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>.

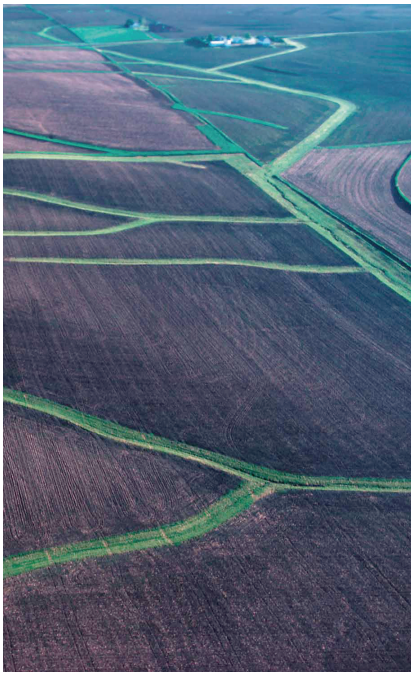
State	Year initiated[a]	Number of contracts	Number of farms	Acres	Annual rental (× $1,000)	Payments[b] ($/acre)
Arkansas	2001	223	142	6,447	647	100.41
California	2001	43	40	4,051	497	122.75
Delaware	1999	428	248	4,934	576	116.76
Florida[c]	2002					
Illinois	1998	5,403	3,955	109,764	17,508	159.51
Iowa	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.



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

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).

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	Native	Existing grass	Wildlife habitat[1]	Rare and declining habitat	Wildlife food plots	Grass filter-strips	Riparian buffers	New and existing trees	Wetland practice[2]	Wind buffers[3]	Other[4]
	CP1	CP2	CP10	CP4	CP25	CP12	CP2[1]	CP22	CP3&11			
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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Literature Cited

Adam, B. D., S. J. Hong, and M. R. Dicks. 2004. Effects of the Conservation Reserve Program on elevator merchandising margins in Oklahoma. Journal of Agricultural and Applied Economics 36:83–96.

Allen, A. W., B. S. Cade, and M. W. Vandever. 2001. Effects of emergency haying on vegetative characteristics within selected conservation reserve program fields in the northern Great Plains. Journal of Soil and Water Conservation 56:120–125.

———, and M. W. Vandever. 2003. A national survey of Conservation Reserve Program (CRP) participants on environmental effects, wildlife issues, and vegetation management on program lands. Biological Science Report USGS/BRD/BSR-2003-0001. U.S. Government Printing Office, Denver, Colorado, USA.

Bangsund, D. A., F. L. Leistritz, and N. M. Hodur. 2002. Rural economic effects of the Conservation Reserve Program in North Dakota. Agribusiness and Applied Economics Report 497, Department of Agribusiness and Applied Economics, Agricultural Experiment Station, North Dakota State University, Fargo, USA.

Best, L. B., H. Campa, III, K. E. Kemp, R. J. Robel, M. R. Ryan, J. A. Savidge, H. P. Weeks, Jr., and S. R. Winterstein. 1997. Bird abundance and nesting in CRP fields and cropland in the Midwest: a regional approach. Wildlife Society Bulletin 25:864–877.

Brady, S. J., and C. H. Flather. 2001. Estimating wildlife habitat trends on agricultural ecosystems in the United States. Pages 156–167 in Agriculture and biodiversity: developing indicators for policy analysis. Proceedings from an Organization for Economic Co-operation and Development Expert meeting, Zurich, Switzerland, November 2001.

Büchs, W. 2003. Biotic indicators for biodiversity and sustainable agriculture—introduction and background. Agriculture, Ecosystems and Environment 98:1–16.

Carmichael, D. B., Jr. 1997. The Conservation Reserve Program and wildlife habitat in the southeastern United States. Wildlife Society Bulletin 25:773–775.

Commonwealth of Kentucky. 2003. Kentucky Green River Conservation Reserve Enhancement Program (CREP) annual program accomplishment report (CEP-68R), federal fiscal year 2003.

Das, C., W. J. Capehart, H. V. Mott, P. R. Zimmerman, and T. E. Schumacher. 2004. Assessing regional impacts of Conservation Reserve Program-type grass buffer strips on sediment load reduction from cultivated lands. Journal of Soil and Water Conservation 59:134–141.

Davie, D. K., and C. L. Lant. 1994. The effect of CRP enrollment on sediment loads in two southern Illinois streams. Journal of Soil and Water Conservation 49:407–412.

Dunn, C. P., F. Stearns, G. R. Gutenspergen, and D. M. Sharpe. 1993. Ecological benefits of the Conservation Reserve Program. Conservation Biology 7:132–139.

Feather, P., D. Hellerstein, and L. Hansen. 1999. Economic valuation of environmental benefits and targeting of conservation programs: the case of the CRP. Agricultural Economic Report 778. U.S. Department of Agriculture, Economic Research Service, Washington, D.C., USA.

Fleming, R. A. 2004. An econometric analysis of the environmental benefits provided by the Conservation Reserve Program. Journal of Agricultural and Applied Economics 36:399–413.

Illinois Department of Natural Resources. 2003. Illinois Conservation Reserve Enhancement Program: a partnership between the USDA and the State of Illinois. 2003 Annual Report.

Keeney, D., and L. Kemp. 2003. A new agricultural policy for the United States. North Atlantic Treaty Organization Advanced Research Workshop on Biodiversity and Rural Sustainability, November 2002. Institute for Agriculture and Trade Policy, Minneapolis, Minnesota, USA.

Kingsbury, L., and W. Boggess. 1999. An economic analysis of riparian landowners' willingness to participate in Oregon's Conservation Reserve Enhancement Program. Paper presented at Annual Meeting of the American Agricultural Economics Association, Oregon State University, Corvallis, USA.

Kleiman, D. G., R. P. Reading, B. J. Miller, T. W. Clark, M. Scott, J. Robinson, R. L. Wallace, R. J. Cabin, and F. Felleman. 2000. Improving the evaluation of conservation programs. Conservation Biology 14:356–365.

Krapu, G. L., D. A. Brandt, and R. R. Cox, Jr. 2004. Less waste corn, more land in soybeans, and the switch to genetically modified crops: trends with important implications for wildlife management. Wildlife Society Bulletin 32:127–136.

Lamont, g. L. 2005. Protecting New York City's water supply with the Conservation Reserve Enhancement Program. In A. W. Allen and M. W. Vandever, editors. The Conservation Reserve Program: planting for the future. Proceedings of a national conference, 6–9 June 2004, Fort Collins, Colorado, USA. U.S. Geological Survey Biological Science Report USGS/BRD/BSR-xxxx. In Press

Lant, C. L., S. E. Kraft, and K. R. Gilman. 1995. Enrollment of filter strips and recharge areas in the CRP and USDA easement programs. Journal of Soil and Water Conservation 50:193–200.

Lee, K. H., T. M. Isenhart, R. C. Schultz, and S. K. Mickelson. 1999. Nutrient and sediment removal by switchgrass and cool-season grass filter strips in central Iowa, USA. Agroforestry Systems 44:121–132

Lines, K. J. 2003. Minnesota River Watershed Conservation Reserve Enhancement Program. Annual report October 1 to September 30, 2002, to the U.S. Department of Agriculture Farm Service Agency from the Minnesota Board of Water and Soil Resources, St. Paul, USA.

Mersie, W., C. A. Seybold, C. McNamee, and M. A. Lawson. 2003. Abating endosulfan from runoff using vegetative filter strips: the importance of plant species and flow rate. Agriculture, Ecosystems and Environment 97:215–223.

Moulton, R. J., B. Baldwin, and J. Snellgrove. 1991. Impacts of Conservation Reserve Program tree planting on biological diversity. Proceedings of the Southern Forest Economists Annual Meeting, 20–22 February 1991, Washington, D.C., USA.

Nusser, S. M., W. R. Clark, J. Wang, and T. R. Bogenschutz. 2004. Combining data from state and national monitoring surveys to assess large-scale impacts of agricultural policy. Journal of Agricultural, Biological, and Environmental Statistics 9:381–397.

Nuttle, T., and L. W. Burger, Jr. 1996. Response of breeding bird communities to restoration of hardwood bottomlands. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 50:228–236.

Ohio Department of Natural Resources. 2003. Ohio Upper Big Walnut Creek CREP annual report, federal fiscal year 2002.

Peak, R. G., F. R. Thompson, III, and T. L. Shaffer. 2004. Factors affecting songbird nest survival in riparian forests in a midwestern agricultural landscape. Auk 121:726–737.

Pimentel, D., B. Berger, D. Filiberto, M. Newton, B. Wolfe, E. Karabinakis, S. Clark, E. Poon, E. Abbett, and S. Nandagopal. 2004. Water resources: agricultural and environmental issues. BioScience 54:909–918.

Rabalais, N. N., R. E. Turner, Q. Dortch, D. Justic, V. J. Bierman, Jr., and W. J. Wiseman, Jr. 2002. Nutrient-enhanced productivity in the northern Gulf of Mexico: past, present, and future. Hydrobiologia 475/476:39–63.

Renner, R. W., R. E. Reynolds, and B. D. J. Batt. 1995. The impact of haying Conservation Reserve Program lands on productivity of ducks nesting in the Prairie Pothole Region of North and South Dakota. Transactions of the North American Wildlife and Natural Resources Conference 60:221–229.

Reynolds, R. E., T. L. Shaffer, R. W. Renner, W. E. Newton, and B. D. Batt. 2001. Impact of the Conservation Reserve Program on duck recruitment in the U.S. Prairie Pothole Region. Journal of Wildlife Management 65:765–780.

Richards, R. P., and G. L. Grabow. 2003. Detecting reductions in sediment loads associated with Ohio's Conservation Reserve Enhancement Program. Journal of the American Water Resources Association 39:1261–1268.

Ronaldson, J. 2003. North Dakota 2003 CREP annual report. North Dakota Fish and Game Department, Bismarck, USA.

Santelmann, M. V., D. White, K. Freemark, J. I. Nassauer, J. M. Eilers, K. B. Vache, B. J. Danielson, R. C. Corry, M. E. Clark, S. Polasky, R. M. Cruse, J. Sifneos, H. Rustigian, C. Coiner, J. Wu, and D. Debinski. 2004. Assessing alternative futures for agriculture in Iowa, U.S.A. Landscape Ecology 19:357–354.

Smith M. E. 2000. Conservation Reserve Enhancement Program: early results from a federal–state partnership. U.S. Department of Agriculture, Economic Research Service, Agricultural Outlook (December 2000):16–19.

State of New York. 2004. Conservation Reserve Enhancement Program for the New York City water supply watersheds. federal fiscal year 2004 annual report.

State of North Carolina. 2004a. North Carolina Conservation Reserve Enhancement Program annual report, FY2002–FY2003.

State of North Carolina. 2004b. North Carolina Conservation Reserve Enhancement Program annual report, FY2004.

Sullivan, P., D. Hellerstein, L. Hansen, R. Johansson, S. Koenig, R. Lubowski, W. McBride, D. McGranahan, M. Roberts, S. Vogel, and S. Bucholtz. 2004. The Conservation Reserve Program: Economic implications for rural America. Agricultural Economic Report 834. U.S. Department of Agriculture, Economic Research Service, Washington, D.C., USA.

Trenbath, B. R., G. R. Conway, and I. A. Craig. 1990. Threats to sustainability in intensified agricultural systems: Analysis and implications for management. Pages 337–365 in S. R. Gliessman, editor. Agroecology: researching the ecological basis for sustainable agriculture. Springer-Verlag, New York.

[USDA] U.S. Department of Agriculture. 2004. The Conservation Reserve Program: 29th signup statistics summary. U.S. Department of Agriculture, Farm Service Agency, Washington, D.C., USA.

Wanhong, Y., M. Khanna, R. Farnsworth, and H. Önal. 2005. Is geographical targeting cost-effective? The case of the Conservation Reserve Enhancement Program in Illinois. Review of Agricultural Economics 27:70–88.

Wentworth, K., and M. C. Brittingham. 2003. Effects of local and landscape features on avian use and productivity in Conservation Reserve Enhancement Program fields. Pennsylvania Game Commission CREP progress report (July 2001–May 2003). Cooperative agreement ME231002. Pennsylvania State University, University Park, USA.

West Virginia Conservation Agency. 2003. CREP performance report, fiscal year October 1, 2002–September 30, 2003.

Whitworth, M. R., and D. C. Martin. 1990. Instream benefits of CRP filter strips. Transactions of the North American Wildlife and Natural Resources Conference 55:40–45.

Wisconsin Department of Agriculture, Trade and Consumer Protection. 2004. 2003 annual report: Wisconsin's Conservation Reserve Enhancement Program (CREP).

Wisconsin Department of Agriculture, Trade and Consumer Protection. 2005. 2004 annual report: Wisconsin's Conservation Reserve Enhancement Program (CREP).

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.