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

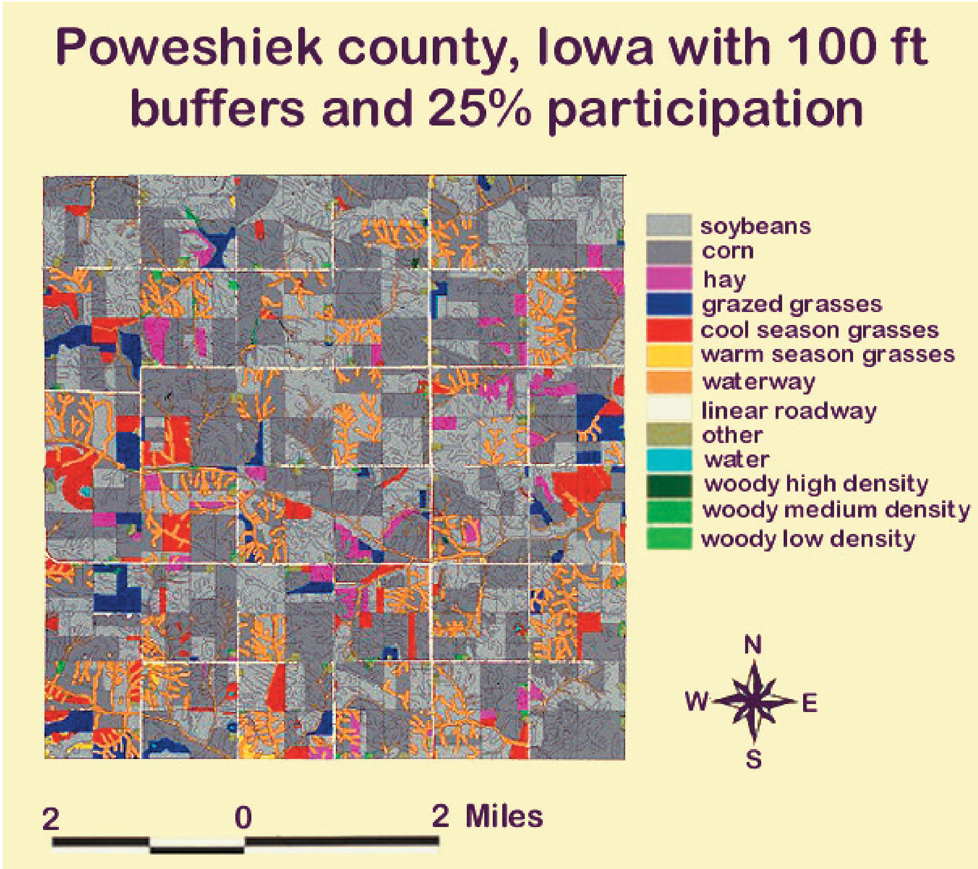
Landscape context influences local distribution patterns, and, on a larger scale, the long-term population dynamics of wildlife. Landscape variables, such as the amount of cover in the landscape or the proximity of a habitat patch to other landscape features, affect avian abundance and reproductive success (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.

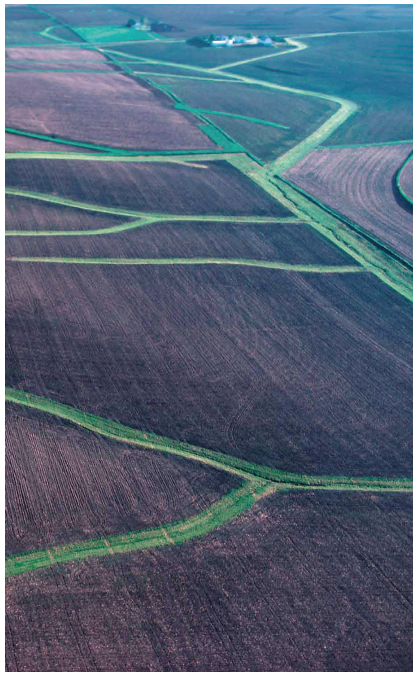
[b] Payments scheduled to be made October 2005. Payments include annual incentives and maintenance allowance payments, but do not include one-time signing incentive payments, practice incentive payments, or payment reductions, such as for lands enrolled for less than 1 year and payment reductions as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

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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 nf 1.7	4,700	Bayou Metro Watershed	Drinking, surface water quality, wildlife habitat	Riparian buffers
California	2001	F 19.0 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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.

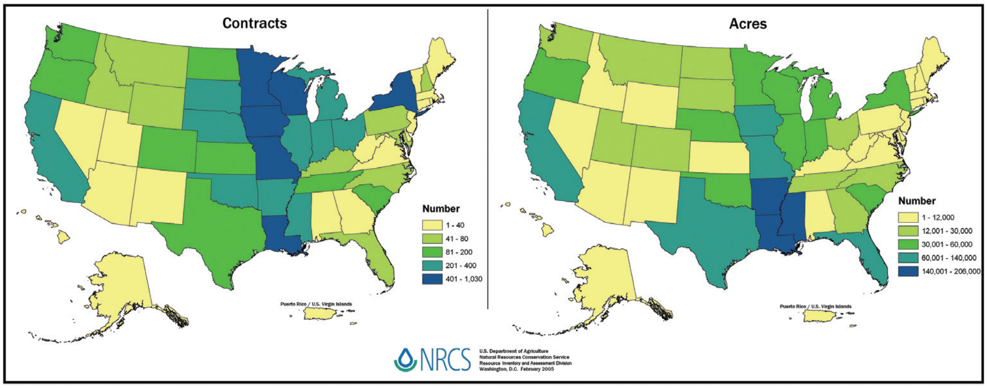

Figure 1. Distribution of total Wetlands Reserve Program contracts and acres enrolled through fiscal year (FY) 2004.

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 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.

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)

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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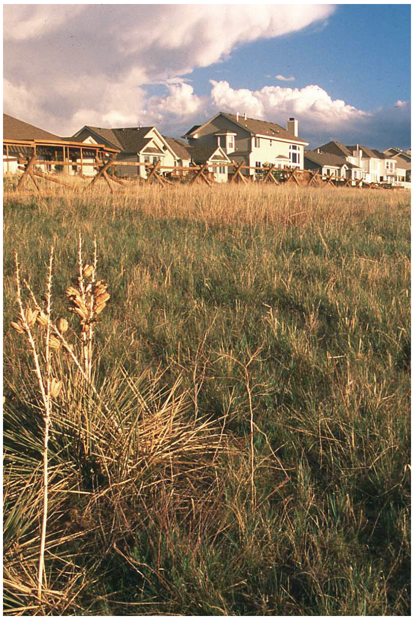
Abstract

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.

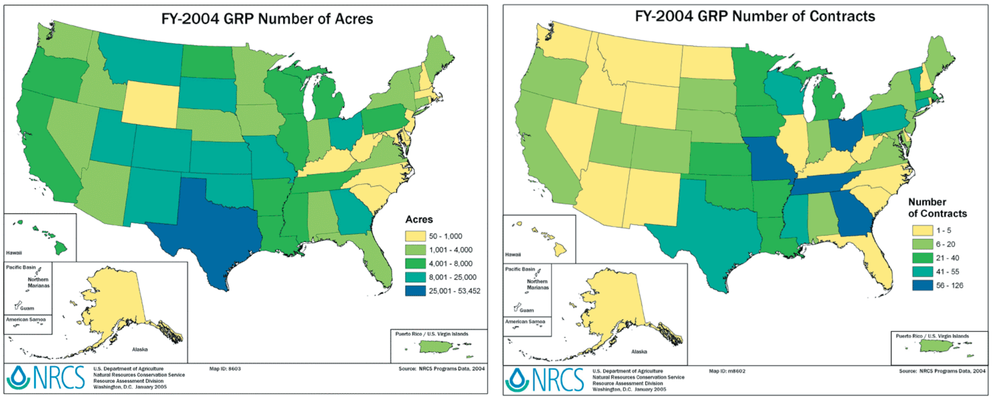


Figure 1. Distribution of number of acres and contracts enrolled in the Grassland Reserve Program during fiscal year (FY) 2004.

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.

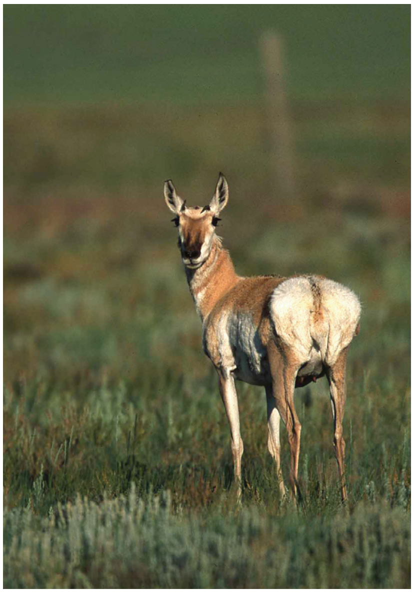
By prioritizing enrollment acceptance to lands with the greatest biodiversity and where the threat of conversion to other land uses is greatest, GRP is maximizing the benefits to wildlife species that depend on these lands for survival. The program is being implemented to target declining species and 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 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*).



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

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 Early successional/ grasslands Range lands Forest lands Shrub/scrub 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 Fencing Livestock management Prescribed burning Shrub thickets and shelterbelts Creation of forest openings Disking or mowing (meander disking through woodlands) Woody cover control Brush management Aspen stand regeneration Exclusion of feral animals Winter flooding of crop fields
Wetland Tidal flushing areas Salt marshes Wetland hardwood hammocks Mangrove forests Wild-rice beds Freshwater marshes Estuaries 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 Invasive plant control Fencing Creation of green-tree reservoirs Moist soil unit management Creation of shallow water area
Riparian and in-stream Riparian areas along streams, rivers, lakes, sloughs and coastal areas 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 Fencing with livestock management and off-stream watering In-stream structures, including installation of large wood Seeding Streambank protection and stabilization Stream deflectors Creation of small pools Installation of buffers Removal of dams Fencing Creation of fish passage Gravel bed creation
Threatened and endangered, and other rare or declining species 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 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.


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

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).

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


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.

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.

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.

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

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.

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.

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

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?

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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