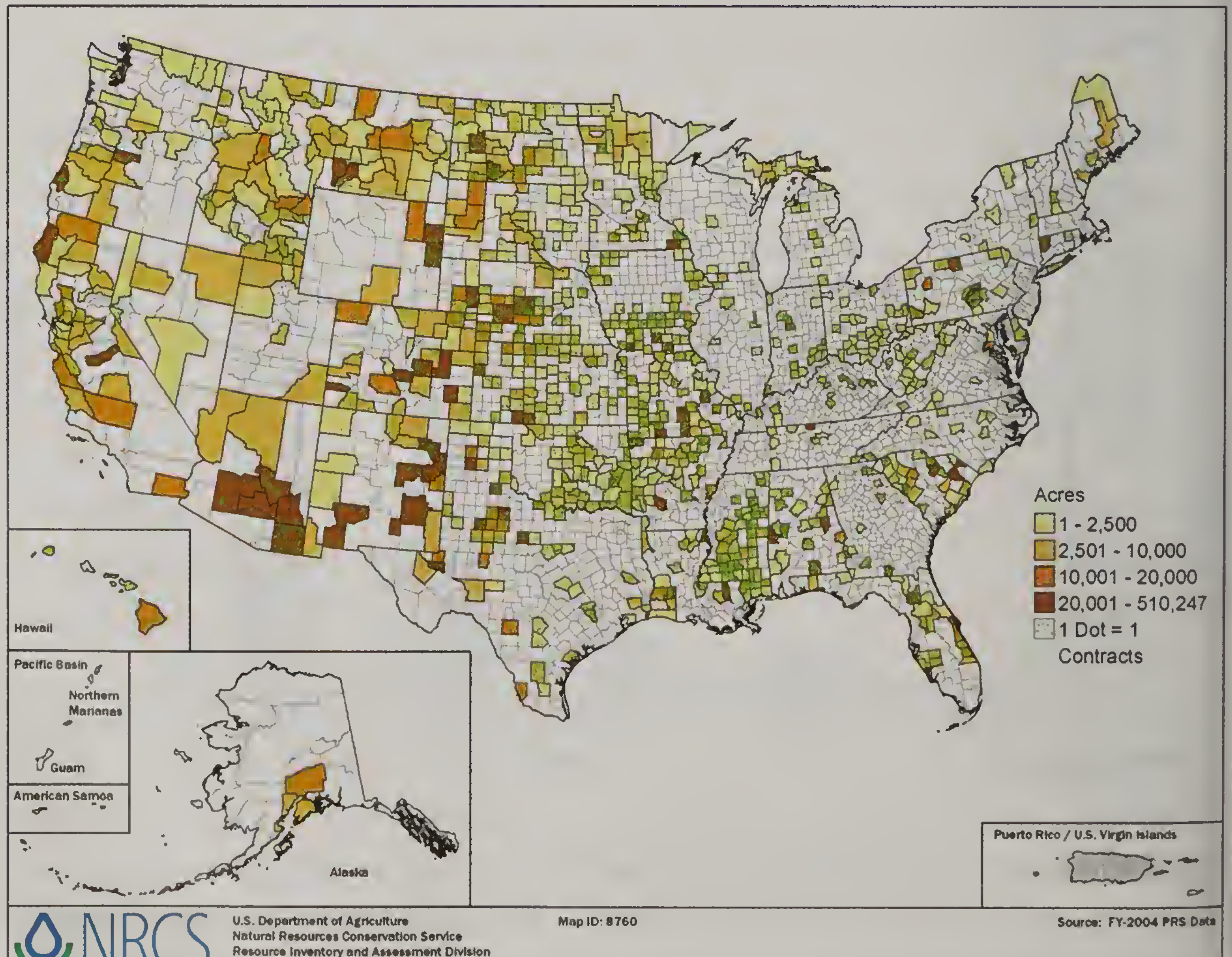



Figure 3. EQIP acres of land where threatened and endangered species was a primary resource concern, 2000–2004.

One example of the use of EQIP to benefit at-risk species is the case of the arctic grayling (*Thymallus arcticus*), a species that is a candidate for listing as threatened within its range in Montana and Wyoming. The arctic grayling is a salmonid that requires high-quality, cold-water streams and lakes to survive. Practices funded by EQIP helped arctic grayling survive in Montana during severe drought conditions. In June 2003, landowners along Montana's Big Hole River agreed to shorten their irrigation season on 14,304 acres of agricultural land to maintain river flows to support this fish. Landowners received nearly $800,000 in EQIP cost-share funds to implement water-conservation practices in the watershed. Irrigators ceased water withdrawal early and installed 12 new off-stream livestock water facilities to enable restriction of livestock access to the stream. Typical low-water flows in the Big Hole River occur at the end of August. In recent years, water levels have dropped to as low as 6 cubic feet per second (cfs) in late summer; artic grayling need a minimum of 20 cfs of flow to survive in this reach. On 10 August 2003, water levels were at 28 cfs, a level twice as high as the previous year. Montana's Fish and Wildlife and Parks biologists gave EQIP much of the credit for helping the artic grayling survive the drought and perhaps helping to keep the species off the endangered species list.

The NRCS is currently using EQIP to support the Colorado River Basin Salinity Control Program by working with producers in to implement on-farm salinity control measures in 6 project areas in western Colorado, eastern Utah, and southwestern Wyoming. Wildlife conservation and mitigation measures are included. Additional information on EQIP activities in these salinity areas can be accessed at <www.usbr.gov/uc/progact/salinity/index.html> and <www.nrcs.usda.gov/programs/salinity/>.

Farmers and ranchers in the Klamath Basin in Oregon and California are working with conservation agencies and organizations to address water needs to sustain environmental quality and agricultural production. EQIP is among the programs providing direct assistance to producers to address water flow issues to benefit threatened and endangered fish species. See that following web pages for additional information on conservation efforts in the Klamath Basin: <http://www.nrcs.usda.gov/feature/klamath/images/BrochureProgressReport2004.pdf> and <http://www.nrcs.usda.gov/feature/klamath/klamplan.html>.

In FY 2005, NRCS is increasing emphasis on assisting producers implement measures to benefit the greater sage-grouse (*Centrocercus urophasianus*), a species that has been declining in recent decades and has been considered for listing under the Endangered Species Act. In response to congressional language encouraging USDA to enhance its efforts for greater sage-grouse conservation, NRCS is making $2 million of EQIP funds available for projects to address sage-grouse habitat in FY 2005.

### *In-field Conservation Practices*

Many conservation practices applied to cropping systems have direct and indirect benefits to fish and wildlife. Practices that reduce soil erosion and sediment loss to streams invariably help protect surface water quality necessary for healthy stream biota (Robinson 1990). Estimates of soil-erosion rates on croplands show a reduction of 42% between 1982 and 2001 (USDA Natural Resources Conservation Service, National Resources Inventory data). Nearly all of this reduction has been due to the application of conservation practices, including those cost-shared under EQIP. Practices that provide food and cover for upland wildlife in crop fields are also beneficial to terrestrial species in intensively managed agricultural landscapes.

Miranowski and Bender (1982) identified wildlife benefits from the installation of conservation practices that reduce soil erosion. They concluded that by reducing soil loss from 8.3 tons/acre to 5.2 tons/acre through the use of conservation tillage, their general wildlife habitat index score for an agricultural landscape within the Iowa River Basin was raised from 0.08 to 0.15. By installing other conservation practices to reduce soil loss in addition to conservation tillage, their habitat index score was raised to 0.30. In croplands in Saskatchewan, minimally tilled crop fields have been shown to support higher relative abundance of birds than conventionally tilled fields (Shutler et al. 2000). Although tillage operations may result in some mortality, others have documented the benefits of conservation tillage to nesting birds and other wildlife over conventional tillage operations (Rodgers and Wooley 1983, Warburton and Klimstra 1984, Duebbert and Kantrud 1987, Best 1986, Lokemoen and Beiser 1997, Martin and Forsyth 2003).

Warner and Brady (1994) indicated that the net effect of a combination of conservation practices (i.e., conservation system) may be beneficial to wildlife. Their conservation system of practices included conservation tillage, contour strip cropping, grassed backslope terraces, and field borders. When properly operated and maintained, most conservation practices can benefit wildlife. Grassed waterways, farmstead windbreaks, crop rotations, and effective nutrient and tillage management can provide wildlife cover while reducing the delivery of sediments and related pollutants to riparian, wetland, and other aquatic habitats (Robinson 1988, 1990). Structural and cultural conservation practices installed through incentive programs such as EQIP and/or applied to meet conservation compliance requirements (Brady, *this volume*) result in sustainable agricultural systems that provide greater benefits to many species of fish and wildlife than conventional systems (Jahn and Schenck 1991). As noted, individual conservation practices have been shown to provide fish and wildlife habitat. Although additional study is needed to document the combination of practices on wildlife (Freemark 1995), the cumulative effect of a system of conservation practices applied to landscapes that are intensively used and managed for crop production is likely much more effective than application of individual practices.

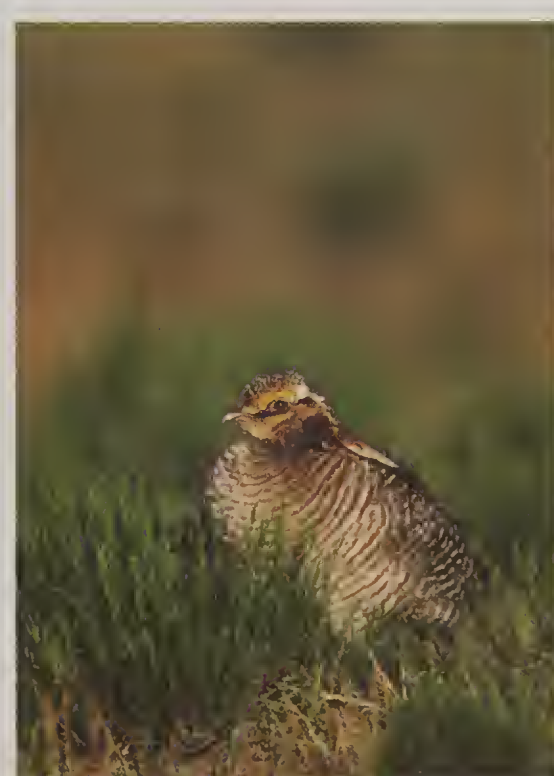
Contour strip cropping to reduce erosion. (L. Betts, USDA-NRCS)

Conservation practices planned during FY 2004 reveal the potential of EQIP to improve fish and wildlife habitat conditions in cropped landscapes (Appendix 2). Buffer practices such as field borders (over 432 miles planned), grassed waterways (104,315 acres), riparian forest buffers (7,178 acres) and windbreak/shelterbelts (over 934 miles planned) provide habitat structure and water-quality functions. In-field practices such as nutrient management (over 3.8 million acres planned) and residue management (over 2.8 million acres planned) help reduce soil erosion and sediment and excess nutrient transport to waterways. With proper planning, EQIP has the potential to positively affect millions of acres of cropland habitats.

## *Rangeland Practices*

Rangeland systems of the United States have been impacted by a variety of factors, including elimination of native grazers, introduction of tame grasses and domestic livestock, suppression of fire, conversion to cropland, and other modifications associated with human habitation and development (Knight et al. 2002). Restoring heterogeneity to homogenized range landscapes to echo conditions that occurred before European settlement has been suggested as a means of promoting biological diversity and wildlife habitat on rangelands used by domestic livestock (Fuhlendorf and Engle 2001). Practices such as rotational grazing and controlled patch burning can be used to foster disturbance regimes that have historically driven natural rangeland ecology (Fuhlendorf and Engle 2004).

Lesser prairie-chicken in New Mexico. (G. Kramer, USDA-NRCS)



A number of EQIP practices have great potential to contribute to increasing the extent and heterogeneity of fish and wildlife habitat quality on rangelands. Although these practices can benefit a wide variety of species associated with rangelands, EQIP has also been recognized for its potential to specifically improve habitat conditions for high-priority wildlife such as prairie grouse (sage-grouse, prairie-chickens [*Tympanuchus* spp.], sharp-tailed grouse [*Tympanuchus phasianellus*]) (Riley 2004). This is primarily because the majority of EQIP funds are targeted toward addressing natural resource issues related to livestock production, and funding levels are significant compared to other public and private efforts engaged in prairie grouse conservation matters. Practices planned during FY 2004 that provide fish and wildlife habitat potential on grazing lands include brush management (over 1.4 million acres planned), fencing (13,788 miles planned), prescribed burning (200,806 acres planned), and prescribed grazing (over 9 million acres planned). Although these practices have substantial potential to provide habitat value, there is not an effective way of characterizing how fish and wildlife habitat was factored into the thousands of plans involved. Since EQIP is targeted to a range of natural resource concerns, habitat considerations may or may not have a great influence on the specifications that guide how individual practices are planned and installed.

### *Habitat Practices*

Many multipurpose conservation practices have the potential to provide significant benefits to fish and wildlife, as described above (e.g., conservation cover, field borders, riparian forest buffers, hedge rows, prescribed grazing and burning, conservation tillage, etc.—see practices in bold print in Appendix 2). There are also a number of practices with purposes weighted more heavily toward fish and wildlife resource concerns. These practices are more likely to be designed in a manner that will provide greater fish and wildlife benefit per unit effort than other more general purpose practices. Data from Appendix 2 were extracted to construct Table 4, which illustrates the level of effort supported by EQIP during FY 2004 directed toward these fish and wildlife–oriented practices.

Table 4. Practices with fish and wildlife resource concerns as the primary objective planned and applied under the Environmental Quality Incentives Program during fiscal year (FY) 2004.

| Conservation practice (units) | NRCS code | Planned[a] | Applied[b] |
|---|---|---|---|
| Early successional habitat development/ management (acres) | 647 | 2,746 | 173 |
| Fish passage (no.) | 396 | 5 | 1 |
| Fishpond management (no.) | 399 | 46 | 34 |
| Restoration and management of declining habitats (acres) | 643 | 3,270 | 107 |
| Riparian herbaceous cover (acres) | 390 | 804 | 79 |
| Shallow water management for wildlife (acres) | 646 | 6,549 | 1,381 |
| Stream habitat improvement and management (acres) | 395 | 8,119 | 2,320 |
| Upland wildlife habitat management (acres) | 645 | 973,119 | 1,345,495 |
| Wetland creation (acres) | 658 | 205 | 101 |
| Wetland enhancement (acres) | 659 | 827 | 167 |
| Wetland restoration (acres) | 657 | 1,088 | 9,582 |
| Wetland wildlife habitat management (acres) | 644 | 15,100 | 26,097 |
| Wildlife watering facility (no.) | 648 | 191 | 35 |

Source: NRCS Performance Results System.

[a] Practices planned during FY2004 that were approved for cost-share under EQIP contracts.

[b] Practices approved for cost-share under EQIP contracts established in FY 2004 or prior years and installed during FY 2004.

Over 99% of the acreage reported in Table 4 is encompassed by the Upland Wildlife Habitat Management practice. This is an umbrella practice that encompasses a broad array of upland habitat establishment and management actions to support many different types of upland wildlife. Without knowing the specifics contained in the many EQIP conservation plans involving this practice, it is difficult to draw conclusions on the type of benefits that are being realized by the program.

There are several conservation programs that, while different from EQIP, have some similarity in purpose. Primary objectives of the Wildlife Habitat Incentives Program (WHIP) and WRP are to promote fish and wildlife habitat. EQIP has multiple resource objectives including reducing soil erosion and improving water quality, along with addressing fish and wildlife habitat concerns. As previously stated, EQIP is oversubscribed. When developing conservation plans with clients, planners may direct participants who are primarily interested in fish and wildlife to programs such as WHIP or WRP, provided their lands are eligible for enrollment in these programs. Alternatively, since WHIP and WRP are also oversubscribed (Gray et al., *this volume*; Rewa, *this volume*), planners may work to integrate fish and wildlife habitat considerations into EQIP conservation plans, thereby increasing habitat benefits achieved through EQIP.

As the growth of EQIP has expanded over the years (Table 2), so has its capability to improve fish and wildlife habitats. While the majority of practices are targeted toward soil and water conservation, nutrient management, and other production-oriented conservation practices (Table 3), EQIP is being used to put a significant amount of habitat on the ground. The fish and wildlife–oriented practices presented in Table 4 represent a small fraction of the overall EQIP effort (see Appendix 2). However, wildlife work in EQIP for some practices is comparable to the effort being made by WHIP (e.g., Upland Wildlife Habitat Management practice FY 2004 planning for EQIP and WHIP was reported as 973,119 acres and 659,735 acres, respectively). For other practices, EQIP contributions are substantially less than the more fish and wildlife–targeted WHIP (e.g., the number of fish passage structures reported as planned in FY 2004 under WHIP and EQIP were 106 and 5, respectively). An important note is that many EQIP practices planned may be subsequently withdrawn and not implemented by producers. For example, approximately 14.6% of wildlife habitat related practices contracted under EQIP between 1997 and 2000 were withdrawn (Cattaneo 2003). Since participants in programs such as WHIP are primarily interested in fish and wildlife habitat management, withdrawal rates are likely substantially lower.

## Knowledge Gaps

Esser et al. (2000) concluded that additional monitoring and research was needed in 2000 to adequately assess the value of practices installed under EQIP to fish and wildlife. Our review of the literature indicates that that need remains unmet. Specifically, a more concerted effort is needed to assess the effects of all conservation practices supported by EQIP and other conservation programs on fish and wildlife response. Practice data presented in this paper will assist literature reviewers currently working with The Wildlife Society to characterize fish and wildlife response to specific conservation practices (to be produced as a companion document to this publication). In addition, efforts are being made through the USDA Conservation Effects Assessment Project to develop protocols for assessing fish and wildlife benefits provided by conservation practices installed under EQIP and other conservation programs.

Where EQIP is used to target specific fish and/or wildlife issues, studies are needed to document how the taxa targeted respond to program efforts. EQIP is a large program affecting millions of acres of agricultural lands every year. Better means of tracking projects with the primary purpose of benefiting fish and wildlife are needed, including details on what species are targeted and what measures are undertaken to benefit those species. For example, better information on actions taken under the Upland Wildlife Habitat Management practice is needed to determine how fish and wildlife response can be assessed. Conservation plans and contracts under EQIP require completion of environmental evaluations (on Form CPA-52). Data used for these evaluations and documentation of proposed effects need to be collected and analyzed.

## Conclusion

The use of agricultural landscapes in the United States for production of food and fiber is likely to continue into the foreseeable future. Measures to integrate conservation of fish and wildlife and other natural resources into the production of crops and livestock are being taken to foster biodiversity on and sustainability of these agricultural lands. The welfare of many species of fish and wildlife depends on the ability of agricultural landscapes to provide habitats necessary for survival (Peterjohn 2003). Voluntary efforts of producers through conservation plans and practices supported by EQIP can play a major role in restoring and maintaining wildlife habitats on actively managed croplands and rangelands.

The significant funding made available for EQIP by the 2002 Farm Bill makes the program a significant tool for landowners and natural resource managers concerned with fish and wildlife conservation. With proper planning, fish and wildlife habitat can be emphasized in EQIP while addressing soil and water resource concerns. While data are lacking on how wildlife has responded to EQIP to date, practices targeted to address declining or at-risk and other fish and wildlife imply that substantial benefits are being realized through the program. Additional study is needed to document the extent and character of these benefits.

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# Appendix 1. EQIP program purposes as defined by the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill).

## SEC. 1240. [16 U.S.C. 3839aa] PURPOSES

The purposes of the environmental quality incentives program established by this chapter are to promote agricultural production and environmental quality as compatible goals, and to optimize environmental benefits, by—

(1) assisting producers in complying with local, State, and national regulatory requirements concerning—

(A) soil, water, and air quality;
(B) wildlife habitat; and
(C) surface and ground water conservation;

(2) avoiding to the maximum extent practicable, the need for resource and regulatory programs by assisting producers in protecting soil, water, air, and related natural resources and meeting environmental quality criteria established by Federal, State, tribal, and local agencies;

(3) providing flexible assistance to producers to install and maintain conservation practices that enhance soil, water, related natural resources (including grazing land and wetland), and wildlife while sustaining production of food and fiber;

(4) assisting producers to make beneficial, cost effective changes to cropping systems, grazing management, nutrient management associated with livestock, pest or irrigation management, or other practices on agricultural land; and

(5) consolidating and streamlining conservation planning and regulatory compliance processes to reduce administrative burdens on producers and the cost of achieving environmental goals.

# Appendix 2. Practices planned and applied under EQIP during FY 2004.

While all practices potentially affect fish and wildlife, practices generally recognized for the potential to directly benefit fish and wildlife are identified by bold text.

| Conservation Practice (NRCS practice code) (units reported) | Planned | Applied |
|---|---|---|
| Access Road (560) (ft) | 1,755,377 | 359,001 |
| Agrichemical Mixing Facility (702) (no) | 151,313 | 10,618 |
| Agrichemical Mixing Station, Portable (703) (no) | 600 | |
| Agricultural Fuel Containment Facility (701) (no) | 2,985 | 9 |
| Agro Tillage (761) (ac) | | 7 |
| Air Management (705) (ac) | 207,336 | 24,834 |
| Alley Cropping (311) (ac) | 820 | 716 |
| Alum treatment of Poultry Litter (786) (no) | 3,519 | 267 |
| Anaerobic Digestor, Ambient Temperature (365) (no) | 2 | 1 |
| Anaerobic Digestor, Controlled Temperature (366) (no) | 4 | |
| Animal Mortality Facility (316) (no) | 1,723 | 54 |
| Animal Trails and Walkways (575) (ft) | 259,912 | 67,165 |
| Anionic Polyacrylamide (PAM) Erosion Control (450) (ac) | 8,546 | 659 |
| Aquaculture Ponds (397) (ac) | 1,831 | |
| Atmospheric Resource Quality Management (370) (ac) | 1,514 | 0 |
| Barnyard Runoff Management (707) (no) | 14,487 | 31 |
| Bedding (310) (ac) | 17 | 98 |
| Bio-Filter (793) (no) | 3 | |
| **Brush Management (314) (ac)** | **1,465,377** | **364,950** |
| Channel Bank Vegetation (322) (ac) | 1,271 | 12 |
| Channel Stabilization (584) (ft) | 33,217 | 4,822 |
| Cistern (708) (no) | 7 | |
| Clearing and Snagging (326) (ft) | 4,100 | 2,000 |
| Closure of Waste Impoundment (360) (no) | 930 | 45 |
| Composting Facility (317) (no) | 3,805 | 2,975 |
| **Conservation Cover (327) (ac)** | **10,366** | **6,341** |
| Conservation Crop Rotation (328) (ac) | 901,806 | 551,302 |
| Constructed Wetland (656) (no) | 4 | |

| **Conservation Practice (NRCS practice code) (units reported)** | **Planned** | **Applied** |
|---|---|---|
| Contour Buffer Strips (332) (ac) | 565 | 650 |
| Contour Farming (330) (ac) | 73,535 | 58,856 |
| Contour Orchard and Other Fruit Area (331) (ac) | 756 | 830 |
| Controlled Stream access for Livestock Watering (730) (no) | 3,570 | 630 |
| Corral Dust Control (no. and ac.) (785) (no) | 1,205 | 184 |
| Cover Crop (340) (ac) | 274,013 | 75,597 |
| Critical Area Planting (342) (ac) | 27,968 | 6,064 |
| Cross Slope Farming (733) (ac) | 161 | |
| Cross Wind Ridges (589A) (ac) | 1,096 | 1,732 |
| Cross Wind Stripcropping (589B) (ac) | 319 | |
| Cross Wind Trap Strips (589C) (ac) | 956 | 329 |
| Cut Bank Stabilization (742) (ac) | 1,765 | 1,600 |
| Dam (402) (no) | 22 | 1 |
| Dam, Diversion (348) (no) | 27 | 6 |
| Deep Tillage (324) (ac) | 34,329 | 9,245 |
| **Dike (356) (ft)** | **579,392** | **127,900** |
| Diversion (362) (ft) | 1,525,510 | 284,335 |
| Drainage Water Management (554) (ac) | 2,082 | 626 |
| Dry Hydrant (432) (no) | 12 | 4 |
| **Early Successional Habitat Development/Management (647) (ac)** | **2,746** | **173** |
| **Fence (382) (ft)** | **72,801,299** | **16,594,527** |
| **Field Border (386) (ft)** | **5,585,776** | **1,328,318** |
| Filter Strip (393) (ac) | 10,826 | 3,489 |
| Firebreak (394) (ft) | 3,026,943 | 677,488 |
| **Fish Passage (396) (no)** | **5** | **1** |
| **Fishpond Management (399) (no)** | **46** | **34** |
| Forage Harvest Management (511) (ac) | 115,839 | 54,294 |
| Forest Site Preparation (490) (ac) | 33,475 | 8,287 |
| **Forest Stand Improvement (666) (ac)** | **68,755** | **30,517** |
| Forest Trails and Landings (655) (ac) | 4,653 | 5,900 |
| Grade Stabilization Structure (410) (no) | 24,613 | 3,260 |
| Grade Stabilization Structure-Tire Bales (790) (no) | 1 | |
| **Grassed Waterway (412) (ac)** | **104,315** | **8,893** |
| Grazing Land Mechanical Treatment (548) (ac) | 49,538 | 8,803 |
| Heavy Use Area Protection (561) (ac) | 722,887 | 33,025 |

| Conservation Practice (NRCS practice code) (units reported) | Planned | Applied |
|---|---|---|
| **Hedgerow Planting (422) (ft)** | **204,001** | **555,997** |
| Herbaceous Wind Barriers (603) (ft) | 3,810,530 | |
| Hillside Ditch (423) (ft) | 216,445 | 51,405 |
| Improved Water Application (743) (ac) | 381 | 128 |
| Incinerator (769) (no) | 129 | 52 |
| Infiltration Ditches (753) (ft) | 1,172 | 300 |
| Irrigation Canal or Lateral (320) (ft) | 2,781 | 9,350 |
| Irrigation Field Ditch (388) (ft) | 154,379 | 23,281 |
| Irrigation Land Leveling (464) (ac) | 126,476 | 126,807 |
| Irrigation or Regulating Reservoir (552) (no) | 205 | 25 |
| Irrigation Storage Reservoir (436) (ac-ft) | 31,735 | 442 |
| Irrigation System, Microirrigation (441) (no) | 19,773 | 2,841 |
| Irrigation System, Sprinkler (442) (no) | 220,564 | 26,722 |
| Irrigation System, Surface and Subsurface (443) (no) | 16,025 | 2,450 |
| Irrigation System, Tailwater Recovery (447) (no) | 1,686 | 49 |
| Irrigation Water Conveyance, Corrugated, Ribbed or Profile wall thermal pipeline (794) (ft) | 11,913 | 10,638 |
| Irrigation Water Conveyance, Ditch and Canal Lining, Flexible Membrane (428B) (ft) | 82,241 | 23,232 |
| Irrigation Water Conveyance, Ditch and Canal Lining, Galvanized Steel (428C) (ft) | 110 | |
| Irrigation Water Conveyance, Ditch and Canal Lining, Nonreinforced Concrete (428A) (ft) | 1,053,267 | 282,122 |
| Irrigation Water Conveyance, Pipeline, Aluminum Tubing (430AA) (ft) | 17,384 | 5,455 |
| Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic (430DD) (ft) | 7,251,859 | 3,682,862 |
| Irrigation Water Conveyance, Pipeline, Low-Pressure, Underground, Plastic (430EE) (ft) | 3,624,958 | 1,198,368 |
| Irrigation Water Conveyance, Pipeline, Nonreinforced Concrete (430CC) (ft) | 10,540 | |
| Irrigation Water Conveyance, Pipeline, Reinforced Plastic Mortar (430GG) (ft) | 1,100 | |
| Irrigation Water Conveyance, Pipeline, Rigid Gated Pipeline (430HH) (ft) | 1,827,532 | 464,555 |
| Irrigation Water Conveyance, Pipeline, Steel (430FF) (ft) | 14,286 | 6,682 |
| Irrigation Water Management (449) (ac) | 799,351 | 267,158 |
| Land Clearing (460) (ac) | 504 | 55 |
| Land Grading (744) (ac) | 693 | 82 |
| Land Smoothing (466) (ac) | 6,765 | 1,251 |
| Lined Waterway or Outlet (468) (ft) | 49,910 | 6,244 |
| Livestock Shade Structure (717) (no) | 3 | 1 |
| Livestock Use Area Protection (757) (ac) | 761,887 | 38,523 |
| Long Term No. Till (778) (no) | 12,937 | 4,831 |

| **Conservation Practice (NRCS practice code) (units reported)** | **Planned** | **Applied** |
|---|---|---|
| Manure Transfer (634) (no) | 101,184 | 2,947 |
| Milking Center Wastewater Treatment System (719) (no) | 329 | 6 |
| Mulching (484) (ac) | 34,689 | 243 |
| Nutrient Management (590) (ac) | 3,889,489 | 1,195,881 |
| Obstruction Removal (500) (ac) | 7,646 | 101 |
| Open Channel (582) (ft) | 23,690 | 7,124 |
| Pasture and Hay Planting (512) (ac) | 508,013 | 149,050 |
| Pathogen Management (783) (ac) | 2,209 | |
| Pest Management (595) (ac) | 2,636,632 | 850,914 |
| Pipeline (516) (ft) | 35,849,891 | 11,032,141 |
| Planned Grazing System (762) (ac) | 36,569 | 50,440 |
| **Pond (378) (no)** | **35,774** | **26,784** |
| Pond Sealing or Lining, Bentonite Sealant (521C) (no) | 200,108 | 6 |
| Pond Sealing or Lining, Flexible Membrane (521A) (no) | 78,336 | 12,244 |
| Pond Sealing or Lining, Soil Dispersant (521B) (no) | 75 | 3 |
| Precision Land Forming (462) (ac) | 3,209 | 711 |
| **Prescribed Burning (338) (ac)** | **200,806** | **43,461** |
| **Prescribed Grazing (528) (ac)** | **1,404,366** | **904,679** |
| **Prescribed Grazing (528A) (ac)** | **7,624,246** | **4,768,032** |
| Pumping Plant (533) (no) | 7,531 | 679 |
| Range Planting (550) (ac) | 217,448 | 48,407 |
| Rangeland Fertilization (721) (ac) | 447 | |
| Record Keeping (748) (no) | 35,174 | 31,165 |
| Recreation Land Grading and Shaping (566) (ac) | 1 | |
| Recreation Trail and Walkway (568) (ft) | 8,501 | |
| **Residue Management -Direct Seed (777) (ac)** | **133,015** | **24,700** |
| **Residue Management, Mulch Till (329B) (ac)** | **846,668** | **285,649** |
| **Residue Management, No-Till/Strip Till (329A) (ac)** | **1,516,465** | **474,288** |
| **Residue Management, Ridge Till (329C) (ac)** | **32,290** | **9,383** |
| **Residue Management, Seasonal (344) (ac)** | **282,690** | **237,439** |
| **Restoration and Management of Declining Habitats (643) (ac)** | **3,270** | **107** |
| Rice Water Control (746) (ac) | 87 | |
| Rinsate Management (764) ($ft^3$) | 1 | 1 |
| **Riparian Buffers - Vegetative (759) (ac)** | **15** | **1** |
| **Riparian Forest Buffer (391) (ac)** | **7,178** | **2,413** |

| Conservation Practice (NRCS practice code) (units reported) | Planned | Applied |
|---|---|---|
| Riparian Herbaceous Cover (390) (ac) | 804 | 79 |
| Road/Landing Removal (722) (ac) | | 2 |
| Rock Barrier (555) (ft) | 830 | 330 |
| Roof Runoff Structure (558) (no) | 22,999 | 3,276 |
| Row Arrangement (557) (ac) | 744 | 682 |
| Runoff Management System (570) (ac) | 15 | 7 |
| Sediment Basin (350) (no) | 13,009 | 64 |
| **Shallow Water Management for Wildlife (646) (ac)** | **6,549** | **1,381** |
| Silage Leachate Collection and Transfer (765) ($ft^3$) | 12 | |
| Silvopasture Establishment (791) (ac) | 67 | |
| Sinkhole and Sinkhole Area Treatment (725) (no) | 10 | 9 |
| Soil Salinity Control (738) (ac) | 26,036 | 6,181 |
| Soil Salinity Management-Nonirrigated (571) (ac) | 13,385 | 5,581 |
| Spoil Spreading (572) (ft) | 24,649 | 1 |
| Spring Development (574) (no) | 2,410 | 1,077 |
| Stream Crossing (728) (no) | 23,161 | 104 |
| **Stream Habitat Improvement and Management (395) (ac)** | **8,119** | **2,320** |
| Streambank and Shoreline Protection (580) (ft) | 615,617 | 160,772 |
| Stripcropping (585) (ac) | 6,860 | 1,553 |
| Stripcropping, Field (586) (ac) | 3,472 | 208 |
| **Structure for Water Control (587) (no)** | **41,082** | **7,561** |
| Subsurface Drain (606) (ft) | 2,946,072 | 463,054 |
| Surface Drainage, Field Ditch (607) (ft) | 322,420 | 1,200 |
| Surface Drainage, Main or Lateral (608) (ft) | 52,737 | 3,500 |
| Surface Roughening (609) (ac) | 8,493 | 14,786 |
| Surface Wetting (760) (ac) | 11 | 1 |
| Temporary Steel Windbreak (771) (no) | 13,038 | 3 |
| Terrace (600) (ft) | 25,025,835 | 6,020,058 |
| Toxic Salt Reduction (610) (ac) | 17,775 | 11,356 |
| Transition to Organic Production (789) (ac) | 6,884 | 1,920 |
| **Tree/Shrub Establishment (612) (ac)** | **47,637** | **13,589** |
| Tree/Shrub Pruning (660) (ac) | 51,708 | 383 |
| Underground Outlet (620) (ft) | 3,394,228 | 757,821 |
| **Upland Wildlife Habitat Management (645) (ac)** | **973,119** | **1,345,495** |
| Use Exclusion (472) (ac) | 160,595 | 25,629 |

| Conservation Practice (NRCS practice code) (units reported) | Planned | Applied |
|---|---|---|
| Vegetative Barrier (601) (ft) | 10,500 | 4,600 |
| Vertical Drain (630) (no) | 294 | 39 |
| Waste Facility Cover (367) (no) | 12,667 | |
| Waste Field Storage Area (749) (no) | 16 | 6 |
| Waste Storage Facility (313) (no) | 235,909 | 79,604 |
| Waste Treatment Lagoon (359) (no) | 108 | 32 |
| Waste Utilization (633) (ac) | 563,208 | 112,981 |
| Waste Water & Feedlot Runoff Control (784) (ac) | 161,617 | 910 |
| Waste Water Irrigation (732) (ac) | 20 | 18 |
| Wastewater Treatment Strip (635) (ac) | 31,394 | 1 |
| Water and Sediment Control Basin (638) (no) | 108,976 | 8,964 |
| Water Harvesting Catchment (636) (no) | 5 | 2 |
| Water Well (642) (no) | 18,831 | 1,595 |
| Watering Facility (614) (no) | 241,572 | 21,583 |
| Waterspreading (640) (ac) | 398 | 171 |
| Well Decommissioning (351) (no) | 2,066 | 1,542 |
| Well Plugging (755) (no) | 2 | 1 |
| Well Testing (731) (no) | 17 | 80 |
| **Wetland Creation (658) (ac)** | **205** | **101** |
| **Wetland Enhancement (659) (ac)** | **827** | **167** |
| **Wetland Restoration (657) (ac)** | **1,088** | **9,582** |
| **Wetland Wildlife Habitat Management (644) (ac)** | **15,100** | **26,097** |
| **Wildlife Watering Facility (648) (no)** | **191** | **35** |
| **Windbreak/Shelterbelt Establishment (380) (ft)** | **4,934,765** | **1,753,327** |
| **Windbreak/Shelterbelt Renovation (650) (ft)** | **969,648** | **204,164** |

# The Conservation Security Program: A New Conservation Program That Rewards Historic Land Stewards Who Have Applied and Managed Effective Conservation Systems

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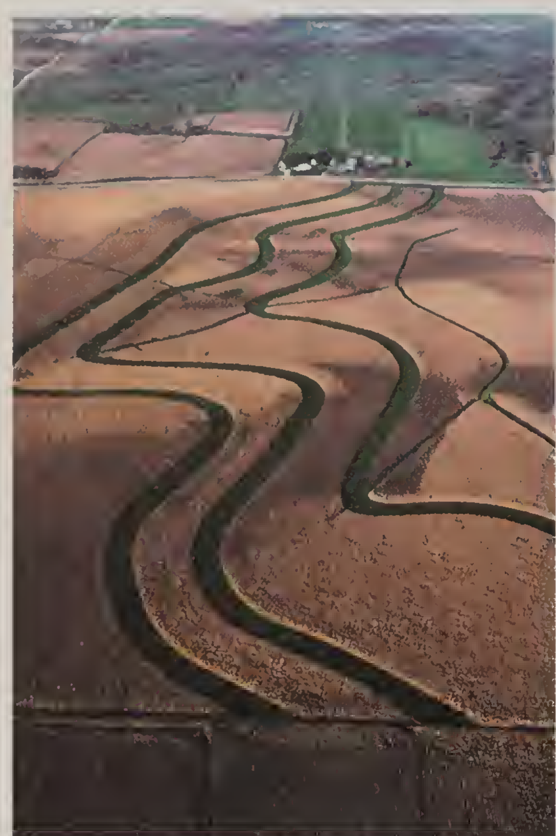
## Abstract

*The Conservation Security Program (CSP) is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on tribal and private working lands. Working lands include cropland, grassland, prairie land, improved pasture, and rangeland, as well as forested land that is an incidental part of an agriculture operation. In the first signup, CSP was offered in 18 watersheds located in 22 states. In 2005, the program is available in all 50 states, the Caribbean, and the Pacific Basin. The program provides equitable access to benefits to all producers, regardless of size of operation, crops produced, or geographic location.*

## Introduction

The Farm Security and Rural Investment Act of 2002 (2002 Farm Bill) (Pub. L. 107-171) amended the Food Security Act of 1985 to authorize the Conservation Security Program (CSP). The CSP is administered by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS). The CSP is a voluntary conservation program that supports ongoing stewardship of private agricultural lands by providing payments for maintaining and enhancing natural resources. The CSP identifies and rewards those farmers and ranchers who are meeting the highest standards of conservation and environmental management on their operations (NRCS 2004).

The program provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on tribal and private working lands. Working lands include cropland, grassland, vineyards/orchards, prairie land, improved pasture, and rangeland, as well as forested land that is an incidental part of an agricultural operation (NRCS 2004). The CSP will help producers maintain conservation stewardship and implement additional conservation practices that provide added environmental enhancement, while creating powerful incentives for other producers to meet those same standards of conservation performance.



Contour buffer strips in highly erodible cropland. (T. McCabe, USDA-NRCS)

## Watershed Selection

For CSP, NRCS decided on a staged, watershed-based implementation process. This was done for economic and administrative reasons. Focusing on high-priority watersheds reduced both the administrative burden and costs of processing a large number of applications for which funding was not available. For the 2004 CSP signup, 18 watersheds in 22 states (some watersheds were in multiple states) were selected (Figure 1). There were several criteria for selecting the 18 watersheds. These included watersheds that had a wide variety of eligible land uses, have a history of good land stewardship on the part of landowners, have high-priority resource issues to be addressed, and have technical tools necessary, such as digitized soils information, to streamline program implementation. There were 2,200 CSP contracts signed in the 18 watersheds selected for the FY 2004 signup. These contracts accounted for 1.9 million acres entering the program.

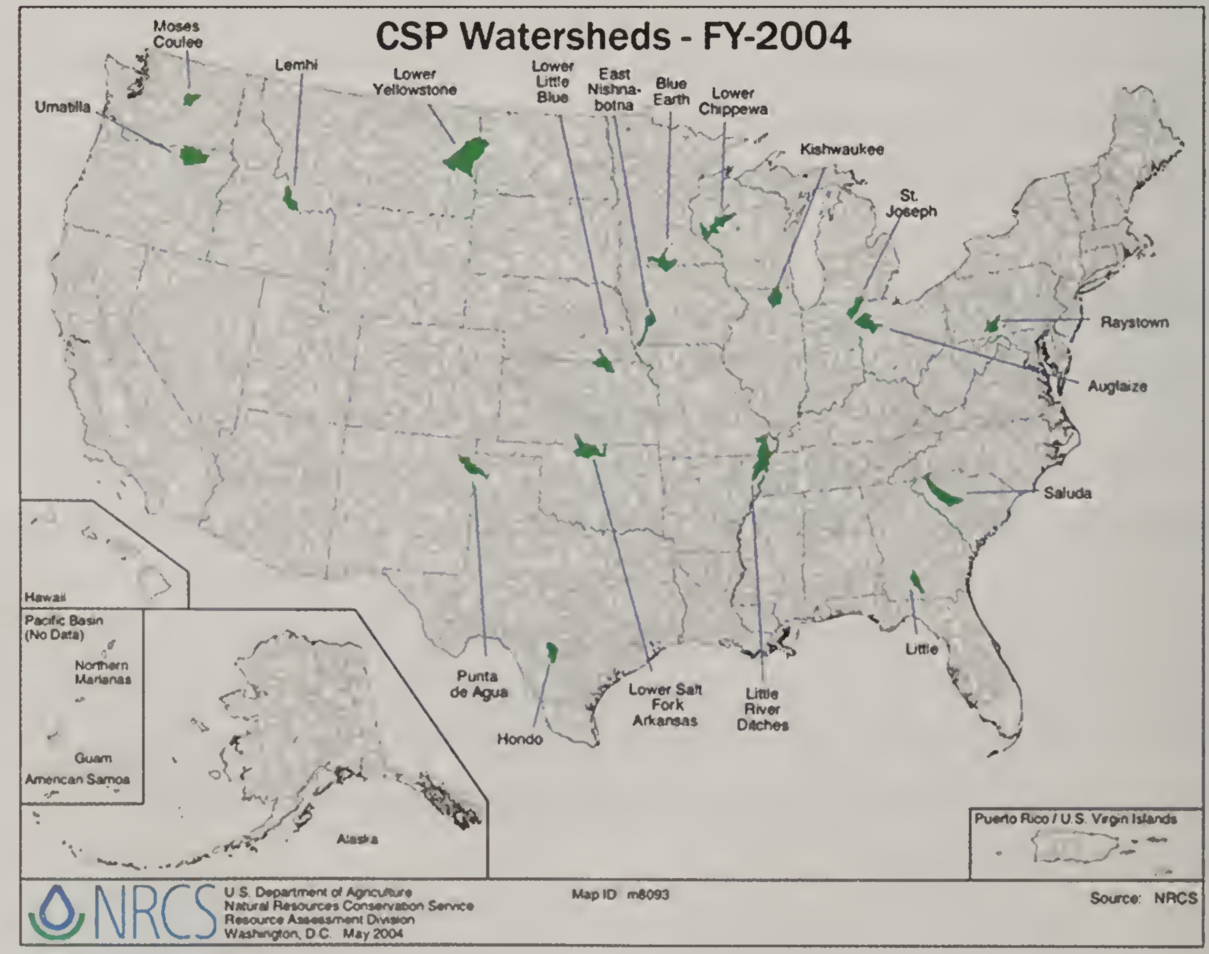



Figure 1. Map of watersheds included in CSP in 2004. There were 2,200 CSP contracts signed in these 18 watersheds in the contiguous U.S. for the fiscal year 2004

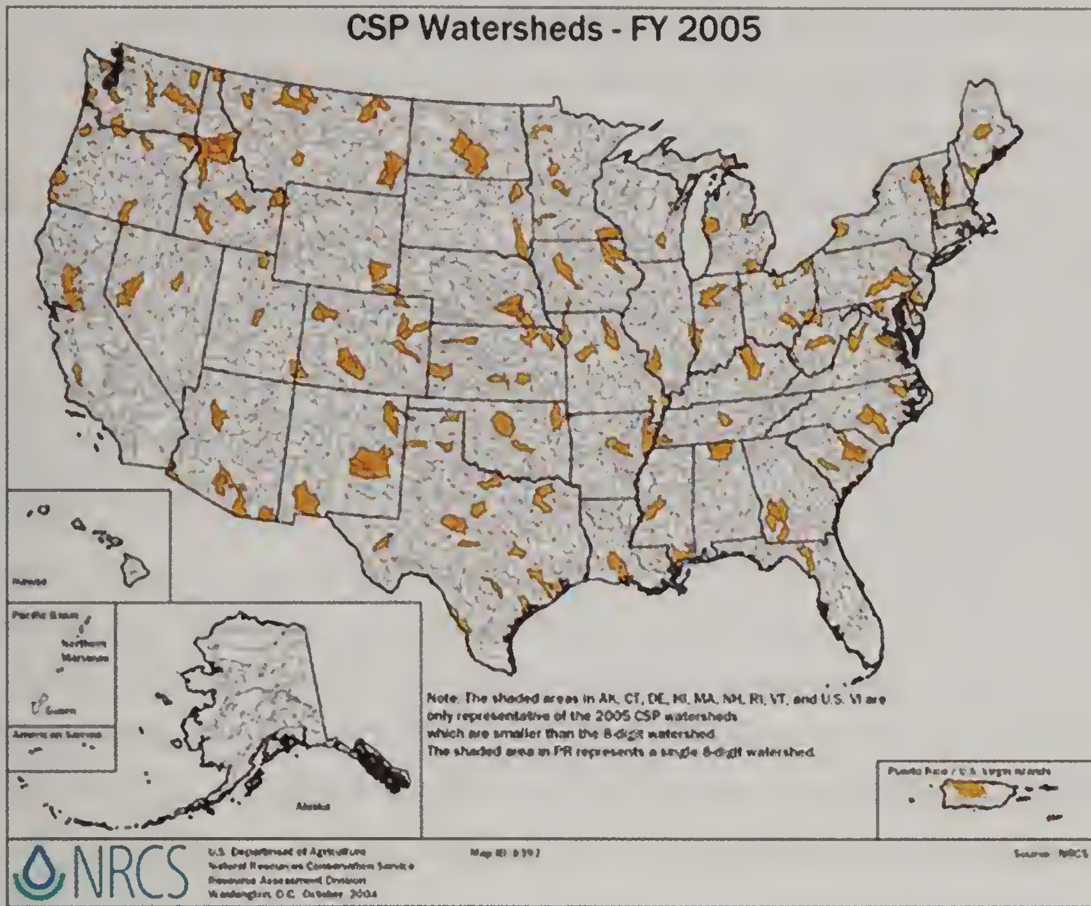



Figure 2. Map of 202 CSP watersheds for 2005.

For the FY 2005 CSP signup, land in 202 watersheds representing every state and the Caribbean will be eligible to participate in the program (Figure 2). Combined, these watersheds cover a little more than 83 million acres. The same criteria were used to select these watersheds as were used to select the watersheds in the FY 2004 signup.

The intent of the program is to rotate watersheds available for CSP on an 8-year cycle. Each year, approximately one-eighth of the nation's 2,119 watersheds will be eligible for the signup. Producers who aren't eligible for the signup can utilize other funding and technical programs offered by NRCS and other state, federal, and private partners to help them achieve a higher level of conservation so that they can apply for CSP in the future.

## Land Eligibility

To be eligible for CSP, the producer and the producer's operation must meet the following basic criteria:

- The land must be privately owned or tribal land, and the majority of the land must be located within one of the selected watersheds.
- The applicant must be in compliance with highly erodible and wetland provisions of the Food Security Act of 1985, have an active interest in the agricultural operation, and have control of the land for the life of the contract.
- The applicant must share in the risk of producing any crop or livestock and be entitled to a share in the crop or livestock marketed from the operation.

Once basic eligibility is met, all applicants must meet the following minimum tier eligibility and contract requirements, plus any additional requirements in the signup announcement:

- For Tier I, the producer must have addressed water quality and soil quality to the NRCS Field Office Technical Guide (FOTG) standards on part of the agricultural operation prior to acceptance.
- For Tier II, the producer must have addressed water quality and soil quality to the FOTG standards on the entire agricultural operation prior to acceptance and agree to address 1 additional resource by the end of the contract period.
- For Tier III, the producer must have addressed all resource concerns to a resource-management system level that meets the FOTG standards on the entire agricultural operation prior to acceptance and must agree to additional enhancement activities outlined in the signup announcement.

Soil-quality practices include crop rotations, cover crops, tillage practices, prescribed grazing, and providing adequate wind barriers. Water-quality practices include conservation tillage, filter strips, terraces, grassed waterways, managed access to streams, nutrient and pesticide management, prescribed grazing, and irrigation water management.

Proper nutrient management of hog manure. (T. McCabe, USDA-NRCS)

## Potential Impacts on Wildlife Habitat

The potential for improving wildlife habitat across the landscape through the CSP is enormous. By using the watershed approach, states can target locally or nationally significant wildlife species or habitat types that are in critical need of improvement. By concentrating the management activities in selected watersheds, the benefits can be far greater than if the same management activities were scattered across a state. If installed and managed with wildlife as a consideration, the conservation practices applied to address soil and water quality for CSP will also add to the wildlife habitat benefit.

Each state develops a list of conservation practices or enhancements (activities) for which producers can receive payments. The state then sets a per-acre payment or a fixed payment amount per activity. For example, a state may offer to pay $5 per acre for inter-seeding native forbs into established nonnative grass stands. An example of a fixed payment is a state that pays $250 per vernal pool that a producer creates and maintains. These payments are made each year for the life of the contract. Since the CSP is intended to reward producers who are good land stewards, these payments can be made for activities that producers have already installed, as well as for activities the producers are willing to install.

In Tier I and Tier II, a producer is not required to address wildlife habitat concerns. In Tier III, a producer must meet FOTG standards for wildlife. However, producers may elect to receive payments for wildlife habitat activities in any tier. Figure 3 shows a breakdown of payments for habitat-management enhancements by watershed and tier for the 2004 CSP contracts. These payments totaled approximately $960,000. Some watersheds had producers receiving payments for wildlife habitat activities in all 3 tiers while producers in other watersheds only received payments in 1 or 2 tiers. Samples of various activities producers received payments for included constructing brush piles; establishing habitat transition zones using native vegetation beneficial to wildlife; controlling access to sensitive designated wildlife or riparian areas; reducing livestock grazing to 50% of the recommended carrying capacity; installing resting, basking, and hibernation structures for amphibians and reptiles; and managing the land to improve wildlife habitat evaluation scores above the minimum quality criteria required by NRCS policy to meet the FOTG standards. These are just a few of the many activities states were willing to pay producers for improving or maintaining wildlife habitat.

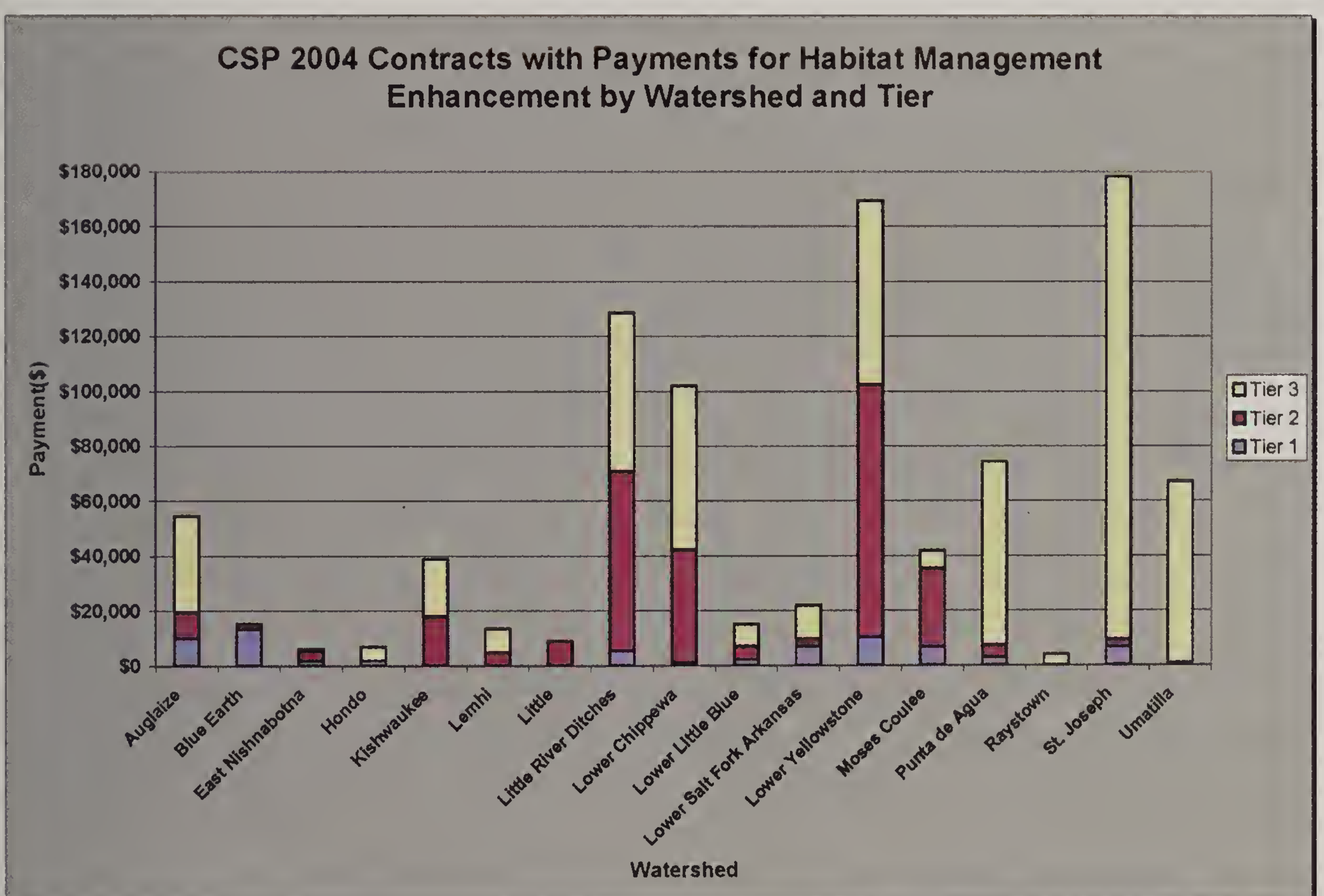



Figure 3. Breakdown of payments for habitat-management enhancements by watershed and tier for the fiscal year 2004 CSP contracts.

## Conclusions

At this time, there is not a national database that gives a breakdown of the acres or individual activities installed by watershed. Currently, to get this information, an individual would have to go to each state, and in some cases, each watershed and review the contracts. Once this information is available on a national database, information such as acres of field borders established and maintained, acres of riparian areas excluded from grazing, acres of grazing land and pasture managed for wildlife, and acres of various wetland types created will be readily available. This information will help managers and researchers assess the effectiveness of the Conservation Security Program.

## Literature Cited

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# Participant Observations on Environmental and Social Effects of the Conservation Reserve Program: Results of a National Survey

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## Abstract

*A national survey of Conservation Reserve Program (CRP) contractees was completed to obtain information about environmental and social effects of the program on participants, farms, and communities. Over 75% of respondents believed CRP benefits to wildlife were important. Seventy-three percent of respondents observed increased numbers of wildlife associated with CRP lands. A majority of respondents (82%) believed the amount of assistance furnished by the U.S. Department of Agriculture related to planning and maintaining wildlife habitat associated with CRP lands was appropriate. The majority of respondents reported CRP benefits, including increased quality of surface and ground waters, improved air quality, control of drifting snow, and elevated opportunities to hunt or simply observe wildlife as part of daily activities. Income stability, improved scenic quality of farms and landscapes, and potential increases in property values and future incomes also were seen as program benefits. Negative aspects, reported by less than 30% of respondents, included seeing the CRP as a source of weeds, fire hazard, and attracting unwanted requests for trespass.*

## Introduction

Those with the greatest potential to observe changes resulting from U.S. Department of Agriculture (USDA) conservation policies are those who live on the land affected. Over the years, personal communications with farm operators enrolled in the Conservation Reserve Program (CRP) suggest that wide-ranging personal and social effects of the program have not been formally recognized. To many, the CRP has delivered an increased abundance of wildlife, reduced erosion, more aesthetically pleasing landscapes, financial stability, control of drifting snow, and an agricultural landscape that cultivates recreational and social interactions among family and friends. From a national perspective, these conservation benefits may appear unquantifiable and relatively unimportant. To these individuals, however, these assets delivered by adoption of USDA conservation policies are not trivial. An appreciation of such unrecognized effects can improve our understanding of environmental and social implications of long-term conservation programs within agricultural ecosystems.


White-tailed deer in Iowa. (USDA-NRCS)

In 2001, a survey was completed by the U.S. Geological Survey at the request of the Farm Service Agency (FSA) to collect information pertaining to environmental and social benefits of the CRP (Allen and Vandever 2003). The survey was delivered to 2,212 CRP participants across the 10 USDA Farm Production Regions (FPR). Survey response rate was 65%.

This chapter provides a brief summary of results of the survey presented primarily through a discussion of findings at the national level, and furnishes more detailed information presented by FPR of both positive and negative effects of the CRP as seen by those enrolled in the program. The complete report can be downloaded from the FSA web site at <http://www.fsa.usda.gov/dafp/cepd/crpinfo.htm>.

## Participant Observations on Environmental and Social Effects of the Conservation Reserve Program

### *Environmental Benefits*

Eighty-five percent of survey respondents said the CRP has contributed to diminished erosion of soil (Table 1). The effect the CRP has had on wildlife associated with agricultural landscapes is illustrated by 73% of respondents reporting an increased abundance of wildlife associated with lands enrolled in the program. From a national perspective, 75% of survey respondents either agreed or strongly agreed that CRP benefits to wildlife are important and requirements to periodically improve habitat quality are a reasonable expectation of participation in the program. Although 38% of respondents reported that the CRP provided more opportunities to hunt and 12% found increased opportunities to lease land for hunting, nearly 60% of respondents believe the improved ability to simply observe wildlife was an important benefit of the program.

Table 1. Survey respondent identified environmental and social benefits of the Conservation Reserve Program by U.S. Department of Agriculture Farm Production Region (FPR). Numbers represent percentage of respondents by FPR and combined national response ($n$ = 1,412).

| | Farm Production Region[a] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Benefit** | **PAC** | **MTN** | **NP** | **SP** | **LAK** | **CB** | **DLT** | **SE** | **APL** | **NE** | **NATL** |
| Improved control of soil erosion | 93.4 | 87.9 | 84.9 | 90.7 | 76.6 | 89.3 | 79.4 | 85.2 | 88.1 | 74.1 | 85.4 |
| Positive changes in wildlife populations | 82.0 | 69.7 | 77.1 | 67.4 | 75.2 | 72.7 | 75.8 | 68.9 | 69.5 | 62.1 | 73.2 |
| Increased opportunities to observe wildlife | 62.3 | 50.5 | 55.8 | 45.3 | 72.0 | 58.6 | 67.7 | 57.4 | 61.0 | 60.3 | 59.4 |
| Improved water quality | 45.9 | 28.3 | 38.0 | 22.1 | 36.2 | 48.2 | 23.8 | 37.7 | 45.8 | 27.6 | 38.8 |
| Increased opportunities to personally hunt | 27.9 | 22.2 | 42.8 | 24.4 | 40.8 | 37.0 | 61.9 | 37.7 | 32.2 | 41.4 | 37.6 |
| Improved scenic quality of farm or landscape | 37.7 | 33.3 | 35.3 | 30.2 | 40.8 | 37.3 | 42.9 | 45.9 | 45.8 | 29.3 | 37.4 |
| Improved control of drifting snow | 41.0 | 56.6 | 51.2 | 33.7 | 34.9 | 22.3 | 0.0 | 0.0 | 11.9 | 8.6 | 30.5 |
| Improved air quality | 54.1 | 40.4 | 31.4 | 45.3 | 21.1 | 21.6 | 30.2 | 45.9 | 32.2 | 15.5 | 29.2 |
| Increased permanence of surface water | 36.1 | 21.2 | 19.8 | 25.6 | 19.7 | 27.3 | 20.6 | 18.0 | 23.7 | 27.6 | 23.7 |
| Potential increase in future income (e.g., timber sales) | 8.2 | 8.1 | 8.9 | 9.3 | 15.6 | 9.8 | 65.1 | 73.8 | 33.9 | 13.8 | 16.7 |
| Increased opportunities to lease land for hunting | 9.8 | 9.1 | 19.4 | 15.1 | 8.7 | 6.6 | 23.8 | 19.7 | 13.6 | 10.3 | 11.9 |
| No positive effects | 0.0 | 2.0 | 0.0 | 1.2 | 1.4 | 0.9 | 1.6 | 1.6 | 1.7 | 3.4 | 1.1 |

[a] Farm Production Region: APL (Appalachian): Kentucky, Tennessee, West Virginia, Virginia, North Carolina; CB (Corn Belt): Iowa, Missouri, Illinois, Indiana, Ohio; DLT (Delta): Arkansas, Louisiana, Mississippi; LAK (Lake States): Minnesota, Wisconsin, Michigan; MTN (Mountain): Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico; NATL (National): Results for all FPRs combined; NE (Northeast): Maine, Vermont, New Hampshire, Rhode Island, Massachusetts, Connecticut, New York, Pennsylvania, New Jersey, Delaware; NP (Northern Plains): North Dakota, South Dakota, Nebraska, Kansas; PAC (Pacific): Washington, Oregon, California; SE (Southeast): Alabama, Georgia, South Carolina, Florida; SP (Southern Plains): Oklahoma, Texas.

Slightly more than 29% and 39% of respondents acknowledged improvements in air and water quality, respectively. Improved control of drifting snow was recognized by 30.5% of survey respondents. Over 23% of respondents believed the CRP contributed to greater permanence of surface waters. Improvement in the aesthetic quality of agricultural landscapes was cited as a CRP benefit by 37% of respondents.

In addition to responding to formal questions in the survey many respondents "wrote-in" additional benefits derived from the CRP. Other positive aspects described included enhancement of soil organic matter and fertility improving potential future productivity of CRP lands, retention of water from rain and snow, and prevention of erosion on lands adjacent to CRP acres. Other environmental benefits included reappearance of springs below CRP fields, less debris in streams, and improved quality of well water.

### *Economic and Social Benefits*

Respondents to the CRP survey described benefits of the program as elevation of grain prices, assistance in paying taxes, assured income to support retirement, provision of additional income to support continued operation of the farm, an increase in overall farm property values, stabilization of farm income, and savings in operation costs by not having to farm corners and small fields. Some respondents stated the CRP has enabled them to take land out of production that they knew should have never been farmed. Nearly 17% of respondents saw the CRP as contributing to their future income either through future sale of timber resources, improved fertility of soils, or increased recreational value of their land.

Enhanced recreation opportunities from the CRP. (G. Kramer, USDA-NRCS)

Social benefits described were diverse and included satisfaction from doing something favorable for the environment, having hay to give neighbors in time of need, providing a place for children and grandchildren to camp or play, provision of sites for local schools to hold conservation/ecology classes, and providing places for family/friends to hunt and socialize. Lower use of agricultural chemicals, diminished noise from equipment and other farm operations, and helping to prevent unwanted urban expansion/development also were attributed to the CRP. By far, the majority of comments focused on increased numbers and variety of wildlife associated with CRP lands. Numerous individuals stated the enhanced presence of wildflowers and insects were an unforeseen but welcome benefit of the program.

## *Negative Aspects of the CRP*

Not all perceptions concerning environmental and social effects of the CRP were positive. Almost 29% of respondents viewed CRP lands as a source of weeds (Table 2). Similarly, 13% of respondents perceived the CRP as making their farm, or landscape, appear untidy or poorly managed. The CRP was viewed as a potential fire hazard by 19% of those responding to the survey. Four percent of respondents felt that too much land had been taken out of production and enrolled in the CRP. Likewise, 8% of respondents believed that the program had a negative effect on local economies due to lower production of crops and related impacts on local agricultural-based businesses. Conversely, others expressed apprehension about too many acres of highly erodible land going back into production due to more stringent enrollment requirements in recent CRP signups.

Table 2. Negative aspects of the Conservation Reserve Program as identified by survey respondents by U.S. Department of Agriculture Farm Production Region (FPR). Numbers represent percentage of respondents by FPR and combined national response ($n$ = 1,412).

| | Farm Production Region[a] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Negative effect | PAC | MTN | NP | SP | LAK | CB | DLT | SE | APL | NE | NATL |
| Source of weeds | 34.5 | 23.7 | 29.7 | 22.8 | 32.2 | 33.6 | 14.1 | 13.6 | 26.3 | 21.1 | 28.8 |
| Potential fire hazard | 44.8 | 46.4 | 24.7 | 30.4 | 19.6 | 8.9 | 17.2 | 15.3 | 10.5 | 1.8 | 19.3 |
| Attracts unwanted requests for permission to hunt | 20.7 | 12.4 | 20.5 | 16.5 | 12.6 | 23.3 | 14.1 | 13.6 | 15.8 | 7.0 | 18.0 |
| Makes farm appear unkempt or poorly managed | 12.1 | 9.3 | 6.2 | 11.4 | 18.7 | 14.2 | 18.7 | 8.5 | 22.8 | 14.0 | 13.1 |
| Attracts unwanted wildlife | 10.3 | 8.2 | 7.7 | 11.4 | 7.9 | 11.0 | 4.7 | 3.4 | 7.0 | 5.3 | 8.7 |
| Negative effects on local economy | 20.7 | 23.7 | 11.2 | 16.5 | 3.7 | 3.9 | 4.7 | 1.7 | 3.5 | 3.4 | 7.8 |
| Too much cropland taken out of production | 3.4 | 8.2 | 3.1 | 5.1 | 3.3 | 3.4 | 7.8 | 5.1 | 3.5 | 5.3 | 4.1 |
| No negative effects | 25.9 | 24.7 | 7.7 | 40.5 | 40.7 | 13.3 | 54.7 | 39.0 | 47.4 | 52.6 | 25.4 |

[a] Farm Production Regions: APL (Appalachian): Kentucky, Tennessee, West Virginia, Virginia, North Carolina; CB (Corn Belt): Iowa, Missouri, Illinois, Indiana, Ohio; DLT (Delta): Arkansas, Louisiana, Mississippi; LAK (Lake States): Minnesota, Wisconsin, Michigan; MTN (Mountain): Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico; NATL (National): Results for all FPRs combined; NE (Northeast): Maine, Vermont, New Hampshire, Rhode Island, Massachusetts, Connecticut, New York, Pennsylvania, New Jersey, Delaware; NP (Northern Plains): North Dakota, South Dakota, Nebraska, Kansas; PAC (Pacific): Washington, Oregon, California; SE (Southeast): Alabama, Georgia, South Carolina, Florida; SP (Southern Plains): Oklahoma, Texas.

In relation to wildlife, 18% of respondents indicated that the CRP had caused problems due to greater numbers of wildlife. The CRP has attracted unwanted wildlife that includes an increase in insects, deer (*Odocoileus* spp.), coyotes (*Canis latrans*), predators, and other "varmints". Eighteen percent of respondents attributed an increase in unwelcome requests for permission to hunt to presence of the CRP. One of the most commonly voiced concerns was trespass and an apparent presumption by some individuals that CRP lands were open to public hunting. In some cases, the increase in habitat quality furnished by the CRP resulted in more requests from strangers to have access to land for hunting.

## Satisfaction with U.S. Department of Agriculture Performance

Overall, survey respondents appreciated the high quality of information and assistance in CRP enrollment and administration furnished by the USDA. Eighty-two percent of respondents believed that the amount of assistance furnished by USDA related to planning and maintaining wildlife habitat associated with CRP lands was appropriate. Only 2% believed that too much aid in relation to wildlife issues was furnished. Slightly more than 15% of respondents advocated more awareness of wildlife needs, while 11% believed that wildlife had received excessive attention in CRP enrollment criteria. Almost 16% of respondents thought that not enough assistance was furnished, while 55% felt that they had been well informed about why specific types of CRP management practices were required to maintain or improve wildlife habitat. In contrast, 38% of respondents felt they had been only partially informed, and 7% said they had not been informed about these requirements at all.

Nearly half (49%) of respondents to the survey wished to see the CRP continue relatively unchanged. Many respondents indicated a willingness to implement management to maintain vegetation quality and wildlife habitat but seek financial assistance, educational materials, and technical assistance to do so. Written comments by respondents indicated a desire for more on-the-ground technical assistance, simplification of paperwork, integration of periodic use or management to maintain long-term quality of grasslands, and greater amounts of information and conservation options that extend beyond CRP lands into entire agricultural ecosystems.

## Summary

The goal of the participant survey was to describe largely intangible, undocumented environmental and personal effects of the CRP as seen by those most affected. Because the agricultural community and American public value environmental health and because conservation programs have long-term effects on the social fabric of rural communities, improvement in program performance has become an increasingly important goal of USDA conservation policies (USDA 2001). Appropriate incentives for agriculture to deliver societal benefits beyond production of food and fiber will require a thorough understanding of ecological as well as social and economic issues as affected by agricultural and land-use policies (Robertson et al. 2004).

Not all conclusions about program performance must be made upon years of data and analysis of results. While scientific evaluation is unquestionably needed, straightforward observations and uncomplicated statements from those who have seen their land change in response to conservation after decades, or even generations, of production reflect the perceived value of the program. Recognition of opinions and constraints expressed by participants is essential for refinement in administration and management of lands enrolled in conservation programs. Individual benefits may be imperceptible at the national scale but knowledge of local, personal profits, and successes ultimately will support greater involvement in conservation programs, thereby improving the connection of agriculture to rural and national environmental health.

## Literature Cited

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