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The Conservation Reserve Program–Planting for the Future:

Proceedings of a National Conference, Fort Collins, Colorado, June 6–9, 2004

Scientific Investigations Report 2005–5145

U.S. Department of the Interior
U.S. Geological Survey

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By Arthur W. Allen and Mark W. Vandever, editors, U.S. Geological Survey

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U.S. Geological Survey
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Foreword

In June 2004 the U.S. Department of Agriculture's Farm Service Agency (FSA), with support from the U.S. Geological Survey (USGS), held a three-day symposium on the Conservation Reserve Program (CRP) in Fort Collins, Colorado. These proceedings contain papers by most of those who made presentations at the symposium, but some were unable to provide written papers. This shortcoming has been addressed in part by addition of papers presenting information on prairie grouse response to the CRP, long-term trends in Southern Plains CRP grassland vegetation, and discussion of FSA support of an investigation to regionally refine management of CRP grasslands to address ecological conditions in the short-grass prairie region.

Each person attending the conference was requested to fill out a questionnaire to obtain information about how the future of the CRP should be directed and major issues of concern about how the program has and could be managed. Appendix A provides results and discussion of the questionnaire. Appendix B presents information prepared by the FSA on historical and current distribution and enrollment in the CRP. A list of those who attended and participated in the conference is furnished in Appendix C.

Contrary to conventions in most USGS publications and current scientific literature, measures of area and length in this publication are generally presented in acres or miles rather than metric measures (e.g., hectares, kilometers). This approach was adopted because townships, sections, and acres define the United States landscape and are the units of measure upon which management of agricultural lands in this nation is based. Unless noted otherwise, the authors of the respective chapters provided all photographs and figures presented in this document. The findings, conclusions, and recommendations expressed in this document are those of the author(s) and do not necessarily represent those of the USGS.

Acknowledgments

Many share responsibility for the success of the June 2004 Conservation Reserve Program (CRP) conference. Appreciation is extended to the U.S. Department of Agriculture's (USDA) Farm Service Agency's (FSA) Economic and Policy Analysis staff, Larry Walker, Ed Rall, Tom Lederer, Alex Barbarika, and Skip Hyberg for their forward thinking in organization of the conference and publication of these proceedings. Special thanks are extended to Mary Tjeerdsma and her Resource Coordination staff with the Management Services Division and the FSA Office of External Affairs for assistance in initial coordination and making the conference a reality. We thank Steve Curry, U.S. Forest Service, Pawnee National Grasslands District Ranger, Arapaho and Roosevelt National Forests; Daniel Milchunas, Natural Resource Ecology Laboratory, Colorado State University; Jon Wicke, NRCS Weld County District Conservationist; and Tom Remington, Colorado Division of Wildlife for their assistance in putting together an informative field trip to the Pawnee National Grasslands and nearby CRP sites, adding significantly to the quality of the conference. We sincerely thank Tom Browning, USDA FSA (retired); Tom Lederer, Alex Barbarika, and Skip Hyberg, USDA FSA; Max Schnepf, Soil and Water Conservation Society; and James Roelle and James Terrell, USGS, for their thoughtful and meticulous review of earlier drafts of this document. While funding for publication was provided by the USDA Farm Service Agency, the document you hold would not have been possible without the skills and talents of Fort Collins Science Center Technical Services staff Jennifer Shoemaker, Dale Crawford, Dee Story, and Dora Medellin.

Contents

Welcome and Opening Remarks

By Tom Casadevall, Regional Director, U.S. Geological Survey, Central Region[1]

On behalf of the U.S. Geological Survey (USGS), I am very pleased to see this workshop come to fruition, and especially pleased that we are doing this in partnership with the Farm Service Agency (FSA) of the U.S. Department of Agriculture (USDA).

For those of you not familiar with the USGS, we are the science research agency within the Department of the Interior. Our mission is to provide reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life. The USGS has approximately 9,300 employees who work in all 50 states. Our scientific strength comes from our workforce which is made up of biologists, hydrologists, geologists, and geographers. We are managed at the regional level and in the USGS we have three regions. The Eastern Region is headquartered in Reston, Virginia and includes the states east of the Mississippi River. The Central Region includes the 15 states west of the Mississippi River up to the Continental Divide, and is headquartered in Denver, Colorado. The Western region includes the nine western states and is headquartered in Seattle, Washington.

The USGS has been working the past few years to better integrate its various programs and to do more multi-disciplinary science. We have many federally funded programs that do work related to agricultural issues: National Water Quality Assessment (NAWQA), Toxics, Contaminants, Ecosystems, Invasives, Fisheries and Aquatic Resources, Mineral Resources, Cooperative Water Program, and others. We are looking across these programs to identify products that can be delivered in ways more useful to USDA agencies and the agricultural community.

We are also actively looking for ways to collaborate with other agencies and universities on programs and locations that compliment each other. For instance, our NAWQA program has several Agricultural Chemical Transport (ACT) and Nutrient Enrichment Effects Team (NEET) studies that can be combined with work proposed under the USDA's Conservation Effects Assessment Program (CEAP). Historically, our Geography Discipline has supported the development of detailed Hydrologic Unit Codes (HUCs) and spatial geographic information for the Natural Resources Conservation Service (NRCS). We would like to find other such opportunities to work more closely with USDA.

Providing scientific information about the environmental effects of agriculture is a priority for the USGS, and we are working to improve our delivery of scientific data, expertise, and capabilities to the agricultural community. There are 34 million acres (14 million ha) in the Conservation Reserve Program (CRP) nationwide, of which 72% are in USGS Central Region. The expiration of over 16 million acres (6.5 million ha) of CRP contracts in 2007 and over 6 million acres (2.4 million ha) in 2008 is fast approaching. This conference is being held to provide science-based CRP analysis to inform producers, legislators, budget overseers, and other decision makers on how best to manage CRP, minimize taxpayer costs, and maximize agricultural and environmental benefits. The overall goal for this conference is to provide a scientific forum to exchange ideas, discuss issues, and help define the future of CRP. We have been very

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pleased with our collaborations with FSA on the CRP program. We consider this program a model to follow in developing future agricultural collaborations with the National Resources Conservation Service; Cooperative State Research, Education, and Extension Service; Agricultural Research Service; the U.S. Environmental Protection Agency (EPA); and others. There are numerous opportunities and needs for agencies to collaborate in answering questions being asked by legislators and the public nationwide about what conservation measures have done to improve the quality of our agriculturally influenced watersheds and habitats.

Environmental scientists, land managers, and agricultural policy advisors are increasingly confronted with situations requiring scientifically based assessments of the specific effects of agricultural practices on the environment. New administrative and conservation programs, arising out of provisions within the 2002 Farm Bill, combined with recent technological advances, including new cropping practices, chemical identification methodologies, and genetically modified crops, to land-use change, and increased water demands have posed fundamental questions and increased uncertainty concerning the effects of agricultural practices on the environment.

Conference Overview and Objectives

By James R. Little, Administrator, Farm Service Agency, U.S. Department of Agriculture[1]

Good morning! On behalf of the Farm Service Agency (FSA) and the Secretary of Agriculture, welcome to this very significant conference. We are all here—just as the title says—to help plant the future of one of our country's most successful environmental programs ever—the Conservation Reserve Program (CRP).

I would like to start by thanking Tom Casadevall and his staff at the U.S. Geological Survey (USGS) for their support and teamwork in planning this joint FSA/USGS conference. I would also like to thank Chief Bruce Knight and the Natural Resources Conservation Service (NRCS) staff, as well, for their support. The USGS and NRCS' collaborative work on the CRP has helped FSA harness the power of science to make the CRP a more effective program.

This conference could not have happened at a better time. New Farm Bill discussions are right around the corner. And in just 3 years 16 million acres (6.5 million ha) of CRP will expire. Another 6 million acres (2.4 million ha) will follow in 2008. All told, that is 56%, well over half, of the land authorized for CRP enrollment.

These upcoming benchmark years and the ever-growing scrutiny from legislators, stakeholders, and critics require us to evaluate and address critical issues regarding the program. For example:

1. How do we quantify CRP benefits and costs?
2. How do we allocate acres in future signups, while considering the program's varied objectives and regional differences?
3. How do we meet the conflicting demands of a diverse group of stakeholders?
4. And in today's environment, how do we factor in our conservation goals and still ensure a safe and viable food supply?

Some may wonder if the program has outlived its usefulness, despite its huge success and popularity. But we are not here to debate policy issues. We are here to meet with the top experts in the country—to better understand in scientific and technical terms what we know and what we need to know to improve the program.

The best way to be prepared for CRP's unknowns is to arm ourselves with knowledge. To properly move forward with CRP—especially at such a critical time—FSA needs a solid foundation of science-based research and analysis. When we have accomplished this, we can better inform legislators, budget overseers, and other decision makers on how to proceed.

But before we talk about where we need to go with CRP, let us take a quick look at where we stand right now.

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The CRP's role in improving wildlife habitat and protecting America's natural resources is widely recognized. The program is USDA's largest conservation initiative on private lands, with 34.6 million acres (14 million ha) enrolled and a $2 billion annual budget.

Much of the program's success is attributable to partnerships between USDA, other federal and state agencies, and private groups. But our performance really hinges on the remarkable commitment to the environment shared by America's farmers and ranchers. Their natural conservation ethic has laid a strong groundwork for maintaining and improving our natural resources.

Considering the size and complexity of CRP and the number of people involved—in a country that holds private land ownership in the highest regard—the CRP is benefiting America on a national scale. The program:

- has played a major role in reducing soil erosion by more than 40% since 1982;
- has restored more than 1.9 million acres (0.8 million ha) of wetlands and wetland buffers, and with other USDA conservation programs accounts for a net gain of about 26,000 wetland acres (10,522 ha) between 1997 and 2002. The programs have offset losses from converting wetlands to other land uses;
- has installed more than 1.5 million acres (0.6 million ha) of riparian buffers and grass filters;
- has improved habitat that has increased populations of pheasants, ducks, many grassland birds including the sharp-tailed grouse and a multitude of other wildlife species;
- shows that more than 2.5 million new ducks are attributable to the CRP per year; and
- is the largest carbon sequestration program.

While these statistics are significant, what do they mean to the average person? The average taxpayer? The Chair of the Appropriations Committee? The Office of Management and Budget? How do we communicate the benefits of conservation in a meaningful way?

Under President Bush's Management Initiative, unless you can measure your accomplishments against your stated goals, your programs are not going to be funded.

If we expect the CRP to continue as a funded mandate, we need to be able to measure and communicate CRP goals and accomplishments to the public and to Congress, well beyond the bounds of the agricultural and environmental communities.

The FSA has already taken major strides in this area by initiating research to quantify CRP accomplishments and improve the program's accountability. Many of you are familiar with some of this research, as you are some of its contributors.

The studies will offer insight on the changes that occur when conservation covers are established on cropland. From there, we can report our progress more effectively.

For instance, rather than simply reporting the number of restored wetland acres, we want to be able to talk about:

  - how much pollution these wetlands are keeping from our streams, rivers, and lakes;
  - how much erosion was prevented;
  - how much carbon was sequestered; and
  - how much restored wetlands have reduced flood levels.

- Along with noting the number of established wildlife acres, we want to document the increases in wildlife populations—similar to my previous remark that we have increased the number of new ducks by 2.5 million per year.

- Rather than just saying how many acres of riparian buffers and grass filters have been installed, we want to show how much nitrogen, phosphorus, and sediment the buffers and grass intercept before reaching our surface waters.

- We also want to talk about the effects different grassland management activities have on vegetative vigor and wildlife populations. A great example is the effect haying and grazing have on CRP lands.

In a nutshell, we need to apply the best science available to make the most informed program decisions. So if certain aspects of CRP are not performing as well as we would like, we can then determine where we need to fine-tune the program. While I believe we need to ensure the CRP remains sustainable, the means of education must be sustainable as well. Many of us have witnessed new wildlife and vegetation—that helps bear out the results of our strategies, but communicating these results is often difficult.

I would like to share a story that illustrates this point. I grew up in Old Town Alexandria, right outside of Washington. When you fly into Ronald Reagan Airport, you can actually see my parents' home. When I was growing up, the Potomac River had a horrible reputation of being polluted.

Thirty/forty/fifty years ago, swimming in the Potomac was forbidden—and you would dare not eat any fish you might have caught. But over the years, with good stewardship, the health of the Potomac has improved. As an avid runner, I take an early morning run along the Potomac River before I report to my South Building office. And over the past four years, I have witnessed a flock of blue heron establish itself right at the base of the Jefferson Memorial in the Tidal Basin. Along side these blue heron you can even find beaver, literally within the shadow of the Washington Monument.

The Potomac River is a true environmental success story evident throughout the Potomac River and the Chesapeake Bay watersheds. And these both, in my opinion, can be considered some of the most significant CRP success stories in the Atlantic region. But we need to be able to quantify what these improvements are.

Better science will lead to better reporting of CRP accomplishments in quantitative terms that have real-world meaning. For example, lake and seaside charter boat crews who know cleaner water means more fish, they know more fish mean more happy customers, which translates clearly into positive economic benefits—all attributable to the CRP.

With better data, we can better defend the program's societal worth to those who control the purse strings and defend it against our critics as well. As budget pressures increase, we can forever expect even more competition for limited discretionary funds. Agencies that cannot relay their story and justify their budget requests will be less likely to receive full, or any, funding in the future.

We know that both budget constraints and commodity availability will always play a role in conservation programs. That is a given. And we need to understand the ramifications of these givens and what these trade-offs mean to the process of developing policy. I would argue, however, that the more we understand in quantitative terms about the impacts of the CRP, the better we can focus limited funds and limited acres to get the most benefit out of the program.

The FSA is aggressively moving ahead to identify goals with measurable outcomes. In terms of CRP, this means achieving the maximum agricultural and environmental benefits at a minimal cost to the taxpayer.

John Marburger, the President's science advisor, has said, and I quote: "Agriculture is not only the first industry, it is—in a sense—the first science as well." We need to bear this philosophy out, by developing a rigorous scientific basis for future CRP policy and program discussions.

That is why we are having this conference. We need your feedback—the top CRP experts. The tasks at hand include:

- reviewing ongoing and planned research,
- identifying lessons learned, and
- determining future research needs.

Many items on the agenda may raise questions or issues. They may also raise eyebrows. I encourage you to voice your opinions freely, but constructively. As I said before, this is not a debate, and I am confident that this stellar group can use its collective brainpower to make CRP a model of conservation success. With the insights gained and intelligently applied to the process of developing policy, the potentially divisive issues will become less divisive, and program decisions will become more informed. The challenge is to make good public policy even better with a clearer understanding of how to manage the program in the public interest.

Conclusion

The CRP affects far more people than those on the farms and ranches where it is implemented. Every United States citizen is a stakeholder in our natural resources. The CRP helps save many of the environmental characteristics that define a community's character, culture, and very way of life.

If this conference can contribute usefully to this vision, then it can be regarded as a great success!

Thank you again for coming! And thank you in advance for your contributions and for making this conference a success!

Session I. Large Accomplishments and Great Expectations

The Role of Science in Guiding the Conservation Reserve Program

Moderator: Skip Hyberg[1]

Science is a process of developing hypotheses, testing these hypotheses, and reporting results. Experiments are repeated and conclusions are challenged. It is a relentless ferreting out of facts. In the end, a hypothesis survives only when it is supported by strong evidence provided by multiple sources generating similar conclusions.

In an applied science such as agriculture, this process roots out production methods that increase yields, lower costs, and protect natural resources. With production agriculture, progress has been easy to demonstrate. Research has led to a better understanding of genetic properties, pathogens, insect predators, and overall plant growth leading to increased crop production. Between 1935 and 2004, wheat yields increased over 250% and corn yields increased over 560%. Other major crops have also seen substantially increased yields. These increased yields measure agricultures progress in feeding America and the world.

The progress of conservation is harder to measure. Since 1935 and the establishment of the U.S. Department of Agriculture's (USDA's) Soil Conservation Service, conservation practices have been planned and installed on millions of acres of agricultural land. These conservation practices protect soils, keep sediment and nutrients from waterways, provide wildlife habitats, sequester carbon, and provide other beneficial services. Most practices provide more than one of these services; however, we do not have an agreed upon measure such as yield to assess the progress of conservation efforts. Because conservation programs rely on conservation practices, these programs have lacked the means to communicate accomplishments.

The USDA is actively developing measures to set conservation goals and assess whether the programs are meeting these goals. Science provides us with the tools to develop these measures and assure that these measures provide a meaningful assessment of environmental progress. The panel that follows is going to lay out some ways that science is helping to provide such measures.

I will start by giving a brief history of the Conservation Reserve Program (CRP), discussing how science has influenced the program, and providing an overview of the Farm Service Agency's (FSA's) plan to measure conservation accomplishments. Following my presentation, Dr. Chip Euliss from the U.S. Geological Survey's Northern Prairie Wildlife Research Center is going to talk about a research effort to measure wetland functions obtained from restoring wetlands on previously cropped land. This collaborative project involves the Departments of Agriculture, Energy, and Interior. Dr. Terry Bidwell from Oklahoma State University will provide a discussion of grassland ecosystems. He will discuss why grassland systems require management, how grassland systems differ from one another, and how these ecosystems respond to different management treatments. Finally, Dr. Bob Kellogg will speak about how FSA's CRP research effort relates to the Conservation Evaluation and Assessment Project (CEAP), USDA's broader effort to assess conservation effects.

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The Role of Science in Guiding the Conservation Reserve Program: Past and Future

By Skip Hyberg[1]

It is an honor to be speaking to you today. To be part of a group of people looking forward 3 years, examining America's premier conservation program. Seeking to improve our most successful conservation program is an enriching experience.

I have three things to accomplish with this presentation. First, I want to touch upon where the Conservation Reserve Program (CRP) started, where we are now, and how sound science has had a role in the changes that have taken place. Next is a discussion of the need for measurement of conservation benefits from the CRP and accountability in U.S. Department of Agriculture (USDA) conservation programs and the need for research to identify these benefits and provide accountability. Finally I will furnish a brief review of the Farm Service Agency's (FSA) applied research program, and introduce the other panelists who are providing important pieces of this research.

It is important to examine the economic and policy environment that led to the establishment of the Conservation Reserve Program. In December 1985, when the Food Security Act established the CRP, the farm sector was under stress. Large and growing stocks were pushing crop prices lower, high farm debt weighed on producers, and high budget deficits were forecast for the foreseeable future. In addition, there was a growing body of research demonstrating that farm programs were creating a strong incentive for landowners to bring fragile, erosive lands into crop production in order to qualify for additional commodity payments (Ogg, 1983; Reichelderfer, 1985). This work showed highly erosive lands were contributing inordinately to soil erosion and reducing future cropland productivity. Additional research was emerging indicating soil erosion generated high damages to navigation, water storage, irrigation facilities, and overall water quality (Clark and others, 1985; Ribaudo, 1986).

When the first CRP signup took place in 1986, the CRP was a land retirement program that targeted highly erodible cropland and accepted all enrollment offers below an acceptable rental rate. Program accomplishments were simply reported by whether enrollment met its statutory acreage target. By establishing conservation cover on highly erodible cropland, the CRP was targeted to reduce erosion. It should be noted the first signup took place only 3 months after the program was authorized.

As a conservation program set to enroll 40 to 45 million acres (16 to 18 million ha) of cropland, agronomists, biologists, hydrologists, and other scientists rigorously studied effects of the CRP. Over ensuing years, a body of research emerged demonstrating the CRP was accomplishing more than reducing soil erosion. Research demonstrated how CRP could improve water quality by intercepting sediment and nutrients before they reached waterways. U.S. Geological Survey (USGS) and Fish and Wildlife Service wildlife biologists documented the grass cover established was providing excellent breeding and brooding habitat for upland-nesting ducks, grassland songbirds, and other avian species (Reynolds, 1992; Johnson and Schwartz, 1993; Allen, 1994; Reynolds and others, 1994, 1996; Igl and Johnson, 1995, 1999; Johnson and Igl, 1995). Researchers from the Agricultural Research Service (ARS), Natural Resources Conservation Service (NRCS), and universities documented benefits of CRP for storing atmospheric carbon in soil (Lal and others, 1998). Research by the USGS demonstrated that managed disturbance of CRP grasslands could increase the diversity and vigor of the vegetation, enhancing its quality for wildlife while offering economic opportunities for landowners (Allen and others, 2001). This sound and objective research provided support for continuation and refinement of the CRP.

In addition, each of these studies helped improve the CRP by identifying opportunities to better target enrollment. The CRP has evolved from a program solely targeting soil erosion to one focusing on multiple conservation benefits that include maintaining soil productivity, improving water quality, and enhancing quality and distribution of wildlife habitats. Rather than selecting land solely based on eligibility and cost, an Environmental Benefits Index (EBI) was adopted to further target and refine benefits from the CRP.

Research also identified conservation practices such as riparian buffers, grass filter strips, and wetland restoration as having potential to yield large water quality and wildlife benefits. These research findings, in association with higher crop prices, and an interest in further targeting CRP led to the development of the Continuous CRP (CCRP), where landowners can enroll partial fields of high environmental value into the CRP without waiting for a general signup. To participate in the CCRP, landowners agree to install one of a set of designated conservation practices on eligible land.

Some of the researchers who conducted this work are here at the conference, and I would like to encourage you to speak with them and the exhibitors here. They and many

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others have made a significant difference by documenting and quantifying environmental change, bringing this information to the public, and helping Congress and the USDA to make more informed decisions. This is to me science at its best: meaningful, unbiased, and timely.

Accountability

Government resources are finite. Consequently, programs need to demonstrate they are effective and efficient if they are to continue to receive Congressional, Departmental, and Office of Management and Budget (OMB) support. Establishment of clear goals and a strong program accountability system that measures progress towards these goals can demonstrate program effectiveness. An essential component of any accountability system is the use of quantifiable measures that communicate to a non-technical but involved audience.

While science has provided information used to better target the CRP and enhance environmental quality, the FSA has not always taken full advantage of science to communicate these benefits. For much of its existence, CRP progress and accomplishments have been reported in terms of acres enrolled, acres of practices established, and reduced tons of erosion. In 2000, the FSA was still describing CRP benefits in terms of number of acres enrolled (table 1). While some information is provided by stating CRP has restored 1.9 million acres (0.8 million ha) of wetlands and 1.6 million acres (0.6 million ha) of buffers, acres enrolled does not fully communicate conservation benefits realized nor the information necessary to determine whether the practice is appropriate for obtaining desired conservation goals.

Conservation programs have a large set of objectives, use a number of practices, and provide a wide range of benefits. Installing a riparian buffer or restoring a wetland provides multiple benefits, including reduced erosion, interception or filtering of nutrient runoff, enhanced wildlife habitat, and carbon sequestration. Monitoring consequences of these and other conservation practices provides measures of effectiveness and efficiency necessary for successful administration and implementation of conservation programs. Conservation effects need to be quantified to measure progress towards conservation objectives and to provide a means to identify tradeoffs between conservation alternatives. This information is necessary for decision makers in USDA, Congress, and elsewhere to understand tradeoffs between alternatives, determine appropriate program authorization levels, and communicate conservation accomplishments. When budgetary constraints grow ever tighter, well-defined goals and documentation of accomplishments become even more important.

In 2003, USDA undertook a research program to identify, quantify, and communicate measures for conservation accomplishments. In a few minutes Bob Kellogg will present an overview of the long range USDA plan to assess conservation program accomplishments. Here I would like to highlight a few efforts FSA is undertaking in coordination with NRCS and our research partners to identify and estimate CRP conservation benefits.

The first step was to identify conservation measures we could produce immediately which communicate progress over time but do not require technical expertise to interpret (table 2). These measures better communicate conservation progress, but frankly are still not adequate because they do not clearly communicate how water quality has been improved, or wildlife habitats or populations have been enhanced. To address these questions we need more information. While we can do a good job on documenting changes in erosion, we cannot yet estimate the change in nutrients leaving a field. While we now have an estimate of the amount of carbon dioxide sequestered, we still are discussing wetlands, wildlife habitat, and buffers by the number of acres enrolled rather than what these practices actually accomplish.

The second step was to develop a set of measures that could begin to succinctly communicate conservation outcomes to an interested non-technical audience. We restricted our attention to those we could provide in the near future with additional information (table 3). These measures are being incorporated into the FSA performance measurement system and will be used to evaluate FSA accomplishments. A question for you the audience is do these measures communicate progress over time towards maintaining soil productivity, improving air and water quality, and enhancing wildlife populations? We want to hear from you.

The next step is to develop information that will let FSA fill in table 3. To get this information and make sure we ask the right questions we turn again to science. The USDA has entered into a number of cooperative agreements to examine effects of conservation on nutrient and sediment movements, wetland functions, wildlife populations, and grassland health. Each of these projects will allow FSA and USDA to better communicate our goals and document our progress towards achieving these goals.

Improved Water Quality

The FSA and the Office of Risk Analysis and Cost Benefits Analysis (ORACBA) are working with Verel Benson at the Food and Agricultural Policy Research Institute (FAPRI) to quantify nitrogen, phosphorus, and sediment runoff reductions when cropland enters the CRP. Because nitrogen, phosphorus, and sediment are the primary agricultural agents contributing to water degradation, reduced nutrient and sediment runoff is an important measure of CRP effectiveness. The results of this study will provide a more direct estimate of CRP's effect on water quality. FAPRI is also estimating the effectiveness of CRP riparian buffers and grass filter strips for intercepting nutrients and sediment.

Table 1. Fiscal Year 2000 Conservation Reserve Program performance.

Reduce soil erosion, protect water and air quality, restore wetlands, and improve wildlife habitat by establishing conservation cover and/or installing priority practices on enrolled Conservation Reserve Program acreage.

Regular (competitive enrollment) acres

- Target: 30.9 million
- Actual: 30.3 million

Continuous [including Conservation Reserve Enhancement Program (CREP)] enrollment acres

- Target: 1.4 million
- Actual: 1.2 million

States with approved CREP agreements

- Target: 15
- Actual: 12

Acres of high environmental sensitivity enrolled in CREP

- Target: .25 million
- Actual: .12 million

Acres established in conservation buffers (including filter strips and riparian buffers)

- Target: 1.4 million
- Actual: 1.2 million

Acres of highly erodible land (HEL) retired

- Target: 24.0 million
- Actual: 23.7 million

Acres of HEL that would erode above "T"[1] when farmed with conservation plan (Environmental Index 15)

- Target: 10.7 million
- Actual: 10.4 million

Acres enrolled in the Prairie Pothole, Chesapeake Bay, Great Lakes, and Long Island Sound national conservation priority areas

- Target: 7.2 million
- Actual: 7.2 million

Acres in trees or other non-crop vegetative or water cover that provides permanent wildlife habitat

- Target: 4.6 million
- Actual: 5.3 million

Acres planted with vegetative covers determined best suited for wildlife

- Target: 17.1 million
- Actual: 16.7 million

Restored acres of wetlands

- Target: 1.6 million
- Actual: 1.5 million

Acres planted with trees

- Target: 2.0 million
- Actual: 2.1 million

Established acres of restored rare and declining wildlife habitat

- Target: 274,000
- Actual: 249,000

[1] "T" (tolerance rate) is the maximum rate of erosion that can occur without significant damage to the productive capacity of the soil.

Table 2. Fiscal Year 2003 performance goals and indicators.

	Conservation Reserve Program					
Performance goals and indicators	**FY 1999 actual**	**FY 2000 actual**	**FY 2001 actual**	**FY 2002 actual**	**FY 2003 target**	**FY 2003 actual[1]**
Increase the number of acres enrolled in CRP and expand CREP						
Number of acres enrolled in CRP (million acres, cumulative)	29.8	31.4	33.6	33.9	34.3	34.1
General signup (competitive) enrollment (million acres, cumulative)	28.9	30.2	32	31.8	31.7	31.6
Continuous (including CREP) enrollment (million acres, cumulative)	0.09	1.2	1.6	2.1	2.7	2.7
CREP enrollment (million acres, cumulative)	0.03	0.08	0.19	0.36	0.5	0.5
Tree plantings (million acres, cumulative)	2.2	2.5	2.9	3.1	3.2	3.2
Acres enrolled in the Prairie Pothole, Chesapeake Bay, Great Lakes, Long Island Sound, and Long Leaf Pine national conservation priority areas (million acres, cumulative)	6.9	7.2	7.8	8.0	8.2	8.1
Approved CREP agreements (#)	8	12	18	24	30	26
Reduce soil erosion, protect water and air quality, restore wetlands, and improve wildlife habitat by establishing conservation cover and/or installing priority practices.						
Soil Erosion						
Reduced soil erosion (million tons/year)	N/A	407	428	447	449	446
Water and Air Quality						
Reduced sheet and rill erosion (million tons/year)	N/A	166	178	215	216	214
Reduced wind erosion, also a measure of air quality (million tons/year)	N/A	241	250	232	233	232
Reduced nitrogen applications on land under long-term land retirement contract (thousand acres)	553	605	634	681	691	655
Reduced phosphorus applications on land under long-term land retirement contract (thousand acres)	80	87	97	104	106	103
Acres established in conservation buffers including filter strips and riparian buffers[2] (million acres, cumulative)	1.2	1.3	1.7	2.1	2.4	2.4
Carbon sequestered in soil and vegetation through long-term retirement of crop and grazing land (million metric tons/year)	14.5	15.2	16.1	16.3	16.8	17
Wetlands						
Restored wetlands[3] (million acres, cumulative)	1.3	1.5	1.7	1.7	1.9	1.9
Wildlife Habitat (million acres, cumulative)						
Acres planted with vegetative covers defined as best suited for wildlife	12.4	16.6	18.2	18.1	18.1	18.1
Land restored to ecosystems with high benefits for wildlife[4]	1.3	2.1	2.6	3.3	3.5	3.5

[1]Year-end estimates based on preliminary data. Final FY 2003 data available in December.

[2]Most buffers installed under the CRP are installed primarily for water quality; however, buffers provide multiple benefits, including air quality, wildlife habitat, and carbon sequestration.

[3]Primarily wetland restoration, which includes adjacent upland.

[4]Primary conservation practices include, but are not limited to, wetland restoration, wildlife corridors, riparian buffers, longleaf pine establishment, and rare and declining habitats.

Table 3. Proposed environmental outcome measures.

Measure	Quantify change	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Additional measures and comments
Reduced erosion	Tons/year	428	449	446			
Sheet and rill erosion	Tons/year	178	216	214			
Wind erosion	Tons/year	250	233	232			
Water quality							
Reduced nitrogen							
Runoff	Tons/year						
Leaching	Tons/year						
Reduced phosphorus							
Runoff							
Leaching							
Wildlife habitat enhancements							
Enhanced wildlife population: ducks	Millions or percent						See Reynolds (1992)
Enhanced wildlife population: pheasant	Millions or percent						
Enhanced wildlife population-bobwhite	Millions or percent						
Enhanced wildlife population-other	Millions or percent						
Wetland functions							
Hydrologic storage	Acre feet						
Carbon dixoide sequestered	Million tons/year	44.3	44.6	45.4			
Other							

Wetland Functions

The USGS Northern Prairie Wildlife Research Center, NRCS, and the FSA are working to identify critical wetland functions and estimate changes in these functions when prairie pothole wetlands are restored on previously cropped land. The project will focus on the impacts of conservation practices that establish introduced and native grasses, and restore Prairie Pothole Region wetlands. Dr. Ned Euliss will be discussing the wetland research that will enable USDA to set wetland restoration goals and communicate progress toward restoring multiple wetland functions. The project will:

- estimate acres of farmable wetlands enrolled;
- estimate potential reduction in movement of sediments and nutrients entering the wetlands;
- apply soil loss models to estimate reduced soil erosion within catchment basins;
- estimate carbon sequestered;
- estimate increased water storage volumes;
- based on existing research, summarize the potential to offset greenhouse gas emissions (e.g., methane and nitrous oxide); and
- estimate wildlife enhancements.

Grassland Management Systems

The Farm Security and Rural Investment Act of 2002 authorizes the Secretary of Agriculture to permit managed haying and grazing on CRP grasslands. The Act directs the Secretary to develop appropriate vegetative management requirements. To help define these requirements, Dr. Terry Bidwell from Oklahoma State University will be working to identify regionally appropriate conservation management systems for CRP grasslands. The grassland management systems will help the FSA and CRP participants identify appropriate practices leading to more vigorous and diverse grassland stands, increased forage for livestock, reduced invasive species, and increased environmental benefits (e.g., enhanced wildlife habitat and improved water quality and soil productivity).

Wetland Filters Restoration

Tile drainage systems are a primary source of nutrient runoff into streams and rivers. Excess nitrogen runoff in the Mississippi River Basin has been specifically blamed for causing hypoxia, an oxygen deprived 'dead zone', in the Gulf of Mexico. Scientists believe that restored filters can help filter excess nitrogen from tile drainage systems. Iowa State University researchers have determined that nitrogen delivered to streams via tile drains can be reduced 50% or more by wetland restoration. Bill Crumpton will be discussing his project in a later session to identify suitable areas in the Upper Mississippi River Basin for filtering tile drainage systems with restored wetlands and the potential for total nitrate reduction (in mass and percent) that could be achieved.

Wildlife Benefits

The NRCS, Cooperative State Research Education and Extension Service (CSREES), and the FSA are working together to develop a national wildlife conservation reporting framework. This work is taking place within the larger USDA Conservation Evaluation and Assessment Program (CEAP) process described by Robert Kellogg. In fact, immediately after returning from tomorrow's field trip wildlife biologists from around the country will be meeting to continue and expand this effort. The CRP has an immediate need for wildlife performance measures that will not be met by the multi-year timeframe of the broader CEAP project. For this reason, the FSA is conducting research compatible to the CEAP effort to develop models using existing national or regional data to estimate CRP wildlife benefits. This research will move the interagency efforts forward by developing data and a framework for measuring broader wildlife benefits. A request for applications is being issued by the FSA. Successful proposals will provide a plan for using Natural Resource Inventory (NRI), CRP contract data, and other data bases (including the Breeding Bird Survey, State game records, Fish and Wildlife Service waterfowl data, USGS grassland bird research records, etc.) to develop estimates of CRP effectiveness in increasing wildlife populations.

Conclusion

The CRP is a program that has benefited from careful scientific examination and analysis. These analyses helped identify high value conservation systems and better target CRP. As this information developed, the program evolved to increase conservation benefits. Research will continue to influence CRP by identifying conservation systems that effectively and efficiently generate environmental benefits and by quantifying and communicating the consequences of these benefits.

References Cited

Allen, A.W., 1994, Regional and state perspectives on Conservation Reserve Program contributions to wildlife habitat, report prepared for the Habitat Protection Committee of the International Association of Fish and Wildlife Agencies, Fort Collins, Colorado, Midcontinent Ecological Science Center: National Biological Survey: Federal Aid in Wildlife Restoration Report, 28 p.

Allen, A.W., Cade, B. S., and Vandever, M.W., 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, v. 56, no. 2, p.120–125.

Clark, E.H., Haverkamp, J.A., and Chapman, W., 1985, Eroding soils: The off-farm impacts: The Conservation Foundation, Washington, D.C., 252 p.

Igl, L.D., and Johnson, D.H., 1995, Dramatic increase of Le Conte's sparrow in Conservation Reserve Program fields in the northern Great Plains: Prairie Naturalist, v. 27, no. 2, p. 89–94.

Igl, L.D., and Johnson, D.H., 1999, Le Conte's sparrows breeding in Conservation Reserve Program fields: precipitation and patterns of population change: Studies in Avian Biology, v. 19, p. 178–186.

Johnson, D.H., and Schwartz, M.D., 1993, The Conservation Reserve Program: Habitat for grasslands birds: Great Plains Research, v. 3, no. 2, p. 273–295.

Johnson, D.H., and Igl, L.D., 1995, Contributions of the Conservation Reserve Program to populations of breeding birds in North Dakota: Wilson Bulletin, v. 107, no. 2, p. 709–718.

Lal, R., Kimble, J.M., Follett, R.F., Cole, C.V., 1998, The potential of U.S. cropland to sequester carbon and mitigate the greenhouse effect: Ann Arbor Press, Chelsea, Michigan, 128 p.

Ogg, C., 1983, Cross-compliance proposals and fragile croplands, presented at American Agricultural Economics Association Annual Meeting, West Lafayette, Indiana.

Reichelderfer, K., 1985, Do USDA farm program participants contribute to soil erosion?: Economic Research Service, U.S. Department of Agriculture, Agricultural Economic Report, no. 532, 74 p.

Reynolds, R.E., 1992, Evolution of the effect of CRP on duck recruitment in the Prairie Pothole Joint Venture Area of

FWS, Region 6, 1992 Progress Report: U.S. Department of Interior, Fish and Wildlife Service, Bismarck, North Dakota, 6 p.

Reynolds, R.E., Schaffer, T.L., Sauer, J.R. and Peterjohn, B.G., 1994, Conservation Reserve Program: Benefit for grassland birds in the northern plains: Transactions of the North American Wildlife and Natural Resources Conference, v. 59, p. 328–336.

Reynolds, R.E., Cohan, D.R., and Johnson, M.A., 1996, Using landscape information approaches to increase duck recruitment in the Prairie Pothole Region: Transactions of the North American Wildlife and Natural Resources Conference, v. 60, p. 86–93.

Ribaudo, M.O., 1986. Reducing soil erosion: Offsite benefits: Economic Research Service, U.S. Department of Agriculture, Agricultural Economic Report, no. 606, 30 p.

Quantifying the Environmental Benefits of the Conservation Reserve Program on Prairie Wetlands: Separating Acts of Nature from Acts of Congress

By Ned H. Euliss, Jr.[1], and M.K. Laubhan[1]

Introduction

The global diversity of ecosystems is the result of complex interactions between and among physical, chemical, and biological factors at specific locations. Physical and chemical characteristics are largely determined by events, such as structural (e.g., volcanoes), weathering (e.g., Karst topography), and depositional or erosional (e.g., glacial deposition) processes, that occurred at the landscape level. Landscape formation processes also determine topography, type of parent material available for soil genesis, and the basic hydrologic framework. Although components (e.g., aquatic, terrestrial) of a single ecosystem often are subdivided for evaluation and management, all components were derived from formation events that occurred at a landscape scale. Further, evolution of ecosystems involves the flow of energy and material between ecosystem components at multiple scales; thus, factors such as landscape position (e.g., elevation, slope, aspect), geomorphic processes (e.g., soils, hydrology, water quality), and climate (e.g., precipitation and temperature) continue to influence modern ecosystems. The influence of these abiotic factors on system function cannot be ignored because they are involved in complex feedback loops that define and constrain biotic communities composing an ecosystem and, ultimately, the types and extent of values (e.g., biodiversity, floodwater retention, and carbon sequestration) provided to landowners and society. Thus, evaluation and management of an entire ecosystem, or even a single ecosystem component, must be interpreted within the context of landscape-scale processes.

In systems devoid of human intervention or activity, such "acts of nature" are the only determinants of ecosystem functions and biological communities. However, humans represent a significant component of most systems in the conterminous United States, where anthropogenic activities have significantly altered relationships between the abiotic and biotic components of most ecosystems. In the Great Plains, for example, agriculture has resulted in replacement of native vegetation with crops, nutrient enrichment, soil erosion, and altered hydrology. Initially, such land-use changes occurred as the result of human ingenuity and desire. However, over time government has attempted to influence many of these activities through congressional acts (Fischman, 2003). Hence, we refer to such activities as "acts of Congress." Although modern ecosystems still function within historic constraints defined by specific acts of nature, anthropogenic disturbances resulting from acts of Congress have altered processes that influence biotic community composition, system function, and values provided to society. Therefore, determining the environmental benefits accrued as a result of conservation programs, such as the Conservation Reserve Program (CRP), requires acts of Congress be distinguished from acts of nature.

Widespread concern over global resources has stimulated considerable interest in conducting evaluations of land-use programs in terms of environmental health and the sustainability of modern ecosystems. However, these terms are vague and measuring success tends to be difficult because diverse stakeholders evaluate programs from very different perspectives. In some cases, definitions of success may be unrealistic because of expectations that an ecosystem can be returned to its original condition or managed to optimize a single function or value. Regardless, the response of the entire system to land-use change will result in a mix of positive and negative changes, and depending on stakeholder perspective, will result in success or failure of specific programs or land-use practices. Given the inherent ambiguity of these types of evaluations, we think a paradigm shift is needed to objectively evaluate land-use practices implemented through acts of Congress. Specifically, programs need to be evaluated from a perspective that considers interrelationships of ecosystems, and ecosystem components, in the modern landscape. Further, evaluations of success should be within the context of ecological fit, which we define here as how well specific acts of Congress are integrated with acts of nature. This definition is analogous to one proposed by Aldo Leopold, which states that "an understanding of ecology does not necessarily originate in courses bearing ecological labels; it is quite as likely to be labeled geography, botany, agronomy, history, or economics" (Leopold, 1949). Key to understanding rationale for the method of evaluation we propose is that many acts of nature at specific geographic locations cannot be changed (e.g., basic parent material, climate); hence, success will depend on how well acts of Congress are coordinated with acts of nature. Based on ecological fit, programs would be successful if they result in land-use changes that optimize specific functions, yield

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sustainable habitats, and do not produce unintended and negative impacts on other ecosystem functions valued by society. Again, this is similar to Leopold (1949), who stated "quit thinking about decent land-use as solely an economic problem. Examine each question in terms of what is ethically and esthetically right, as well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." Although evaluating programs within the context of ecological fit is clearly needed, conducting such evaluations will be daunting because ecosystems are complex and basic processes are interrelated. Thus, multiple aspects of an ecosystem must be evaluated simultaneously to obtain accurate assessments. Although evaluations based on ecological fit will not eliminate the perception of negative change from the perspective of individual stakeholder groups, such evaluations would provide an objective and scientific approach to evaluate programs in relation to stated objectives because functional changes attributable to specific land-uses could be quantified and predicted. Further, it would provide a means to develop new programs that optimize specific ecological functions, minimize unintended outcomes, and bring diverse stakeholder groups closer to consensus.

Applying the Concept of Ecological Fit

The concept of ecological fit requires information from multiple disciplines (e.g., geology, hydrology, biology, economics, agronomy) to be collected or obtained from existing sources to define the acts of nature and acts of Congress impacting the system of interest. Complete information may be lacking in many cases. Although this may hinder complete understanding, it does not preclude an evaluation based on the concept. Further, given that each ecosystem often exhibits unique characteristics, and the types and extents of human perturbations vary greatly, application of ecological fit likely will differ among ecosystems. Therefore, it is neither feasible nor advisable to provide a "cookbook" approach to evaluation of conservation programs. Rather, we provide an annotated example using the Prairie Pothole Region (PPR) to describe a general course of action that could be adapted for other geographic areas.

Formation and Historic Functions of the Prairie Pothole Region

The PPR of North America is approximately 347,490 mi^2 (900,000 km^2) (Phospahala and others, 1974; Mann 1986) and may have contained more than 49 million acres (20 million ha) of wetlands prior to European settlement (Tiner, 1984; Millar, 1989). The PPR was a unique area dominated by a background matrix of prairie interspersed with shallow depressions created by the scouring action of Pleistocene glaciation. Historically, a dynamic midcontinental climate influenced precipitation and temperature patterns, coupled with complex groundwater pathways that determined solute concentrations and transport mechanisms (i.e., import, export), functioned to create and maintain a diversity of wetland and prairie types. Further, a given ecosystem component could undergo significant changes among years. For example, the hydroperiods of a wetland can range from dry to extremely wet, salt concentrations can vary from fresh to nearly 10 times the salinity of the world's oceans (Euliss and others, 1999), and vegetation can fluctuate between facultative upland and obligate wetland species. Despite this harsh abiotic environment, the PPR was extremely productive and the biological communities inhabiting it were well suited to cope with these conditions. However, populations of terrestrial and aquatic biota exhibited dynamic shifts in relation to interannual climate variation. A conceptual model has been developed that simultaneously considers the influence of climate and hydrologic setting on undisturbed wetland biological communities (Euliss and others, 2004; fig. 1).

Agriculture as a Perturbation in the Prairie Pothole Region

The present climate of the PPR remains highly dynamic and characterized by extreme variation. Abundant rainfall can be followed by severe drought and annual temperatures can range from 104 °F to -40 °F (40°F to -40°C). Similarly, groundwater pathways still exert a primary influence on solute concentrations and transport of nutrients. Biological communities still vary in response to these dynamic conditions. For example, the PPR is the most important area in North America for the production of dabbling ducks (Smith, 1995), but annual production varies depending on climatic conditions (Batt and others, 1989). However, agriculture has significantly altered relationships between these and other abiotic features. Extensive areas of native prairie have been converted to agriculture. In North Dakota alone, 68% of the mixed-grass prairie has been converted to agricultural production (Samson and others, 1998). Similarly, it has been estimated that >50% of the wetland area in the United States PPR (Tiner, 1984; Dahl, 1990; Dahl and Johnson, 1991) has been drained for agricultural development. Remaining wetlands, which comprise 23% of the land area in the PPR, are embedded within a predominately agricultural landscape (Euliss and others, 1999) and most are cultivated for agricultural production, especially during drought years (Euliss and others, 2001). In addition to loss, historic processes (e.g., hydrology, fire, herbivory) important for maintaining the integrity of the remaining native communities have been altered, which has led to changes in biotic communities and other ecosystem benefits. For example, the planting of crops in upland areas has altered relations between surface and subsurface water in

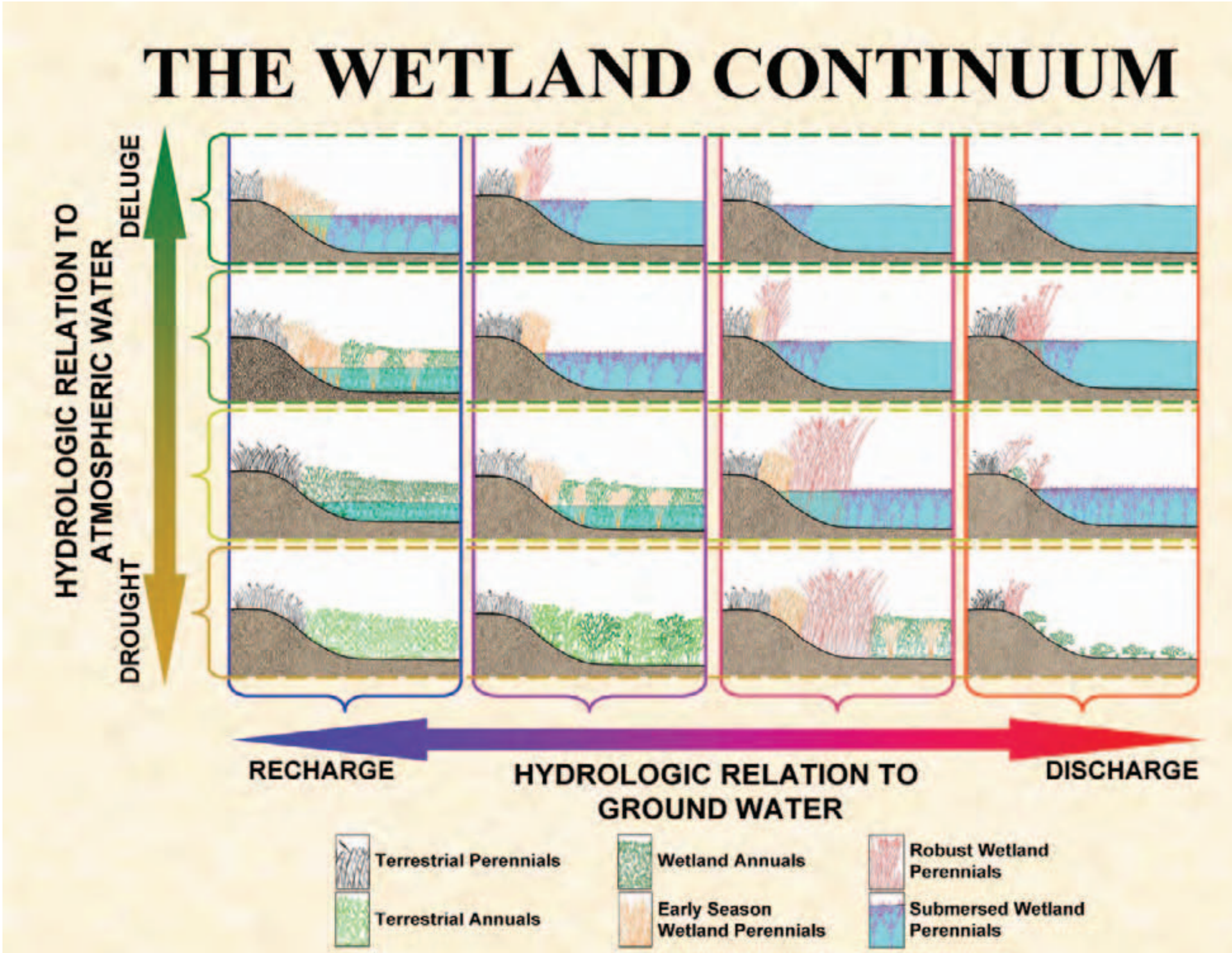

Figure 1. A visual depiction of the wetland continuum. Wetlands located at the recharge end of the hydrological relation to ground water axis recharge ground water but do not receive ground-water discharge. Wetlands at the discharge end of the same axis receive ground-water discharge but do not recharge ground water. Wetlands located between the two extremes are located along the axis based on their relative ratio of ground-water recharge to ground-water discharge. Potential plant communities in wetlands at four discrete points along this axis are depicted. The "hydrological relation to atmospheric water" axis extends from drought to deluge. Again, the plant communities of the same four wetlands are depicted at different points in the drought-deluge cycle to show how community response to climatic change is largely dictated by the hydrologic relation to ground water (from Euliss and others, 2004).

both uplands and wetlands (Euliss and Mushet, 1996). As a result, changes also have occurred in sediment transport (e.g., erosion), nutrient enrichment (e.g., fertilizers), water quality (e.g., agrichemicals), and, ultimately, biotic communities (e.g., vegetation, wildlife). For example, large-scale conversion of prairie to cropland has changed the communities of birds and other animals that rely on grassland habitats (Johnson, 2000). Similarly, wetlands remain an important component of the regional ecosystem, but many important ecological functions (e.g., fish and wildlife habitat, global carbon cycling, flood water retention, water quality improvement, and sediment retention) performed by wetlands (Mitsch and Gosselink, 2000) have been altered to various extents.

Application of Ecological Fit to Restore Prairie Pothole Region Wetlands

Extensive conversion of wetlands and prairie to agricultural fields has stimulated considerable interest in restoring previously farmed uplands and wetlands for conservation (Knutsen and Euliss, 2001). Here, we describe considerations necessary to successfully evaluate environmental benefits of conservation programs (e.g., CRP) only in relation to wetlands, but the same principles apply to uplands as well.

Most wetlands restored are within large blocks of marginal farmland that landowners have voluntarily idled from production and planted to perennial grassland through conservation programs of the Farm Bill (Food Security Act of 1985; Public Law 99-198, Farm Security and Rural Investment Act of 2002; Public Law 107-171). Wetland restoration typically involves plugging or destruction of drains and relying on natural processes for reestablishment of wetland vegetation. An often reported goal of these restorations is to return farmed wetlands to their original condition. However, although plugging drains will alter the existing hydrology, this single activity will not necessarily result in the emulation of the desired hydroperiod. Further, it is unrealistic to expect this single activity will ensure that other abiotic and biotic features will recover to desired levels. For example, failure to restore sediment dynamics within wetland catchments may hinder the diversity of plant and invertebrate propagules that can emerge from wetland sediments, which is a major factor facilitating the rapid replacement of the biological community within individual wetlands as climate regimes (e.g., acts of nature) fluctuate (see review in Euliss and others, 1999). Therefore, implementing restoration efforts to enhance a single function may represent a poor ecological fit if the restored habitat is not sustainable or it has great potential to produce unintended negative outcomes. In contrast, a good ecological fit would require that all ecological processes be evaluated to determine the impacts of past perturbations. Using the above example, not only would changes in hydrology be evaluated, but also the amount of sediment in wetlands, extent of erosion in uplands, and surface water movement. A primary benefit of evaluating all wetland functions simultaneously is that potential negative outcomes would be identified. Thus, decisions regarding the type of actions to implement would be improved because acts of Congress would be objectively evaluated in relation to complementing acts of nature. Thus, the goal of modern land management is not only to develop practices that insure the long-term sustainable productivity of the Nation's ecosystems, including agroecosystems, but also to develop improved criteria for selection and management to improve ecological fit. This will require an objective evaluation of the types and extent of change in fundamental abiotic features related to ecosystem processes. Although a seemingly impossible task, long-term studies indicate that changes in abiotic and biotic features can be related to natural climate variations (Euliss and others, 2004). Thus, the potential exists to develop a modeling approach that predicts and relates changes in the composition of biological communities to normal climatic variation. Coupled with monitoring information, the operational use of such a model would serve to better integrate science-based evaluations into land management and facilitate formulation of policy by enabling observed variation to be partitioned between acts of nature and acts of Congress.

Conclusions

There are increasing requests to evaluate the success of federal conservation programs in terms of achieving stated goals and quantifying outcomes to facilitate program evaluation and develop more effective environmental policy. Although such programs undoubtedly have had beneficial results, our ability to quantify specific values has been confounded in past evaluations. Therefore, improving existing conservation programs will require developing the capacity to partition changes due to acts of nature from those due to acts of Congress. Accomplishing this task necessitates understanding relations between natural and anthropogenic influences relative to fundamental ecosystem processes and developing a framework (e.g., model) that facilitates monitoring and interpretation of existing programs. The operational use of such a model would serve to better integrate science-based evaluations into land management decisions and contribute to improved policy formulation.

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References Cited

Batt, B.D., Anderson, M.G., Anderson, C.D., and Caswell, F.D., 1989, The use of prairie potholes by North American ducks, *in* van der Valk, A., ed., Northern prairie wetlands: Iowa State University Press, Ames, p. 204–227.

Dahl, T.E., 1990, Wetland losses in the United States 1780's to 1980's: U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., 21 p.

Dahl, T.E., and Johnson, C.E., 1991, Status and trends of wetlands in the coterminous United States, mid-1970's to mid-1980's: U.S. Fish and Wildlife Service, Washington, D.C., 28 p.

Euliss, N.H., Jr., and Mushet, D.M., 1996, Water-level fluctuation in wetlands as a function of landscape condition in the prairie pothole region: Wetlands, v. 16, p. 587–593.

Euliss, N.H., Jr., Wrubleski, D.A., and Mushet, D.M., 1999, Invertebrates in wetlands of the Prairie Pothole Region—species composition, ecology, and management, *in* Batzer, D., Rader, R.B., and Wissinger, S.A., eds., Invertebrates in freshwater wetlands of North America—ecology and management: New York, John Wiley and Sons, p. 471–514.

Euliss, N.H., Jr., Mushet, D.M., and Johnson, D.H., 2001, Use of macro invertebrates to identify cultivated wetlands in the prairie pothole region: Wetlands, v. 21, p. 223–231.

Euliss, N.H., Jr., LaBaugh, J.W., Fredrickson, L.H., Mushet, D.M., Laubhan, M.K., Swanson, G.A., Winter, T.C., Rosenberry, D.O., and Nelson, R.D., 2004, The wetland continuum: A conceptual framework for interpreting biological studies: Wetlands, v. 24, p. 448–458.

Fischman, R.L., 2003, The National Wildlife Refuges: Coordinating a conservation system through law: Washington, D.C., Island Press.

Johnson, D.H., 2000, Grassland bird use of Conservation Reserve Program fields in the Great Plains, *in* Hohman, W.L., and Halloum, D.J., eds., A comprehensive review of Farm Bill contributions to wildlife conservation, 1985–2000: U.S. Department of Agriculture, Natural Resources Conservation Service, Wildlife Habitat Management Institute Technical Report, USDA/NRCS/WHMI-2000, p. 19–33.

Knutsen, G.A., and Euliss, Jr., N.H., 2001, Wetland restoration in the Prairie Pothole Region of North America: A literature review: Biological Science Report USGS/BRD/BSR 2001-0006.

Leopold, A., 1949, A Sand County almanac: New York, Oxford University Press, 226 p.

Mann, L.K., 1986, Changes in soil carbon after cultivation: Soil Science, v. 142, p. 279–288.

Millar, J.B., 1989, Perspectives on the status of Canadian prairie wetlands, *in* Sharitz, R.R., and Gibbons, J.W., eds., Freshwater wetlands and wildlife: U.S. Department of Energy Symposium Series Number 61, Oak Ridge, Tennessee, p. 829–852.

Mitsch, W.J., and Gosselink, J.G., 2000, Wetlands (3d ed.): New York, Van Nostrand Reinhold, 537 p.

Phospahala, R.S., Anderson, D.R., and Henry, J.C., 1974, Population ecology of the mallard II, breeding habitat conditions, size of the breeding population, and production indices: U.S. Fish and Wildlife Service Resource Publication 115, Washington, D.C., 73 p.

Samson, F.B., Knopf, F.L., and Ostlie, W.R., 1998, Grasslands, *in* Mac, M.J., Opler, P.A., Puckett Haecker, C.E., and Doran, P.D., eds., Status and Trends of the Nation's Biological Resources, vol. 2: Jamestown, North Dakota, Northern Prairie Wildlife Research Center Home Page, p. 437–472. http://www.npwrc.usgs.gov/resource/2000/grlands/grlands.htm (Version 21JAN2000).

Smith, G.W., 1995, A critical review of aerial and ground surveys of breeding waterfowl in North America: National Biological Service Biological Science Report 5, Washington, D.C., 252 p.

Tiner, R.W., 1984, Wetlands of the United States: Current status and recent trends: U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 59 p.

Fine Tuning the Conservation Reserve Program for Biological Diversity and Native Wildlife

By Terrence G. Bidwell[1] and David M. Engle[1]

Introduction

Native prairies and shrublands in the Great Plains are characterized by diverse native flora and fauna that reflect varied habitats and stages of plant succession. Habitat diversity, manifested as vegetation structure and composition, is driven by climate, soil, fire, and herbivory. However, through habitat fragmentation by human activities, many native wildlife species are declining (Woodward and others, 2001; R.J. Robel, unpub. data, 2002). Bobwhite quail (*Colinus virginianus*) (Bidwell and others, 2004), lesser prairie chicken (*Tympanuchus pallidicinctus*) (Bidwell and others, 2003), mountain plover (*Eupoda montana*) (Knopf, 1996) and other grassland birds require large unfragmented landscapes with specific vegetation structure and composition to maintain viable populations. For example, in the Texas Panhandle, the lesser prairie chicken population is stable, but across the state line in Oklahoma populations are declining (fig. 1).

The eastern Texas Panhandle, in contrast with western Oklahoma, has few Conservation Reserve Program (CRP) fields on the landscape. Why does the CRP not benefit the lesser prairie chicken in a fragmented landscape of western Oklahoma where presumably nesting cover is limiting? Is it because most CRP fields in this area are unburned, ungrazed, and in many cases home to invasive plants such as eastern redcedar (*Juniperus virginiana*) and other woody species? It is interesting to note that landowners with land in the CRP receive a yearly maintenance payment to preclude woody plants and other noxious weeds from invading, but in most cases, no maintenance treatment has been applied. To understand how the CRP needs to be adjusted and administered, we need to review how the program was implemented and then look at opportunities for improvement.

Has the Conservation Reserve Program Met Its Goals for Wildlife?

The initial goal of the CRP was to reduce water and wind erosion on the most highly erodible and fragile croplands (U.S. Congress, 1985). Other purposes were more utilitarian, including removing land from annual crop production and placing land under permanent vegetation cover (CAST, 1990). Some policymakers surely saw in the CRP potential for reducing money spent on federal crop subsidies. In the early years of the program, recommended vegetation (i.e., habitat) was selected without regard for habitat needs of native wildlife species or within the context of landscape (fig. 2) function or ecological drivers such as fire and grazing. Unfortunately, the decision of what to plant generally was not based on historical plant community composition. As a result, benefits to native wildlife were often unplanned and incidental.

One of the main CRP benefits to wildlife in the Great Plains was an increase in herbaceous habitat structure (height) in areas historically over-used by livestock. In areas dominated by cultivated annual crops, like in the spring wheat, winter wheat, and cotton belts, the CRP provided a presence of perennial vegetation that commonly enhanced wildlife habitat. In both situations, any addition of herbaceous habitat benefited birds and other wildlife requiring tall, relatively permanent herbaceous cover. Even with increased area of habitat and enhanced habitat structure, the CRP did not address missing elements of habitat (nesting cover, brood cover, protective cover, and interspersion of these elements) over the landscape for species such as the mountain plover and lesser prairie chicken. In some cases, lands enrolled in the CRP were planted to mid-grasses and tallgrass prairie species on historically shortgrass prairie sites, a practice that actually diminishes habitat value for shortgrass prairie obligates such as the mountain plover. Many wildlife species, including most birds, identify preferred habitat by a predetermined set of specific search images. This concept suggests there are predictable relations between occurrence of a bird and its characteristic habitat requirements. This is a basic configuration of the ecological niche called the Niche-Gestalt (James, 1971) and demonstrates why habitat specialists such as endemic prairie birds are specific about habitat selection.

Some CRP lands created islands of habitat across the landscape that benefited some native wildlife species but caused other native species to decline while favoring introduced wildlife species, such as the ring-necked pheasant (*Phasianus colchicus*). For example, trees are particularly insidious to native wildlife in prairies and shrublands (Coppedge and others, 2003; Chapman and others, 2004). In some cases, CRP fields planted to trees or in which trees invaded as a consequence of improper management resulted in fragmented prairie/shrubland habitat that allowed distribution of non-native wildlife to expand (Knopf, 1994). In contrast, isolated islands of good quality native habitat in landscapes

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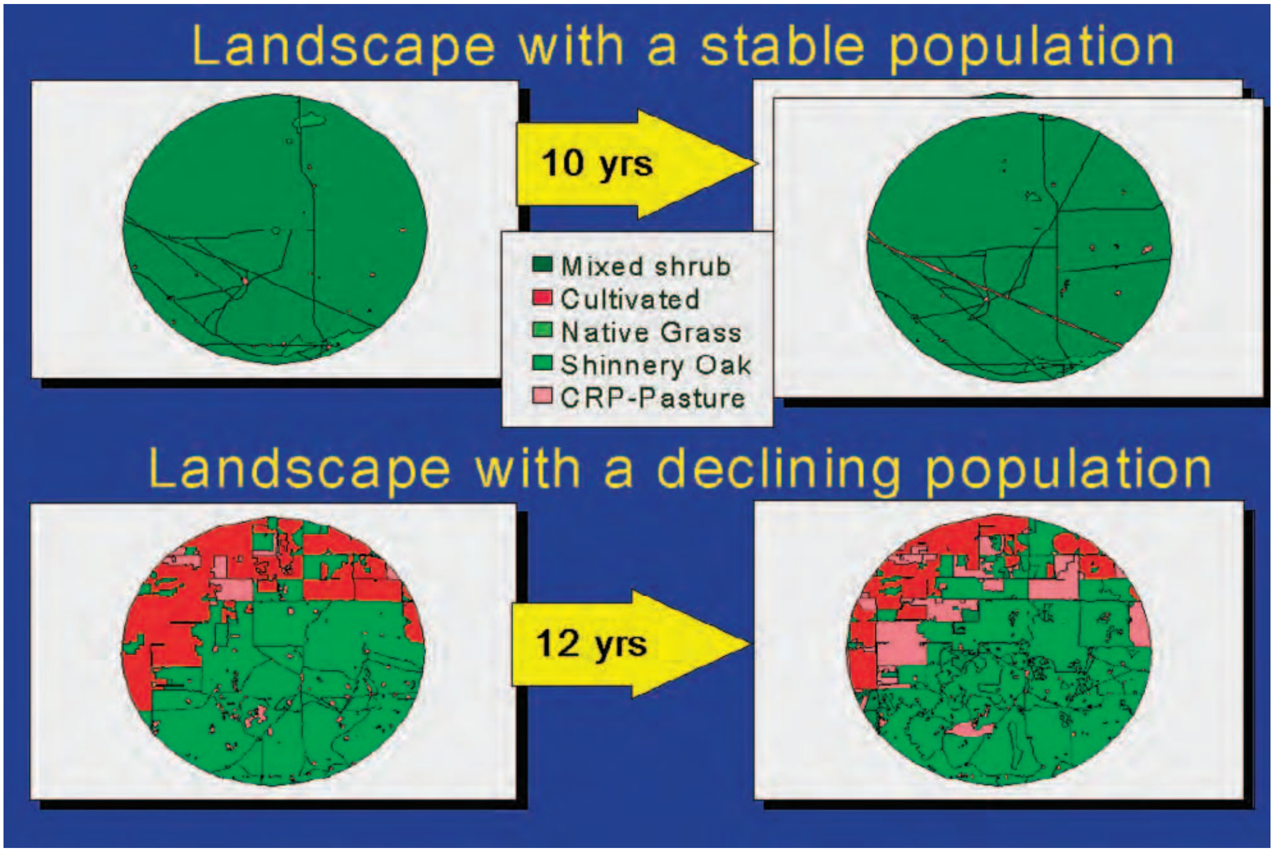

Figure 1. Comparison of a Texas Panhandle landscape (with a stable population) and a western Oklahoma landscape (with a declining population) in terms of effects of landscape change on lesser prairie chicken populations. Landscapes in western Oklahoma are becoming increasingly fragmented. To maintain viable populations, lesser prairie chickens require expansive areas [perhaps >25,000 acres (10,000 ha)] of contiguous habitat in native vegetation devoid of trees.

of introduced forages, crops, or tree plantings do not meet prairie/shrubland wildlife needs (Knopf, 1994). Research has demonstrated that tree planting and tree invasion in prairies or shrublands degrades habitat for prairie wildlife species (Chapman and others, 2004).

Tree planting or invasion attracts habitat generalists such as white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), and brown-headed cowbird (*Molothrus ater*) from the forest-prairie ecotone into prairies and shrublands (Knopf, 1994). In prairies and shrublands where trees have been planted or allowed to invade, habitat generalists have become formidable competitors with native wildlife. For example, where trees now exist in former prairie/shrubland habitat, brown-headed cowbirds have caused increased nest depredation on prairie birds (Knopf, 1994). In summary, research indicates CRP, although increasing the amount of habitat available to wildlife in general has failed to leverage this increase to the extent possible, and in some cases the program and its management have been detrimental to native wildlife.

Opportunities to Modify the Conservation Reserve Program to Meet Habitat Needs of Indicator Species

The CRP can be modified to greatly benefit wildlife species native to the Great Plains. To do so, future CRP administrative decisions must be based on research formulated in the context of landscape composition and needs of habitat specialists (also known as indicator species). Indicator wildlife and plant species are those where abundance and distribution reflect a healthy landscape and ecosystem. In this setting, single species management (i.e., of indicator wildlife species) is appropriate within the context of restoring whole landscapes rather than of establishing vegetation cover on individual fields without considering the spatial influence of individual management decisions.

Another key to restoration success is to reestablish ecological drivers of herbivory and fire with appropriate prescriptions to produce desired habitat elements and appro-

Figure 2. Habitat for avian species is most appropriately viewed at a variety of spatial scales. Most management is applied to individual fields or pastures. However, populations of most avian species respond to landscapes composed of multiple fields and pastures and a mosaic of vegetation in different successional stages. In this landscape, individual cropland fields revegetated to grassland, regardless of the effort devoted subsequently to habitat management, are fragmented by remaining cropland and invading trees, therefore furnishing inadequate habitat to maintain population viability of some declining grassland obligate bird species.

priate spatial extent of habitat to maintain population viability of the indicator wildlife species. Fire and herbivory did not historically occur or function independently but as interactive drivers across landscapes that can be described as the fire-grazing interaction (Fuhlendorf and Engle, 2001). The interaction occurred during all seasons across landscapes in the Great Plains (Engle and Bidwell, 2001) and provided the habitat diversity necessary to meet the needs of many different indicator wildlife species (Fuhlendorf and Engle, 2004).

Use Natural Resources Conservation Service Ecological Site Guides to Select Plant Species for Planting

Ecological site guides are being revised and developed by the Natural Resources Conservation Service (NRCS) throughout the United States. Some states are further along than others in this process. These guides provide the framework from which decisions can be made for appropriate native plantings based on the historical potential plant community and corresponding native wildlife. Native refers to plants and animals that historically occurred on the ecological site and not necessarily those native to the region or continent. An example of failure to apply this concept resulted in inappropriate planting of native mid and/or tall grasses on shortgrass prairie ecological sites in eastern Colorado. Another example is either tree planting or allowing trees native to the region to invade loamy prairie ecological sites in Kansas and Oklahoma. In both examples, native plants (grasses or trees native to the region) were used, but these plants were historically not native to the specific ecological site and thus had a negative effect on habitat for wildlife native to these sites. Wildlife native to prairie and shrublands do not require, use, or tolerate trees (Knopf, 1994; Chapman and others, 2004).

Kill Trees Instead of Paying to Plant Them!

Lands enrolled in the CRP in the Great Plains hold potential to benefit native wildlife species if appropriate vegetation composition and structure exists on the landscape but planting or allowing invasion of nonnative or introduced exotic trees, shrubs, or herbaceous plants on sites where these plants did not historically occur must stop. These activities should not be funded at the taxpayers' expense under the guise of conservation. Existing non-native plants (i.e., those plants not native to the site as indicated by ecological site guides) should be removed. Not only have many of these plants degraded or destroyed the habitat for native wildlife but they have served as a seed source for invasion of adjacent areas. Decisions on what kinds of plants are appropriate for the site should be guided based on NRCS ecological site guides.

Refine Management Provisions to Meet Site Characteristics Described in Ecological Site Guides

Recently proposed haying and grazing provisions for the CRP appear to be conceived as "one-size fits all." The provisions can be described as appropriate or inappropriate depending on how and where they are implemented. The provisions are too general and need to be refined for specific ecological sites. For example, the following questions must be answered before implementing the haying and grazing provisions for the CRP.

- Which plants are native to the ecological site and which are invasive or exotic?
- Which indicator wildlife species' habitats are being targeted for restoration?
- What specific habitat components [e.g., the kind, amount, condition, and interspersion of habitat elements such as leking grounds, nesting cover, brooding cover, protective cover, (thermal and escape); food (insects, greens, and seeds)]; and interspersion of these elements are needed in the landscape?

Only after these questions are answered can the site be evaluated for its contribution to wildlife habitat restoration and appropriate implementation of CRP conservation provisions.

Implementing grazing on most CRP lands will require water and fencing development at the taxpayers' expense. Cross fencing and water development through NRCS prescribed grazing plans (e.g., management intensive grazing) should be discouraged because they do not provide expected benefits (table 1 and fig. 3). Multi-paddock rapid rotation grazing systems in general are not beneficial to the grazing animal or to prairie wildlife because they reduce habitat diversity and homogenize habitat structure across the landscape (table 1 and fig. 3) (Fuhlendorf and Engle, 2001). Recent and ongoing research has shown a significant increase in mortality of

Table 1. Traditional rangeland management practices are based on agronomic rather than ecological principles. Consequently, recommended and cost-shared practices have encouraged homogenizing of habitats at all scales resulting in degraded wildlife habitat for some species. Practices based on ecological principles and supported by scientific research should be used to restore habitats.

	Spatial availability of units		
	Homogeneous	Heterogeneous	Shifting mosaic
Traditional			
Continous grazing		X	
Rotational grazing	X		
Herbicide application	X		
Multi-species grazing	X		
Area burns	X		
Improved water distribution	X		
Restoration			
Patch burning			X
Patch herbicide application			X
Patch fertilization			X
Focused grazing disturbances			X
Shitfting attractants (salt, etc.)			X

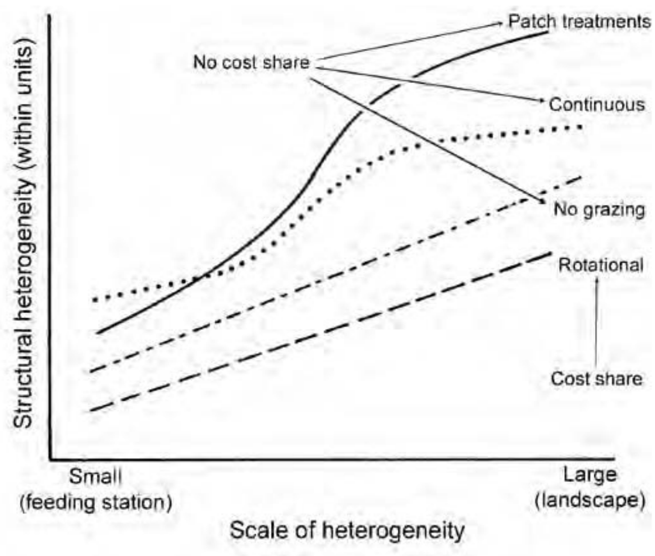

Figure 3. Habitat structure is the key element in habitat selection for most wildlife species, especially birds. Birds have a predetermined set of specific search images that they use to select habitat. Patch treatments provide maximum heterogeneity and consequently optimize habitat diversity for native species. Unfortunately, government cost-share programs may encourage homogeneity through inappropriate grazing and haying recommendations that degrade wildlife habitat for species endemic to grassland ecosystems (Fuhlendorf and Engle, 2001).

lesser prairie chicken because of fence collisions in the highly fragmented landscape of western Oklahoma (32% mortality) versus a relatively unfragmented landscape in eastern New Mexico (13% mortality) (Patten and others, 2005; fig 1).

The fire-grazing interaction, also know as patch burning or rotational grazing without fences, is an alternative to rapid rotation grazing systems and provides comparable livestock performance. However, the fire-grazing interaction provides habitat structure heterogeneity mandatory for multiple wildlife habitat components (Fuhlendorf and Engle, 2004). Unfortunately, research on patch burning has only been done on native grasslands and not on grasslands established as part of the CRP. Research on patch burning on CRP fields, has been initiated recently.

Prioritize New Conservation Reserve Program Offerings in the Context of the Landscape

Habitat-based models for indicator wildlife species can be implemented at the landscape level using GIS technology (Woodward and others, 2001). Each CRP field can be evaluated for its contribution to habitat restoration within a landscape through the GIS process at extensive spatial scales (fig. 1). Thus, current and new CRP fields can be prioritized based on their potential contribution to the habitat needs of indicator wildlife species of most concern. Without a landscape-level approach, decisions for appropriate selection of planting and management of vegetation cannot be expected to furnish long-term environmental benefits nor meet the needs of regionally important wildlife species.

References Cited

Bidwell, T.G., Masters, R.E., Sams, M., and Tully, S., 2004, Bobwhite quail habitat evaluation and management guide: Publication E-904, Oklahoma State University, Stillwater, 21 p.

Bidwell, T.G., Fuhlendorf, S.D., Gillen, R.L., Harmon, S., Horton, R., Rodgers, R., Sherrod, S., Wiedenfeld, D., and Wolf, D., 2003, Ecology and management of the lesser prairie chicken in Oklahoma: Publication E-970, Oklahoma State University, Stillwater, 17 p.

CAST, 1990, Ecological impacts of federal conservation and cropland reduction programs: Task Force Report No 117, Council for Agricultural Science and Technology, Ames, Iowa, 28 p.

Chapman, R.N., Engle, D.M., Masters, R.E., and Leslie, D.M., 2004, Tree invasion constrains the influence of herbaceous structure in grassland bird habitats: Ecoscience, v. 11, no. 1, p. 55–63.

Coppedge, B.R., Engle, D.M., Masters, R.E., and Gregory, M.S., 2001, Avian response to landscape change in fragmented Southern Great Plains grasslands: Ecological Applications, v. 11, no. 1, p. 47–59.

Engle, D.M., and Bidwell, T.G., 2001, Viewpoint: The response of central North American prairies to seasonal fire: Journal of Range Management, v. 54, no. 1, p. 2–10.

Fuhlendorf, S.D., and Engle, D.M., 2001, Restoring heterogeneity on rangelands: Ecosystem management based on evolutionary grazing patterns: BioScience, v. 51, no. 8, p. 625–632.

Fuhlendorf, S.D. and Engle, D.M., 2004, Application of the fire-grazing interaction to restore a shifting mosaic on tallgrass prairie: Journal of Applied Ecology, v. 41, p. 604–614.

James, F.C., 1971, Ordinations of habitat relationships among breeding birds: The Wilson Bulletin, v. 83, p. 215–236.

Knopf, F.L., 1994, Avian assemblages on altered grasslands, *in* Jehl, Jr., J.R. and Johnson, N.K., eds., a century of avifaunal change in western North America: Cooper Ornithological Society, Studies in Avian Biology, no. 15, p. 247–257.

Knopf, F.L., 1996, Perspectives on grazing nongame bird habitats, *in* Krausman, P.R., ed., Rangeland wildlife: The Society for Range Management, Denver, Colorado, p. 51–58.

U.S. Congress, 1985, Food Security Act of 1985, Title XII, Subtitles B and C, highly erodible land and wetland conservation: Public Law 99-198.

Patten, M.A., Wolfe, D.H., Shochat, E., and Sherrod, S.K., in press, Habitat fragmentation, rapid evolution and population persistence: Evolutionary Ecology Research, v. 7.

Woodward, A.J., Fuhlendorf, S.D., Leslie, Jr., D.M., and Shackford, J., 2001, Influence of landscape composition and change on lesser prairie chicken (*Tympanuchus pallidicinctus)*: The American Midland Naturalist, v. 145, no. 2, p. 261–274.

Measuring Environmental Benefits of Conservation Practices: The Conservation Effects Assessment Project

By Robert L. Kellogg[1]

Introduction

Conservation programs reduce environmental impacts associated with agricultural activities and help establish sustainable production systems. Conservation practices are designed to reduce losses of soil, nutrients, pesticides, pathogens, and other biological and chemical materials from agricultural lands, conserve natural resources, and enhance the quality of the agro-ecosystem. Additionally, conservation practices often contribute to establishment of wildlife habitat that is compatible with agricultural production.

The Farm Security and Rural Investment Act of 2002 (the 2002 Farm Bill) substantially increased funding levels of conservation programs. Overall, the 2002 Farm Bill authorized federal expenditures for conservation practices on U.S. farms and ranches at a level about 80% above the amounts defined under the 1996 Farm Bill. Most of the increased funding will support conservation on working lands. While it is widely recognized these conservation programs will protect millions of acres from soil erosion, enhance water and air quality, promote wetland and wildlife habitat restoration and preservation, and conserve agricultural water use, the environmental benefits have not been quantified for reporting at the national scale. Moreover, while an extensive literature exists on the effects of conservation practices at the field level, there are few research studies designed to measure off-site effects.

The Natural Resources Conservation Service (NRCS) and the Agricultural Research Service (ARS) are working together on the Conservation Effects Assessment Project (CEAP) to quantify environmental benefits of conservation practices at watershed and national scales. Estimating the environmental benefits of these programs will allow policymakers and program managers to improve implementation of existing programs and design new programs to more effectively and efficiently meet the goals of the U.S. Congress.

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Scope of the Conservation Effects Assessment Project

The scope of this national project covers most conservation practices implemented through the Environmental Quality Incentive Program (EQIP), Conservation Reserve Program (CRP), Conservation Security Program (CSP), Wetland Reserve Program (WRP), Wildlife Habitat Incentives Program (WHIP), and NRCS Conservation Technical Assistance Program (CTAP). Conservation practices to be emphasized in the initial assessment include the NRCS CORE 4 practices: conservation buffers; nutrient management; pest management; and tillage management. Additionally, evaluation of irrigation, drainage, manure, and grazing management practices, establishment of wildlife habitat, and wetland protection and restoration will be emphasized. Environmental benefits will be estimated for each of the five resource concerns that conservation programs are designed to address:

- water quality (nutrient, pesticide, and sediment delivery to lakes, rivers, and streams),
- soil quality (including soil erosion and carbon storage),
- water conservation (including flood and drought protection),
- air quality (including particulates and odors), and
- wildlife habitat (including aquatic and terrestrial habitats).

Benefits will be estimated separately for agricultural land use categories to which most conservation practices apply:

- cropland, including cropland enrolled in CRP,
- grazing lands, and
- wetlands.

Because a large portion of the conservation funding is allocated to cropland, the primary focus will be cropland, including CRP. The first efforts and annual reports will primarily address three (water quality, soil quality, and water conservation) of the five resource concerns for cropland. For the remaining land use categories and for the two other resource concerns (air quality and wildlife benefits), analytical approaches will be developed and, in some cases, additional research conducted before estimates of benefits can be determined.

The CEAP is an on-going mix of data collection, model development, model application, and research. One goal is to develop appropriate databases and applications over the course of the project. It is anticipated some of the new indicators and performance measures will be included in the 2006 and 2007 annual reports, and the 2008 annual report will include performance measures for all land uses and resource concerns.

The CEAP is a multi-agency effort that will include involvement from groups outside of the federal government. U.S. Department of Agriculture (USDA) collaborators include the Farm Service Agency (FSA); Cooperative State Research, Education, and Extension Service (CSREES); the National Agricultural Statistics Service (NASS); and the Office of Risk Assessment and Cost Benefit Analysis (ORACBA). Together with NRCS and ARS, this core group of USDA agencies will coordinate with other federal agencies involved in natural resource issues, such as the Forest Service (FS); Economic Research Service (ERS); U.S. Environmental Protection Agency (EPA); and U.S. Geological Survey (USGS), to seek opportunities for further collaboration. A national panel consisting of experts not directly involved in the project, including representatives outside of government, will be established to provide guidance and recommendations on CEAP.

Forums and workshops will be held periodically to obtain comments and suggestions from academic institutions, state agencies, private organizations, and the public on the analytical approach and findings. Professional societies' meetings will also provide an important forum for the exchange of information and ideas. For example, the fourth annual joint symposium of Soil Water Conservation Society (SWCS) and Soil Science Society of America (SSSA) "Assessment of Measurements of Conservation" was presented during the 2003 annual meetings of the SWCS and SSSA. This initial meeting was so successful that the fifth annual joint symposium of the SWCS and SSSA during 2004 was expanded to "Assessment of Effectiveness of Conservation Practices in North America, including Watershed Case Studies." The SWCS, SSSA, Canadian Society of Soil Science, and Mexican Soil Science Society sponsored the fifth joint symposium in 2004. At this meeting American, Canadian, and Mexican soil scientists interacted and talked about how to assess conservation practices throughout North America.

There are two main components of the CEAP. A national assessment component will provide modeled estimates of conservation benefits for annual reporting. The purpose of the national assessment is to provide an accounting of environmental benefits obtained from USDA conservation program expenditures for farmers and ranchers, landowners, conservationists, the public, Congress, the Office of Management and Budget, or others involved with environmental policy issues. At a finer scale the watershed assessment component will provide detailed, landscape-specific assessments of environmental benefits that are not possible at the national scale. A framework for evaluating and improving performance of national assessment models and research on conservation practices and their expected effects at the watershed scale will also be developed.

The National Assessment

The national assessment for cropland will be built using existing modeling capabilities. This assessment will include estimates for reductions in nutrient, pesticide, and soil losses, improvements in water quality and use efficiency, and enhancement of soil quality. Water quality improvements in terms of reductions in instream nutrient and sediment concentrations will also be estimated. Modeling capabilities and databases will be enhanced for all estimates throughout the project, and initial estimates will be revised to reflect improved modeling capabilities and information developed during the project.

During the first year of the project, expert teams will be formed to identify appropriate indicators and performance factors to be measured by subject areas. These teams will identify data needs and develop modeling approaches needed to estimate environmental benefits at the national level. Throughout this process, NRCS and ARS will work closely with other agencies and with non-governmental entities to achieve a national level of accounting for conservation benefits associated with conservation practices. As new models and databases are developed, other resource concerns and land use categories will be estimated at the national level.

A National Simulation Model for Assessment of Reductions in Losses from Farm Fields, Water Conservation, and Enhancement of Soil Quality for Cropland

A simulation model built on the National Resources Inventory (NRI) will provide the basis for estimating reductions in sediment, nutrients, and pesticides from farm fields, increased water use efficiency, and enhancement of soil quality. The NRI is a scientifically based survey designed to assess conditions and trends of soil, water, and related resources of the Nation's non-federal lands at the national and regional level. In the past, the NRI has been conducted at 5-year intervals from 1982 through 1997. The NRI is currently in transition from a 5-year cycle to an annual cycle of data collection (Goebel, 1998).

There are 800,000 sample points in the current NRI, about 300,000 of which are cropland points. At each sample point, information is collected on nearly 200 attributes including land use and cover, soil type, cropping history, conservation practices, erosion potential, water and wind erosion estimates, wetlands, wildlife habitat, vegetative cover conditions, and irrigation method. Data gathered in the NRI are linked to NRCS Soil Survey databases and can be linked spatially to climate databases. Thus, the NRI sampling frame captures the diversity of the Nation's agricultural resource base (soils, topography, and climate), which is a critical factor in assessing the contribution of conservation practices to reduction of environmental impacts associated with agricultural activities. (For more information see www.nrcs.usda.gov/technical/NRI/)

While the NRI is designed to provide statistical information on private land natural resources, it can also be used as an analytical framework for simulation modeling (Goebel and Kellogg, 2002). The NRCS has previously made extensive use of the NRI as an analytical framework to address issues related to natural resources and agriculture. For these applications NRI sample points are treated as representative fields. Data on field management activities are obtained from farmer surveys and integrated with information on land use and soil characteristics at each NRI sample point. This information is used in conjunction with field-level fate and transport process models to estimate loss of materials from farm fields or other outcomes such as accumulation of soil organic carbon.

The statistical sample weight associated with each sample point is used to aggregate modeling results to the national or regional scale. The resulting simulation model captures diversity of land use, soils, climate, and topography from the NRI, estimates loss of materials from farm fields at the field scale where the science is best developed, and provides a statistical basis for aggregating results to the national and regional levels. Previous studies have used a similar approach to estimate pesticide loss from cropland (Kellogg and others, 1992, 1994, 2002), and to identify priority watersheds for water quality protection from nonpoint sources related to agriculture. (For examples of NRI modeling applications, see reports available at www.nrcs.usda.gov/technical/land/pubs/)

A subset of about 30,000 NRI cropland sample points will be selected for constructing the simulation model for the national assessment on cropland. The target population is land in the 48 contiguous states classified by the NRI as cultivated cropland or CRP land. The sample is selected so as to be representative of the resource base (soils, topography, and climate) for cropland. For these sample points, a farmer survey is being implemented to obtain additional information needed by the fate and transport process model, such as crops grown, tillage, nutrient and pesticide applications, and conservation practices implemented. A separate set of about 10,000 sample points will be selected and surveys conducted in each of 3 years: 2003, 2004, and 2005. The final dataset is obtained by pooling samples for the three years. Preliminary results will be reported based on results from the first 2 years. At the end of the 3 years of sampling, adequacy of the sample will be assessed and if additional sampling is needed, farmer surveys will continue.

The NRCS is collaborating with NASS and FSA to conduct the farmer survey. The survey will utilize personal interviews to administer a questionnaire designed to obtain field-specific data associated with selected sample points from farm operators. Specific questions are asked about physical characteristics of the field and associated conservation practices. Farming activities for the most recent 3 years are obtained so that the farming system, including crop rotations and associated crop residue management practices, nutrient management practices, and pesticide management practices, can be properly represented in the fate and transport model. Information on the operator's participation in conservation programs, structural conservation practices associated with the field, and resource concerns will be provided by the local NRCS field office. The survey will be conducted in the fall of each year.

The CEAP sample is designed to provide national and regional estimates. The current budget precludes derivation of state-level estimates. In addition to using information from the survey to determine and report benefits of conservation practices, NRCS will release summaries of the full set of survey results at an appropriate level of aggregation for use by other researchers. Since the sample frame is based on the NRI points, which are geospatially located, NRCS will explore possibilities for summarizing survey results for large watersheds and ecosystems.

For each sample point, survey information will be used to construct a before conservation plan scenario and an after conservation plan scenario. Differences in model output from these scenarios will be used to estimate per-acre benefits. Conservation benefits for NRI sample points in the CRP general signup will be estimated by simulating practices representative of the region for the before scenario, and constructing the after scenario by converting the land use to either trees or grass. The FSA is providing a link between the NRI sample point and their database on CRP practices. For continuous CRP signups and the Conservation Reserve Enhancement Program (CREP), practices will be evaluated in the same manner as other conservation practices, such as EQIP.

Estimates of reductions in sediment, nutrients, and pesticides from farm fields, increased water use efficiency, and enhancement of soil quality will be obtained for each sample point using the field-level physical process model called EPIC (Erosion-Productivity Impact Calculator). The EPIC is a continuous simulation model used to determine the effect of management strategies on agricultural production and soil and water resources. This model was initially developed to assess the effect of soil erosion on soil productivity (Williams and others, 1989). The model has been expanded and refined to allow simulation of many processes important in agricultural management as well as fate and transport of potential pollutants such as nitrogen, phosphorous, soil erosion, salt, and pesticides. The EPIC operates on a daily time step, integrating daily weather data, soil characteristics, farming operations such as planting, tillage, and nutrient applications, and a plant growth model to simulate the growth and harvest of a crop. All farming operations that take place on the field throughout the year are taken into account. On a daily basis, EPIC tracks the movement of water, the cycling of nitrogen, phosphorus, and carbon, and soil erosion. The drainage area considered by EPIC is generally a homogeneous field-sized area of up to about 250 acres (100 ha). Model outputs represent pollutant and water movement to the bottom of the root zone and field edge. A wide variety of soil, weather, and cropping practice data options allow simulation of most crops on virtually any soil and climate combination. (For more information on how EPIC simulates the various processes, see www.brc.tamus.edu/epic/documentation/)

The final step in the calculation of conservation benefits is to multiply the per-acre estimates of reductions in soil erosion, nutrients, and pesticides from farm fields, increased water use efficiency, and enhancement of soil quality from the EPIC model by official USDA accounting records on the number of acres implemented from the EQIP practice database, the NRCS Performance Results System database, or FSA's database on CRP enrollments. The calculation will be done on a regional basis to account for differences in per-acre estimates. The calculation will be done for each year, providing a time series of national estimates of reductions in soil erosion, nutrients, and pesticides from farm fields, increased water use efficiency, and enhancement of soil quality associated with conservation practices implemented each year.

A National Simulation Model for Assessment of Reductions of Instream Concentrations of Sediment and Nutrients

Water quality benefits will also be assessed at the 8-digit hydrologic unit code watershed scale using a combination of models and databases called HUMUS (Hydrologic Unit Modeling for the United States) (Arnold and others, 1998). The HUMUS includes databases on land use and sources of non-point and point source pollutants used with the Soil and Water Assessment Tool (SWAT) model, which simulates transport of water from the land to receiving streams and routes the flow downstream to the next watershed and ultimately to oceans and estuaries. Outputs from the EPIC model will be combined with HUMUS databases and the SWAT watershed model to estimate instream concentrations of nutrients and sediment at the outlet of each watershed in agricultural regions. This will allow estimation of reduction in instream concentrations attributable to implementation of conservation practices. Other outcome measures are also possible, such as reductions in the number of days during the year that instream nitrogen concentrations exceed the drinking water standard, and reductions in the number of days during the warm summer months that instream nitrogen and phosphorus concentrations exceed critical thresholds related to algal blooms and eutrophication. (For more information on HUMUS, see srph.brc.tamus.edu/humus; for more information on the SWAT model, see www.brc.tamus.edu/swat/)

Model Evaluation

To assure the national assessment is based on the best possible models and fully captures existing research findings on environmental effects of conservation practices, a component of the national assessment will focus on model evaluation. The analytical approach used to make national level estimates of conservation benefits for each resource concern and each land use category will be evaluated to assure that state-of-the-art modeling capabilities are being used for estimating conservation effects at the national level; incorporate new information on conservation practice effects where needed; evaluate the adequacy of the data available and how those data are used; and recommend improvements and alternative approaches where appropriate.

Teams of ARS, NRCS, and other experts will evaluate models used to estimate water quality, soil quality, and water conservation effects. A team of experts will evaluate the way EPIC and SWAT/HUMUS models simulate critical processes and make recommendations on needed upgrades. Model evaluations for other resource concerns and land use categories will follow model development and application.

Literature Review

As a first step, ARS and NRCS will organize a review of research literature and prepare a summary report on what is known about environmental effects of conservation practices at field and watershed scales. Initially, the ARS National Agricultural Library will prepare a set of abstracts from the published literature on environmental effects/results from USDA conservation programs from 1985 to the present for each of the five resource concerns (water quality, soil quality, water conservation, air quality, and wildlife habitat). The set will contain abstracts about studies on implementation barriers and incentives, and research needs from 1985 to the present; and data and modeling for environmental credit trading from 1993 to the present.

The summary report will establish boundaries of what science knows about this subject, and consequently establish the scientific underpinning for the national assessment. This report will also identify the gaps in scientific understanding that need to be addressed to fully quantify environmental benefits. Workshops will be held followed by publication of a synopsis of findings by resource concern. Scientists and technical experts from federal and state agencies, universities, and consulting organizations will be invited to participate in these workshops, which are being planned for 2004 and 2005.

Watershed Assessment Studies

The watershed assessment studies component of CEAP complements the national assessment by providing more in-depth assessment of water quality and other benefits at a finer scale of resolution than possible for the national assessment. An extensive body of literature exists that describes plot or field-scale conservation practices aimed at protecting water quality, and in some cases, improving soil quality or enhancing water conservation (Hapeman and others, 2003; Hatfield and others, 2001; Howell, 2001; Sharpley and others, 2003). However, research results from plot- and field-scale studies are limited in that they cannot capture complexities and interactions of conservation practices within a watershed.

There are five specific objectives for the CEAP watershed assessment studies:

1. Assess water quality, water conservation, and soil quality effects and benefits of conservation practices at the watershed scale, and begin investigations into how to quantify wildlife and air quality benefits beyond the edge of the farm field. Assessments will include estimates of uncertainties associated with achieving targeted improvements, such as water quality standards. Practice costs and cost efficiencies will also be evaluated as part of the watershed assessment. Some watersheds will address all resource concerns, while others will be focused primarily on one or two resource concerns.

2. Develop a set of regional watershed assessment models that can be used to address benefits of conservation practices and other environmental issues in major agricultural regions of the nation and for use in future watershed and national assessments.

3. Develop water quality, water conservation, and soil quality databases that can be used to evaluate effects of conservation practices, and to compile air quality and wildlife habitat data for future assessment. These databases will be used periodically to validate and enhance models used in watershed and national assessments and to validate and verify the regionalized models.

4. Develop indicators or performance measures for documenting water quality, soil quality, air quality, and aquatic and terrestrial habitat benefits associated with conservation practices.

5. Expand research on effects of conservation practices at the watershed scale for different soils, climates, topography, farming practices, cropping systems, and other land uses.

Only a few watersheds will be selected for study. No attempt will be made to aggregate estimates of benefits for watershed studies to represent national level estimates, since too many watersheds would be needed to properly represent various environmental and resource-based characteristics in the country. The objective is to select watersheds where there is on-going work (either monitoring, modeling, or both) in agricultural areas with databases and resource concerns (Hatfield and others, 2000, 2002). Funding and assistance will be provided to adapt and augment existing watershed models and databases for the specific purpose of evaluating environmental benefits associated with implementation of conservation practices.

Three categories of watershed studies will be conducted as part of the CEAP. The first set of watersheds is the ARS Benchmark Watersheds where ARS has conservation effects research projects underway. These are primarily long-term research sites where it is anticipated that watershed-scale research and assessment will be continued over many years. Most of these watersheds already have several years of water resource and soil quality monitoring data. Development of regional watershed models will be associated primarily with the ARS research watersheds. (For information on the present research being conducted on the ARS watersheds, see the Water Quality and Management National Program at www.ars.usda.gov/research/programs)

The second set of watersheds is special emphasis watersheds. These will be selected to address specific resource concerns: manure management from animal feeding operations; water use on irrigated cropland; drainage management practices; and nutrient, sediment, and pesticide loss.

The third set of watersheds will be selected through the CSREES Water Quality Initiative Competitive Grants Program. This program will sponsor a collection of case studies that will explicitly investigate the linkages among a variety of conservation and land management practices as implemented over space and time and resultant effects on water quality. The ultimate goal of the program is to understand how to optimally locate and schedule implementation of conservation practices within a watershed to achieve locally defined water quality goals. The Request for Applications (RFA) responds to the need to conduct research that evaluates interactions among conservation practices and their biophysical setting on water quality at the watershed scale.

There are seven specific questions to be addressed by these watershed studies:

1. What are the measurable effects of agricultural conservation and management practices on ground and/or surface water quality and other environmental issues at the watershed scale?

2. Within the hydrologic and geomorphic setting of a watershed, how does timing and location of a suite of conservation practices affect water quality or other environmental effects?

3. What is the appropriate time scale to expect changes in surface or ground water conditions and other environmental effects from implementing conservation practices?

4. What are the uncertainties associated with achieving these water quality and other environmental effects from conservation practices?

5. What social and economic factors within the study watershed facilitate, or impede, implementation of conservation practices?

6. What are relations among agricultural conservation and management practices implemented in a given

watershed with respect to their impact on water quality and other environmental effects? Are effects additive, multiplicative, contradictory, or independent?

7. What is the optimal collection and placement of conservation management practices in a watershed to achieve environmental goals?

Summary

The 2002 Farm Bill substantially increased funding levels for existing conservation programs and established the Conservation Security Program. The NRCS and the ARS have joined together, in collaboration with other federal agencies and universities, to initiate studies to quantify environmental benefits of conservation practices implemented through these programs. An assessment is being implemented to track environmental benefits over time at the national scale. In selected regions, watershed studies are being initiated to provide more in-depth assessments at a finer scale of resolution. This national effort will advance knowledge of how watershed scale assessments should be done and provide additional research findings and insights on the expected off-site effects of conservation practices. Annual reports documenting environmental benefits of conservation practices will be published beginning in 2006. Tracking progress of conservation programs in terms of the outcomes achieved will allow policymakers and program managers to improve effectiveness of existing programs and design new programs to increase the conservation of our nation's natural resources.

References Cited

Arnold, J.G., Srinivasan, R., Muttiah, R.S., and Williams, J.R., 1998, Large area hydrologic modeling and assessment, Part I: model development: Journal of the American Water Resources Association, v. 34, no. 1, p. 73–89.

Goebel, J.J., 1998, The National Resources Inventory and its role in U.S. agriculture, *in* Agricultural Statistics 2000: International Statistical Institute, Voorburg, The Netherlands, p. 181–192.

Goebel, J.J., and Kellogg, R.L., 2002, Using survey data and modeling to assist the development of agri-environmental policy, *in* Conference on Agricultural and Environmental Statistical Applications in Rome: National Statistical Institute of Italy, Rome, Italy, p. 695–704.

Hapeman, C.J., McConnell, L.L., Rice, C.P., Sadeghi, A.M., Schmidt, W.F., McCarty, G.W., Starr, J.L., Rice, P.J., Angier, J.T., and Harman-Fetcho, J.A., 2003, Current U.S. Department of Agriculture—Agricultural Research Service Research on understanding agrochemical fate and transport to prevent and mitigate adverse environmental impacts: Pest Management Science, v. 59, no. 6–7, p. 681–690.

Hatfield, J.L., Sauer, T.J., and Prueger, J.H., 2001, Managing soils to achieve greater water use efficiency: A review: Agronomy Journal, v. 93, no. 2, p. 271–280.

Hatfield, J.L., Bucks, D.A., and Horton, M.L., 2000, The Midwest water quality initiative: research experiences at multiple scales, *in* Steinheimer, T.R., Ross, L.J., and Spittler, T.D., eds., Agrochemical fate and movement: perspective and scale of study: American Chemical Society, Washington, D.C., p. 232–247.

Hatfield, J.L., Bucks, D.A., Albert, E.E., Dowdy, R.H., Fausey, N.R., and Schepers, J.L., 2002, Assessment of the water quality impacts of farming systems by integrating databases and simulation models–Proceedings of the National Water Quality Monitoring Council: May 20–23, 2002, Madison, Wisconsin, CD ROM.

Howell, T.A., 2001, Enhancing water use efficiency in irrigated agriculture: Agronomy Journal, v. 93, no. 2, p. 281–289.

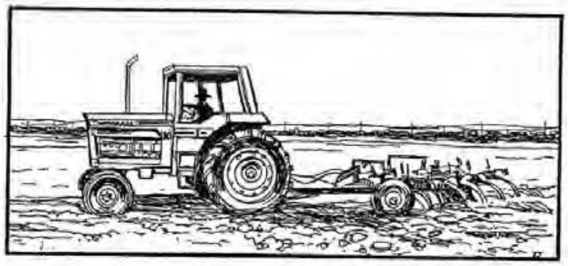
Kellogg, R.L., Maizel, M.S., and Goss, D.W., 1992, Agricultural chemical use and ground water quality: Where are the problem areas?: Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C.

Kellogg, R.L., Maizel, M., and Goss, D.W., 1994, The potential for leaching of agrichemicals used in crop production: A national perspective: Journal of Soil and Water Conservation, v. 49, no. 3, p. 294–298.

Kellogg, R.L., Nehring, R.F., Grube, A., Goss, D.W., and Plotkin, S., 2002, Environmental indicators of pesticide leaching and runoff from farm fields, *in* Ball, V.E. and Norton, G.V., eds., Agricultural productivity: Measurement and sources of growth: Boston, Massachusetts, Kluwer Academic Publishers, p. 213–256.

Sharpley, A.N., Daniel, T., Sims, T., Lemunyon, J., Stevens, R., and Parry, R., 2003, Agricultural phosphorus and eutrophication (2d ed.): U.S. Department of Agriculture, Agricultural Research Service, ARS-129, 44 p.

Williams, J.R., Jones, C.A., and Dyke, P.T., 1989, The EPIC Crop Growth Model: Transactions of American Society of Agricultural Scientists, v. 32, no. 2, p. 497–511.

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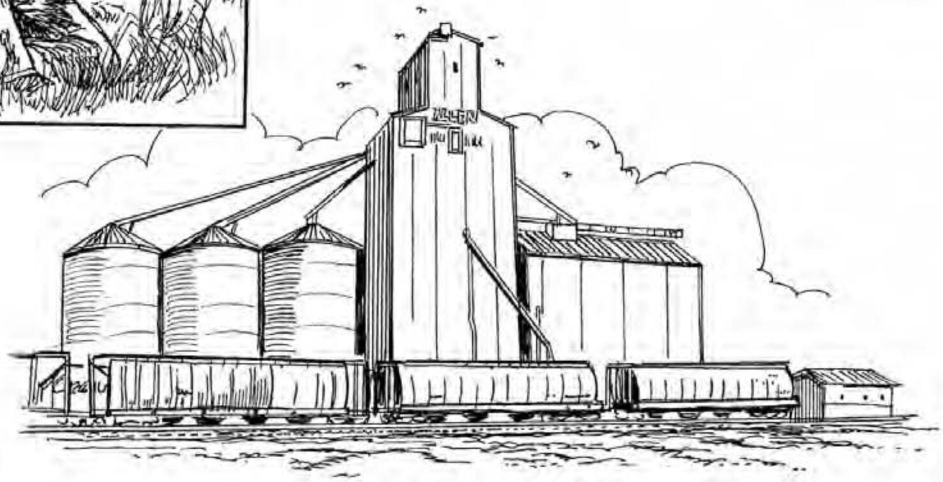

Session II. Stakeholders Look at the Conservation Reserve Program through Different Windows

Stakeholders Look at the Conservation Reserve Program Through Different Windows

Moderators: John Johnson[1] and Robert Stephenson[1]

Introduction

The Conservation Reserve Program (CRP) provides significant environmental benefits across the nation, primarily by providing wildlife habitat, improving water quality, and reducing soil erosion. The U.S. Department of Agriculture (USDA) is committed to full enrollment of CRP up to the authorized level of 39.2 million acres (15.9 million ha). To ensure continuation of CRP environmental benefits and because of significant acreage expirations beginning in 2007, USDA is planning to offer early reenrollments and extensions of existing contracts to current CRP participants.

Conservation Reserve Program contracts for more than 28.7 million acres (11.6 million ha) are scheduled to expire between September 20, 2007 and 2010. The Farm Security and Rural Investment Act of 2002 (2002 Act) authorizes CRP enrollment of up to 39.2 million acres (15.9 million ha) under 10- to 15-year rental agreements. Expected contract expirations and reenrollment or replacement of expiring acreage represent a management challenge concerning CRP environmental objectives, USDA staffing needs, and technical service provider resources.

Background

The CRP was authorized by Title XII of the Food Security Act of 1985 (1985 Act) to provide farm and ranch owners, operators, and tenants a voluntary long-term land retirement program. The 1985 Act authorized enrollment of 40 to 45 million acres (16–18 million ha). By the end of 1990, a total of 33.9 million acres (13.7 million ha) were enrolled in the CRP.

Initially, the CRP emphasized reducing soil erosion. However, the public was becoming more sensitive to other environmental issues such as water quality and environmental conditions in streams, lakes, and rivers, and the need to preserve game and non-game wildlife species. In the Food, Agriculture, Conservation, and Trade Act of 1990 (1990 Act), Congress extended the CRP enrollment period through 1995 and broadened the program's focus. The CRP's objectives expanded to include improving water quality, turning marginal pasture land into riparian areas, increasing wildlife habitat, and other environmental goals of growing importance to the American public.

From 1991 to 1995, an additional 2.5 million acres (1.0 million ha) were enrolled in the CRP, bringing the total enrollment to 36.4 million acres (14.7 million ha) in 1993. Subsequent appropriations legislation and budget reconciliations prohibited further enrollment or reduced the authorized enrollment level, effectively capping CRP enrollment at 38 million acres (15.4 million ha) through 1995.

In September 1996, the Farm Service Agency (FSA), on behalf of the Commodity Credit Corporation (CCC), initiated "continuous" signups to allow certain high-priority conservation practices that yield highly desirable environmental benefits to be offered and accepted at any time. A major advantage of continuous signup is that it allows management flexibility in implementing special conservation practices on cropland and certain marginal pasture land.

In April 1996, the Federal Agriculture Improvement and Reform Act (1996 Act) further amended the 1985 Act, confirmed the new focus, and set the maximum enrollment authority at 36.4 million acres (14.7 million ha) through 2002. Beginning with signup 15 in 1997, FSA began ranking eligible "general" signup offers using an Environmental Benefits Index (EBI) under an open competition.[2] Scores derived from the EBI are based on expected environmental improvement in soil resources, water quality, wildlife habitat, and other natural resources during the time the land is enrolled in the program. Each offer submitted by a producer is assigned a point score based on its relative environmental benefits and cost, and is compared nationally with all other offers. Offers are accepted or rejected based on the resulting ranking. This ensures the most cost-effective environmentally sensitive lands are selected for enrollment in the CRP.

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[2]An EBI was first developed for use in ranking offers in 1991 (signup 10), but EBI rank did not play a prominent role in determining offer acceptability until 1997 (signup 15).

The first CRP signup under the new EBI was conducted in March 1997, when contracts first enrolled in the mid-1980's were beginning to expire. Much of the land under these contracts was eligible to be re-offered for enrollment. This signup yielded the largest single signup contract acceptance under the program with over 16 million acres (6.5 million ha) enrolled. Approximately 11.7 million acres (4.7 million ha) of the total 16 million acres (6.5 million ha) were existing CRP land subject to expire in September 1997.

In 1997, the FSA implemented the Conservation Reserve Enhancement Program (CREP), a voluntary initiative using state, tribal, federal, and non-government funding to help solve grassroots environmental issues related to agriculture. Under CREP agreements, USDA establishes partnerships with state governments and tribal and local interests to create programs tailored for each state. The objective is to share costs and resources to address specific, high-priority local environmental problems in targeted areas.

In 2000, Congress authorized the Farmable Wetlands Pilot Program (FWP), a six-state pilot that provided for enrollment of certain wetlands and buffer acreage into the CRP. Wetlands not exceeding 5 acres (2.0 ha) in size could be enrolled if certain eligibility requirements were met. The pilot program was limited to a total of no more than 500,000 acres (202,342 ha) in Iowa, Minnesota, Montana, Nebraska, North Dakota, and South Dakota.

Also in 2000, Congress authorized the Biomass Pilot Projects. These projects allowed producers enrolled in the CRP to harvest biomass on certain CRP acreage to be used for energy production.

The 2002 Act extended the CRP to December 31, 2007, and expanded program enrollment authority from 36.4 million acres to 39.2 million acres (14.7–15.7 million ha). The 2002 Act also expanded the FWP from a six-state pilot program to a nationwide program and provided authority for managed haying and grazing, including harvesting biomass for energy production. The Act also expanded eligibility authority to include marginal pasture land to be devoted to appropriate vegetation, including trees, in or near riparian areas, or devoted to similar water quality purposes. This allowed for creation of new wetland and wildlife habitat buffer practices.

Further, the 2002 Act amendments to the 1985 Act require that cropland must be planted or considered planted for 4 of the 6 years preceding enrollment and created new eligibility criteria for conservation of ground or surface water. Refinement of eligibility standards permitted entire fields to be enrolled through the continuous CRP as buffers when more than 50% of the field is eligible for enrollment and the remainder of the field is infeasible to farm, and made land enrolled in CRP basically eligible for reenrollment.

New Continuous Signup Initiatives

Since the 2002 Act was enacted, the FSA began a number of initiatives to target important environmental issues.

Wetland Restoration in Floodplains

In 2003, FSA moved enrollment of lands for wetland restoration from the competitive general signup to the continuous signup, and provided for a 500,000 acre (202,342 ha) enrollment. Restoring wetlands enhances water quality, reduces impacts of flooding, enhances wildlife habitat, and protects and restores floodplains.

Hardwood Tree Initiative

In December 2003, the FSA created a 500,000 acre (202,342 ha) Hardwood Tree Initiative and provided a new practice, under the CRP continuous signup, to enroll bottomland hardwood trees in floodplains. This practice is designed to restore floodplains, reduce nutrient and sediment loading, enhance wildlife habitat, and restore critical ecosystems.

Isolated Wetland Restoration Initiative

A new 250,000 (101,171 ha) acre Wetland Restoration Initiative for renovation of wetlands, including playa lakes was approved. The practice, Wetland Restoration Non-Floodplain, is designed to enroll larger wetland complexes and playa lakes not addressed in the FWP or the current, pre-existing wetland restoration practice limited to acreage within the 100-year floodplain.

Northern Bobwhite Quail Habitat Initiative

A new 250,000 acre (101,171 ha) Northern Bobwhite Quail Initiative provides a new practice under the CRP continuous signup that provides habitat buffers for upland birds. Over the past 20 years, populations of northern bobwhite quail have decreased from an estimated 59 million to 20 million birds. The practice is designed to provide food and cover for quail, upland birds, and other species by furnishing early stages of vegetative succession and increasing interspersion of needed habitat resources between farmed and non-farmed lands. The practice may be applied around field edges on eligible cropland provided the cropland is suitably located and adaptable to establishment of wildlife habitat.

Addressing the Future of the Conservation Reserve Program

At the meeting in Fort Collins, Colorado on the future of CRP, discussions illustrate the currents and crosscurrents within the CRP program. At the core of this discussion is the central issue: "What is the purpose of CRP?" The 1985 Act states the purpose of CRP is conservation of water, soil, and wildlife and there must be an equitable balance of these goals. Despite this mandate, however, other, sometimes conflicting goals persist. Some consider CRP to be a soil reserve program, akin to the former Soil Bank Program of the 1950's and 1960's. Others think of the CRP as a land retirement system, a way to give the land a rest to improve future productivity of farmland. Still others view the CRP as a program with dynamic potential to resolve environmental issues on working lands through use of continuous signup practices such as filter strips and riparian buffers, the use of CREP, and new initiatives. These conflicting visions of CRP's purpose carry through to technical, policy, and programmatic decisions. They also affect the degree of satisfaction and support for the program because when expectations do not align with perceived program goals, key stakeholders become disappointed.

Experts in wildlife and conservation familiar with the programs authorized by the 2002 Act are discussing how to better balance wildlife benefits with soil and water enhancement through the EBI, the ranking criteria at the heart of this balancing act. In addition, numerous researchers call for more attention to be focused on monitoring the wildlife benefits of CRP. Case studies demonstrate that wildlife benefits accrue as a result of CRP practices, but little systematic research has been accomplished. Baseline monitoring needs to become a part of the program. Both long- and short-term monitoring demonstrate accomplishments of the CRP and help refine and focus the program to achieve maximum environmental benefits.

Economic impacts of the CRP are also being addressed. Economists and representatives of farming communities debate whether the CRP has adverse economic impacts on rural communities. Proponents of the idea that CRP reduces community productivity and undercuts demand for goods and services in small agriculture-dependent communities argue there is strong correlation between numbers of acres taken out of production and loss of rural economic vitality. Some experts reject this position, pointing to other compounding factors, such as consolidation of farms, overseas competition, or trade barriers to explain economic stress in rural communities. The experts continue to disagree, except that both sides embrace the need for further economic studies of this issue.

In May 2004, USDA's Economic Research Service (ERS) issued a legislatively mandated report, "CRP's Effect on Local Economies," which indicates that, in the aggregate, local economic impacts have been limited. The report concludes high enrollment in CRP did not have statistically significant adverse effects on population trends in farm counties across the United States. While CRP enrollment was associated with some job loss in rural counties between 1986 and 1992, the years immediately following the program's introduction, this negative relationship did not persist throughout the 1990's. Further, ERS research uncovered no statistically significant evidence that CRP participation encouraged absentee ownership or that high levels of CRP participation affected local government services or tax burdens in a systematic way.

The FSA is also working to change the way it does business to make it easier for farmers and ranchers to participate in agency programs. One of the main tools in this effort is adoption of new information technologies. Software is being developed that will allow customers and employees to harness the power of the Internet to manage their program benefits and responsibilities. With respect to implementation of CRP, FSA is part of a USDA-wide process in which standards will be developed to eliminate unnecessary complexity from a producer's online interaction with USDA. Geographic Information Systems (GIS) and other sophisticated technologies are being used to make it easier for farmers and ranchers to understand how program rules may apply to them and to their land. As an initial step, the FSA has developed new web-enabled software to process offers for general CRP signups. This software is currently for use only by FSA employees but represents a critical step in being able to deliver programs directly to potential CRP participants who use the Internet.

Entities other than USDA have a strong interest in the CRP, including nonprofit conservation and environmental groups, private landowners, and state and other federal agencies. Many voice strong concern over the need for increased funding and more staffing for technical services. Nonprofit organizations are especially interested in the potential for supporting CRP in the role of technical service providers. Beyond technical services, these entities voice eagerness to be more involved with program development and policymaking and applaud USDA efforts to reach out to nonprofit conservation and environmental groups for ideas, support, funding partnerships, and technical support for the program.

Reenrollments and Extensions

On August 4, 2004, President Bush announced USDA will offer early reenrollment and contract extensions of CRP acreage. At present, 16 million acres (6.5 million ha) under CRP contract are scheduled to expire in 2007. Another 6 million acres (2.4 million ha) follow in 2008, 4 million acres (1.6 million ha) in 2009, and 2 million acres (0.8 million ha) in 2010. Offering early reenrollments and contract extensions for these lands will help sustain environmental benefits realized from existing CRP acreage and ensure this farmland stays protected.

The public was asked to comment on how best to implement President Bush's directive for early reenrollments and contract extensions under full enrollment. The comment period ended December 8, 2004. The following issues guided the request for comments.

1. How should the CCC address the large number of expiring CRP contracts and associated acres in a manner that achieves the most environmental benefits but is administratively feasible and cost effective? What methods should be pursued to address the large acreage expiring beginning in 2007 (for example, how could CCC stagger contract expirations over several year intervals, and what criteria could CCC use to select and extend contracts)?

   The Department is committed to maintaining CRP environmental benefits by offering early reenrollments and contract extensions. The 1985 Act provides enrollment authority for 39.2 million acres (15.9 million ha) through December 31, 2007. Replacing the contracts expiring in 2007 with new, or the same, acres will require significant USDA expenditures for salaries and expenses. Extending existing contracts over time would spread workflow over several years, reducing costs rather than allowing large numbers of contracts to expire at one time.

2. What factors should be considered in determining acceptability of offers for CRP to provide an equitable balance between soil erosion, water quality, and wildlife benefits, and why?

   The 1985 Act requires that, in determining acceptability of offers for CRP, an equitable balance be provided for conservation purposes of soil erosion, water quality, and wildlife benefits. Offers and practices are accepted and contracts approved based, in part, on equal weighting of water quality, soil erosion, and wildlife environmental factors. Other environmental factors are considered in ranking offers, such as enduring benefits, the likeliness of the practice continuing past the contract expiration, and emphasis on planting native vegetation historically suited to the site. These factors were primarily considered in anticipating measures to provide the greatest environmental benefits across the nation. Cost was also considered.

3. How could the Environmental Benefits Index (EBI) be modified?

   The CCC used the EBI to rank offers nationally. The EBI for an offer is based on points given for five environmental factors plus a cost factor. The environmental factors are wildlife, water quality, erosion, enduring benefits, and air quality.

   - **Wildlife factor:** Scores expected benefits of offers on a scale of 0 to 100 points, and has three components: wildlife habitat cover, wildlife enhancement, and wildlife priority.

   - **Water quality factor:** Ranges from 0 to 100 points and also has three components: location, groundwater quality, and surface water quality.

   - **Erosion factor:** Ranges from 0 to 100 points and evaluates the potential for land under evaluation to erode as the result of wind or water. Points are based on an Erodibility Index (EI) and are awarded for the weighted average of the higher value of either the wind or water EI.

   - **Enduring benefits factor:** Ranges from 0 to 50 points and considers the likelihood of certain conservation practices remaining in place beyond the contract period.

   - **Air quality factor:** Ranges from 0 to 45 points and evaluates air quality improvements gained by reducing cropland airborne dust and particulates from wind erosion. This factor has points for the value of CRP land to provide carbon sequestration.

   - **Cost factor:** This is an evaluation of the cost of environmental benefits per dollar expended. This provides farmers and ranchers with an incentive to present cost-effective offers. The cost factor provides a weighted average to assist in considering optimizing environmental benefits per dollar for CRP rental payments.

4. How could the program be better targeted to certain practices (e.g., filter strips, riparian buffers), address geographic priorities, or some other issues of importance?

   Historically, conservation programs, including CRP, employed a variety of targeting approaches. For example, one CRP eligibility criteria is highly erodible land. This selects for enrollment based on geographic, soil, and topographical characteristics. The CRP has also used a bidding system to enroll farmers and ranchers who are willing to participate at the lowest cost, a form of cost targeting. The most complete form of targeting used in the CRP has been use of the EBI, intended to balance environmental benefits associated with enrolling a parcel of land in the program (items such as water and air quality, wildlife habitat, and soil quality among others) against costs. Future adjustments to the program could favor other priorities, including: priority for certain practices, such as use of native species; specific areas of the country, such as watersheds contributing to hypoxia in the Gulf of Mexico or the Chesapeake Bay; or economic status, such as favoring selection toward smaller family farms over larger operations.

5. If the CCC offered CRP reenrollment without competition, how could it ensure program goals are achieved in a manner maximizing environmental benefits yet remaining administratively feasible and cost effective? How could the CCC determine which contracts and acres would be most environmentally valuable to reenroll into CRP without competition through a standard EBI ranking process?

   Over 33 million acres (13 million ha) were enrolled in the CRP from 1986 to 1990. During the mid-1990's, the early contracts began to expire. Over 85% of the producers offered their land for reenrollment. These existing contracts were ranked based on the EBI, and the highest-ranked offers were selected for reenrollment. A majority of expiring contracts were reenrolled based on their relatively high ranking under the EBI. Offering reenrollment without competition could entail, for example, automatically reenrolling offers with an EBI score above a certain level, without having to compete. This would permit the Agency to spread out work flow through the year while protecting the most environmentally sensitive land.

6. In what ways, and for what purposes, could acreage be set aside to address local environmental practices or issues?

   Under CREP, States identify resources with CRP to address local environmental issues of importance to the state and nation. The CCC has reserved approximately 4 million acres (1.6 million ha) to prioritize and address State and local environmental issues under the continuous CRP enrollments, including acres eligible under CREP, the FWP, and wetland restoration, bottomland hardwoods, and other initiatives.

7. Because CCC is concerned about the supply, quality, and cost of seed and tree stock, how can the agency manage large CRP enrollments in future years to address the need to effectively establish vegetation on newly enrolled acres?

   On September 30, 2007, CRP contracts on approximately 16 million acres (6.5 million ha) will expire. Enrollment of large amounts of new land or re-seeding large portions of such a large amount of expiring land may tax the availability of existing seed and tree stock.

8. How can Geographical Information System (GIS) technology be used more effectively?

   GIS technology is being used for CRP general signups to assess and capture information for environmental benefits and to aid farmers and ranchers in understanding impacts of various offer scenarios. GIS is also utilized for program data capture and analysis through recording of program practice boundaries. It is anticipated that GIS will serve an increasingly comprehensive role in the CRP signup process.

9. How can local adverse economic impacts, if any, be mitigated?

   Landowners and farm operators have voluntarily enrolled approximately 34 million acres (13.8 million ha) of highly erodible and environmentally sensitive cropland into the CRP. In return for planting qualifying land to grasses, trees, and other protective vegetative cover, enrollees receive an annual rental payment and are reimbursed for roughly half the cost of establishing approved covers. The program provides a stable source of income to participants and producers as well as a wide range of environmental benefits but, by retiring farmland, it also reduces demand for farm inputs, marketing services, and labor. To limit the local economic impact of taking land out of production, no more than 25% of a county's cropland can normally be enrolled in the CRP without formal approval to exceed this cap. Nonetheless, critics of the program contend the CRP contributes to loss of farm-related jobs and the depopulation of nearby communities that provide agricultural and retail services.

10. What performance measures can be adopted that are most meaningful and accurately reflect the CRP's benefits, but also can be reasonably measured and evaluated?

    Consistent with the President's Management Agenda, a set of performance measures is needed to accurately measure and communicate benefits of the CRP. Environmental benefits of the CRP include improved soil, water, wildlife habitat, and air quality. Perhaps the greatest obstacle to demonstrating effectiveness of the program is complexity of environmental systems. The complexities include the lag between the adoption of conservation systems and the change in environmental quality, the need to enroll sufficient numbers of participants in a program to achieve a measurable change in environmental conditions, and difficulties in explaining how the conservation measures affect the system.

11. How could the CRP be designed to most effectively address hypoxic conditions in the Gulf of Mexico?

    Hypoxia refers to a process driven by high nutrient loads in which water does not have enough dissolved oxygen to support life, essentially creating a "dead zone." This dead zone has been an increasing problem in the Gulf of Mexico and can lead to progressively severe effects on the ecosystem. The area affected averaged 5,400 mi^2 (14,000 km^2) between 1996 and 2000, about the size of the State of New Jersey.

    A Congressionally mandated task force led by the National Oceanic and Atmospheric Administration and the Environmental Protection Agency recommended changes in agricultural practices in the Mississippi River Basin, including increased acreage devoted to CRP, to significantly reduce nutrient loading thought to be the primary cause of hypoxia. CRP could help achieve the goal of halving the area of hypoxia through enrollment of wetlands and buffers, which would reduce nutrient loading to streams and groundwater. Associated benefits include habitat for waterfowl, migratory birds, and other wildlife, flood control, safer drinking water supplies, and carbon sequestration.

The Conservation Reserve Program—Through the Farm Bureau Window: An Outline

By Don R. Parrish[1]

Support for the Conservation Reserve Program (CRP) among Farm Bureau members is generally broad. Farmers and ranchers support CRP because it provides them with:

- a stable secure source of rental income,
- an opportunity to improve soil, air, and water resources, and
- an opportunity to improve wildlife habitat.

Farmers and ranchers view the CRP from several different perspectives; they include:

- environmentally fragile land that should be taken out of production,
- strategic base of productive land – a long-term set-aside,
- as a direct competitor for limited farmland, and
- as a threat to the economic stability of an agricultural area.

Farm Bureau Policy

Supports

- limiting acreage to 25% of county cropland acres,
- maintaining base history,
- revaluating/updating of rental rates to ensure they mirror rental rates of comparable lands,
- control of noxious weeds,
- control of fire hazards and the development of a fire protection plan appropriate for the local area, and
- leasing land for hunting and fishing.

Opposes

- haying and grazing generally, but supports Secretarial discretion in case of emergencies, and
- practices that jeopardize drainage or flood control.

Overall Policy Observations

- With no significant policy changes in the program or the enrollment requirements, the Farm Bureau would anticipate the CRP cap would range somewhere between 35 and 40 million acres (14–16 million ha). The program will likely be extended "well into the future—(forever in policy years)."
- There will likely be a considerable debate over the future of Title II funding—one that supports taking land out of production (in large blocks) and another that supports more focused incentives for "working" agricultural lands. It will be interesting to see how this conflict is resolved or how the competing interests are balanced from a budget standpoint.
- We expect budget concerns to drive the "cap" debate, but we also recognize that Title I costs are inversely related to CRP acreage (not dollar-for-dollar but inversely related, nonetheless).
- We recognize that corn and wheat stocks are being drawn down globally even with normal to above normal production – therefore, we would expect higher market prices to influence the available CRP acreage.

Bigger Picture Policy Observations

- The Farm Bureau could envision a more integrated approach to CRP—a kind of landscape approach. An approach that merges what farmers and ranchers do (e.g., Conservation Security Program) with where farmers and ranchers do it (CRP).
- Long-term—we envision a more seamless approach to implementation of conservation programs (CRP, CSP, EQIP, WRP, WHIP, etc.).
- Longer-term—we could envision a more seamless approach and enhanced incentives for Title I and Title II integration and implementation.

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Perspectives of the National Grain and Feed Association

By Kendell W. Keith[1]

Introduction

It is a pleasure to have the opportunity to present the views of the National Grain and Feed Association and the North American Export Grain Association, whom we share a joint operating arrangement with, regarding the future of the Conservation Reserve Program (CRP). My educational background is in agricultural economics, and I also have considerable personal experience in observing the impacts of land idling programs directed at conserving soils, the environment, and other purposes. I grew up in Southwestern Oklahoma where my family owns land that was in the Soil Bank program of the 1950's as well as the CRP, starting in the 1980's. Long-term land idling programs have been a strong influence in that part of the country for 50 years.

We commend the U.S. Department of Agriculture (USDA) for holding this conference. With substantial CRP acreage expiring in 2007 and 2008, some forward policy thinking today could help manage a smoother transition toward whatever new directions the program takes.

Our view of the current CRP programs is that, while there are acknowledged benefits, there are also facets of the program that create negative consequences and deserve serious reconsideration. We would urge the following options be considered:

- First, we would urge the program be shifted away from enrollment of whole farms toward partial field enrollment. This approach would better address water quality issues which many believe are the most critical environmental element in U.S. agriculture's long-term economic future.

- The cap of no more than 25% of tillable acres in a county being entered in the program needs to be reconsidered. Because of inaccurate data used to set the actual numerical cap in each county, and because CRP ground often becomes concentrated in certain sections of a county, the impact on a local economy can sometimes far exceed a 25% loss in agricultural output.

- We would also urge the overall cap of the program should be revised downward. Because of many factors at work in the global economy, we believe there will be excellent opportunities to grow the U.S. agricultural economy in the next few years. We foresee the need for more acres in production to feed a growing demand. One way to accomplish that would be to change the law to allow some early outs from the CRP to gradually add to production resources, and then to reduce the acreage cap on the program.

Impact of the Conservation Reserve Program on Local Communities

One of the most surprising conclusions of a recent USDA, Economic Research Service (ERS) study on CRP impacts was that in counties having high percentages of cropland enrolled in CRP, there generally was not, on average, a long-term negative impact on jobs, the local economy, or local services, such as schools, hospitals, and local government revenues. I have not reviewed the methodology of the study in depth, but there are plenty of other investigations that draw dramatically different conclusions. The anecdotal information we have received from our members that live in some of these counties is at odds with the USDA's study findings. Intuitively, when productive farms are idled for 10–20 year periods, and the community is largely dependent on agriculture to drive economic activity, economic damage would be an obvious expected outcome. Regardless of whether you are talking about farming, a manufacturing facility or any other business, it is hard to shut down a major part of the local business economy without losing jobs and foregoing economic opportunity.

Attached to my presentation are some real-world examples of economic damage to local economies caused by high enrollment of productive whole farms in the CRP. The examples come from Oklahoma, North Dakota, Idaho, and Washington state. In Ellis County, Oklahoma land now in the CRP totals 63,000 acres (25,495 ha). Harvested cropland is only 97,000 acres (39,254 ha) suggesting the effective "cap" on CRP in that county is not 25% but nearly 40% of normal cropland acres. Since 1988 the town of Shattuck in Ellis County has lost 23 local businesses (see Attachment, III).

Harmon County, Oklahoma, where I grew up has been awarded the dubious distinction of losing population at the fastest rate of all 77 Oklahoma counties. Why? No jobs—pure and simple economics. Agriculture is the only industry in Harmon County. It also happens to be the only county in Oklahoma having no commercially recoverable oil reserves. How much of the population loss in Harmon County is being driven by CRP versus just consolidation among farmers? I do not know the answer, but total harvested crop acres in Harmon

[1]President, National Grain and Feed Association, 1250 Eye Street, NW., Suite 1003, Washington, D.C. 20005

County are only 84,000 (33,994 ha), while CRP ground totals 51,000 acres (20,639 ha), suggesting an effective CRP cap of about 38% of normal cropland acres. Go to a county in the U.S. somewhere solely dependent on a local manufacturer and ask them to sacrifice 40% of their productive capacity. Maybe you can compensate the owner of the factory to make that happen, but what happens to the rest of the population dependent on the factory remaining at reasonably high capacity? (see Attachment, IV).

A recent North Dakota study shows recreational revenues from activities related to CRP such as hunting averaged returning only 26% of lost revenues from agriculture.

Another problem with idling large tracts of land for 10–20 years is loss of rural infrastructure. The Red River Valley & Western Railroad, a regional railroad in North Dakota submitted a letter to us explaining two branch lines had been abandoned in areas having a high concentration of CRP ground. The Burlington Northern Santa Fe Railroad just announced abandonment of another 50 miles of track in North Dakota. Loss of such infrastructure means it becomes more expensive to move remaining grain to market. Rail lines, once abandoned, are rarely rebuilt. For those who think that idling large tracts of productive farmland for extended periods is good policy, I suggest you go out and interview businessmen with investments in production agriculture support industries. Those who invest in agricultural marketing and input infrastructure do not just keep blindly pouring money into maintaining that infrastructure, based upon a hope someone someday will eventually decide to forego the government's land idling payments and start actively farming the land again (see Attachment, V).

We received a letter recently from the Co-op manager in Moscow, Idaho telling us he was not going to renew his membership in our Association. That company is about to be merged with another cooperative. The manager writes, "USDA's CRP is a major reason for the downfall of our company. Over 45,000 acres (18,211 ha) in our service area are now in CRP" (see Attachment, VI).

The elevator manager from Lind, in Adams County, Washington, says that about one-third of the acres in his marketing area are out of production, much due to the CRP. In Lind, Washington, the population has dropped nearly 30%. School enrollment has dropped 40%. The town lost two farm equipment dealerships, a bank, an insurance broker, and a hardware store. In a neighboring town in the same county, the school has half the enrollment it had 12 years ago. The elevator manager there, Randy Roth, asked me to extend a personal invitation to anyone, including those who conducted the USDA's Economic Research Report, to visit that area to see first person what CRP has done to their way of life. To be sure, some of the "environmental damage" of CRP that does not appear in the researchers' formal analysis is the reduced quality of life for those that do remain in local communities where large numbers of houses are just abandoned, store fronts are boarded up and local infrastructure falls into disrepair (see Attachment, II).

Impact of the Conservation Reserve Program on Tenant Farmers

At a recent Washington, D.C. farm policy conference, ERS economists noted current farm programs—including all types of farm programs—were having the unintended consequences of artificially inflating land values and creating benefits that largely flow to land owners rather than farm operators.

In this respect, the CRP has the same shortcomings as all other farm programs. However, the CRP is more pernicious for tenant farmers than any other farm program, because it not only benefits solely the landowner, but also increases economic pressures on tenant farmers. While CRP rental rates are intended to reflect local market conditions, the program puts the U.S. government into active competition with tenant farmers bidding for the use rights to land. For farmers trying to put together an economic-sized farming unit, this may make available rental land more scarce and expensive. The National Farmers Organization in 2001 noted this in testimony stating, "CRP is widely utilized by retiring farmers and investors as an income source that artificially inflates land rental costs and discourages retired farmers from renting land to beginning farmers for a 10-year period."

A former president of the American Soybean Association has noted in the past the CRP added as much as 75 cents per bushel to the average cost of growing soybeans in some areas where enrollment is high. When we are trying to compete against aggressive growing agricultural economies, such as those in South America, we do not need our policies to be inflating production costs for U.S. farmers who rent a large portion of the land they are planting.

The Overall Market Impacts of the Conservation Reserve Program

The United States has used acreage idling programs since the 1930's in an attempt to raise prices. When the U.S. held a more dominant position in global agriculture, the U.S. could temporarily raise prices by shorting the market with heavy resource idling programs. But in the last 25 years, because of expanded global competition and the decline of U.S. domination in production (which to some degree has been self-inflicted), unilaterally trying to raise prices through idling schemes is futile. In a recent policy conference, two noted ERS economists, Edwin Young and Paul Westcott, stated one of the major lessons learned over seven decades of farm policy is that "supply controls are unworkable." It has become abundantly clear that in an open world economy, what the U.S. does not plant on productive U.S. soils will be planted elsewhere, Europe, Canada, South America, Australia, India, the Ukraine, etc.

Not only does acreage idling no longer have a lasting price impact in the U.S. or anywhere else around the globe, because it forces the agricultural economy to spread fixed costs over fewer acres, it raises the average production cost per unit. Idling schemes thus inhibit the U.S.'s global competitive position in two significant ways—bidding up land costs and increasing average production costs by reducing total units of output over which fixed costs can be spread.

The major commodity most affected by CRP buyout of whole, productive farms has been wheat. A majority of the CRP ground has been concentrated in wheat states. The result is we have struggled at times in the U.S. to grow adequate quantities of certain classes of wheat for our own domestic mills. Predictably, wheat imports into the U.S. have accelerated over the life of the CRP.

Capturing the Growth Opportunities in U.S. Agriculture

We are entering a period in U.S. and global agriculture having many similarities with the early 1990's when global food markets experienced dynamic growth from expanding economies and improved diets. During that period, global food production truly struggled to keep pace with the growth in demand, and we may again face similar market conditions.

Global meat and poultry demand is growing at 2.5% annually (fig. 1). Export markets for beef, pork, and poultry have been one of the most dynamic growth markets in the last 15 years. Given the U.S.'s continued strong production of feed grains, we have the comparative advantage to grow this export business more, provided we have the grain and protein supplies to fuel that growth.

Soybean production has been expanding at a rapid pace around the globe as well (fig. 2). The Chinese economy growing at an 8–10% annual rate across multiple years coupled with a decline in agricultural production in that country is a big reason for the growth spurt in soybean products. And the future Chinese demand is not limited to oilseeds, as two recent ERS reports on future Chinese wheat and corn markets project that country will remain a net importer of both of those important grains. The fact the U.S. dollar is declining and remains under pressure to assist in rebalancing global trade flows suggests the U.S.'s competitive position may also be enhanced by currency markets.

Fuel ethanol production in the U.S. is projected to absorb increasing quantities of corn. Of course, some of that industrial demand will be determined by tax and other government incentives and future legislation, but if crude oil markets stay firm near the levels they are today (in the $40 per barrel range) we will no doubt maximize output from existing ethanol facilities, and very likely give further investment incentives to build even more capacity. Again, the growth potential will depend on whether we have the grain production capacity to facilitate growth. The potential for growth in U.S. and world markets is there, but the real question is whether the U.S. will have the resources to participate in that growth? A current assessment of the supply and demand situation suggests we will have to stretch our resources to grow with the market.

Table 1 displays USDA ending stock estimates for the 2004–2005 marketing year at two different times. The left-hand column presents the estimate provided in the February baseline report. Ending corn stocks were forecast at 1.289 billion bushels, wheat stocks at 735 million bushels and soybeans at a snug 186 million bushels. We have known for some time the soybean market would test our market rationing skills in the U.S. this year and next. The May USDA WASDE report forecast ending corn stocks to be down to 741 million bushels and wheat down to 499 million bushels. Thus, projected supplies in the grains are shrinking rather quickly. Projected soybean stocks remain about the same, largely because as a practical matter, they cannot get much lower to maintain pipeline supplies.

While this supply situation may not look too dire to some observers, if you dig a little into the numbers, the picture

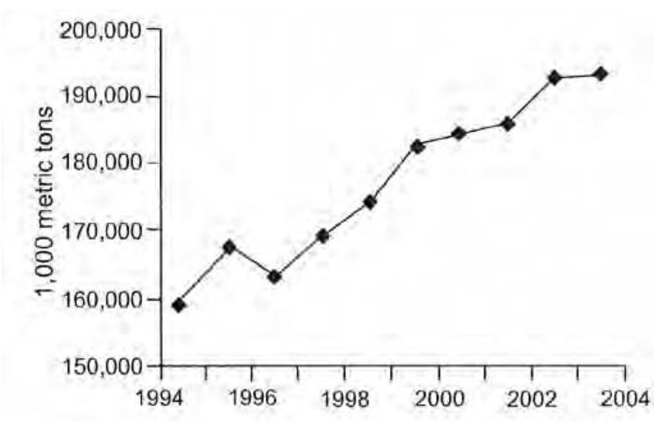

Figure 1. Global meat consumption.

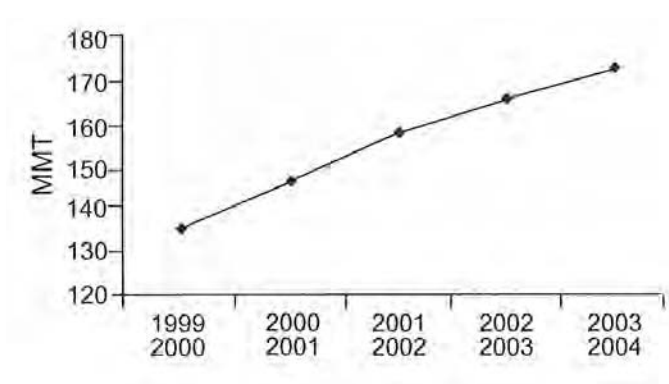

Figure 2. World soybean crush.

Table 1. Ending stocks estimates for the 2004–2005 marketing year.

	2004–2005 USDA baseline (February 2004)	USDA/WASDE (May 2004)
Corn ending stocks	1,289	741
Wheat ending stocks	735	499
Soybeans ending stocks	186	190

Table 2. Ending stocks estimates presented in Table 1 based on data from 5-year average, 1999–2003.

	2004–2005 USDA baseline (February 2004)	USDA/WASDE (May 2004)	Assume crop average yield 1999–2003
Corn ending stocks	1,289	741	224
Wheat ending stocks	735	499	476
Soybeans ending stocks	186	190	48

becomes more concerning. The USDA corn estimate assumes a record yield. It is not that a record cannot happen, but that would be two record corn yields back-to-back, and recent floods in Iowa will not help make that happen. The soybean yield assumption behind these numbers is for a near-record 40 bushels per acre. Again, this is possible, but we have only one year where soybeans exceeded 40 bushels per acre (100 bushels/ha). Soybean yields appear very flat in the last 5 years in the U.S., even assuming that last year's poor yields are thrown out of the mix. Figure 3 compares corn and soybean actual yields and the USDA May projection for 2004 crops.

So what happens if soy and corn yields fail to trend upward as USDA predicts in its May report? Going back to the ending stocks estimates, table 2 adds another column to the data shown in table 1 with some yield assumptions changed. Without any adjustment in expected demand levels for corn, wheat, and soybeans, if these major crops only achieve yields at the 5-year average, and this includes throwing out the single-worst years for corn and soybeans that were substantially below trend, we are looking at ending stock numbers like these: corn at 224 million bushels, wheat at 476 million bushels, and soybeans at 48 million bushels. These numbers for corn and soybeans, of course, are below pipeline quantities, and in reality cannot occur. What that means is anything below virtual peak yields and we are into another heavy rationing process. Tight market rationing does not grow demand. It will restrict the U.S.'s ability to participate in demand growth, and encourage our competitors to pick up the slack.

We can play with the yield and acreage numbers and come up with various conclusions, but under the circumstances we face, I submit that it is much easier to conclude we are in a tight market for grains and oilseeds for next year, and potentially several years in the future, unless fundamentals shift considerably.

How is this outlook being reflected in land markets? Cash rents are escalating, and rapidly in some areas. The difference in average cash rents for non-irrigated acreage and rent being paid for the average CRP acres is presented in fig. 4. While averages reflect only a $6 spread, the spread has grown to $40–$50 in some locations where highly productive acres have been idled. Clearly, the market for rented farm ground is telling us more land is needed in active cultivation.

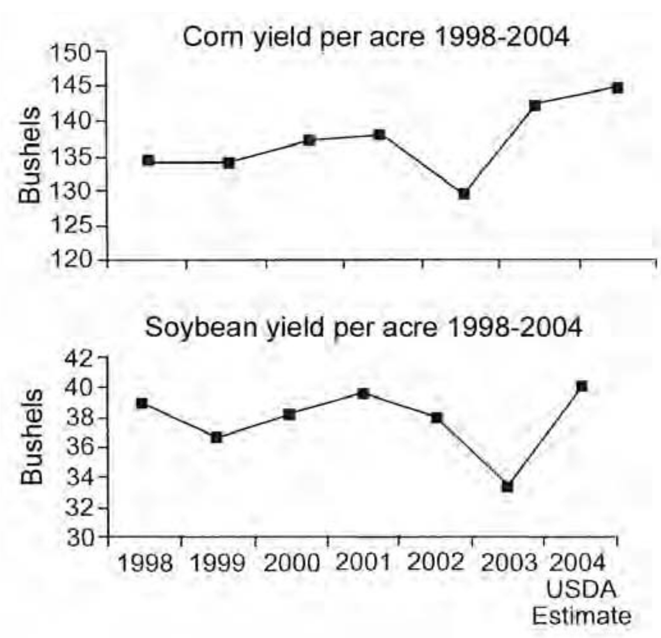

Figure 3. Corn and soybean yields and USDA 2004 crop projections.

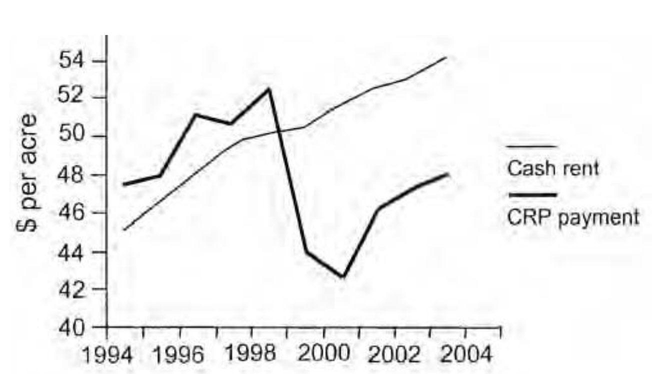

Figure 4. National cash rent versus Conservation Reserve Program rent.

Conclusion

The evidence is compelling that the optimal structure for the CRP program is not simply an extension of the existing program. A substantial move away from enrollment of whole productive fields is needed for several reasons:

- There is a need to focus more of CRP resources on soil conservation and water quality. Deteriorating water quality is one of the most significant long-term challenges to a prosperous U.S. agriculture.

- Fewer whole farms enrolled in the program will lessen economic pressures on farmer tenants, and allow them to have more flexibility in correctly sizing their operation to be competitive with both U.S. and international farmers. As tenant farmers make up 70% of all U.S. production today, the economic structure of tenant farmers' business will do much to determine whether the U.S. can remain competitive.

- Reducing the current CRP cap and allowing some of the whole farm tracts to be bid back into active production will allow the U.S. to respond to today's growing demand. To allow a smoother transition over more than 2 years, we think it would make sense to ease some of the acres back into production prior to the mass expiration of program acres in 2007 and 2008.

- Conservation needs to be a priority going into the future, but there are other ways of accomplishing conservation without idling resources that can contribute to higher income and economic performance.

In the interest of supporting local rural communities, we would also urge Congress to revisit the rule that no more than 25% of available land in a county be enrolled in the program. Because of measurement error or other mistakes in policy implementation, the effective acreage cap is much higher than 25% in a number of counties. While the number of counties in the U.S. that rely heavily on a production agriculture economy has been reduced in the last two decades, there are rural communities that remain highly dependent on an active agricultural sector. In a recent policy conference, one USDA economist defined a county dependent on agriculture as one with a "lack of success in all other business enterprises." The way we shape policy needs to reflect this reality where it exists. Our policies need to be chosen very carefully so we do not take away the lifeblood of communities that are still closely tied to production agriculture.

Attachment. Examples of Local Economic Impacts of the Conservation Reserve Program

I. Letter from Grain Merchandiser in Lind, Washington

May 25, 2004
Kendell W. Keith, President
National Grain & Feed Association
kkeith@ngfa.org

Dear Kendell:

Concerning the impact that the CRP Program has had on local economies: All any person would have to do is drive around Lind, Washington for 10 minutes to see the detrimental impact that CRP can have on a community. Half the stores in downtown are closed. A significant number of houses are abandoned. In the immediate vicinity it looks like half the farm ground is idle. Our grain elevator at the Main Office in Lind does not come close to filling up at harvest. We have to truck wheat in from other stations to utilize the storage capacity.

In truth about 200,000 acres in our service area are in CRP. Since it most likely would be dryland summer fallow that amounts to 100,000 acres per year of lost production. At 40 bushels per acre that totals 4,000,000 bushels. 4,000,000 bu that is not harvested, not stored, not fertilized and not farmed. The farm families needed to farm the 4,000,000 bushels are gone. The people needed to service the equipment are gone. The people needed to handle and market the grain are gone.

As a result of the loss of population, the non-agricultural businesses also are impacted. That's why half of downtown is gone. That's why the businesses that remain are struggling. That's why the local schools have lost 40% of their enrollment and have to partner up with neighboring schools so students can participate in after school activities. That's why the crime rate is higher. And that's why the quality of life is worse.

Sincerely,
Pearson Burke
Grain Merchandiser
Union Elevator & Warehouse Co.

II. Letter from Grain Elevator Manager in Lind, Washington

Dear Kendell:

I believe that our area would be a good example of how devastating the CRP has been to our rural economy.

Our service area covers most of Adams County in Washington State. Although Adams County has 25% of its acreage in CRP, closer to 1/3 of the acres in our service area are now out of production. Adams County has the most acres of any county in the nation in CRP, over 200,000. Within our service area are two small farm communities. If we look at the changes that have taken place in just the last 10 years since the full effect of CRP has taken hold, it is obvious that CRP has literally destroyed both of these communities. In Lind, where our office is located, the population of the town has dropped nearly 30%. School enrollment has dropped 40%. Businesses that have closed include one of the two farm equipment dealerships, the drugstore, a tavern, a bank, an insurance office, and a hardware store with the remaining one in the process of a close-out sale. Those few businesses still operating are, without exceptions, barely hanging on. In Washtucna, where we have a grain receiving station, the main street, which once was home to a grocery store, drug store, hardware store, and a barbershop is completely empty! The school has 1/2 of the enrollment it had just a dozen years ago. It is our believe that CRP is the only reason that these communities have seen such a total downward spiral. Less acres to farm means less equipment to sell, less money circulating to purchase goods locally, less people to support not only the local economy but to contribute to local programs and activities that are the lifeblood of small communities. What CRP has done to these small towns should not be a surprise to anyone. It was predicted by many once it was known that whole farms would be eligible for CRP enrollment. Our company lost 1/3 of our customers after the first few rounds of CRP enrollment in the early 90's. Our survival has been dependent on enlarging our service area into the irrigated farmland, storing grain for the CCC, and by reducing expenses in any way possible without comprising customer service. The double whammy of losing customers due to CRP and loss of grain storage income because of CCC's liquidation of some of their stocks is not what we would consider equitable and responsible policies from our government. Our own government has done more to hurt rural economies and small town existence than anything else anyone could imagine. We would invite anyone, including those who conducted the USDA's Economic Research Report, to visit our area to see first person what CRP has done to our way of life. Our communities will never recover from the damage done by CRP. To conclude that CRP has not had a long-term impact on jobs, the local economy and local services is not only ludicrous, it puts the validity of the entire report by the USDA's Economic Research Service in question. It would be interesting to know if any of the people conducting this study actually visited any of the areas with the highest CRP acres in person.

Randy Roth
Manager
Union Elevator and Warehouse Co.
Lind, Washington

(**Note:** Adams County, Washington has 215,000 acres in the CRP. Total harvested cropland is 413,000 (1997 Census of Ag. Total cropland is 808,000.)

III. Information on CRP Program in Ellis County, Oklahoma

In Ellis County, Oklahoma, 63,000 acres are enrolled in the CRP. Current plantings of crops in Ellis County is 97,386 acres. Total cropland (Census of Ag, 1997) is 193,836. Since 1988 Ellis County has lost 23 local businesses, mostly in the town of Shattuck.

IV. Information on CRP Program in Harmon County, Oklahoma

(From Altus, Oklahoma Paper: "Harmon County Population Loss Leads Oklahoma"

"The Hollis High School choir no longer sings, and the driver's education program has hit a dead end. The retiring elementary school principal was not replaced.

"The schools in Harmon County just don't have enough students to support those programs anymore. The district's cuts illustrate what happens in rural counties as their population dwindles. ….

"Harmon County lost people at a faster rate than any other Oklahoma county between July 2002 and July 2003, the U.S. Census Bureau said Thursday in releasing its latest population estimates…..

"It's part of a nationwide trend of people moving from rural to urban areas," said Amy Polonchek, director of research and policy at the Oklahoma Department of Commerce……

"There's no jobs, whatsoever," Smith said. "That's pure and simple economics. They go to the larger towns where there are more opportunities."

(**Note:** Total CRP contract acres in Harmon County: 51,000 acres. Total harvested cropland in the county: 84,000 acres.)

V. Letter from Co-operative Elevator Manager in Moscow, Idaho

January 20, 2004
(to) National Grain and Feed Association (NGFA)
attn: Randy Gordon

Dear Randy:

The purpose of this letter is to notify NGFA that we will no longer be able to be a member (of the Association) starting in 2004. As I told you in my letter last February, the economic situation with our Company continues to erode. The Board of Directors and I are working toward a merger or sale of the Company within this calendar year. Most likely, it will be a merger with another cooperative.

The $600 minimum dues bill is not a "make or break" expense on its own. But, I am under the directive of the Board of Directors to make sweeping reductions across the board. NGFA has, and will continue to, provide value to the grain industry. I have no doubt about that. This cancellation is not based on the value the Association provides.

USDA's CRP program is a major reason for the downfall of our Company. Over 45,000 acres in our service area is now in CRP and probably will be for the foreseeable future. The impact to our Company as a result of this program is approximately

$600,000 annually in lost income. A mini-drought in 2002 and a major drought in 2003 reduced our income on the acres that are still in production. The winter wheat looks really good at this time, and with decent spring and early summer weather, maybe we will do better this year. That remains to be seen.

In closing I want to tell you that I have appreciated the work you and others in the NGFA have done for all of us over the years. I wish the Association good fortune in the future. Please share this letter with Kendell and Todd. Thank you!

Sincerely yours,
Dave Strong
Manager
Latah County Grain Growers, Inc.
Moscow, Idaho

VI. Letter from Red River Valley and Western Railroad Company

May 25, 2004

Dear Mr. Keith:

The Red River Valley & Western Railroad Company (RRV&W) is a 500-mile short line Railroad headquartered in Wahpeton, North Dakota. Our small railroad provides rail service to approximately 60 customers in some of the most rural and agricultural regions of North Dakota. Many of these rural areas have high concentrations of agricultural lands enrolled in the Conservation Reserve Program. These rural areas have lost their rail service due in part to the removal of large volumes of grain from the grain marketing system. Two branch lines have been abandoned in central North Dakota, right in the midst of some of the highest concentrations of CRP in North Dakota. While many factors have undoubtedly contributed to abandonment of these branch lines, loss of these grain volumes is a significant contributor.

Many businesses and the jobs they support are dependent on the volumes of grain produced and moved through the marketing chain. With the advent of the CRP program, and especially in areas with higher proportions of participant acres, the jobs formerly generated by the seed dealers, fertilizer dealers, grain elevators, and other businesses are lost.

The Red River Valley & Western Railroad supports the position of the National Grain and Feed Association in reducing the number of acres in the CRP program through early exit, and an overall change in the use of the CRP program to concentrate on the most environmentally sensitive areas. The RRV&W asks that this be a part of the record with NGFA's presentation before the USDA.

Sincerely,

Dan Zink
Red River Valley & Western Railroad Company

Perspectives of the National Cattlemen's Beef Association

By Terry Fankhauser[1]

Introduction

The Conservation Reserve Program (CRP) is valuable in serving the purpose of reducing soil erosion, protecting water quality, and enhancing habitat for wildlife, but if this program is not managed correctly, it could negatively affect local economies and entire regional ecosystems.

Recommendations for Conservation Reserve Program Policy

WHEREAS, the CRP is mandated to utilize a conservation cover crop, and

WHEREAS, CRP conservation cover crops can be utilized as emergency forage, and

WHEREAS, the CRP can be utilized as part of a maintenance or management plan,

THEREFORE BE IT RESOLVED that the National Cattlemen's Beef Association (NCBA) is opposed to haying and grazing on lands enrolled in the CRP program, except under the following conditions:

- In the case of drought or other emergency situation declared by the Secretary of Agriculture or,
- In the case of incidental grazing in conjunction with grazing contiguous crop residue or stubble on lands enrolled in continuous signup CRP or Conservation Reserve Enhancement Program (CREP) or,
- In the case of a Natural Resource Conservation Service (NRCS) or Farm Service Agency (FSA) determination that maintenance or management is required on lands enrolled in CRP to maintain plant health and proper resource management.

BE IT FURTHER RESOLVED that in all instances of grazing on lands enrolled in CRP, continuous signup CRP, or CREP, the NCBA believes the rental payment should be reduced by the value of the forage grazed.

BE IT FURTHER RESOLVED that managed grazing on CRP lands should be permitted during the primary nesting and brood rearing season where State Technical Advisory Committees recommend such use under an approved plan.

BE IT FURTHER RESOLVED that the exceptions in this policy should not be construed as, or considered part of, a routine grazing plan.

Whole Farm Enrollment

The CRP should be amended to make it a priority to keep working lands in production. When an entire farm is enrolled in the CRP, agricultural use is lost for the term of the contract. Greater emphasis should be placed on enrolling buffers and only portions of farms, thus substantially limiting whole farm enrollment. NCBA's members believe this to be the proper course for the CRP, as it was not designed as a "set aside" program for entire farms. Rather, we believe the CRP is best designed and used as a means to improve the natural resources of working farms and to decrease overuse of lands not suited to farming. To this end, for NCBA to support expanding the CRP enrollment acreage, discussions must occur that emphasize keeping productive lands working with a strong move to reducing whole farm enrollment in the program.

Haying and Grazing

The NCBA's policy only supports haying and grazing in the case of drought or other emergency situation declared by the Secretary of Agriculture or in the case of incidental grazing in conjunction with grazing contiguous crop residue or stubble on lands enrolled in continuous signup CRP or Conservation Reserve Enhancement Program (CREP). The NCBA also suggests haying or grazing where the NRCS or FSA determines maintenance or management is required on land enrolled in CRP to maintain plant health and proper resource management. In every instance of haying or grazing allowance, however, programmatic payments must be decreased by the value of the forage harvested.

Annual Use

Discussion continues to ensue in the agricultural industry of allowing a portion of producers' CRP acres to be grazed annually. If the CRP were to evolve in this direction, a number

[1]Representing Colorado Cattlemen's Association, 8833 Ralston Road, Arvada, CO 80002

of issues must be addressed. The CRP was not designed, nor intended, to become a subsidized grazing program. If such an amendment were developed, how would it be managed? Would grazing be limited to a percent of the total enrolled acres per year or a percent of the total forage production of the enrolled acres per year? In the first instance, an individual could rotationally graze a portion of his/her enrolled acres each year, thus supporting a livestock herd that might not have existed prior to enrollment in the CRP. In the beef industry, our markets, like many other agriculture industry markets, are fragile. Introducing a potentially large number of or lower production costs could have a negative impact on the existing beef industry. How would the CRP be managed in recognition of these potentially negative factors and the overriding conservation goals of the program?

Grassland Maintenance

While the NCBA does not support grazing of CRP lands as part of a continuous program, we do support haying and grazing to maintain plant health and proper resource management when determined by the NRCS or FSA. Properly maintaining CRP lands must be required at a higher level into the future. Problems presently exist as a consequence of noxious weed and non-native species invasion, not to mention proper growth control of desired species. Management is often very costly and in many instances could be accomplished through prescriptive grazing and haying. These two practices have proven very effective and efficient for generations on both private and public lands.

Of a final note, the NCBA does support haying and grazing, through disaster designation and for prescriptive management, during the primary nesting seasons. We support this management alternative with the guidance of State Technical Committees when developing management plans that do not impact nesting species.

Drought and Other Emergency Use

Lands enrolled in the CRP have proven to be of great value during a disaster declaration due to drought. By allowing emergency use of these lands, many livestock producers are able to stay in business. While the program is not meant to act as a grass bank, this needed, incidental use has been invaluable. The NCBA supports continued authorized emergency use of CRP lands for this reason at the designation of the Secretary of Agriculture through state advisement. Of course, the organization's members continue to support payment reductions when CRP lands are used for disaster reasons.

Economies and Demographics

The NCBA asks consideration be given to how over 35 million acres (over 14 million ha) of CRP lands have affected local economies and demographics across entire ecosystems. If you were to talk to producers from the east and southeast, they might tell you the majority of their productive lands are now tree plantations. How has this impacted their regions and local communities? Many of the businesses dependent on the agricultural industry have ceased to exist. Wildlife populations have shifted in numbers to match habitat. The same is true with mid-west and western lands. In some cases in the west, wildlife species do not utilize CRP lands but inhabit lands that provide them a more desirable food source furnished by cropland.

Conclusion

The NCBA believes the impact, good and bad, of the CRP should be strongly analyzed before expanding acreage is considered. The goal of the CRP is to keep good, well-suited working lands in production and to provide for conservation of species and natural resources. It is the conclusion of the NCBA this balance must be maintained.

The Future of the Conservation Reserve Program: A Soil and Water Conservation Society Perspective

By Craig Cox[1] and Max Schnepf [2]

Introduction

From a budgetary point of view, the Conservation Reserve Program (CRP), now approaching 20 years of age, is the largest conservation program within the U.S. Department of Agriculture (USDA). Over its two-decade span, the CRP has retired something on the order of 30 million to 35 million acres (12 to 14 million ha) of cropland from production a year and put $1.5 billion or more a year into the pocketbooks of agricultural producers. The program has also produced substantial environmental benefits, which, according to some research, could be valued at several billion dollars a year. These benefits include soil erosion control, water conservation, air and water quality improvement, fish and wildlife habitat enhancement, and conservation of biodiversity.

At the outset, CRP was a multi-objective program. While labeled a conservation program, there were clear intentions to restrain commodity supplies and enhance farm income as well. The conservation objective, or objectives, of the program were initially viewed in a particularly narrow sense—largely soil conservation on highly erodible land.

Farm Bills enacted in 1990, 1996, and 2002 gave the program a much more proprietary focus on conservation and substantially broadened the conservation objectives of CRP. Today, soil, water, and fish and wildlife conservation are co-equal objectives of the program.

The Soil and Water Conservation Society Record

The Soil and Water Conservation Society (SWCS) has accumulated a notable track record in assessing conservation performance of the CRP. Late in 1988, SWCS organized a national Farm Bill conference to assess implementation of conservation provisions in the 1985 Farm Bill, including the CRP. Much of the material presented at that conference was later published in SWCS's Journal of Soil and Water Conservation.

Just months later, SWCS, in cooperation with USDA agencies and several nongovernmental organizations, initiated a field-based evaluation of the 1985 Farm Bill conservation provisions. Once again, the CRP was included. A series of reports based on that work was published by SWCS between 1990 and 1992.

At the request of USDA, two national mail surveys of CRP contract-holders were conducted by SWCS, in 1991–1992 and 1993–1994. The latter involved nearly 20,000 contract-holders nationwide. The primary objective of both surveys was to determine what use might be made of CRP acres once contracts covering those acres expired. Reports were constructed around the findings of both surveys. In the case of the second, more extensive survey, USDA's Economic Research Service assisted with analysis of responses and preparation of the final report. This survey work was followed in 1994 by an SWCS-organized national conference aimed specifically at discussing what policy options might be appropriate once the first CRP contracts began to expire.

The SWCS also organized a national Farm Bill conference in 1993, with much the same objective as the 1988 conference, and in 1995, just prior to debate on what became the 1996 Farm Bill. In addition, three symposia were held in Washington, D.C., on how the Farm Bill might be used to achieve soil erosion control, water quality improvement, and fish and wildlife conservation objectives. Each of these activities addressed, in part, the contributions of the CRP to these objectives. Coupled with two unique sets of regional conservation forums and workshops conducted prior to the 1996 and 2002 Farm Bill debates, these activities gave SWCS a unique perspective from which to discuss the future of the CRP.

Current Day Realities

In SWCS's view, the future of the CRP is now threatened by five important realities:

1. *The federal budget deficit.* The rising federal budget deficit will almost certainly demand reductions in annual spending, including, in all likelihood, conservation program spending. This may not bode well for the CRP, given the ongoing tension between spending for conservation programs and spending for agricultural

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price support programs. Any attempt to maintain significant authorizations for the latter could come at the expense of conservation programs, including the CRP.

2. *World grain stocks.* Worldwide stocks of most food and feed grains are at near record lows, and commodity prices, as a result, are high. Further, weather abnormalities in major grain producing regions, with accompanying low production, could result in considerable pressure to put some CRP acres back into crop production. Such was the case in 1995 when considerable discussion revolved around the world grain stocks situation and the extent to which putting CRP acres back into production might help alleviate the situation.

3. *Perceived impacts of land retirement on local economies.* A political backlash resulting from perceived negative impacts of agricultural land retirement on local economies has developed in some areas of the country where CRP participation has reached significant levels. The contention is that such land retirement has forced agricultural suppliers, grain elevators, and related retail firms out of business, with a ripple effect on broader local and regional economies. Some state and local policymakers as a result have called on Congress and/or USDA to limit CRP enrollments below what they have traditionally been in certain parts of the country.

4. *The CRP remains relatively inaccessible to producers in certain regions of the country.* For all intents and purposes, CRP has been, and remains, a Great Plains-centered program. Nearly half of all CRP acres and rental payments go to landowners and tenants in five Great Plains and Corn Belt states. The program historically has had little appeal to farmers in the Northeast and in West Coast states, largely because of the relatively low rental rate payments in these parts of the country.

5. *Many taxpayers are passive toward the program.* In recent years the conservation program "buzz" has centered around such relatively new programs as the Environmental Quality Incentives Program (EQIP), the Grassland Reserve Program (GRP) and the Conservation Security Program (CSP). Many people take the 20-year-old CRP for granted, or at least they do not talk or think much about the program anymore.

What Role for the Conservation Reserve Program?

In a recent report, SWCS recommended assessing how USDA has implemented conservation provisions of the 2002 Farm Bill and urged USDA to create what SWCS termed a more balanced conservation program portfolio. This program portfolio would, in SWCS's view, integrate existing conservation programs better and serve the Nation's agricultural producers, taxpayers, and the environment more effectively and efficiently. This more balanced portfolio of conservation programs would consist of three major elements:

- *CSP:* Written by Congress as an entitlement program, this would serve as the base conservation program nationwide—available to every farmer and rancher at every location across the country.

- *EQIP:* As the Nation's major conservation cost-share program, it would focus first and foremost on place-based conservation needs.

- *CRP:* The CRP and other land retirement programs, such as the Wetlands Reserve Program (WRP) and GRP, would serve to protect and restore environmentally fragile areas and critical wildlife habitats.

Improvements in the Conservation Reserve Program

To perpetuate CRP as the component of USDA's portfolio of conservation programs designed to restore and/or protect environmentally fragile areas and critical habitats, policymakers and USDA program administrators should, in SWCS's view, consider four actions:

1. Some degree of permanence must be built into the program via longer-term contracts or easements. A greater degree of permanence would reduce the annual cost of the program, allow additional acres to enter the program, and produce greater economic and environmental returns to taxpayers. There are many different ways to achieve this end, of course. A variable rental rate or easement payment could be applied, depending on the length of time a producer might be willing to reenroll his or her land. There could be consequences for those producers unwilling to reenroll their land at the prescribed rates or times; for example, a prohibition on program participation for "x" number of years.

2. The overall conservation objectives of the CRP might be reconsidered and some "division of labor" ascribed to its soil, water, and fish and wildlife objectives. For example, the general CRP could focus first and foremost on restoration of critical terrestrial habitats on a large scale, while soil and water conservation could become the primary focus of the continuous CRP signup (CCRP), perhaps with some added emphasis on aquatic resources—riparian restoration and protection.

3. The CCRP [including the Conservation Reserve Enhancement Program (CREP) and the Farmable

Wetlands Program (FWP)] requires fine-tuning and simplification to realize its full potential. Following are the key refinements needed:

a. All agricultural land should be made eligible for the CCRP.

b. USDA should establish a significant acreage holdback for the CCRP—5 million acres (2 million ha) at a minimum for conservation buffers and a substantially larger holdback if a nationwide riparian protection and restoration initiative were undertaken. Additional holdback for riparian protection and restoration could come in large part by raising the program's acreage cap to something on the order of 40 million to 45 million acres (16 to 18 million ha) to avoid competition with whole-field, whole-farm enrollments under the general CRP needed to protect/restore environmentally fragile areas and critical habitats.

c. All buffers should earn the same financial incentives. Currently, some buffer practices earn variable incentives and other buffer practices earn no incentives. This hinders understanding of the program among producers and complicates administration by USDA personnel.

d. Haying/grazing should be allowed under an approved conservation management plan to maintain buffer functionality. It makes little sense to continue the prohibition on haying and grazing of buffers when such management can be so critical to their environmental performance over time.

e. USDA should offer financial incentives, or bonuses, to groups of producers willing to act collectively to install buffers on watershed or other landscape scales. These financial incentives should be offered for riparian forest buffers and filter strips at a minimum. This is essential if CCRP specifically and USDA programs generally are to achieve the critical mass of conservation action needed to produce desired environmental outcomes.

f. USDA should consider paying a "finder's fee" to individuals and institutions willing to promote the program within a specified geographic area. Many partners exist who are willing and able to help promote use of buffers. Those partners include new technical service providers as well as state governmental agencies and nongovernmental organizations.

g. CRP rents should be adjusted from time to time to keep the program competitive with cash rents. There is some evidence already in parts of the country that CRP rents are no longer competitive with commodity price supports and cash rents for cropland.

h. An effective nationwide outreach program—National Conservation Buffer Initiative—should continue. This initiative already has resulted in installation of more than 5 million acres (2 million ha) of buffers nationwide. Buffers of various types remain a greatly underused conservation technology.

4. Considerable potential exists to give riparian restoration and protection major emphasis within the National Conservation Buffer Initiative. The need for such a "spin" was articulated recently in a National Research Council report that stressed environmental values of protecting and restoring riparian areas and called for a national law requiring such protection and restoration. An emphasis of this sort within the National Conservation Buffer Initiative could yield the following results:

   - major opportunities to achieve significant ecological and environmental benefits;
   - the potential to achieve multiple (soil, water, and terrestrial and aquatic wildlife) environmental benefits simultaneously;
   - an expansion of the reach of CRP into new states and to new constituencies;
   - a reduction in the CRP's vulnerability to volatile swings in world grain stocks;
   - a reduction in the CCRP's vulnerability to budget cutting, perhaps more so than in the case of the general CRP's whole-field, whole-farm enrollments; and
   - establishment of CRP as a valuable adjunct to CSP if CSP becomes the nationwide entitlement program it was intended to be.

Conclusion

The CRP should remain a key component of USDA's portfolio of conservation programs, but the Nation's environmental management objectives change over time, and CRP must evolve to remain relevant—to producers, to taxpayers, and to the environment.

A Wildlife Management Institute View of the Future: Questions Still Need Answering

By Ron Helinski[1]

Introduction

The Conservation Reserve Program (CRP) is the single most effective program for wildlife enhancement in Farm Bill history. From a wildlife management and economic perspective, 36 million acres (14.6 million ha) in habitat and billions of dollars added to the rural/national economy make the CRP the kind of conservation program that dreams are made of. But we cannot accept past accomplishments and rest on our laurels. The world of the past is not necessarily what the future brings.

There are many components that make up the CRP…the Conservation Reserve Enhancement Program (CREP), continuous as well as traditional programs. The CRP facilitates various accomplishments within physiographic regions across the United States. In the Northeast for example, CREP enrollment continues to expand. The CREP is often customized to the needs of private landowners and size of farms in the region. Land rental rates allow for realistic returns, thus the program experiences vitality and popularity. The CREP is uniquely targeted with matching funds from state and often conservation non-governmental organizations. There is an investment of public funds with accountability ideally integrated into the process. Despite wildlife often not being the primary objective of the program, state wildlife agencies see its potential and often are the primary drivers of the program. Because of their commitment and oversight to the process, state conservation agencies and their constituents reap many of the environmental benefits realized through establishment of the CREP. To date, Pennsylvania leads CREP enrollment in the northeast, recently confirming their next 50,000 acre (20,234 ha) program in the Ohio River watershed.

Table 1 provides a summary of funds committed to the CREP. The traditional CRP lies mostly west of the Mississippi River. Due to the larger size of western farms, much of the land in the CRP exists in relatively large blocks of land often affecting the distribution and quality of wildlife habitat on a landscape scale. A large amount of this acreage will be eligible to come out of CRP in 2 years. This can be viewed as an opportunity or a problem. Given the dollars expended, acreage enrolled (via continuous CREP and CRP) it is important we communicate to Congress definitive information describing the environmental and social benefits realized for soil, water, and wildlife conservation. That is the purpose of this workshop and there is a sincere need for such information.

How Much Is Enough Plots Course for Conservation Reserve Program Needs

In November 2000, the Wildlife Management Institute (WMI) published the “How Much Is Enough” report. Stated in the introduction, “Americans must understand and support multiple benefits of world market competitiveness for U.S. farmers, reliable food and fiber supplies, wildlife conservation, soil stability, and improved air and water quality.” The CRP facilitates the retirement of environmentally fragile lands, thus contributing to soil, water, air, and wildlife enhancements.

Many natural resource professionals across the Nation believe there is a need for a total enrollment of 63.9 million acres (25.9 million ha) in the CRP to meet this Nation’s wildlife needs. Specifically targeted are:

- Undisturbed grasslands restored from cropland [54 million acres (21.9 million ha)]. By region, this can be broken down to: west–17.3 million acres (7.0 million ha) idle grasslands; Southeast–10 million acres (4.0 million ha) idle grasslands; Midwest–25 million acres (10.0 million ha) idle grasslands; and northeast–1.6 million acres (0.6 million ha) idle grasslands.
- Filter strips/riparian habitat restored under continuous CRP/CREP [8.7 million acres (3.5 million ha)].
- Reestablished longleaf pine (Southeast) with herbaceous understory [1.2 million acres (0.5 million ha)].

The question is how best to achieve these acreage needs both in the short- and long-terms?

Money, Established Priorities and Focus Needed to Succeed

In the short-term, we need to stay focused on goals of the CRP. The potential wildlife habitat enhancements described above should be our goal as we move towards the 2007 reauthorization process. To make this more of a reality it will

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Table 1. Summarization of funding for the Conservation Reserve Enhancement Program.

Southeast	Midwest	West
Arkansas – $10 million	Illinois – $250 million	Montana – $57 million
Florida – $153 million	Iowa – $40 million	Oregon – $250 million
Kentucky – $110 million	Michigan – $177 million	California – $24 million
North Carolina – $275 million	Nebraska – $209 million	
Virginia – $91 million	Minnesota – $268 million	
West Virginia – $8 million	Missouri – $85 million	
	North Dakota – $43 million	
	Ohio – $201 million	
	Wisconsin – $243 million	

be necessary to conduct monitoring and evaluation to assess effectiveness of current CRP management as it relates to wildlife goals and objectives. This need raises the bigger question, “Do we know what the conservation goals for any given state, region, or landscape are for targeted wildlife species or habitats via the CRP?” I have asked that question in different forums as, “Does the state have a specific, detailed vision for water, soil, air, and wildlife enhancements for conservation?” If we are to make a difference for wildlife via the CRP, we must know what our target/focus is to be able to hit it. In fact, if conservation and environmental goals are definitely and quantifiably defined, then we can delineate specific roles and responsibilities of participants in contributing to those objectives.

If we can accomplish this, we will be in a defendable position to justify continuation and future funding requests from Congress to meet the conservation needs across the Nation.

The Conservation Reserve Program is Driven by People

Effective communication is essential when information comes via state technical committees in consultation with landowners or between federal, state, and non-governmental organizations, its impact and value are enhanced. The wildlife community needs to be engaged, especially at the local level where decisions are made. Without specific goals and evaluation of their effects, management actions, like haying and grazing, may be detrimental to wildlife. Consequently, we have a responsibility to inform and educate.

Conclusion

Questions that need to be considered as we approach the upcoming Farm Bill:

- Does the CRP offer adequate options to achieve landscape goals to contribute to prioritized wildlife objectives?
- Is there a vision for conservation by state, region, or national level focusing on wildlife needs that delineates roles and responsibilities of organizations/individuals to contribute to the desired vision?
- Does data exist that quantify CRP contributions to priority wildlife objectives? What specific monitoring and evaluation programs are in place to obtain these data?
- Given reauthorization of the Farm Bill, conservation programs may begin in 2006, if not sooner. What strategy does the conservation community have to insure adequate enhanced allocation of dollars occurs for the CRP?

We need answers to these questions to make the CRP and associated USDA conservation programs more effective in meeting our regional and national wildlife and environmental goals. It is our hope that we not leave this workshop without addressing them.

The Conservation Reserve Program Wildlife Legacy: Continuing and Strengthening the U.S. Department of Agriculture's Most Successful Wildlife Conservation Program

By David E. Nomsen[1]

Introduction

I have three areas I would like to cover in my presentation. First, I will present background information on Pheasants Forever; who we are and what we do. Second, I am going to take a few minutes to describe recent and current Pheasants Forever activities related to 2002 Farm Bill conservation programs, focusing on the Conservation Reserve Program (CRP). Lastly, in preparation for this conference I queried state wildlife agencies about their views on CRP and will offer some of their perspectives on the importance of the CRP as a conclusion of my presentation.

Pheasants Forever Focus on Conservation

Pheasants Forever is an upland wildlife conservation organization with 100,000 members located in 600 county-based chapters across 28 states. At our core are grassroots local volunteers that work hand-in-hand with our Nations' farmers and landowners on wildlife conservation projects. Pheasants Forever chapters complete 30,000 projects each year including food plots, nesting cover and tree plantings, wetland restorations, and land acquisitions. To summarize the Pheasants Forever mission in one word – HABITAT. Our local habitat focus allows us to benefit pheasants and other wildlife, while providing soil, water, and other environmental benefits to local landowners and society as a whole. Pheasants Forever is also actively engaged in conservation education activities through our widely recognized Leopold Education Project.

Pheasants Forever has played an active role in Washington, D.C. during each of the last several major Farm Bills. Here is why our habitat-focused mission can directly benefit from Farm Bill conservation projects that enhance wildlife habitat. Programs like the Wetlands Reserve Program (WRP), Wildlife Habitat Incentives (WHIP), Environmental Quality Incentives (EQIP), and Conservation Security Program (CSP) can complement and increase our ability to deliver wildlife habitat in cooperation with farmers and landowners. The CRP has become a favorite of Pheasants Forever members and all upland sportsmen and sportswomen Nationwide. The reason is simple—CRP has doubled and tripled pheasant populations over much of their range.

Pheasants Forever is routinely involved with the establishment and refinement of rules and regulations for conservation programs. We pride ourselves on our ability to help deliver programs "to the ground." Our network of grassroots volunteers, skilled field staff, habitat specialists, and resource agency staff work closely with some of our Nation's finest land stewards, conservation-minded farmers and landowners, to get projects completed. It is this expertise we carry to Washington, D.C. policymakers as we strive to help improve program implementation or support and encourage new conservation programs.

Looking to the Future of Farmland Conservation

In these past 6 months, Pheasants Forever President and CEO Howard Vincent has had two opportunities to voice our support and concerns over the future of the CRP with President Bush. Along with many of our conservation community colleagues, we heard President Bush and Agriculture Secretary Veneman express their support for the CRP in a White House meeting in December 2003. On April 2004, during a tour of President Bush's Crawford ranch, we heard the President again express support for the CRP, and a meaningful dialogue was held concerning the CRP's large expiring acreages in 2007 and 2008. It remains our view at Pheasants Forever that the Administration should publicly and formally announce CRP reauthorization as a top priority now. If the CRP's "wildlife legacy" is to be enhanced and continue we need information now regarding the future of the program.

Pheasants Forever is currently involved with efforts to reestablish wetland restoration eligibility for the CP23 practice allowing for depressional wetland restoration with adequate upland buffers outside of 100-year floodplains. These changes are necessary to maximize wildlife benefits from wetland-related CRP projects and to provide farmers with a wildlife-friendly option to avoid farming in difficult-to-farm areas. In addition, we are continuing efforts to promote stand-alone wildlife practices within the continuous CRP (CCRP), including a proposed new wildlife field border practice focused on providing valuable habitat for bobwhite quail.

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Conclusion

As we approach the twentieth anniversary of CRP next year, it is our view that this legacy continue for current and future generations of sportsmen and sportswomen, farmers and ranchers, and society as a whole. The resource benefits have proven to be unparalleled. The question at hand is not one about whether or not the program should be continued, but a question of how best to build and expand upon the CRP's proven success.

State Testimonials of Benefits of the Conservation Reserve Program

The CRP has been rightfully heralded as the most successful wildlife conservation program in U.S. Department of Agriculture history. Prior to this conference, I queried state wildlife agencies from around the country for their views on the CRP. The following are excerpts from correspondence I received. Notes like these are but a few of the vast wildlife success stories contributing to the CRP "wildlife legacy".

Idaho Department of Fish & Game

CRP provides valuable habitat for several wildlife species in Idaho, including pheasants, sharp-tailed grouse, mule deer, and elk (J. Unsworth, written commun., 2004). CRP appears to be very important to Columbian sharp-tailed grouse, a species of special concern, in Idaho. Harvest data indicates sharp-tailed grouse numbers have increased (285 harvested in 1984 to a high of 6,200 in 1992) in southeast Idaho since the enrollment of over 400,000 acres in CRP from the late 1980s to mid-1990s. Most of the 56 new leks identified were on CRP lands in close proximity to native shrub communities.

Illinois Department of Natural Resources

…the CRP has been an unparalleled success in conserving rural America's land, water and wildlife since its inception in 1985 (J. Brunsvold, written commun., 2004). The continued existence of Henslow's sparrow, greater prairie chickens and species important to sportsmen such as the ring-necked pheasant and northern bobwhite in Illinois is dependent on maintaining CRP grasslands.

Iowa Department of Natural Resources

Quite simply the CRP is the largest and best wildlife conservation program ever implemented by USDA in Iowa (R.A. Bishop, written commun., 2004). In the 14 years prior to CRP pheasant numbers were declining 2.6 birds per year in our prime pheasant range. A comparison of the 14 years after CRP shows pheasant populations increasing at a rate of 1.2 birds per year. In 1996, our peak for hunter and pheasant numbers, the economic impact of upland game hunting in Iowa was almost ¼ billion dollars (retail and multiplier effects). We estimate our current CRP acreage may produce 3.8 million pheasants per year. USDA data shows 1.4 million acres of Iowa CRP contracts will expire between now and 2010. If not replaced the remaining CRP acreage in Iowa would produce an estimated 890,000 pheasants per year. Bringing these same lands back into row crop production would increase soil sheet and rill erosion in Iowa an estimated 7-17 million tons per year.

Kansas Department of Wildlife & Parks

In general terms, we can honestly say that CRP has provided far greater wildlife benefits in Kansas than any other USDA program in history (J.M. Hayden, written commun., 2004). CRP has been the backbone of KDWP's hunting access program. In 2003, Kansas' producers enrolled nearly a million acres of private land in this popular program, receiving 1.25 million dollars in return. Bobwhite quail numbers have increased in the western half of the state and coveys occur in places where there were none prior to CRP. Perhaps the most obvious benefit of CRP has been to the lesser prairie chicken (LPC), a bird than has been petitioned for listing… The range of the LPC has greatly expanded since CRP. Two hundred and fifteen leks have been found in 10 counties north of the Arkansas River where the species was once virtually absent. …we are extremely pleased with wildlife response to CRP and hope the program continues and is expanded in the future.

Minnesota Department of Natural Resources

In Minnesota's pheasant range, the CRP has restored more wildlife habitat than any other program (G. Merriam, written commun., 2004). With the addition of 1.2 million acres of CRP cover during 1987-96, average fall pheasant harvest increased 34% compared to the period 1965-85 (pre-CRP). The CRP and other related farm programs will continue to be key to maintaining and expanding wildlife habitat and populations in the future.

Montana Fish Wildlife & Parks

To illustrate the importance of CRP to upland game birds and upland game bird hunters, we have made a comparison of upland game bird harvest levels for Sheridan, Roosevelt, and Richland Counties in northeast Montana, where CRP is a dominant feature (D. Childress, written commun., 2004). Over the survey period from 1971 to 1986 (pre-CRP) combined harvest levels for ring-necked pheasants, gray partridge, and sharp-tailed grouse averaged 21,209 birds bagged. That is compared to an average annual harvest of 32,926 birds from

1987 through 2002, a 55% increase coinciding with over 400,000 acres of cropland enrolled into CRP. Because of its many benefits to wildlife, as well as to soils, water, air and local economies, we feel very strongly that CRP should continue to be funded, and program funds should be directed to areas of national significance for wildlife, such as the Prairie Pothole Region.

Oklahoma Department of Wildlife Conservation

The CRP program is the only program that is effectively protecting and enhancing large acres of grasslands, riparian areas, and playa lakes (G.D. Duffy, written commun., 2004). The future of this program is very important for the opportunity to create large scale habitat enhancements and protection that is required for population stability for several grassland bird species in Oklahoma.

South Dakota Department of Game, Fish and Parks

Successful implementation of conservation provisions of the 2002 Farm Bill has resulted in a virtual renaissance of South Dakota's diverse wildlife populations (J.L. Cooper, written commun., 2004). But of all the conservation provisions, the CRP provides hands-down the single most significant wildlife habitat benefits by providing a landscape level of undistiburbed cover for numerous wildlife species. CRP in South Dakota has contributed to an increased pheasant population to levels not experienced in over 35 years. In 2003, pheasant hunters harvested an estimated 1.8 million birds, with the direct impact of pheasant hunting on small town rural economies estimated at over $90 million annually. CRP is vital to healthy wildlife populations and the South Dakota Game, Fish & Parks unequivocally supports the program's reauthorization and expansion in the next Farm Bill.

Texas Department of Parks and Wildlife

CRP… has also proven to be of enormous benefit to a number of declining short- and mid-grass prairie species, including lesser prairie chickens, swift foxes, burrowing owls, Swainson's hawks and other grassland wildlife (M.E. Berger, written commun., 2004). Nearly 3 of our 4 million acres of CRP land will be coming up for renewal in Texas over the next 3 years. Failure to reenroll this highly erodible and marginal cropland in permanent cover would have serious environmental consequences.

Washington Department of Fish and Wildlife

CRP is the single most important state or federal program for at-risk shrub-steppe species (D. Larsen, written commun., 2004). In 2003 a study in Washington documented use of CRP by 14 bird species, 10 small mammals, and 4 reptile species. CRP provides deep soil and herbaceous habitats that are critically lacking in Washington's shrub-steppe range. CRP provides a much needed economic incentive for private landowners to provide habitat. Currently no other program exists that can provide this economic incentive on a scale large enough to benefit populations of grouse and other shrub-steppe species on a landscape scale.

The Conservation Reserve Program: Proven Benefits in the Prairie Pothole Region

By Stephen E. Adair[1] and Barton C. James[2]

Introduction

Over the past two decades, Farm Bill conservation programs have played an integral role in the economic vitality and general well-being of this Nation's farmers and ranchers. In addition, these participants have improved conservation on private lands by enhancing and protecting wildlife habitat, as well as water and soil quality. The increased importance of conservation in agriculture and its role in private lands stewardship has led to consensus and partnerships among government and private interests including commodity groups, producers, livestock organizations, and wildlife conservation organizations. Voluntary, incentive-based conservation provisions included in the Farm Bill have provided the framework for "win-win" solutions on farms across both rural and urban landscapes.

The Conservation Reserve Program (CRP) is one of our Nation's most successful agricultural conservation programs. The CRP has provided landscape-level conservation of soil, water, and wildlife habitat (Heard and others, 2000) while offering producers a significant and stable source of income (Economic Research Service, 2004). The 2002 Farm Bill increased the acreage cap on CRP from 36.4 to 39.2 million acres (14.7 to 15.9 million ha), with the clear implication that an additional 2.8 million acres (1.1 million ha) of CRP contracts should be available to producers. This acreage increase was an important step given the popularity of the program with landowners, as evidenced by demand for land enrollment (acres bid) often exceeding availability by a 2:1 ratio.

As the future of the CRP is debated in preparation for the 2007 Farm Bill, it is vital that policymakers and stakeholders take a close look at the collection of scientific investigations that have analyzed impacts of the program to separate fact from opinion. It is upon these sources of information that we should make informed decisions about where and with what practices the program is having the greatest positive impacts. These data also reveal where desired outcomes are not being achieved and suggest improvements to the program. It is also vital that policymakers hear from individual producers involved in the program to better understand decisions they are facing with their operations and how the CRP contributes to achieving environmentally and economically sustainable agricultural landscapes.

Proven Benefits in the Prairie Pothole Region and Beyond

The CRP is a proven, results-oriented conservation program that has accomplished a variety of positive outcomes for wildlife habitat. If allowed to be relatively undisturbed, CRP grasslands provide extremely desirable nesting and brood-rearing habitat for a host of grassland species (Higgins and others, 1992; Renner and others, 1995; Johnson and others, 1998). Nowhere have the benefits of the CRP been more obvious than in the Prairie Pothole Region (PPR) where large blocks of grassland and wetlands provided by the general signup are approaching a critical mass of providing a semblance of the habitats where waterfowl and grassland bird species evolved and require for reproductive success.

During 1992–1997, nest success of five common upland nesting duck species [mallard (*Anas platyrhynchos*), gadwall (*A. strepera*), blue-winged teal (*A. discors*), northern shoveler (*A. clypeata*), and northern pintail (*A. acuta*)] was 46% higher with CRP acreage on the landscape in the PPR of North Dakota, South Dakota, and Montana than compared to a simulated scenario where existing CRP acreage was replaced with cropland (Reynolds and others, 2001). This study concluded an additional 12.4 million waterfowl were added to the fall flight as a result of the CRP from 1992–1997. In a recent analysis of factors influencing population size of mid-continent mallards, Hoekman and others (2002) found nest success, hen breeding survival, and duckling survival explained 76% of the variation in population growth rate. By providing large blocks of restored grasslands and wetlands through general signups, the CRP directly addresses the vital reproductive rates of waterfowl populations in their most important breeding grounds in North America, the PPR.

During 1990–1994, nest success of female ring-necked pheasants (*Phasianus colchicus*) in north central Iowa was 40% higher in large blocks of CRP than recorded in smaller

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fragmented nesting cover like roadsides and fence lines (Clark and Bogenschutz, 1999). Clark and Bogenschutz (2001) modeled the impact of CRP on pheasant populations and found in townships where 25% of the land was enrolled in buffer strips, pheasant populations were only 5% greater than when there was no CRP acreage at all. When equivalent CRP acreage was enrolled in large fields, pheasant populations were 53% greater compared to a scenario with no CRP. The impact of large blocks of restored grasslands has been especially effective in South Dakota where fall pheasant populations have grown from 1.4 to 6.1 million since establishment of CRP acreage across that state (Wildlife Management Institute, 2001).

The CRP has been a boon to white-tailed deer (*Odocoileus virginianus*) populations throughout the Great Plains states, as well as great value to populations of grassland songbirds that require extensive, densely vegetated grasslands. Based on densities of 12 grassland songbird species in CRP fields compared to adjacent croplands, Johnson and Igl (1995) predicted populations of at least five species would decline statewide in North Dakota by 17% or more if CRP acreage was replaced with cropland. While the CRP has provided important habitat to many species of grassland songbirds, not all species flourish there (Heard and others, 2000). Populations of species requiring heavy grazing or untilled native grasslands are better addressed through conservation programs preventing tillage of native prairie.

These studies document positive impacts of the CRP on wildlife populations in and beyond the PPR. Overall, the collection of scientific evidence demonstrates the CRP has been a major contributor in recovery of waterfowl populations to record levels following return of precipitation to the northern prairies in 1993 (Reynolds and others, 2001). The impact of the CRP on waterfowl populations is further substantiated by comparisons with the Canadian prairies, where CRP and other conservation cover programs do not exist and waterfowl nest success and population growth remain lower than recorded in the PPR (Howerter, 2003; U.S. Fish and Wildlife Service, 2004).

Grassland songbirds, one of the fastest declining groups of birds in the country, have responded positively to habitat afforded by the CRP, staving off declines that might have led to increased listings of threatened and endangered species, and additional restrictions on land use. These results would not have been achieved without large blocks of restored grassland physically associated with wetlands provided through the general signup. Nest success, which is the most important factor influencing population size, increases with greater amounts of cover on the landscape because it allows nesting females to more effectively hide their nests and themselves from predators (Clark and Bogenschutz, 1999; Reynolds and others, 2001; Stephens 2003). While buffer strips, grass waterways, and field borders may help reduce soil erosion and improve water quality of runoff, these conservation practices do not provide the nesting cover required by most prairie wildlife to successfully reproduce (Heard and others, 2000).

Dispelling Concerns about the Conservation Reserve Program

The CRP has been blamed for many of the challenges facing rural America. From declining numbers of farms, shrinking rural populations, and failing rural economies, the CRP has often been indicted as the root of the problems (Economic Research Service, 2004). To the contrary, case studies and participant surveys have shown the CRP has helped many farmers diversify their income by incorporating grass-based agriculture and recreational opportunities into their operations (Ducks Unlimited, unpub. data, 2001). Some producers have decided to use the CRP to assist in the transition from cropping to ranching while others have used the program to reduce water pollution originating from their operations (Ducks Unlimited, unpub. data, 2001; Allen and Vandever, 2003). Hundreds of farmers in the PPR have restored formerly drained wetlands within their CRP tracts through Conservation Practice (CP) 23. Many others are using available incentive programs to install grazing systems on expiring CRP acreage. Others are using CRP payments to stabilize their financial situation and to pay debts (Allen and Vandever, 2003; Economic Research Service, 2004). As of March 2004, portions of almost 400,000 farms have been enrolled in the CRP across the Nation (Farm Service Agency, 2004). The CRP remains highly popular in the prairie states of Kansas, Minnesota, Nebraska, North Dakota, South Dakota, and Texas where portions of over 12,000 farms have been enrolled in the CRP (Farm Service Agency, 2004).

In a recent survey of 1,000 North Dakota CRP contract holders, researchers found only 11% enrolled as a transition to retirement while the other 89% enrolled in the program for economic and environmental benefits (Hodur and others, 2002). Thirty-one percent of contract holders indicated the CRP was instrumental in keeping them on the farm, representing a net gain in farmer retention from the 11% saying the CRP helped them retire. Very few contract holders enrolled land in the CRP and then left the area. Only 23% lived outside the area of their CRP contracts, and 73% of these contract holders indicated they had already lived outside the area for 10 years or more (Hodur and others, 2002). A national study of CRP contract holders reached a similar conclusion, finding population trends in rural counties were unaffected by high levels of CRP enrollment (Economic Research Service, 2004). While there may be instances where landowners use the CRP as a mechanism to retire from farming and subsequently move away, taking their financial resources with them, this is clearly the exception from the more common result of the CRP helping farmers stay on their land and contribute to improving local economic and environmental conditions.

The CRP has been criticized as not being a working-lands program, instead referred to as a land-retirement program. This confusion and criticism has little scientific basis and is an argument of scale of farming operations in relation to conservation practices. In most prairie and western states, farming operations are large and many producers choose to solve environmental problems and provide wildlife habitat by enrollment of whole fields in the CRP to remove marginal, or fragile lands from production. In the majority of cases, these whole fields only represent a portion of individual farming operations. For example, in North Dakota, the average farm size is 1,800 acres (728 ha). Sixty-eight percent of CRP contract holders questioned indicated they had enrolled less than 300 acres (121 ha) in the program (Hodur and others, 2002). Although whole field CRP contracts were only a small fraction of producers' land holdings in this state, they do represent a positive influence on the viability of farming operations because they help stabilize income and remove marginal land from production while providing options for additional income from recreation. Smaller scale conservation practices such as buffer strips, grassed waterways, field borders, and grassed terraces also retire farmland. In more populated areas of the eastern U.S., farming operations tend to be smaller (U.S. Department of Agriculture, 2004). Consequently, these practices are more practical and often meet environmental concerns more effectively than whole field enrollments. In the Great Plains states and many western states, rural populations are low. Larger farm operations are more prevalent (U.S. Department of Agriculture, 2004). In these situations, whole field enrollments make better sense. Since these distinctions are simply a matter of scale and geography, arbitrarily classifying some practices and programs as working lands and others as land retirement is misleading and should be avoided. Most conservation practices and some production practices include some scale of land retirement. Producers should be allowed to choose the scale of practices that best fits their operation as well as conservation goals. In order to do this, the CRP should continue to offer practices ranging from whole field enrollment to options best addressed by practices of smaller spatial scale (e.g., field borders, grassed waterways, buffers).

United States citizens are benefiting from cleaner air because the CRP removes greenhouse gases and wind-driven soil particles from the atmosphere. Reductions in soil erosion and nutrient runoff into our waterways as a consequence of the CRP have improved water quality. Sportsmen and wildlife watchers enjoy recovering wildlife populations across the Nation, generating millions of dollars and jobs in rural economies. The 1.6 million waterfowl hunters in the Nation generate \$3.9 billion in total economic activity each year, while 20 million waterfowl and shorebird watchers annually generate \$9.8 billion in economic benefits (Southwick Associates, 1991). Because the CRP contributes to maintaining populations of these migratory species through improved reproductive success on their prairie breeding grounds, it contributes significantly to this economic activity. The benefits of the CRP in the PPR accrue both locally and nationally as the migratory wildlife produced there are enjoyed by every state in the Nation (fig. 1). Additionally, increasing wildlife populations are helping to diversify income sources for those producers responding to strong demand for fee hunting opportunities by operating hunting-related businesses. Many producers have also opened up the land they have enrolled in the CRP to public access for hunting and fishing, thus improving relations between landowners, state fish and wildlife agencies, and the hunting and fishing public.

The CRP is often admonished for causing the population decline across rural America by taking land out of crop production. However, upon examination of the data, it is clear declines in both rural populations and farm numbers started decades before the CRP was created. In North Dakota (fig. 2) the decline in farm numbers began in the 1930's and has actually slowed since introduction of the CRP in 1986. In prairie Canada, where there is no CRP or conservation program that idles large amounts of land from production, these same trends in declining farm numbers and rural populations are also occurring. A comparison of farm numbers in states with large amounts of CRP acreage (e.g., South Dakota, Kansas) to states with small amounts of CRP acreage (e.g., Indiana, Louisiana) shows trends of declining farm numbers and consolidation of smaller farms into larger farms was evident before the CRP and has continued at an equal rate regardless of the amount of land enrolled in the CRP (fig. 3).

Conclusions drawn from these data imply that factors other than the CRP are driving the long-term decline in farm numbers and rural populations. It is possible, however, that the CRP is helping to reduce this trend. Several prominent economists have demonstrated that technological advancements in agriculture now allow a producer to cultivate many more acres than was possible in the past and they require a smaller labor force to do so (Power, 1996). In many ways agriculture is a mature industry in America, relying on large

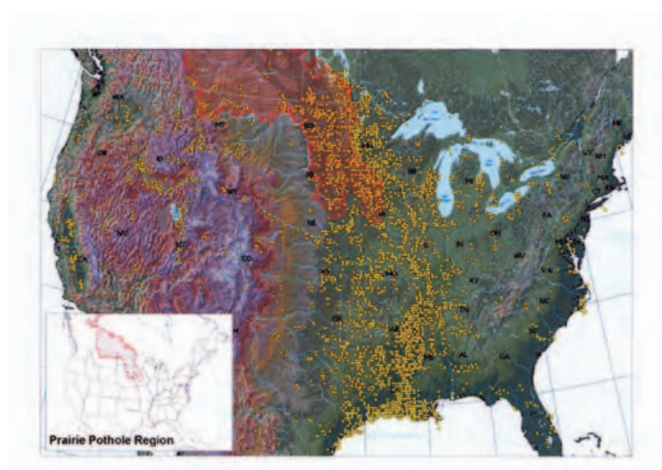

Figure 1. Band recovery locations of waterfowl (yellow areas) produced in the U.S. Prairie Pothole Region.

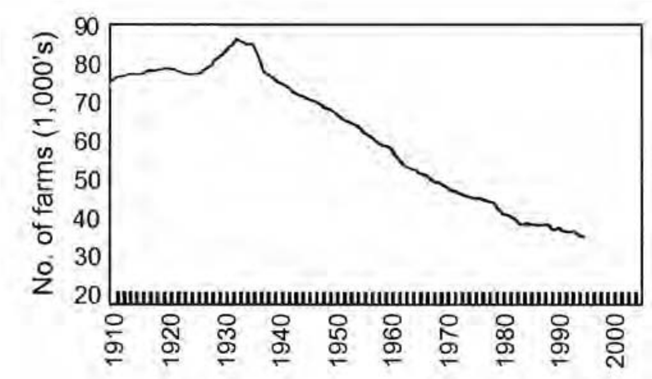

Figure 2. Number of farms in North Dakota, 1910–1997. Source: National Agricultural Statistical Service.

automated machines, an extensive transportation network, and precision equipment to plant, harvest, and transport products. These technological developments require a much smaller labor force than was historically needed in rural America. In fact, other service-based industries, which require larger labor forces, such as tourism, recreational operations, and retail to support entrepreneurial small businesses are often founded around high-quality natural landscapes and are supported by conservation programs such as the CRP. Therefore, instead of the CRP being viewed as contributing to the decline of rural America, analysis suggests the program holds promise in helping to restore quality natural landscapes upon which a new and diversified service sector and small business jobs can be built (Power, 1996; Economic Research Service, 2004). This perspective is further supported by a recent analysis of CRP effects that show any negative impacts of the CRP to rural economies were transitory and quickly replaced by growth in other economic sectors (Economic Research Service, 2004).

An additional condemnation of the CRP is it has been disproportionately allocated to states in the PPR (Montana, North Dakota, South Dakota, Minnesota, Iowa). Of the 34.1 million acres (13.8 million ha) currently enrolled in the CRP, 11.8 million acres (4.8 million ha; 35%) occur in these states. The Southern Great Plains states (Colorado, Nebraska, Kansas, Oklahoma, New Mexico, Texas) have received an equal amount of CRP [11.9 million acres (4.8 million ha or 35%)] and the lower Mississippi River states (Missouri, Tennessee, Arkansas, Mississippi, Louisiana), have received 3.1 million acres (1.3 million ha; 9%) (Farm Service Agency, 2004). When CRP acreage is analyzed in the context of the total acreage of cropland in each of these regions, the percentage of cropland enrolled in the CRP is remarkably similar. Ten percent of cropland in the Prairie Pothole states, 11% of cropland in the Southern Great Plains states, and 8% of cropland in the lower Mississippi River states is enrolled in the CRP (U.S. Department of Agriculture, 2000). While the

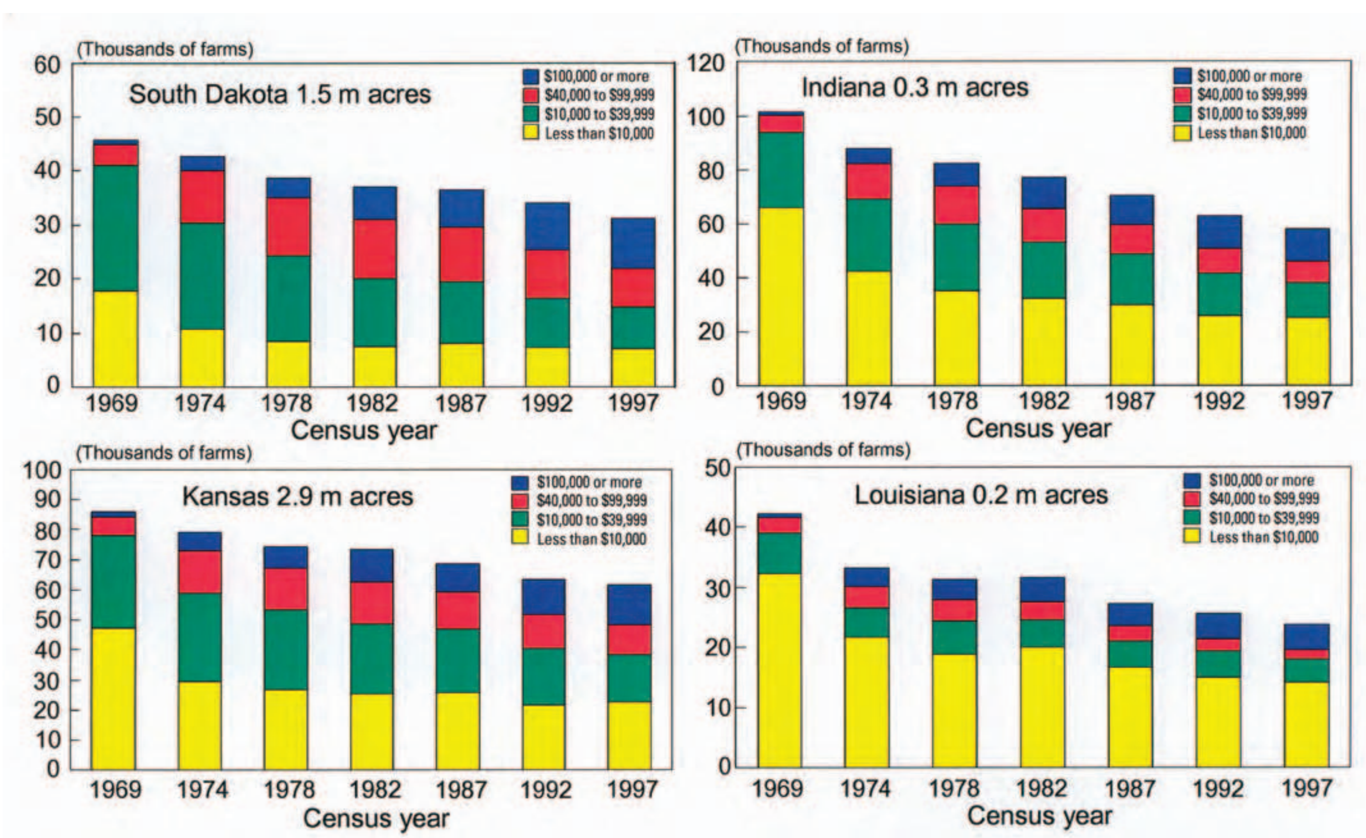

Figure 3. Number of farms by market value of agricultural products sold, 1969–1997. Source: 1997 Census of Agriculture.

CRP should continue to be available to address environmental concerns across the Nation, we must remain cognizant of the fact that in order to achieve desired and measurable benefits, enough CRP acreage has to be applied to critical landscapes to make a difference. The PPR is one of these critical landscapes and the 11.8 million acres (4.8 million ha) of CRP established within states in that region are producing measurable soil, water, and wildlife benefits.

Threats to Benefits

Although the CRP has provided documented benefits to waterfowl, upland game birds, grassland songbirds, and many other species of wildlife, gains made in the past are now threatened by recent changes in eligible general signup practices and the Environmental Benefits Index (EBI) used to score CRP offers. During the last general signup (Signup 26), acceptance rates of CRP offers from key Prairie Pothole states of Montana, North Dakota, and South Dakota were significantly below the national average of 54%. In Montana only 545 (24%) of 2,293 offers were accepted, in North Dakota only 270 (9%) of 3,003 offers were accepted, and in South Dakota only 344 (15%) of 2,202 offers were accepted (Farm Service Agency, 2003). In signups prior to the 26th (15–20), the acceptance rate for offers from these key PPR states compared favorably to the national average. The average acceptance rate for Signups 15–20 was 61% in North Dakota, 49% in South Dakota, and 75% in Montana, while the national average was 68%. In 2007, 4.1 million (50%) of the 8.2 million acres (1.7 million of 3.3 million ha) of CRP in the critical Prairie Pothole states of North Dakota, South Dakota, and Montana will expire. If the CRP is not reauthorized, if contracts are not extended or reenrolled, and the current EBI remains in place, less than 25% of offers from producers in these states may be accepted. The subsequent loss of grassland cover will have significant impacts on continental waterfowl, pheasant, and grassland songbird populations that will negate many of the gains realized over the past 20 years.

Several changes in the CRP are necessary to prevent this looming crisis. Most importantly, because of the national importance of the CRP in the PPR to providing waterfowl and other migratory birds to every state in the Nation, EBI bonus points for offers from the PPR national priority area need to be reinstated. Bonus points for offers from national priority areas help target the CRP to regions of the country where it can have the greatest environmental benefits. Under the current EBI, national priority area designation has lost meaning and only serves to determine program eligibility in conjunction with state priority area designations. This change has contributed to very low acceptance rates for offers from PPR states in the last general signup. While it is important for the CRP to address critical environmental needs in other areas of the country, it does not make sense to trade away benefits achieved over 20 years to do this. If the CRP is achieving the desired benefits in selected national priority areas, bonus points for offers from those regions should remain to retain progress made in meeting conservation objectives. As environmental issues in other areas reach national priority area status and it is determined that CRP practices can effectively address those issues, additional national priority areas can be identified. This should be done, however, with realization elevating the national acreage cap back to the 45 million acres (18.2 million ha) originally authorized may be necessary to achieve conservation in multiple national priority areas to achieve measurable impacts.

Secondly, the CP23 wetland restoration practice has been vital to restoring both small wetlands and adjacent grasslands necessary for waterfowl, pheasant, and shorebird population growth. Under the general signup option, this practice has contributed 1.7 million acres (0.7 million ha) to the Nation's landscape with 89% of these acres occurring in the PPR. Recently, the CP23 practice was removed as a general signup option and placed into the continuous signup where it was thought more producers would be eligible and enrollment would increase. However, in November 2003, Notice CRP-454 significantly changed eligibility requirements for this practice. Among other things, this notice limited the practice to 100-year floodplains and capped enrollment at 500,000 acres (202,342 ha). The Prairie Pothole states of Montana, North Dakota, South Dakota, Minnesota, and Iowa, where the practice has been very popular and effective, were only allocated 90,000 acres (36,422 ha). This revised policy resulted in substantially fewer wetland acres being eligible for restoration in the PPR where they are likely to have the greatest impact on nationally important wildlife populations. The recent announcement by the Administration to establish the Non-Floodplain Wetlands Restoration Initiative (CP23a) to restore up to 250,000 acres (101,171 ha) of wetland complexes and playa lakes with 138,000 acres (55,847 ha) allocated to the PPR states is a very positive step towards solving this issue. However, given the large demand and documented benefits of this practice in the PPR, more CP23a acres should be allocated to PPR states, and CP23 should be reinstated as an eligible practice for general CRP signups with appropriate EBI points.

Across the plains states of the central U.S., loss of native grassland continues at an alarming rate. In the United States' PPR, 74 million acres (30 million ha; 72%) of the original 103 million acres (41.6 million ha) of native grassland has been converted to other land uses. Approximately 7.8 million acres (3.2 million ha) of grassland restored on marginal soils in the PPR through the CRP has helped recapture some of the wildlife, soil, and water quality values of grassland on this landscape. However, given the historic and continuing losses of grassland in this region, more grassland restoration through the CRP is needed to achieve a sustainable level of public benefits from our Nation's grasslands. Options to further discourage the plowing of remaining native grasslands should be considered in the 2007 Farm Bill to decrease the pressure on the CRP to fill this growing habitat void.

Given all of the benefits of the CRP to producers, the environment, and the American public, we cannot afford loss of CRP authorization in the next Farm Bill or the looming loss of CRP acres in the PPR in 2007 and beyond. Such a defeat would negate many documented wildlife and environmental benefits that have resulted from the CRP over the past 20 years.

Meeting the Challenges Ahead

The majority of wetlands and native grasslands originally existing in the U.S. have been drained and plowed. Many species of grassland and wetland wildlife continue to decline; water and habitat quality in streams, rivers, and lakes continue to fall below acceptable standards; and carbon and organic matter depletion persists from agricultural soils as a result of cultivation. The conservation title of the Farm Bill provides our Nation with critical tools for long-term conservation of soil, water, and wildlife habitat while ensuring a sound financial base for agriculture. The CRP has been the most successful agricultural program in restoring critical habitats on a scale that is truly meaningful. However, given the habitat deficit that we started with when the CRP was first authorized in 1986, our Nation's conservation work is far from complete.

As we look forward to shaping the future of the CRP, it is critical we do not sacrifice gains that have been made. Scientific studies demonstrate that the CRP, especially those acres in the PPR, is producing measurable benefits to our Nation's wildlife, soil, air, and water resources as well as to our producers and farming communities. Given the low acceptance rates of recent offers in the PPR and looming expiration of contracts on the majority of CRP acres in this region during 2007 and beyond, we must work to keep these acres on the ground in the future. Offering early reenrollments and extensions to expiring CRP acres in the PPR national priority area, expanding CP23a acreage caps and reinstating CP23 as a cover practice in general signups, and modifying the EBI to award points to wetland-grassland complexes in the PPR are excellent ways to accomplish this. Reenrollment and extension offers need to be tailored to regional differences in CRP performance. If certain cover types are not producing desired environmental benefits in other regions (Heard and others, 2000), those contracts should not be eligible for reenrollment or extensions. In the PPR, the data are clear; existing CRP acres are working and producing desired environmental benefits, and we strongly believe producers should have the option of renewing those contracts.

There are important environmental issues in parts of the country that the CRP has not adequately addressed. These include Gulf of Mexico hypoxia resulting from nutrient loading in the upper Mississippi River Watershed, declining northern bobwhite quail populations in the Midwest and southeastern U.S., several threatened and endangered species, and regional water quality problems such as represented by conditions in the lower Great Lakes and Chesapeake Bay. Given the suite of programs available through the conservation title of the Farm Bill, should we look to the CRP to solve all of these problems? Can the program be funded at a level to have a measurable impact on all issues, or should we be more selective in targeting CRP acres to those issues the program is most suited to address?

It is clear that the CRP has been especially effective where cropland replaced grassland on marginal soils. No other conservation programs in the Farm Bill have available practices to restore historic grasslands in the Plains states at landscape levels as does the CRP. The ability to restore large blocks of grassland and associated wetlands should continue to make up the majority of acres allocated to the CRP. Opportunities to adequately address water quality issues across the country through the CRP should be balanced with the opportunity to achieve similar benefits through other programs such as the Environmental Quality Incentives Program and the Conservation Security Program. More finely targeted programs such as the Conservation Reserve Enhancement Program option may prove more effective in addressing specific water quality problems than would an increase in general signup acres. Likewise, in areas where more linear cover types (e.g., buffer strips, grassed waterways, and field borders) are adequate to address wildlife and water quality concerns, those practices should be targeted to those regions instead of favoring larger blocks of acres better directed to regions requiring more expansive grassland coverage.

To restore their marginal lands to more sustainable uses, diversify their economic base, and improve environmental conditions on land under their stewardship, farmers and ranchers desire a higher level of conservation program funding and acreage availability than our Nation is currently providing. Simply put, we are not meeting their demand for assistance in these efforts. These are the people that make up our rural communities, are working the land, and are the primary constituents of our Nation's Farm Bill. We need to acknowledge these facts, reject undocumented claims of negative impacts of conservation programs, and seek to better meet the demand for scientifically proven practices of the CRP and the other conservation title programs in the future.

References Cited

Allen, A.W., and Vandever, M.W., 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, 51 p.

Clark, W.R., and Bogenschutz, T.R., 1999, Grassland habitat and reproductive success of ring-necked pheasants in northern Iowa: Journal of Field Ornithology, v. 70, no. 3, p. 380–392.

Clark, W.R., and Bogenschutz, T.R., 2001, Modeling pheasant responses to conservation buffers in Iowa: Wildlife Habitat Management Note, Wildlife Habitat Management Institute, 4 p.

Economic Research Service, 2004, The Conservation Reserve Program: Economic and social impacts on rural communities: U.S. Department of Agricultural ERS Report to Congress, February 2004, 143 p.

Farm Service Agency, 2003, The Conservation Reserve Program 26th Signup: U.S. Department of Agriculture, Washington, D.C., 12 p.

Farm Service Agency, 2004, Conservation Reserve Program Summary: U.S. Department of Agriculture, Washington, D.C., 14 p.

Heard, L.P., Allen, A.W., Best, L.B., Brady, S.J., Burger, W., Esser, A.J., Hackett, E., Johnson, D.H., Pederson, R.L., Reynolds, R.E., Rewa, C., Ryan, M.R., Molleur, R.T., and Buck, P., 2000, *in* Hohman, W.L., and Halloum, D.J., eds., A comprehensive review of Farm Bill contributions to Wildlife Conservation, 1985–2000: U.S. Department of Agriculture, Natural Resources Conservation Service, Wildlife Habitat Management Institute, Technical Report USDA/NRCS/WHMI-2000, 208 p.

Higgins, K.F., Kirsch, L.M., Klett, A.T., and Miller, H.W., 1992, Waterfowl production on the Woodworth Station in south-central North Dakota, 1965–1981: U.S. Fish and Wildlife Service, Resource Publication 180, 79 p.

Hodur, N.M, Leistritz, F.L., and Bangsund, D.A., 2002, Local socioeconomic impacts of the Conservation Reserve Program: North Dakota State University, Fargo, Agribusiness and Applied Economics Report Number 476, 119 p.

Hoekman, S.T., Mills, L.S., Howerter, D.H., Devries, J.H., and Ball, I.J., 2002, Sensitivity analyses of the life cycle of mid-continent mallards: Journal of Wildlife Management, v. 66, no. 4, p. 883–900.

Howerter, D.W., 2003, Factors affecting duck nesting in the Aspen Parklands: A spatial analysis: Ph.D. dissertation, Montana State University, Bozeman, 135 p.

Johnson, D.H., and Igl, L.D., 1995, Contributions of the Conservation Reserve Program to populations of breeding birds in North Dakota: Wilson Bulletin, v. 107, no. 4, p. 709–718.

Johnson, D.H., Igl, L.D., and Schwartz, M.D., 1998, Effects of haying Conservation Reserve Program fields on breeding birds, contributed paper: Ecological Society of America Annual Meeting, Baltimore, Maryland.

Power, T.M., 1996, Lost landscapes and failed economies: The Search for a value of place: Washington, D.C., Island Press, 303 p.

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

Reynolds, R.E., Shaffer, T.L., Renner, R.W., Newton, W.E., and Batt, B.D.J., 2001, Impact of the Conservation Reserve Program on duck recruitment in the U.S. Prairie Pothole Region: Journal of Wildlife Management, v. 65, no. 4, p. 765–780.

Southwick Associates, 1991, The economic contributions of bird and waterfowl recreation in the United States: Southwick Associates, Fernandina Beach, Fla, 31 p.

Stephens, S.E., 2003, The influence of landscape characteristics on duck nesting success in the Missouri Coteau region of North Dakota: Ph.D. dissertation, Montana State University, Bozeman, 169 p.

U.S. Department of Agriculture, 2000, Summary report: 1997 National Resources Inventory (revised December 2000): Natural Resources Conservation Service, Washington, D.C., and Statistical Laboratory, Iowa State University, Ames, 89 p.

U.S. Department of Agriculture, 2004, Farms and land in farms: National Agriculture Statistics Service, Washington, D.C., 16 p.

U.S. Fish and Wildlife Service, 2004, Waterfowl population status, 2004: U.S. Department of the Interior, Washington, D.C.

Wildlife Management Institute, 2001, How much is enough for 2002?: A regional wildlife habitat needs assessment for the 2002 Farm Bill: Wildlife Management Institute Report, Washington, D.C., 36 p.

Session III. The View from Capitol Hill

The View from Capitol Hill: An Interpretative Summary

By Skip Hyberg[1] and Tom Lederer[1]

Introduction

Congressional staff members offered thoughts on a number of broad issues, focusing on conservation programs in general and the Conservation Reserve Program (CRP) in particular. Although a wide range of political perspectives and opinions was expressed, we believe the following summaries capture key points where there was broad consensus among staff members. Panelists included Barbara Johnson, Congressional Research Service, session moderator; Alison Fox, Senate Agriculture Committee; Ryan Weston, House Agriculture Committee; and Anne Simmons, House Agriculture Committee. Although presented in a different session of the conference, a budget overview by Craig Jagger, Chief Economist, House Agriculture Committee, has been added to this section to offer insight on budgetary issues that may affect future implementation of conservation policies.

Agricultural Interests Need to Hang Together

A fundamental message expressed was conservation and commodity groups need to work together as the Farm Bill is written. Each panelist noted there is temptation to seek advantage by targeting other programs as a source for funds, but that both conservation and commodity interests will lose if they give into this enticement. Agriculture is only one of many competing concerns facing the federal government. Tight budget numbers for the foreseeable future provide little room for maintaining current agricultural budget levels, let alone expansion. If agricultural interests turn against one another, internal disputes will be used by competing interests to reduce the budget available for the next Farm Bill. On the other hand, if conservation and commodity groups can identify common objectives and work together to support these goals, agriculture will be better able to defend its budget, keeping more available for the next Farm Bill.

Do Not Ask for the Moon

The panelists agreed the next Farm Bill is going to be formulated under strict budget guidelines. If the conservation community enters the debate asking for multiple programs requiring substantial additional funding conservation interests will find themselves marginalized. To avoid being irrelevant, conservation groups need to develop common priorities, and avoid competing against one another.

Conservation Interests Must be Able to Clearly Demonstrate Accomplishments

The benefits of conservation programs need to be communicated to a broader audience. Congress is constantly being asked to weigh costs and benefits of programs against others. Without measures clearly demonstrating programs are making progress towards identifiable goals, conservation will have difficulty competing against other programs showing budgetary savings and measurable outcomes.

To remain viable, conservation programs need quantifiable measures showing progress towards cleaner air, cleaner water, more abundant wildlife, more productive lands, stable rural communities and a higher quality of life. Better outcome measures, such as those discussed in the first session of this conference, need to be adopted to set goals, measure progress, and communicate successes.

A Solution is Needed to Fund Technical Assistance[2]

Technical assistance tends to be mentioned only when there is a problem, generally a funding shortage. As of June 2004, technical assistance for the CRP and the Wetlands Reserve Program (WRP) is funded using Environmental Quality Incentive Program (EQIP), Wildlife Habitat Incentives Program (WHIP), Grassland Reserve Program (GRP), and Conservation Security Program (CSP) funds. Taking funds from one conservation program to pay for technical assistance in other programs has created regrettable competition within the conservation community. These rivalries, either real or perceived, have led to complaints that monies intended for farmers and ranchers are being diverted to hire Federal staff. Although these difficulties are not the result of USDA actions, they put the CRP and WRP in a negative light. It is in the best interests of USDA, CRP and WRP participants, and conservation interests to cooperate and find ways to make the technical assistance funding issues go away.

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[2]This issue was addressed through subsequent legislation enacted December 2004 that requires using CRP and WRP funds for their technical assistance costs.

The Conservation Reserve Program is Perceived as a Program for Midwestern States

The perception that the CRP is a program for landowners in the Midwestern states reduces Congressional support for the CRP from east and west coast representatives. In order to garner greater political support for the CRP, the program needs to project a national perspective. The panelists discussed several alternatives that might generate broader support including adjusting rental rates to permit greater participation from areas with high land values, and greater use of continuous CRP and CREP, which place greater emphasis on practices using partial field CRP enrollment.

Conservation Reserve Program versus Conservation Security Program

The CRP and CSP have similar names but dissimilar goals and approaches. The CRP targets fragile agricultural lands with potentially high environmental benefits if removed from active production and put into conservation uses. In contrast, the CSP recognizes landowners for establishing and maintaining sound conservation practices on working lands. Both approaches are valid, both have their place, and one program cannot substitute for the other. Bottom-line: It would be a mistake to advocate survival of one program over the other.

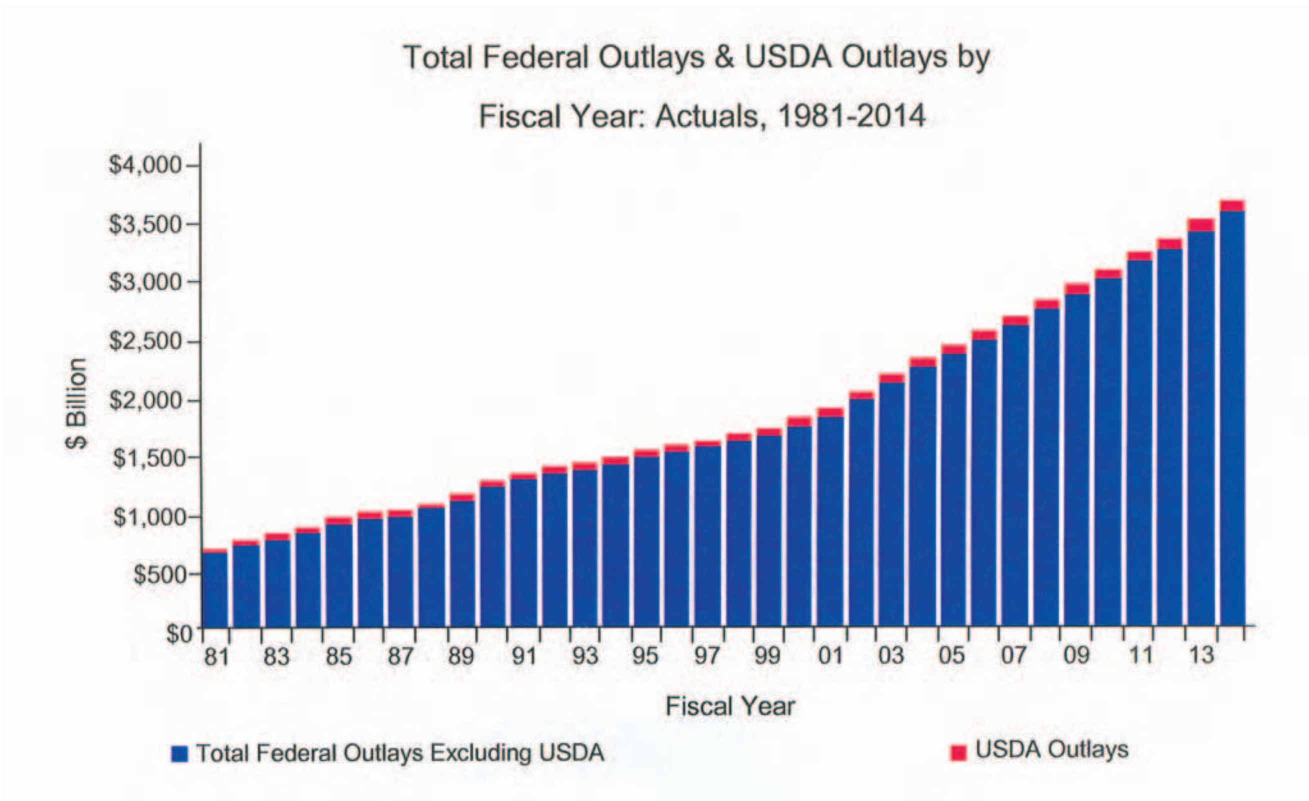
Budget Issues are Always Critical

Dr. Jagger's presentation is an excellent overview of the budget process. He gives an historical perspective on Commodity Credit Corporation expenditures, and a comparison of commodity program and conservation program spending projections. Dr. Jagger reminds us of ongoing power struggles between authorizing and appropriations committees. Of keen interest also is the discussion of budget constraints and deficits, and the difficult public policy choices facing Members of Congress. The following is information presented by Dr. Jagger at the CRP conference.

The Federal Budget and Agriculture (and How the Conservation Reserve Program Fits in)

By Craig Jagger[1]

Total U.S. Department of Agriculture (including non-farm outlays) typically are 2.5% to 5% of total federal outlays [March 2004 Congressional Budget Office (CBO) baseline]



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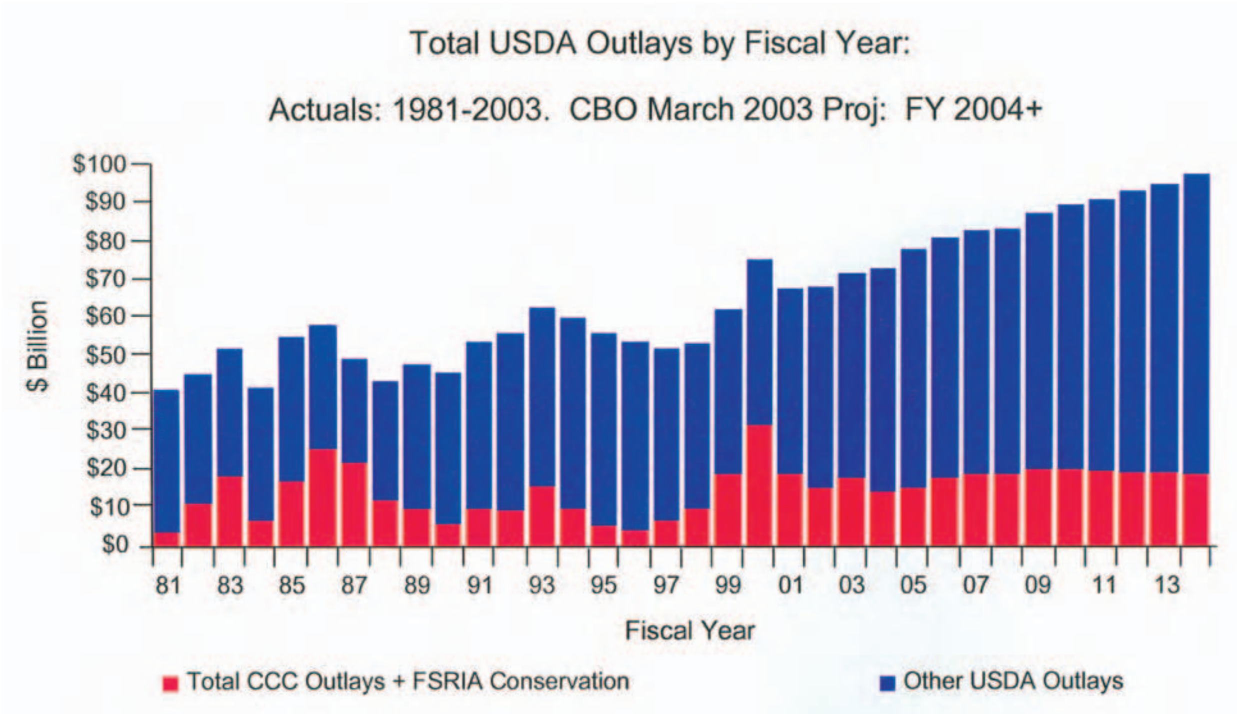
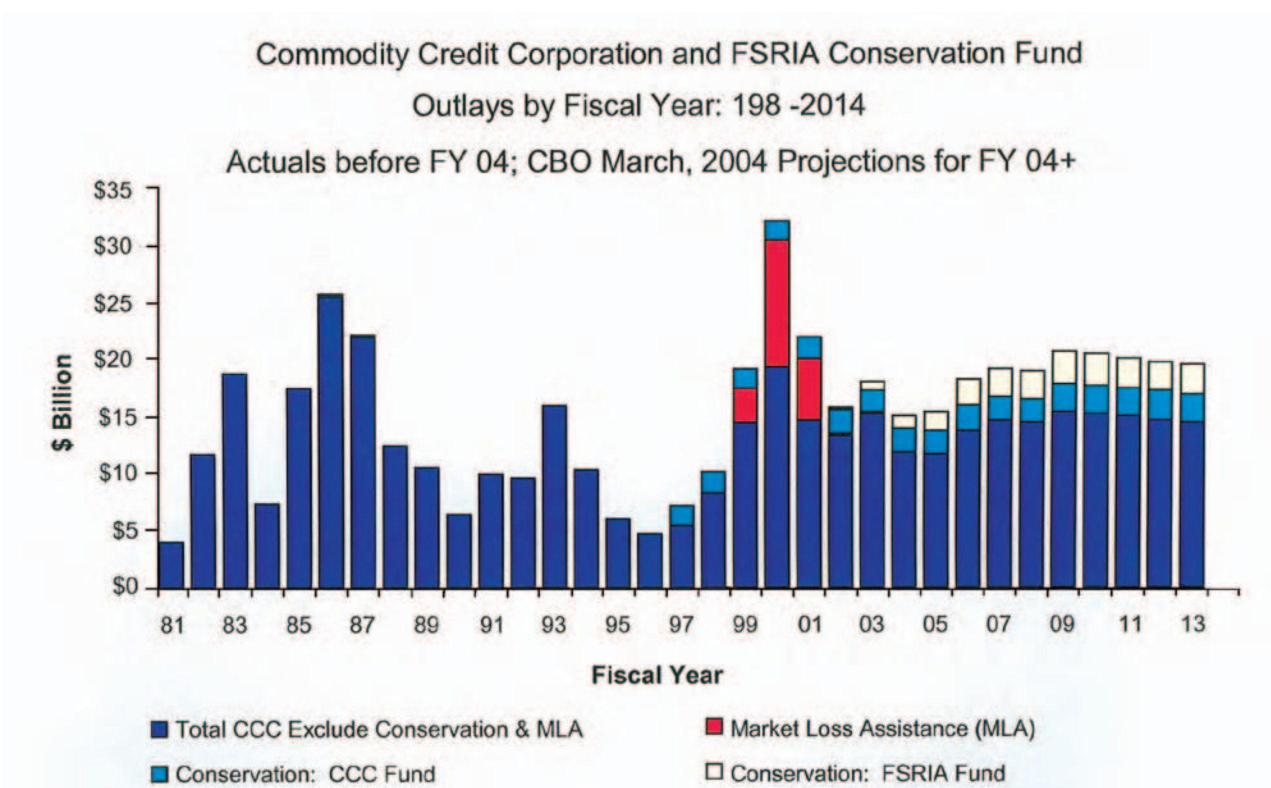
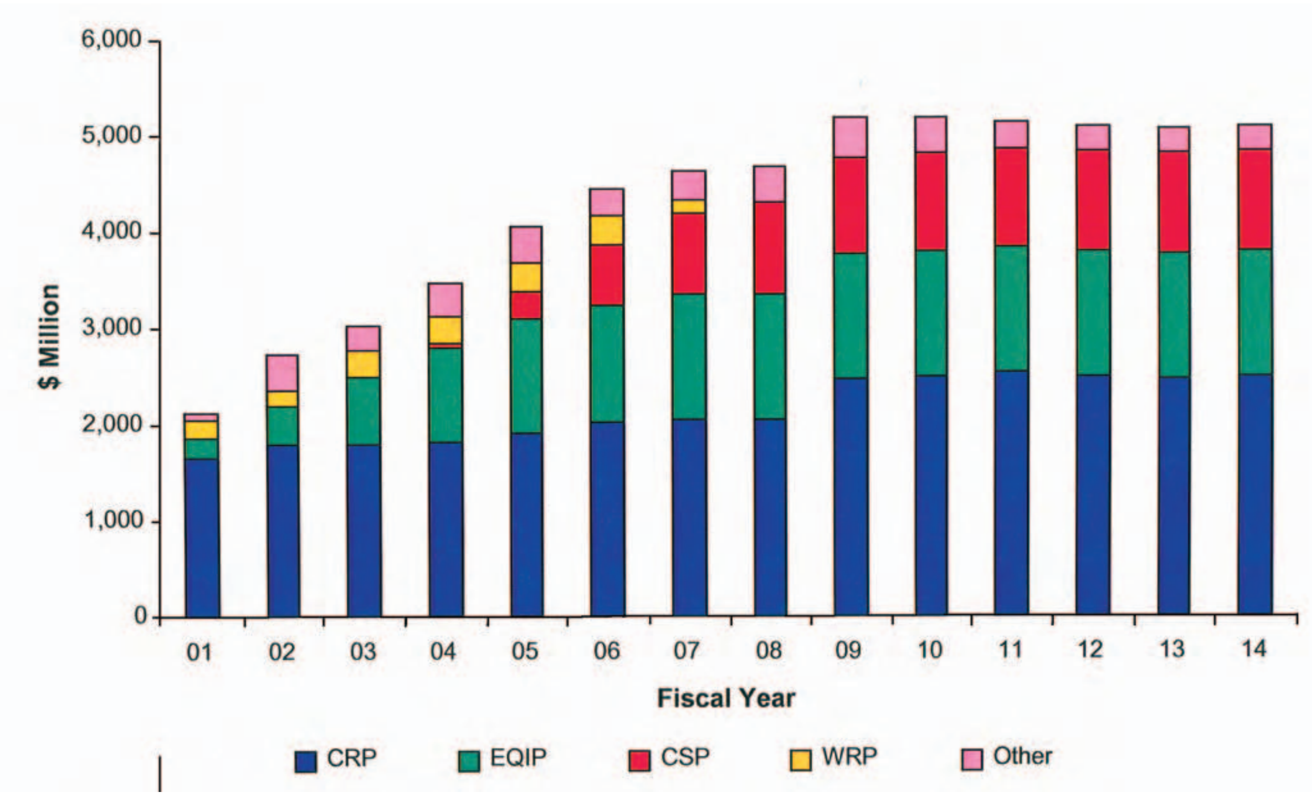
The projected growth in total U.S. Department of Agriculture outlays is not from Commodity Credit Corporation (CCC) and related programs



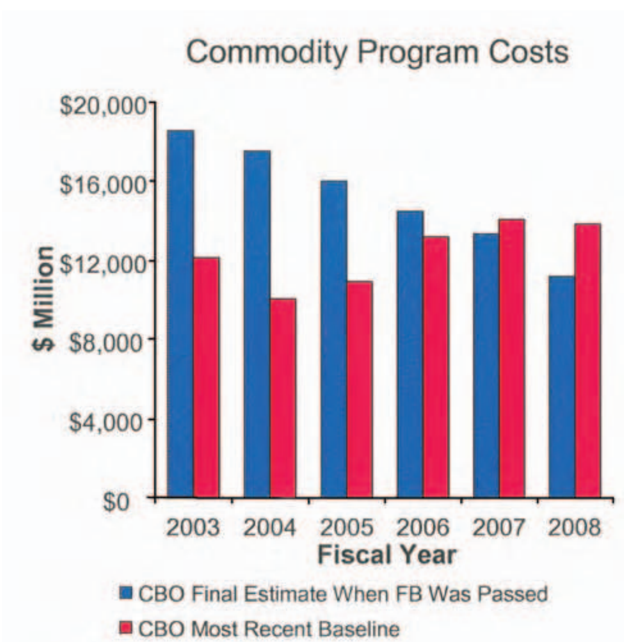
CCC outlays have varied considerably. Conservation programs started to be funded through the CCC beginning with the 1996 Farm Bill (CRP had CCC funding in 1986 and 1987)

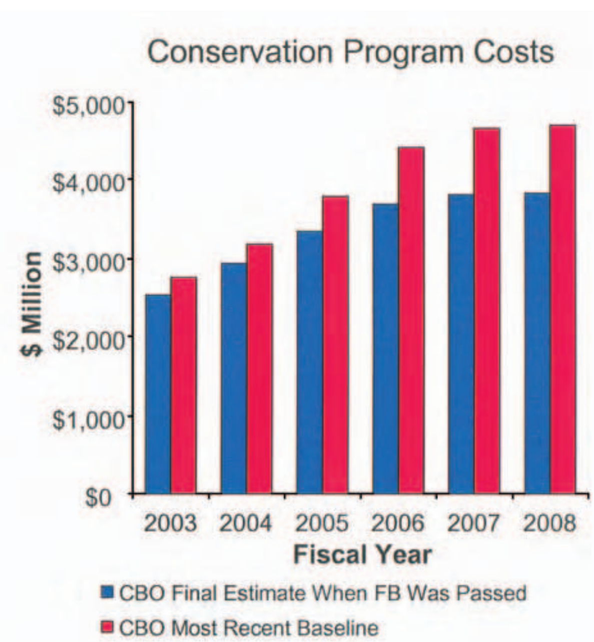


Congressional Budget Office (CBO) projects that, despite a 15% increase in CRP costs from FY 01 to FY 05, CRP costs will drop from more than three-fourths of total conservation program costs to less than half (March 2004 CBO baseline: Budget authority)

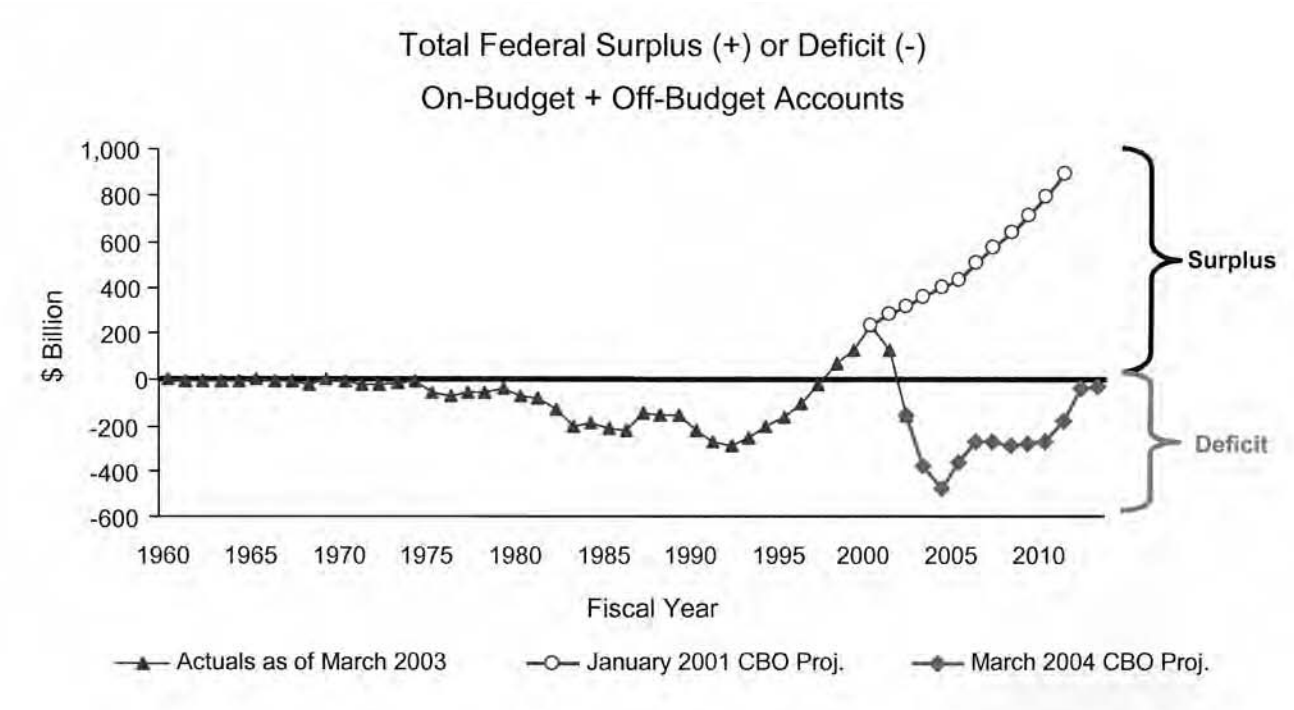


CBO now estimates that for the six fiscal years of the Farm Bill, Commodity program costs are $17 billion (19%) less than its final estimate when the Farm Bill was passed—compared to $2 billion (9%) more for conservation programs





Projected surpluses that facilitated extra funding for the 2002 Farm Bill have disappeared



Budget Reconciliation: Sharing the Pain of Cutting Federal Spending on Mandatory Programs to Reduce the Deficit

- The Congressional Budget Resolution instructs authorizing committees to draft changes to existing laws to achieve specified spending reductions.
- Instructions include how much each committee must cut and over what time period (e.g., 5, 7, or 10 years).
- Prior Budget Reconciliation Bills: 1997, 1996, 1995, 1993, 1990, 1989, 1987, 1985, 1983, 1981.
- The Budget Resolution specifies a maximum level for appropriations that may be lower than in prior years, but cutting discretionary spending is done outside of reconciliation by the appropriators.
- Cuts are made from baseline spending—CBO's projections (with any Budget Committee Adjustments) of mandatory spending over the next 10 years under the assumption that current laws continue.
- Only reduced spending caused by legislated changes are credited—No credit is given for lower than expected costs from changes in market conditions or USDA implementation decisions different than expected.
- Cuts can come from any program under the jurisdiction of the Ag Committees: commodity, conservation, crop insurance, trade, rural development, research, food stamps, or forestry.
- The 10-year mandatory baseline for programs under the jurisdiction of the House Ag Committee is about $540 billion.
- If reconciliation occurs, agricultural cuts will probably not be less than the FY 04 House-proposed level of $18.6 billion.
- Levels of cuts are determined by the Budget Committees.
- Budget Committee decisions can be based on various factors, but it is likely that the higher the spending in the baseline, the higher the required cuts.
- Cuts must be prospective (i.e., cuts in future contracts, not current contracts). Signed long-term contracts cannot be cancelled to get savings.
- So be careful when people say that "We've got to push implementation and get contracts signed to get a higher baseline for reconciliation," especially if long-term contracts are involved.
  - A higher baseline may cause higher reconciliation cuts.

- The more long-term contracts that are signed, the larger the cuts must be from other programs.

Are We Having Fun Yet?

- Proposed cuts may lead to interest group wars. Every program has a constituency.
- Policy changes that save money may be viewed as more attractive than they otherwise would be.
- Can lead to "bad" policy if policies are designed to capture quirks in CBO baselines or estimating assumptions.
- Programs with perceived problems could be viewed as likely candidates for cutting.
- better fix the CRP and Wetlands Reserve Program (WRP) technical assistance problem (see below),
- better ensure that technical assistance is cost-effective.
- Cost trade-offs and savings opportunities can be heavily dependent on CBO baselines and scoring.

Mandatory Program Cuts Taken by the Appropriators

- A one-way street—Appropriators can cut authorizing committee mandatory programs but authorizors cannot cut appropriators' discretionary programs.
- Producers do not get full benefits we intended when the Farm Bill was passed and that the agriculture committees paid for.
- Upsets the delicate balances and compromises that were struck during negotiations on the 2002 Farm Bill.
- Sets up a potential fight between agriculture committees seeking reconciliation cuts and appropriators who have come to depend on limiting our programs to make their ever tightening budget target.

CHIMPS

Appropriations Cuts in Mandatory Programs are Called CHIMPS: Changes in Mandatory Programs

- For FY 04, agriculture CHIMPS were 31% of total CHIMPS. Agriculture appropriations are 2% of total appropriations.
- FY 04: Gross cuts of $647 million; net cuts of $533 million.
- All cuts were from conservation, rural development, research, and energy programs.
- FY 05: House agriculture appropriation allocation of $16.722 billion—$67 million lower than the FY 04 enacted level of $16.839 billion.

Conservation Technical Assistance for CRP and WRP[3]

- Currently, the only way to pay for CRP and WRP technical assistance is to take from program funding (i.e., producer benefits) for the Environmental Quality Incentives Program (EQIP), Farmland Protectoin Program (FPP), Wildlife Habitat Incentives Program (WHIP), and Grassland Reserve Program (GRP) programs.
- Over $1 billion is needed over the next 10 years to pay for CRP and WRP technical assistance.
- Funds available for providing program benefits to producers under the non-CRP and non-WRP programs can be significantly less than enacted levels once funding is reduced for: (1) appropriations cuts, (2) funds donated to pay for CRP and WRP technical assistance, and (3) funds used to pay for own-program technical assistance.

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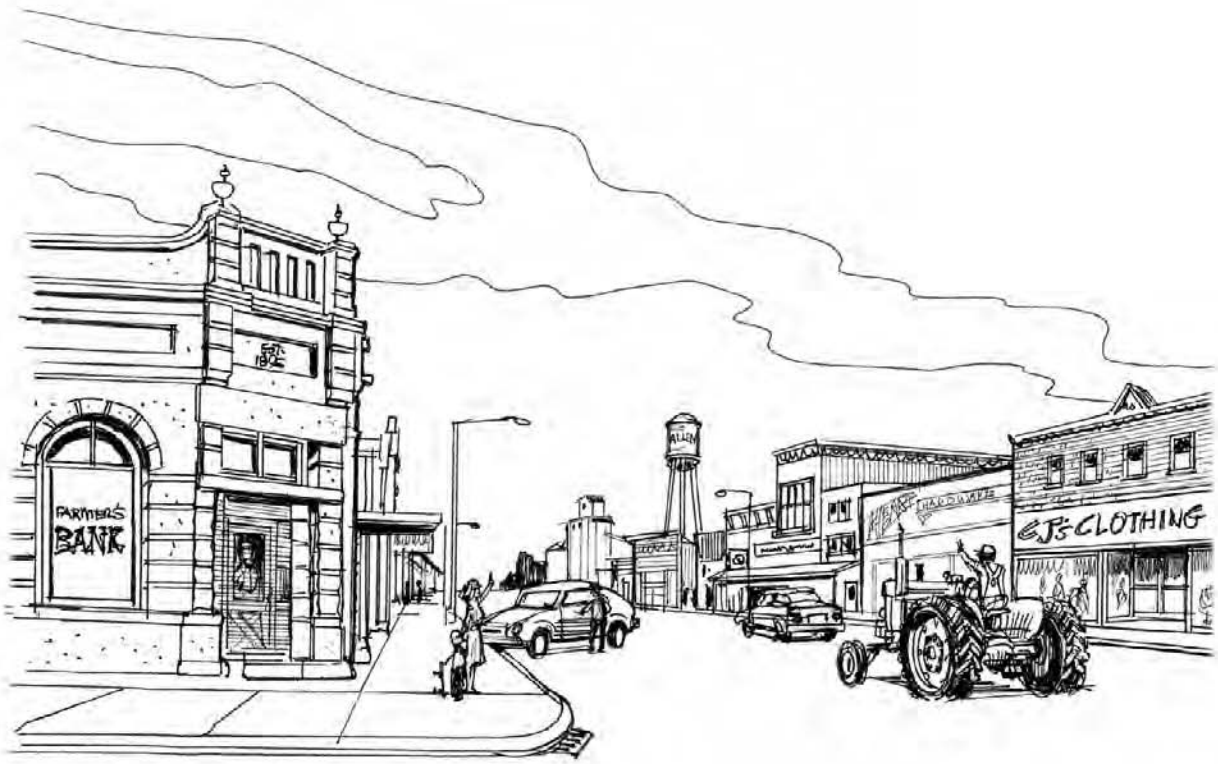
[3]This issue was addressed through subsequent legislation, enacted December 2004, that requires using CRP and WRP funds for their technical assistance costs.

For FY 04, the appropriators cut $146 million from the conservation baseline (excludes watershed rehab). For FY 05:
-- The same % cuts would cut $211 million
-- The same program limits would cut $600 million
-- The administration proposal would cut $265 million

$ million					
	FY 04 cut	% of baseline	FY 05 cut if same % cut	FY 05 cut if same limit	FY 05 Presidential budget cuts
WRP	69	25	69	69	0
EQIP	25	3	30	225	200
WHIP	18	30	26	43	25
FPP	13	10	13	13	0
CSP	12	23	64	241	40
G&S water	9	15	9	9	0
Total	$146	---	$211	$600	$265


FARMER'S BANK
EST. 1892
CJ's CLOTHING
HARDWARE

Session IV. National Program with Local Impacts

National Program with Local Impacts

Moderator: Michael R. Dicks[1]

Yesterday's program offered some insights that I feel compelled to share. Some of these observations may be new to some but not others. However, my involvement in the last five Farm Bills, within the U.S. Department of Agriculture (USDA), the House, Senate and from a University, and my long tenure of involvement with the Conservation Reserve Program (CRP) may offer a unique perspective.

First, a dichotomy of CRP objectives has been expressed by previous speakers. Some view the CRP as an environmental restoration program while others see it as a supply management program with potential to provide environmental benefits. We heard arguments about whether or not the CRP has adversely affected local communities. And we heard from Congressional staffers about program efficiency versus equity.

Each of these topics is very important to the future of the CRP and all are linked. Let me address them one at a time starting with the important topic of efficiency versus equity.

Economists receive considerable training for measuring efficiency. We do, in fact, focus a great deal of our energies on measuring efficiency of programs and policies. While this is certainly important, the Congressional staff in yesterdays' session were quick to point out that legislators are much more interested in equity than in efficiency. Efficiency deals with how well money is spent while equity addresses where money is spent. With respect to the CRP, Congress is much more interested in the allocation of acres and the impacts of that allocation within their political boundaries than they are with how efficiently the program is administered. Thus, while we continue our discussions about how to increase benefits from each acre enrolled in the CRP (efficiency), it is important not to forget that where that acre is located has just as much importance in the big picture. Allison Fox noted many legislators from the east and west coasts view the CRP as a mid-America rather than a national program. This view reduces importance of the CRP in the eyes of coastal legislators. While the bid-selection criteria may seek to maximize program benefits per dollar expended, if all acres are acquired in the Midwest, east and west coast legislators may not show enough interest in the CRP to continue spending $2 billion per year to maintain its presence.

The first panel discussed important changes that would improve the efficiency of the CRP with respect to increasing the ability of the program to obtain water quality and wildlife benefits. And certainly, given the afternoon GIS demonstration yesterday by Paul Harte of the Farm Service Agency (FSA) our ability to better target and manage the CRP has increased over the last two decades, providing us with a capability to more efficiently implement the program. That is, in the environmentalist jargon, improve on our ability to "get the biggest bang for the buck."

The second panel coupled with the opening remarks of Jim Little, USDA/FSA administrator, established the dichotomy of CRP perspectives. Jim discussed the need to talk about the CRP in the context of supply management. Don Parrish expressed the Farm Bureau's perspective that the CRP should be considered as a strategic reserve rather than a conservation program and there should be a "seamless" operation between CRP and other farmland. Kendell Keith of the Grain and Feed Association expressed the need to consider CRP within the context of the "global food economy."

These are important considerations for two reasons: (1) domestic and world demand for grains and their products is projected to continue to increase at a steady pace well into the future; and (2) U.S. supply is still increasing but at a declining rate. More importantly, grain production is increasingly more volatile (i.e., year-to-year fluctuations are escalating).

The CRP contains roughly 10% of the Nation's cropland. Counting only land devoted to the eight major crops (e.g., barley, corn, cotton, oats, rice, sorghum, soybeans, and wheat), the CRP contains 15% of cropland.

The panel of Congressional staff made three very important points several times regarding the action needed to renew the CRP in the next Farm Bill:

- determine the most important reason for CRP,
- make the program as national as possible, and
- resolve reported adverse impacts of the CRP on local communities.

Excess capacity has been a persistent problem for U.S. agriculture since World War I. That is, our ability to produce has exceeded the amount that could be sold in the market at a price acceptable to producers. This problem is what led to the first farm legislation in 1933 and has remained the most persistent problem for agriculture. The most important question for agricultural policy is, "How do we manage U.S. agricultural excess capacity?"

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[1]Oklahoma State University, 314 Agriculture Hall, Stillwater, OK 74078

In response to the Congressional staff's request to keep the purpose of the CRP as "national as possible" let me suggest the following. The CRP is a tool to manage the land resources of U.S. agriculture's excess capacity. If this is not the case then permanent easements should be used to remove fragile land from the cropland base and every attempt should be made to restore the land to its natural state.

No one today should be fooled into believing if crop prices were to return to a level comparable to the 1973–1974 period, the CRP would remain intact. To the contrary, we would likely see every acre of CRP returned to production.

We have used many tools over time to manage land resource capacity; the 34 million acre (14 million ha) CRP is just one of them. On the plus side, the CRP enables us to target lands that have considerable adverse environmental consequences associated with their use in production of annual agricultural commodities. Thus, efficient targeting of the program may provide more benefits to society than it costs to administer the program. On the negative side, acres enrolled in the CRP often are concentrated geographically and thus adversely impact specific local communities. The size of the impact depends on many factors, including:

- importance of agriculture to the local economy,
- size of the farms that have enrolled acres in the CRP,
- percentage of each farm enrolled in the CRP, and
- crop yield, type, and percent of acres planted annually.

Anytime a factory (manufacturing or farm) shuts down or reduces output there is an adverse impact on the local economy. Whether that impact continues over the long term depends on the ability of the community to attract new business. One way to minimize this adverse impact is to retool the factory for the production of another output. In the Plains states, moving environmentally sensitive lands from cropland to grassland to provide recreation, hunting, or cattle forage would certainly reduce the negative impacts on the local economies.

As we listen to speakers on this panel and those for the remainder of the meeting, let us keep in mind that the CRP is just one excess capacity management tool that may be used most efficiently by trying to capture the largest environmental gains while minimizing adverse economic consequences for local communities. Above all else, remember the CRP would not be possible if U.S. crop production contained no excess capacity.

The Conservation Reserve Program's Economic and Social Impacts on Rural Counties: Results from an Interagency Study

By Daniel Hellerstein[1] and Patrick Sullivan[1]

Introduction

The primary objective of the Conservation Reserve Program (CRP), as established by the Food Security Act of 1985 (the 1985 Act), was to retire environmentally sensitive cropland from production. Originally envisioned as a 40 to 45-million-acre (16- to 18-million-ha) program, roughly 34 million acres (14 million ha) were enrolled in the CRP, and by 2002, 13% of farm operators were participants. According to the U.S. Department of Agriculture's (USDA) 2001 Agricultural Resource Management Survey, over half of farm operators participating in the CRP were retired from farming or considered their primary occupation to be something other than farming ["residential" farmers in Economic Research Service (ERS) farm typology]. While this participant profile has led to the view the CRP retires farmers as well as environmentally sensitive cropland, it is generally acknowledged the program has resulted in sizeable environmental benefits and higher farm incomes.

By taking environmentally sensitive cropland out of production, the CRP can influence spending patterns and resource allocations in rural economies. As a way of limiting the program's unintended economic consequences, the 1985 Act provided that not more than 25% of a county's cropland can normally be enrolled in CRP. Nonetheless, concerns continue that high levels of CRP enrollment can hurt nearby farming communities (Hodur and others, 2002). This paper summarizes a USDA report on the CRP's economic and social impacts on rural counties.[2]

In the Farm Security and Rural Investment Act of 2002 (the 2002 Act), Congress instructed USDA to answer several questions about the CRP's economic, social, and land-use effects. These questions fell into four broad categories: (a) impacts of the CRP on rural businesses and communities; (b) impacts of the CRP on rural population trends and beginning farmers; (c) impacts of differential per-acre payment rates on the soil productivity of land enrolled in the CRP; and (d) impacts of CRP enrollment on outdoor recreation opportunities.

[1]Economists, Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW, Washington, D.C. 20036

[2]An electronic copy of the full report, "The Conservation Reserve Program: Economic and Social Impacts on Rural Counties," ERS Report to Congress, February 2004, is available from Dan Hellerstein (danielh@ers.usda.gov) or Pat Sullivan (sullivan@ers.usda.gov). See also Sullivan and others (2004).

Discussion of Economic and Social Impacts of the Conservation Reserve Program

The ERS, assisted by the Farm Service Agency (FSA), the Natural Resource Conservation Service (NRCS), and other USDA agencies, investigated these issues. Overall, our analysis found that aggregate impacts of the CRP on rural communities have been slight. Among other findings, high CRP enrollment did not significantly affect rural population trends. Furthermore, while CRP enrollment was associated with some loss of jobs in rural counties between 1986 and 1992, this negative relationship did not persist throughout the 1990's.

The remainder of this report expands on these findings by addressing each of the four broad questions posed by Congress in the 2002 Act concerning the economic and social effects of the CRP on rural America.

What impact do Conservation Reserve Program enrollments have on rural businesses, civic organizations, and community services (such as schools, public safety, and infrastructure), particularly in communities with a large percentage of whole-farm enrollments?

High enrollment in the CRP was associated with some loss of jobs in rural counties between 1986 and 1992, but this negative relationship did not persist throughout the 1990's. Farm-related businesses, such as input suppliers and grain elevators, continued contracting throughout the 1990's, but other business expansions eased the countywide impact. Simulations suggest regional impacts of CRP enrollment vary widely and there are likely to be winners and losers. We find no statistically significant evidence that high levels of CRP participation affected local government services or tax burdens in a systematic way. The proportion of whole-farm enrollees did not have strong impacts on employment or the provision of local government services.

The CRP's impact on rural communities varies with time, geography, and the economic importance of the land being retired. Not only has the program evolved since its creation in 1985, but so have the economic trends influencing rural communities (Barbarika, 2001). The CRP began during the farm sector's worst financial crisis since the Great Depression and grew in size as the farm sector slowly recovered. As shown in fig. 1, employment trends in counties with high

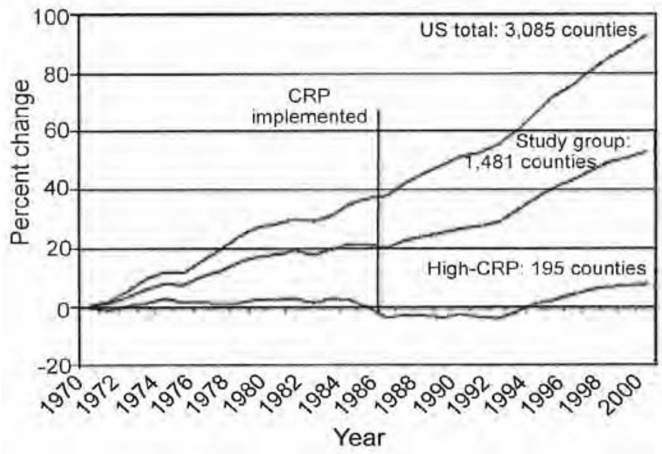
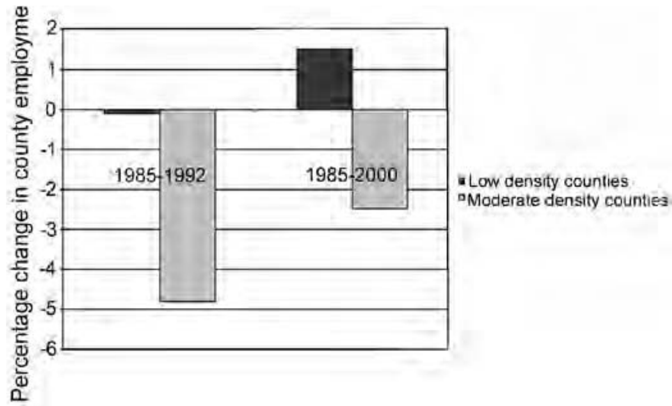


Figure 1. Average job growth, 1970–2000.



Note: Bars represent predicted changes in employment due to an increase in the ratio of CRP payments to income. Low- and moderate-density counties have fewer than 2 and more than 9 persons per square mile, respectively.

Figure 2. Nonfarm job growth in counties with low and moderate population density.

levels of CRP enrollment indicate their local economies performed poorly both before and after the CRP was implemented. Therefore, careful measurement of the effect of the CRP requires some means of disentangling these larger trends in rural America.

We adopt two approaches to estimate economic impact of the CRP. First, a retrospective analysis uses a rural county growth model that considers county-level socioeconomic changes accompanying CRP enrollment in the late 1980's and early 1990's. Second, a prospective analysis uses a simulation model to estimate potential employment and output changes if all land currently enrolled in the program could be put to other uses, given its current distribution, prevailing commodity market conditions, and public policies.

Our retrospective analysis suggests high CRP enrollment in rural counties was associated with some loss of jobs in years immediately following CRP's implementation (1986–1992), but this negative relationship did not persist. This implies local economies adapted to any loss in jobs associated with removing cropland from production. We found employment trends in counties with very low population densities (those without small towns) were unaffected by the level of CRP enrollment. As can be seen in fig. 2, rural counties with slightly higher population densities (indicating the presence of small towns that serve as local agricultural centers) were far more likely to lose jobs when 20% or more of the area's cropland was enrolled in the CRP. Job growth in these counties rebounded as time passed. More densely populated rural counties with diverse local economies and ties to nearby metropolitan areas were unlikely to be affected by CRP in either the short or long run.[3]

The pattern of results from our retrospective analysis of employment trends before and after the CRP was implemented is generally consistent with prospective predictions of what might happen if land currently enrolled in the CRP could be put to other uses. If all CRP contracts were to end, we estimate roughly half of enrolled acres would be planted to crops, with the remainder going into pasture, range, and nonfarm uses, or left idle. The resulting increase in farm production would stimulate demand for nonagricultural goods and services, but would also depress farm commodity prices and decrease farm enterprise income. Releasing CRP lands could have a small positive effect on national output and employment, but incomes of medium-income households (which receive most CRP payments) could decline. In addition, if the CRP's expiration substantially decreased recreational travel, total household income could fall.

The regional effects of releasing CRP land could vary widely. Places with similar enrollments can have dissimilar responses to program changes, depending on the structure of the regional economy and its ties to other regions. Isolated regions with relatively low labor productivity, but substantial agricultural production, are likely to be affected most by changes in CRP enrollment. Even though the CRP's national impacts are small, local economic adjustments might be sizeable. There are likely to be economic winners and losers. Our prospective results are qualitatively similar to previous efforts predicting CRP's impact on regional output (Martin and others, 1988; Mortensen and others, 1990; Hines and others, 1991; Hyberg and others, 1991; Siegel and Johnson, 1991; Dodson and others, 1994). But we demonstrate the size of CRP's impact on regional output is sensitive to the model's assumptions and, when combined with our retrospective analysis, suggest jobs lost to CRP are fairly quickly replaced as economies adjust.

Since our primary concern is with how CRP enrollment influences development of rural counties, most of our attention is focused on trends in the total number of jobs. But

[3]Note that the predicted loss in long-term (1985–2000) employment in moderate density counties is composed of a large loss in the short-term (1985–1992) followed by a partial recovery from 1992 to 2000.

these aggregate trends can mask sizeable adjustments within specific industries. The late 1980's was a difficult period for farm-related businesses. Our analysis suggests the rate of loss of farm-related businesses, such as farm input suppliers and grain elevators, in high-CRP counties was roughly the same as in other farm-dependent areas immediately after CRP was implemented, but since these industries accounted for a larger share of economic activity in high-CRP counties their loss may have had a greater impact. While the loss of farm-related businesses and jobs required difficult adjustments for those directly involved, the data suggest other businesses and jobs were created as time passed.

High enrollment in the CRP could affect civic associations and community services through the program's influence on job, income, and population trends. Although we lacked detailed quantitative information on civic associations, we were able to investigate relations between CRP participation and community services by examining local government spending and tax trends. If high CRP enrollment slowed short-term income and job growth, it could also depress nonfarm property values, tax collections, and public service provisions. But a comparison of high- and low-CRP enrollment counties found no statistically significant evidence that high levels of CRP participation affected local government services or tax burdens in any systematic way when other explanatory variables were taken into account.

Aggregate measures of CRP activity can mask important differences among program participants. One hypothesis is whole-farm enrollees (those using CRP to transition out of farming) may affect neighboring communities differently than partial-farm enrollees (CRP participants who continue to farm). When our growth models were re-estimated with whole- and partial-farm CRP participation replacing aggregate enrollment, results did not provide strong support for this hypothesis. For both partial- and whole-farm participation, CRP was associated with slower employment growth in the short term, but had no effect in the longer term. Neither form of CRP participation significantly affected local government services and tax burdens.

What effect do CRP enrollments have on rural populations and beginning farmers (including a description of any connection between the rate of enrollment and the incidence of absentee ownership)?

When county characteristics are taken into account, post-1985 population trends in rural counties were largely unaffected by high levels of CRP enrollment. The relationship between the level of CRP enrollment and changes in the number of beginning farmers was sensitive to the type of CRP enrollment: whole-farm enrollment was negatively related and partial-farm enrollment was positively related with beginning farmer trends. We found no statistically significant evidence that CRP participation encourages absentee ownership.

By providing a stable source of income to participants, the CRP has helped many financially vulnerable farm operators stay within their communities rather than leave in search of employment elsewhere. This trend was particularly evident early in the program's history. By improving wildlife populations and providing a cleaner and more scenically appealing environment, CRP may have made some rural communities more attractive places to live, work, and vacation. On the other hand, by making it easier for farm operators to retire, CRP may have facilitated population outmigration from farming communities. Since migration patterns are sensitive to employment opportunities, slower job growth in some high-CRP counties may have discouraged immigration.

Enrollment in the CRP tends to be higher in areas with a long history of population decline (fig. 3). Of the 195 high-acreage CRP counties analyzed, nearly 75% lost population between 1970 and 1985, before CRP was authorized. The question is whether high levels of CRP enrollment exacerbated these trends or merely reflect the greater appeal CRP has to eligible landowners in poorly performing economies. We find when county characteristics such as low population density and specialization in agriculture are taken into account, post-1985 population trends were largely unaffected by high levels of CRP enrollment.

Beginning farmers are more likely to be affected by CRP enrollment than many other rural residents. One hypothesis is land enrolled in the CRP reduces the supply available for agricultural production, putting upward pressure on farmland rental rates and asset values, thereby making it more difficult for beginning farmers to start viable businesses. Contrary to this hypothesis, we find evidence the relationship between the level of total CRP enrollment and changes in the number of beginning farmers may be slightly positive, but is sensitive to the way CRP land is enrolled. When CRP participation is divided into whole- and partial-farm enrollment, beginning-farmer trends are negatively associated with whole-farm enrollments and positively associated with partial-farm enrollments (fig. 4).

Partial-farm enrollments are often smaller plots of land that would not have been available for lease or purchase in the absence of CRP. Furthermore, CRP can benefit beginning

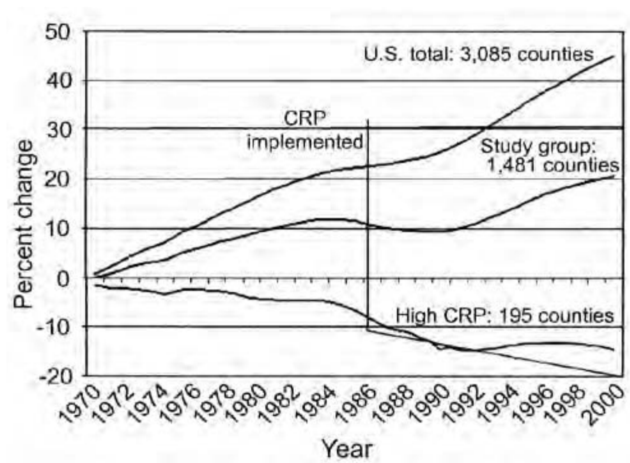
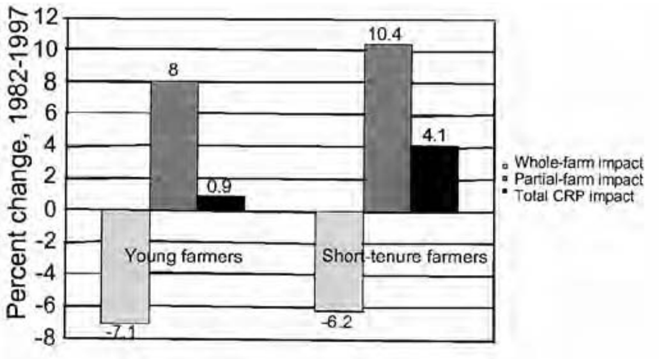


Figure 3. Average population growth, 1970–2000.



Note: The bars represent the expected change in the growth rate of beginning farmers between 1982 and 1997 in the typical low-CRP county if the ratio of CRP enrollment to cropland increased to levels typical of high-CRP counties. Young farmers are those under 35 years of age. Short-tenure farmers are those who have operated their farm for less than 10 years.

Figure 4. Estimated impacts of high levels of Conservation Reserve Program enrollment on beginning farmer trends, 1982–1997.

farmers who have land enrolled in the program. Whole-farm enrollments, on the other hand, may involve tracts of farmland large enough to support viable operations. The retirement of whole farms may make it more difficult for beginning farmers to get started. Or, the relationship between whole-farm enrollments and beginning farmers may simply reflect the dearth of beginning farmers vying for cropland in some areas of the country, making CRP the most attractive option for retiring farmers. Either way, relative to the consequences of technological advances, market trends, and other federal policies, CRP's effect on beginning-farmer trends is minor.

To investigate relations between CRP enrollment and absentee landowners, we analyzed data on where CRP acres are located, and where CRP payments are delivered. Regions of the country with the highest enrollment often experience net outflows of CRP payments, indicating absentee landowners. However, the geographic distribution of CRP payments is similar to other federal commodity payments, suggesting CRP payment flows merely reflect the pre-existing distribution of landowners. We found no evidence suggesting CRP participation systematically encourages absentee ownership.

Using CRP payment flows going outside the county as a proxy for absentee landowners, we found no statistically significant evidence absentee landowners affected population, beginning-farmer, and government fiscal trends. However, CRP participation was associated with higher job growth when payments stayed within the county and a lower rate of job growth when payments went outside the county. Nonetheless, the impacts were small and only apparent in the short run.

What is the manner in which differential per acre payment rates potentially impact the types of land (by productivity) enrolled? How might changes to the per acre payment rates affect this impact? Can differential per acre payment rates facilitate retention of productive agricultural land in agriculture?

Changing the CRP enrollment mechanism from regional rental rates to parcel-specific rental rates resulted in increased environmental benefits, reduced overall program costs, and modestly increased productivity of enrolled lands. When possible, two modifications to parcel-specific rental rates were considered (imposing an upper limit or not using costs when ranking bids); neither had much impact on the environmental benefits, soil productivity, or rental rates of enrolled land.

Without some reference to local farmland rental rates, USDA would risk overcompensating CRP participants, and distribution of enrolled acres would likely be skewed toward less productive land in remote areas, yielding lower environmental benefits than possible when the full range of eligible land is considered (Feather and others, 1999). USDA has used two mechanisms to ensure CRP rental payments reflect local farmland rental market rates: (1) an area-wide rental rate cap, and (2) a parcel-specific rental rate cap reflecting the quality of soils enrolled.

Through 1989, USDA used maximum acceptable rental rates (MARRs) for multicounty geographic areas (referred to as bidding pools) to limit CRP per acre rental payments. The bidding pools grouped land into contiguous, somewhat homogeneous areas. The area-wide MARR reflected average per acre rental rate received on non-irrigated cropland within the area. Due in part to efforts to enroll land into the CRP quickly, USDA accepted nearly every eligible offer requesting less than the area-wide MARR. As a result, farmers tended to offer their least productive eligible parcels for enrollment, and CRP payments often exceeded cash rental rates on similar land.

The windfall gains possible under a fixed rental rate system, such as an areawide MARR, are higher for a farmer's least productive eligible acreage. In 1990, parcel-specific rental rate caps were established to reduce overpayment and increase competition in the bid process. For a particular parcel, the rental rate cap reflects the local market rental rate received for similar soils. Although the parcel-specific MARR reduced systematic overpayments, it also allowed more productive cropland into the program by paying above average rents on such land if projected environmental benefits warranted higher payments.

Using simulation models, we evaluated how changes in the bid selection process affect productivity of land selected into the CRP. Switching from the original CRP enrollment system (used prior to 1990) to one that employs a parcel-specific MARR and environmental benefits rankings resulted in increased environmental benefits, reduced overall program costs, and increased the productivity of enrolled lands. Nonetheless, the difference in productivity of enrolled lands was modest.

We also consider whether it is possible to retain the benefits of parcel-specific MARRs while keeping more productive soils out of the program. To investigate this issue, we simulate the impact of two alternative selection systems: (1) placing an upper limit on the rental rate, and (2) dropping the cost factor from the CRP bid ranking process. Neither approach noticeably affects environmental qualities, soil productivity, nor rental cost of land enrolled in CRP. Any gains in lowering the soil productivity criteria of enrolled land come with reduced environmental benefits.

Due to its multiple objectives, administering CRP requires tradeoffs where goals are incompatible. The CRP's primary focus has always been to retire environmentally-sensitive lands from agricultural production, but environmentally-sensitive lands are found across the productivity spectrum. Our analysis suggests adopting a parcel-specific differential payment system has led to more productive parcels being removed from production. We also find the exact mechanism for implementing parcel-specific MARRs, such as systems that cap payments, has little effect on the productivity of enrolled acres. These results would be expected if highly erodible productive lands were retired to meet the program's environmental objectives; a parcel-specific payment system merely allows the Government to do so in a cost-effective manner.

What is the effect of CRP enrollment on opportunities for recreational activities (including hunting and fishing)?

Prior research indicates the CRP has reduced soil erosion, improved surface water quality, and helped support wildlife populations. An overall measure of all benefits attributable to CRP's effects on wildlife and outdoor recreation is not available, but research indicates the benefits are considerable. Based on limited data, our estimates on the extent to which these environmental benefits increase recreation-related jobs have a wide range.

By taking land out of production and establishing permanent ground cover, the CRP eliminates wind-blown particulates and other forms of erosion originating from enrolled lands. The result is cleaner air and streams, and a wider array of wildlife than on land actively farmed. Permanent cover improves the health of wildlife ecosystems by providing nesting cover, wintering habitat, and plant and insect feeds for wildlife. More wildlife, cleaner air and water, and more attractive scenery all encourage greater use of the outdoors for recreation.

Based on previous research, it is generally acknowledged the CRP has reduced erosion, improved surface water quality, and helped support wildlife populations (Ribaudo, 1986; Ribaudo and others, 1990; Allen and Vandever, 2003). By improving the quality and quantity of outdoor recreational opportunities, CRP benefits consumers and local economies. For example, by reducing lake and stream sediment, CRP has increased the quality of fishing, boating, and other water-based recreation. People may value improvements to water-based recreation whether or not they spend money while taking advantage of these opportunities. But improvements in the quality of outdoor amenities can also have market effects if recreationists increase purchases of fishing equipment, cabin rentals, boat rentals, and similar purchases.

An overall measure of all benefits attributable to the CRP's effects on wildlife populations and enhancements to outdoor recreation is not available. However, based on a summary of available literature, a conservative estimate of the value placed on selected wildlife-related activities attributable to the CRP is in excess of $700 million per year. Most of this is related to wildlife-viewing opportunities. CRP also affects recreational spending. To investigate these market-related benefits, two types of outdoor recreation most likely to be affected by CRP, freshwater-based and wildlife-based recreation, were examined.

Given the lack of data linking CRP to recreational expenditures, we generated estimates using two methods. The first method combines survey data on recreational trip-taking behavior with information on land uses; in particular, with information on the amount and distribution of CRP land. The second method combines information on expenditures by hunters with information on income received by farmers for recreational uses of their land. The first method (referred to as the "trips-based" method) suggests CRP-induced recreational travel spending does not amount to much as recreationists change travel destinations but do not really increase recreational spending. The second method (referred to as the "receipts-based" method) yields a sizeable estimate of annual recreational travel expenditures attributable to the CRP (approximately $300 million), comparable to partial estimates previously reported in the literature. While CRP certainly adds to the quality of recreational opportunities, its impact on recreation-related jobs in high enrollment CRP areas depends on whether the program affects number of trips (yielding a higher impact) or primarily increases enjoyment derived from trips that would have been made anyway (yielding a limited impact).

Limitations of the Economic and Social Impacts Analysis

We selected statistical procedures and made assumptions that should err on the side of finding CRP impacts on rural counties. Nonetheless, limitations with the models and available data need to be acknowledged.

Our analysis was conducted at the county or multicounty level to take advantage of available data and analytical techniques to determine if CRP enrollment systematically affects socioeconomic trends. We did not look for evidence that any particular county was affected by the CRP. In contrast, much of the anecdotal evidence concerning CRP's rural impacts appears to be based on individual towns or cities. It is likely the percentage of cropland enrolled in the CRP is much higher within small geographic areas than it is for the county as a whole. Therefore, individual towns may be affected (some positively and some negatively) as land is taken out of production and jobs shift elsewhere within the county. Due to the lack of nationwide data on sub-county units, our analysis did not assess the program's impact on small towns and cities. Furthermore, some areas appeared to benefit from high levels of CRP enrollment. Therefore, general statements about the program's systematic impacts may be misleading for individual cases.

While our growth models show the CRP is associated with reduced job growth in high-enrollment areas and whole-farm enrollments are associated with fewer beginning farmers, we do not know in which direction the causality occurred. One plausible explanation is as CRP took agricultural land out of production, the demand for farm inputs and agricultural marketing services declined, leading to slower employment growth and fewer beginning farmers than would have been the case in the program's absence. An alternative explanation is CRP enrollment was particularly high in rural areas that were not going to prosper economically— due to their isolation, dependence on agriculture, and marginal farmland— whether the CRP was operational or not. In this case, CRP enrollment was greater in those counties for the same underlying reasons that job growth was lower. We cannot rule out either explanation. Nonetheless, if CRP had a systematic impact on farming communities, it was small and short lived.

Economic growth models typically focus on jobs and output as measures of "success," but the CRP aims to provide society with cleaner air and water, more abundant wildlife, and access to improved agricultural resources in the future. Its greatest successes may not involve creation of new jobs or traditional goods and services as much as improving the quality of life for consumers and reducing pollution-related costs for households, businesses, governments, and society in general.

Finally, CRP's benefits and costs can be widely dispersed. While these multi-jurisdictional impacts are one of the primary justifications for operating a federally financed environmental program, they complicate measurement of program impacts on local communities. Communities with relatively little CRP enrollment often benefit from enrollment in neighboring and upstream communities, making comparisons between high- and low-CRP counties misleading. As a result, the CRP's environmental benefits may affect the quality of life in rural communities, which in turn can lead to demographic and economic changes. Our analyses capture these impacts indirectly and imperfectly.

References Cited

Allen, A.W., and Vandever, M.W., 2003, A national survey of Conservation Reserve Program (CRP) participants on environmental effects, wildlife issues, and vegetation management on program lands: Biological Science Report No. 2003-001, Fort Collins, Colorado, U.S. Geological Survey, 51 p.

Barbarika, A., 2001, Conservation Reserve Program: Program summary and enrollment statistics as of August 2001: Farm Service Agency, U.S. Department of Agriculture, Washington, D.C., 60 p.

Dodson, C., McElroy, R., Gale, F., Hanson, K., and Carlin, T., 1994, Gauging economic impacts as CRP contracts expire: Agricultural Outlook, AO-211, p. 20–24.

Feather, P., Hellerstein, D., and Hansen, L., 1999, Economic valuation of environmental Benefits and the targeting of conservation programs: The case of the CRP: Agricultural Economic Report No. 778, Economic Research Service, Washington, D.C., 56 p.

Hines, F., Sommer, J., and Petrulis, M., 1991, How the CRP affects local economies: Agricultural Outlook, AO-178, p. 30–34.

Hodur, N.M., Leistritz, F.L., and Bangsund, D.A., 2002, Local socioeconomic impacts of the Conservation Reserve Program: Agribusiness & Applied Economics Report No. 476, North Dakota State University, Fargo, 119 p.

Hyberg, B.T., Dicks, M.R., and Hebert, T., 1991, Economic impacts of the Conservation Reserve Program on rural economies: Review of Regional Studies, v. 21, no. 1, p. 91–105.

Martin, M., Radtke, H., Eleveld, B., and Nofziger, S.D., 1988, The impacts of the Conservation Reserve Program on rural communities: The case of three Oregon counties: Western Journal of Agricultural Economics, v. 13, no. 2, p. 225–232.

Mortensen, T.L., Leistritz, F. L., Leitch, J.A., Coon, R.C., and Ekstrom, B.L., 1990, Socioeconomic impacts of the Conservation Reserve Program in North Dakota: Society and Natural Resources, v. 3, no. 1, p. 53–61.

Ribaudo, M.O., 1986, Consideration of offsite impacts in targeting Soil Conservation Programs: Land Economics, v. 62, no. 4, p. 402–411.

Ribaudo, M.O., Colacicco, D., Langner, L.L., Piper, S., and Schaible, G.D.,1990, Natural resources and user benefit from the Conservation Reserve Program: Agricultural Economic Report No. 627, Economic Research Service, Washington, D.C., 51 p.

Siegel, P.B., and Johnson, T.G., 1991, Break-even analysis of the Conservation Reserve Program: The Virginia Case: Land Economics, v. 67, no. 4, p. 447–461.

Sullivan, P., Hellerstein, D., Hansen, L., Johansson, R., Koenig, S., Lubowski, R., McBride, W., McGranahan, D., Roberts, M., Vogel, S., and Bucholtz, S., 2004, The Conservation Reserve Program: Economic implications from rural America: Agricultural Economic Report no. 834, Economic Research Service, Washington, D.C., 106 p.

The Conservation Reserve Program: A National Program with Local Impacts

By James B. Johnson[1]

Introduction

The Conservation Reserve Program (CRP) was initiated with passage of the Food Security Act of 1985. The program was intended to retire cropland from production over a multiple-year contract period. Cropland was eligible for enrollment if it had appropriate cropping history and was considered highly erodible under specific definitions.

Under the Food Security Act, the CRP's primary objective was to reduce erosion occurring on cropland, but several secondary objectives were also specified. These were to: (1) protect the long-term capacity to produce food and fiber; (2) reduce sedimentation; (3) improve water quality; (4) create fish and wildlife habitat; (5) curb production of surplus commodities; and (6) provide income support for farmers (Federal Register, 1986).

The CRP has been reauthorized through several subsequent legislative actions. Changes in authorizing legislation and implementation rules have periodically shifted the primary environmental focus of the program from erosion control on cropland, to improved water quality, and then to enhanced wildlife habitat. Particular issues, especially those related to the implementation of the CRP, have occasionally received attention in the appropriations process. But through all of these changes farm managers, tenants, landlords, and managers in associated agribusinesses have tended to focus on CRP objectives with economic content.

In this discussion, emphasis is placed on some intended consequences (and possibly some unintended consequences) of achieving those CRP objectives with economic content. Local economic impacts will be discussed with respect to contract holders (owner/operators, tenants, and landlords), associated agribusinesses, and intended post-contract uses of land in CRP.

Impacts on Contract Holders

The CRP has consistently been a voluntary land retirement program in which eligible cropland (and certain other environmentally sensitive lands) may be enrolled through a bidding process. The initial CRP Interim Rule stated "the annual rental payment shall be determined by submission of a bid by the owner or operator and is designed to compensate the participant for taking cropland out of crop production and devoting it to a less intensive use." The initial CRP Interim Rule also provided definitions of annual rental payment and bid. Annual rental payment means the annual payment specified in the CRP contract that is made to the participant to compensate such participant for placing eligible cropland in the CRP. Bid means the per acre rental payment requested by the owner or operator in such owner or operator's offer to participate in the CRP (Federal Register, 1986).

Several interpretations of the purpose of the CRP annual payment have been made. The narrowest interpretation is the annual payment only compensates the owner or operator for idled cropland. A more encompassing interpretation is that the CRP annual payment is an economic bribe to compensate contract holders for idling all resources fixed to the farm allocated to producing agricultural commodities on cropland to be enrolled in the CRP.

With this limited legislative and implementation rule guidance relative to the CRP annual rental payment, Montana State University and University of Nebraska faculty developed and provided bidding procedures to potential CRP contract holders. A procedure used in Montana and Nebraska was based on one concept: base your CRP bid on your next best alternative. That is, potential contract holders should make bids that would compensate them for the opportunity costs for all resources idled. The next best alternative was usually continued production. Typically the crop or crop rotation involved a program crop, or program crops, with accompanying price supports and income subsidies.

The bidding procedure allowed potential CRP contract holders to calculate break even bids equivalent to the value of their next best alternative. The value of the next best alternative was the net returns above short-term variable costs for continued crop production. Gross returns to crop production included the market value of production and any potential income subsidies that would be foregone when crop base was placed in escrow during the CRP contract period. Variable costs subtracted from these gross returns included payments for seed, fertilizer, chemicals, fuel, oil, and repair costs associated with machinery used for crop cultural practices from planting through harvest. Interested bidders were encouraged not to offer cropland at current net return levels, but rather to make their offer relative to some average annual net returns over the contract period. Therefore, the bid was appropriately adjusted for inflation and the time value of money over the contract period. [For arithmetic details of the bidding procedure, see Johnson and Clark (1989)].

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Net returns above variable costs are considered the returns to factors of production fixed to the farm. For a cash grain farm such factors include land, buildings, machinery and equipment, family-supplied labor, and operator-supplied management. The intent of many CRP bidders was to reward these fixed factors at least as well as if they had continued with their next best alternative.

Appropriations legislation for federal programs on rural development and agriculture for the year ending September 30, 1988, required that CRP contracts "not be entered into at a rate in excess of the prevailing local rental rates for an acre of comparable land." Instructions were provided to the County Agricultural Stabilization and Conservation Service (ASCS) committees. "The county ASCS committee shall, at a minimum, consider the following in establishing a maximum rental rate for the county which shall not exceed the MARR (maximum acceptable rental rate) announced by the Secretary (USDA, 1988).

1. The up-front, cash outlay contributed by producers for one-half of the cost of establishing a cover on CRP land. The compensation (rate of return) received, if this amount is invested.

2. Necessary costs to participants over the 10-year period to remain in compliance with contract terms and conditions.

3. Data and information provided by local government and farm-related agencies, Agricultural Foreign Investment Disclosure Act (AFIDA) reports, etc., as well as personal knowledge of the farming communities within the county regarding land values and economic trends.

4. The cash rent value of an acre of land in 1998 (year of contract expiration) will not be the same as the land's current cash rent value. Comparison of cash rent values to comparable land must be done on the basis of present and future projected cash rental rates expected over the 10-year contract period.

5. Other impacts on land values over a 10-year period (Establishment of Prevailing Local Rental Rates by COC for the Sixth Signup, 1988)."

Later, the above procedure was modified to allow use of crop-share rental rates in areas where cash rentals of cropland were uncommon. With the passage of the Food, Agriculture, Conservation and Trade Act in 1990, CRP bids were evaluated for environmental benefits. A similar process continues for periodic (but not continuous) CRP signups. Bids within the prescribed bid caps with the greatest environmental benefits ratings are the first accepted.

Beginning with the last signup under the 1990 Act, there was an important change to the bidding process. The bid was no longer limited by a maximum acceptable rental rate set at the county level, but rather each tract being bid for CRP participation had its own bid cap. Soil rental rates were set for each soil type in a county based on the relative productivity of the soil type and the preestablished dryland cash rental rates in the county. Soil rental rates could be as high as 50% above the county rental rate and as low as 50% below the county rental rate. Bid caps for a tract were calculated as the weighted average of up to three predominant soils in the tract being bid. The bid cap included a maintenance rate. Bids under the bid cap received an environmental benefits index rating. With minor modifications this process has continued (Preparations for CRP Signup 13, 1996) (USDA, 1996).

In general, Montana CRP contract holders have fared well. For active CRP contracts, excluding the impacts of Conservation Reserve Enhancement Program (CREP) contracts, the CRP rental rate to cropland rental rate ratios have ranged from a low of 1.76 in 1996 to a high of 2.29 in 2002 (table 1). These average CRP rental rates for new contracts can also be compared with net returns above variable costs for a composite farm in north central Montana, an area that encompasses Major Land Resource Area 58 (table 2).

Costs included in the net returns calculation are for the 1995 crop year and product prices are long-term price projections considered applicable to wheat and barley from 1996 to 2002 when commodity provisions of the Federal Agriculture Improvement Act of 1996 were applicable (Johnson and others, 1998).

Net returns above variable costs for the composite acre were estimated to be $44.49. The statewide average CRP rental rates for new contracts in the 1996 though 2001 period would have compensated from 67% to 80% of the composite acre net returns above variable costs.

Table 1. Comparison of Conservation Reserve Program rental rates with cash, non-irrigated cropland rental rates in Montana.

Year	Conservation Reserve Program rental rate ($/acre)[a]	Non-irrigated cropland cash rental rate ($/acre)[b]	Ratio: Conservation Reserve Program rental rate/cropland rental rate
1996	29.96	17.00	1.76
1997	34.50	17.00	2.02
1998	32.58	17.00	1.91
1999	33.62	18.00	1.87
2000	35.12	17.30	2.03
2001	35.00	18.00	1.94
2002	42.45	18.50	2.29
2003	65.95	18.50	3.56

[a]For active Conservation Reserve Program (CRP) contracts initiated in the program year noted. The 2002 year was entirely non-Conservation Reserve Enhancement Program (CREP) Continuous CRP signup and 2003 was dominated by CREP contracts (Monthly Contract Report, 2004).

[b]Annual crop rental values per acre, including fallow acres (Montana Agricultural Statistics, 2003).

Table 2. Net returns above variable costs for a dryland farm in north central Montana with 2,020 acres of active cropland.

Crop	Net returns per acre ($/acre)[a]	Percent of cropland[b]	Acres	Total net returns ($)[c]
Winter wheat on fallow	96.44	11.7	236	22,760
Winter wheat on stubble	70.11	2.3	46	3,225
Spring wheat on fallow	91.39	27.2	549	50,175
Spring wheat on stubble	83.00	5.0	101	8,385
Barley on fallow	74.96	4.9	100	7,495
Barley on stubble	72.60	5.1	103	7,480
Fallow	(10.89)	43.8	885	(9,640)
Total		100.0	2,020	89,880
Composite acre				44.49

[a]The net returns are based on 1995 crop year costs and long-term produce price: $3.44, $3.75, and $2.09 per bushel for winter wheat, spring wheat, and barley, respectively.

[b]The original percentages were normalized to eliminate minor crops and durum wheat.

[c]These estimates were rounded to the nearest $5 or $10.

Average CRP rental rates in select counties in north central Montana even more closely parallel the composite net returns per acre. Teton County was purposely selected as north central Montana's county of comparison because of substantial CRP enrollments in recent years (Monthly Contract Report, 2004). The CRP rental rates in this county ranged from 84% to 96% of the composite net returns per acre for the illustrative north central Montana farm. Differences between the CRP rental rates in the latter years of this comparison may be overstated as the net returns per acre were held constant at 1995 levels (table 3).

Comparing CRP payments with net returns above variable costs or a break even bid based on the amortized sum of the net present value of future net returns implicitly assumes everything else equal. But everything else is not necessarily equal. There is near certainty attached to receiving the annual CRP payment over the life of the contract. There is definitely not certainty in the net returns per acre above variable costs in the production of a rotation of annually planted dryland crops in Montana. Perhaps CRP contact holders were willing to trade off some of their break even bid for a certain CRP payment.

Table 3. Comparison of Teton County average Conservation Reserve Program rental rates with composite acre net returns above variable costs.

Year	Conservation Reserve Program rental rate ($/acre)	Composite acre net returns ($/acre)	Ratio: Conservation Reserve Program rental rate/composite acre net returns
1996	37.98	44.49	0.85
1997	39.09	44.49	0.88
1998[a]	41.55	44.49	0.93
1999	40.62	44.49	0.91
2000	43.11	44.49	0.97
2001	39.43	44.49	0.89
2002[b]	45.38	44.49	1.02
2003[b]	42.76	44.49	0.96
2004	38.29	44.49	0.86

[a]Nearly 50% of the acres enrolled in this year were non-Conservation Reserve Enhancement Program continuous contracts.

[b]In these years, 100% of acres enrolled were in non-CREP continuous contracts.

Impacts on Associated Agribusinesses

Studies conducted within a year, or two, after inception of the CRP generally indicated subsectors of the economy most adversely impacted due to implementation and continuation of the program would be farm input suppliers and first handlers of agricultural commodities such as trucking firms, grain merchandisers, and elevators. Perhaps these adverse impacts did exist for a time, but they do not appear to have persisted (Standaert and others, 1990).

Undoubtedly some individual grain elevators experienced declines in wheat and barley production in their service areas due to CRP enrollment. These firms had to expand their service areas to obtain sufficient volumes to remain in business, sometimes at the expense of competing elevators. Grain companies, because their income is a function of the margin between the prices at which they purchase and prices at which they sell and the volumes they handle, remain concerned about total production, specifically wheat and barley in Montana.

Reductions in production may have adversely impacted individual elevators, but these patterns have not been evident with respect to wheat for the entire state of Montana. In contrast, barley acreage and total production have declined through time. Although these patterns developed when the CRP was in place, everything else was not equal.

Changes in acres of wheat and barley planted through time were influenced not only by the CRP, but also by changes in commodity policy, variations in prices and net returns for wheat and barley, changing production technologies, and climatic conditions, especially continuing drought. Through the 18-year period the CRP has been in place, total average annual planted acres of wheat and barley in Montana has declined only slightly (table 4). Wheat acreage has increased in certain periods while average annual barley acres have declined to about 60% of their pre-CRP level (Montana Agricultural Statistics, 2003).

Often the first reaction to the number of acres enrolled in the CRP is "that is a lot of acres removed from crop production." However, in Montana and in portions of several nearby Northern Plains and Mountain States, fallow was used extensively in crop rotations at the inception of the CRP. That pattern is slowly changing. Crop acreage base was in place at the inception of CRP, and only acres planted or considered planted to a program crop counted in the base calculations. Consider what this meant early in the CRP.

For example, the USDA would report that Montana had 2,000,000 acres (809,371 ha) enrolled in the CRP. But only about 1,200,000 acres (485,623 ha) of aggregate program base were placed in escrow, as only about 60% of the active cropland acres had program base. Producers had to plant program crops on base if they intended to receive commodity program price support and income payments. So, at most, 1,200,000 acres would likely have been planted to program crops. But supply control mechanisms in the commodity programs further restricted acres of program base that could be planted. The annual acreage retirement mechanism was the "acreage conservation reserve" more commonly called the "set-aside."

Table 4. Average annual acres of wheat and barley planted in Montana during select time periods.

Years	Wheat	Barley	Total
2001–2003	4,480,000	1,126,000	6,606,000
1996–2000	5,866,000	1,230,000	7,096,000
1991–1995	5,499,000	1,410,000	6,909,000
1986–1990	5,345,000	1,960,000	7,305,000
1981–1985	5,455,000	1,934,000	7,389,000

In the 1986 crop year, the set-aside requirement for wheat and barley was 25% and 20%, respectively. Assuming the base in escrow was all barley base, only 960,000 acres [1,200,000 x (1-0.20)] of the 2,000,000 acres enrolled in the CRP could have been planted to program crops.

The crop acreage base and set-aside mechanisms existed, as described in the example above, until the 1991 crop year. The Food, Agriculture, Conservation and Trade Act of 1990 provided for normal and optional flex acres. On normal flex acres, a producer could produce the subject crop and receive available price support or certain other crops and receive their price supports. Wheat was often planted on barley normal flex acres because the expected net returns per acre of wheat exceeded expected net returns per acre of barley. Since the 1996 crop, through provisions of the Federal Agriculture Improvement and Reform Act of 1996, commodity program income payments have been totally separated from crop acreage bases; that is, a producer will receive the income payments even if none of the subject crop with a historical production record is planted. In Montana, since 1991 and increasingly since 1996, wheat has been planted on some acres previously planted to barley.

The total production of wheat and barley is influenced by acres planted, acres harvested, and yield per acre. Prior to 1996 acres planted to a particular crop were, at times, constrained by commodity program provisions. More recently acres planted have adjusted to market signals–moving to crops with higher net returns per acre. Acres planted and harvested and yields per acre have been affected by growing conditions, including prolonged drought.

In fact, in Montana annual wheat production was greater in the 1990s than during the 5-year period just prior to the inception of the CRP (table 5). Producers have been able to respond to market signals to some degree since 1991 and especially since 1996. Wheat prices realized in Montana in the 1992 through 1996 crop years were relatively high in comparison to those in the 1986 through 1991 crop years (Montana Agricultural Statistics, 2003).

Average annual wheat and barley production declined substantially in the 2001–2003 period. Both the 2001 and 2002 crop years were adversely impacted by drought in several of Montana's production areas. In both years, only about 67% winter wheat and barley acres planted were harvested.

But the question remains. What would happen to the acres currently enrolled in the CRP at contract expiration if the CRP was continued or terminated?

Intended Uses of Conservation Reserve Program Land

Occasionally concerns about possible changes in the CRP stimulate studies of future uses of land enrolled in the program. In late 1991, Montana had over 2.8 million acres (1.1 million ha) of cropland enrolled in the CRP [out of a

Table 5. Average annual production of wheat and barley in Montana during select time periods.

Years	Wheat (bushels)	% of 1981–1985 production	Barley (bushels)	% of 1981–1985 production
2001–2003	114,945,000	89	33,900,000	56
1996–2000	162,966,000	126	51,200,000	85
1991–1995	177,066,000	137	63,520,000	106
1986–1990	128,121,000	99	66,980,000	111
1981–1985	128,995,000	100	59,996,000	100

possible maximum of 4.3 million acres (1.7 million ha)]. There was growing concern within the state about the disposition of enrolled acres if this cropland could not be bid back into the CRP. Under statute provisions applicable at the time, lands enrolled in the CRP could be retained in annual cropping, used in some alternative commercial use such as haying or grazing, or remain in a conserving use at contract termination.

Some 224 respondents to the 1991 Montana State University Farm and Ranch Survey indicated they had cropland enrolled in the CRP. On average each respondent had 620 cropland acres (251 ha) enrolled in the program. Respondents indicating CRP participation were post-stratified as crop producers, livestock producers, or diversified operations. An estimated 57% of the respondents received 70% or more of their total gross incomes from crop sales and were classified as crop producers.

An estimated 16% of the respondents received 70% or more of their total gross incomes from livestock sales and were considered livestock producers. The remaining 27% of respondents were diversified operations. The respondents indicated their intentions for post-contract use of land enrolled in the CRP as shown in table 6 (Sheard and others, 1992).

Table 6. Percent of Montana Conservation Reserve Program land to be returned to specific uses, by type of producer.

Intended land use	Crop producers (%)	Livestock producers (%)	All respondents (%)
Return to crops	62	16	51
Hay or graze	30	84	42
Retain in conserving use	6	0	6
Other	2	0	1
Total	100	100	100

It was postulated that intentions of CRP contract holders for future use of CRP lands were a function of expected net returns from various alternative land uses, and the capital outlays associated with the various post-CRP land uses. Statistical analyses of survey data indicated CRP land use subsequent to the contract period primarily depended on existence of resources and improvements necessary to pursue one of the alternative land uses. However, the lower the necessary initial capital outlays for pursuing haying and grazing, or returning land to annual crop production, the more apt the contract holder was to pursue that alternative. The CRP contract holders did not seem to be heavily influenced by expected net returns for each alternative land use.

Subsequent to the Montana investigation, an Oregon study was conducted that involved a survey of CRP contract holders and an economic analysis of relative returns. The central question addressed in this study was what mix of institutional and market conditions would lead to resumption of wheat production on land that was enrolled in CRP at the time of the survey? North-central Oregon was in the study area. Most of Oregon's CRP enrollment is located in this five-county area. The survey of contract holders indicated 65% intended to resume wheat production on some of their land if the CRP was changed or terminated. The economic analysis ascertained probable post-CRP contract land use by budgeting net returns above variable costs for wheat at varying wheat prices. Net revenue schedules were developed for wheat at each price and net returns from production were compared to CRP payments. Estimates were obtained on proportions of CRP acres with wheat base that would be more profitable than bidding the cropland back into CRP at certain per acre annual payment rates. The percentages of CRP acreage that would be more profitable in wheat production at prices ranging from \$3.50 to \$5.00 per bushel than receiving a \$50.00 per acre payment are shown in table 7 (D. McLeod, S. Miller, and G. Perry, unpub. data). At wheat prices less than \$4.00, only a small percentage of enrolled acres in north central Oregon, with the exception of Umatilla County, were projected to come back into soft white wheat production.

These two studies are illustrative of a host of studies about future uses of lands enrolled in the CRP. In general, these studies suggest lands will tend to revert to their prior

Table 7. Percent of Oregon Conservation Reserve Program acres more profitable in wheat production than receiving an annual $50/acre payment, at alternative wheat prices.

	Wheat prices ($/bushel)				
County	$3.00	$3.50	$4.00	$4.50	$5.00
Gilliam	0%	3%	39%	71%	89%
Morrow	0%	11%	41%	68%	81%
Sherman	0%	7%	28%	50%	71%
Umatilla	16%	30%	53%	79%	91%
Wasco	1%	11%	34%	60%	67%

uses as long as the underlying nature of the overall farm or ranch operation has not changed during the CRP contract period. Crop farms will return land to crop production and livestock operations may retain come CRP lands in less intensive uses as they are capitalized for hay production and livestock management.

Summary

Holders of CRP contracts in Montana have generally faired well from participating in the program. Most are receiving returns to productive factors fixed to the farm or ranch commensurate with those returns from their use in crop production, especially when the near certainty of the annual CRP payments is taken into account.

Some individual elevators experienced reductions in net income due to decreased wheat and barley production in areas where CRP enrollment was concentrated, but total production of wheat did not decline in Montana over the years CRP has been in place. Barley production has, however, declined during this period, possibly more in response to major changes in the commodity program provisions than in the CRP.

Substantial changes in the CRP should be accompanied by continued evaluations of land use intentions for enrolled acres. Prior studies indicate lands not reenrolled in the CRP will revert back to prior uses.

References Cited

Federal Register, March 1986, U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, 7 CFR, Part 704, 9 p.

Johnson, J.B., and Clark, R.T., 1989, How some potential CRP participants were taught to bid and ensuring land market distortions: Journal of Soil and Water Conservation, v. 44, no. 5, p. 441– 444.

Johnson, J.B., Zidack, W., Capablo, S., Antle, J., July 1998, Production costs for annually-planted crops produced on dryland cropland produced on northern Montana MLRA 52: Department of Agricultural Economics and Economics, Montana State University, Bozeman, Special Report #28, 29 p.

Montana Agricultural Statistics, 2003, Montana Agricultural Statistics Service, v. l. XL, 96 p.

Sheard, M., Johnson, J.B., Saltiel, J., Bullock, D., 1992, Future uses of Montana croplands enrolled in CRP: A preliminary economic analysis: Department of Agricultural Economics and Economics, Montana State University, Bozeman, ESR-92-2, 23 p.

Standaert, J., Smith, A., Johnson, J.B., 1990, Effects of the Conservation Reserve Program on the Montana economy: Department of Agricultural Economics and Economics, Montana State University, Bozeman, EB 67, 31 p.

U.S. Department of Agriculture, 1988, Agricultural Stabilization and Conservation Service: Notice CRP-92, Establishment of prevailing local rental rates by COC for the sixth signup, 8 p.

U.S. Department of Agriculture, 1996, Preparations for CRP signup 13: Consolidated Farm Service Agency, Notice CRP-229, 32 p.

Perspectives of the American Seed Trade Association

By Wayne Vassar[1]

Introduction

I am representing the American Seed Trade Association (ASTA). I have been in the seed business for approximately 25 years.

Founded in 1883, ASTA is one of the oldest trade organizations in the United States. Its membership consists of about 850 companies involved in seed production, distribution, plant breeding, and related industries in North America. Our mission is to be an effective voice of action in all matters concerning development, marketing, and free movement of seed-associated products and services throughout the world.

The ASTA has nine standing committees addressing key seed science, policy, and education issues. The Environmental and Conservation Committee, of which I am a member, is one such committee, which I am representing today. Most of us on this committee are environmentally aware, having backgrounds not only in agriculture and business management but also in wildlife, range management, plant ecology, watershed management, and soil science. After receiving comments from our members, I wish to discuss four issues with regard to the Conservation Reserve Program (CRP) that we as an industry, hope will help make the program a more effective conservation program.

Issue 1: The Seed Industry Needs to be Involved before the Process Begins

Farmers and the seed industry need appropriate conservation practices at reasonable prices. It is our belief the U.S. Department of Agriculture (USDA) needs input from ASTA as to what grass seed mixture composition is most appropriate for regional conditions. The seed industry should be given flexibility to recommend appropriate species and suggest substitutions for seeds in short supply and therefore extremely expensive. The seed industry has received criticism by some wildlife groups for recommending grass monocultures. However, during previous phases of the CRP the seed industry was not consulted on any seed species requirements. It is the opinion and desire of the seed industry that representatives be appointed to Natural Resources Conservation Service (NRCS) State Technical Committees to become involved in the overall process.

The past and current approach for CRP signup notification has typically operated on short notice to farm operators and those involved in the agricultural industry. In addition, it appears signup announcement dates are decided, delayed, and conducted primarily for political reasons, which impact the market in such a way that can dramatically increase seed prices. This ultimately results in an increase to taxpayers to run an effective CRP. A set timetable, with adequate preparation time for stockpiling seed supplies, would save millions of dollars. We recommend CRP signup announcements be made at least 6 months in advance and even 1–2 years in advance, if possible. The ASTA also recommends CRP participants whose contracts expire in 2007 and 2008 be offered an early opportunity to rebid their acres so ASTA can accurately anticipate upcoming needs for seeds.

Issue 2: Local Effects and Economic Considerations

Landowners with lands currently enrolled in the CRP are dependent on income generated by the program. Income from this conservation program is much more reliable than production from marginal, highly erodible land. There still are, however, many areas of the country having highly erodible land still needing assistance in conservation issues. Acreage in the CRP has definitely cut down on the amount of blowing soil in many of the hardest hit drought areas of the Great Plains. Some commodity groups, however, complain the CRP has taken too many acres out of crop production, which in turn has hurt local economies and agribusinesses, and contributed to a decline in rural populations. There may at times be negative impact in isolated areas; however, ASTA believes low commodity prices, high prices for large farm equipment, and rising costs for land have had more negative effects on economic declines in these communities than has the CRP.

With current shortages of water and fossil fuel-based energy, we highly question use of these resources on marginally productive cropland (i.e., energy and water costs for a bushel of wheat or corn on marginal land are substantially greater than on productive agricultural land). It is our opinion marginally productive land enrolled in the CRP represents a highly significant economic savings and is a wiser use of increasingly limited resources.

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Issue 3: Administration of the Conservation Reserve Program Needs to be Reevaluated

Administration of governmental programs needs to be the best it can be in a political environment. Being commodity oriented, Farm Service Agency (FSA) employees, we believe, have limited understanding of basic management concepts of native grasses and little knowledge about differences between cultivars and local ecotypes when providing guidance to farmers on which grass species to select and plant.

In many areas of the country there are wide differences in environmental philosophies and concerns between the FSA and NRCS. In general, FSA county committees (characteristically, locally elected agricultural producers who decide final approval of CRP plantings) can override NRCS technical recommendations. Local FSA staff have a difficult time explaining ecological and economic differences between Conservation Practice (CP) 2 (native grasses), CP4 (permanent wildlife habitat), and CP25 (rare and declining habitat) practices to a farmer trying to enroll acres into the CRP. The result is sometimes unenthusiastic toward the use of native plants. Many landowners desire the easiest and most economical seed, which often may not meet the best overall ecological or conservation objectives of the CRP. An excellent example of this occurred in Missouri this year with an emphasis on enrollment of land into rare and declining habitat (CP25). This conservation practice required use of local origin material that generally cost the farmer 50%, or more, for seed than did native grasses (CP2) or permanent wildlife habitat (CP4). The Environmental Benefits Index (EBI) used to evaluate and weigh potential enrollment of lands needs to be reviewed and modified. During the 2003 signup, out of 1,769,000 acres (715,889 ha) accepted into the program (excluding trees), 225,000 acres (91,054 ha; 13%), were planted to new, introduced (CP1) cool-season grasses with 79,000 new acres (31,970 ha) accepted in Missouri and Illinois alone. Although cheaper to establish (because the EBI cost share factor of 150 points maximum was used) it is questionable these areas meet overall environmental and conservation objectives for the national CRP. In eastern areas of the country, ASTA received complaints that producers wanting to plant native grasses were essentially excluded from using those conservation practices but rather encouraged by USDA staff to plant only trees.

Issue 4: Local, Native versus Released or Improved Material

The controversy about local ecotype and local origin of vegetation continues. As stated in yesterday's session, the overall purpose of the CRP should be to provide enduring, stable groundcover comprised of appropriate grasses, forbs and legumes proven to be beneficial for erosion control, enhancement of water quality, improvement in air quality, and provision of wildlife habitat. The best quality seed available should be used. The ASTA strongly recommends use of NRCS ecological site guides when selecting plant materials to use in the CRP and other conservation programs.

We need plants used for conservation practices to be selected based on science rather than emotion. Our experience tells us local range sites are just as important as local origin when it comes to adaptation. For example, the use of hard land origin versus sandy land origin little bluestem (*Schizachyrium scoparium*) can have a significant effect on success of stand establishment. Currently there is no information in the scientific literature supporting the premise that long-lived cross-pollinated grasses of local origin are "better" or "different" than improved native grasses selected for a multitude of beneficial characteristics. The ASTA is not opposed to using local native plant material in certain CRP practices such as rare and declining habitats (CP25) when the landowner desires, and is willing to pay the higher price, for such material.

It has often been stated improved types of vegetation are too competitive with native species and ultimately are detrimental to wildlife populations. I have been planting improved cultivars and local native plant materials for 20 years and have never seen this except when planted as a monoculture. In fact, a planting of local origin big bluestem (*Andropogon gerardii*) as a monoculture is just as competitive as a single species planting of a cultivar or named variety of big bluestem.

Presented below are definitions of plant materials and arguments for and against using both local-native and released plant materials.

Definitions

Local-Native Plant Material

Plant material that is the same species as plant material naturally occurring at the site and whose origin is from the same geographic region in which it is being planted. The source can be wild-land harvested, pre-varietal seed, or release plant material as long as the first generation of plant material came from the geographic region in which it is being planted.

Non-Local Native Plant Material

Plant material that is the same species as that occurring at the site but does not originate from the geographic site targeted for planting. Non-local native plant material can be wild-land harvested seed, pre-varietal seed, or released plant material.

Introduced Plant Material

Plant material whose species is not native to the site on which it is being planted. Such material is usually released plant material but could be wild-land harvested.

Released Plant Material

Plant material made available to the public after approval by official in the public or private sectors. It may be a variety/cultivar or pre-variety germplasm, either local-native or non-local native. Released plant material may be either a native or introduced species, originate either from a single or multiple location, and be developed by using the plant breeding techniques of hybridization and artificial selection for certain performance characteristics (genetically manipulated) or without such techniques (natural).

Arguments For and Against Use of Plant Materials

Local-Native Material

For Use

- Local-native materials are more likely to be adapted to the site than non-local materials. They are more likely to be compatible with other organisms on the site without becoming too aggressive or weak.

Against Use

- Local-native materials often are not readily available in the marketplace for emergency or unforeseen needs. It is almost impossible to predict the quantity of local-native seed needed since sites needing seeding and quantities of seed required are not predictable.
- Local-native materials may be difficult to field produce.
- Local-native materials are typically unproven for establishment, growth, or reproduction at any site other than the origin.
- Local-native materials may not establish and reproduce as successfully as released materials.
- It is difficult to identify the original origin of local-native material because many sites are currently comprised of plants established during prior seeding of the site, often using seeds of unknown origin.

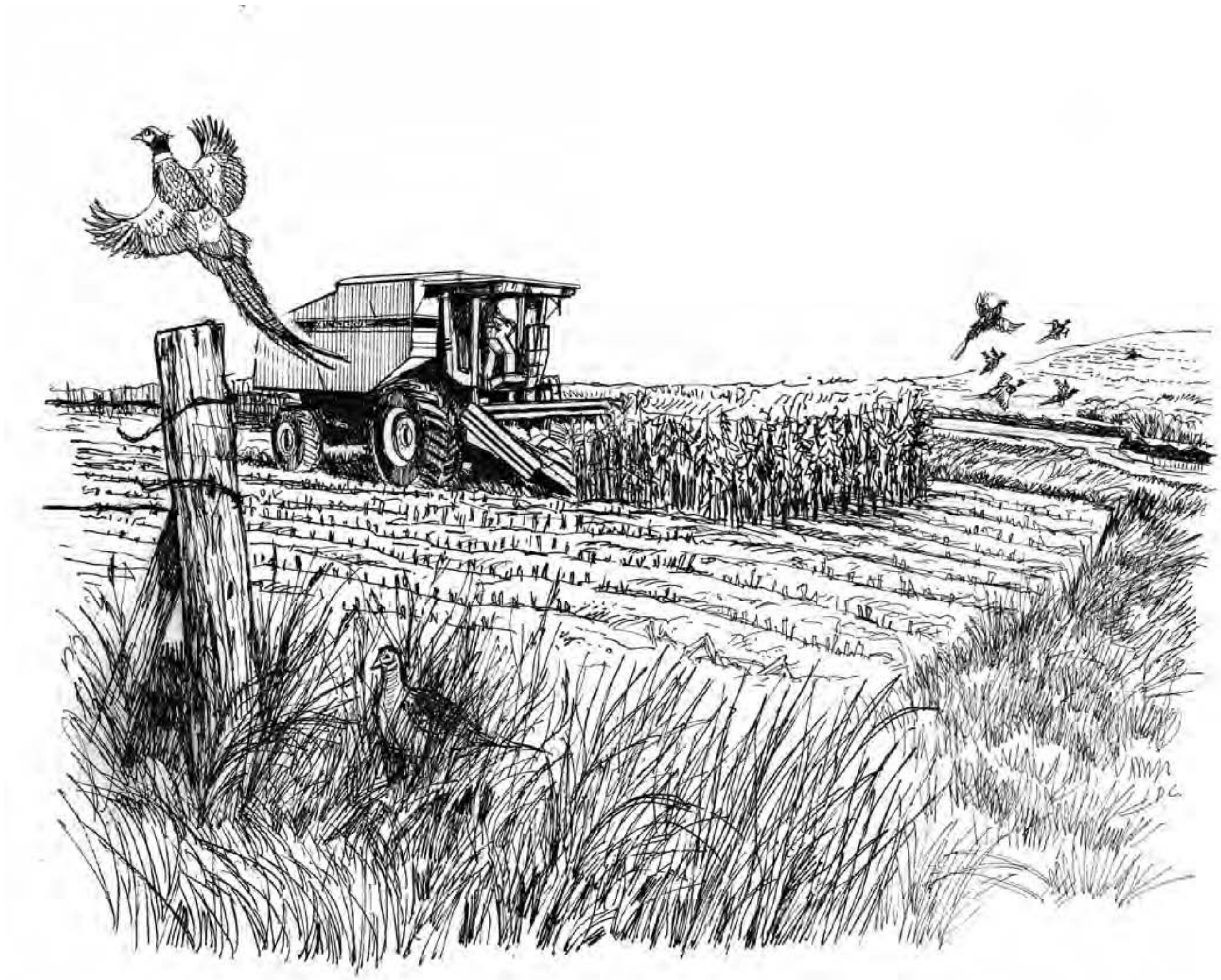
Released Plant Material

For Use

- Released materials have been developed to exhibit traits of good fitness and, therefore, are more likely to be adapted to disturbed sites than local-native materials.
- When developed from a broad range of materials, they are likely to be more genetically diverse and, therefore, better adapted to a larger geographic range than non-released materials.
- Typically, released plant materials have been chosen or genetically selected from improved seed production; hence, they are often less expensive to produce than are local-native seeds. Plant researchers have developed and tested them with the intention they will be used within certain parameters of climate and soil. Thus, released plant material is likely to be adapted to sites on which it is intended for use.

Against Use

- Released plant materials may out-compete local-native material of the species.
- Released plant materials alter the gene pool of the local-native materials by cross-pollination or hybridization. This assumes that the local-native material is still present and the species can cross-pollinate.
- Released plant materials might not co-exist in harmony with other organisms found at the site.
- Released plant materials may not persist as well as local-native materials.



"The pheasant rides the farmer's coattails."

R.A. MacMullan

Session V. Management for Desired Wildlife Outcomes

Management for Desired Wildlife Outcomes

Moderators: Arthur W. Allen[1] and Stephen J. Brady[2]

Spend days, weeks, and months over years through all seasons in Great Plains and Midwestern Conservation Reserve Program (CRP) fields and you will see surprisingly large, equally ugly, spiders and the assortment of insects they prey upon. You will come across toads, frogs, lizards, and too many snakes. Numerous species of songbirds, upland nesting ducks, pheasants, sharp-tailed grouse, prairie chickens, turkeys, scaled and bobwhite quail, falcons, and hawks of various species will share your sky. Voles, mice, ground squirrels, cottontail rabbits, jackrabbits, badgers, skunks, foxes, coyotes, bobcats, pronghorn, and mule, as well as white-tailed deer, will cross your path. In fall, you will see people. Parents, sons and daughters, long lines of comrades stretched across fields in search of "birds." In winter's seclusion, you are more likely to see a lone individual with a dog wandering through time and space in a sea of grass with the hunt itself often more important than the quarry. In decades immediately preceding the CRP many of these creatures were no longer regularly seen within many intensively farmed landscapes. Those more academically inclined could tend to characterize this as an enhancement of biodiversity. Will this diversity of life ever be measured, reduced to a set of numbers projected to quantify and describe changes brought by intermingling agricultural and conservation policies? With exception of few isolated studies, probably not.

Journey across an intensively farmed landscape in winter's depth where cropped fields lie adjacent mile after mile and you will see countryside largely incapable of supporting wildlife in meaningful numbers through any season. Across much of the Midwest and Great Plains interlace this landscape with relatively permanent, high quality grass-dominated cover and the fundamental elements of pheasant habitat, food and cover, are provided. The ring-necked pheasant does ride the farmer's coattails, as do many other obscure as well as socially important species.

Across this Nation live other equally significant species whose abundance and health can stand for a practical balance between conservation of wildlife and economically viable agriculture. In the Northern Great Plains it most likely would be upland-nesting waterfowl, across the Southeast the bobwhite quail and wintering waterfowl, anadromous fisheries and sage-grouse in the Northwest, and perhaps grassland birds in the Northeast. Locally within each of these expansive regions other species may be of greater concern, or signify a more fitting management priority, but by and large these species represent those about which we know most. Much does remain to be known about how wildlife has responded to conservation programs and how to manage landscapes to their benefit, but the CRP is now and decisions about the program's future will be made regardless of how much, or little, we currently understand about wildlife ecology in agricultural ecosystems.

Enrollment characteristics such as size and location, planting mix composition, and long-term management generally define significance of CRP lands as wildlife habitat. Even though planting mixes may be alike, no two fields enrolled in the CRP are identical. Physical characteristics such as slope and aspect, differences in soils, climate, management, and cropping history prior to enrollment, and the amount, or lack of, disturbance once in CRP all influence vegetative uniqueness of individual fields. Desirable size of enrolled lands and management prescriptions will vary depending on wildlife species identified as a management priority. Not all wildlife requirements can be met on any given piece of CRP land. No management prescription will be universally applicable. Not all fields need to be managed or disturbed to meet the needs of wildlife. Many fields will require management only rarely. In contrast, habitat objectives in some regions, or sub-regions, may involve frequent management of CRP covers to maintain desirable characteristics or early successional stages of vegetative cover.

Management decisions made in concert between the USDA, state agencies, NGO's, and most importantly, desires and limitations of landowners, will define CRP effectiveness in meeting environmental priorities both in and beyond agriculturally dominated landscapes. We may have to assume how the CRP and other conservation programs have improved biodiversity but many positive benefits to wildlife continue to be documented. It is upon this growing body of knowledge and experience we must refine agricultural policies to make conservation and economically sustainable agriculture indistinguishable.

As will be demonstrated by the presentations in this panel, one of the greatest benefits of the CRP has been to wildlife. While 34.7 million acres (14 million ha) enrolled (April 2004) represents an impressive sum and accounts for about 9% of the cropland, it represents just 2.5% of the nonfederal rural land in the 48 contiguous states. This modest density of CRP acres, however, has had a very positive effect on population trends of grassland and scrub/shrub nesting birds in many locations across the country. This group of birds has suffered substantial population declines over the last few decades due primarily to land use conversion, intensive use, or disturbance of their native habitats for agricultural purposes. The CRP has reestablished peren-

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nial herbaceous vegetation on fragile lands recently used for crop production. As a consequence, soil erosion, sedimentation, and runoff have been reduced, the water is cleaner, and habitat (especially nesting cover) has been established. The CRP is an exceptional program for wildlife because it provides habitat elements in the midst of landscapes intensively used for agriculture, and also restores and complements other habitat features, such as wetlands, that occur in the landscape. Other USDA programs act synergistically with the CRP to increase the environmental benefits. The Swampbuster provision protects wetlands in agricultural settings from being drained, while the Wetland Reserve Program assists in restoring wetlands. The combination of CRP grasslands with nearby wetlands provides many prairie-nesting waterfowl the right mix of habitats for nesting and brood-rearing cover.

This session is largely focused on management of CRP vegetation covers, descriptions of wildlife profits brought, and suggestions on ways to refine program design to meet regional wildlife objectives. Although not presented at the conference, papers furnishing an overview of CRP participant attitudes toward wildlife issues, a description of long-term trends in vegetation within southern Great Plains CRP grasslands, and effects of the CRP on prairie grouse populations have been included.

As we have seen in previous sessions, establishment and continuation of the CRP is not without controversy. The program has social and economic implications that can reach from individual farms to local communities and beyond. No one expects agriculture to disappear and our landscape returned to predevelopment conditions, but as we enter this new millennium many hope we can find ways to lessen unintentional and unwanted impacts of agricultural production. The potential of the CRP and other USDA conservation programs to set agriculture on a course that complements environmental health and restores wildlife habitat and populations within and past the borders of this Nation is unquestionable. Hopefully, wildlife response to how we manage our agriculturally dominated landscapes can serve as the proverbial canary in the coal mine, which we can hold up as proof we are doing things right.

A National Survey of Conservation Reserve Program Participants on Environmental Effects, Wildlife Issues, and Vegetation Management on Program Lands: An Overview

By Arthur W. Allen[1]

Introduction

In response to a request by the U.S. Department of Agriculture's (USDA) Farm Service Agency (FSA), a national survey of over 2,000 persons holding existing Conservation Reserve Program (CRP) contracts was completed in 2001. The purpose of the survey was to solicit and describe participant opinions about personal effects of the CRP, wildlife issues, and USDA administration of the program. Our objective was to gather information on CRP participant judgments concerning effects of the program on their family, farm, or community and capture information related to environmental or social outcomes of the program not previously described in the literature. Of 2,189 surveys delivered to contractees, 1,412 were answered and returned, providing a 65% rate of response.

Presented here is a summary of the national results of the survey. The formal publication of results (Allen and Vandever, 2003) presents more detail and discussion of the survey by USDA Farm Production Regions (FPR). Figure 1 displays FPR's and percentage of CRP contracts within each region in 2001. The entire document can be obtained by contacting the authors or downloaded from the U.S. Geological Survey's (USGS) website (http://www.fort.usgs.gov/) and selecting the Product Library prompt or the FSA website (http://www.fsa.usda.gov/dafp/cepd/crpinfo.htm) and selecting the Survey of CRP Participant Response prompt.

Respondent Relations to the Conservation Reserve Program

Nationally, retired farmers were the largest category (52%) of survey respondents, while 43% were owners remaining active in farming. Renters of CRP land represented 3% of respondents while 2% were trustees or non-farming owners (e.g., churches, airports, local governments) of CRP land. The number of CRP acres owned by respondents ranged from 0.3 acres to 3,825 acres (0.1 ha to 1,548 ha) with a mean of 156 acres (63 ha). Over half (55%) of respondents characterized their CRP land as being planted to native grasses, followed by nonnative grasses (31%) and trees (14%). Dominant vegetation covers reported by survey respondents correspond to current, recently established, vegetative covers on CRP lands (USDA, 2003). Of the 11.4 million acres (4.6 million ha) devoted to grass or tree cover establishment, 10% are trees while 54% are native grasses, and 36% are nonnative grasses. (These values are, however, exclusive of 14.9 million acres (6.0 million ha) of grass existing under renewed contracts that include both nonnative and native grass.) Nearly 85% of respondents reported that CRP covers on their land were successfully established at the first planting. Drought was acknowledged by 9% of respondents as the primary cause of failure in initial planting of CRP covers.

Emergency Use and Disturbance of Conservation Reserve Program Vegetative Covers

Nationally, 15% of respondents said they had used CRP grasslands for haying or grazing under emergency conditions. Most of these respondents (63%) said they had used

Figure 1. U.S. Department of Agriculture Farm Production Regions and percentage of Conservation Reserve Program contracts within the regions in 2001.

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these lands only one time under emergency use. Slightly less than 27% had used their grasslands two times and 7% had employed emergency haying or grazing three times. Only 3% of respondents said they had used grasslands under emergency conditions more than four times in the life of their contract. Weed control was the most frequently reported type of management applied to CRP lands. Nearly twice as many respondents (62%) reported mowing as compared to 35% who employed spot treatment using herbicides as the primary method of weed control. Slightly over 12% of respondents reported that, to their knowledge, no known disturbance had ever occurred on their CRP lands.

Environmental and Social Effects of the Conservation Reserve Program

Positive Effects

As might be expected, the greatest percentage of respondents (85%) believed the CRP contributed to diminished erosion of soil (table 1). The effect the CRP has had on wildlife associated with agricultural landscapes is illustrated by 73% of respondents reporting increased populations of wildlife associated with lands enrolled in the program. Although 38% of respondents reported the CRP provided more opportunities to hunt and 12% found increased opportunities to lease land for hunting, nearly 60% of respondents believed the ability to simply observe wildlife was an important benefit of the program. Slightly over 29% and 39% of respondents acknowledged improvements in air and water quality, respectively. Improved control of drifting snow was recognized by 31% of survey respondents. Over 23% believed the CRP contributed to greater permanence of surface waters. Improvement in scenic quality of agricultural landscapes was cited as a CRP benefit by 37% of respondents. Nearly 17% saw the CRP as contributing to their future income either through future sale of timber resources, improved fertility of soils, or increased recreational value of their land.

In addition to responding to formal questions in the survey, many respondents "wrote-in" additional benefits derived from the CRP. Other positive aspects described included enhancement of soil organic matter and fertility improving potential future productivity of CRP lands, retention of water from rain and snow, and prevention of erosion on lands adjacent to CRP acres. Other environmental benefits included reappearance of springs below CRP fields, less debris in streams, and improved quality of well water. Lower use of agricultural chemicals, diminished noise from equipment and other farm operations, and helping to prevent unwanted urban expansion/development were also attributed to the CRP. Economic benefits described included helping to raise grain prices, assistance in paying taxes, assured income to support retirement, provision of additional income to support continued operation of the farm, an increase in overall farm property values, stabilization of farm income, and savings in operation costs by not having to farm corners and small

Table 1. Survey respondent identified environmental and social benefits of the Conservation Reserve Program by U.S. Department of Agriculture Farm Production Region. PAC = Pacific; MTN = Mountain; NP = Northern Plains; SP = Southern Plains; LAK = Lake States; CB = Corn Belt; DLT = Delta; SE = Southeast; APL = Appalachian; NE = Northeast; and NATL = National.

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

fields. Many respondents stated the CRP has enabled them to take land out of production that they knew should have never been farmed. Social benefits described were diverse and included satisfaction from doing something beneficial for the environment, having hay to give neighbors in time of need, providing a place for children and grandchildren to camp or play, provision of sites for local schools to hold conservation/ecology classes, and providing places for family/friends to hunt and socialize. By far, the majority of comments focused on increased numbers and variety of wildlife associated with CRP lands. Many respondents stated the enhanced presence of wildflowers and insects was an unforeseen, but welcome benefit of the program.

Negative Effects

Not all perceptions concerning environmental and social effects of the CRP were positive. Almost 29% of respondents viewed CRP lands as a source of weeds (table 2). Similarly, 13% of respondents perceived the CRP as making their farm, or landscape, appear untidy or poorly managed. The CRP was viewed as a potential fire hazard by 19% of those responding to the survey. Four percent felt too much land had been taken out of production and enrolled in the CRP. Likewise, 8% of respondents believed the program had a negative effect on local economies due to lower production of crops and related impacts on local agricultural-based businesses. In relation to wildlife, 18% of respondents indicated the CRP had caused problems due to greater numbers of wildlife.

Respondents provided comments describing negative effects of the CRP other than those listed as options in the formal questionnaire. One of the most commonly voiced concerns was trespass and an apparent presumption by some individuals that CRP lands were open to public hunting. In some cases, the increase in habitat quality furnished by the CRP resulted in unwelcome requests from strangers to have access to land for hunting. The CRP has attracted unwanted wildlife that includes an increase in insects, deer (*Odocoileous* spp.), coyotes (*Canis latrans*), predators, and other "varmints." The increased abundance of pocket gophers (*Geomys* spp.) in CRP grasslands was a concern voiced several times because, over years, the presence of gopher mounds makes fields rough and difficult to mow. Several respondents expressed concern that the CRP has had a negative effect on populations of northern bobwhite quail (*Colinus virginianus*). Elimination of row crops and establishment of tall fescue (*Festuca arundinacea*) grasslands were perceived as having the most negative effects on northern bobwhite quail populations. Some respondents expressed concern that too many acres removed from crop production had a negative effect on local economies. Several respondents believed the large number of acres enrolled in the CRP prevents young farmers from being able to start a viable farming operation and that the program could cause an unnecessary increase in farmland property values. Conversely, others expressed apprehension about too many acres of highly erosive land going back into production due to more stringent enrollment requirements in recent CRP signups. As might be expected from the response to formal questions, the need for additional funds to cover costs for weed control and the potential hazard of fire presented by CRP grasslands were commonly expressed concerns.

Wildlife and Habitat Issues

In response to attention given to wildlife in CRP enrollment requirements, 73% of respondents felt USDA furnished

Table 2. Survey respondent identified negative aspects of the Conservation Reserve Program by U.S. Department of Agriculture Farm Production Region. PAC = Pacific; MTN = Mountain; NP = Northern Plains; SP = Southern Plains; LAK = Lake States; CB = Corn Belt; DLT = Delta; SE = Southeast; APL = Appalachian; NE = Northeast; and NATL = National.

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

an appropriate level of consideration. Slightly over 15% of respondents advocated more awareness of wildlife needs by the USDA, while 11% believed that wildlife had received too high a priority in CRP enrollment criteria. In relation to wildlife habitat associated with the CRP, 2% of respondents believed too much aid was furnished, while 82% believed the amount of assistance provided was appropriate. Almost 16% of respondents thought not enough assistance was furnished. Almost 55% of those responding to the survey felt they had been well informed about why specific types of CRP management practices were required to maintain or improve wildlife habitat. In contrast, 38% of respondents believed they had been only partially informed and 7% alleged they had not been informed about these requirements at all.

In relation to requirements to modify existing vegetation to qualify for renewal in the CRP, over 75% of respondents agreed or strongly agreed CRP benefits to wildlife were important. Slightly over 6% of respondents disagreed with the statement that CRP benefits to wildlife were important. Three percent of respondents strongly disagreed with requirements to change the composition of existing vegetation to benefit wildlife. Fifteen percent were impartial about these management requirements. Almost 62% of respondents agreed or strongly agreed USDA requirements to enhance CRP vegetation composition to maintain long-term quality of wildlife habitat were reasonable. Slightly less than 12% of respondents disagreed with management requirements to maintain wildlife habitat quality, while 4% voiced strong opposition. Of those who answered this question, 22% expressed no opinion. In response to the question about disturbance of existing CRP vegetation cover, 82% of respondents agreed or strongly agreed that established vegetation should not be disturbed to qualify for renewal in the program. Four percent of respondents disagreed or strongly disagreed, believing it reasonable to disturb established vegetation to furnish improvements in quality of wildlife habitat. No opinion about these requirements was expressed by 14% of respondents.

Vegetation Management Alternatives

In response to which methods would be most acceptable if periodic management of CRP land was needed, 58% of respondents identified mowing followed by shredding of vegetation (35%). Application of herbicides was cited by 26% as the most desirable management alternative while use of prescribed fire or burning was selected by 25% of respondents. Grazing was acknowledged as the preferred management alternative by 21% of respondents. Disking, or plowing, of CRP ground was the least desirable management practice, being selected by 8% of respondents.

Over 14% of respondents stated they did not have the necessary equipment to implement management of vegetation. Slightly over 4% of respondents declared they did not want to manage their CRP land to improve the quality of wildlife habitat. Thirty-four percent of respondents said they opposed disturbance of CRP grasslands.

The final question of the survey asked participants to identify the most acceptable choice between four scenarios describing possible alternatives for management of CRP lands. Nationally, nearly half (49%) of respondents indicated they wanted to see no changes in enrollment or management criteria. In this scenario, CRP lands could only be hayed or grazed under emergency conditions with a reduction in rental payment for acres used. The second most popular alternative (32%) offered an increase in CRP rental payments to cover management to maintain long-term quality of wildlife habitat. Restricted use following limited haying or grazing was the preferred alternative of 12% of respondents. Under this scenario CRP land could be used for limited haying or grazing without reduction in rental payments, but emergency use in the used portion of the field would be prohibited for up to 2 years following managed use. Periodic haying or grazing with a 25% reduction in rental payments for acres used was the preferred alternative of only 7% of respondents.

Conclusion

Survey results reveal the majority of respondents value environmental and social benefits derived from the CRP. From the response of survey participants wildlife obviously remains an important part of agricultural ecosystem and rural lifestyles. For a large number of survey respondents, the opportunity to simply observe wildlife as part of their daily activities is a treasured profit of the CRP. A smaller proportion of CRP participants believe that wildlife has received too much attention and the primary goal of the program should remain focused on improvements in water quality and control of soil erosion.

Overall, survey respondents appreciated the quality of information and assistance in program enrollment and administration furnished by the USDA. More personal attention by USDA staff, reduction of paperwork, periodic on-site visits, attention to regional or local conservation issues, efficient methods to communicate successful management strategies between program participants, and incorporation of periodic use of CRP covers were suggested ways to improve administration of the program.

We hope results of this survey will contribute to refinement of conservation policies that continue to uphold rural communities, sustain wildlife populations, and enhance environmental quality within and beyond agriculturally dominated landscapes. The continued success of USDA conservation policies in providing lasting benefits depends on continued public support for the agricultural community, recognition of landowner limitations in meeting resource objectives, and an unrelenting willingness to innovatively link environmental and agricultural objectives in USDA conservation legislation and program rules.

References Cited

Allen, A.W., and Vandever, M.W., 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, Colo, 51 p.

U.S. Department of Agriculture, 2003, 2003 Farm Service Agency, monthly CRP summary statistics report, December 2002: www.fsa.usda.gov/dafp/cepd/crpreports.htm

Vegetation Changes Over 12 Years in Ungrazed and Grazed Conservation Reserve Program Grasslands in the Central and Southern Plains

By Brian S. Cade[1], Mark W. Vandever[1], Arthur W. Allen[1], and James W. Terrell[1]

Introduction

The Conservation Reserve Program (CRP) established under the 1985 Food Security Act has the fundamental objectives of jointly providing economic support to segments of the agricultural community and conservation of natural resources (Osborn, 1997; Heard and others, 2000). Although soil loss on highly erodable lands was the principal natural resource conservation issue addressed in the 1985 CRP, improving water quality and wildlife habitat both became important considerations as the program evolved (Farmer and others, 1988). For example, Best and others (1997) found that production of young birds on CRP fields in the Midwest was ≥15 times the production on row-crop fields because of improved habitat. The increasing importance of wildlife habitat is reflected in continuing refinement of the Environmental Benefits Index (EBI) used by the U.S. Department of Agriculture (USDA) to quantify the potential benefits of enrolling lands in CRP (Osborn, 1997; Ribaudo and others, 2001). The refinements reflect input furnished by federal, state, and non-government organizations seeking greater wildlife habitat quality on CRP lands (Roseberry and David, 1994; Hughes and others, 1995; Millenbah and others, 1996; Patterson and Best, 1996; Rodgers, 1999; Allen and others, 2001).

Refinement in the EBI has changed the types of grasses planted on newly enrolled land. In early CRP signups (1 through 11), 71% of new grassland acres were planted to introduced grasses and legumes [Conservation Practice (CP) 1] while 29% of the acres were planted to native grasses (CP2) (Osborn and others, 1992). By the 27th signup in July 2004, over 34.8 million acres (14 million ha) were enrolled in the CRP. More than 73% of these lands were planted to various mixtures of introduced (CP1) or native (CP2) grasses for a minimal contract period of 10 years (USDA, 2004). Continuation of grass plantings under the 2002 Farm Bill may result in CRP lands furnishing grass dominated cover for 20 or more consecutive years.

The species of grass established in seeded grasslands can have a major influence on the potential quality of wildlife habitat where vegetation is maintained over a multi-year period. Different species of grass may have comparable abilities to alleviate soil erosion but furnish dissimilar qualities of wildlife habitat (fig. 1). For example, smooth brome, an introduced cool-season grass (grass species and scientific names are presented in table 1), is highly valued for its erosion control and forage attributes (Casler and Carlson, 1995). Switchgrass, a native warm-season grass, also is valued for its soil and water conservation qualities (Moser and Vogel, 1995) but provides greater benefits for some species of wildlife (Clubine, 1995). The quality of nesting and winter cover for ring-necked pheasants (*Phasianus colchicus*) furnished by smooth brome on northeastern Colorado CRP lands is inferior to that provided by the taller, more robust switchgrass (Allen, 1994). Characteristics of the agricultural landscape surrounding individual CRP fields also play a role in the wildlife habitat potential of CRP plantings (Weber and others, 2002; Nusser and others, 2004).

Regardless of species planted, vegetative characteristics of native and seeded grasslands change in response to the presence (and absence) of physical disturbances such as fire, grazing, tillage, and haying (Hobbs and Huenneke, 1992; Millenbah and others, 1996; Allen and others, 2001; Renfrew and Ribic, 2001; Swengel and Swengel, 2001). The perpetuation of diversity in species composition and vegetation structure following disturbance sustains desirable habitat for a variety of grassland-dependent wildlife (Hall and Willig, 1994; Barnes and others, 1995; King and Savidge, 1995; Granfors and others, 1996; Herkert and others, 1996; Kurzejeski, 1996; Patterson and Best, 1996; Klute and others, 1997). Undisturbed grasslands have lower grass and forb species diversity, greater amounts of dead plant material, decreased as well as seasonally delayed productivity, and diminished structural diversity of vegetation (Peet and others, 1975; Rice and Parenti, 1978; Butler and Briske, 1988; Campa and Winterstein, 1992). Recommendations for the timing of disturbance to increase grass and forb species diversity range from 3 to 8 years following establishment of seeded grasslands in the northern Great Plains and Midwest (Duebbert and others, 1981; Higgens, 1987; Millenbah and others, 1996). The management interval, however, is affected by climatic conditions, soils, grass species, and management history of the individual stand.

We quantified changes in vegetation structure and species composition across the typical 10-year contract period in undisturbed southern and central Great Plains CRP fields (fig. 2) planted to introduced and native grasses. In addition, we compared changes in vegetation in fields grazed during the emergency release of 1996 by comparing conditions prior

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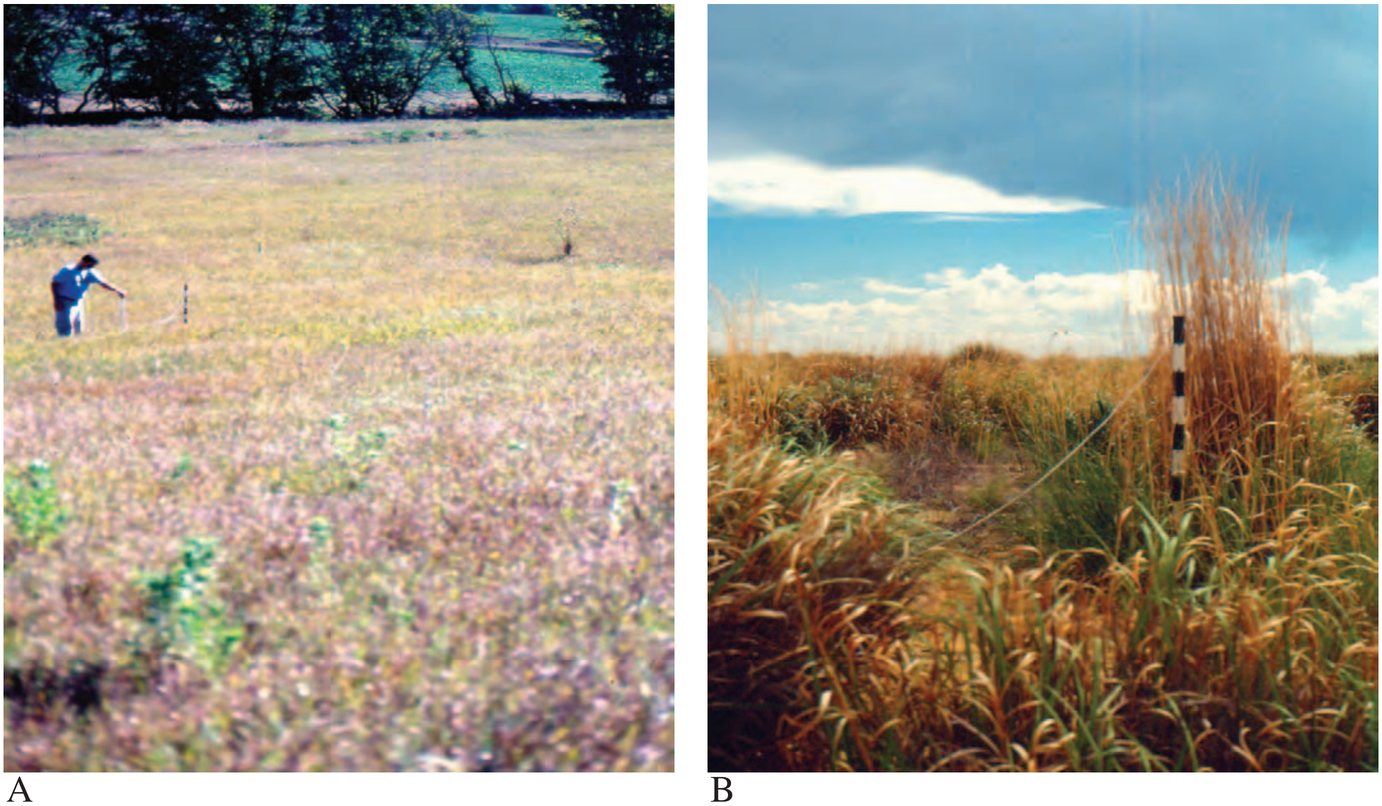

Fig. 1. Two Conservation Reserve Program grasslands of comparable age (8–10 years old) illustrate differing potential as wildlife habitat as a consequence of species composition and structural characteristics. Smooth brome (photo A), a cool-season, introduced grass often becomes a monoculture with maturity. This grass may provide spring nesting cover for some avian species but, due to low physical stature and inability to remain erect under snow furnishes relatively poor cover during the balance of the year. A mix of warm-season, native grasses (photo B) provides greater structural diversity and a higher likelihood of standing against winter snows, generally supporting an enhanced ability to furnish habitat for a larger number of species throughout the year.

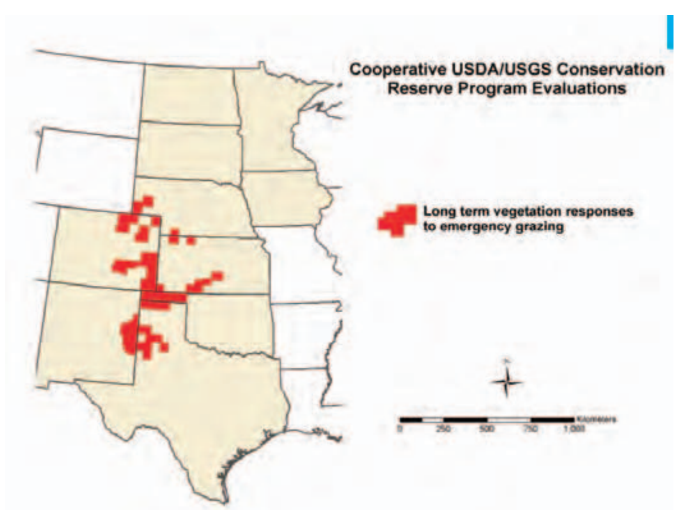

Figure 2. Counties where Conservation Reserve Program fields were monitored from 1988 to 2000 in the southern and central Great Plains.

to grazing and two and four years post grazing relative to changes in similar fields that were not grazed. Documentation of long-term changes in vegetation structure and composition for fields planted to common grass seed mixtures across a wide range of environmental conditions provides information to improve long-term wildlife habitat potential, guide program administration, and define management practices that yield economic benefits to operators while still meeting wildlife and conservation objectives. Emergency grazing provisions of the CRP are controversial. Although grazing can alter vegetative characteristics and reduce habitat quality in the short-term (Temple and others, 1999), periodic disturbance may be necessary to maintain habitat quality, and more information is needed assessing long-term effects of emergency grazing on vegetative structure and species composition.

Methods

Introduced (CP1) and native (CP2) grass fields were randomly chosen from a larger sample of CRP fields monitored as part of a 31 state study initiated in 1986 (Farmer and others, 1988; Allen, 1995). Only undisturbed fields (not known to be grazed, hayed, or burned since establishment in 1986 or 1987) were included in our initial sample pool. After being informed of study objectives, cooperating landowners furnished permission to access fields included in the evaluation. The original pool of CRP fields was chosen based on sample populations defined by: (1) the conservation practice, (2) the crop base retired from production (as a coarse indicator of environment), and (3) the year the CRP contract was initiated. We collected data in the southern and central Great Plains during the spring and summer of 1996, 1998, and 2000. Various USDA and state fish and game agency personnel collected data in 1988, 1990, and 1992 as part of the original monitoring study. In 1997, we surveyed landowners to determine disturbance history of fields so that we could select a sample of fields that had been grazed during the 1996 emergency release. Landowners provided information on timing and duration of grazing and other disturbances.

Fields initially were classified as either CP1 or CP2 on the CRP contracts. However, based on documentation of seed mixtures planted, we reclassified fields into introduced warm-season (C_4 photosynthetic pathway), native warm-season, and cool-season (C_3 photosynthetic pathway) grasses. Introduced warm-season grass plantings were predominately weeping lovegrass, plains bluestems, or klinegrass. However, some warm-season native blue grama or sideoats grama often was included in the seed mixture for the fields we classified as introduced warm-season grasses. Native warm-season grass seed mixtures were predominantly sideoats grama, blue grama, buffalograss, switchgrass, little bluestem, indiangrass, big bluestem, occasionally with small amounts of western wheatgrass, a cool-season species. Cool-season grasses were smooth brome or mixtures of crested, tall, western, and intermediate wheatgrasses.

We used visual obstruction readings (VOR) to characterize vertical and horizontal density of foliage (Robel and others, 1970). Measurements of residual vegetation (pre-greenup VOR) remaining from the previous years' growth were completed prior to spring growth in March and April. We measured mid-summer VOR from late June to mid-July. The proportion of herbaceous vegetation comprised of forb and grass species was estimated within a 0.5-m^2 quadrat (Daubenmire, 1959). Only live vegetation was used as a measure of herbaceous or grass canopy cover. Grass species were identified during mid-summer when floristic characteristics enabled classification. Grass species composition during 1996 was compared to the original seeding mixture when data were available from USDA records.

Vegetation measurements were made around three (1988, 1990, and 1996) or five (1998 and 2000) points separated by 50 m on transects with a fixed starting point but random direction through the field. Eight Daubenmire quadrats (two adjacent in each of four ordinal directions) and four VOR's (1 in each of 4 cardinal directions) were measured around each point. Averages across all sample points within a field were the primary unit of analysis. Fields that had obviously been burned immediately prior to sampling were not measured and were excluded from analyses. It is possible that some fields were burned or otherwise disturbed between the sampling years without this disturbance being documented in the contract.

The vegetation measurements were analyzed as a repeated measures (years) design with main effects for grass planting type (native warm-season, introduced warm-season, and cool-season grasses). We initially considered year planted (1986 or 1987) as an additional factor (e.g., Haroldson and others, 1998) but there were too few fields planted in 1986 (n = 9) to provide reliable cohort estimates. Unevenly spaced orthogonal polynomials were computed for average vegetation measures in undisturbed fields across 1988, 1990, and 1996. The hypotheses of no linear or quadratic time trends were tested with a 1-sample version of Multiresponse Permutation Procedures (MRPP) for matched-pairs followed by tests for no interaction of linear and quadratic time trends with grass planting (introduced warm-season, cool-season, and native warm-season) using MRPP (Mielke and Berry, 2001). We used MRPP to test for any distributional differences because we expected that vegetation changes would be more complex than simple, homogeneous shifts in means (or other measure of central tendency). Probabilities in MRPP were computed by exact enumeration when total sample size $n < 22$ fields and by a 3 moments Pearson type III approximation for larger samples. When making comparisons among grass plantings by year, we used Holm's sequential procedure on id k adjusted probabilities to account for the multiplicity of comparisons (Westfall and Young, 1993). Differences were estimated by changes in quantiles. We graphed 10^{th}, 50^{th} (median), and 90^{th} percentiles as a concise description of distributional differences. We also estimated quantiles and graphed 10^{th}, 50^{th}, and 90^{th} percentiles for undisturbed fields sampled in 1992, 1998, and 2000 although they were not used in the repeated measures analyses because most fields were not sampled in all of those years.

Because many of the undisturbed fields originally selected for sampling prior to 1996 were not reenrolled in the program in 1997, we had to select additional contracts from the original monitoring database to obtain sufficient samples of grazed and ungrazed fields for measurement in 1998 and 2000. Our 1997 survey of landowners of central and southern plains contracts in the original monitoring study allowed us to identify and obtain a sample of fields in the three grass planting types that had no authorized disturbance except for grazing during the 1996 emergency release. Fields sampled were grazed 1 to 3 months between May and September 1996 in Colorado, Nebraska, and Kansas (n = 16) and 4 to 8 months between February and December 1996 in New Mexico, Oklahoma, and Texas (n = 11). Grazed fields in New Mexico, Oklahoma, and Texas were primarily introduced warm-season grass plantings, whereas in Colorado, Nebraska, and Kansas they were primarily native warm-season grass plantings. Based on our analyses of undisturbed fields that established

Table 1. Introduced grasses [Conservation Practice (CP) 1 and native grasses (CP2) most frequently seeded, or present, in Conservation Reserve Program fields sampled from 1988 to 2000 in the southern and central Great Plains states.[1]

Introduced grasses	Native grasses
Bermudagrass (*Cynodon* L.C. Rich)	Alkali sacaton [*Sporobolus airoides* (Torr.) Torr.]
Cheatgrass (*Bromus* spp. L.)	Arizona cottontop [*Digitaria californica* (Benth.) Henr.]
Crested wheatgrass [*Agropyron cristatum* (L.) Gaertn.]	Big bluestem (*Andropogon gerardii* Vitman)
Foxtail bristlegrass [*Setaria italica* (L.) Beauv.]	Blue grama [*Bouteloua gracilis* (Willd. ex Kunth) Lag. ex]
Intermediate wheatgrass [*Thinopyrum intermedium* (Host) Barkworth and D.R. Dewey]	Buffalograss [*Buchloe dactyloides* (Nutt.) Engelm.]
Johnsongrass [*Sorghum halepense* (L.) Pers.]	Green sprangletop [*Leptochloa dubia* (Kunth) Nees]
Klinegrass [*Panicum coloratum* (L.)]	Hairy grama (*Bouteloua hirsuta* Lag.)
Plains bluestem [*Bothriochloa ischaemum* (L.) Keng]	Indiangrass [*Sorghastrum nutans* (L.) Nash]
Orchardgrass [*Dactylis glomerata* (L.)]	Little bluestem [*Schizachyrium scoparium* (Michx.) Nash]
Redtop (*Agrostis gigantea* Roth)	Needle and thread [*Hesperostipa* (Elias) Barkworth]
Smooth brome (*Bromus inermis* Leyss.)	Plains bristlegrass [*Setaria vulpiseta* (Lam.) Roemer & J.A. Schultes]
Tall fescue [*Lolium arundinaceum* (Schreb.) S.J.]	Purple threeawn (*Aristida purpurea* Nutt.)
Tall wheatgrass [*Thinopyrum ponticum* (Podp.) Z.-W. Liu & R.-C. Wang]	Sand dropseed [*Sporobolus cryptandrus* (Torr.) Gray]
Timothy (*Phleum pratense* L.)	Sand lovegrass (*Eragrostis trichodes*)
Weeping lovegrass [*Eragrostis curvula* (Schrad.) Nees]	Sideoats grama [*Bouteloua curtipendula* (Michx.) Torr.]
	Silver bluestem [*Bothriochloa saccharoides* (Sw.) Rydb.]
	Squirreltail [*Elymus elymoides* (Raf.) Swezey]
	Switchgrass (*Panicum virgatum* L.)
	Western wheatgrass [*Pascopyrum smithii* (Rydb.) A. Löve]

[1]The southern and central Great Plains included western Nebraska, eastern Colorado, western Kansas, Oklahoma and Texas Panhandles, and eastern New Mexico.

that maximum vegetative growth occurred around 1990, we used 1990 estimates as the base against which to compare conditions two (1998) and four (2000) years after the 1996 emergency grazing. We compared vegetation characteristics between grazed (1996) and ungrazed fields by grass planting type by forming linear contrasts between pre-grazing estimates in 1990 and two and four years post-grazing estimates in 1998 and 2000. Again, we used MRPP to test for any distributional differences in these linear contrasts and provided quantile estimates to characterize differences.

Results

Undisturbed Fields

Nonzero linear and quadratic orthogonal polynomials were consistent with nonlinear changes in pre-greenup VOR from 1988 to 1996, and nonzero interactions between year and planting type indicated differences among grass plantings were not consistent across time (fig. 3a). Pre-greenup VOR distributions with 10th to 90th percentiles of 0 to 2 dm that were similar among plantings in 1988 (P_{adj} = 0.816), increased to 1 to 5 dm for introduced warm-season, 0 to 8 dm for native warm-season, and 0 to 4 dm for cool-season plantings by 1990 (P_{adj} = 0.031). Pre-greenup VOR for native warm-season and cool-season grasses declined to 1988 levels by 1996, whereas there was less decline for introduced warm-season grasses (P_{adj} = 0.005). The incomplete records for 1998 and 2000 suggested pre-greenup VOR for all grass types continued to decrease in undisturbed fields as contracts exceeded 10 years of age. Mid-summer VOR increased from 1988 to 1990 followed by a decrease in 1996 that was similar among the three grass planting types (fig. 3b). Introduced warm-season grasses had higher mid-summer VOR than native warm-season and cool-season grasses across all years (P = 0.010), with 10th and 50th percentiles about 1 dm greater but considerable overlap in higher quantiles. There appeared to be additional decline in mid-summer VOR in 1998 and 2000 with little difference among the grass plantings, although these results should be interpreted cautiously as few fields were sampled in those years. Mid-summer herbaceous cover exhibited nonlinear changes over time with greatest cover values (most fields >40%) in 1990 followed by declines to lower cover values (20%–40%) in 1996 (fig. 3c). Introduced warm-season grass plantings had greater cover values in 1990 (P_{adj} = 0.031), but there was little difference among plantings in 1988 (P_{adj} = 0.214) and 1996 (P_{adj} = 0.177). Incomplete records for 1998 and 2000 suggested that mid-summer herbaceous cover declined to even lower cover as fields exceeded 10 years of age, with the same caveats on reliability of these results as made previously. Proportion of the herbaceous cover that was grass increased similarly among plantings from the highly variable initial levels (0.05–1.0) in 1988 to proportions exceeding 0.4 in 1990 and exceeding 0.6 in 1996 (fig. 3d). Introduced warm-season grass plantings had greater proportion of grass cover across 1988 to 1996 (P = 0.018). The small declines in proportion of grass cover in 1998 and 2000 should be interpreted cautiously given that few fields were sampled in those years.

Cover by grass species was measured in 1996. Sideoats grama occurred most frequently and abundantly in fields planted with native grasses with half of the fields having >10% cover (fig. 4a). Blue grama also occurred frequently with half of the fields having >1% cover. Little bluestem and switchgrass occurred less frequently but either might have up to 30% cover when present. Western wheatgrass occurred infrequently and had <10% cover when present. Buffalograss also occurred infrequently and had <3% cover when present. Other species that occurred infrequently in native warm-season plantings included big bluestem, needle-and-thread grass, and alkali sacaton. Introduced warm-season grass plantings were dominated by monocultures of either plains bluestem with 2%–51% cover or weeping lovegrass with 2%–34% cover (fig. 4b). Although klinegrass was listed as one of the dominant seeds used in 2 of 31 introduced warm-season grass plantings, it was never detected in our sample of undisturbed fields. Blue grama and sideoats grama occurred infrequently in some fields but occasionally had cover >10%. Other grasses that occurred infrequently in introduced warm-season plantings were purple threeawn, Arizona cottontop, sand dropseed, plains bristlegrass, hairy grama, Bermuda grass, and green sprangletop. Cool-season grass plantings were either dominated by smooth brome, western wheatgrass, or crested wheatgrass (fig. 4c). Cheatgrass and intermediate wheatgrass occurred infrequently in cool-season grass fields.

Grazed versus Ungrazed Fields

We observed no strong evidence that pre-greenup VOR, mid-summer VOR, herbaceous cover, or proportion of grass cover differed between grazed and ungrazed fields two (all MRPP P > 0.073) or four years (all MRPP P > 0.130) post-grazing. Vegetation changes from 1990 to 1998 (2 years post-grazing) and to 2000 (4 years post-grazing) were highly variable for both ungrazed and grazed fields (fig. 5). There was weak evidence that herbaceous cover in grazed cool-season fields declined 15%–20% less from 1990 to 1998 than ungrazed cool-season fields; however, the small sample size (n = 3) made these results unreliable. In introduced warm-season grass fields, there were weak indications that pre-greenup VOR decreased around 1 dm more from 1990 to 1998 in grazed compared to ungrazed fields and that lower percentiles of herbaceous cover decreased 10%–20% more from 1990 to 2000 in grazed compared to ungrazed fields (fig. 5). Reduced sample sizes for the four years post-grazing comparisons makes these results less reliable than the two years post-grazing comparisons.

Grass species composition in 1998 for ungrazed and grazed fields (fig. 6) was similar to composition in the 1996 sample of ungrazed fields (fig. 4). Sideoats grama was the most frequently occurring grass in native warm-season grass plantings with half of the fields having >5% cover (fig. 6a). Blue grama also occurred frequently with half of the fields having >1% cover. Little bluestem and switchgrass occurred less frequently but had up to 20% and 22% cover, respectively, when present. Unlike the 1996 sample of undisturbed fields, Indiangrass was detected infrequently in fields but with 1%–11% cover when present. Western wheatgrass and big bluestem occurred infrequently with the former having 1%–14% cover when present and the latter having <3% cover when present. Introduced warm-season grass plantings were monocultures of either plains bluestem, weeping lovegrass, or klinegrass, with blue grama or sideoats grama occurring infrequently but with 1%–36% cover when present (fig. 6b). Cool-season plantings were dominated by smooth brome with 10%–34% cover or western wheatgrass with 1%–9% cover, occasionally mixed with crested or intermediate wheatgrass and smooth brome (fig. 6c). We detected no evidence that grass species composition differed between grazed and ungrazed fields.

Discussion

The strong nonlinear changes in vegetative cover in undisturbed central and southern plains CRP grass plantings, where maximum cover occurred 3–5 years after establishment, differ from those reported in more mesic regions. Vegetative cover increased or remained fairly constant over the 10 years after grass plantings were established in northern Missouri (McCoy and others, 2001), Minnesota (Haroldson and others, 1998), and Michigan (Millenbah and others, 1996). Annual variation in vegetative cover in more mesic regions was primarily associated with annual weather variation with no consistent trend over time (Millenbah and others, 1996; Haroldson and others, 1998). Introduced warm-season grasses (weeping lovegrass and plains bluestem) maintained greatest cover values (% herbaceous and VOR) over time in the central

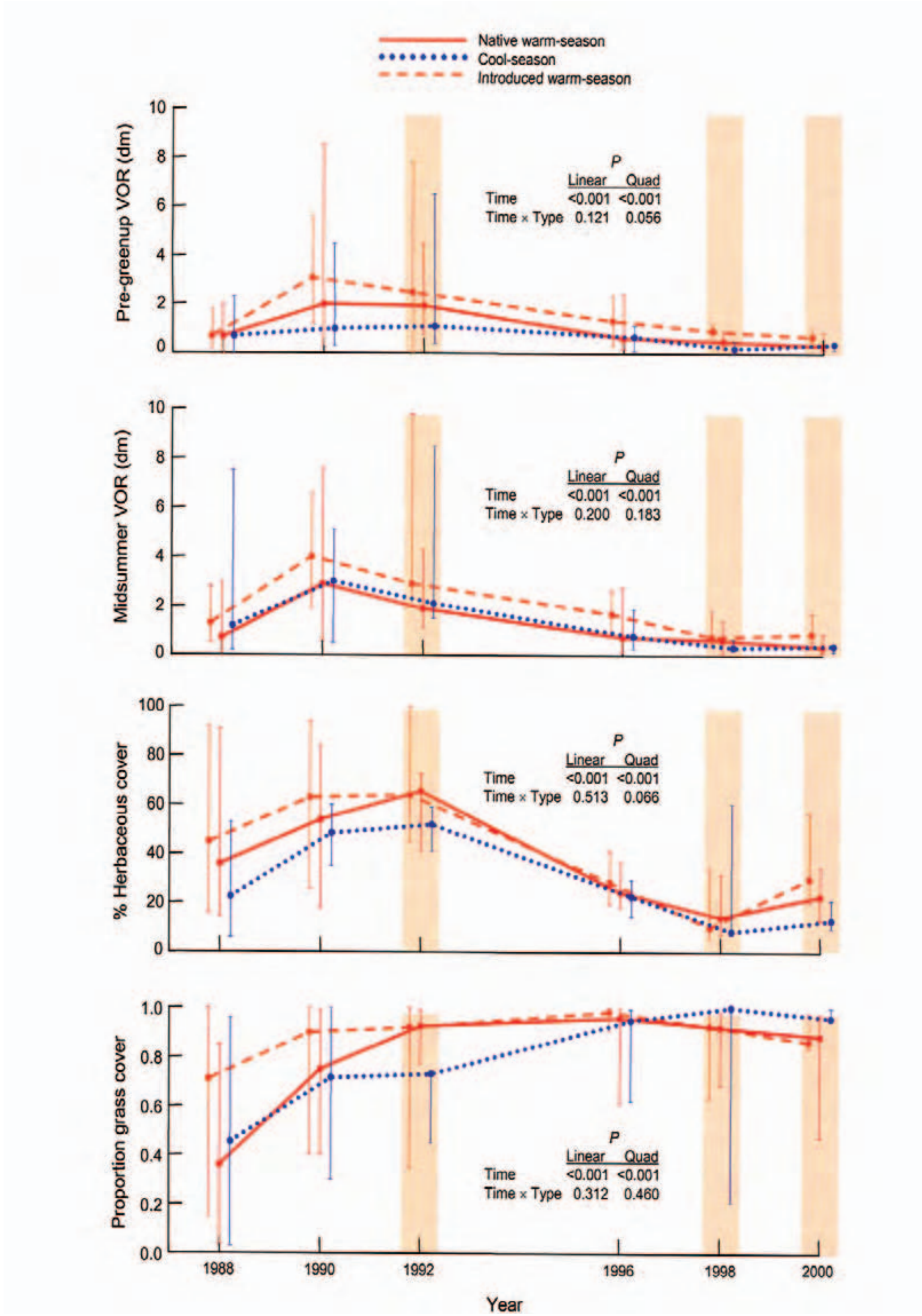

Figure 3. 10th (lower point of interval), 50th (circles), and 90th (upper point of interval) percentiles of vegetation measurements made over 1988 to 2000 in sample Conservation Reserve Program fields in the central and southern Plains classified as native warm-season (red, solid lines), introduced warm-season (orange, dashed lines), and cool-season (blue, dotted lines) grass plantings. Probabilities are for MRPP comparisons of linear and quadratic orthogonal polynomials for repeated measures across 1988, 1990, and 1996 (n = 39 for native warm-season, n = 31 for introduced warm-season, and n = 15 for cool-season plantings). Incomplete records obtained in 1992 (n = 12 for native-warm season, n = 9 for introduced warm-season, and n = 3 for cool-season plantings), 1998, and 2000 (n = 18 for native warm-season, n = 5 for introduced warm-season, and n = 3 for cool-season plantings) are shown in golden background and were not used in repeated measures analyses.

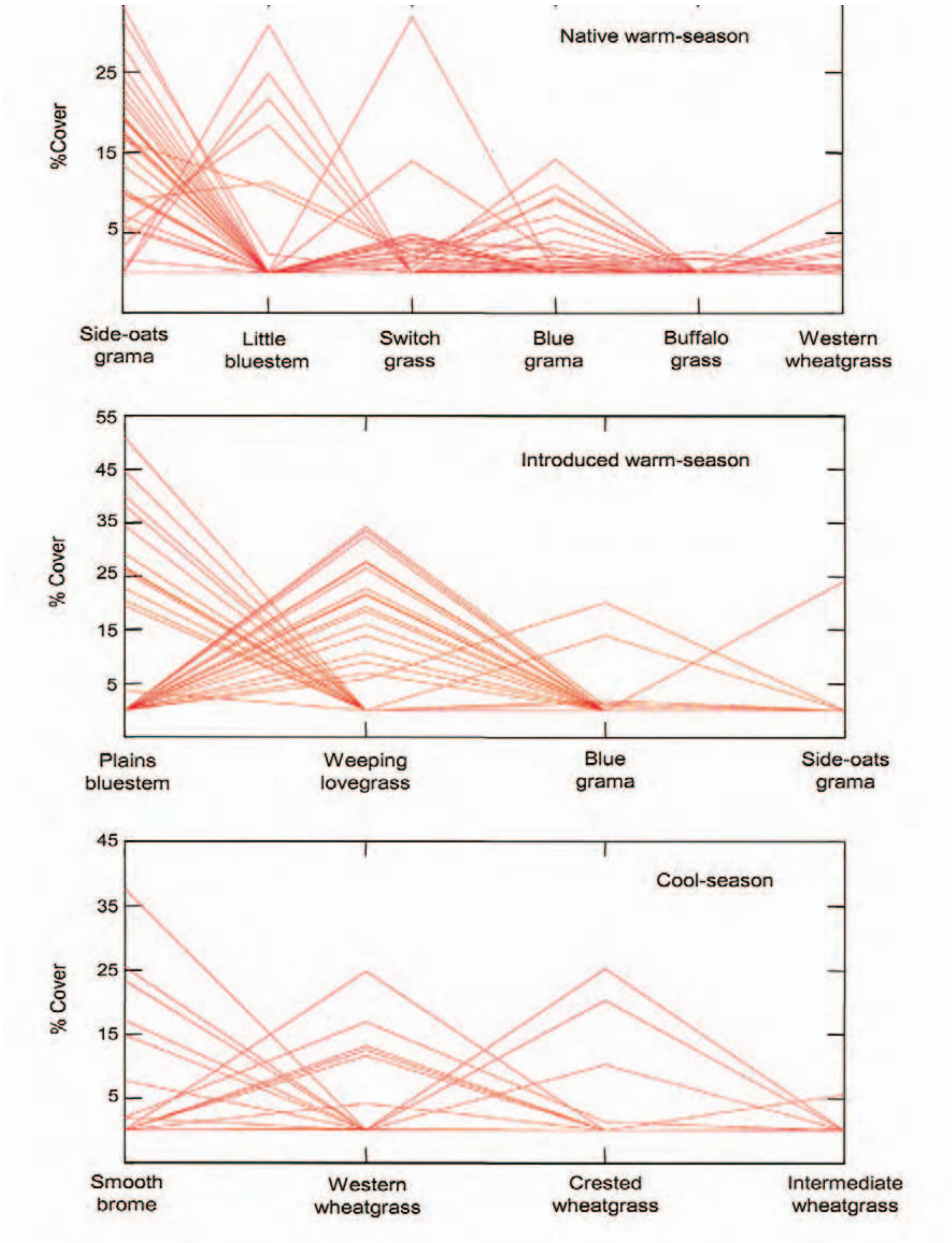

Figure 4. Parallel coordinate plot of percent cover of dominant grass species in native warm-season (n = 39), introduced warm-season (n = 31), and cool-season (n = 15) grass plantings measured in 1996 in Conservation Reserve Program fields in the central and southern plains. Each line connects percentages across a single field. Latin names of species are in table 1.

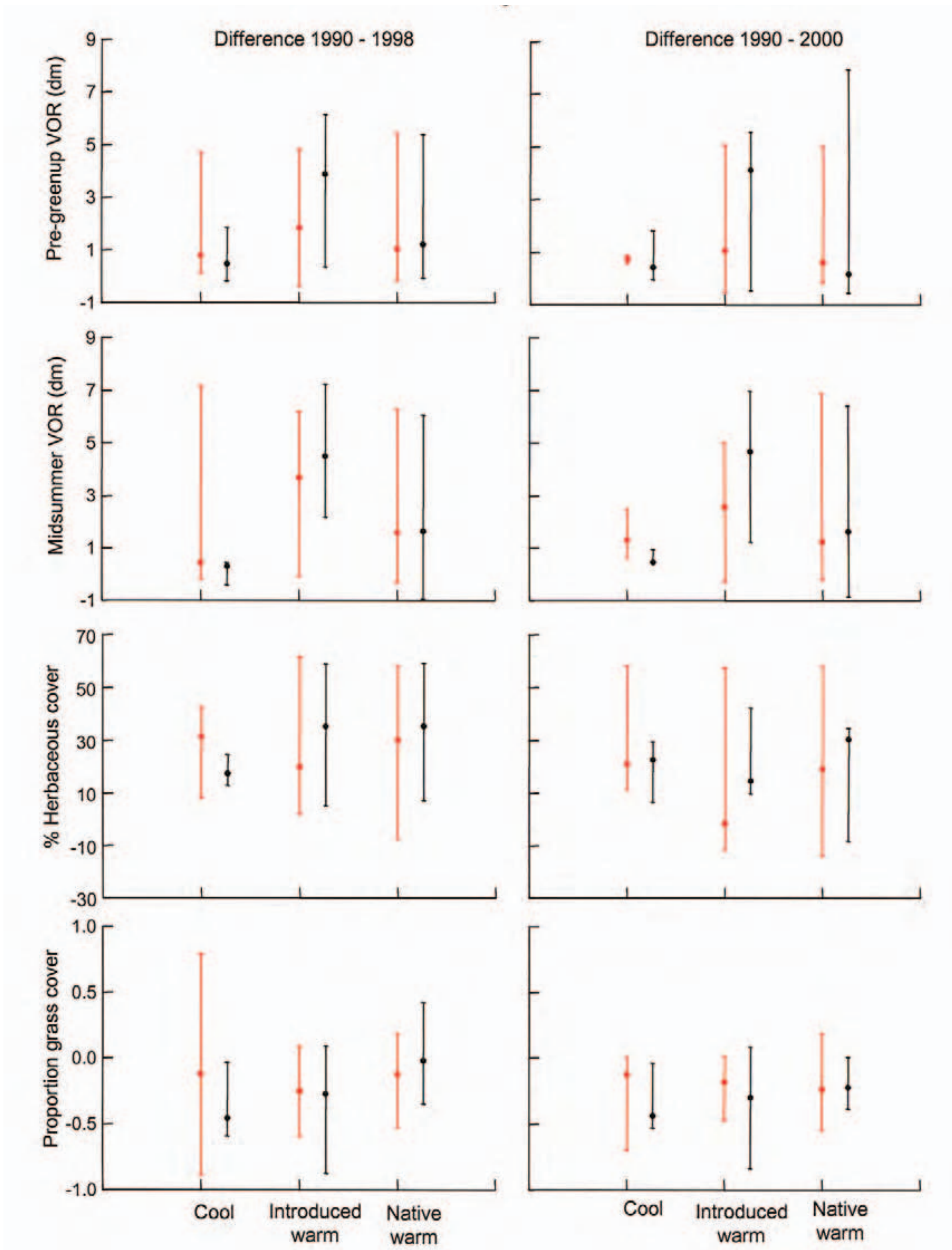

Figure 5. 10th (lower point of interval), 50th (circles), and 90th (upper point of interval) percentiles for differences between vegetation measurements in 1990 and 1998 and between 1990 and 2000 for Conservation Reserve Program fields in the central and southern plains grazed in 1996 (black) and those that were not grazed (red). For vegetation differences between 1990 and 1998: n = 36 ungrazed and n = 16 grazed native warm-season, n = 28 ungrazed and n = 7 grazed introduced warm-season, and n = 8 ungrazed and n = 3 grazed cool-season grass plantings. For vegetation differences between 1990 and 2000: n = 22 ungrazed and n = 5 grazed native warm-season, n = 11 ungrazed and n = 6 grazed introduced warm-season, and n = 5 ungrazed and n = 4 grazed cool-season grass plantings.

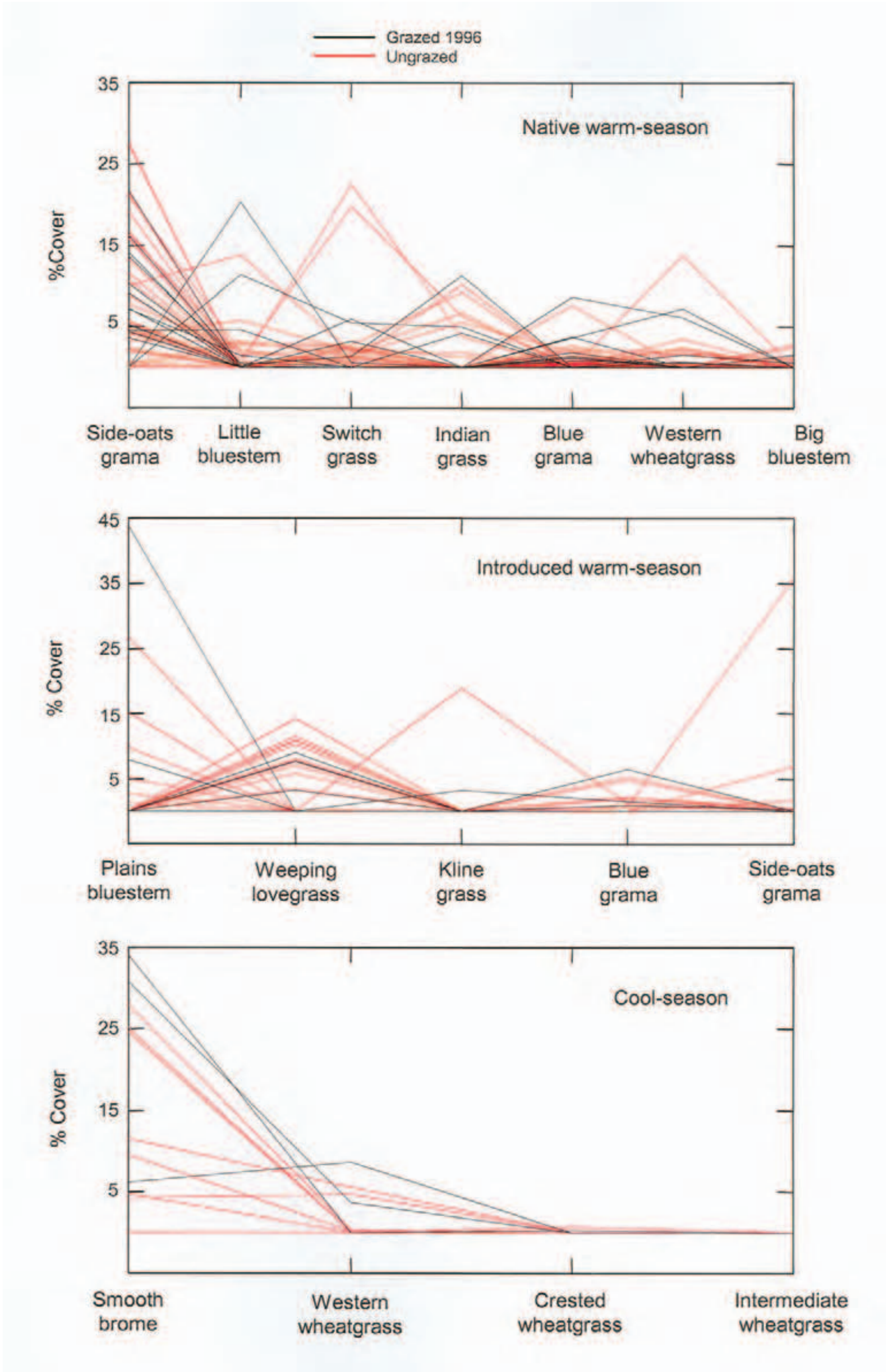

Figure 6. Parallel coordinate plot of percent cover of dominant grass species in native warm-season (n = 36 ungrazed and n = 16 grazed in 1996), introduced warm-season (n = 28 ungrazed and n = 7 grazed in 1996), and cool-season (n = 8 ungrazed and n = 3 grazed in 1996) grass plantings measured in 1998 in Conservation Reserve Program fields in the central and southern plains. Each line connects percentages across a single field. Latin names of species are in table 1.

and southern plains, native warm-season grasses maintained slightly less cover, and cool-season grasses (smooth brome and wheatgrasses) maintained the least cover. This is consistent with other analyses that characterize the central and southern plains as a region where warm-season (C_4) grasses predominate over cool-season (C_3) grasses (Epstein and others, 1997). Cool-season grasses provided more vegetative cover than warm-season grasses in locations north of the central and southern plains such as Minnesota (Haroldson and others, 1998) and South Dakota (Eggebo and others, 2003), whereas the converse was true in southeast Nebraska (Delisle and Savidge, 1997), Missouri (McCoy and others, 2001) and our central and southern plains samples.

All grass plantings in the central and southern plains exhibited an increasing dominance of grass cover over time with a corresponding reduction in the proportion of forbs. A similar increase in predominance of grass relative to forb cover has been observed in CRP grass plantings in more mesic regions such as eastern Kansas (Baer and others, 2002) and northern Missouri (McCoy and others, 2001). The decline in forbs with increasing age of CRP grass plantings can reduce the value of the habitat for some species of wildlife such as ring-necked pheasants (Farmer and others, 1988; Allen, 1994). Pronounced changes in vegetative cover over time and differences among grass planting types have additional implications for changes in wildlife habitat quality. Cover associated with VOR <2.5 dm and proportions of grass cover >0.25 results in suboptimal habitat for ring-necked pheasants (Farmer and others, 1988; Allen, 1994). Species such as western meadowlark (*Sturnella neglecta*) find optimal habitat with greater proportions of grass cover (≥0.80) and mid-summer herbaceous cover ≥50% (Farmer and others, 1988; Allen, 1994). Greater mid-summer VOR and more ring-necked pheasants were associated with cool-season CRP plantings in South Dakota (Eggebo and others, 2003), whereas warm-season native or introduced grass plantings in the southern plains provided greater mid-summer VOR and, presumably, better habitat for pheasants. Thus, it is important for large-scale assessments of agricultural policy (e.g., Nusser and others, 2004) to recognize that vegetation dynamics differ among grass plantings types, that these dynamics also differ among geographic regions, and, therefore, that the quality of wildlife habitat provided by specific grass planting types can vary regionally.

Changes in vegetative cover over time on CRP fields also have implications for recovery of soil condition and productivity following cessation of agricultural cultivation. The great variation in vegetative cover dynamics within a grass planting type that we observed across the central and southern plains has been noted in more regionally restricted studies. Coffin and others (1996) observed high variability in recovery of vegetation cover on shortgrass steppe in Colorado dominated by blue grama and buffalograss even 50 years after seeding to grasses following agricultural abandonment. Primary productivity, belowground biomass, and mineralizable and microbial carbon (C) and nitrogen (N) pools may resemble native grasslands 50 years after cessation of agricultural cultivation (Burke and others, 1995; Baer and others, 2002), with a significant fraction of recovery occurring the first 10 years (Robles and Burke, 1997). Soil organic matter (SOM), total soil C, and microbial biomass recover more slowly (Burke and others, 1995; Baer and others, 2002). A decrease in forbs may slow recovery of plant N content and labile soil N in shortgrass steppe (Robles and Burke, 1997).

Our results indicated that a single year of emergency grazing of CRP fields with well established grass plantings (>8 years old) had minimal impacts on the vegetation structure and composition two and four years after grazing. Short-term degradation of wildlife habitat associated with reduced vegetative cover the year a field was grazed does not imply a longer-term degradation of vegetative cover and wildlife habitat. These results do not apply to grazing of incompletely established grass plantings or to grazing in multiple years. Either is likely to have greater impacts on vegetation over time (Temple and others, 1999). Our ability to detect subtle vegetation changes associated with a single year of grazing might have been hindered by small sample sizes for introduced warm-season and cool-season grasses. However, our data demonstrated that high variability in the temporal vegetation changes for both grazed and ungrazed fields would overwhelm subtle effects for region-wide assessments even with much larger samples.

Selection of grasses for planting should be based on synchronous benefits for wildlife habitat, erosion control, and livestock forage. Grasses characterized by long-life, deep roots, robust structure that stands well against winter weather, and utility as forage provide potential for meeting multiple-use goals. Although our results indicated that introduced species of warm-season grasses provided the greatest vegetative cover over time, these species are not necessarily the best to plant to meet multiple wildlife habitat benefits. Introduced grasses often out compete native species by forming monotypic stands (e.g., plains bluestem) or develop so densely that use by preferred species of wildlife is restricted (e.g., Bermuda grass, weeping lovegrass). Forage grasses that have limited value for wildlife habitat should not be planted (Clubine, 1995).

Management prescriptions for CRP fields must be based on clear objectives with measurable criteria for defining success since effects of disturbance influence habitat for individual species differently (Campa and Winterstein, 1992; Szentandrasi and others, 1995; Ford and McPherson, 1996; Kruse and Bowen, 1996). Incorporating universal management guidelines (e.g., graze fields every 5 years) across large spatial scales in grasslands conservation programs may simplify policy but fail to account for differences among grass seeding mixtures, geographic regions, weather anomalies, and target wildlife species.

Whether for aesthetic or economic reasons, concern by landowners for wildlife and environmental quality does influence management of agricultural lands (McBeth and Foster, 1994; Long, 1996; Williams and Deibel, 1996). Governmental conservation programs should eliminate conflicting regulations, simplify forms of assistance, and actively encourage adoption of innovative techniques that permit optimal use of lands to address multiple conservation objectives (Ervin and Smith, 1996; Risser, 1996; Sieg and others, 1999). It must be realized, however, that improving wildlife habitat may not always be a landowner priority and that other conservation issues may at times conflict with habitat management objectives. Conservation policies associated with agricultural production must be formulated on strategies that address entire agricultural ecosystems including typical unpriced benefits such as wildlife and landscape diversity (Opie, 1994; Solbrig and Solbrig, 1994; Licht, 1999; Tucker, 1999). Individual policies that treat resource issues as independent problems (e.g., soil erosion vs. wildlife habitat) exemplify economically ineffective management that will fail to meet expectations of both rural and urban populations (Baydack and others, 1995; Crosson, 1995; Ervine and Smith, 1996).

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References Cited

Allen, A.W., 1994, Regional and state perspectives on Conservation Reserve Program contributions to wildlife habitat, report prepared for the Habitat Protection Committee of the International Association of Fish and Wildlife Agencies. Fort Collins, Midcontinent Ecological Science Center, National Biological Survey. Federal Aid in Wildlife Restoration Report, 28 p.

Allen, A.W., 1995, Agricultural ecosystems, *in* LaRoe, E.T., Puckett, G.S., Doran, P.D., and Mac, M.J., eds., Our Living Resources: A report to the Nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems: U.S. Department of the Interior, National Biological Service, Washington D.C., p. 423–426.

Allen, A.W., Cade, B.S., and Vandever, M.W., 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, v. 56, no. 2, p. 40–45.

Baer, S.G., Kitchens, D.J., Blair, J.M., and Rice, C.W., 2002, Changes in ecosystem structure and function along a chronosequence of restored grasslands: Ecological Applications, v. 12, no. 6, p. 1688–1701.

Barnes, T.G., Madison, L.A., Sole, J.D., and Lacki, M.J., 1995, An assessment of habitat quality for northern bobwhite in tall fescue-dominated fields: Wildlife Society Bulletin, v. 23, no. 2, p. 231–237.

Baydack, R.K., Patterson, J.H., Rubec, C.D., Tyrchniewicz, A.J., and Weins, T.W., 1995, Management challenges for prairie grasslands in the twenty-first century, *in* Samson, F.B., and Knopf, F.L., (eds.), Prairie conservation: Preserving North America's most endangered ecosystem, Washington, D.C., Island Press, p. 249–259.

Best, L.B., Campa, H., III, Kemp, K.E., Robel, R.J., Ryan, M.R., Savidge, J.A., Weeks, H.P., Jr., and Winterstein, S.R., 1997, Bird abundance and nesting in CRP fields and cropland in the Midwest: A regional approach: Wildlife Society Bulletin, v. 25, no. 4, p. 864–877.

Butler, J.L., and Briske, D.D., 1988, Population structure and tiller demography of bunchgrass *Schizachyrium scoparium* in response to herbivory, Oikos, v. 51, no. 2, p. 306–312.

Burke, I.C., Lauenroth, W.K., and Coffin, D.P., 1995, Recovery of soil organic matter and N mineralization in semiarid grasslands: Implications for the Conservation Reserve Program: Ecological Applications, v. 5, no. 3, p. 793–801.

Campa, H., III, and Winterstein, S.R., 1992, Wildlife and vegetative response to diverted agricultural land in Gratiot County, Michigan: Michigan State University, Department of Fisheries and Wildlife Annual Report, 1992, 26 p.

Casler, M.D., and Carlson, I.T., 1995, Smooth bromegrass, *in* Barnes, R.F., Miller, D.A., and Nelson, C.J., eds., Forages, vol. I: An introduction to grassland agriculture: Ames, Iowa State University Press, p. 313–324.

Clubine, S.E., 1995, Managing forages to benefit wildlife, *in* Barnes, R.F., Miller, D.A., and Nelson, C.J., eds., Forages, vol. II: The science of grassland agriculture: Ames, Iowa State University Press, p. 263–275.

Coffin, D.F., Lauenroth, W.K., and Burke, I.C., 1996, Recovery of vegetation in a semiarid grassland 53 years after disturbance: Ecological Applications, v. 6, no. 2, p. 538–555.

Crosson, P., 1995, The use and management of rural space, *in* Castle, E.N., ed., The changing American countryside: Rural people and places: Lawrence, University Press of Kansas, p. 134–154.

Daubenmire, R., 1959, A canopy-coverage method of vegetation analysis: Northwest Science, v. 33, p. 43–64.

Delisle, J.M., and Savidge, J.A., 1997, Avian use and vegetation characteristics of Conservation Reserve Program fields: Journal of Wildlife Management, v. 61, no. 2, p. 318–325.

Duebbert, H.F., Jacobson, E.T., Higgens, K.F., and Podoll, E.B., 1981, Establishment of seeded grassland for wildlife habitat in the prairie pothole region: U. S. Department of the Interior, Fish and Wildlife Service, Special Scientific Report, Wildlife no. 234, Washington, D.C., 21 p.

Eggebo, S.L., Higgins, K.F., Naugle, D.E., and Quamen, F.R., 2003, Effects of CRP field age and cover type on ring-necked pheasants in eastern South Dakota: Wildlife Society Bulletin, v. 31, p. 779–785.

Ervin, D.E., and Smith, K.R., 1996, What it takes to "Get to yes" for whole farm planning policy: Henry A. Wallace Institute for Alternative Agriculture, Greenbelt, Maryland. Policy Studies Report no. 5, 42 p.

Farmer, A.H., Hays, R.L., and Webb, R.P., 1988, Effects of the Conservation Reserve Program on wildlife habitat, *in* Transactions of the 53rd North American Wildlife and Natural Resources Conference, A cooperative monitoring study, p. 232–238.

Ford, P.L., and McPherson, G.R., 1996, Ecology of fire in shortgrass prairie of the southern Great Plains, *in* Finch, D.M., ed., Ecosystem disturbance and wildlife conservation in western grassland—Proceedings of a symposium, September 22–26, 1994: Albuquerque, New Mexico, General Technical Report RM-GTR-285. U.S. Department of Agriculture, Rocky Mountain Forest and Range Experiment Station, Ft. Collins, Colorado, p. 20–39.

Granfors, D.A., Church, K.E., and Smith, L.M., 1996, Eastern meadowlarks nesting in rangelands and Conservation Reserve Program fields in Kansas: Journal of Field Ornithology, v. 67, no. 2, p. 222–235.

Hall, D. L., and Willig, M.R., 1994, Mammalian species composition, diversity, and succession in Conservation Reserve Program grasslands: The Southwestern Naturalist, v. 39, no. 1, p. 1–10.

Haroldson, K.J., Kimmel, R.O., and Riggs, M.R., 1998, Cover quality of Conservation Reserve Program grasslands in Minnesota, *in* Birkan, M., Smith, L.M., Aebischer, N.J., Purroy, F.J., and Robertson, P.A., eds.: Perdix VII, International Symposium on Partridges, Quails, and Pheasants, Gibier Faune Sauvage, Game Wildlife, v. 15, p. 501–516.

Heard, L.P., Allen, A.W., Best, L.B., Brady, S.J., Burger, W., Esser, A.J., Hackett, E., Johnson, D.H., Peterson, R.L., Reynolds, R.E., Rewa, C., Ryan, M.R., Molleur, R.T., and Buck, P., 2000, A comprehensive review of Farm Bill contributions to wildlife conservation, 1985–2000, *in* Hohman, W.L., and Halloum, D.J. (eds.): U.S. Department of Agriculture, Natural Resources Conservation Service, Wildlife Habitat management Institute, Technical Report, USDA/NRCS/WHMI-2000, 208 p.

Herkert, J.R., Sample, D.W., and Warner, R.E., 1996, Management of Midwestern grassland landscapes for the conservation of migratory birds, *in* Thompson, F.R., III, ed., Management of midwestern landscapes for the conservation of neotropical migratory birds: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota, General Technical Report NC-187, p. 89–116.

Higgens, K.F., 1987, Maintenance of planted grass stands for wildlife: North Dakota Academy of Science, v. 41, p. 42.

Hobbs, R.J., and Huenneke, L.F., 1992, Disturbance, diversity, and invasion: implications for conservation: Conservation Biology, v. 6, no. 3, p. 324–327.

Hughes, J.S., Hoag, D.L., and Nipp, T.E., 1995, The Conservation Reserve: A survey of research and interest groups: Council for Agricultural Science and Technology, Special Publication, no.19, 44 p.

King, J.W., and Savidge, J.A., 1995, Effects of the Conservation Reserve Program on wildlife in southeast Nebraska: Wildlife Society Bulletin, v. 23, no. 3, p. 377–385.

Klute, D.S., Robel, R.J., and Kemp, K.E., 1997, Will conversion of Conservation Reserve Program (CRP) lands to pasture be detrimental for grassland birds in Kansas?: American Midland Naturalist, v. 137, no. 2, p. 206–212.

Kruse, A.D., and Bowen, B.S., 1996, Effects of grazing and burning on densities and habitats of breeding ducks in North Dakota: Journal of Wildlife Management, v. 60, no. 2, p. 233–246.

Kurzejeski, E.W., 1996, Vegetation structure and avian species composition in diverted farmland: Federal Aid Project No. W-13-R-50, final report to the Missouri Department of Conservation, Jefferson City, 57 p.

Licht, D.S., 1999, Ecology and economics of the Great Plains: University of Nebraska Press, Lincoln, 225 p.

Long, W., 1996, Free market wildlife management: a plus for landowners, hunters, and the environment, *in* Evans, K.E., compiler, Sharing common ground on western rangelands-Proceedings of a livestock/big game symposium.: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, Utah, General Technical Report INT-GTR-343, p. 90–91.

McBeth, M.K., and Foster, R.H., 1994, Rural environmental attitudes: Environmental Management, v. 18, no. 3, p. 401–411.

McCoy, T.D., Kurzejeski, E.W., Berger, L.W., Jr., and Ryan, M.R., 2001, Effects of conservation practice, mowing, and temporal changes on vegetation structure on CRP fields in northern Missouri: Wildlife Society Bulletin, v. 29, no. 3, p. 979–987.

Mielke, P.W., Jr., and Berry, K.J., 2001, Permutation methods: A distance function approach: New York, NY, Springer-Verlag, 352 p.

Millenbah, K.F., Winterstein, S.R., Campa, H., III, Furrow, L.T., and Minnis, R.B., 1996, Effects of Conservation Reserve Program field age on avian relative abundance, diversity, and productivity: Wilson Bulletin, v. 108, no. 4, p. 760–770.

Moser, L.E., and Vogel, K.P., 1995, Switchgrass, big bluestem, and Indiangrass, *in* Barnes, R.F., Miller, D.A., and Nelson, C.J., eds., Forages, Volume I: An introduction to grassland agriculture: Ames, Iowa State University Press, p. 409–420.

Nusser, S.M., W.R. Clark, Wang, J., and Bogenschutz, T.R., 2004, Combining data from state and national monitoring surveys to assess large-scale impacts of agricultural policy: Journal of Agricultural, Biological, and Environmental Statistics, v. 9, no. 3, p. 381–397.

Opie, J., 1994, The law of the land: Two hundred years of American farmland policy: Lincoln, University of Nebraska Press, 253 p.

Osborn, C.T., 1997, Conservation Reserve Program, *in* Anderson, M., and Magleby, R., eds., Agricultural resources and environmental indicators, 1996–1997: U.S. Department of Agriculture, Economic Research Service. Agricultural Handbook Number 712, Washington, D.C., p. 286–296.

Osborn, C.T., Llacuna, F., and Linsenbigler, M., 1992, The Conservation Reserve Program: Enrollment statistics for signup periods 1–11 and fiscal years 1990–1992: U.S. Department of Agriculture, Economic Research Service, Statistical Bulletin Number, no. 843, Washington, D.C., 86 p.

Patterson, M.P., and Best, L.B., 1996, Bird abundance and nesting success in Iowa CRP fields: The importance of vegetation structure and composition: American Midland Naturalist, v. 135, no. 1, p. 153–167.

Peet, M.R., Anderson, R., and Adams, M.S., 1975, Effect of fire on big bluestem production: American Midland Naturalist, v. 94, no. 1, p. 15–26.

Renfrew, R.B., and Ribic, C.A., 2001, Grassland birds associated with agricultural riparian practices in southwestern Wisconsin: Journal of Range Management, v. 54, no. 5, p. 546–552.

Ribaudo, M.O., Hoag, D.L., Smith, M.E., and Heimlich, R., 2001, Environmental indices and the politics of the Conservation Reserve Program: Ecological Indicators, v. 1, p. 11–20.

Rice, E.L., and Parenti, R.L., 1978, Causes of decreases in productivity in undisturbed tall grass prairie: American Journal of Botany, v. 65, no. 10, p. 1091–1097.

Risser, P.G., 1996, A new framework for prairie conservation, in Samson, F.B. and Knopf, F.L., eds., Prairie conservation: Preserving North America's most endangered ecosystem: Washington, D.C., Island Press, p. 261–274.

Robel, R.J., Briggs, J.N., Dayton, A.D., and Hulbert, L.C., 1970, Relationships between visual obstruction measurements and weight of grassland vegetation: Journal of Range Management, v. 23, no. 4, p. 295–297.

Robles, M.D., and Burke, I.C., 1997, Legume, grass, and Conservation Reserve Program effects on soil organic matter recovery: Ecological Applications, v. 7, no. 2, p. 345–357.

Rodgers, R.D., 1999, Why haven't pheasant populations in western Kansas increased with CRP?: Wildlife Society Bulletin, v. 27, no. 3, p. 654–665.

Roseberry, J.L., and David, L.M., 1994, The Conservation Reserve Program and northern bobwhite population trends in Illinois: Transactions of the Illinois State Academy of Science, v. 87, nos. 1&2, p. 61–70.

Sieg, C.H., Flather, C.H., and McCanny, S., 1999, Recent biodiversity patterns in the Great Plains: Implications for restoration and management: Great Plains Research, v. 9 (Fall 1999), p. 277–313.

Solbrig, O.T., and Solbrig, D.J., 1994, So shall you reap: Farming and crops in human affairs: Island Press, 284 p.

Swengel, S.R., and Swengel, A.B., 2001, Relative effects of litter and management on grassland bird abundance in Missouri, USA: Bird Conservation International, v. 11, no. 113–128.

Szentandrasi, S., Polasky, S., Berrens, R., and Leonard, J., 1995, Conserving biological diversity and the Conservation Reserve Program: Growth and Change, v. 26, p. 383–404.

Temple, S.A., Fevold, B.M., Paine, L.K., Undersander, D.J., and Sample, D.W., 1999, Nesting birds and grazing cattle: Accommodating both on Midwestern pastures: Studies in Avian Biology, v. 19, no. 2, p. 196–202.

Tucker, G., 1999, Measuring the impact of agriculture on biodiversity, *in* Brouwer, F., and Crabtree, B., eds., Environmental indicators and agricultural policy: New York, New York, CABI Publishing, p. 89–103.

U.S. Department of Agriculture, 2004, http://www.fsa.usda.gov/dafp/cepd/crp.htm

Weber, W.L., Roseberry, J.L., and Woolf, A., 2002, Influence of the Conservation Reserve Program on landscape structure and potential upland wildlife habitat: Wildlife Society Bulletin, v. 30, no. 2, p. 888–898.

Westfall, P.H., Young, S.S., 1993, Resampling-based multiple testing: Examples and methods for p-value adjustment: New York, New York, John Wiley and Sons, Inc., 340 p.

Williams, J.R., and Diebel, P.L., 1996, The economic value of the Prairie, *in* Samson, F.B., and Knopf, F.L., eds., Prairie conservation: Preserving North America's most endangered ecosystem: Washington, D.C., Island Press, p. 135–148.

Prairie Grouse Population Response to Conservation Reserve Program Grasslands: An Overview

By Randy D. Rodgers[1] and Richard W. Hoffman[2]

Introduction

The Conservation Reserve Program (CRP) of the Federal Food Security Act of 1985, resulted in seeding 34.8 million acres (14 million ha) of marginal croplands to permanent vegetation, mostly grasses. Reports of positive avian population responses to CRP grassland are numerous and include benefits to songbirds (e.g., Reynolds and others, 1994; King and Savidge, 1995; Johnson and Igl, 1995; Best and others, 1997); ducks (e.g., Kantrud, 1993; Reynolds and others, 1994); and pheasants (*Phasianus colchicus*) (e.g., Berthelsen and others, 1989; King and Savidge, 1995; Riley, 1995). These positive responses are particularly significant when considered in the context of long-term decline of many species of grassland birds (Knopf, 1994). Although over 80% of the 31 million acres (12.5 million ha) of general signup CRP grasslands occurs in states with populations of greater prairie-chicken (*Tympanuchus cupido*), lesser prairie-chicken (*T. pallidicinctus*), or sharp-tailed grouse (*T. phasianellus*), little information on the responses of prairie grouse to CRP grasslands has been published.

This paper summarizes documented responses of prairie grouse to CRP grasslands and supplements this with field observations of natural resource professionals working throughout the ranges of prairie grouse. We obtained the latter through telephone interviews of state and federal wildlife biologists, and resource conservationists with the Natural Resources Conservation Service (NRCS) in 20 states who had first-hand knowledge of prairie grouse relations to CRP grasslands in their respective regions. States included were Alaska, Colorado, Idaho, Illinois, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, Wisconsin, and Wyoming. Scientific names of vegetation follow the U.S. Department of Agriculture (USDA) Plants web database. Stand heights refer to maximum heights of the vegetation at the end of the growing season.

Greater Prairie-Chicken

Positive greater prairie-chicken (hereafter GPC) responses were indicated in parts of five of the eight states where CRP grasslands were available to the species (table 1). GPC responded positively to a variety of CRP seedings, including native warm-season grass mixtures as well as introduced cool-season stands. Little or no CRP grasslands occurred near GPC populations in Oklahoma and Wisconsin, or near Attwater's prairie chickens (*T. cupido attwateri*) in Texas.

By the mid-1990's, biologists observed substantial increases in GPC numbers in northwest and west-central Kansas. The increase in west-central Kansas was particularly striking since GPC, previously rare in this region, became common where CRP grasslands were established near [0–2 miles (0–3 km)] extensive complexes of native rangeland. In western Kansas, CRP stands were seeded with multiple-species mixtures of native warm-season grasses, often dominated by little bluestem (*Schizachyrium scoparium*) with significant amounts of sideoats grama (*Bouteloua curtipendula*) and/or switchgrass (*Panicum virgatum*), and lesser amounts of other species. These stands reach 14–32 inches (35–80 cm) in height.

A moderate positive response by GPC, with some range expansion, occurred in southwestern Nebraska. Here, CRP stands were originally seeded to native warm-season grass mixtures dominated by tall grasses that included big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and switchgrass. Sideoats grama and sand lovegrass (*Eragrostis trichodes*) are common on some sites. Most of these stands reach 24–40 inches (60–100 cm) in height. Taylor (2000) reported a significant increase in the population of GPC in Southeastern Nebraska concurrent with establishment of CRP grasslands. About 80% of these stands were seeded with smooth brome (*Bromus inermis*) and reach 12–24 inches (30–60 cm).

In western Minnesota, Toepfer (1988) documented GPC nesting in CRP stands, and Merrill and others (1999) found GPC leks associated with areas containing above average amounts of CRP grasslands. Most of the original seedings consisted of smooth brome and alfalfa (*Medicago sativa*) that reached 20–28 inches (50–70 cm). Populations of GPC in Minnesota increased significantly in response to CRP grasslands that roughly doubled available habitat. However, this increase was limited because alfalfa disappeared from many stands, in effect creating smooth brome monocultures. Minnesota CRP stand quality varies considerably, depending on seeding mixtures and subsequent management (Svedarsky and others, 1997). Plant diversity, and GPC benefits, could be enhanced by controlled fire, using clean-disked firebreaks,

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Table 1. Summary by state[1] and region of identified responses of greater prairie-chickens to available grasslands established during the first decade of the Conservation Reserve Program. Abbreviations used are as follows: CS = cool season; WS = warm season; Intr = introduced species; Natv = native species; Mix = multiple-species mixture; and Mono = one species of grass seeded. Grasses seeded refers to the most common type(s) of CRP seedings in the designated region.

State	Region	Grasses seeded	Forbs	Stand heights[2] (cm)	Range expansion	Population increase
Colorado	Northeast	CS Intr Mono	None	10–15	None[3]	None
Illinois	South	CS Intr Mix	None	30–90[4]	None	None
Kansas	West	WS Natv Mix	None	35–80	Strong	Strong
Kansas	Central/East	WS Natv Mix	None	80–150	None	None
Minnesota	West	CS Intr Mono	Intr[5]	50–70	Moderate	Strong
Missouri	West	CS Intr Mono/Mix	None	45–70	None	None
Nebraska	Southwest	WS Natv Mix	None	60–100	Moderate	Moderate
Nebraska	Southeast	CS Intr Mono	None	30–60	Moderate	Strong
North Dakota	East	CS Intr Mono/Mix	Intr[5]	50–100	Moderate	Moderate
South Dakota	East	CS Intr Mix	Intr[5]	50–70	Moderate	Moderate

[1]Little or no Conservation Reserve Program grassland occurred near greater prairie-chicken populations in Oklahoma and Wisconsin, or near Attwater's prairie chickens in Texas.

[2]Stand height refers to maximum height of vegetation at the end of the growing season (1 cm = 0.4 inches).

[3]A slight initial range expansion was not sustained.

[4]Lower height was maintained due to mowing.

[5]The forb component diminished over time where seeded with smooth brome.

with mowing, haying, or grazing as alternatives (Svedarsky and others, 1998).

Populations of GPC increased significantly, with moderate range expansion, in eastern North Dakota. A restored GPC population near Grand Forks depends on a complex of about 37,000 acres (15,000 ha) of grassland, about 70% of which is enrolled in the CRP. Much of the CRP grasslands in this area were seeded to a salt-tolerant mixture of tall wheatgrass (*Thinopyrum ponticum*), western wheatgrass (*Pascopyrum smithii*), and sweet clover (*Melilotus* spp.). Populations of GPC previously restricted to the Sheyenne National Grasslands have also expanded onto CRP grasslands originally seeded to a smooth brome, alfalfa, and sweet clover. Stands of CRP in eastern North Dakota range from 20–40 inches tall (50–100 cm).

In eastern South Dakota, GPC populations also increased and moderately expanded their range. Most stands seeded early in the CRP were dominated by intermediate wheatgrass (*Thinopyrum intermedium*), but many also contained smooth brome or tall wheatgrass. Alfalfa and/or sweet clover were seeded in many stands, but these diminished over time, particularly where seeded with smooth brome. Cool-season stands available to GPC reach 20–28 inches (50–70 cm) in height.

Very little CRP grassland is present near two small, intensively managed populations of GPC in southern Illinois. However, one group of GPC utilizes about 1,000 acres (400 ha) of CRP containing mixtures of tall fescue (*Lolium arundinaceum*), orchardgrass (*Dactylis glomerata*), and redtop (*Agrostis gigantea*). The stands, often mowed to <12 inches (30 cm), can reach 30–36 inches (75–90 cm).

Populations of GPC showed minimal responses to available CRP grasslands in areas of three states. In contrast to the case in semi-arid western Kansas, there is little indication CRP grasslands benefited GPC in central and eastern Kansas. Biologists believe the greater [32–60 inches (80–150 cm)] height and density of mixed native-grass stands in these higher precipitation regions is excessive for GPC. Inadequate management has allowed trees to invade many CRP stands, diminishing their value for GPC and other grassland birds.

In Missouri, CRP grasslands have not produced a population response by GPC, where about 40% of the original stands were single-species seedings of tall fescue. Most such stands reach 18–24 inches (45–60 cm) but become too dense for GPC or most other grassland birds. Much of the remainder of Missouri's CRP was composed of lightly-seeded orchardgrass or orchardgrass-dominated mixtures that reach 24–30 inches (60–75 cm). In northern Missouri, GPC have nested in CRP consisting of smooth brome, orchardgrass, and timothy (*Phleum pratense*), with some legumes.

Insufficient stand height apparently prevented a sustained GPC population response to CRP in northeastern Colorado.

Numbers of GPC did not increase, but may have expanded their distribution slightly following initial establishment of smooth brome CRP stands. However, these stands diminished in vigor 2–3 years after establishment in this semi-arid region and subsequently reached only 4–6 inches (10–15 cm) in height.

With the 16th and subsequent CRP signups, new seeding mixtures were utilized and vegetation composition in existing stands enhanced. Native warm-season grass mixtures with significant compliments of forbs became more prevalent for new CRP seedings. Such stands reach 16–24 inches (40–60 cm) in semi-arid Colorado and are considered a significant habitat improvement for GPC over earlier stands established under the CRP. In western Kansas and southwestern Nebraska, interseeding of forbs (both introduced and native) into existing stands and addition of forbs to new seeding mixtures is also expected to significantly benefit GPC by increasing invertebrate availability (Fields, 2004) and improving habitat structure. J.E. Toepfer (oral commun., 2004) indicated GPC were attracted to new CRP stands dominated by little bluestem in Minnesota, and had nest success comparable to that recorded in native prairie. New CRP stands of native warm-season grass mixtures in eastern South Dakota and Missouri are considered typically to be too tall [60–80 inches (150–200 cm)] to benefit GPC without grazing.

Lesser Prairie-Chicken

The lesser prairie-chicken (hereafter LPC) is a "candidate" species for Endangered Species Act (ESA) listing. Positive LPC responses to CRP grasslands were indicated in portions of two of the five states encompassing the species' range (table 2). Population responses of LPC were highly variable, ranging from virtually none in states where exotic CRP warm-season monocultures were prevalent to a strong positive response in western Kansas where native warm-season mixtures were standard.

Very few LPC were present north of the Arkansas River in west-central Kansas prior to the CRP, but Rodgers (1999) attributed a strong population increase and substantial range expansion to grassland establishment under the CRP. Spring listening surveys (1998–2004) identified 215 LPC leks in west-central Kansas, particularly where extensive CRP grasslands were near [0–2 miles (0–3 km)] larger native rangeland complexes (R.D. Rodgers, unpub. data, 2004). Expansion of LPC range has brought this species together with GPC in a zone of overlap about 40 miles (60 km) wide for the first time since the early twentieth century. Stands in CRP in western Kansas consist of warm-season native mixtures dominated by little bluestem, with significant components of sideoats grama and switchgrass, and lesser amounts of other species. These CRP stands reach greater height [14–32 inches (35–80 cm)] than is generally provided by native range and have been used extensively by LPC for nesting (Fields, 2004), roosting, and loafing. In this region, LPC leks generally occur in the shorter vegetation of native pastures, but are often near CRP stands.

About 70–80% of the original CRP seedings in eastern New Mexico consisted of dense, single-species stands of weeping lovegrass (*Eragrostis curvula*), yellow bluestem (*Bothriochloa ischaemum*), or Caucasian bluestem (*Bothriochloa bladhii*). A few counties seeded mixtures that included sand dropseed (*Sporobolus cryptandrus*), sideoats grama, and blue grama (*Bouteloua gracilis*). Populations of LPC have generally not increased in response to the monocultures noted, but have increased slightly in range and population, in an area north of Clovis, where mixed stands are more prevalent.

Early CRP stands in southeastern Colorado were seeded to warm-season native mixtures, but were so heavily dominated by sideoats grama as to be, in effect, monocultures. Sand dropseed and sand lovegrass were dominant species on sandy soils. In Colorado, LPC have been observed roosting and loafing in Colorado CRP grasslands. A few leks have been associated with these stands, perhaps contributing to slight range expansion. However, LPC populations do not appear to have increased.

Lesser prairie-chicken populations have not increased in response to CRP grasslands in Oklahoma. Single-species seedings of Caucasian bluestem, yellow bluestem, and weeping lovegrass, all old-world species, made up about 70% of the early seedings and typically reach 14–24 inches (35–60 cm) in height. Seedings on sandy soils were mainly native warm-season mixtures consisting of sand bluestem (*Andropogon hallii*), indiangrass, switchgrass, little bluestem, and sideoats grama. Sometimes LPC roost in and, occasionally, nest in old-world species CRP in Oklahoma, but research indicated a greater nesting preference for warm-season mixed stands (Sutton Avian Research Center, unpub. data).

Texas Panhandle CRP grasslands were similar to those in adjacent Oklahoma and New Mexico. Most stands consisted of single-species seedings of exotic warm-season species, including weeping lovegrass, yellow bluestem, Caucasian bluestem, or klinegrass (*Panicum coloratum*). Use by LPC of these CRP stands was limited. No population response was evident. Broods of LPC have used margins of these CRP stands where they adjoin native rangeland.

Generally, new CRP seedings and enhancements that occurred with the 16th and subsequent signups have placed greater emphasis on native warm-season mixtures with significant forb components. In southeastern Colorado, new seedings may include up to 16 species of native grasses, forbs and shrubs. Other states in the LPC range also use native grass mixtures with forbs for new CRP seedings, although these seedings still represent <50% of new stands in Oklahoma. For a period, USDA required existing CRP enhancements in Oklahoma, New Mexico, and Texas by destroying 51% of the existing exotic monoculture and reseeding to native mixtures. In Kansas, where native mixtures were seeded at the beginning of the CRP, interseeding of alfalfa (which persists well in these warm-season stands) and native forbs has been the primary method of stand enhancement.

Table 2. Summary by state and region of identified responses of lesser prairie-chickens to available grasslands established during the first decade of the Conservation Reserve Program. Abbreviations used are as follows: WS = warm season; Intr = introduced species; Natv = native species; Mix = multiple-species mixture; and Mono = one species of grass seeded. Grasses seeded refers to the most common type(s) of CRP seedings in the designated region.

State	Region	Grasses seeded	Forbs	Stand heights[1] (cm)	Range expansion	Population increase
Colorado	Southeast	WS Natv Mix[2]	None	25–50	Slight	None
Kansas	West	WS Natv Mix	None	35–70	Strong	Strong
Oklahoma	Northwest	WS Intr Mono	None	35–60	None	None
New Mexico	East	WS Intr Mono	None	35–90	None	None
New Mexico[3]	East	WS Intr/Natv Mix	None	35–90	Slight	Slight
Texas	Panhandle	WS Intr Mono	None	35–90	None	None

[1]Stand height refers to maximum height of vegetation at the end of the growing season (1cm = 0.4 inches).

[2]Although seeded as mixtures, most stands became so heavily dominated by sideoats grama that they were, in effect, monocultures.

[3]Lesser paririe-chickens have responded positively to mixed Conservation Reserve Program stands in an area north of Clovis, New Mexico but introduced monocultures are also present in the area.

Sharp-Tailed Grouse

Sharp-tailed grouse (hereafter STG) appear to have benefited more from the CRP than either species of prairie chicken. Positive STG responses, in both population and range expansion, occurred in parts of 10 of 12 states where CRP was available to the species (table 3). Little or no CRP grassland is proximate to prairie STG (*T. p. campestris*) populations in Michigan or Wisconsin. The greatest benefits to STG were obtained with mixtures of cool-season grasses and forbs.

Plains STG (*T. p. jamesi*) populations exhibited strong increases, with moderate range expansion, in response to CRP grasslands in a contiguous region that include portions of southeastern Wyoming, northeastern Colorado, and the Nebraska Panhandle (fig. 1). Wachob (1997) found STG using CRP grasslands more than any other habitat type for nesting and brood rearing. In southeastern Wyoming, most early seedings were planted to smooth brome and/or crested wheatgrass (*Agropyron cristatum*) that gradually crowded out alfalfa or sweet clover seeded with them. However, STG hens and broods selected stands with the greatest vegetative diversity, particularly those with abundant forbs. Early CRP stands in the Nebraska Panhandle were commonly seeded to mixtures that included crested wheatgrass, smooth brome, and intermediate wheatgrass, with either alfalfa or sweet clover. In adjacent northeastern Colorado, early CRP stands were more variable and included smooth brome monocultures, cool-season mixtures, and some native warm-season mixtures. In this 3-state region, CRP grasslands vary from 8–30 inches (20–75 cm) in height. Wachob (1997) strongly advocated inclusion of alfalfa in new CRP seedings and management that encouraged early-succession vegetation.

Conservation Reserve Program grasslands provided varying degrees of benefit to STG in different regions of Montana. Most original CRP seedings in Montana included crested wheatgrass, either seeded alone or with alfalfa or sweet clover. These stands typically reach 10–18 inches (25–45 cm). As occurred elsewhere, crested wheatgrass tended to out-compete and exclude forbs seeded with it. However, some early CRP seedings, more commonly in northeastern Montana, were seeded to a combination of western wheatgrass and intermediate wheatgrass, with sweet clover and/or alfalfa. Plains STG have responded most positively in northeastern Montana where such diverse stands [12–36 inches (30–90 cm)] are more abundant, but STG numbers have also improved moderately in southeastern Montana in response to CRP grasslands. Clawson and Rotella (1998) demonstrated high potential nest survival in Montana CRP stands when compared to other habitats.

Plains STG population response to CRP grasslands in the Dakota's has been positive, but perhaps less pronounced than STG responses noted above. The addition of CRP grasslands in southeastern North Dakota has allowed populations to increase moderately and extend their distribution into areas that were predominantly cropland. In eastern South Dakota, STG have similarly increased and extended their range. Much of the CRP grassland in both states was originally seeded to smooth brome with alfalfa and sweet clover. Such stands typically reach 20–28 inches (50–70 cm). Legumes diminished, over time, due to competition with smooth brome. In South Dakota, available warm-season mixed CRP stands reach 60 inches (150 cm) exceeding heights preferred by STG. However, STG have been observed using such stands for thermal cover during extreme winter conditions.

Although many counties in northwestern Minnesota reached CRP maximum enrollments, prairie STG populations in the region have only increased slightly. About 80–90% of the CRP stands in the region were originally seeded to smooth brome and alfalfa, reaching 20–42 inches (50–105 cm). Alfalfa virtually disappeared from these stands a few years after seed-

Table 3. Summary by state[1] and region of identified responses of sharp-tailed grouse to available grasslands established during the first decade of the Conservation Reserve Program. Abbreviations used are as follows: CS = cool season; Intr = introduced species; Natv = native species; Mix = multiple-species mixture; and Mono = one species of grass seeded. Grasses seeded refers to the most common type(s) of CRP seedings in the designated region.

State	Region	Grasses seeded	Forbs	Stand heights[2] (cm)	Range expansion	Population increase
Alaska[3]	East	CS Intr/Natv Mix	Intr	30–90	Slight	Slight
Colorado[4]	Northeast	CS Intr Mono/Mix	None	65–75	Slight	Moderate
Colorado[5]	Northwest	CS Intr Mono	Intr	25–50	None	Moderate
Idaho[5]	Southeast/West	CS Intr Mix/Mono	Intr[7]	45–60	Moderate	Strong
Minnesota[6]	Northwest	CS Intr Mono	Intr[7]	50–105	None	Slight
Montana[4]	Northeast	CS Intr Mix	Intr	30–90	Moderate	Strong
Montana[4]	Southeast	CS Intr Mono	Intr[7]	25–45	None	Moderate
Nebraska[4]	Panhandle	CS Intr Mix	Intr	20–40	Moderate	Strong
North Dakota[4]	Southeast	CS Intr Mono	Intr[7]	50–70	Moderate	Moderate
Oregon[5]	Northeast	CS Intr Mix/Mono	Intr[7]	45–60	None[8]	None[8]
South Dakota[4]	East	CS Intr Mix	Intr[7]	50–70	Slight	Moderate
Utah[5]	Northern	CS Intr/Natv Mix	Intr	45–75	Strong	Strong
Washington[5]	East	CS Intr Mono	None	40–90	None	None
Wyoming[4]	Southeast	CS Intr Mono/Mix	Intr[7]	45–60	Moderate	Strong

[1]Little or no Conservation Reserve Program grassland occurred near prairie sharp-tailed grouse populations in Michigan and Wisconsin, or near Columbian sharp-tailed grouse in Montana or Wyoming.

[2]Stand height refers to maximum height of vegetation at the end of the growing season (1 cm = 0.4 inches).

[3]Alaska subspecies (*T. p. caurus*).

[4]Plains subspecies (*T. p. jamesi*).

[5]Columbian subspecies (*T. p. columbianus*).

[6]Prairie subspecies (*T. p. campestris*).

[7]The forb component diminished over time where seeded with smooth brome or crested wheatgrass.

[8]Oregon's sharp-tailed grouse consists of a small, recently reintroduced population.

ing. Hybrid poplar (*Populus* spp.) plantations were established on some CRP grasslands, substantially altering not only the specific CRP field, but also diminishing the open character of the surrounding prairie landscape. A few poplar plantations were established on existing prairie STG leks, resulting in abandonment. This use of hybrid poplar was the only case encountered where CRP plantings were clearly detrimental to prairie grouse.

Columbian STG (*T. p. columbianus*) have benefited from CRP grasslands to such an extent that state wildlife agencies in Colorado (Hoffman, 2001), Idaho (Mallet, 2000), and Utah (Utah Division of Wildlife Resources, 2002) consider the CRP integral to Columbian STG conservation. The greatest benefits to this subspecies were derived from stands with several species of cool-season grasses and strong components of introduced and native forbs.

In northwestern Colorado, 26% of all known Columbian STG leks were in CRP, although such stands comprised just 3% of the area (Hoffman, 2001). Many CRP stands in this region are dominated by smooth brome and reach 10–20 inches (25–50 cm). Heavy winter snows tend to flatten such stands, making them more suitable for leks, but few hens nested in them with nest success typically low (Boisvert, 2002). Diverse stands that include bunchgrasses, forbs, and mountain shrubs were recommended for this region (Boisvert, 2002).

Populations of STG in both southeastern and western Idaho increased sharply in response to establishment of CRP grasslands (Mallet, 2000). Over 80% of 172 new STG leks located in southeastern Idaho from 1995–1998 were in CRP (Mallet, 2000). Sirotnak and others (1991) reported proportionally greater numbers of Columbian STG in CRP grasslands than expected, based on habitat availability. Nest success in non-native vegetation (mostly CRP stands) was good (45%), but lower than in native vegetation (Apa, 1998). More diverse CRP stands often included three cool-season grasses and three

Figure 1. The Colorado Division of Wildlife has implemented two transplant programs to reintroduce plains and Columbian sharp-tailed grouse into formerly occupied habitats in northeastern and southwestern Colorado where Conservation Reserve Program grasslands are a prominent component of the landscape.

legumes, and reached 18–24 inches (45–60 cm). These stands mimic native bunchgrass communities providing valuable nesting and brood habitat for Columbian STG. Fewer STG benefits were derived from the one to two species seedings of crested wheatgrass, sometimes with intermediate wheatgrass, that made up about half of Idaho's CRP stands. Such stands reach 18–30 inches (45–75 cm).

Results in Utah were similar to those in Idaho. Columbian STG populations increased substantially and distribution increased approximately 400% as CRP stands reconnected previously isolated populations (Utah Division of Wildlife Resources, 2002). Most of these CRP grasslands were originally seeded with a combination of intermediate wheatgrass, tall wheatgrass, and basin wild rye (*Leymus cinereus*) with a strong component of forbs, including alfalfa.

About 14, 000 acres (6,000 ha) of CRP grasslands represent an important part of the habitat mosaic for a small, reintroduced population of Columbian STG in northeastern Oregon. All active leks are located in CRP fields, but most nesting occurs in native bunchgrass pastures. Clumpy CRP stands [12–28 inches (30–70 cm)] of orchardgrass, red clover (*Trifolium pratense*), and alfalfa are used by STG in late summer when native grasslands become dormant. Stands of CRP originally seeded to smooth brome and alfalfa are not used by STG. These stands flatten under winter snows and the alfalfa has not persisted.

Most of the CRP stands originally available to Columbian STG in Washington consisted of sparse monocultures of crested wheatgrass [16–36 inches (40–90 cm)]. These CRP stands are used by STG, but their numbers have not increased. McDonald (1998) noted extensive use of such CRP stands in spring and summer, but considered these patches to be ecological traps since they attracted STG nesting, but nest success was low (18%). He recommended such stands either be removed and replanted to mixtures of native grasses and forbs, or augmented with native species.

In Alaska, the presence of about 30,000 acres (12,000 ha) of CRP grasslands in the Delta Agricultural Project 125 miles (200 km) southeast of Fairbanks has produced range expansion and perhaps some population increase in the local populations of Alaska STG (*T. p. caurus*). These CRP stands [12–36 inches (30–90 cm)] consist of a mixture of introduced and native grasses, including smooth brome and Arctared fescue (*Festuca rubra*), plus alsike clover (*Trifolium hybridum*). Persistent woody invasion has been controlled with mowing or fire at 3 year intervals.

With the 16th and subsequent signups, states throughout the STG range have diversified their CRP seeding mixtures. These improved mixtures contain a minimum of four species, including at least one forb. Some newer mixtures contain as many as seven species of grasses, up to six species of forbs, and one to three species of native shrubs. In addition to introduced cool-season species, many states are adding native plants, including warm-season species, to CRP mixtures. The use of smooth brome and crested wheatgrass has been deemphasized.

Summary

Many examples of positive population responses by prairie grouse to CRP grasslands were evident. Some of these successes include GPC in the Central and Northern Great Plains; LPC in western Kansas; Plains STG in much of the western Great Plains; and Columbian STG in parts of the Intermountain West. The greatest benefits to prairie grouse occurred where CRP stands were established near pre-existing grasslands, thus augmenting the coverage and habitat diversity of the grassland complex. In other cases, it is equally evident prairie grouse populations did not significantly benefit from the establishment of CRP grasslands. Examples of minimal response include GPC in eastern Kansas, Missouri, and northeast Colorado; LPC in Texas and Oklahoma; and STG in Minnesota. In some cases, prairie grouse exhibited some use of CRP grasslands, but showed little or no population improvement.

Common threads run through successes and failures, both among different prairie grouse species and across their extensive geographic ranges. Grasslands in CRP ranging from 12–30 inches (30–75 cm) in height, appear most valuable to prairie grouse. Stands <12 inches (<30 cm) generally provide inadequate concealment and weather protection. Prairie grouse appear intolerant of excessive stand heights, although vegetation >30 inches (>75 cm) does sometimes provide thermal cover in severe winter conditions. Prairie grouse apparently benefit most from multi-species CRP grasslands that are structurally diverse, in both height and growth form. Vigorous components of forbs, especially legumes, greatly enhanced habitat quality for prairie grouse.

Single-species CRP seedings or stands that effectively became monocultures, with few exceptions, provided minimal benefits to prairie grouse. Monocultures of crested wheatgrass, smooth brome, tall fescue, weeping lovegrass, yellow bluestem, or Caucasian bluestem were commonly established in the early years of the CRP. This pattern was partly due to inadequate availability and greater expense of more desirable seed mixtures. The Environmental Benefits Index, introduced with the 16th CRP signup, invoked changes in seeding mixtures and existing-stand enhancements that should generally, but not always, benefit prairie grouse. Homogenous stands still remain prevalent in many regions. Aggressive cool-season grasses, notably smooth brome and crested wheatgrass, gradually excluded desirable legumes initially seeded with them. Some grasses, particularly smooth brome, flatten under heavy snow cover, further limiting their habitat quality.

The relative value of CRP grasslands to prairie grouse was not determined simply by the use of native, as opposed to introduced, species. Positive prairie grouse population responses to introduced species occurred if the introduced species attained desirable heights and, particularly, if they contributed to a diverse habitat structure, as did alfalfa.

Recommendations

Seeding mixtures used in the CRP should include many species to produce a diverse, clumpy structure. Plantings should include forbs, particularly legumes, and where STG or LPC are present, native shrubs may be considered. Bunchgrasses should generally be favored over sod-forming grasses. Introduced species should not be excluded, but their inclusion in CRP seedings requires greater consideration of their growth form and persistence, their effect on other species planted, landowner acceptance, and invasive potential. Appropriate introduced species, like alfalfa, can be particularly valuable where they provide an ecological substitute for structurally important but commercially unavailable native species, even for “declining habitat” restorations (CP25). Aggressive species (e.g., smooth brome, crested wheatgrass, tall fescue, Caucasian bluestem, yellow bluestem, weeping lovegrass) that may crowd out other components of the mixture must be avoided.

Potential heights attained under typical CRP conditions should be considered in selecting grasses and forbs for seeding mixtures. Stands of CRP intended to benefit prairie grouse should range from 12–30 inches (30–75 cm) tall at maturity, roughly shin-to-thigh high. In higher-precipitation regions, ungrazed CRP stands of native tall grasses can reach excessive heights, unsuitable for prairie grouse. In such cases, species with lower growth potential may provide greater benefits to grassland wildlife. Weak-stemmed species that flatten easily under heavy snows (e.g., smooth brome) should be avoided.

There is a recognized need for better CRP grassland management. Without periodic disturbance, CRP stands become less vigorous, forb abundance may dwindle, excess litter can accumulate, and trees may invade, each diminishing the capacity of these stands to support prairie grouse. Stand management should be mandatory, but associated costs could be covered or shared by USDA, provided payments occur only after required management (e.g., burning, disking) is performed and verified. Flexibility should be provided to implement practices that facilitate appropriate CRP management (e.g., clean-tilled firebreaks prior to controlled burns). Periodic soil disturbance (livestock or mechanical) of CRP stands is appropriate, but its frequency should occur in accordance with regional conditions (higher precipitation – more frequent; lower precipitation – less frequent).

Although emergency CRP haying has negative short-term implications for wildlife, especially if permitted too frequently, the practice has not produced long-term negative effects on CRP grasslands in the Northern Plains (Allen and others, 2001). Since excess litter removal is critical for successful legume interseeding in established CRP stands (M.W. Vandever and others, unpub. data, 2005), emergency haying or grazing could provide an opportunity to enhance stand quality. Stand improvement could be encouraged by forgiving the 25% payment reduction required for emergency CRP haying or grazing, if the landowner subsequently enhances the affected area.

Ecologically appropriate CRP stand enhancement should be required for future reenrollment of non-enhanced or unsuccessfully enhanced fields. Conspicuous in this regard are the 11 million acres (4.5 million ha) of established CRP grasslands reenrolled through the 15th general signup on which stand-quality enhancement was not performed. Reenrollment in the CRP or enrollment of these grasslands in other federal programs should be contingent on rectifying problems (e.g., invading trees) that stem from prior avoidance of management.

Incentives that encourage tree plantings on CRP grasslands must be discontinued. Tree plantings hinder grassland management and create focal points from which undesirable tree invasion spreads. The declining status of grassland birds (Knopf, 1994) and evidence that even minimal encroachment by trees into grasslands produces significant losses in grassland bird abundance (Coppedge and others, 2001; Rosenstock and van Riper, 2001) dictate that such tree plantings stop. Where woody cover is considered essential to address conservation issues, native shrubs are appropriate.

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References Cited

Allen, A.W., Cade, B.S., and Vandever, M.W., 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, v. 56, no. 2, p. 120–125.

Apa, A.D., 1998, Habitat use and movements of sympatric sage and Columbian sharp-tailed grouse in southeastern Idaho: Ph.D. dissertation, University of Idaho, Moscow, 199 p.

Berthelsen, P.S., Smith, L.M., and Coffman, C.L., 1989, CRP land and game bird production in the Texas High Plains: Journal of Soil and Water Conservation, v. 44, no. 5, p. 504–507.

Best, L.B., Campa, H., III, Kemp, K.E., Robel, R.J., Ryan, M.R., Savidge, J.A., Weeks, Jr., H.P., and Winterstein, S.R., 1997, Bird abundance and nesting in CRP fields and cropland in the Midwest: A regional approach: Wildlife Society Bulletin, v. 25, no. 4, p. 864–877.

Boisvert, J.H., 2002, Ecology of Columbian sharp-tailed grouse associated with Conservation Reserve Program and reclaimed surface mine lands in northwestern Colorado: M.S. thesis, University of Idaho, Moscow, 184 p.

Clawson, M.R., and Rotella, J.J., 1998, Success of artificial nests in CRP fields, native vegetation, and field borders in southwestern Montana: Journal of Field Ornithology, v. 69, no. 2, p. 180–191.

Coppedge, B.R., Engle, D.M., Masters, R.E., and Gregory, M.S., 2001, Avian response to landscape change in fragmented southern Great Plains grasslands: Ecological Applications, v. 11, no. 1, p. 47–59.

Fields, T.L., 2004, Breeding season habitat use of Conservation Reserve Program (CRP) lands by lesser prairie chickens in west central Kansas: M.S. thesis, Colorado State University, Fort Collins, 125 p.

Hoffman, R.W., tech. ed., 2001, Northwest Colorado Columbian sharp-tailed grouse conservation plan: Northwest Colorado Columbian Sharp-tailed Grouse Work Group and Colorado Division of Wildlife, Fort Collins, Colorado, 79 p.

Johnson, D.H., and Igl, L.D., 1995, Contributions of the Conservation Reserve Program to populations of breeding birds in North Dakota: Wilson Bulletin, v. 107, p. 709–718.

Kantrud, H.A., 1993, Duck nest success on Conservation Reserve Program land in the prairie pothole region: Journal of Soil and Water Conservation, v. 48, no. 3, p. 238–242.

King, J.W., and Savidge, J.A., 1995, Effects of the Conservation Reserve Program on wildlife in southeast Nebraska: Wildlife Society Bulletin, v. 23, no. 3, p. 377–385.

Knopf, F.L., 1994, Avian assemblages on altered grasslands, *in* Jehl, J.R., Jr., and Johnson, N.K., eds.: Studies in Avian Biology, no. 15: A Century of Avifaunal Change in Western North America, Cooper Ornithological Society, p. 247–257.

Mallet, J., 2000, Idaho Department of Fish and Game response to the 90-day finding on a petition to list the Columbian sharp-tailed grouse as threatened, administrative record of the Status Review Team: U.S. Fish and Wildlife Service, Portland, Oregon, 8 p.

McDonald, M.W., 1998, Ecology of Columbian sharp-tailed grouse in eastern Washington: M.S. thesis, University of Idaho, Moscow, 125 p.

Merrill, M.D., Chapman, K.A., Poiani, K.A., and Winter, B., 1999, Land-use patterns surrounding greater prairie-chicken leks in northwestern Minnesota: Journal of Wildlife Management, v. 63, no. 1, p. 189–198.

Reynolds, R.E., Shaffer, T.L., Sauer, J.R., and Peterjohn, B.G., 1994, Conservation Reserve Program: Benefit for grassland birds in the Northern Plains: Transactions of the North American Wildlife and Natural Resources Conference, v. 59, p. 328–390.

Riley, T.Z., 1995, Association of the Conservation Reserve Program with ring-necked pheasant survey counts in Iowa: Wildlife Society Bulletin, v. 23, no. 3, p. 386–390.

Rodgers, R.D., 1999, Recent expansion of lesser prairie-chickens to the northern margin of their historic range, *in* Baydack, R., ed., Proceedings of the 23rd meeting of the Prairie Grouse Technical Council, Gimli, Manitoba, Canada, p. 18–19.

Rosenstock, S.S., and van Riper, C., III, 2001, Breeding bird responses to juniper woodland expansion: Journal of Range Management, v. 54, no. 3, p. 226–232.

Sirotnak, J.M., Reese, K.P., Connelly, J.W., and Radford, K., 1991, Effects of the Conservation Reserve Program (CRP) on wildlife in southeastern Idaho: Idaho Department of Fish and Game, Job Completion Report, Project W-160-R-15, Boise, 45 p.

Svedarsky, W.D., Wolfe, T.J., and Toepfer, J.E., 1997, The greater prairie-chicken in Minnesota: Minnesota Department of Natural Resources Wildlife Report 11, 19 p.

Svedarsky, W.D., Toepfer, J.E., Kollman, F., and Berg, W.E., 1998, CRP opportunities for prairie grouse in Minnesota, *in* Silvy, N.J., ed.: Proceedings of the 22nd meeting of the Prairie Grouse Technical Council, College Station, Texas, p. 21.

Taylor, J.S., 2000, Greater prairie chicken in southeast Nebraska: An overview of population status and management considerations: Nebraska Game and Parks Commission, Lincoln, 13 p.

Toepfer, J.E., 1988, Ecology of the greater prairie chicken as related to reintroductions: Montana State University, Bozeman, Ph.D. dissertation, 536 p.

Utah Division of Wildlife Resources, 2002, Strategic management plan for Columbian sharp-tailed grouse, 2002: Utah Division of Wildlife Resources Publication 02-19, 39 p.

Wachob, D.G., 1997, The effects of the Conservation Reserve Program on wildlife in southeastern Wyoming: University of Wyoming, Laramie, Ph.D. dissertation, 136 p.

Conservation Reserve Program Successes, Failures, and Management Needs for Open-Land Birds

By Randy D. Rodgers[1]

Introduction

With the steady intensification of agriculture and the associated declines in wildlife populations (e.g., Warner, 1984; Rodgers, 2002), conservationists have increasingly emphasized the need for proper establishment and management of Conservation Reserve Program (CRP) grasslands. Reports of positive responses by avian species to CRP grasslands are numerous and include benefits to songbirds (e.g., Reynolds and others, 1994; Best and others, 1997); ducks (e.g., Kantrud, 1993; Reynolds and others, 2001); ring-necked pheasants (*Phasianus colchicus*) (e.g., King and Savidge, 1995; Riley, 1995), and prairie grouse (*Tympanuchus* spp.) (e.g., Rodgers and Hoffman, 2005). Considering the long-term decline of many species of grassland birds (Knopf, 1994), these CRP benefits are particularly welcome. However, it is clear CRP grasslands, in some situations, failed to produce a significant positive wildlife response. The relative success, or failure, of CRP grasslands in benefiting wildlife can be directly linked to the species composition of original seedings, subsequent management of stands, and the physical location of lands enrolled in the program.

General Signup

The species originally seeded in General Signup CRP tracts are quite variable across the nation, understandably reflecting the need for vegetation suitable to local precipitation, soils, and conservation priorities. However, the species used in early CRP seedings (approximately 1987–1995) were also significantly influenced by availability, cost, social biases, and political boundaries. As a result, wildlife habitat needs were addressed in some regions and ignored in others, with sharp contrasts often appearing at state or county boundaries. Rodgers and Hoffman (2005) list numerous examples where single-species stands of aggressive, exotic grasses provided little or no benefit to prairie grouse. In particular, they indicated single-species stands of tall fescue (*Lolium arundinaceum*), crested wheatgrass (*Agropyron cristatum*), yellow bluestem (*Bothriochloa ischaemum*), Caucasian bluestem (*B. bladhii*), and weeping lovegrass (*Eragrostis curvula*) offered little benefit to prairie grouse. They noted two cases in which prairie grouse appeared to benefit from pure CRP stands of smooth brome (*Bromus inermis*), but still considered this species undesirable due to its tendency to crowd out other species of vegetation, especially forbs. The invasive nature of aggressive exotic grasses, most notably yellow bluestem and Caucasian bluestem (Knight, 2004), and the resultant threat they pose to native grasslands is, in itself, sufficient reason to prohibit any further inclusion of new seedings or existing stands containing these species in the CRP.

Most species of birds in early life depend on an invertebrate diet (e.g., Hill, 1985; Erpelding and others, 1987) and diverse habitats often provide greater invertebrate diversity and availability (e.g., Rands, 1985; Thomas and others, 1992; Chiverton, 1999). Thus, it is not surprising grassland birds have responded positively to multi-species CRP seedings, particularly those including a strong component of forbs. Rodgers and Hoffman (2005) noted the greatest positive responses of sharp-tailed grouse (*Tympanuchus phasianellus*) and greater prairie chickens (*T. cupido*) in regions where forbs, especially alfalfa (*Medicago sativa*), were present in initial CRP mixtures. Other researchers have called for a greater forb component in both CRP seeding mixtures and existing stands (e.g., Burger and others, 1993; Rodgers, 1999).

A key factor in the creation and longevity of vegetatively diverse CRP stands is application of periodic management. Most North American grasslands, and the grasses in them, evolved with, and consequently require, the periodic disturbances of fire and/or grazing by large herbivores (e.g., Fuhlendorf and Engle, 2001). Similarly, CRP grasslands generally require periodic disturbance to remain vigorous, diverse, and productive for wildlife. Such grassland disturbances remove excessive accumulated litter, accelerate nutrient cycling, and prevent encroachment of invasive woody species.

Appropriate management of CRP grasslands through periodic disturbance has been inadequate throughout most of the life of the program. In regions of modest to high precipitation, this lack of disturbance typically resulted in CRP stands choked with accumulated litter. Such stands not only lose vigor, but become nearly useless to all but larger wildlife species, such as whitetail deer (*Odocoileus virginianus*). While modest amounts of litter can facilitate nesting, the chicks of northern bobwhite quail (*Colinus virginianus*), ring-necked pheasant, and prairie grouse cannot forage effectively in unmanaged stands with excessive accumulation of litter.

Lack of adequate management has permitted encroachment of woody vegetation into CRP grasslands (fig. 1), particularly by eastern red cedar (*Juniperus virginiana*), Russian

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Figure 1. Encroachment of woody vegetation, such as red cedar (*Juniperus virginiana*), into undisturbed older Conservation Reserve Program grasslands threatens the quality of habitat for many species of grassland birds.

olive (*Elaeagnus angustifolia*), and several other highly invasive trees. Left unchecked, such encroachment will ultimately negate, in many regions, habitat benefits CRP grasslands have accrued for grassland birds. Densities of grassland songbirds rapidly decline as trees invade open grasslands, beginning even in the comparatively early stages of invasion (Coppedge and others, 2001; Rosenstock and van Riper, 2001; Grant and others, 2004). Declines in grassland songbird nest densities may be partly associated with behavioral avoidance of woody vegetation (Winter and others, 2000). A greater concern is the clear tendency for predation of grassland songbird nests to increase as distance to woody vegetation decreases (e.g., Gates and Gysel, 1978; Johnson and Temple, 1990; Winter and others, 2000). Similarly, parasitism of grassland bird nests by brown-headed cowbirds (*Molothrus ater*) is greater close to woody edges (e.g., Best, 1978; Gates and Gysel, 1978; Johnson and Temple, 1990; Winter and others, 2000).

Open-land gamebirds are also negatively affected by tree invasion. Raccoon (*Procyon lotor*) tree rest sites are strongly associated with eastern red cedar (Henner and others, 2004). Raccoons often use shelterbelts as travel lanes (Fritzell, 1978). Such increased activity by raccoons has been shown to decrease nest success of northern bobwhite (Taylor and Burger, 1997; L.W. Burger, Jr., unpub. data, 2004). Snyder (1984) found predation of ring-necked pheasant nests was 2.4 times greater within 660 yards (600 m) of tree plantings than at more distant locations. He indicated these tree plantings harbored not only greater numbers of mammalian predators, but also more avian nest predators such as American crow (*Corvus brachyrynchos*) and black-billed magpie (*Pica pica*). Indirect reduction in predation and parasitism of grassland birds could be accomplished by removing trees, thus reducing mammalian rest sites, and the nesting and perching sites of avian predators and nest parasites (Herkert, 1994).

Long-term declines of grassland birds (Knopf, 1994) could be exacerbated if the U.S. Department of Agriculture (USDA) fails to act decisively in requiring removal and appropriate herbicide treatment of invasive trees from CRP grasslands. Such stands could become seed sources effectively accelerating tree invasion of native grasslands. Misdirected (albeit well intentioned) policies have not only allowed, but sometimes encouraged, tree planting on CRP grasslands.

Geographic proximity of CRP grasslands to existing habitats has played a large role in the relative derivation of wildlife benefits. Wildlife population increases or range expansions attributed to CRP grasslands generally occurred in situations where new grasslands provided suitable habitats accessible to pre-existing populations. Prairie grouse in the Great Plains and Intermountain West have primarily benefited from the CRP where enrolled grasslands were established near existing occupied native rangelands (Rodgers and Hoffman, 2005). The melding of new CRP grasslands into existing grassland mosaics, or at the periphery of large blocks of existing grassland, had the effect of creating grassland complexes large enough and of adequate quality to foster prairie grouse population growth. In the case of the lesser prairie chicken, a candidate species for listing under the Endangered Species Act, their CRP-related population expansion in Kansas has played a significant role in averting a need to list the species. Similarly, juxtaposition of CRP grasslands near prairie potholes in the Northern Great Plains has provided much needed nesting habitat for ducks (e.g., Kantrud, 1993), resulting in strong population increases. In contrast, CRP tracts isolated in vast cropland expanses are less likely to contribute substantially to conservation of grassland species experiencing long-term declines in populations and distribution, although such stands are valuable to more ubiquitous species.

Continuous Signup of the Conservation Reserve Program

The various grass buffers available through the Continous Conservation Reserve Program (CCRP) offer excellent opportunities to improve habitat in regions of extensive croplands, as occur on the Great Plains, while effectively treating erosion. Wildlife requiring extensive grasslands, such as prairie grouse, may obtain little direct benefit from buffers. However, buffers can create abundant, high quality edge habitats furnishing brood and escape cover for popular species like ring-necked pheasant and northern bobwhite. Concerns that CRP grass buffers might create predator travel lanes where nesting success is low, as in narrow fencerows, are mitigated by the much greater widths and better concealment provided by buffers (Rodgers, 1999). On the central and Southern Great Plains, buffer strips also commonly occur adjacent to winter wheat (*Triticum aestivum*), which together in spring comprise large blocks of nesting-cover rather than strips.

Considerable USDA emphasis has understandably been placed on CCRP buffers addressing water quality issues. While establishment of grass filter strips has been successful in the Corn Belt states, particularly in Iowa, buffer establishment on the Great Plains has fallen far short of desired targets. This disappointing response to CCRP on the Great Plains is not due to a lack of buffer practices suitable for the region, nor can it be attributed to insufficient need for application of these practices. Poor acceptance of CCRP practices by farm operators, particularly on the High Plains, is more attributed to well-intentioned but impractical program rules that have created unreasonable barriers to buffer establishment.

The prolonged drought that has plagued much of the western United States since 1999 has triggered numerous wind erosion events of a magnitude reminiscent of those experienced during the Dust Bowl era of the 1930's (fig. 2). Smaller, less noted events cumulatively may have accounted for even greater soil loss than occurred in these spectacular dust storms.

Perhaps the most effective CCRP buffer practice that could be used to combat wind erosion and to enhance moisture

Figure 2. A dust storm in northcentral Kansas, May 29, 2004. This storm caused significant loss of soil and highway fatalities due to loss of visibility and accidents. This storm was estimated to be 125 miles (200 km) wide, and approximately 2,000 feet (600 m) high. The storm traveled about 185 miles (300 km) across the High Plains before dissipating. Photographer unknown.

conservation, Cross Wind Trap Strips (CP24), has had negligible enrollment, only 667 acres (270 ha) nationwide, as of June 2004. Other in-field buffers that could address these issues on the windy High Plains (Contour Grass Strips CP15A, CP15B) have to date also had limited enrollment. Despite substantial efforts to promote such buffers, acceptance has been poor, due, in no small part to USDA rules that either prohibit or make impractical winter grazing of fields where these buffers occur. This so-called incidental grazing is totally prohibited under CRP rules. When Cross Wind Trap Strips are present, even in situations where incidental grazing is permitted with in-field buffers, program requirements to obtain county Farm Service Agency (FSA) permission and to sustain a 25% reduction in CRP rental payment are unacceptable to most farm operators who manage livestock. Livestock producers regard these requirements as inflexible, cumbersome, and impractical for their operations, particularly considering the small acreages and payments typically associated with buffer practices. Consequently, existing rules have become impediments to the implementation of otherwise outstanding conservation practices. To avoid these impractical USDA barriers to effective management of their operations, a few producers have gone to the extent of installing buffers at their own expense, without CCRP enrollment.

These well-intentioned incidental grazing rules appear to have been implemented under an incorrect assumption that winter grazing will degrade grass buffer function and/or longevity. Yet, grasses utilized in these buffers are the same used in general signup CRP stands where periodic grazing disturbance has recently been recognized by USDA as a benefit, not a detriment, to stand vigor and to wildlife habitat. Even the term incidental grazing is probably a misnomer since it is unlikely that livestock will actually graze the coarse, dormant grasses in buffers during winter when they have access to much more palatable, nutritious crop residue or green wheat. Actual disturbance of in-field buffers during winter grazing has been observed to be limited to the hoof action that occurs when livestock cross grass strips or occasionally bed on them. Neither of these activities is likely to impair buffer function. Research is currently underway to measure potential effects of winter grazing on in-field buffers and results should be available in 2005 (A.W. Allen, oral commun., 2004).

Recommendations for Refinement and Future Management of the Conservation Reserve Program

1. No further planting of aggressive exotic grasses in new CRP seedings should be allowed. Further, USDA should not permit future reenrollment of CRP stands that contain significant areas of invasive exotic grasses or grasses that offer little or no wildlife benefit. Grass species that should be eliminated from the CRP include tall fescue, Caucasian bluestem, yellow bluestem, weeping lovegrass, and crested wheatgrass. This would force either total conversion (not 51%) of such stands to more favorable vegetation or would have the effect of making those program acres available in other areas.

2. Progress toward making multi-species stands, with strong forb components, the standard for CRP grasslands must continue. Multi-species does not imply the sole use of native species, but introduced species used for CRP grasslands must not be invasive and should not be overly aggressive. Alfalfa is a notable example of an introduced species that provides habitat characteristics highly desirable to native wildlife. Especially when critical native forb equivalents are commercially unavailable, small quantities [0.1 lb/acre (0.05 kg/0.4 ha)] of alfalfa should also be included in rare and declining habitat (CP25) stands. Forbs, including legumes, will benefit CRP grasslands by fixing nitrogen and extracting micronutrients from deep subsoils through taproots, thus building both soil quantity and quality. Forbs also diversify stand structure and increase invertebrate diversity, both of which improve habitat qualities for grassland birds.

3. A greater proportion of program acres currently assigned to agriculturally isolated CRP grassland blocks should gradually be shifted to localities near existing native habitats. In doing so, these new CRP blocks will complement habitats such as wetlands or existing rangelands, effectively creating habitat mosaics that benefit critical grassland bird populations much more than do isolated stands of CRP. This goal could be accomplished through modification of the Environmental Benefits Index or through Conservation Priority Areas.

This geographic reassignment of CRP priorities need not come at the expense of soil, water, or wildlife conservation on agriculturally isolated tracts. Most conservation benefits derived from isolated CRP blocks could be maintained by automatically retaining CRP eligibility for critical portions (10–30%) of such stands in a new *residual* CRP designation. Local soil and wildlife conservationists, in cooperation with the farm operator and landowner, could determine what acres to retain in CRP based on soils, erodibility (wind or water), wildlife benefits, and farming efficiency. Critical conservation acres in residual CRP might be configured as blocks, a series of conservation buffers, or block and buffer combinations. These retained critical CRP acres could benefit species like ring-necked pheasant and northern bobwhite quail more than the pre-existing large blocks if configured to create abundant cropland-grassland edge. Retaining critical acres in residual CRP and adding more CCRP buffers on working lands may provide the best overall soil, water, and wildlife conservation opportunities in regions dominated by vast expanses of cropland.

4. Proper management of CRP grasslands must be encouraged through continued development of practices and incentives flexible enough to accommodate regionally variable needs as determined by climate, soils, and local conservation priorities. For example: Periodic controlled burning can be made simpler, safer, and more effective by encouraging establishment of clean-tilled firebreaks around the field periphery prior to the burn. Tilled firebreaks facilitate a safe burn and typically encourage establishment of annual vegetation during the subsequent growing season, an essential component of reproductive habitat for numerous avian species. Experience has clearly shown tilled grasses, even when disked with 3–5 passes, fully recover after two to three growing seasons.

   Managed grazing or, to a lesser degree, haying offer potential for effective, desirable periodic disturbance of CRP grasslands. Both types of practices should be viewed as opportunities for CRP stand enhancement, since associated removal of excess litter could facilitate subsequent interseeding of forbs. Short-term (<2 months), intensive grazing conducted outside the primary nesting season is more likely to provide the hoof action needed to diversify and reinvigorate CRP grasslands than is low-density, long-term stocking or haying. These practices should not be applied across the country in a one-size-fits-all manner. Managed disturbance can be applied at 3–4 year intervals in regions with moderate to high precipitation, but these disturbances should occur less frequently as aridity increases. If emergency haying or grazing must be applied, such events should count as part of the managed haying and grazing cycle and should not become additive to managed haying or grazing events.

5. Invasive trees on existing CRP grasslands must be eliminated. With species such as the eastern red cedar, this may involve cutting and/or controlled fire. Invasive deciduous trees that readily resprout will require cutting and immediate treatment of stumps with an appropriate herbicide. Invasion by woody vegetation in CRP grasslands has often occurred as a consequence of maintenance avoidance. As a consequence, it is reasonable that future reenrollment of tree-invaded CRP grasslands should be contingent on agreement by landowners and/or operators to appropriately remedy this problem, at their expense, and to prevent reinvasion. Remaining incentives that encourage tree plantings on or adjacent to CRP grasslands must be discontinued and even landowner/operator tree plantings strongly discouraged. Where woody cover is considered appropriate and essential, native shrubs should be utilized.

6. Impractical incidental grazing restrictions that have impeded acceptance of in-field CCRP buffers [e.g., Cross Wind Trap Strips (CP24); Contour Grass Strips (CP15)] on the Great Plains should be discontinued, both for the winter gleaning of crop residue and for winter grazing of green wheat. This includes restrictions requiring permission from county FSA officials before such grazing can occur, restrictions on timing and duration of winter grazing, and the requirement to forego 25% of the annual CRP rental payments when winter grazing occurs. It is not in the landowner's or the operator's own interest to maintain livestock on such fields at an inappropriate time or for a duration that exceeds forage availability. Consequently, regulation of these issues is unnecessary and wasteful of USDA human resources. Winter occurrence of livestock on crop fields containing in-field buffers appears unlikely to impair buffer function and may help maintain the vigor of buffer grasses.

7. Continued consultation between USDA, state wildlife conservationists, and non-governmental organizations is essential if CRP rule formulation and application are to optimize soil, water, and wildlife conservation benefits. Program rules must provide a practical framework that makes the outstanding conservation practices of the CRP attractive to producers within their respective agricultural contexts.

References Cited

Best, L.B., 1978, Field sparrow reproductive success and nesting ecology: Auk, v. 95, no. 1, p. 9–22.

Best, L.B., Campa, III, H., Kemp, K.E., Robel, R.J., Ryan, M.R., Savidge, J.A., Weeks, H.P., and Winterstein, S.R., 1997, Bird abundance and nesting in CRP fields and cropland in the Midwest: A regional approach: Wildlife Society Bulletin, v. 25, no. 4, p. 864–877.

Burger, L.W., Jr., Kurzejeski, E.W., Dailey, T.V., and Ryan, M.R., 1993, Relative invertebrate abundance and biomass in Conservation Reserve Program plantings in northern Missouri, *in* Church, K.E. and Dailey, T.V., eds.: Quail III: National Quail Symposium, 14–17 July 1992, p. 102–108, Kansas City, Missouri, published by Kansas Department of Wildlife and Parks, Pratt.

Chiverton, P.A., 1999, The benefits of unsprayed cereal crop margins to grey partridges (*Perdix perdix*) and ring-necked pheasants (*Phasianus colchicus*) in Sweden: Wildlife Biology, v. 5, p. 83–92.

Coppedge, B.R., Engle, D.M., Masters, R.E., and Gregory, M.S., 2001. Avian responses to landscape change in fragmented southern Great Plains grasslands: Ecological Applications, v. 11, no. 1, p. 47–59.

Erpelding, R., Kimmel, R.O., and Lockman, D.J., 1987, Foods and feeding behavior of young gray partridge in Minnesota, *in* Kimmel, R.O., Schultz, J.W., and Mitchell, G.J., eds., Perdix IV: gray partridge workshop, 29 September–4 October 1986, Regina, Saskatchewan, Canada, Minnesota Department of Natural Resources, Madelia, p. 17–30.

Fritzell, E.K., 1978, Habitat use by prairie raccoons during waterfowl breeding season: Journal of Wildlife Management, v. 42, no. 1, p. 118–127.

Fuhlendorf, S.D., and Engle, D.M., 2001, Restoring heterogeneity on rangelands: Ecosystem management based on evolutionary grazing patterns: BioScience, v. 51, no. 8, p. 625–632.

Gates, J.E., and Gysel, L.W., 1978, Avian nest dispersion and fledgling success in field-forest ecotones: Ecology, v. 59, no. 5, p. 871–883.

Grant, T.A., Madden, E., and Berkey, G.B., 2004, Tree and shrub invasion in northern mixed-grass prairie: Implications for breeding grassland birds: Wildlife Society Bulletin, v. 32, no. 3, p. 807–818.

Henner, C.M., Chamberlain, M.J., Leopold, B.D., and Burger, L.W., Jr., 2004. A multi-resolution assessment of raccoon den selection: Journal of Wildlife Management, v. 68, no. 1, p. 179–187.

Herkert, J.R., 1994, The effects of habitat fragmentation on Midwestern grassland bird communities: Ecological Applications, v. 4, no. 3, p. 461–471.

Hill, D.A., 1985, The feeding ecology and survival of pheasant chicks on arable farmland: Journal of Applied Ecology, v. 22, no. 3, p. 645–654.

Johnson, R.G., and Temple, S.A., 1990, Nest predation and brood parasitism of tallgrass prairie birds: Journal of Wildlife Management, v. 54, no. 1, p. 106–111.

Kantrud, H.A., 1993, Duck nest success on Conservation Reserve Program land in the Prairie Pothole Region: Journal of Soil and Water Conservation, v. 48, no. 3, p. 238–242.

King, J.W., and Savidge, J.A., 1995, Effects of the Conservation Reserve Program on wildlife in southeast Nebraska: Wildlife Society Bulletin, v. 23, no. 3, p. 377–385.

Knight, R., 2004, Assessment of the spread and distribution of Old World Bluestems (*Bothriochloa* spp.) at local and landscape scales: M.S. thesis, Fort Hays State University, Hays, Kansas, 77 p.

Knopf, F.L., 1994, Avian assemblages on altered grasslands: Studies in Avian Biology, v. 15, p. 247–257.

Rands, M.R.W., 1985, Pesticide use on cereals and the survival of grey partridge chicks: A field Experiment: Journal of Applied Ecology, v. 22, no. 1, p. 49–54.

Reynolds, R.E., Shaffer, T.L., Sauer, J.R., and Peterjohn, B.G., 1994, Conservation Reserve Program: benefit for grassland birds in the Northern Plains: Transactions of the North American Wildlife and Natural Resources Conference, v. 59, p. 328–336.

Reynolds, R.E., Shaffer, T.L., Renner, R.W., Newton, W.E., and Batt, B.D., 2001, Impact of the Conservation Reserve Program on duck recruitment in the U.S. Prairie Pothole Region: Journal of Wildlife Management, v. 65, no. 4, p. 765–7780.

Riley, T.Z., 1995, Association of the Conservation Reserve Program with ring-necked pheasant counts in Iowa: Wildlife Society Bulletin, v. 23, no. 3, p. 386–390.

Rodgers, R.D., 1999, Why haven't pheasant populations in western Kansas increased with CRP?: Wildlife Society Bulletin, v. 27, no. 3, p. 654–665.

Rodgers, R.D., 2002, Effects of wheat-stubble height and weed control on winter pheasant abundance: Wildlife Society Bulletin, v. 30, no. 4, p. 1099–1112.

Rodgers, R.D., and Hoffman, R.W., 2005, Prairie grouse population response to Conservation Reserve Program grasslands: An overview, *in* Allen, A.W., and Vandever, M.W., eds., Conservation Reserve Program: Planting for the Future, Proceedings of a National Symposium, Fort Collins, Colorado, June 6–9, 2004: U.S. Geological Survey, Biological Resources Discipline, Scientific Investigations Report 2005-5145, p. 122–130.

Rosenstock, S.S., and van Riper, C., III, 2001, Breeding bird responses to juniper woodland expansion: Journal of Range Management, v. 54, p. 226–232.

Snyder, W.D., 1984, Survival of radio-marked hen ring-necked pheasants in Colorado: Journal of Wildlife Management, v. 49, no. 4, no. 3, p. 1044–1050.

Thomas, M.B., Wratten, S.D., and Sotherton, N.W., 1992, Creation of 'island' habitats in farmland to manipulate populations of beneficial arthropods: predator densities and species composition: Journal of Applied Ecology, v. 29, no. 3, p. 524–531.

Taylor, J.D., and Burger, L.W., Jr., 1997, Reproductive effort and success of northern bobwhite in Mississippi: Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies, v. 51, p. 329–341.

Warner, R.E., 1984, Declining survival of ring-necked pheasant chicks in Illinois agricultural ecosystems: Journal of Wildlife Management, v. 48, no. 1, p. 82–88.

Winter, M., Johnson, D.G., and Faaborg, J., 2000, Evidence for edge effects on multiple levels in tallgrass prairie: The Condor, v. 102, no. 2, p. 256–266.

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

By L. Wes Burger, Jr.[1]

Introduction

The Conservation Reserve Program (CRP) was established under the Food Security Act of 1985 with the purpose of assisting owners and operators of agricultural land in conserving and improving soil, water, and wildlife resources. In 1996, Congress reauthorized the CRP with an acreage limit of 36.4 million acres (14.7 million ha). The 2002 Farm Act increased the enrollment limit to 39.7 million acres (16 million ha). Environmental goals of the CRP were expanded under the 1990, 1996, and 2002 Farm Bills. The 2002 Farm Act explicitly required an equitable balance among conservation purposes of soil erosion control, water quality protection, and wildlife habitat. Insofar as provision of wildlife habitat is one of the statuary objectives of the CRP, broad benefits through creation and enhancement of wildlife habitat might be an expected outcome of this program. However, the realized wildlife habitat benefits of the CRP vary considerably regionally and within region in relation to specific cover crop established, time since enrollment, and management regimes. In the Southeastern United States, unlike the Great Plains (Johnson, 2000; Reynolds, 2000) and the Midwest (Ryan, 2000), the wildlife habitat value and resulting population responses to the CRP have been more equivocal and less thoroughly documented. Within the Southeast, implementation of the CRP and practices established vary considerably among states and differ substantially from other regions. In the Southeastern states, the wildlife benefits are less obvious and in some cases the program has had potentially negative effects on wildlife (Carmichael, 1997; Burger, 2000).

Conservation Reserve Program Enrollment in the Southeast

As of June 2004, 3,247,015 acres (1,314,020 ha) were enrolled in the CRP in 12 Southeastern states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia) (table 1; USDA, 2004a). Enrollment in the CRP was not equitably distributed among states, with Mississippi (28%) and Alabama (15%) having the highest enrollment. Georgia (10%), Kentucky (10%), Tennessee (8%), Louisiana (7%), and South Carolina (7%) had moderate enrollments, and the remaining five states collectively accounted for only 15% of total enrollment. As of June 2004, more than 1.8 million acres (0.7 million ha), or nearly 60% of the CRP in the Southeast was enrolled in one of three tree cover practices including: CP3 pine plantings (12% of total enrollment); CP3a hardwood plantings (16% of total enrollment); and CP11 existing trees (31% of total enrollment) (USDA, 2004b). Approximately 20% [626,272 acres (253,443 ha)] of the total acreage was enrolled as CP10 existing grass; 5% [143,139 acres (57,926 ha)] in CP1 introduced grass; and 3% [95,816 acres (38,775 ha)] in CP2 native grasses. In the southeast CP1 grasses are largely cool season species and CP2 plantings are warm season grasses. Eleven percent of CRP acres [335,542 acres (135,789 ha)] were planted to various buffer practices, principally CP21 filter strips and CP22 riparian forest buffer. Given the preponderance of enrollment in CP3, CP11, CP1, and CP10 (much of which was reenrolled CP1) more than 68% of total enrollment in the Southeast was in practices that have limited or short-duration benefits to wildlife.

Distribution of Cover Practices

Within the Southeast, the distribution of enrollment among various cover practices differed substantially among states. Conservation Reserve Program enrollment in mid-south states of Kentucky (80.1%) and Tennessee (78.1%) was principally in grass practices (CP1, CP2, CP10). Kentucky and Tennessee accounted for 62% and 22%, respectively, of the total CP1 enrollment in the Southeast. Similarly, these states led in CP10 enrollment, with Kentucky accounting for 23% of total enrollment, followed closely by Tennessee with 22%, Mississippi with 21%, and Alabama with 18%. Much of this enrollment of existing grass was likely reenrollment of CP1, cool-season grass. Kentucky and Tennessee were the only southeastern states with substantial enrollment in CP2, native warm season grasses. CP2 accounted for 11.3% of total enrollment in Kentucky and 15.8% in Tennessee. These two states collectively accounted for 85% of the total CP2 enrollment in the Southeast (Kentucky, 40%; Tennessee, 45%). In contrast, the deep south states of Mississippi, Alabama, and Georgia principally enrolled acreage in tree planting practices (CP3, CP3a, and CP11). These CPs accounted for 68.8% of acres enrolled in Mississippi, 66.1 % in Alabama, and 93.7% of CRP acres in Georgia. Mississippi, and Alabama led in CP3, new pine, enrollment accounting for 45% and 20% of total enrollment, respectively. Similarly, Mississippi, Alabama, and Georgia led in CP11, existing tree, enrollment accounting for 35%, 18%, and 13% of total enrollment, respectively. Not

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Table 1. Distribution of Conservation Reserve Program enrollment (acres) by state and type of conservation practice for contracts active June 2004.

State	Cool season grass	Native warm season grasses	Established grass	Wildlife habitat	New pine trees	New hard-wood trees	Established trees	Erosion practices	Buffer practices	Other	Total
Alabama	5,136.9	3,642.1	114,382.0	10,684.8	79,266.2	61,999.9	178,498.2	52.1	26,639.9	2,529.8	482,831.9
Arkansas	3,202.1	2,712.6	27,469.8	3,000.8	8,732.6	32,806.1	57,106.7	21.6	35,430.4	18,176.1	188,658.8
Florida	297.3	150.5	2,152.6	3,499.3	12,867.2	12,767.8	56,565.4	0.0	67.5	159.1	88,526.7
Georgia	572.1	389.4	7,407.9	6,651.3	36,749.7	127,713.9	124,690.5	76.5	1,625.5	2,901.0	308,777.8
Kentucky	88,896.9	37,893.9	141,121.5	773.2	442.6	5,968.7	1,932.0	3,119.5	42,803.4	10,968.9	333,920.6
Louisiana	141.7	2,866.1	18,079.2	758.7	20,678.1	115,441.9	40,571.7	58.1	4,196.8	35,384.5	238,176.8
Mississippi	6,013.3	432.7	132,276.8	8,379.6	176,636.8	120,051.1	345,512.3	68.8	125,500.3	18,741.7	933,613.4
North Carolina	2,312.3	1,669.9	18,338.4	2,965.2	7,539.5	10,296.3	42,046.7	146.6	31,637.0	4,597.5	121,549.4
South Carolina	681.1	107.2	11,680.9	9,460.8	30,687.8	21,034.3	102,624.4	127.0	32,037.7	4,991.4	213,432.6
Tennessee	31,616.6	43,211.9	138,723.8	9,373.7	13,833.7	3,593.8	16,969.4	153.7	13,747.6	1,992.0	273,216.2
Virginia	4,258.8	2,717.2	13,972.0	1,079.4	4,359.3	281.9	14,346.0	76.3	20,406.9	520.4	62,018.2
West Virginia	10.2	22.4	666.9	0.0	134.5	0.0	9.0	0.0	1,449.1	0.3	2,292.4
Total	143,139.3	95,815.9	626,271.8	56,626.8	391,928.0	511,955.7	980,872.3	3,900.2	335,542.1	100,962.7	3,247,014.8

surprisingly, Mississippi and Louisiana, occurring in the lower Mississippi Alluvial Valley, led in hardwood establishment, each accounting for 23% of CP3a enrollment. Additionally, Georgia and Alabama accounted for 25% and 12% of CP3a acreage; however, a substantial portion of the CP3a acreage in Georgia, Alabama, and Louisiana was planted to longleaf pine (*Pinus palustris*). Throughout the Southeast, the most commonly planted tree species was loblolly pine (*P. taeda*); however, a national Conservation Priority Area (CPA) was established with signup 18. The longleaf pine CPA included parts of nine southeastern states and provided special incentive bonus points on the Environmental Benefits Index (EBI) and exemption from the highly erodible criteria for establishment of longleaf pine, on eligible sites. As of September 2004, 207,674 acres (84,043 ha) of CRP had been established to longleaf pine. Mississippi enrolled 37% of the total buffer practice acreage (primarily CP21 and CP22), followed by Kentucky (13%), Arkansas (11%) and South Carolina (10%).

Stand Age

Previous enrollment history and changes in rules and EBI structure influenced distribution of specific CRP cover practices across the Southeast over time. Of the extant CP3 acres in the Southeast, 81% were enrolled between 1998 and 2001 and, as such, are currently 3–6 years old (fig. 1). Three to five years after establishment, CRP pine plantings rapidly close canopy and shade out herbaceous ground cover, contributing to a loss of early sucessional habitat and declining seed production and forage quality for many species of wildlife. Closed-canopy mid-rotation pine plantings provide relatively poor wildlife habitat and support a relatively simple faunal community between the time of canopy closure and the first thinning [see Burger (2000) for a review]. Thus, a substantial proportion of currently enrolled CP3 acreage in the Southeast is entering an extended period of relatively low habitat quality.

The majority (91.5%) of CP11 acreage in the Southeast was enrolled between 1998 and 2000 (fig. 2). Presuming most of these contracts were reenrolled following an initial 10-year contract, these stands are currently 15–17 years old. Nearly 55% of the CP3a enrollment in the Southeast occurred during 2000 and 2001, reflecting large enrollments in the longleaf pine practice in Alabama, Georgia, and Louisiana (fig. 3). Most CP3a enrollment prior to this time involved planting

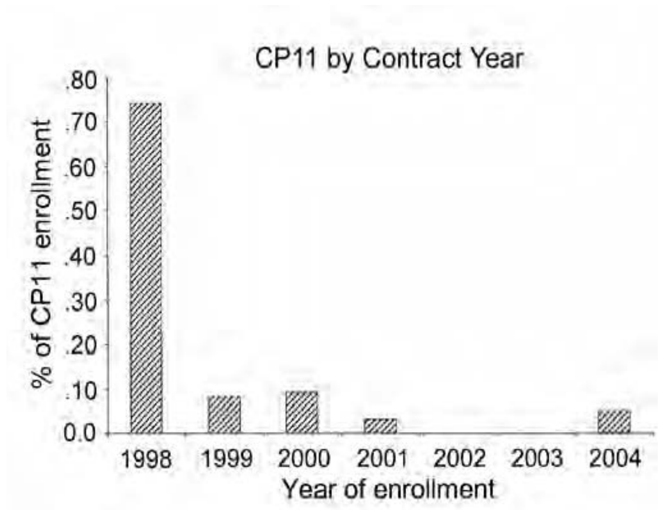

Figure 2. Enrollment in Conservation Reserve Program CP11 (vegetative cover, trees already established) in 12 Southeastern states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia), 1998 to 2004.

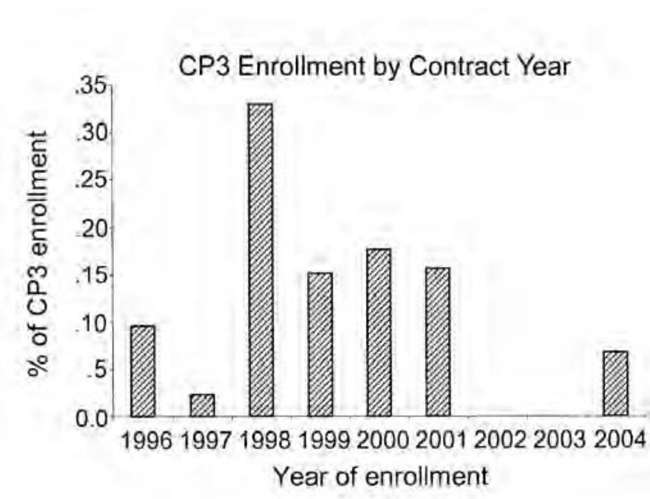

Figure 1. Enrollment in Conservation Reserve Program CP3 (softwood tree planting) in 12 Southeastern states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia), 1996 to 2004.

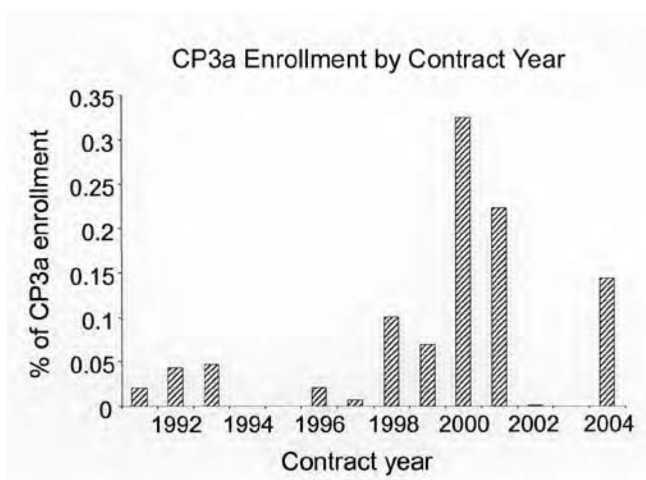

Figure 3. Enrollment in Conservation Reserve Program CP3a (longleaf pine) in 12 Southeastern states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia), 1992 to 2004.

hardwood tree species. Although Mississippi had substantial CP3a enrollment [119,591 acres (48,397 ha); 23% of all CP3a], virtually all was planted to hardwoods in the Mississippi Alluvial Valley. Approximately 10% of the total CP3a is more than 10 years old.

Wildlife Habitat Value

Burger (2000) provided an overview of the potential value of CRP for wildlife in the Southeast and concluded: "Overall, the potential wildlife benefits of CRP in the Southeast are substantial, but they may be unrealized because of the selection of specific practices (e.g., pine plantations and exotic forage grasses)." If that potential is to be realized and CRP is to achieve the statutory goal of improving wildlife habitat resources on private land, existing CRP in the Southeast must be proactively managed and future enrollments must focus on cover practices with high wildlife habitat value. Specifically, adoption of the following recommendations would substantially enhance the realized wildlife habitat value of the CRP in the Southeast.

Mid-Contract Management

In 2004, USDA's Farm Services Agency (FSA) provided direction to state offices to, with input from State Technical Committees, develop mid-contract management guidelines for new and existing CRP contracts. Cost-share for these management activities would be provided where appropriate to enhance wildlife habitat values of the CRP while still preserving the soil erosion and water quality benefits of these fields. This directive represented a substantial change of policy on behalf of the FSA and provided the suite of management options and incentives that many in the wildlife community had been requesting since nearly the inception of the CRP (Burger, 2000; Burger and others, 1990; Ryan and others, 1998,). Although specific guidelines varied from state to state, in general they permitted, cost-shared, and in some cases, required management activities such as strip-disking, prescribed fire, and herbicidal control of invasive species on grasslands as well as thinning, prescribed fire, disking, and use of selective herbicides on mid-rotation pine plantations.

Management on Grasslands

In the Southeast, annual weed communities provide essential resources for northern bobwhite (C*olinus virginianus*) and other early successional species of wildlife. Annual weed communities are characterized by grasses, forbs, and legumes that occur following some form of soil disturbance such as agriculture, timber harvest, or disking. Annual plants reproduce by prolific production of seeds, providing granivorous (seed-eating) birds and mammals with abundant food resources. Additionally, this plant community supports an abundant and diverse insect community furnishing critical nutrients, including protein, energy, and essential amino acids, for growing nestlings and chicks. Annual weed communities are short-lived, lasting only one to two growing seasons. In the absence of further disturbance, plant community composition changes over several years through a normal successional process. Annual weeds are typically replaced by perennial forbs, grasses, and eventually woody plants. Changes in vegetation composition are accompanied by changes in vegetation structure. As a plant community ages, bare ground declines, litter accumulates, and vegetation density increases. The rate of successional change is a function of site fertility, rainfall, local hydrology, temperature, and length of the growing season. Plant communities on CRP fields enrolled in grass cover practices are not static but exhibit predictable successional changes over time (McCoy and others, 2001). Planned disturbance on CRP fields is required to maintain a diverse plant community in a managed landscape. Planned disturbance such as prescribed fire or light disking has been shown to enhance the structural and floristic characteristics of CRP plantings and improve their wildlife value (Greenfield and others, 2002, 2003). Light disking, when applied in a strip fashion on the contour, can be implemented without compromising the erosion controlling objectives of the CRP (Greenfield and others, 2002). Planned disturbance should be incorporated into the conservation plan of operation for all grass plantings in the Southeast.

However, prescribed fire or disking may have limited value in CRP fields dominated by forage grasses (Greenfield and others, 2001; Washburn and others, 2000). In the Southeast, there are more than 143,000 acres (57,870 ha) of CRP in cool-season introduced forage grasses and more than 626,000 acres (253,333 ha) of existing grass, much of which is reenrolled CP1. Introduced sod-forming forage grasses provide poor quality habitat for grassland early successional species and their aggressive growth form inhibits establishment of more desirable native grasses and forbs. With regard to fescue, Barnes and others (1995) reported tall fescue (*Lolium arundinaceum*) fields in Kentucky had dense vegetation with little bare ground and low plant species diversity. They observed fescue stands provided few food resources for granivorous birds. Although tall fescue supported abundant and diverse insect communities, the authors concluded these food resources likely were unavailable to breeding bobwhites or their broods because of the dense vegetation structure. Tall fescue provides poor habitat for ground foraging granivores because it lacks proper vegetation structure, floristic composition, and sufficient quality food resources. Consequently, CRP fields revegetated through natural succession or with native species may provide better wildlife habitat than those established in introduced forage grasses. Fields planted to introduced forage grasses may require herbicidal control of these grasses to achieve lasting habitat benefits (Washburn and others, 2000; Greenfield and others, 2001). Herbicide-facilitated cover crop enhancements should be permitted and cost-shared on CRP fields enrolled in CP10. Program-wide application of planned recurring management activities and herbicidal control of invasive exotic forage grasses would substantially enhance wildlife habitat quality on nearly 700,000 acres (283,280 ha) of CRP in the Southeast.

Management on Pine Plantations

Unthinned, mid-rotation pine plantations are characterized by dense, closed canopies, little to no understory or ground cover, and substantial accumulation of needles and other debris. Thinning opens the forest canopy, allows sunlight to reach the forest floor, and stimulates development of a herbaceous understory, thereby enhancing wildlife habitat value of the stand (fig.4). Many of the CP11 contracts were reenrolled under the 30 or 50 point N1a option of the signup 18 or 20 EBI. This option required thinning of pine stands within 3 years after reenrollment. However, the window allowing for thinning was expanded due to landowner difficulty in executing the prescribed thin. As such, many of these contracts have just recently been thinned, or are scheduled for thinning. To enhance the wildlife value of these contracts, thinning should be required regardless of market conditions on mid-rotation CP11 pine stands. Implementation of a second thinning during the contract would further enhance habitat value and should be encouraged. Thinning prescriptions should be based on silvicultural principles and landowner objectives. Early guidance from FSA required thinning to below 300 trees/acre (741 trees/ha), leaving at least 200 trees/acre (494 trees/ha). This requirement is overly restrictive, particularly for second thins. Within 3–4 years following a thin to 200 trees/acre, stands will likely again have closed canopy, mitigating any accrued wildlife benefits. Timber thinning guidelines should be flexible and based on landowner wildlife objectives. Optimal thinning targets vary depending on wildlife objectives. For example, if creation of bobwhite habitat is a desired condition, stands should be thinned to 30–40 trees/acre (75–100 trees/ha), whereas thinning to 50–60 trees/acre (125–150 trees/ha) may achieve better habitat objectives for wild turkeys (*Meleagris gallopavo*). Management guidelines based on basal area, instead of trees/acre are intuitively more meaningful and would be more likely to achieve desired outcomes.

Depending on site conditions, proximity to other forest cover, and seed bank, encroachment of low quality invasive hardwoods in the midstory may be problematic following thinning of pine stands. Use of selective herbicide (Imazapyr®) and prescribed fire will effectively control hardwood invasion, release a diverse herbaceous ground cover rich in grasses, forbs, and legumes, and create a stand structure that mimics a pine/grassland. The combination of selective herbicide and fire is called Quality Vegetation Management (QVM) and is approved for cost share under mid-contract management guidelines in several southeastern states. In southern pine forests, QVM has been shown to increase herbaceous and understory leaf biomass 4-fold, digestible protein 5-fold, and carrying capacity for white-tailed deer (*Odocoileus virginianus*) 38-fold (Edwards and others, 2004). QVM used in mid-rotation pine plantations has been shown to increase avian species richness and abundance, and support a bird community that includes regionally declining species of high conservation priority such as northern bobwhite, Bachman's sparrow (*Aimophila aestivalis*), and brown-headed nuthatch (*Sitta pusilla*) (Thompson, 2002). Implementation of QVM should be encouraged and cost-shared as a mid-contract management practice throughout the Southeast.

Future Enrollment

If the CRP is to achieve the statuary objective of providing wildlife habitat, future enrollments must be much more restrictive than past enrollments. There is little ecological justification for enrolling CRP acreage in introduced forage

A

B

Figure 4. Loblolly pine (*Pinus taeda*) plantations of comparable age illustrate effects of thinning, prescribed fire, and chemical treatment to enhance habitat quality for wildlife. Photo A is an unthinned 17 year-old plantation with a nearly closed canopy and a resultant lack of diversity in vegetation species composition and structure. Photo B depicts a 15 year-old loblolly pine plantation treated by thinning of the overstory, prescribed fire, and Imazapyr to control invasive hardwoods. The managed stand mimics regionally scarce pine-grasslands providing enhanced habitat for wildlife.

grasses with little or no wildlife habitat value [e.g., fescue, Bermuda grass (*Cyndon dactylon*)]. These grasses should not be included in available seeding mixtures for CP1. Local county and state offices should actively promote selection of cover practices with greater wildlife benefits (e.g., native warm-season grasses and legumes). Furthermore, reenrollment of CP10 acres should be predicated on eradication of these undesirable species prior to enrollment, or should provide a cost-share to support mandatory herbicidal eradication following enrollment.

Tree planting practices should emphasize longleaf pine on appropriate sites. Additional incentives associated with the national longleaf pine CPA were very effective in promoting establishment of this conservation practice. There is little environmental justification for reenrollment of existing trees after CP11 contracts expire. These contracts should be allowed to expire. The environmental benefits of reenrollment of CP3 stands are of questionable value. If left unthinned, these stands provide virtually no wildlife habitat. Incentives to promote thinning and creation of early successional openings within these stands have largely been ineffective due to lack of enforcement and relaxed standards. Reenrollment of CP3 as CP11 will produce wildlife habitat benefits only if aggressive thinning, control of hardwood midstory, and use of prescribed fire are mandatory requirements that are enforced.

Future CRP enrollments should target practices that accrue multiple environmental benefits and can be incorporated in production systems within working landscapes. Buffer practices supported under the Continuous Conservation Reserve Program (CCRP) (CP21 and CPP22) meet these criteria. Additional incentives associated with CCRP were effective in eliciting landowner participation. The newly developed CP33-Habitat Buffers for Upland Wildlife has the potential to create early successional grass habitats in agricultural landscapes. Creation of herbaceous field borders in agricultural landscapes has been shown to substantially increase local abundance of northern bobwhite and provide habitat for wintering grassland birds (Marcus and others, 2000). Acceptance of CP33 should be aggressively promoted by the Natural Resources Conservation Service (NRCS) and the FSA. Consistent with other CCRP practices, landowner rental rates for CP33 should be increased to 120% of soil and county-specific weighted mean cash rent values.

Conclusions

The CRP has had substantial impact on land use and landscape composition in the Southeast. However, the wildlife habitat value of fields enrolled in the CRP in the Southeast has been diminished by selection of cover practices with short duration or minimal habitat value. Proactive management of extant CRP acreage and selective enrollment of high value cover practices will be required to achieve the types of wildlife habitat benefits associated with the CRP in other regions.

References Cited

Barnes, T.G., Madison, L.A., and Sole, J.D., 1995, An assessment of habitat quality for northern bobwhite in fescue-dominated fields: Wildlife Society Bulletin, v. 23, no. 2, p. 231–237.

Burger, L.W., 2000, Wildlife responses to the Conservation Reserve Program in the Southeast, *in* Hohman, E.L., ed., A comprehensive review of farm bill contributions to wildlife conservation 1985–2000: Technical Report, USDA/NRCS/WHMI-2000, p. 55–74.

Burger, L.W., Jr., Kurzejeski, E.W., Dailey, T.V., and Ryan, M.R., 1990, Structural characteristics of vegetation on CRP fields in northern Missouri and their suitability as bobwhite habitat: Transactions of the North American Wildlife Resources Conference, v. 55, p. 74–83.

Carmichael, B.D., Jr., 1997, The Conservation Reserve Program and wildlife habitat in the southeastern United States: Wildlife Society Bulletin, v. 25, no. 4, p. 773–775.

Edwards, S.L., Demarais, S., Watkins, B., and Strickland, B.K., 2004, White-tailed deer forage production in managed and unmanaged pine stands and summer food plots in Mississippi: Wildlife Society Bulletin, v. 32, no. 3, p. 739–745.

Greenfield, K.C., Burger, L.W., and Chamberlain, M.J., 2001, Herbicide and prescribed fire as habitat management tools for northern bobwhite in Conservation Reserve Program fields: Proceedings of the Southeastern Association of Fish and Wildlife Agencies, v. 55, p. 445–455.

Greenfield, K.C., Burger, L.W., Jr., Chamberlain, M.J., and Kurzejeski, E.W., 2002, Vegetation management practices on Conservation Reserve Program fields to improve northern bobwhite habitat quality: Wildlife Society Bulletin, v. 30, no. 2, p. 527–538.

Greenfield, K.C., Chamberlain, M.J., Burger, L.W., Jr., and Kurzejeski, E.W., 2003, Effects of burning and discing Conservation Reserve Program fields to improve habitat quality for northern bobwhite (*Colinus virginianus*): American Midland Naturalist, v. 149, no. 2, p. 344–353.

Johnson, D.H., 2000, Grassland bird use of Conservation Reserve Program fields in the Great Plains, *in* Hohman, W.L., ed., A comprehensive review of farm bill contributions to wildlife conservation 1985–2000: Technical Report, USDA/NRCS/WHMI-2000, p. 19.

McCoy, T.D., Kurzejeski, E.W., Burger, L.W., Jr., and Ryan, M.R., 2001, Effects of conservation practice, mowing, and temporal changes on vegetation structure on Conservation Reserve Program fields in northern Missouri: Wildlife Society Bulletin, v. 29, no. 3, p. 979–987.

Reynolds, R.E., 2000, Wildlife responses to the Conservation Reserve Program in the Northern Great Plains, *in* Hohman, W.L., ed., A comprehensive review of farm bill contributions to wildlife conservation 1985–2000: Technical Report, USDA/NRCS/WHMI-2000, p. 35–44.

Ryan, M.R., 2000, Impact of the Conservation Reserve Program on wildlife conservation in the Midwest, *in* W. L. Hohman, ed., A comprehensive review of farm bill contributions to wildlife conservation 1985–2000: Technical Report, USDA/NRCS/WHMI-2000, p. 45–54.

Ryan, M.R., Burger, L.W., Jr., and Kurzejeski, E.W., 1998, The impact of CRP on avian wildlife: A review: Journal of Production Agriculture, v. 11, no. 1, p. 61–67.

Thompson, J., 2002, Response of plant and avian community to prescribed burning and selective herbicide treatments in thinned, mid-rotation loblolly pine plantations in Mississippi: M.S. thesis, Mississippi State University, 118 p.

USDA, Farm Services Agency, 2004a, CRP state office reports, August 5, 2004. http://www.fsa.usda.gov/crpstorpt/preapprove/default.htm

USDA, Farm Services Agency, 2004b, Statistical reports: http://www.fsa.usda.gov/dafp/cepd/stats.htm

Washburn, B.E., Barnes, T.G., and Sole, J.D., 2000, Improving northern bobwhite habitat by converting tall fescue fields to native warm-season grasses: Wildlife Society Bulletin, v. 28, no. 1, p. 97–104.

Conservation Buffers in East-Central Illinois: Use by Nesting Passerines and Management Characteristics[1]

By Richard E. Warner[2], Laura A. Kammin[2], Catherine L. Hoffman[2], Philip C. Mankin[2]; Patrick G. Hubert[3]; Daniel J. Olson[4]; and Leon Wendte[5]

Introduction

Conservation buffers are of growing importance for natural resource conservation programs in agriculture. We evaluated conservation buffers established under the Conservation Reserve Program (CRP) in central Illinois, a leading region for enrollment in conservation buffer practices. While Illinois ranks thirteenth in land enrolled in the CRP, 23% of the 970,636 acres (392,802 ha) of CRP in the state from 1986–2004 were enrolled as Conservation Practice (CP21), grass filter strips, or CP22, riparian buffers in trees. Nationally, Illinois ranked third in CP21 and first in CP22 for this period.

Our study focused on CP21 conservation buffers in east-central Illinois, primarily in Ford and Champaign Counties. The objectives of our study were to: (1) evaluate use of these tracts by nesting passerine birds; and (2) describe typical habitat conditions and management practices.

Land cover in Ford County is 91% row crops (primarily corn and soybeans). Ford County ranks eighth among all counties in the United States in land enrolled in CP21 and twenty-fourth in CP21 + CP22. Fifty-five percent of CRP acreage in Ford County is CP21 or CP22. CP21 provides 16% of rural grassland. Ford County has 938 miles (1,510 km) of stream bank of which 16% [152 miles (245 km)] are protected by existing vegetation and 37% [348 miles (560 km)] are protected by conservation buffers. As of 2003, there were 753 contracts comprising 3,124 acres (1,264 ha) of conservation buffers within the county.

Land cover in Champaign County is 85% row crops. Champaign County ranks third among all United States counties enrolled in CP21 and fourth in CP21 + CP22. Within Champaign County, 73% of CRP acreage is CP21 or CP22. Eleven percent of rural grassland in the county is due to enrollment in CP21. Champaign County has 1,376 miles (2,214 km) of stream bank; 28% [391 miles (629 km)] are protected by existing vegetation; 42% [580 miles (933 km)] are protected by conservation buffers. As of 2003 there were 1,491 contracts comprising 5,933 acres (2,401 ha) of conservation buffers within the county.

Use of Conservation Buffers by Nesting Passerines

Avian use of filter strips and associated streambanks and treelines was evaluated during the 2002–2003 breeding seasons along 59 randomly selected CP21 tracts in Ford and Champaign Counties. Filter strips supported high numbers of nesting birds [688 nests/247 acres (668 nests/100 ha)], but are marginal nesting habitat due to low nest success caused by high rates of predation. Specifically, we found 18 avian species nesting in filter strips and associated streambanks or treelines. Red-winged blackbird (*Agelaius phoeniceus*) and American robin (*Turdus migratorius*) nests were most common. Nest success for these two species was 7% and 10.5%, respectively. Predation caused 77% of all nest failures. Brown-headed cowbirds (*Molothrus ater*) parasitized 5% of active nests. We hypothesized that grass cover (cool or warm season grasses), presence or absence of a treeline, adjacent crop field (corn or soybean), or filter strip width may affect nest site selection or nest survival, but found no biologically significant differences related to these factors.

Habitat and Management Characteristics of Conservation Buffers

Nearly all CP21 contracts established in 1999 and 2000 in Champaign and Ford Counties ($n = 358$) were evaluated in summer (mid-June to mid-August) 2001 (Review 1) and during summer 2003 ($n = 352$; Review 2). These site reviews were completed by U.S. Department of Agriculture (USDA) personnel and included standardized methods for assessing contract compliance and describing habitat characteristics associated with the conservation practices.

Requirements for management interventions on the conservation buffers decreased over time. During the 2001

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[1]This paper presents only an overview of a report submitted for publication in a peer-reviewed journal.

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review, 43% of CP21 tracts had one or more of the following management issues identified: contains invasive plants, has a weed problem, requires reseeding, does not provide adequate filtering, or does not meet contract width. During the 2003 review (after producers implemented suggested management) only 30% were needful of additional management attention based on these criteria.

For the 2001 site review, vegetation on 35% of the tracts was rated as excellent, 41% good, 18% fair, and 6% poor. For the 2003 site review, vegetation on 25% of the tracts was rated as excellent, 48% good, 22% fair, and 6% poor.

While filter strips provide critical resources for grassland birds in the intensively cropped regions of the Midwest, our findings suggest that under typical habitat conditions and management practices these tracts tend to be ecological traps for nesting birds, primarily due to their narrow widths and high perimeter-area ratios. Hence, filter strips alone cannot stem the decline of grassland birds in this region. These relatively narrow, linear conservation practices must be used in concert with larger blocks of grassland habitat in order to help sustain viable avian populations across the intensively farmed region.

The Conservation Reserve Program and Duck Production in the United States' Prairie Pothole Region

By Ronald E. Reynolds[1]

Introduction

The Prairie Pothole Region (PPR) of North America has historically been considered the most important area of the continent for many species of waterfowl, particularly upland nesting ducks (Bellrose, 1976). However, since settlement of this area by Europeans, productivity by species such as mallard (*Anas platyrhynchos*), gadwall (*A. strepera*), blue-winged teal (*A. discors*), northern shoveler (*A. clypeata*), and northern pintail (*A. aguta*) has apparently declined. Beauchamp and others (1996) reported a system-wide decline in nest success of upland nesting duck species in the PPR between 1935 and 1992. Nest success has been identified as the single most important factor influencing population change of mallards breeding in the PPR (Hoekman and others, 2002). Predation has been identified as the primary reason for nest failure of upland nesting duck species in the PPR of the United States (Klett and others, 1988; Reynolds and others, 2001). Declines in nest success in the PPR have coincided with conversion of large areas of perennial grasslands to cropland that has presumably altered predator/prey relationships in ways unfavorable to upland nesting birds (Cowardin and others, 1983). In 1985, Congress authorized the Conservation Reserve Program (CRP) as part of the Food Security Act (Public Law 99-198). Under this Act, landowners enroll cropland to be converted to perennial cover for a specified period (e.g., 10–15 years) in exchange for annual payments. The CRP has been part of all subsequent Farm Bills since the 1985 Act and resulted in approximately 4.7 million acres (1.9 million ha) of cropland being converted to undisturbed grass cover in the PPR of the Dakotas and northeastern Montana from 1992 to the present. Conservationists have heralded the CRP as the most significant conservation program benefiting wildlife populations ever implemented by the U.S. Department of Agriculture (USDA). During the period 1992–1997, Reynolds and others (2001) conducted a study to assess the impact of CRP on duck productivity in the PPR of North Dakota, South Dakota, and northeastern Montana. This paper presents results from that study and other data to demonstrate the benefits of CRP to waterfowl beyond 1997.

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Impacts of the Conservation Reserve Program on Waterfowl in the Prairie Pothole Region

Duck Production 1992–1997

For nesting cover to provide meaningful benefits to duck populations, the following criteria need to be met: (1) cover must be characterized by nest success that is higher than other major cover types, (2) vegetation should be more attractive to nesting hens than is less secure competing cover, and (3) cover should be accessible to a large number of nesting hens. In addition, nest success should exceed 15–20% in order for productivity to balance annual mortality (Klett and others, 1988). During the period 1992–1997, Reynolds and others (2001) studied use and success by five duck species (mallards, gadwall, blue-winged teal, northern shoveler, and northern pintail) nesting in CRP cover in the PPR. Over 30,000 acres (12,141 ha) of CRP cover in the Dakotas and northeastern Montana were searched, providing information on over 10,000 duck nests. Results showed nest success in the CRP, averaged among years and species, was 23%, and was higher than any other major cover type used by ducks. The investigators found CRP cover was preferred over all other major cover types on the landscape by all duck species studied, and 30% of all successful nests across the study area were initiated in CRP fields, which accounted for 7% of the total land area. Nest success in CRP fields was positively related to the percent of total perennial cover on study sites, and nest success in other cover types was higher during the CRP period than that observed prior to the CRP. Study results indicated the CRP was having a positive impact on the entire landscape. Overall, these investigators estimated duck productivity in the PPR increased by 30% compared to that expected in the absence of CRP. It is estimated an additional 12.4 million ducks (2.1 million per year) were produced in the United States' PPR during the study period over what would have occurred in the absence of the CRP. This is equivalent to approximately 33% of the entire U.S. harvest of those species studied during the 6-year period.

Duck Production 1998–2002

Models developed from data provided by the 1992–1997 study can be used to estimate the impact of CRP on duck production beyond 1997 if certain information is available and assumptions made as follows: (1) estimates of duck breeding pair numbers and distribution are available annually, (2) the distribution of CRP since the 1996 Farm Bill is available in the digital/spatial databases, and (3) nest success estimates were updated or assumed to be unchanged since the 1992–1997 period. Since 1997, the U.S. Fish and Wildlife Service (USFWS) has annually surveyed duck breeding populations; therefore, this critical component of evaluation exists. Because broad-scale temporal variation in nest success was not observed during the 1992–1997 period (Reynolds and others, 2001), the assumption that nest success has remained similar in subsequent years seems reasonable. The most important change that has occurred since 1997 has been the amount and distribution of CRP throughout the PPR. There have been large shifts among counties and states in the region that will need to be incorporated into any serious attempt to quantify CRP benefits to waterfowl production beyond 1997. However, a rather crude examination can be made if we assume the current CRP is equivalent to that which was in place during 1992–1997. Under those conditions, model projections predict during the 1998–2003 period (the period for which breeding populations have been summarized) an additional 13.3 million (2.2 million/year) upland nesting ducks have been produced as a result of the CRP. The slightly greater average annual incremental increase during the 1998–2002 period compared to the 1992–1997 period is due to the larger average breeding population size during the later period. This brings the total incremental increased production of ducks to 25.7 million for the period 1992–2003.

Breeding Duck Pairs and Wetlands in Conservation Reserve Program Fields

In addition to providing relatively secure nesting cover for upland nesting ducks, the CRP has the potential to impact the number of breeding ducks settling in the PPR. There is speculation that homing by adult and young females due to increased productivity from the CRP has resulted in greater than expected densities of breeding duck pairs using much of the PPR. However, wetland habitat has also been positively affected by CRP cover. Wetlands that occur in grasslands tend to attract higher densities of ducks and are considered superior in biological function to those that occur in cropland (Kantrud and Newton, 1996; Krapu and others, 1997). I examined breeding duck data from over 2,400 wetland observations collected by the USFWS (USFWS Habitat and Population Evaluation Team, Bismarck, N.D., unpub. data) for the period 2000–2003 to compare the density of 13 combined duck species using three wetland classes (Cowardin and others, 1979) occurring in CRP fields ($n = 466$) and crop fields ($n = 1,957$). Wetlands in both CRP and crop fields showed frequent use by breeding ducks, but greater densities were recorded for wetlands in CRP fields compared to those in crop fields (fig. 1). These results suggest CRP cover planted around wetlands and the curtailment of disturbance associated with tilling and planting crops has improved the function of wetlands relative to breeding duck use. This impact is not trivial as evidenced by estimates from landscape samples indicating there are about 230,000 acres (93,078 ha) of small-shallow (temporary and seasonal) wetlands in CRP fields throughout the PPR. These wetlands attracted 492,000 duck pairs annually during 2000–2003 which was 210,000 more pairs per year than if these wetlands had been in cropland instead of CRP.

Wetland Conservation

Vegetation cover furnished by the CRP provides benefits to duck production only when it occurs in proximity to wetlands that attract numerous breeding hens. Some nesting hens will travel as much as 2 miles (3.2 km) or more from core wetlands to access suitable nesting cover (Derrickson, 1975; Dwyer and others, 1979; Cowardin and others, 1985). Loss of wetlands due to drainage can have a significant effect by reducing the capability of an area to attract ducks. Tiner (1984) reported over half of the original 7 million acres (2.8 million ha) of pothole wetlands in the Dakotas have already been lost, mostly due to agriculture. In addition, small shallow wetlands in the PPR are critical to brood survival by providing security from predators (Krapu and others, 2000) and food requirements for developing ducklings. Since 1985, all Farm Bills have included conservation compliance (Swampbuster) provisions that restrict wetlands from being drained and converted to cropland. Swampbuster has been effective in reducing wetland loss, but some farm groups question the need to protect small-shallow wetlands that interfere

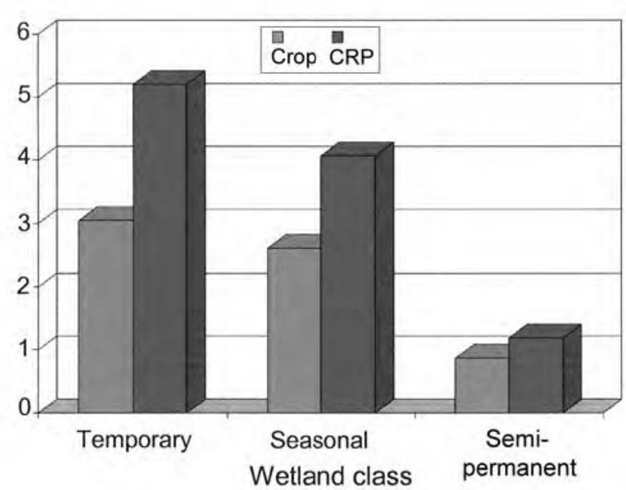

Fig. 1. Duck pairs/wet acre (13 species combined) on wetlands occurring in crop fields versus those in Conservation Reserve Program fields in the U.S. Prairie Pothole Region during spring 2000–2003.

with tilling and planting. I examined data collected by the USFWS (USFWS, Habitat and Population Evaluation Team, Bismarck, ND, unpub. data) during the period 1987–2003 to determine which wetland types attracted the highest amount of use by breeding ducks in the PPR. The types of wetlands in all land-uses that showed highest use by breeding ducks were temporary and seasonal classes (fig. 2) that averaged only 0.60 and 1.46 acres (0.24 and 0.60 ha) in size, respectively. Further examination of data revealed that 63% of all upland nesting ducks in the area depend on temporary and seasonal wetlands that are less than 1 acre (0.4 ha) in size. The majority of these wetlands occur in crop fields.

Discussion

The PPR is the most important breeding area in the nation for many duck species. The PPR area of the Dakotas makes up about 7% of the traditional waterfowl survey area (Cowardin and Blohm, 1992), considered the principle breeding range for ducks in North America (Reynolds, 1987). During the period 1994–2002, 21% of all breeding ducks from the traditional continental survey area occurred in the PPR of the Dakotas (USFWS Administrative Reports, 1994–2002). The CRP has been popular with landowners in this area who have enrolled and maintained nearly 5 million acres (2 million ha) of land in the program since 1992. Reynolds and others (2001) documented the importance of the CRP to duck production, concluding the program has provided widespread landscape-level affects. In addition, CRP cover appears to have improved the attractiveness of certain wetlands and increased the regional carrying capacity of breeding ducks.

Notwithstanding demonstrated profits the CRP has provided for waterfowl in the PPR, there is concern about the future continuation of these benefits. Nearly 2.5 million acres (1.0 million ha) (more than half of the total) of CRP in the PPR are due to expire in 2007 and by 2010 only about 20% of the current CRP acres will remain in active contracts. The CRP will need to be reauthorized prior to contract expiration if benefits to waterfowl are to continue. However, even with reauthorization of the CRP, changes need to be made in the current Environmental Benefit Index (EBI) (used to determine which CRP contracts are accepted by USDA) if waterfowl are considered a conservation priority. The EBI has changed considerably since signups in 1997–2000 when most of the CRP in the PPR was enrolled. Earlier signup EBI criteria included points for offers in the PPR National Conservation Priority Area, proximity to wetlands, proximity to protected areas such as National Wildlife Refuge System Waterfowl Production Areas, and upland to wetland ratios that allowed enrollment of entire fields with numerous pothole wetlands. The most recent signups have emphasized criteria such as riparian buffers, shelterbelts, grass waterways, contour grass strips, wetland buffers, and filter strips (USDA, Farm Service Agency, 2004). While these latter criteria may result in plantings that provide certain conservation benefits, they are unlikely to be compatible with the habitat needs of prairie ducks. Idle grass plantings with these configurations are similar to road rights-of-way and other fragmented habitats described by Cowardin and others (1988) that are attractive to nesting ducks, but have been characterized by low nest success due to excessive predation (Klett and others, 1988; Reynolds and others, 2001). Conversely, landscapes shown to be associated with high productivity of ducks include large blocks [e.g., ≥80 acres (≥32 ha)] of CRP associated with other CRP or perennial grasslands in close proximity to wetland complexes supporting moderate to high densities of breeding duck pairs. Whole field enrollments in CRP cover will be needed to meet the nesting habitat requirements of upland nesting ducks.

As a result of EBI changes in later signups, only 50,954 acres (20,620 ha) of 428,470 acres (173,396 ha) (12%) of CRP offered from the Dakotas were accepted during the most recent general signup (signup 26) (USDA, Farm Services Agency news release, 2004). This is in contrast to the national CRP acceptance rate of 48%. If waterfowl are to be a priority wildlife group for a future CRP, practices popular with landowners in the PPR need to be emphasized (table 1). Also, the USDA should consider using available biological data to maximize waterfowl benefits from the program. The USFWS Habitat and Population Evaluation Teams in Bismarck, North Dakota, and Fergus Falls, Minnesota have developed spatially explicit models using Geographic Information System technology to create maps that can be used to target programs such as the CRP to achieve the greatest waterfowl production results (e.g., Reynolds and others, 1996). Maps developed from these models can be made available for the entire PPR.

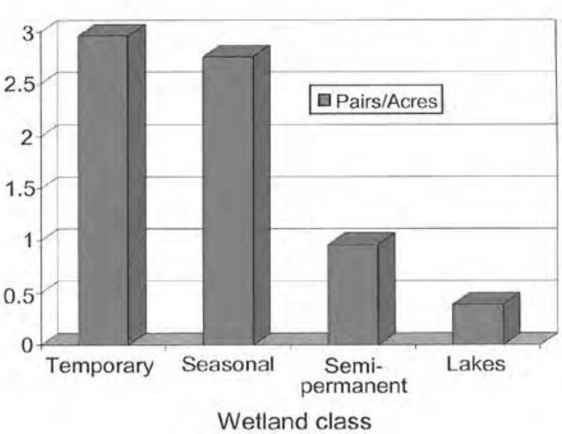

Fig. 2. Duck pairs/wet acre (13 species combined) observed on four classes of wetlands in the U.S. Prairie Pothole Region during May 2000–2003.

Conclusion

In summary, the CRP has resulted in significantly increased productivity of ducks from the most important duck breeding area in North America. Ducks produced in the

Table 1. Percent distribution of the Conservation Reserve Program by practice category for states that comprise the majority of the Prairie Pothole Region.[1]

Conservation Reserve Program practice	% of total Conservation Reserve Program in the north-central plains
CP1 Introduced Grasses	16.5
CP2 Native Grasses	12.6
CP4 Wildlife Habitat	10.4
CP10 Established Grasses	35.1
CP23 Wetland Restoration	15.0
All other practices combined	8.4

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

PPR migrate to virtually every state, province, and territory in North America, Mexico, and several countries in South America. Waterfowl hunters and observers nationwide have been the beneficiaries of the CRP. In order to maintain duck production levels in the PPR, at least 5 million acres (2 million ha) of CRP will need to be targeted toward areas of moderate to high duck density. To maximize duck production and meet other regional migratory bird and upland bird population goals, a total of 8 million acres (3.2 million ha) of CRP cover is recommended (Wildlife Management Institute, 2001). Finally, Swampbuster provisions of the Farm Bill must be continued to protect wetlands habitat critical to breeding waterfowl and broods. Waterfowl enthusiasts nationwide will be looking forward to continuing the benefits of these landmark conservation initiatives.

References Cited

Beauchamp, W.D., Koford, R.R., Nudds, T.D., Clark, R.G., and Johnson, D.H., 1996, Long-term declines in nest success of prairie ducks: Journal of Wildlife Management, v. 60, no. 2, p. 247–257.

Bellrose, F.C., 1976, Ducks, geese, and swans of North America: Harrisburg, Pa, Stackpole Books, 543 p.

Cowardin, L.M., and Blohm, R.J., 1992, Breeding population inventories and measures of recruitment, *in* Batt, B.D.J., Afton, A.D., Anderson, M.G., Ankney, C.D., Johnson, D.H., Kadlec, J.A., and Krapu, G.L., eds., The ecology and management of breeding waterfowl: Minneapolis, University of Minnesota Press, p. 423–445.

Cowardin, L.M., Gilmer, D.S., and Shaiffer, C.W., 1985, Mallard recruitment in the agriculture environment of North Dakota: Wildlife Monographs, v. 92, 37 p.

Cowardin, L.M., Sargeant, A.B., and Duebbert, H.F., 1983, Problems and potentials for prairie ducks: Naturalist, v. 34, no. 4, p. 4–11.

Cowardin, L.M., Carter, V., Golet, F.C., and LaRoe, E.T., 1979, Classification of wetlands and deepwater habitats of the United States: Washington, D.C., U.S. Government Printing Office, 103 p.

Cowardin, L.M., Johnson, D.H., Shaffer, T.L., and Sparling, D.W., 1988, Application of a simulation model to decisions in mallard management: U.S. Fish and Wildlife Service Technical Report 17, 28 p.

Derrickson, S.R., 1975, Mobility and habitat-use of breeding pintails (*Anas acuta*): M.S. thesis, University of Minnesota, Minneapolis, 48 p.

Dwyer, T.J., Krapu, G.L., and Janke, D.M., 1979, Use of prairie pothole habitat by breeding mallards: Journal of Wildlife Management, v. 43, no. 2, p. 526–531.

Hoekman, S.T., Mills, L.S., Howerter, D.W., Devries, J.H., and Ball, I.J., 2002, Sensitivity analyses of the life cycle of midcontinent mallards: Journal of Wildlife Management, v. 66, no. 3, p. 883–900.

Kantrud, H.A., and Newton, W.E., 1996, A test of vegetation-related indicators of wetland quality in the Prairie Pothole Region: Journal of Aquatic Ecosystem Health Management, v. 5, p. 177–191.

Klett, A.T., Shaffer, T.L., and Johnson, D.H., 1988, Duck nest success in the Prairie Pothole Region: Journal of Wildlife Management, v. 52, no. 3, p. 431–440.

Krapu, G.L., Greenwood, R.J., Dwyer, C.P., Kraft, K.M., and Cowardin, L.M., 1997, Wetland use, settling patterns, and recruitment in mallards: Journal of Wildlife Management, v. 61, no. 3, p. 736–746.

Krapu, G.L., Pietz, P.J., Brandt, D.A., and Cox, R.R., Jr., 2000, Factors limiting mallard brood survival in prairie pothole landscapes: Journal of Wildlife Management, v. 64, no. 2, p. 553–561.

Reynolds, R.E., 1987, Breeding duck population, production and habitat surveys, 1979–1985: Transactions of the North American Wildlife and Natural Resources Conference, v. 52, p. 186–205.

Reynolds, R.E., Cohan, D.R., and Johnson, M.A., 1996, Using landscape information approaches to increase duck recruitment in the Prairie Pothole Region: Transactions 61st North American Wildlife and Natural Resources Conference, p. 86–93.

Reynolds, R.E., Shaffer, T.L., Renner, R.W., Newton, W.E., and Batt, B.D.J., 2001, Impact of the Conservation Reserve Program on duck recruitment in the U.S. Prairie Pothole Region: Journal of Wildlife Management, v. 65, no. 4, p. 765–780.

Tiner, R.W., 1984, Wetlands of the United States: Current status and recent trends: Washington, D.C., U.S. Government Printing Office, 59 p.

USDA- FSA, 2004, Conservation Reserve Program overview: Washington, D.C., 25 p.

USDA, 2004, www.fsa.usda.gov/pas/archives02.asp

Wildlife Management Institute, 2001, How much is enough for 2002?: A regional wildlife habitat needs assessment for the 2002 Farm Bill: Washington, D.C., WMI Publications, 36 p.

Getting the Biggest Bang for the Acre

By Terry Schley Noto[1] and Tim Searchinger[2]

Introduction

Few environmental programs have matched the scope and achievement of the Conservation Reserve Program (CRP). The CRP has reduced soil erosion, helped restore grassland communities of the Great Plains, and benefited duck populations in the central U.S. Originally focused on reducing crop surpluses, the Farm Service Agency (FSA) has focused more and more on achieving environmental benefits. The Environmental Benefits Index (EBI) has become more environmentally tailored. The program has increasingly enrolled more erodible lands and planted more native grasses. The creation of the continuous enrollment program has targeted some of the CRP on restoring critical riparian buffers, and the FSA is to be applauded for extending the program to bottomland hardwood restoration and floodplain wetlands. Approval of state Conservation Reserve Enhancement Programs (CREPs) has, for the first time, made the CRP an effective partner in promoting science-based, state-led environmental initiatives. The FSA increased the focus on valuable longleaf pine (*Pinus palustris*) species in the South, and created the capacity to restore rare and declining habitat through Conservation Practice (CP) 25.

The time is appropriate to raise the desired level of environmental achievement even higher. Money is tight. Farmland is precious. Even greater things should be expected from a program that removes 10% of the country's cropland from production at a cost of almost $2 billion per year. Once CRP has removed 34 to 39 million acres (14 to 16 million ha) of land from production, farm groups are appropriately reluctant to remove more, so it is important for farmers and conservationists alike to ensure that acres enrolled in the CRP make as large a contribution toward meeting the country's environmental goals as possible.

Looming Turnover in Enrollment

In fiscal year 2007, approximately 16 million acres (6.5 million ha) of CRP contracts are due to expire, with an additional 6 million acres (2.4 million ha) expiring in fiscal year 2008. Obviously, this will create a large opportunity for new enrollment within the nationwide acreage cap. As we discuss below, more acres should be enrolled through targeted forms of enrollment (continuous signup and CREP) that do a more focused job of installing high value practices where most needed. The EBI should also be improved. As an initial matter, however, the FSA should spread out the enrollment bump in 2007 and 2008 to assure higher environmental quality.

Huge signups, such as a reenrollment of 17 million acres (7 million ha) in one year, are far from ideal. Because so many acres must be available, such signups do not encourage competition, and it is competition that leads to the most bang for the buck. Equally important, these kinds of signups overwhelm administrative capabilities. In the past, Natural Resources Conservation Service (NRCS) staff devoted much of their work in big signup years to CRP, and they report the quality of conservation plans suffered. The involvement of NRCS remains critical to the quality of conservation plans both formally and informally – farmers need their direct advice. It is in everyone's interest to spread out these enrollments.

We recommend two methods by which the FSA can do this. First, some existing CRP acreage should be permitted to compete for reenrollment in any general signups between now and 2007–2008 on the condition they improve the quality of presently enrolled cover to achieve critical objectives. Mid-contract cover management should be required in most contracts. One of the major opportunities to improve CRP is by converting existing stands of non-native grasses to diverse native grasslands. Properly managed, these stands could help the agricultural community improve the health of at-risk species that otherwise threaten to become significant conflicts. Examples could include conversion to native grasslands of CRP land in Texas to benefit the lesser prairie chicken (*Tympanuchus pallidicinctus*). Another might be conversion to shortgrass prairie to address such species as the mountain plover (*Charadrius montanus*) in eastern Colorado. Another major opportunity to improve CRP is by converting stands of loblolly pine (*P. taeda*) to longleaf pine or other appropriate native tree plantings with appropriate management plans (e.g., prescribed burns). These actions would benefit neotropical migrant birds, northern bobwhite quail (*Colinus virginianus*), and in time at-risk species, such as the red cockaded woodpecker (*Picoides borealis*) and the gopher tortoise (*Gopherus polyphemus*).

On the other hand, some of the more valuable existing enrollments could be allowed to extend one and two years to spread out enrollments into 2008 and 2009. This should be conditional on acceptance of important maintenance activities to qualify for extension.

There is some discussion of allowing some acres to be automatically reenrolled if they provide exceptional environ-

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Figure 1. The mountain plover (*Charadrius montanus*) is one of many species endemic to shortgrass prairie ecosystem that may benefit from controlled grazing of Conservation Reserve Program grasslands. (Photo provided by Fritz Knopf.)

mental benefits. An option would be to automatically reenroll certain CRP enrollments critical to providing exceptional environmental value in 15-year contracts. Criteria would need to be carefully selected, and any such reenrollments would need to be located in high priority areas, installed in the best possible native covers for wildlife, and include appropriate midcontract cover management. These lands should only be automatically reenrolled if it is clear they would score so high in an EBI that they would be reenrolled in a competition anyway. Careful, limited automatic reenrollment could lift some of the administrative burden from the FSA but would still require technical assistance for revised conservation and management plans.

Making Continuous Enrollment Work

Another critical issue is making continuous enrollment work. On December 1, 2003, Agriculture Secretary Veneman announced the bottomland hardwood initiative, which seeks to enroll up to 500,000 acres (202,343 ha) of bottomland hardwood forest and up to 500,000 acres (202,343 ha) of floodplain wetlands primarily in the South and Midwest. Strong signup under this initiative could sequester over 1,000,000 metric tons of greenhouse gases, reduce hypoxia in the Gulf of Mexico, improve instream water quality, reduce the likelihood and severity of flooding, and restore vital wildlife habitat essential for migrating waterfowl, neotropical migrant song birds, and black bears (*Ursus americanus*). Bottomland hardwood and floodplain wetland restoration are also essential to restoring the health and ecology of America's rivers and streams and to improving and maintaining native fish stocks. On August 4, 2004, a 250,000-acre (101,171-ha) northern bobwhite initiative and a non-floodplain wetlands initiative of the same size were announced.

We enthusiastically support these continuous signup initiatives, as well as the original buffer initiative. The challenge now is to take full advantage of these initiatives, and build upon them all to reach more acreage. Unfortunately, enrollment is suffering. Past experience has shown automatic enrollments under either the buffer initiative or CREP occur primarily in places where even a single district conservationist is truly out promoting it. Today, NRCS staff has largely retreated from the field as they are overwhelmed by increased responsibilities for an expanded Environmental Quality Incentives Program (EQIP). The Conservation Security Program (CSP) will exacerbate this challenge.

To remedy this problem, the FSA should use its authority to tap the funds of the Commodity Credit Corporation (CCC) to issue competitive contracts to local organizations that promote continuous enrollment, focusing special effort on bottomland hardwood and wetland enrollments. Even a contract as small as $3 million should be meaningful. Recipients should be expected to meet numerical targets. Criteria should favor organizations with ties to the local community and capacity to provide technical assistance for enrollments.

Contracting with local conservation organizations, soil and water conservation districts, and other qualified organizations could be an efficient, cost-effective, and productive approach to conducting outreach. Producers are more likely to be receptive to promotion by local organizations they know and trust. Contracting with local organizations should also strengthen the FSA's relationships with community organizations and build partnerships. We urge the FSA to spend at least $3 million a year in contracts for service with local organizations to conduct outreach for continuous signup, particularly for bottomland hardwood and wetland restoration.

The FSA should also expend practice and special incentive payments to new categories of continuous enrollment, incentives that are particularly warranted given high commodity prices. The USDA offers signing incentive payments (SIPs) and practice incentive payments (PIPs) on the majority of continuous signup practices. The SIPs and PIPs are not offered for restoration of floodplain wetlands, but 25% of cost share is provided for restoration of hydrology. The USDA is providing SIPs and PIPs for the Northern Bobwhite initiative (Habitat Buffers for Upland Birds, CP33). Unfortunately, there are no incentives provided for restoration of bottomland hardwoods. As of March 2004, only 797 acres (323 ha) had been enrolled in bottomland hardwood restoration (CP31), whereas 47,039 acres (19,036 ha) had been continuously enrolled in floodplain wetlands restoration (CP23) and 2,113,394 acres (855,260 ha) had been enrolled in continuous signup practices (excluding CREP enrollment). The discrepancy in incentives helps account for the dramatic difference between enrollment in bottomland hardwood restoration (CP31) and floodplain wetland restoration (CP23). Restoration of bottomland hardwoods is a high value practice that is equally, if not more, deserving of SIP and PIP than other practices currently receiving these incentives. Moreover, given the dramatic conservation benefits sought by Secretary Veneman's bottomland hardwood initiative, it seems penny-wise and pound-foolish to decline to extend these incentives to this important continuous signup practice.

The FSA should also commit to making continuous enrollment work on rangeland. Restoring riparian habitats on rangeland is one of the country's primary conservation needs. In theory, continuous enrollment of riparian buffers is available on rangeland, but it is little used. Possible obstacles include low rental rates, rates that do not reflect relatively wetter rangeland areas near streams, a need for wider buffers, use of buffers on ephemeral streams fed by surface water (particularly common in range areas), and the same lack of outreach affecting continuous enrollment nationwide. The FSA should establish an advisory committee to recommend ways to make continuous enrollment work on rangeland.

Expanding Continuous Enrollment

Environmental Defense urges the FSA to expand continuous enrollment to include enrollments of rare and declining habitat of critical value to wildlife in specially mapped areas identified at the state level. The single greatest need for rare wildlife is habitat preservation and restoration, but general signups can only do so much for wildlife because they cannot do a good job of factoring in the enormous importance of location into enrollment criteria. The value of any particular habitat for wildlife depends on such factors as: the land's proximity or contiguity to existing wildlife populations, the role that particular habitat plays in filling the diverse habitat needs of the species during the course of the seasons and stages of life, and threats posed by other adjacent land uses ranging from cowbirds (*Molothrus ater*) to house cats (*Felis silvestris*) in subdivisions. Location is critical. The CRP can play a valuable role in reducing conflicts between agriculture and the needs of endangered species in many parts of the country.

One targeted, scientific way to restore rare habitat where it is most needed would be to allow states to designate land for continuous enrollment in rare and declining habitat in locations designated as top conservation value. Local evaluation techniques (such as data from natural heritage inventories) should be used to identify these areas. One option may be to permit each state office an allocation of CRP acreage up to 5% of the cropland in the state, or 25,000 acres (10,117 ha), whichever is greater.

An alternative would build on FSA's special initiatives for playa lakes and quail that allocate acreage for continuous enrollment to promote special enrollments of value to at-risk wildlife. The FSA could use the same approach to benefit other special categories of enrollment, such as restoring thorn scrub habitat for endangered ocelots (*Felis pardalis*) in southeastern Texas, longleaf pine habitats where they can provide special benefits to gopher tortoises and red-cockaded woodpeckers, and short grass prairie to benefit the mountain plover.

Conservation Reserve Enhancement Program

The CREPs are a highly leveraged way to partner state and federal investment in voluntary, incentive-based conservation programs tailored to meet local needs and address soil, water quality, and wildlife issues of national importance. The CREP increases benefits of CRP dollars through a focused effort around specific environmental concerns, providing landscape-level conservation in ways the general signup cannot. The CREPs are large and focused enough to make a meaningful difference addressing large environmental issues, such as restoring the health of the Illinois River. Often CREPs partner state and nonfederal resources to obtain significant additional benefits, such as contract extensions, permanent conservation easements, and bonuses for highly valued practices. Interest in CREP is strong. To date, 29 CREPs have been approved in 25 states. These programs enjoy broad support and are often further leveraged by non-governmental organization participation from universities to Pheasants Forever, Ducks Unlimited, and The Nature Conservancy.

Environmental Defense strongly supports increased support for existing and approval of new CREPs, and has worked with many states (e.g., Maryland, Illinois, New York, Wisconsin, Michigan, Kentucky, North Carolina) helping to develop CREP proposals. Environmental Defense continues to place high priority on CREP development and implementation, devoting many hours of staff time to develop new CREP proposals. Currently, we are working on exciting new proposals, like the Scioto CREP proposal in Ohio that would improve drinking water for the City of Columbus, help address hypoxia in the Gulf of Mexico, sequester over 1,000,000 pounds (453,592 kg) of carbon, improve instream water quality, restore habitat for threatened and endangered species, and reduce the severity of flooding. Another exciting proposal we are working on in Hawaii would improve water quality, enhance aquifer recharge, restore instream flow, control erosion, restore habitat for threatened, endangered, and at risk native species, benefit coral reefs, and address invasive species issues (Hawaii is not only the endangered species capital of the world, it is also the invasive species capital of the U.S.).

One of the Environmental Defense farm team's highest priorities is CREP development and implementation because in our experience, these programs exemplify some of the best of voluntary conservation program work–creating win/win situations for producers, states, the federal government, and the environment. The CREPs can be tailored to meet local conditions and producer needs. The CREPs can be targeted to address large scale, national conservation issues, reaping important multiple benefits. The CREPs leverage both state and federal investment. Accordingly, we believe a high priority should be placed on enhancing CREP enrollment in existing programs and approving new CREP proposals. Environmental Defense believes this is an exceptionally good way to handle new acreage coming into CRP.

Improving the Environmental Benefits Index

The EBI has increasingly targeted CRP enrollments to more sensitive lands and more valuable enrollments. Even so, FSA's January 2003 CRP Programmatic Environmental

Impact Statement revealed significant discrepancies between current locations of CRP enrollment and areas of greatest water quality and wildlife habitat needs. The CRP is also playing only a limited role in helping to revive at-risk species even when addressing these problems through incentive-based approaches is becoming a higher priority for conservationists and producer organizations. Further enhancements of the EBI, taking advantage of FSA's increased use of computer technology, could help achieve even greater benefits from the CRP. For example, Environmental Defense recommends:

1. Distinguishing among land use covers in a more sophisticated way. Although the EBI today provides more points for more natural wildlife covers, the point differentials between them and other covers do not fully reflect differences in values. More credit should be given for native plantings appropriate to the locale. Moreover, the EBI should reflect significant distinctions between kinds and diversity of native plantings. The wildlife points should be awarded with more subtle criteria that provide highest points for native plantings that are appropriately diverse for the locale. With new Geographic Information System (GIS) capabilities, this effort could be coupled with an effort to modify conservation practices by tailoring covers to meet local habitat needs at the county and sub-state level.

2. Factoring the commitment of farmers to implement higher levels of management. Today, basic management is required of CRP lands (although often not implemented). The degree of appropriate management, ranging from control of invasive species, to controlled burns, to beneficial grazing at the right time, is critical to the wildlife benefits. The EBI should recognize various degrees of management and award points to producers willing to commit to higher levels of management responsibility.

3. Rewarding wetland restoration and similar kinds of enhancements. Farmers willing to restore wetlands on whole farm fields would provide both wildlife and water quality benefits in excess of those farmers who would not. In areas like the Prairie Pothole Region, the EBI could promote greater benefits by favoring enrollment of lands that already have large numbers of wetlands and by rewarding enrollments that would restore wetlands.

4. Factoring in the size and locational characteristics of potential enrollments. The value of any particular habitat for wildlife depends on the cover, the size of the enrollment, and the location of the enrollment (e.g., the land's proximity or contiguity to existing reservoirs of wildlife populations, the role that particular habitat plays in filling needs of species during different seasons or stages of life, and threats posed by other adjacent land uses). As discussed above, the EBI does not do as good a job of focusing on the size and locational characteristics of potential enrollments as do more targeted methodologies, like the CREP. However, with advances such as GIS, it should be possible to revise the EBI to do a better job of factoring in relative ecological merits of competing offer locations.

5. Discouraging inappropriate plantings. The EBI should not award points for ecologically inappropriate plantings. Examples include mixes that contain invasive, exotic species and plantings that are native to the U.S. but are inappropriate to the locale. Such plantings limit the habitat value of the CRP, fragment surrounding native habitat, and can degrade adjacent wild lands. Invasive species in some CRP planting mixes have, for example, invaded adjacent native unplowed prairie remnants. Inappropriate tree-planting in grassland areas that did not historically support trees has caused further decline in the quality of grassland habitats already fragmented by cropland and other land conversions exposing remaining populations of grassland birds to increased risk of predation. Installations of high-density monocultures of loblolly pine not only provide poor quality wildlife habitat compared to native plantings, they also do not provide as much in terms of water quality benefits compared to native bottomland hardwoods that are more water tolerant and do not require ditching and draining when installed. A further example of inappropriate installation of out-of-system tallgrasses or mid-height grasses planted within range. Such enrollments are not suitable for endemic wildlife, such as mountain plover, and further fragment surrounding shortgrass prairie, such as the Pawnee National Grassland.

6. Targeting water quality points. As a general rule, Environmental Defense believes many whole field enrollments are an inefficient and costly way to meet water quality needs. It is rarely possible, or appropriate, to address water quality problems by taking large blocks of land out of production. The best way to gain more water quality benefits is through expanded use of continuous enrollment to sign up lands of special sensitivity to water quality, such as riparian buffers and wetlands. However, whole field enrollment for water quality purposes may be appropriate for the most highly erodible land in sensitive watersheds, extraordinarily leachable lands, or lands in special locations. The CRP would better improve water quality, we believe, if the EBI were more discriminating in awarding water quality points, and if FSA provided sufficient outreach and incentives to make riparian buffer enrollment a more widely accepted option.

7. Factoring in likely alternative uses of the land. The benefit from enrolling land in CRP obviously depends on the difference between the environmental value of

> the land in CRP and its value if not in CRP. In turn, the value of land if not in CRP depends not just on its inherent characteristics, like erodibility, but on what kind of farming would otherwise be occurring. For example, if the land is likely to be a hayfield if not enrolled in CRP, it probably will not erode much even if not in CRP. The EBI would more accurately predict environmental benefits if likely alternative uses of the land were an evaluation factor. Doing so creates administrative challenges, but the need will be even greater in future signups because the FSA has substantially increased the amount of hayland eligible for CRP through an expanded definition of conserving use. It is possible that unless the EBI is adjusted in this way, enrollment in the future would not truly provide soil erosion benefits.

It makes sense to develop special incentives for the land coming out of CRP in the future to promote buffers, no-till, and related conservation practices by targeting EQIP funds for related soil erosion benefits. It could also encourage expiring lands to enroll both riparian and contour buffer strips directly into CRP without plowing up the existing cover.

We believe a more public process for evaluating the EBI is also legally required. Under the Administrative Procedures Act (APA), any rule shall be subject to notice in the Federal Register and public comment. 5 U.S.C. Sec. 553. There is an exception for "interpretative rules" and "general statements of policy." If an agency treats a policy as binding, it is effectively a rule and must be subject to notice and comment rulemaking. See CropLife America v. EPA, No. 02-1057, 2003 WL 21262716 at 1 (D.C. Cir. June 3, 2003); General Electric Co. v. EPA, 290 F.3d 377 (D.C. Cir 2002); Appalachian Power Co. v. EPA, 208 F.3d 1015, 1024-28 (D.C. Cir. 2000); Syncor International Corp. v. Shalala, 127 F.3d 90, 96 (D.C. Cir. 1997). This is especially true in cases, such as this, where the statute is very general and "the agency's rule gives content to the legal norm in question" Syncor, 127 F.3d at 94 n. 9 (citation omitted). The EBI goes far beyond interpreting the meaning of legislative language or rules; it provides the content used to determine actual results of millions of acres of bids. The EBI is determinative of whether a bid is accepted or not. The APA clearly requires the EBI be promulgated under a notice and comment rulemaking process. The CRP Programmatic Environmental Impact Statement (PEIS) scoping process was in no way a *de facto* substitute for a notice and comment rulemaking. The new Request for Comments that FSA recently issued is a helpful first start. However, meaningful public comment will depend upon having a further opportunity to comment on FSA's eventual proposed alternative formulation of the EBI.

Managed Haying and Grazing

The 2002 Farm Bill allows USDA, for the first time, to authorize managed haying and grazing on CRP lands, consistent with the conservation purposes of the program. This represents an important opportunity to reintroduce or approximate natural forms of disturbance (grazing by native herbivores and fire) that shaped our grassland ecosystems. The FSA has started implementing this change by allowing haying or grazing in accordance with a conservation plan, no more frequently than 1 in 3 years, with restrictions during the nesting season for birds in the area, and in accordance with NRCS field office technical guides. The Farm Bill provides that participants who hay or graze must take a reduction in rental rate. The FSA has assigned a 25% rental rate reduction. Environmental Defense supports the use of managed haying and grazing on CRP as a management tool for conservation.

However, we are concerned this tool is not being properly used. The NRCS needs to provide guidance in the field that specifically addresses how to use haying and grazing as a management tool based on best available science and scientific judgment. It is critical that primary nesting season restrictions are set appropriately for the area, protective conditions are included for highly sensitive areas, and appropriate stocking rates/residual cover heights are set to meet wildlife management objectives. These determinations should be based on existing scientific data and informed scientific judgment. While one year in three is a solid frequency for many areas, the frequency needs to vary by grassland type and location across the Nation. Managed haying and grazing should be conducted less frequently in places, like the Prairie Pothole Region, where experience and scientific data indicate that haying or grazing CRP once in 3 years is too often. In contrast, grazing should be implemented more often on grasses planted in shortgrass prairie areas.[3]

It is also critical that FSA and NRCS work together to ensure managed haying and grazing do not occur in places where it would cause adverse environmental impacts. This is a particularly important consideration with respect to haying because haying has a uniform effect on the mowed area, unlike grazing which is more intermittent in impact unless stocking rates are too high or grazing periods too long. The scientific panel that FSA relied upon in the Interim CRP rule stated haying is inappropriate in the drier mixed grass range CRP and in shortgrass range CRP. Moreover, there are some grassland ecosystems that did not evolve with grazing as disturbance and would not benefit from, and may be severely damaged by, grazing or haying. For example, managed haying and grazing should never be allowed in desert scrub.

The FSA should also reexamine the list of practices on which managed grazing and haying is allowed. Today, FSA

[3]The scientific panel FSA relied on in the interim CRP rule clearly stated that the shortgrass range CRP was undergrazed and required managed grazing more frequently than one in three years to obtain wildlife benefits (although proper precautions must be taken with respect to stocking rates to ensure that shortgrass range CRP is not over-grazed. This is particularly true where out of system tallgrass species have been planted). Annual grazing is needed to reduce the height of out of system tallgrasses to benefit native species, such as the mountain plover, and to allow native shortgrasses a chance to survive (if they are present in the seedbank or adjacent fields).

does not permit managed haying and grazing on so-called "rare and declining habitat" (CP25). That will be appropriate for some habitats, but managed grazing and haying need to be allowed on lands enrolled in native prairies, oak savanna, or other ecosystems requiring this type of disturbance.

Mid-Contract Cover Management

As a whole, most CRP land is not well managed. That is not surprising. Landowners receive the same $5 per acre maintenance payment whether they manage the land well or not. Improving this management is critical to obtaining more benefit from lands enrolled in the CRP.

The CRP rule made a step in the right direction by offering 50% cost-share for major mid-contract management. However, without more incentive or more of a requirement, landowners are unlikely to take advantage of this cost-share. We would support an incentive payment for mid-contract cover management in addition to a 50% cost share.

The goal of mid-contract cover management should be to improve covers by more closely approximating native ecosystem composition and function. Generally, mid-contract cover management should seek to increase plant diversity, improve stand structure, and control invasive species (including, in some cases, brush and tree control on grasslands). Invasive species not only limit the conservation value of and future economic uses of CRP land, they can also jeopardize surrounding preserves, pasturelands, and other lands. Accordingly, the FSA should clearly provide that mid-contract cover management includes invasive species control. Mid-contract cover management could include light discing, prescribed burning, mowing, herbicides and manual controls for invasives, and interseeding, planting seedlings, and plugs of desired plant species.

Marginal Pastureland

We welcome the language in the May 14, 2004 final CRP rule that clarifies, consonant with the 2002 Farm Bill, that non-riparian pasturelands can be included in an approved CREP if these lands are shown to be of special value for water quality. The FSA should also consider allowing enrollment of non-riparian marginal pastureland in appropriate continuous enrollment categories to provide special value for water quality.

Relatedly, FSA should be commended for permitting grasslands to be enrolled in riparian areas and elsewhere in vegetation other than trees where appropriate. There are many prairie areas where even riparian areas were not filled with trees. In such areas, other types of vegetation are appropriate. Unfortunately, FSA is allowing grasslands to be enrolled in CRP in vegetation other than trees (e.g., grass filter strips) even in areas where riparian areas would have been in trees. In the Chesapeake Bay area, these kinds of enrollments undercut the value of buffers for water quality and wildlife. The statute requires these enrollments always be in "appropriate" vegetation. Appropriate was intended to mean consistent with the natural ecology of the area; the FSA should clarify application of this concept.

Summary

With the looming massive turnover in CRP enrollment, it is important to adopt a sound administrative strategy for handling this significant surge in workload and to adopt a few key reforms to get the most benefits per acre out of new CRP enrollments and reenrollments.

Contract expirations should be staggered over years to even-out the administrative work flow. The flow of new enrollments and reenrollments should be handled by a mix of continuous signup, CREP, and general signup. Automatic reenrollment may be a further option but only for CRP lands of exceptional conservation value that are placed in the highest value native cover for wildlife and have an appropriate mid-contract management plan.

To get the most benefits for the acre from future general signups, the next step that should be taken is to revise the EBI to better target offers with the highest conservation value. Given expanding GIS capabilities and scientific understanding of wildlife needs, the EBI should be revised to do a more sophisticated job of distinguishing values between covers and rewarding diverse, native covers, and higher levels of management; discouraging inappropriate plantings; rewarding participants who restore wetlands or provide other enhancements; and rewarding offers more useful as wildlife habitat due to their size or location in the landscape. The EBI should also be revised to more accurately target water quality points and to do a better job of reflecting likely soil erosion benefits.

Finally, to maximize benefits per acre, the FSA should make the most of targeted enrollment through continuous CREPs. The FSA should commit to providing outreach (or grants for outreach) to promote continuous signup, particularly the bottomland hardwood and other new continuous initiatives. Participants should also have the option of restoring rare and declining habitat for at-risk species through continuous enrollment. Sufficient outreach and incentives should be provided for riparian buffer practices to meet water quality objectives. Environmental Defense encourages the FSA to continue to support state and local CREP efforts.

Management of the Conservation Reserve Program for Desired Wildlife Outcomes: Lands Working for Wildlife

By David L. Walker[1]

Introduction

My name is Dave Walker and I have been the Farm Bill Coordinator for the International Association of Fish and Wildlife Agencies (IAFWA) for the past 3 years. The Association's governmental members include all 50 state fish and wildlife agencies. As public agencies charged with protection and management of the Nation's fish and wildlife resources, our members recognize the critical role that Farm Bill conservation programs play in enhancing fish and wildlife habitats on private land.

No program in history has done more than the Conservation Reserve Program (CRP) for landscape-level conservation of soil, water, and wildlife habitat on farmland while offering producers a significant and stable source of income. The CRP is a proven, results-oriented conservation program that has accomplished a variety of positive outcomes for natural resources, including wildlife habitat. My purpose today is to look toward the future of CRP and from a national perspective, talk about how the tremendous wildlife legacy of CRP can be maintained, and how the program can be refined and enhanced.

Both the purposes and effects of the CRP have been evolving since the program was first authorized in 1985 with growing attention given to a broader spectrum of conservation issues. From a state fish and wildlife agency perspective, one of the most important changes over the last two decades has been the expansion of the Program's purpose to include the conservation and improvement of wildlife resources. With these intentional changes, Congress recognized the tremendous wildlife benefits of CRP by placing fish and wildlife resources on equal footing with soil and water quality in program implementation.

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Approach to Achieving Desired Wildlife Outcomes

The 2002 Farm Bill established the expectation that the CRP should achieve desired wildlife outcomes along with soil and water quality benefits. Success in delivering the promise of CRP in the 2002 Farm Bill will depend on an evolution in the way Congress, U.S. Department of Agriculture (USDA) producers, and other stakeholders view the CRP. Rather than thinking about CRP as a "set-aside" program that takes land "out of production," it should be accepted as a program that puts land to work by producing improved water quality, reduced soil erosion, and better fish and wildlife habitat on every acre enrolled. By actively pursuing production of desired high-quality wildlife habitat, CRP implementation issues can be resolved consistent with evolution in program purposes. As a result, the CRP will be better able to fulfill the expectations of Congress and the taxpayer.

This approach to implementation of the CRP will support decisions based on whether a practice or activity contributes to the productivity of the land consistent with the purposes for which it is enrolled. Implementing a practice or activity that would adversely impact one or more program purposes would not be consistent with maintaining lands in a condition capable of improving soil, water, and wildlife resources. In fact, the Farm Bill prohibits practices that tend to defeat the purposes of the contract, and the Secretary of Agriculture is directed to ensure, to the maximum extent practicable, those contracts strike an equitable balance among program purposes. Thinking of ways in which the CRP can best be used to produce the wide array of wildlife that benefit from establishment and maintenance of wildlife-friendly cover will facilitate development of an objective-driven process of program implementation and assessment that also serves program cohesiveness.

Providing fish and wildlife habitat that produces healthy populations has economic values that benefit rural economies just as commodity production does, although some of the benefits may not be measured as easily. The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation estimates that 82 million U.S. residents 16 years old and older participated in wildlife-related recreation and spent over $100 billion pursuing those activities in 2001 (USDI and USDC, 2002). The Economic Research Service, in their February 2004 Report to Congress entitled The Conservation Reserve Program: Economic and Social Impacts on Rural Counties (USDA, 2004), conservatively estimates the value of selected wildlife-related activities attributable to CRP to be in excess of $700 million per year.

Recommendations for Achieving Desired Wildlife Outcomes

If fish and wildlife are to take their place beside soil and water quality as co-equal resources and desired products from CRP lands, four factors need to be addressed:

1. Identify expected wildlife outcomes. Rather than the number of bushels to the acre of a commodity crop produced, it is necessary to define desired response of wildlife to habitat that can be produced during a 10- or 15-year CRP contract. This can be addressed at the national, regional, state, and local levels through the Environmental Benefits Index (EBI), the Natural Resources Conservation Service (NRCS) Field Office Technical Guide, conservation plans, and contract terms and conditions. At the national level, the EBI can be used to target retention and enrollment of important wildlife habitat. Regional planning documents such as the Northern Bobwhite Conservation Initiative can assist identification of desired wildlife outcomes at the regional level. The state agency with fish and wildlife management authority and responsibility should play a major role in identification of desired wildlife outcomes at the state level. Identifying expected outcomes at all levels will help focus limited resources, define administrative and technological obstacles, determine what changes in rule or policy may be necessary, and help to discover what research is needed.

2. Provide management flexibility to produce the desired wildlife habitat throughout the contract period. A one-size-fits-all management approach will not produce the desired outcomes for wildlife habitat or wildlife species across the country. Practices intended to improve the ecological benefits of the CRP, such as managed haying and grazing, must be implemented in a manner that considers regional needs for disturbance based on climate, growing season length, and other environmental variables. Leaving CRP acres undisturbed in the Northern Great Plains may be appropriate, while disturbance every few years may be necessary in the Southeast and parts of the Midwest. Mid-contract management practices will be key to maintaining productive wildlife habitat throughout the contract, but the type, frequency, and intensity of management will vary on a regional basis.

3. Recognition by USDA of state and federal agencies with fish and wildlife management responsibilities as full resource management partners. This recognition is essential to successful implementation of the first two recommendations (i.e., identification of expected wildlife outcomes and management flexibility). When developing program rules and policy designed to conserve and improve wildlife resources, it makes sense to enlist the expertise of wildlife professionals in agencies with the legal mandate for managing the resource as well as the research base on which to make habitat related recommendations. In most cases this means deferring to the wildlife experts when decisions need to be based on biology (i.e., nesting and brood rearing season dates and determining vegetative covers best suited for wildlife in the area).

4. Provide a feedback mechanism to identify what works and what does not work. Adaptive management will play a critical role in managing CRP for desired wildlife outcomes. Resources must be dedicated to monitoring and evaluation so that we can build on the successes and learn from mistakes. It will also be important to detail program performance for Congress if future support for the CRP is expected.

Summary and Conclusions

Making wildlife a co-equal purpose of CRP in statute carries a responsibility to implement the program consistent with Congressional intent and provides an opportunity to produce wildlife benefits on 39.2 million acres (16 million ha) across the country. To make the most of the opportunity, CRP lands should be viewed as working lands that can be managed to produce wildlife and other socially important environmental benefits on every acre. To achieve desired wildlife outcomes from CRP, it will be important to:

- Involve state fish and wildlife agencies throughout CRP policy making, program development, implementation, and evaluation processes.

- Make wildlife co-equal in implementation of NRCS practice standards and guidelines by integrating wildlife as a resource criteria applicable to all purposes. Currently, wildlife practice standards require protection of soil and water resources, but soil and water practice standards do not require protection of wildlife habitat (i.e., a filter strip is not required to be wildlife friendly). It should be mandatory that CRP practices are only implemented if consistent with NRCS practice standards.

- Dedicate technical assistance funding for program monitoring and evaluation, including quantification of wildlife benefits. Provide additional incentives for producers to actively participate in program assessment and evaluation similar to provisions in the Conservation Security Program.

- Reverse the conservative approach toward program enrollment and aggressively sign up acres in both general and continuous CRP. The program can achieve its conservation purposes only to the extent acres authorized by Congress are enrolled.
- Ensure the public is receiving resource benefits expected through compliance efforts.
- Provide necessary management flexibility to ensure wildlife benefits accrue throughout the contract period.

References Cited

U.S. Department of Agriculture, Economic Research Service, 2004, The Conservation Reserve Program: Economic and Social Impacts on Rural Counties: ERS report to Congress, Washington, DC, 143 p.

U.S. Department of Interior and U.S. Department of Commerce, U.S. Census Bureau, 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 116 p.

Refining Conservation Reserve Program Management to Meet Regional Objectives: Evaluation of Limited Grazing on Succession and Stability of Conservation Reserve Program Grasslands in Shortgrass Steppe of Eastern Colorado

By Daniel G. Milchunas[1], Mark W. Vandever[2], Fritz L. Knopf[2], and Arthur W. Allen[2]

Introduction

Under authority of the Conservation Reserve Program (CRP) the U.S. Department of Agriculture (USDA) has successfully established more than 25 million acres (10 million ha) of grassland on environmentally sensitive croplands retired from production. The agency has recognized the need for periodic disturbance (e.g., fire, disking) or limited managed use (i.e., grazing, haying) of some CRP grasslands to meet local or regional wildlife and environmental management objectives (USDA, 2004). Much remains unknown, however, about how to restore and maintain biodiversity and integrity of wildlife habitats associated with Great Plains ecosystems (Samson and others, 2004). Unlike the wealth of knowledge related to restoration of tallgrass prairies, there is virtually no ecological literature or institutional knowledge detailing how to restore the blue grama/buffalograss (*Bouteloua gracilis*/*Buchloe dactyloides*) grassland association characteristic of the shortgrass steppe region.

The shortgrass steppe (108,000+ mi^2, 279,719 km^2) reaches from Colorado's northeastern border with Wyoming south to extreme eastern New Mexico and across the western half of the Texas Panhandle (Laurenroth and Milchunas, 1991). Regional natural vegetation has a long history of grazing by pre-Pleistocene fauna. Prior to settlement by European immigrants, the region's vegetative associations continued to evolve for 10,000 years with grazing by large herds of bison (*Bison bison*) and pronghorn antelope (*Antilocapra americana*) (Milchunas and others, 1988). Potential natural vegetation on most sites across the shortgrass steppe is dominated by the short grasses blue grama and buffalograss. Approximately 40% of the region is cropland, with winter wheat (*Triticum* spp.) the dominant crop produced (Laurenroth and Milchunas, 1991). In southern reaches of the region, cotton (*Gossypium* spp.) is a primary agricultural product. In the absence of seeding and management, it is estimated it may take 40 to 50 years for natural succession to reestablish biological and physical characteristics of the blue grama/buffalograss vegetation association on abandoned cropland in this region (Burke and others, 1995).

Nationwide, the wildlife benefits of the CRP have been relatively well documented (Heard and others, 2000), as have beneficial aspects of the CRP related to wildlife within the shortgrass region of the Great Plains (Bertherlsen and Smith, 1995; Wachob, 1997). In northeastern Colorado, establishment of the CRP has facilitated expansion of sharp-tailed grouse (*Tympanuchus phasianellus jamesi*) southward from Nebraska and Wyoming as well as recovery of greater prairie chicken (*T. cupido*) populations in east central portions of the state. Across the shortgrass region from Colorado to Texas, CRP grasslands furnish nesting, escape, and winter cover for ring-necked pheasants (*Phasianus colchicus*) where agricultural production remains interspersed with lands enrolled in the program. In more southern portions of the region, CRP grasslands furnish habitat for northern bobwhite (*Colinus virginianus*) and scaled quail (*Callipepla squamata*).

Introduction of mid- and tall-grasses under the CRP into shortgrass ecosystems, however, has raised concerns about detrimental affects on shortgrass-associated wildlife species (McIntyre, 2003; McIntyre and Thompson, 2003). While some investigations voice concern but show no unfavorable effects as a consequence of establishing taller native grasses in shortgrass regions (Howard and others, 2001) a Texas investigation concludes CRP grasslands dominated by introduced species (e.g., old world bluestem, *Bothriochloa ischaemum*) have contributed to habitat loss for swift fox (*Vulpes velox*), a species potentially threatened and of special concern (Kamler and others, 2003). Samson and others (2004) conclude grasses established under the CRP in the shortgrass steppe have contributed to a decline in habitat availability and quality for endemic wildlife due to excessive height of vegetation and fragmentation of shortgrass dominated landscapes. Milchunas and others (1998) provide evidence that endemic shortgrass birds avoid nesting in non-grazed or lightly grazed native short grasses, preferring more moderately to heavily grazed habitat physiognomy.

Native mid- and tall-grass species established under the CRP in the shortgrass steppe have contributed to control of soil erosion, but there is concern these grasses are poorly adapted to regional environmental conditions where continued drought or wildfire may result in their eventual elimination. In

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contrast, native shortgrasses are well adapted to both drought and grazing (Lauenroth and others, 1987; Milchunas and others, 1988). The instability of communities with relatively greater aboveground allocation in this environment has been demonstrated for other types of disturbances (Milchunas and Lauenroth, 1995). Over the long term, this may be an issue of greater importance than are negative effects on wildlife habitat.

Properly managed grazing appears to be one option for restoration of desired vegetative conditions in Great Plains grasslands (Milchunas and others, 1988, 1998; Truett, 2003). Laurenroth and Milchunas (1991) concluded recovery and stability of grassland vegetation on abandoned croplands in the shortgrass steppe may ultimately depend on reestablishment of the blue grama/buffalograss association; the most grazing and drought resistant species on the shortgrass steppe. In established native shortgrass steppe, in particular, grazing favors reduction of taller grasses in favor of the indigenous blue grama/buffalograss association (Milchunas and others, 1988, 1989). Grazing of shortgrass steppe has been shown to reduce abundance of exotic and native weed species compared to ungrazed treatments (fig. 1; Milchunas and others, 1989, 1992). Similar to the role of fire in some plant communities, grazing by large herbivores is an integral component of this system that maintains the biodiversity of both endemic plants and animals. Grazing by cattle is a surrogate to grazing by bison much as prescribed burning is for natural fire (Milchunas and others, 1998).

Ninety percent of plant biomass in native, late successional shortgrass steppe is belowground (Milchunas and Lauenroth, 1992, 2001). Only very heavy grazing has small negative effects on root biomass and soil carbon, with moderate grazing showing no effects on total pools (Milchunas and Lauenroth, 1989; Milchunas and others, 1998). However, greater belowground allocation of biomass in perennial grasses compared with annual, invasive forbs (Schenk and Jackson, 2002) has implications for soil organic matter contents and carbon sequestration if grazing can shift plant community composition of newly established, early seral stage communities from high proportions of annual invasive species towards greater proportions of perennial grasses and perennial shortgrasses having greater root:shoot ratios (Reeder and others, 2000). In a mixed-grass prairie in Canada, Christian and Wilson (1999) found greater shoot mass in fields planted to the tall, bunchgrass crested wheatgrass (*Agropyron cristatum*) than in successional or native prairie, but much lower root:shoot ratios and lower soil carbon and nitrogen because of the low root mass and lower inputs to soil of the introduced species.

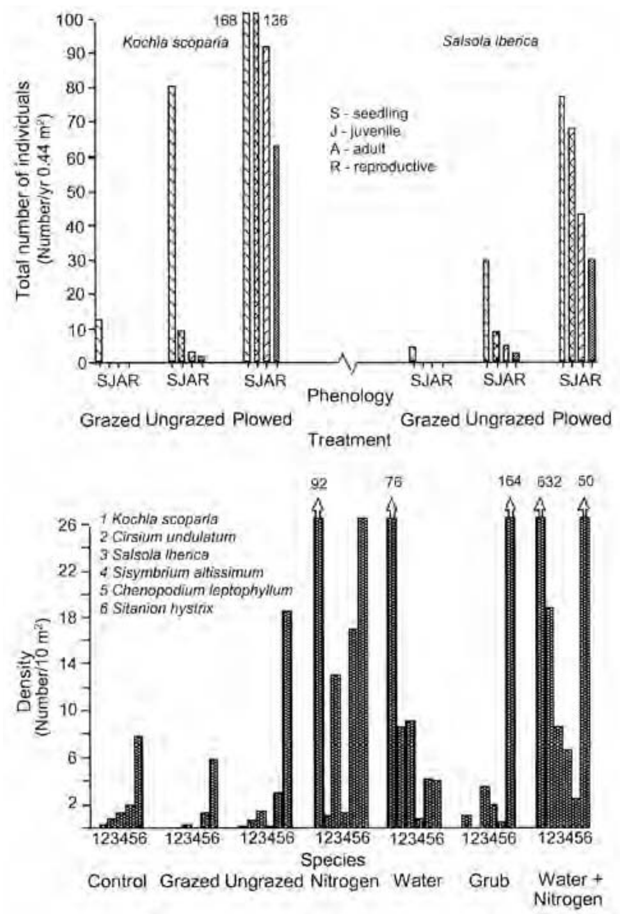


Figure 1. Abundance of early seral 'weed' species in dissimilar shortgrass steppe plant communities. Heavily grazed and ungrazed treatments were established in 1939. Plowed treatment was simulated by blading native plots and hoeing to create a soil disturbance. Plots in these three treatments had seeds of exotic weeds sown into them and their phenological development tracked (data from Milchunas and others, 1992). Water and nutrient treatments were applied in excess, as a stress treatment, and the grub treatment was after an outbreak of white-grubs, which killed perennial grasses on the plots (Milchunas and others, 1990). Note late seral stage grazed shortgrass steppe plant communities have fewer weed species than ungrazed grassland. Communities with high productivity (nutrient additions) shade out shortgrasses and have large increases in weed populations (Milchunas and Lauenroth, 1995).

Evaluation of Controlled Grazing as a Method to Restore Cropland to Shortgrass Ecosystems

Application of concepts described above to reclamation specific to CRP plantings in shortgrass steppe has not been tested. With permission and funding support from the USDA's Farm Service Agency (FSA), an experiment has been designed to assess the potential of managing CRP grassland covers currently being planted to favor establishment of vegetation structure and composition more characteristic of the shortgrass steppe. The purpose of this investigation is to determine if limited grazing of grasses established under the CRP will favor a greater presence of blue grama, speed succession, as well as provide structural characteristics more complimentary to the needs of wildlife species associated with the shortgrass steppe region in northeast Colorado.

Specific Hypotheses

Based on the data from the literature, we pose three specific hypotheses to test during the shortgrass steppe CRP grazing study:

H1: Grazing of the CRP will speed succession towards native shortgrass steppe by reducing abundance of opportunistic ruderal weed species and tall grasses and promote short grasses by preventing over shading and through dietary selection of the less grazing tolerant weedy forbs and tall grasses.

H2: Grazing of the CRP will result in a shift in biomass from relatively greater proportions aboveground to relatively greater proportions belowground.

H3: Grazing of the CRP will sequester greater amounts of carbon in soil organic matter because of the greater belowground inputs from roots.

Methods

A Weld County, Colorado farm operator has agreed to allow 320 acres (129 ha) newly enrolled in the CRP (signup 26) to be used for assessment of limited, controlled grazing on shortgrass steppe CRP. Planting in December 2003 was to the following mixture and composition: western wheatgrass (*Pascopyrum smithii*) 30%; sideoats grama (*B. curtipendula*) 20%; blue grama 20%; green needlegrass (*Stipa viridula*)10%; switchgrass (*Panicum virgatum*) 10%; and purple prairie clover (*Dalea purpurea*)10%.

Baseline data were collected during the summer of 2004 on plant community composition, standing biomass, roots, and soils. Grazing will be initiated once the stand is sufficiently established to support grazing pressure. Currently, drought has hindered establishment of the seeded species, and vegetation within the CRP field is primarily composed of kochia (*Kochia scoparia*) and Russian thistle (*Salsola iberica*). The basic experimental design included three replicates in the CRP planting and three adjacent native grazed shortgrass steppe. The CRP was stratified by previous year stubble and fallow, where each replicate occupied half of each field. There appeared to be differences between the two fields in litter cover, and possibly in species composition of weeds established the first year and root biomass remaining from cropping. It is anticipated these initial differences will become insignificant with time, and with eventual emergence of the seeded species. The CRP area will eventually have replicated grazed and ungrazed treatments when exclosures are constructed and grazing is initiated. Vegetative and physical characteristics of control and grazed replicates will be compared to the adjacent grazed native sites.

Daubenmire quadrats (Daubenmire, 1959) were sampled for both canopy and basal cover by species. Both canopy and basal cover were estimated because canopy cover can be high in an annual weed community, but basal cover can be low, and vice versa in native shortgrass. The crown basal cover is important in holding soil during periods of erosion. We expect grazing to produce a shift from one to the other [lower the canopy, but increase spread of basal cover, see Milchunas and Lauenroth (1989)], as well as affect species composition trajectory towards the native community as compared using a similarity index (Whitaker's Index). When grazing is initiated, sample bite counts by species in belt transects to assess grazer selectivity will be evaluated (Rebollo and others, 2002). These combined measurements will address hypothesis 1.

Movable cages will be used to estimate production on both grazed treatments and clip-grazed treatments to estimate utilization by difference. Clipping of ungrazed CRP will provide productivity estimates as well. Baseline data was collected only for the ungrazed CRP and the grazed native sites, because the other treatments are yet to be imposed. Additionally for baseline, large cores were sampled [(2.6 inches ID x 14 inches deep) 66.5 mm ID x 35 cm deep] for root biomass. Soil is sub-sampled before floating roots out using methods in Milchunas and Lauenroth (1992, 2001). Subsamples of ground root material will be muffle-furnaced for ash correction to organic matter basis. The frequency of additional sampling will depend on funding, but at least end-of-study sampling will be necessary. These measurements will address hypothesis 2.

Total C and N analyses will be done on root, soil, and aboveground plant material. Soil texture analysis may also be done. A later option would be to install root ingrowth donuts for estimates of root production rather than just biomass. Soil will be archived for possible future carbon fractionation analyses. The frequency of additional sampling will depend on funding, but at least end-of-study sampling will be necessary. These measurements will address hypothesis 3.

Once initiated, grazing intensities will be light to moderate based on Bement (1969) and Ashby and others (1993), which leaves 400–500 lbs/ac (448–560 kg/ha) of standing residual at the end of the grazing season. For now, grazing intensity will be left as a range because we will also be adaptive and opportunistic to meet the objective of not allowing weeds or tall grasses to develop a canopy sufficient to shade out late seral stage shortgrass steppe species, when they appear. Grazing will be managed to reach that objective. Timing will also be adaptive, depending on vegetation species composition as it develops.

Conclusion

Recognition by the FSA of the need to refine long-term management of CRP vegetation covers to meet regional environmental objectives represents vital progress in USDA conservation policies. Because of the time required to establish vegetative cover capable of supporting grazing and resultant changes in vegetation species composition over time, we do not expect answers to effectiveness of limited grazing of CRP lands in the shortgrass steppe region to come quickly. We also recognize that, depending upon local priorities and adjacent or surrounding land use, grazing of CRP grasslands may not be an appropriate management option across all areas of the shortgrass steppe.

Effects of conservation polices can take years to materialize, potentially having both positive and negative effects on various wildlife species or environmental conditions. Consequently, conservation policies should be viewed as needing persistent revision and refinement (Heimlich and others, 1998; Costanza and others, 2000). However, the lack of long-term ecological research in agricultural ecosystems represents a severe constraint in policy refinement and enhancement of management practices on landscape scales (Santelmann and others, 2004). Meaningful evaluation will require quantitative definitions of relations between wildlife habitats in agriculturally dominated landscapes and ways to characterize associations between habitats for key indicator species and landscape characteristics. Collection of such data is a time consuming process, requiring long-term commitment of funding addressing not only how environmental conditions change but also how well alternatives meet the expectations and needs of the landowners directly involved in policy implementation.

References Cited

Ashby, M.M., Hart, R.H., and Forewood, J.R., 1993, Plant community and cattle responses to fifty years of grazing on shortgrass steppe: USDA-Agricultural Research Service, Rangeland Resources Research Unit, RRRU-1, Fort Collins, Colorado, 14 p.

Bement, R.E., 1969, A stocking-rate guide for beef production on blue-grama range: Journal of Range Management, v. 22, no. 2, p. 83–86.

Bertherlsen, P.S., and Smith, L.M., 1995, Nongame bird nesting on CRP land in the Texas southern high plains: Journal of Soil and Water Conservation, v. 50, no. 6, p. 672–675.

Burke, I.C., Laurenroth, W.K., and Coffin, D.P., 1995, Soil organic matter recovery in semiarid grasslands: Implication for the Conservation Reserve Program: Ecological Applications, v. 5, no. 3, p. 793–801.

Christian, J.M., and Wilson, S.D., 1999, Long-term ecosystem impacts of an introduced grass in the northern Great Plains: Ecology, v. 80, no. 7, p. 2397–2407.

Costanza, R., Daly, H., Folke, C., Hawken, P., Holling, C.S., McMichael, A.J.D., Pimentel, D., and Rapport, D., 2000, Managing our environmental portfolio: Bioscience, v. 50, no. 2, p. 149–155.

Daubenmire, R., 1959, A canopy coverage method of vegetation analysis: Northwest Science, v. 33, p. 43–46.

Heard, L.P., Allen, A.W., Best, L.B., Brady, S.J., Burger, W., Lesser, A.J., Hackett, E., Johnson, D.H., Pederson, R.L., Reynolds, R.E., Rewa, C., Ryan, M.R., Molleur, R.T., and Buck, P., 2000, A comprehensive review of Farm Bill contributions to wildlife conservation, 1985–2000: U.S. Department of Agriculture, Natural Resources Conservation Service, Wildlife Habitat Management Institute, Technical Report, USDA/NRCS/WMI-2000, 208 p.

Heimlich, R.E., Wiebe, K.D., Claassen, R., Gadsby, D., and House, R.M., 1998, Wetlands and agriculture, private interests and public benefits: U.S. Department of Agriculture, Economic Research Service, Washington, D.C. Agricultural Economic Report, no 765, 94 p.

Howard, M.N., Skagen, S.K., and Kennedy, P.L., 2001, Does habitat fragmentation influence nest predation in the shortgrass prairie?: The Condor, v. 103, no. 3, p. 530–536.

Kamler, J.F., Ballard, W.B., Fish, E.B., Lemons, P.R., Mote, K., and Perchellet, C.C., 2003, Habitat use, home ranges, and survival of swift foxes in a fragmented landscape: conservation implications: Journal of Mammalogy, v. 84, no. 3, p. 989–995.

Lauenroth, W.K., and Milchunas, D.G., 1991, Shortgrass steppe, *in* Coupland, R.T., ed., Ecosystems of the World 8A. Natural Grasslands: Introduction and Western Hemisphere: New York, Elsevier Press, p. 183–226.

Lauenroth, W.K., Sala, O.E., Milchunas, D.G., and Lathrop, R.W., 1987, Root dynamics of *Bouteloua gracilis* during short-term recovery from drought: Functional Ecology, v. 1, no. 2, p. 117–124.

Milchunas, D.G., and Laurenroth, W.K., 1989, Three-dimensional distribution of plant biomass in relation to grazing and topography in the shortgrass steppe: Oikos, v. 55, no. 1, p. 82–86.

Milchunas, D.G., and Lauenroth, W.K., 1992, Carbon dynamics and estimates of primary production by harvest, C^{14} dilution, and C^{14} turnover: Ecology, v. 73, no. 2, p. 593–607.

Milchunas, D.G., and Lauenroth, W.K., 1995, Inertia in plant community structure: state changes after cessation of nutrient enrichment stress: Ecological Applications, v. 5, no. 2, p. 452–458.

Milchunas, D.G., and Lauenroth, W.K., 2001, Belowground primary production by carbon isotope decay and long-term root biomass dynamics: Ecosystems, v. 4, no. 2, p. 139–150.

Milchunas, D.G., Lauenroth, W.K., and Burke, I.C., 1998, Livestock grazing: animal and plant biodiversity of shortgrass steppe and the relationship to ecosystem function: Oikos, v. 83, no. 1, p. 65–74.

Milchunas, D.G., Lauenroth, W.K., and Chapman, P.L., 1992, Plant competition, abiotic, and long- and short-term effects of large herbivores on demography of opportunistic species in a semiarid grassland: Oecologia, v. 92, no. 4, p. 520–531.

Milchunas, D.G., Lauenroth, W.K., Chapman, P.L., and Kazempour, M.K., 1989, Effects of grazing, topography, and precipitation on the structure of a semiarid grassland: Vegetatio, v. 80, no. 1, p. 11–23.

Milchunas, D.G., Lauenroth, W.K., Chapman, P.L., and Kazempour, M.K., 1990, Community attributes along a perturbation gradient in a shortgrass steppe: Journal of Vegetation Science, v. 1, no. 3, p. 375–384.

Milchunas, D.G., Sala, O.E., and Lauenroth, W.K., 1988, A generalized model of the effects of grazing by large herbivores on grassland community structure: American Naturalist, v. 132, no. 1, p. 87–106.

McIntyre, N.E., 2003, Effects of Conservation Reserve Program seeding regime on harvester ants (*Pogonomyrmex*), with implications for the threatened Texas horned lizard (*Phrynosoma cornutum*): The Southwest Naturalist, v. 48, no. 2, p. 274–277.

McIntyre, N.E., and Thompson, T.R., 2003, A comparison of Conservation Reserve Program habitat plantings with respect to arthropod prey for grassland birds: American Midland Naturalist, v. 150, no. 2, p. 291–301.

Rebollo, S., Milchunas, D.G., Noy-Meir, I., and Chapman, P.L., 2002, The role of a spiny plant refuge in structuring grazed shortgrass steppe plant communities: Oikos, v. 98, no 1, p. 53–64.

Reeder, J.D., Franks, C.D., and Milchunas, D.G., 2000, Root biomass and microbial processes, chap. 6, *in* Follett, R.F., Kimble, J.M., and Lal, R., eds., The potential of U.S. grazing lands to sequester carbon and mitigate the greenhouse effect: Boca Raton, Florida, Lewis Publishers, p. 139–166.

Samson, F.B., Knopf, F.L., and Ostlie, W.R., 2004, Great Plains ecosystems: Past, present, and future: Wildlife Society Bulletin, v. 32, no. 1, p. 6–15.

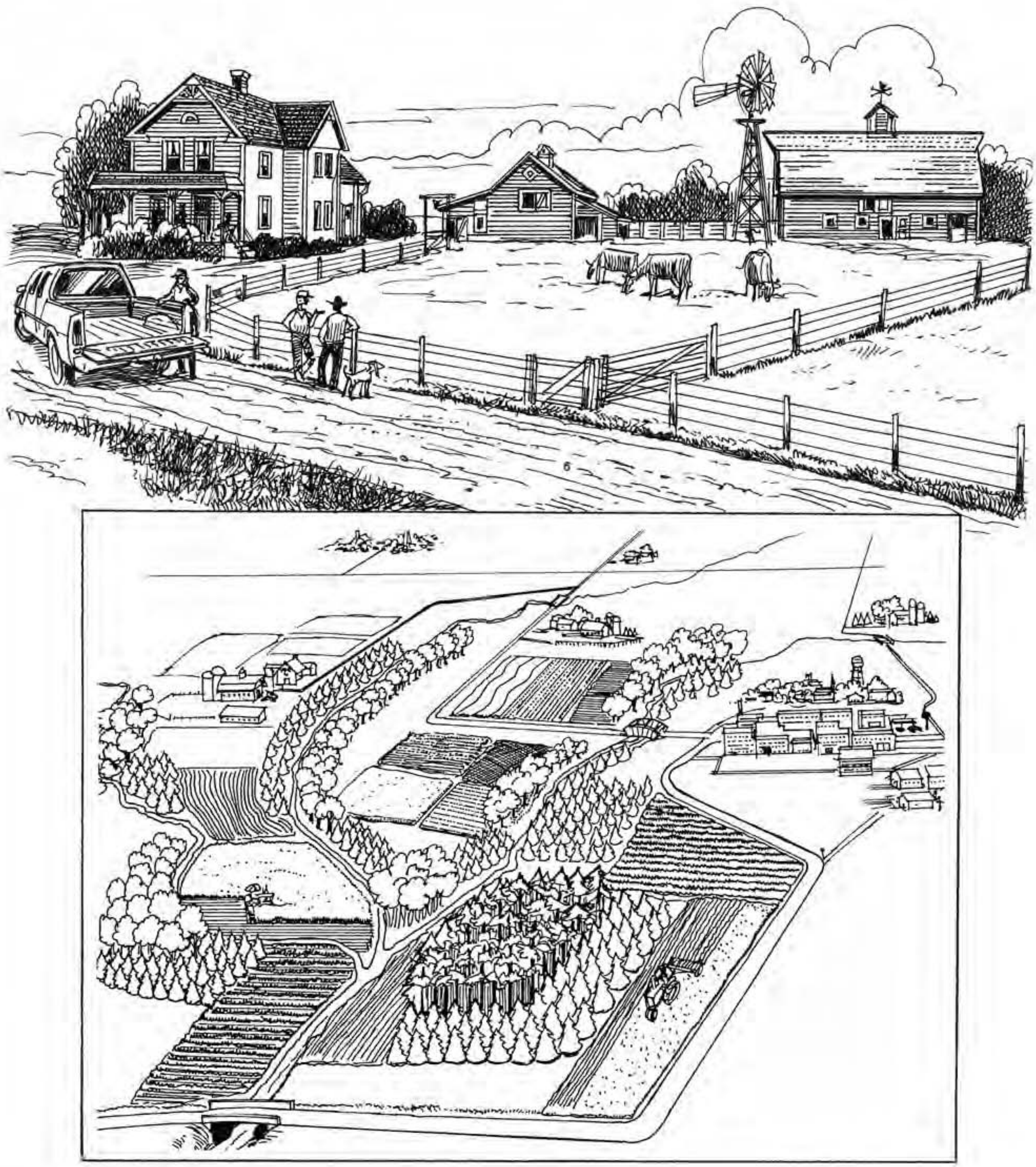
Santelmann, M.V., White, D., Freemark, K., Nassauer, J.I., Eilers, J.M., Vache, K.B., Danielson, B.J., Corry, R.C., Clark, M.E., Polasky, S., Cruse, R.M., Sifneos, J., Rustigian, H., Coiner, C., Wu, J., and Debinski, D., 2004, Assessing alternative futures for agriculture in Iowa: Landscape Ecology, v. 19, no. 4, p. 357–374.

Schenk, H.J., and Jackson, R.B., 2002, Rooting depths, lateral root spreads and below-ground and above-ground allometries of plants in water-limited ecosystems: Journal of Ecology, v. 90, no. 3, p. 480–494.

Truett, J.C., 2003, Migrations of grassland communities and grazing philosophies in the Great Plains: A review and implications for management: Great Plains Research, v. 13, no. 2, p. 3–26.

U.S. Department of Agriculture (USDA), 2004, 2002 Farm Bill–Conservation Reserve Program long-term policy; Interim rule: Farm Service Agency, Commodity Credit Corporation: Federal Register, v. 68, no. 89, p. 24830–24845.

Wachob, D.G., 1997, The effects of the Conservation Reserve Program on wildlife in southeastern Wyoming: University of Wyoming, Laramie, Ph.D. dissertation, 123 p.



Session VI. Water Quality—What You Do and Where You Do It Matters

Water Quality–What You Do and Where You Do It Matters

Moderators: Clay Ogg[1] and Marc Ribaudo[2]

Water quality has become one of the major goals of the Conservation Reserve Program (CRP). Enrolling land with high benefits to water quality is being encouraged in the regular sign-ups through the Environmental Benefits Index (EBI), while the Conservation Reserve Enhancement Program (CREP) and continuous signups often rely on vegetative buffers. A valid question is whether more can be done to identify land with the highest potential for generating water quality benefits if enrolled in the CRP.

The following papers describe research that might be used to further enhance water quality benefits from the CRP. Land differs widely in its ability to provide water quality benefits. Factors such as location in relation to water courses, spatial relations to other fields, and on-field water management practices such as tile drainage can affect potential benefits from retiring land from crop production or creating vegetative buffers. Identifying those watershed- or field-level factors important for water quality protection could lead to better targeting of CRP enrollments through a modified EBI or other means.

Of particular interest are the experiences of Conservation Reserve Enhancement Programs (CREP). The CREP's focus on important watersheds, stream buffers, and other powerful tools to reduce pollution problems and enhance environmental quality across ecosystems. A major theme of this conference is measuring performance. Both the CREP and state water quality programs require setting goals and measuring performance. As noted in earlier sessions, performance measurement plays a key role for administrators by indicating what approaches are successful and need more support, as well as indicating where corrections may be needed to improve performance. Performance measurement also allows recognition to be given when farmers are successful in achieving environmental goals. Recognition of accomplishments may provide an important incentive for others to participate in ongoing and future programs.

Because performance measurement plays such a critical role in CREP design as well as in state water quality programs, this session draws from the experience of the New York CREP and other approaches that include strong performance measurement initiatives. By demonstrating approaches to federal/state collaboration in carrying out watershed programs and by showing we can measure progress of these watershed programs, this session hopefully will support others who are attempting to design and implement successful performance-based watershed programs.

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Protecting New York City's Water Supply with the Conservation Reserve Enhancement Program

By Gary L. Lamont[1]

New York City's (NYC) water supply is the largest, unfiltered, surface storage and supply system in the world, covering over a 1.2 million acre (0.5 million ha) watershed in upstate New York. Approximately 8 million residents of NYC and an additional 1 million residents of upstate counties use this watershed as their primary source of drinking water. Three reservoir systems: the Croton, Delaware, and Catskill, collect and transport water to NYC, with the Catskill and Delaware systems providing 90% of the supply.

In the late 1980's, Surface Water Treatment Rules of the Safe Drinking Water Act stipulated unfiltered water supplies coming from surface water sources must meet new federal and state clean, raw water standards or must be filtered. Pollutants, *Cryptosporidium parvum* and *Giardia* are the primary concerns being addressed by these regulations. As evidenced by Milwaukee, Wisconsin's public health catastrophe several years ago, presence of these pathogens in drinking water can cause severe intestinal disorders and even death in individuals with weakened immune systems. Phosphorus entering reservoirs was another issue identified as needing attention. Chlorinating a water supply having an algae problem resulting from phosphorus loading produces carcinogenic by-products. Consequently, NYC was unable to fully utilize the Cannonsville Reservoir when algae blooms are prevalent. Reducing the phosphorus input within NYCs watershed became essential.

Five to 8 billion dollars is the estimated cost to build a system large enough to filter over 1.2 billion gallons (>3,786,000 kiloliters) of water daily. Annual operating costs alone have been calculated between \$200 and \$500 million. Standing on the provision of NYC health laws, which give purveyors of water coming from surface sources the right to initiate rules and regulations in the watershed supplying their needs, NYC decided to update and toughen their 1953 rules in hopes of avoiding these filtration costs.

New York City's Department of Environmental Protection issued a draft of their new regulations in 1990. Agriculture would be heavily impacted by these new rules since it represents a high percentage of the land use in the watershed. Livestock are believed to be a significant source of the two pathogens and phosphorus. For example, farms in the watershed would be required to eliminate surface runoff from grazing areas, barnyards, and feedlots, an impractical if not impossible expectation on most farms. Understandably, these new rules evoked disbelief and outrage from farm operators within the affected area. Painstaking negotiations of an Ad Hoc Task Force persuaded NYC to recognize agriculture as the preferred land use and to agree to pay 100% of costs to implement conservation practices recommended in Whole Farm Plans (WFP) currently being prepared for farms in the watershed.

The Watershed Agricultural Council (WAC) is a locally-led, voluntary, non-profit organization of 19 farmers, agribusinesses, and NYC's Department of Environmental Protection, formed as a result of the Ad Hoc Task Force's efforts. Presently the WAC is experiencing a positive response to the program from a significant percent of the farming community signing on to work with planning teams developing the WFP. The Watershed Agricultural Program (WAP) is the largest program administered by the WAC. New York City has been financing this program with over \$83 million committed to pay for administration of the program, developing WFP's and implementing the recommended practices on farms.

The thriving partnership between various groups and agencies has been a major reason for the success achieved by the WAP. The WAC contracts with several primary agencies; Cornell Cooperative Extension (CCE), various Soil and Water Conservation Districts (SWCD), and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). In addition to these agencies, many other local, state, and federal agencies support and advise the WAC on policy and program direction.

One of the initial goals agreed to by the Environmental Protection Agency and NYC in order to avoid construction of the multi-billion dollar filtration plant, was to achieve an 85% participation rate of farmers in the watershed program. That goal was achieved easily. In fact, approximately 95% of farmers in the watershed are now enrolled in the WAP.

In order to maintain consistency in planning, the concept of developing WFP's was adopted to identify and resolve potential pollution issues on farms. Through partner collaboration, an Environmental Review and Problem Diagnosis tool (ER/PD) was developed. Eleven pollutant categories having negative water quality impacts were identified, with pathogens and phosphorus being the highest priority.

Underlying this is the fundamental concept of addressing potential pollution through a multiple barrier approach; source, field, and stream edge. Addressing pollutants at their source allows development of alternatives that will control the problem at that location. For example, it is possible to control

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pollutant laden runoff from barnyards by preventing outside water from entering the area and treating runoff resulting from rain falling directly on the barnyard. The field barrier addresses pollutants coming from soil erosion and nutrient runoff through use of cover crops, installing strip cropping, etc. The last barrier, stream edge, attempts to control pollutants still remaining just prior to entering a waterbody.

During the early years of the WAP, great progress was made in the first two barriers. Conditions within barnyards were improved and runoff entering barnyards was eliminated or significantly reduced. Nutrient management plans have been developed for proper distribution of nutrients, strip cropping, cover crops and changing crop rotations. All have contributed to reducing polluted runoff at the field level.

There was difficulty, however, in achieving positive results at the stream edge barrier. A primary reason was that an early proposal by NYC in draft regulations was exclusion of livestock from all watercourses in the watershed. The possibility of cattle exclusion with no accommodation for livestock watering needs certainly did not make farmers receptive to this alternative.

To accomplish the workload undertaken, three teams of resource conservationists from NRCS, educators from Cooperative Extension, and technicians from SWCD's developed WFP's with input and concurrence of the farmer, the most important team member. Once Best Management Plans (BMP's) are chosen from various alternatives, the team designs and implements selected practices. Due to the complex nature of many BMP's, technical support is provided by two NRCS engineers and a WAC engineering staff to work on practices for which there are no NRCS standards.

To date, approximately 240 WFP's are being implemented in the watershed resulting in nearly $2.4 million worth of BMP's installed annually. The vast majority of practices installed are typical NRCS practices, barnyard improvements, manure storage structures, milk house waste treatment, etc. It is important to keep in mind all of these practices are funded through money provided by NYC; there is no cost to the farmer. Essential items that will ensure long-term success of this program are the behavioral changes that can be achieved in adoption of nutrient management plans, improved forage management, 'precision feeding' to reduce importation of phosphorous in feed rations, and continual operation and maintenance of structural practices.

The WAP has been very active recently in accelerating planning and implementation on small farms, those with less than $10,000 gross income, in the watershed; approximately 20 farms are now participating in the program. Farms in the East of the Hudson watershed are also being addressed now that the WAP is proceeding with planning and implementation of WFP's in those counties.

Not long after information was released about the Maryland Conservation Reserve Enhancement Program (CREP), administered by the USDA's Farm Service Agency (FSA), the potential benefits that CREP could provide in dealing with the third barrier, stream edge, were seen. That foresight was correct. In late 1998, with a great amount of help from the FSA, locally as well as from the national office, the NYC Watershed CREP was authorized. Although acceptance was slow at first, the program quickly became adopted by the farmers and its implementation began to flourish.

The original NYC Watershed CREP included allocation of 3,000 acres (1,214 ha) of highly erodible land (HEL) to be treated and installation of 2,000 acres (809 ha) of riparian forest buffers. After several years, it became apparent that although there was an abundance of HEL in the watershed, it was not realistic to have 3,000 acres of HEL enrolled due to the lack of sufficient agricultural land and perceived operational barriers by the farmers. In 2001, permission was granted to allocate the entire 5,000 acres (2,023 ha) to riparian forest buffers and filter strips.

Prior to institution of signing incentive payments (SIP) and practice incentive payments (PIP), even riparian forest buffers were often difficult to sell to local operators. The idea of excluding cattle from streams (often the primary water source) was not always looked upon favorably.

Through a vigorous education effort and word-of-mouth testimonials, more farmers realized enrollment in the NYC Watershed CREP could be financially beneficial for their operation while at the same time satisfying the water quality needs of NYC. When the SIP and PIP became available interest in the program soared. A unique feature of the NYC Watershed CREP is that while FSA pays the contracted rental fee, the SIP, PIP and 50% of the BMP costs, NYC funds pay the other 50% of implementation costs resulting in no financial obligation to the farmer.

Today 1,750 acres (708 ha) are planned or contracted for 127 participants. This equates to approximately 375 miles (604 km) of stream corridors being planted with trees or shrubs and having cattle excluded from sensitive waters through CREP. Establishment of the third barrier, the stream edge, is now successfully being achieved.

With the limited acreage of high quality agricultural land, one of the early concerns about CREP in the watershed was too much land would be lost from agriculture. It is interesting to note that in reality, approximately 72% of the land enrolled in CREP is on soil types in land capability classes III through VIII, the poorer soils.

Typical practices used in implementing CREP are: tree and shrub planting along the stream corridor; fencing installed to prevent cattle from having direct access to streams, alternative livestock watering facilities to mitigate the loss of stream access, stream crossings, and access roads.

There is no question that not only has CREP provided an important environmental benefit to New York City and the producer, it has had a positive financial impact for the farmer. For example, a sample 16.5 acres (6.7 ha) CREP project needing alternative water, fencing, and tree planting would result in total payments to a farmer of over $50,000 when contract rental payment and the incentive payments are combined. This economic bonus to the farmer is important to New York City as well. New York City residents have continued to identify agriculture as a preferred land-use in their water supply watershed as opposed to urban development. However, an even more significant impact of the CREP is the considerable benefit to NYCs water supply as shown by results from an ongoing research project conducted by USDA's Agricultural Research Service presented in the following attachment.

Attachment. Phosphorus Contributions from Pastured Dairy Herds to Streams and Factors Affecting Farmer Adoption of Exclusionary Best Management Plans in the Cannonsville Watershed, New York[1]

Introduction

High concentrations of phosphorus (P) in water bodies result in acceleration of the natural eutrophication process, leading to decreased water quality. In areas with intensive agriculture, dairy manure is a substantial source of phosphorus. Farmer choices dictate the content of feed rations, as well as how manure is spread across the landscape through herd and pasture management and decisions to adopt and implement best management practices. The objective of this study is two-fold: (1) to quantify P contributions to streams in the Cannonsville Watershed, New York from pastured dairy cattle; and (2) to identify factors that affect dairy farmer adoption or aversion to exclusionary best management practices [i.e., Conservation Reserve Enhancement Program (CREP), streambank fencing].

The study is composed of three phases. First, four representative pastured dairy herds were observed during spring and summer seasons to ascertain cow behavior and manure deposition patterns over the landscape. Second, the in-stream manure deposition trends observed were extrapolated to watershed scale using Geographic Information System (GIS) pasture data to provide a broad estimate of P deposited directly in streams annually from pastured dairy cattle. Using a subroutine of the Agricultural Research Services' Soil and Water Assessment Tool (SWAT) model, an estimate was derived for the proportion of P in manure deposited within 44 yards (40 m) of the stream that reaches streams during runoff events. Third, a survey will be distributed in the summer of 2004 to all dairy farmers in the Cannonsville Watershed to: (1) gain a better understanding of herd and pasture management strategies used in the watershed; (2) identify factors affecting farmer adoption, non-adoption, and de-adoption of exclusionary best management practices; and (3) provide insight on how these CREP and stream bank fencing initiatives may be more successful.

[1]Provided by and used with permission of Erin James, Penn State University and Peter Kleinman, U.S. Department of Agriculture-Agricultural Research Service

Methods

Phase 1 (Field Observations)

Four representative dairy herds were selected to provide a range of the following variables across the watershed: animal density in pasture (cows/acre), type of herd (heifer/dry cow or lactating cow), time spent in pasture, position and flow of stream, and location of cow amenities in field (shade, alternative water, feeders, salt, etc.). Each herd was observed for approximately four 4-hour periods, during which manure depositions and time spent within stream and near-stream areas [0–11 yards, 12–22 yards, 23–44 yards (0–10 m, 11–20 m, 21–40 m)] were recorded. Manure samples were collected, weighed, and analyzed for nutrient content.

Phase 2 (GIS Data and P Transport Modeling)

Approximately 90% of pastures and CREP zones (planned or contracted) within the Cannonsville Watershed were provided in spatial data form (see fig. 1). To provide an estimate of the order of magnitude of the annual P deposition directly in-stream from pastured cattle, simple calculations were run for every pasture with stream access. Total pasture acreage was calculated on each farm, and each pasture as a percentage of that farm's total pasture. Due to considerable variation between farms, seasons, and years in pasture routines, an assumption was made that herds spent a modest number of hours per year in pasture, and this time was spent evenly on each acre of pasture, regardless of proximity to streams or barns. Milking cows were assumed to spend 6 hours per day for 270 days a year in pasture and heifers and dry cows were assumed to spend 24 hours per day for 310 days a year in pasture. Total manure deposited in each pasture was calculated, assuming that all manure events occurring outside of 44 yards (40 m) from the stream were evenly spread across the field. From results of field observations, it was estimated that between 3% and 5% of total manure deposited in pastures with stream access is deposited directly in the stream, and between 9% and 12 % of total pasture manure was deposited within 11 yards (10 m) of the stream. The non-point source P model was used to estimate dissolved P in runoff from manure deposits within 40 m of streams that reached flowing water.

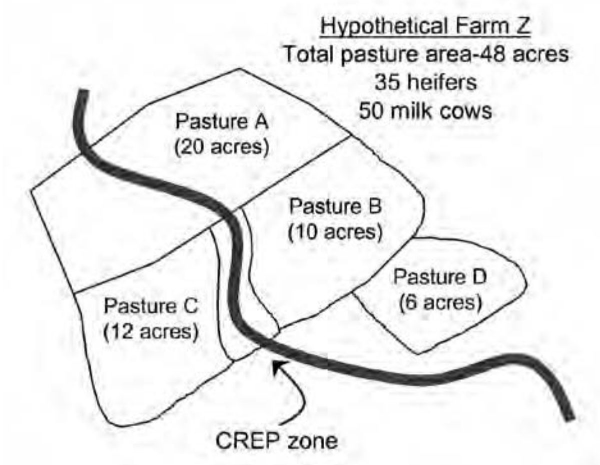

Figure 1. Example of available spatial data at farm-level scale.

To gain an understanding of the benefits derived from the CREP in the Cannonsville Watershed, a baseline scenario was created from available spatial data by assuming all areas currently in the CREP were pastures with stream access. Manure deposition was recalculated for these areas, using the same method discussed above.

Phase 3 (Survey Data Collection)

A survey will be distributed to all dairy farmers in the watershed during the summer of 2004. Questions will address herd and pasture management strategies, and most importantly, economic, social, and personal factors that affect the feasibility of voluntary adoption of exclusionary best management practices. Because adoption of the CREP or stream bank fencing is completely voluntary, a better understanding of these factors is imperative for successful adoption and improved water quality.

Results

The field observation phase of this study revealed several findings. First, a relationship appears to exist between amount of manure deposition and distance from stream. Regardless of pasture size, cattle spend a nearly uniform amount of time in and within 22 yards (20 m) of the stream. Between 3% and 5% of total manure deposited in pastures with stream access is deposited directly in the stream, and between 9% and 12% of the total manure is deposited within 11 yards (10 m) of the stream (see fig. 2). It appears this pattern holds regardless of type of cattle (heifers/dry cows or lactating). Amenities in the pasture, such as shade, salt, alternative water sources, and feeders affect where herds spend their time, but the stream appears to exhibit the same draw regardless of where amenities are located. Manure content analysis indicated average

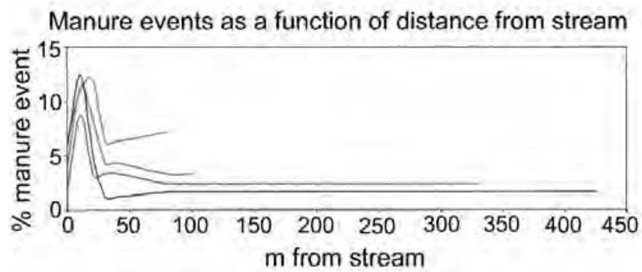

Figure 2. Comparison of four representative farms observed.

nutrient levels of 3.2 g P per manure deposition for milking cows and 2.0 g P per manure event for heifers and dry cows.

When extrapolated to the watershed scale, P deposition directly in streams from the approximately 11,000 pastured dairy cattle within the Cannonsville Watershed is estimated to be approximately 2,646 pounds (1,200 kg) annually. In addition, an estimated 7,055 pounds (3,200 kg) of P is deposited within 11 yards (10 m) of streams annually in the watershed. Using the non-point source P model, approximately 529 pounds (240 kg) dissolved P was estimated to reach streams during runoff events. Adding the P deposited directly into streams to the P in runoff, an annual load of 3,175 pounds (1,440 kg) P to streams may be attributed to pastured dairy cattle. To put these figures in perspective, the total P load to the Cannonsville Reservoir attributed to agriculture is estimated to be 44,533 pounds (20,200 kg) P annually, and the total annual non-point source P load to the reservoir is approximately 99,208 pounds (45,000 kg). Baseline calculations indicate that the CREP has resulted in a 32% decrease in P loading to streams thus far.

Conclusion and Recommendations

Preliminary findings of this study indicate pastured cattle with access to streams can be a substantial source of P loading directly to streams within the Cannonsville Watershed. Using GIS spatial data, a conservative estimate of 2,646 pounds (1,200 kg) of P input directly to streams, 529 pounds (240 kg) P in runoff, and 7,055 pounds (3,200 kg) of P deposited within 11 yards (10 m) of stream channels annually has been made based on seasonal observations of four herds extrapolated to watershed scale. From baseline calculations, the CREP in the Cannonsville Watershed is estimated to have decreased P loading from pastured dairy cattle by nearly one third.

The results support several recommendations in targeting CREP and in documenting program impacts on water quality. In watersheds where manure-derived pollutants are of concern, targeting CREP to pastures on the basis of herd size and the amount of time cattle spend in pasture would result in the greatest reductions in in-stream manure deposits. Such targeting requires additional information about grazing routines be collected as part of the planning process. Collecting this information will improve estimation of CREP benefits concerning water quality.

The final phase of this project is currently underway. Surveying farmers will result in a better understanding of individual pasture and herd management decisions and reveal reasons for acceptance or not adopting voluntary exclusionary best management practices.

With research indicating the CREP is having such a positive impact on water quality, there are several opportunities that could have long-lasting benefits in protecting this water supply. Discussions have been held to look into providing funding to convert the 10–15 year CREP contracts into permanent easements. More likely than not, those acres devoted to CREP at this point will never be converted back to cropland or active pasture use due to economics of conversion. It would make sense to compensate landowners for continued use of these lands into perpetuity.

In planning the CREP areas, consideration needs to be given to problems that could arise. For example, providing shady areas along the stream edge could encourage cows to congregate in those locations. Increased manure deposition by cows gathering by gates and water facilities are also potential sources of polluted runoff. The proper operation and maintenance of these practices is a critical long-term obligation of the landowner.

An important new effort being undertaken in the watershed is a study using fluvial geomorphology to better understand stream dynamics in establishing better stream corridor management. Due to instability of banks on some streams, the decision has been made not to implement the CREP. If an economically feasible mechanism becomes available to stabilize those banks, many additional stream miles will be eligible for riparian forest buffers.

In summary, despite the fear held by many landowners early in the program that NYC would force them to exclude cattle from streams, we are now at a point where the third barrier of pollution prevention has been successfully implemented resulting in a the potential 30% reduction in phosphorus loading to NYC's reservoirs.

Spatial Allocation and Environmental Benefits: The Impacts of the Conservation Reserve Program in Texas County, Oklahoma

By Mahesh Rao[1], Muheeb Awawdeh[1], and Michael R. Dicks[2]

Introduction

Since the 1930's in the United States, land use constraints have been implemented through federal legislation [e.g., Federal Activities Inventory Reform Act (FAIR)] as annual and multi-year programs and policies. These programs and policies have induced land use changes through several formats. With direct payments for each acre, idled land has been removed from cropland and placed in a conserving use. Through eligibility requirements to obtain price and income support payments cropland acreage has been controlled to historically cropped acres. Through price and income support payments, change to a more efficient allocation of use has been achieved. The Food Security and Rural Improvement Act of 2002 (FSRIA) extended planting flexibility in the FAIR Act but added a counter-cyclical payment and increased the amount of money allocated to conservation spending. These changes have important implications for future land use decisions. Addition of the counter-cyclical payment increases potential revenue that farmers may receive without producing an agricultural commodity and augments the farmer's ability to make changes in land use. Increased conservation expenditures provide farmers with a greater opportunity to produce an agricultural commodity and meet, or surpass, state and federal environmental regulations. The 2002 FSRIA continues several existing conservation programs and provides for additional programs. The combination of old and new conservation programs has been allocated $17.1 billion for 2002–2007 (USDA, 2002). These programs affect the vegetation cover type and management of specific land units within landscapes of specific regions of the country. Authorized levels of expenditures for some of the important programs include:

- Conservation Reserve Program – 39.2 million acre (15.9 million ha) cap and $1.517 billion in additional funds,
- Conservation Security Program – $2 billion,
- Environmental Quality Incentives Program – $9 billion,
- Wetland Reserve Program – 2.6 million acre (1.0 million ha) cap and $1.726 billion,
- Grassland Reserve Program – 2 million acre (0.8 million ha) cap and $254 million,
- Farmland Protection Program – $1 billion,
- Wildlife Habitat Incentive Program – $700 million, and
- Small Watershed Rehabilitation Program – $275 million.

The Conservation Reserve Program (CRP) is the largest of the conservation programs in terms of total acres that may potentially undergo land use changes. The CRP was established in the Food Security Act of 1985 to remove highly erodible land from crop production and establish a protective, vegetative cover. The CRP is a voluntary program using financial incentives to encourage farmers to enroll in 10–15 year contracts. Land owners receive annual rental payments and cost-share assistance to establish an approved vegetative cover. The CRP is estimated to have saved 7 million tons (6.4 metric tons) of soil per year from erosion (DeVore, 1994). Nationwide, average reductions in soil erosion declined from a pre-CRP total of 29.7 tons/acre (33.4 tons/ha) to a post-CRP total of 1.6 tons/acre (4.0 tons/ha) (Davie and Lant, 1994). Lindstrom and others (1994) claimed an average erosion reduction of 2.82 tons/acre (6.98 tons/ha) for lands enrolled in the CRP. Other ecologically desirable impacts of the CRP include: (1) reduced sedimentation in lakes, rivers, and streams; (2) reduced nonpoint source agricultural runoff; (3) improved water quality and retention; and (4) development of wildlife habitat (Huang and others, 1990; Young and Osborn, 1990; Kinsinger, 1991).

New legislation has provided for managed (or limited use) haying and grazing on CRP acreage rather than prohibiting all use (except during emergencies such as drought) as in the past. The U.S. Department of Agriculture (USDA), rural communities, farm and commodity groups, and conservation and environmental groups all have a stake in how the haying and grazing provision is implemented. Legislation requires that a reduced rental rate be offered where haying and grazing is permitted. The implementing agency within USDA, the Farm Service Agency (FSA), is interested in simplifying

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signup procedures and management requirements to enable the FSA county employees to implement the program equitably. Farm and commodity groups are interested in management schemes that are workable and maximize net returns. Rural communities, adversely impacted by the absence of use of the land in previous years, are interested in the economic use of the land. Finally, conservation and environmental groups see the use of new provisions having potential for improving and maintaining wildlife habitat.

The CRP has affected land use patterns throughout the country but has had a more concentrated effect on the landscape in specific areas because CRP acreage was geographically concentrated. Twenty-five percent of counties with land enrolled in the CRP contained nearly 80% of total program acreage. In addition, more than 40% of the CRP land came from farmers that enrolled more than 80% of their cropland in the program (Dicks and Coombs, 1994).

The ability of a unit of land to provide environmental amenities is highly dependent on location within the landscape and land use of contiguous units. The concepts of spatial location and landscape structure have been shown to be important elements in determination of quality wildlife habitat (Bidwell and others, 2003). The breaking up of large contiguous areas of grassland (fragmentation) on the Great Plains has caused reduction in the number of breeding bird species (Knopf, 1996). The CRP constitutes an important enhancement of habitat for some wildlife species because most fields enrolled consist of large unbroken tracts–often 90 acres (36 ha) or more (Egbert and others, 2002). Grasslands in CRP are new land covers that constitute a major increase in potential wildlife habitat. Kantrud (1993) found CRP fields provided more secure nesting areas for upland-nesting ducks in the Prairie Pothole Region in North Dakota. Grasslands were enrolled close together with the intention that landscape connectivity would be established. The CRP resulted in both more edge and interior habitat (Dunn and others, 1993). Many other studies documented benefits of CRP grasslands to wildlife habitat (e.g., Howell and Issacs, 1988; Berthelsen and Smith, 1995).

However, CRP benefits to some species of wildlife could be improved through better selection of enrolled lands and improved management of established cover. Bidwell and others (2003) showed the lesser prairie chicken (*Tympanuchus pallidicinctus*), a species of concern in the Southwestern Great Plains, has decreased by 92% since the 1800's as a result of habitat loss associated with agriculture. Remaining populations are threatened by ongoing degradation of rangeland habitats. Habitat fragmentation, tree invasion, long-term fire suppression, and poor management of cattle grazing are the greatest threats to remaining lesser prairie chicken populations. The Bidwell study concludes range and wildlife professionals have serious concerns about the adverse impacts of traditional grassland management philosophies. Furthermore, Bidwell and others (2003) note most CRP lands have few or no forbs, an important component of lesser prairie chicken habitat. The authors believe that while warm-season grasses may provide some benefit to landscapes with "grass only" CRP, the best alternative is to incorporate native forbs and shrubs in CRP plantings at the time of enrollment.

It is clear there is a need for a more active approach to managing grasslands to protect native plants and animals. The market orientation of current farm policy makes the landscape less stable in terms of land use patterns. However, as an offset, current farm policy provides more conservation programs, greater conservation funding, and more latitude within these programs to address wildlife habitat concerns.

In recent years, Geographic Information Systems (GIS) and remote sensing technologies have played an increasingly vital role in understanding how anthropogenic practices affect natural and managed ecosystems while developing improved strategies to achieve sustainability. We need accurate and timely research tools based on advanced remote sensing and GIS technologies geared toward an objective-based integrated framework to facilitate evaluation of potential environmental and ecological benefits of agricultural and environmental policies. GIS, coupled with environmental models, provides an efficient, cost-effective mechanism to characterize and evaluate impacts of landscape changes on environmental and ecological systems.

The main goal of this project was to evaluate potential environmental and ecological impacts of CRP in the Beaver River Watershed located in the Oklahoma Panhandle. This goal included the concept of landscape structure in measuring benefits. A second goal was to evaluate effects of reduced fragmentation on ecological systems. This evaluation implied a clear understanding of CRP impacts on hydrological and ecological systems. Additionally, this understanding helped predict long-term environmental benefits associated with future CRP signups. Our evaluation focused on two time periods: pre-CRP and post-CRP. Pre-CRP refers to the landscape existing prior to CRP introduction (1983), and post-CRP refers to the landscape with significant establishment of the CRP (2003). These time periods mark important transitional stages in the landscape with respect to CRP acreage and valuable information about ecosystem function and related dynamics.

Materials and Methods

Study Area

The study area is the Beaver River Watershed within Texas County, in the Panhandle of Oklahoma (fig. 1). This county has the largest acreage enrolled in the CRP within Oklahoma.

Elevation is approximately 3,806 feet (1,160 m) above sea level along the western boundary of the county, sloping uniformly to the eastern boundary where elevation is approximately 2,598 feet (792 m). The Beaver River flows northeastwardly from a point near the southwestern corner to the center of the county, then eastward into Beaver County (USDA,

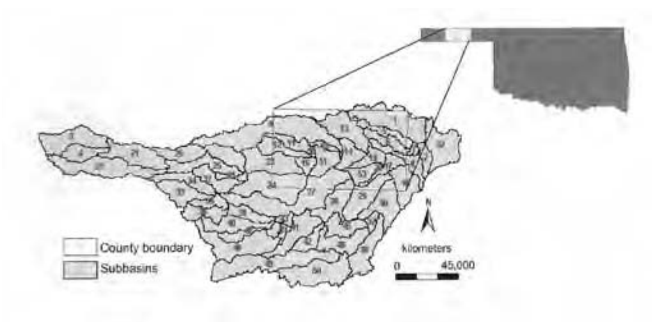

Figure 1. Location of Texas County and the Beaver River Watershed in the Oklahoma Panhandle.

1961). As of July 2003, about 218,305 acres (88,345 ha) were enrolled in the program out of a total of 1.02 million acres (0.4 million ha) enrolled in the state (FSA, 2003).

Data and Methods

Data necessary for this study included topography, land use, soil, climate records, agricultural management data, and stream gage records. The U.S. Geological Survey's (USGS) 30-m digital elevation model (DEM) was used to define topography. Topographic data were required for delineation of the watershed, subbasins, and other data. The high resolution of the DEM (30 m) allows detailed delineation of subbasins and slope and slope length estimates for use in the Modified Universal Soil Loss Equation (MUSLE). Land cover is considered the most important GIS data used in the Soil and Water Assessment Tool (SWAT; Arnold and others, 1993) because it can change spatially and temporally over a short time period. The land use land cover (LULC) affects surface erosion, water runoff, and evapotranspiration (ET) in a watershed. The modeled land cover map was obtained from the USGS National Land Cover Database (NLCD). The land cover map was enhanced by classifying broad land cover classes (row crop and small grains) into more detailed land covers: irrigated wheat, dryland wheat, corn, irrigated sorghum, and dryland sorghum. This map was used for modeling the watershed as the pre-CRP scenario. The CRP tracts were then incorporated into the NLCD map and used as the post-CRP scenario. In other words, both scenarios are the same except for the CRP. This approach allows for determination of the CRP impact as the only factor in reducing soil loss. Climate data was gathered from monitoring sites located within or near the Beaver River Watershed. Because of the spatial and temporal variability of precipitation, multiple climate stations with long periods of records ($\geq$40 years) were selected for this study. Weather data were obtained from the National Climate Data Center (NCDC). All management data were collected from County Extension Agents in the watershed area. The counties include Beaver, Texas, and Cimarron in Oklahoma, Union County in New Mexico, and Dallam, Hansford, and Sherman Counties in Texas.

The SWAT is a long-term, continuous simulation watershed model developed to predict the impact of land management practices on water, sediment, and agricultural chemical yields in large complex watersheds over long periods of time. The SWAT is a physically based model capable of simulating long-term management practices. A single subbasin can be divided into areas with the same soils and land use. Areas with a unique soil and land use combination are defined as Hydrologic Response Units (HRU). Processes within a HRU are calculated independently, and the aggregated total for a subbasin is the sum of all HRUs. Erosion and sediment yield are estimated for each HRU with the MUSLE (Williams, 1975). The SWAT allows the user to define management practices for each HRU.

Model Calibration and Simulation

The SWAT model was calibrated for the Beaver River Watershed region by adjusting sensitive parameters including Curve Number (CN), Soil Available Water Capacity Adjustment (%), and Soil Evaporation Compensation and Factor (ESCO) until an acceptable fit to measured surface flow at the basin outlet was obtained. The model was then run using the same input parameters for validation and goodness-of-fit determination (Arnold and others, 2000). Stream gage data for Guymon gage station (1980 to 1992) and for Beaver River gage station (1989 to 1999) were used for calibration and validation. Using the calibrated model, sediment yield for each subbasin was simulated for a 40-year period. Also, SWAT simulations were conducted on the groundwater recharge for watershed subbasins. For subbasins not completely within the county, an area-weighted method was employed to calculate recharge, assuming recharge was uniformly distributed within each subbasin.

Stream flow was calibrated until average simulated values were within 15% of average measured values and monthly coefficient of determination R^2 >0.60 and Nash-Sutcliffe efficiency coefficients (COE) >0.5 (Santhi and others, 2001). Bednarz (2000) found that measured and predicted total monthly flows compare reasonably well with R^2 ranging between 0.44 and 0.49. Others calibrated SWAT models to R^2 of 0.65 (Arnold and others, 2000), or 0.55 (Peterson and Hamlett, 1997), and COE of 0.58 (Spruill and others, 2000).

Patch Analyst/FRAGSTATS

Potential ecological benefits of CRP tracts were evaluated in terms of various landscape metrics that characterize landscape structure and dynamics. Statistical measures for the CRP patches were calculated. The extension Patch Analyst (grid version) was used to calculate landscape metrics for the pre-CRP and post-CRP land cover. Patch Analyst is an extension to the Arc View GIS system that facilitates spatial analysis of landscape patches and modeling of attributes associated with patches. The extension includes patch analysis functions developed using Avenue code and an interface to the FRAGSTATS spatial pattern analysis program developed by McGarigal and Marks (1994).

Results and Discussion

Sediment Yield

Long-term (40-year) estimates of sediment yield for pre- and post-CRP scenarios were simulated using the calibrated SWAT model. Figure 2 shows sediment yield in Texas County for the pre- and post-CRP scenarios, and their difference. Sediment yield ranged between 0.02 to 0.3 tons/acre/year (0.04 and 0.70 tons/ha/year). The highest sediment yield was observed in the southeastern corner of the county (subbasins 18, 30, 8 and 29) while lowest sediment yield was in the northwestern corner and south of the county (subbasins 9, 11, 12, 27 and 28) (fig. 3). In general there was a reduction in sediment yield between the two time periods. Figure 3 depicts the difference in sediment yield between the pre- and post-CRP scenarios. The spatial distribution of sediment yield was similar in both scenarios except for amount. Reductions in subbasin sediment yield ranged between zero and 68%. The average reduction for the county was 32.60%. In addition, there was an agreement between runoff amount and sediment yield. Subbasins with high surface runoff had high sediment yield.

Sediment Yield and the Conservation Reserve Program

Figure 3 shows the distribution of CRP tracts in Texas County in relation to watershed subbasins showing the percent reduction in sediment yield. Subbasin 9 contains the highest area under CRP with about 39,159 acres (15,847 ha). The other subbasins with high CRP area include subbasins 13, 11, and 23 with 18,417 acres (7,543 ha), 18,147 acres (7,344 ha), and 18,088 acres (7,320 ha), respectively. Subbasins 15, 28, 30, and 16 contain less than 2,471 acres (1,000 ha) of CRP. Predicted sediment yield was highest from subbasins 18 [0.2 ton/acre (0.523 ton/ha)]; 30 [0.119 tons/acre (0.295 ton/ha)]; 29 [0.114 tons/acre (0.284 ton/ha)]; and 8 [0.116 tons/acre (0.289 ton/ha)] (fig. 4). All these subbasins contain low area in CRP with less than 3,954 acres (1,600 ha) enrolled, except subbasin 18, which contains a large area enrolled in CRP. This is probably because average slope is higher than in other subbasins.

However, the relationship between projected sediment yield and CRP area is nonlinear, which is a reflection of multiple factors that influence soil loss. Reduction in sediment yield depends on what crop cover data was used and how much area CRP has replaced. If the replaced crop was wheat, reduction in sediment yield will be higher than if the replaced crop was corn or sorghum. This is because the rate of sediment yield from wheat is much higher than that from corn or sorghum.

As shown in fig. 4, area under CRP is high in subbasins 9, 11, 12, and 23. As expected, most of these subbasins yield low sediment [less than 0.026 tons/acre/year (0.065 ton/ha/year)]. An exception is subbasin 23, which gives a relatively higher value [0.053 ton/acre/year (0.131 ton/ha/year)] that could be due to higher slope. Based on this, we can conclude that area in CRP is closely related to sediment yield. Overall, the greater the CRP acreage in any subbasin the lower the sediment yield. This relationship is strongest in subbasins 9 and 11 [0.014 and 0.011 tons/acre/year (0.036 and 0.029 tons/ha/year, respectively)]. The graph does not depict a clear relationship between the mean slope, sediment yield, and percentage area in CRP. This is because of the slight variations in the slope across Texas County suggesting slope is not a major factor in CRP enrollment.

Spatial Analysis

Using GIS, spatial analyses were completed to map areas of potential sediment yield and examine spatial associations with areas in the CRP. Normality and linearity tests revealed the relationship between CRP area and sediment yield are not linear. This is expected because of the nature of hydrochemical processes in any watershed (Nikolaidis and others, 1998; Tong and Chen, 2002). To find common locations between sediment yield and CRP, the median and mean of each variable were calculated. Using these statistical measures, subbasins were classified into three categories: high, medium or low sediment yield. Similarly, subbasins were classified into three classes based on CRP area: high, medium, or low. Using GIS overlay operations, CRP and sediment yield maps were superimposed. The resulting map (fig. 5) illustrates the spatial relation of CRP with sediment yield. Fourteen of 24 subbasins were correctly classified as ideal associations between CRP and sediment yield. Because sediment yield and area in CRP are inversely related, ideal associations are those subbasins with high, medium, or low sediment yield that coincides with subbasins of low, medium, or high CRP enrollment, respectively.

In addition to visual comparison, the relationship between CRP area and sediment yields was analyzed using statistical measures such as coefficient of area correspondence and Lorenz curve (Taylor, 1983). Numerical assessments of areal association allow exact specification of relations between variables. The coefficient of areal correspondence (CA) relates the area of direct areal correspondence to that of possible correspondence (Taylor, 1983). The value of CA is 1 for complete correspondence and 0 for no correspondence. The CA for sediment yield and CRP area was 53%, indicating positive associations between sediment yield and CRP area in Texas County.

Correlation and regression analysis were completed on subbasin level data. Since data were not distributed normally,

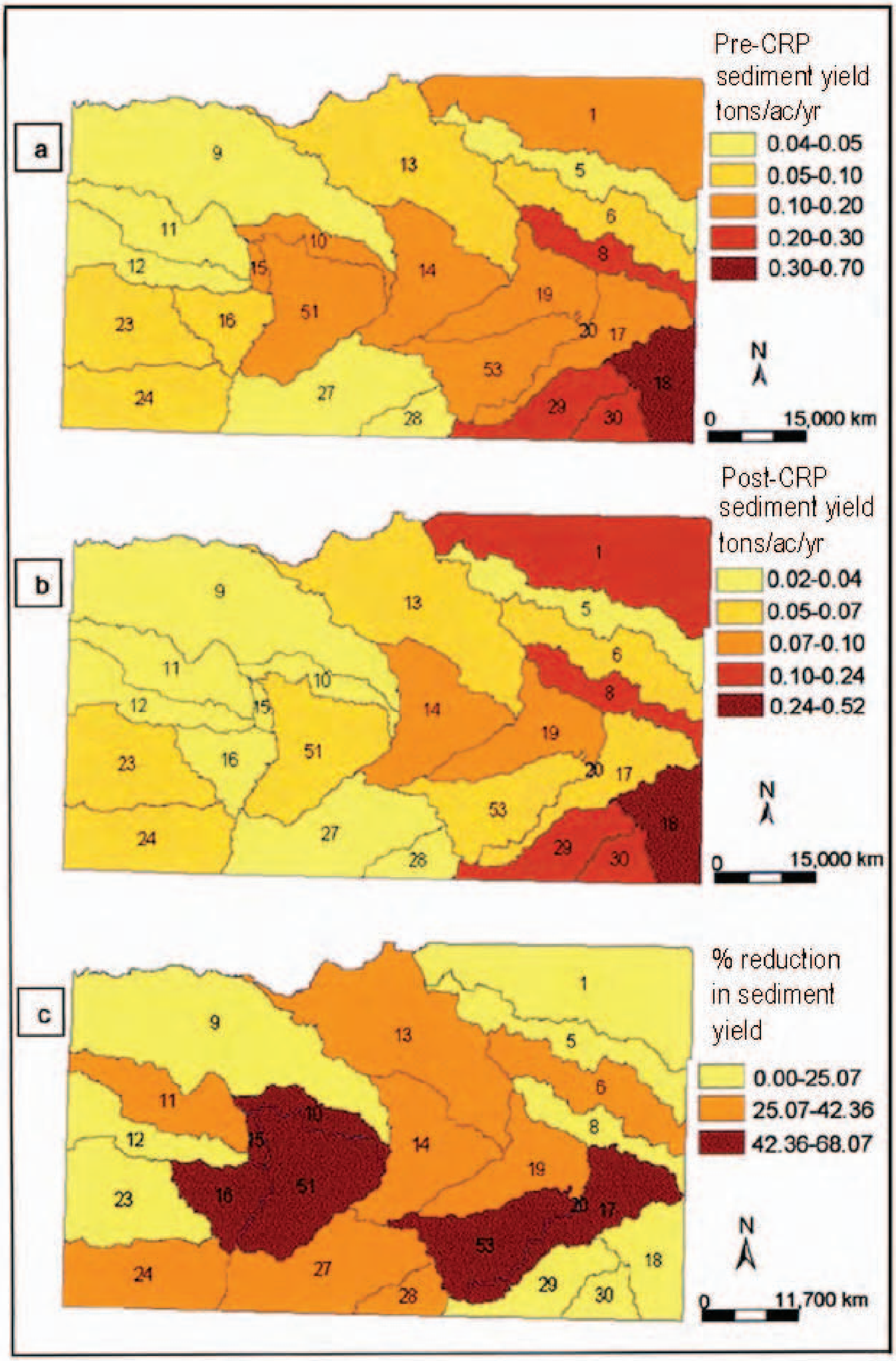

Figure 2. Sediment yield (tons/ha/year) for the: (a) pre-Conservation Reserve Program scenario; (b) post-Conservation Reserve Program scenario; and (c) difference between the pre- and post-Conservation Reserve Program scenarios.

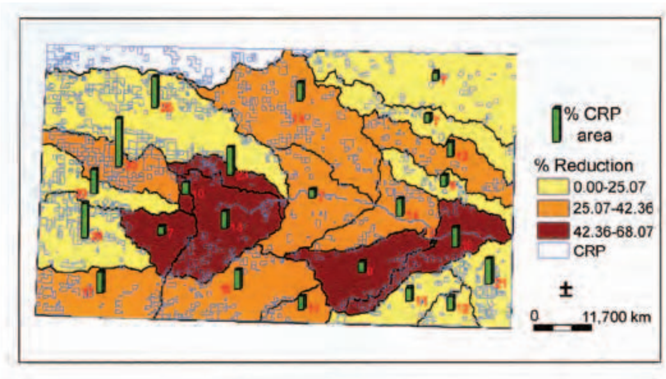

Figure 3. Conservation Reserve Program tracts and subbasins of Texas County, Oklahoma.

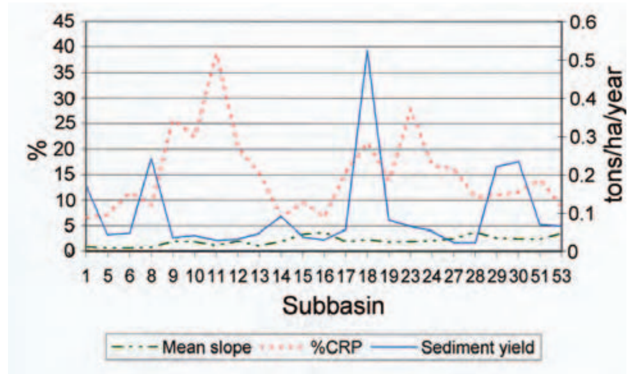

Figure 4. Sediment yield versus area in the Conservation Reserve Program for the Beaver River Watershed subbasins, Texas County, Oklahoma.

a non-parametric statistical test was used (Spearman's correlation coefficient). Calculations revealed that CRP area and sediment yield have strong inverse relationships with r equal to -0.20 for the post-CRP scenario. The greater the CRP area in a subbasin, the lower the sediment yield. Tong and Chen (2002) found similar results from correlating dissimilar land uses with water quality variables. The authors found total nitrogen and total phosphorus were correlated with agriculture land use with r equal to 0.19 and 0.13, respectively.

Groundwater Recharge and the Conservation Reserve Program

Results of the groundwater recharge simulations for the pre- and post-CRP scenarios are shown in fig. 6. Recharge comparisons of pre- and post-CRP in almost all of the subbasins in the watershed, showed positive recharge trends as indicated by the dark colored subbasins. When compared to CRP distribution in the watershed, particularly in the western portions of the county, there seems to be a good correlation. These improvements in groundwater recharge would presumably have significant impact on the groundwater availability in the region.

Landscape Structure and the Conservation Reserve Program

Table 1 summarizes results of a landscape metrics analysis for Texas County. There was a 7% increase in area of grassland from the pre-CRP to post-CRP scenario indicating the influence of the CRP enrollments on landscape characteristics. Mean patch size increased from 61.0 to 90.6 acres (24.7 to 36.11 ha). Total number of patches declined by 24% from 12,754 to 9,666. This might be due to coalescing of small grassland parcels into larger parcels, probably resulting in more contiguous grassland habitats. The decrease in number of patches would result in a decrease in the sum of perimeters of patches. The mean shape index (MSI) is a measure of shape complexity, with lower numbers representing simple, compact shapes, such as circles and squares. The mean shape index and area-weighted MSI decreased from 1.28 to 1.26 and from 51.46 to 47.41, respectively. This decrease reflects the occurrence of CRP in large square or rectangular blocks

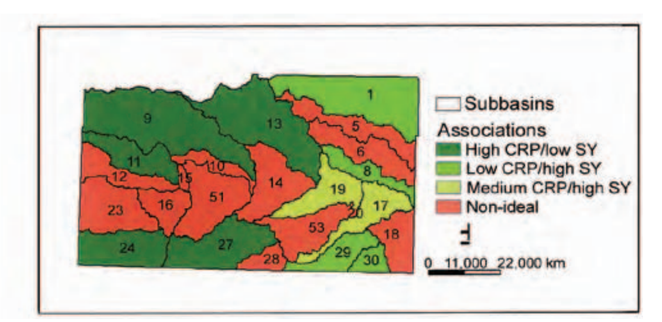

Figure 5. The areal association between the Conservation Reserve Program and sediment yield in Beaver Basin Watershed, Texas County, Oklahoma.

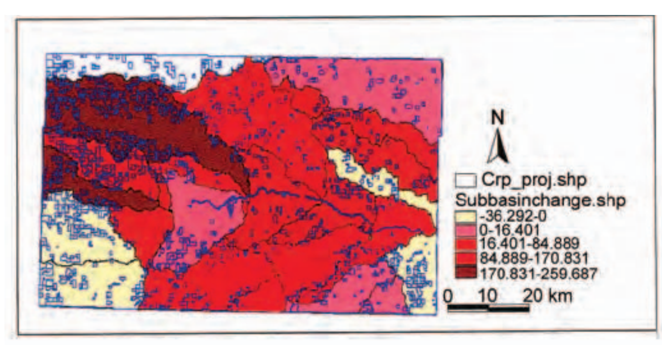

Figure 6. Percent change in recharge (mm) from pre- to post-Conservation Reserve Program time periods within Beaver River Watershed, Texas County, Oklahoma.

Table 1. Grassland landscape metrics pre- and post-Conservation Reserve Program in Texas County, Oklahoma.

Metric	Pre-Conservation Reserve Program	Post-Conservation Reserve Program
Grassland area (ha)	315,038	348,999
Percent area in grassland	62%	69%
Grassland perimeter (m)	18,912,420	17,020,080
Number of patches	12,754	9,666
Mean patch size (ha)	24.7	36.11
Total edge (m)	18,912,420	17,020,080
Edge density (m/ha)	37.43	33.68
Mean shape index	1.28	1.26
Area-weighted MSI	51.64	47.41
Mean nearest neighbor distance (m)	55.04	52.2
Mean proximity index	874,716	1,176,176

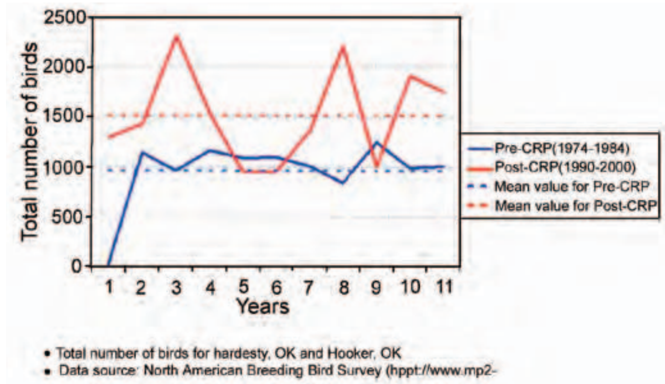

Figure 7. Variations in bird population in pre- and post-Conservation Reserve Program time periods, Texas County, Oklahoma.

of land (Egbert and others, 2002). The mean shape index values for both scenarios are greater than 1, indicating that the average vegetation patch shape in all landscapes is non-square. The nearest neighbor distance reflects mean distance between patches of the same type. This metric decreased from 55.04 to 52.2, indicating clustering of patches in the study area and that inter-patch connectivity increased. This is supported by the mean proximity index (MPI) values increasing from 874,716 to 1,176,176, since higher MPI values indicate lower fragmentation and isolation. These results imply a positive impact on the wildlife populations in the county. A preliminary analysis using the USGS-Breeding Bird Survey (BBS) for the county was completed (fig. 7). The overall trend in the bird populations as indicated by the mean values show the post-CRP period probably provides favorable habitats when compared to the pre-CRP period.

Discussion and Summary

Potential environmental impacts of the CRP were evaluated for the pre-CRP and post-CRP scenarios using the SWAT model. Output from SWAT simulations indicated there was a reduction in sediment yield, increase in groundwater recharge, and reduction in landscape fragmentation due to the presence of CRP in Texas County, Oklahoma. Although sediment yield was low, yield associated well with distribution of CRP in the county, particularly in the western region. Overall, there was a 30% reduction in annual sediment yield for the county. Spatial analysis showed a close aerial association between sediment yield and CRP. The coefficient of association between sediment yield and CRP area was 53.40%. Statistically there was a strong inverse correlation between both variables. Simulations of groundwater recharge using SWAT indicated positive trends as a result of CRP distribution in the county. Landscape metrics derived from patch analysis revealed development of better quality and quantity of wildlife habitat in the county.

The study revealed important hotspots of sediment yield in Texas County that might help the FSA promote future CRP enrollments. Agricultural watershed models and GIS are important analysis tools used by management agencies to identify critical areas and promote appropriate agricultural management practices in targeted areas to control soil erosion and nutrient runoff. Such assessments also offer decision makers much needed information on which recommendations and decisions are based.

The reauthorized CRP allows for limited use on CRP acreage. Limited use may include haying, grazing, and other forage management schemes (e.g., burning, mowing) to maximize wildlife habitat quality. Thus, this modeling technique may aid in identifying optimal locations for CRP enrollment to reduce environmental impacts and landscape fragmentation. However, the SWAT model uses HRUs rather than fields, thereby limiting the ability to accurately measure the impact of CRP on fragmentation. Annual changes in land use associated with other programs and economic incentives provided by the relative net returns of various alternative uses will mandate a continuous update of the environmental benefits.

Neither data nor modeling limitations prevent a simultaneous recalculation of benefits when fields within each HRU change use. However, USDA county officials responsible for implementation of various conservation and commodity programs pose a constraint on that ability as a result of limited resources. Thus, a system may need to be automated to allow constant updating of potential environmental benefits as the landscape changes. The FSA requires landowners involved in commodity programs to complete planting intentions reports annually. These reports could be automatically entered into a modeling system to update ArcView maps for use by both NRCS and FSA county officials. This should be the next stage of research in this area.

Acknowledgments

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References Cited

Arnold, J., Allen, P., and Bernhardt, G., 1993, A comprehensive surface-groundwater flow model: Journal of Hydrology, v. 142, p. 47–69.

Arnold, J.G., Muttiah, R.S., Srinivasan, R., and Allen, P.M., 2000, Regional estimation of base flow and groundwater recharge in the Upper Mississippi river basin: Journal of Hydrology, v. 227, p. 21–40.

Bednarz, S., 2000, Upper Colorado river watershed-hydrologic simulation, chap. 17 of Brush management/water yield feasibility studies for eight watersheds in Texas: Blackland Research and Extension Center, Temple, Tx.

Berthelsen, P.S., and Smith, L.M., 1995, Nongame bird nesting on CRP lands in the Texas southern high plains: Journal of Soil and Water Conservation, v. 50, no. 6, p. 672–675.

Bidwell, T., Fuhlendorf, S., Harmon, S., Horton, R., Manes, R., Rogers, R., Sherrod, S., Wolfe, D., 2003, Ecology and management of the lesser prairie-chicken: Oklahoma Cooperative Extension Service Publication E-970, Oklahoma State University, Stillwater, 17 p.

Davie, K., and Lant, C., 1994, The effect of CRP enrollment on sediment loads in two southern Illinois streams: Journal of Soil and Water Conservation, v. 49, no. 4, p. 407–411.

DeVore, B., 1994, CRP grass: Is there room for people?: The Land Stewardship Letter, v. 12, p. 1–7.

Dicks, M.R., and Coombs, J.E., 1994, CRP in the future: Research Report p-938, Oklahoma Agricultural Experiment Station, Stillwater.

Dunn, C.P., Stearns, F., Guntenspergen, G. Sharpe, D., 1993, Ecological benefits of the Conservation Reserve Program: Conservation Biology, v. 7, no. 1, p. 132–139.

Egbert, S., Park, S., Price, K. Lee, R., Wu, J., and Nellis, D., 2002, Using conservation reserve program maps derived from satellite imagery to characterize landscape structure: Computers and Electronics in Agriculture, v. 37, p. 141–156.

Farm Service Agency, 2003, The Conservation Reserve Program 26th signup: Washington, D.C., U.S. Department of Agriculture, 288 p.

Howell, D., and Issacs, B., 1988, Does CRP spell quail?: Quail Unlimited Magazine, v. 7, no. 3, p. 6–9.

Huang, W.Y., Algozin, K., Ervin, D., and Hickenbotham, T., 1990, Using the Conservation Reserve Program to protect groundwater quality: Journal of Soil and Water Conservation, v. 45, no. 2, p. 341–346.

Kantrud, H.A., 1993, Duck nest success on Conservation Reserve Program land in the prairie pothole region: Journal of Soil and Water Conservation, v. 48, no. 3, p. 238–242.

Kinsinger, A.E., 1991, The promise of the 1990 Farm Bill for fish and wildlife: Journal of Soil and Water Conservation, v. 46, no. 4, p. 255.

Knopf, F.L., 1996, Prairie legacies–birds, *in* Samson, F.B., and Knopf, F.L., eds., Prairie conservation: Preserving North America's most endangered ecosystem, Washington, D.C., Island Press, p. 135–148.

Lindstrom, J., Schumacher, E., and Blecha, L., 1994, Management considerations for returning CRP lands to crop production: Journal of Soil and Water Conservation, v. 49, no. 5, p. 420–425.

McGarigal, K., and Marks, B., 1994, FRAGSTATS: Spatial analysis program for quantifying landscape structure: U.S. Department of Agriculture, Forest Service.

Nikolaidis, P., Heng, H., Semagin, R., Clausin, C., 1998, Non-linear response of a mixed land use watershed in nitrogen loading: Agriculture, Ecosystem, and Environment, v. 67, p. 251–265.

Peterson, J.R., and Hamlett, J.M., 1997, Hydrologic calibration of the SWAT model in a watershed containing fragipan soils and wetlands: ASAE Paper No. 97-2193. St. Joseph, Michigan.

Santhi, C., Arnold, J., Williams J., Dugas, W., Srinivasan, R., and Hauck, L., 2001, Validation of the SWAT model on a large river basin with point and nonpoint sources: Journal of the American Water Resources Association, v. 37, no. 5, p. 1169–1187.

Spruill, C.A., Workman, S.R., and Taraba, J.L., 2000, Simulation of daily and monthly stream discharge from small watersheds using the SWAT model: Transactions of the ASAE, v. 43, no. 6, p. 1431–1439.

Taylor, P., 1983, Quantitative methods in geography: An introduction to spatial analysis: Prospect Heights, Illinois, Waveland Press, Inc., 386 p.

Tong, S., and Chen., W., 2002, Modeling the relationship between land use and surface quality: Journal of Environmental Management, v. 66, p. 377–393.

U.S. Department of Agriculture, 1961, Soil Conservation Service: Soil Survey Texas County, Oklahoma, series 1958, no. 6.

U.S. Department of Agriculture, 2002, National Agricultural Statistics Service: Oklahoma agriculture statistics. Available at http://www.nass.usda.gov/ok/ (verified 30 March 2004).

Williams, J., 1975, Sediment-yield prediction with universal equation using runoff energy factor, *in* Present and prospective technology for predicting sediment yield and resources–Proceedings of the sediment-yield workshop, November 28–30, 1972: ARS-S-40, U.S. Department of Agriculture Sedimentation Lab., Oxford, Mississippi.

Young, C.E., and Osborn, C.T., 1990, Costs and benefits of the Conservation Reserve Program: Journal of Soil and Water Conservation, v. 45, no. 3, p. 370–373.

Water Quality Benefits of Wetland Restoration: A Performance-Based Approach

By William G. Crumpton[1]

Introduction

Agricultural applications of fertilizers and pesticides have increased dramatically since the middle 1960s, resulting in the impact of agrochemicals on water quality becoming a serious environmental concern. Nitrate is a particular concern because of the (1) potential adverse impacts on both public health and ecosystem function, (2) high mobility of nitrate in surface and groundwater, and (3) widespread use of nitrogen in modern agriculture. Annual application of fertilizer-N in the U.S. has grown from a negligible amount prior to World War II to approximately 10 million metric tons of N per year (Terry and Kirby, 1997). As much as 50% of the fertilizer nitrogen applied to cultivated crops may be lost in agricultural drainage water, primarily in the form of nitrate (Neely and Baker, 1989). The impacts of chemical-intensive agriculture are a special concern in the U.S. Corn Belt. This region is characterized by intensive row crop agriculture, with elevated stream nitrate concentrations found in watersheds with greater amounts of cropland (fig. 1). Non-point source nitrogen loads to surface waters in the region are among the highest in the Mississippi River Basin. In addition to the potential local impacts on Corn Belt receiving waters, nitrogen loads from the region are suspected as a primary source of nitrate contributing to hypoxia in the Gulf of Mexico.

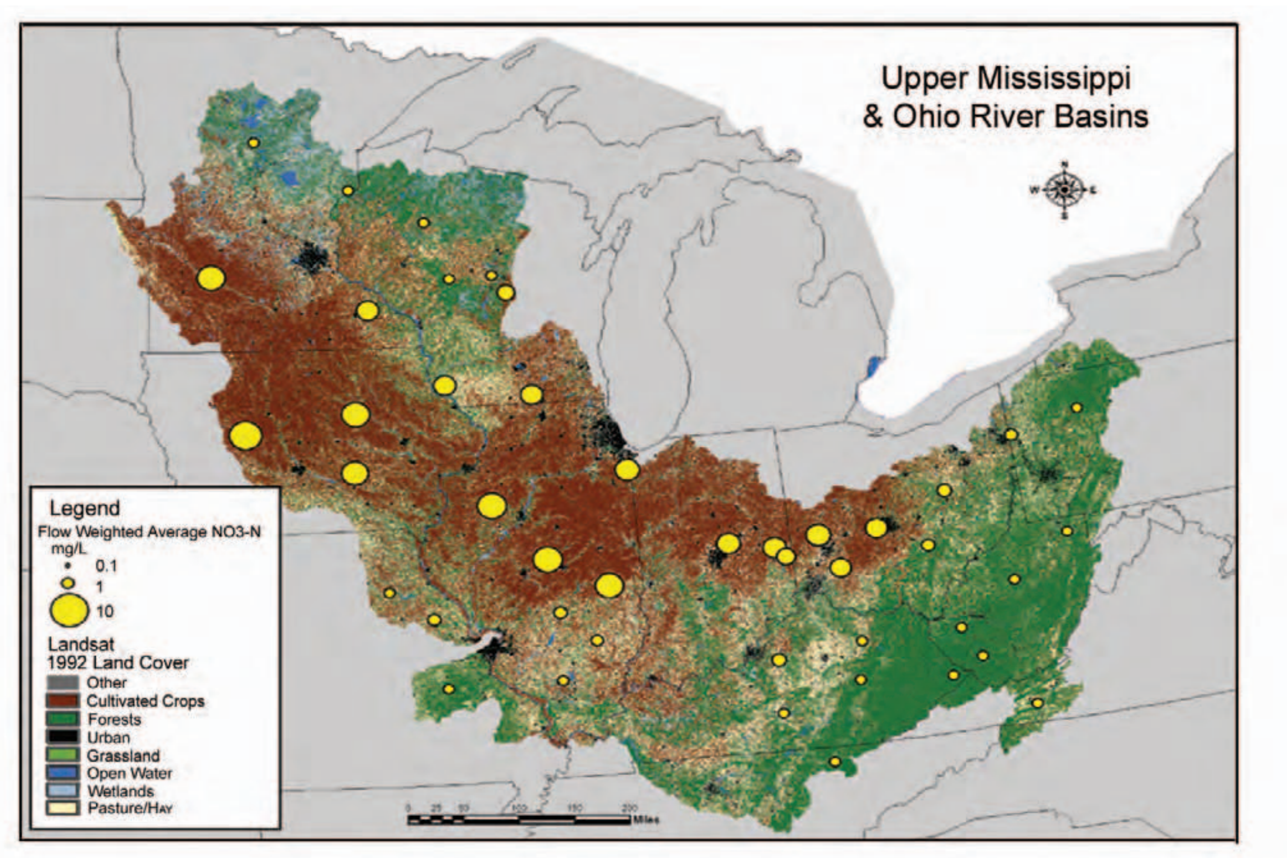

Figure 1. Land use in the Upper Mississippi and Ohio River drainages and average stream nitrate-nitrogen concentrations for selected watersheds. Derived from 1992 Landsat and USGS NASQAN data.

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The problem of excess nitrate loads can probably be ameliorated by a combination of in-field and off-site practices, but the limitations and appropriateness of alternative practices must be considered. Although soil nitrogen transformations involve complex spatial and temporal patterns, nitrogen is transported from cultivated fields primarily by leaching of nitrate in subsurface flow. In well-drained soils, free ammonium not assimilated by organisms is rapidly converted to nitrate by nitrification (fig. 2). This is true whether ammonium is applied in fertilizer or derived from mineralization of organic nitrogen. Whereas ammonium is effectively held by the ion exchange complex in north temperate soils and its movement restricted, nitrate is freely mobile and easily transported with infiltrating water during and after rain events (figs. 3 and 4). Much of the Corn Belt is underlain by networks of subsurface drainage tile (fig. 5) that provide the primary pathway of nitrogen transport to streams in tile drained landscapes. Grass buffer strips, woody riparian buffers, and other practices suited to surface runoff have little opportunity to intercept nitrate loads in these areas. In contrast, wetlands sited to intercept tile drainage have significant capacity to reduce downstream nitrate loads. From a watershed perspective, this can be thought of as coupling nitrification reactions in aerobic, upland soils with denitrification reactions in anaerobic, wetland soils (fig. 6.).

Wetland restoration is a particularly promising approach for heavily tile-drained areas like the Corn Belt. This region was historically rich in wetlands, and in many areas, farming was made possible only as a result of extensive drainage. Across the region, surface water nitrate concentrations are generally highest in watersheds with more cropland and extensive tile drainage (fig. 7). There are opportunities for wetland restoration throughout the region and considerable potential for restored wetlands to intercept nitrate transported in tile flow. However, wetland restorations have been motivated primarily by concern over waterfowl habitat loss, and site selection criteria for wetland restorations generally have not considered water quality functions. Of more than 500 wetland restorations in Iowa and Minnesota surveyed by Galatowitsch (1993) most drain very small areas and would intercept insufficient contaminant loads to significantly affect water quality at the watershed scale. This does not lessen the promise of wetlands for water quality improvement in agricultural watersheds but rather underscores the need for explicitly considering watershed scale processes and endpoints when planning wetland restorations (Crumpton, 2001).

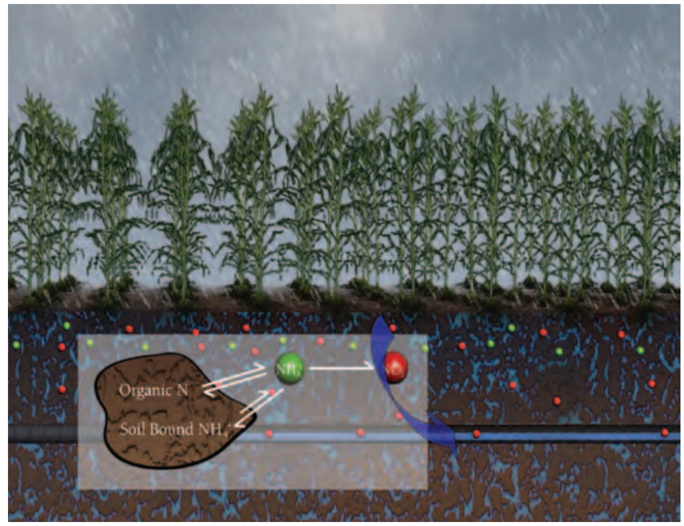


Figure 3. Simplified representation of nitrogen transport in tile drained cropland illustrating nitrate leaching and transport with infiltrating water during a rain event.

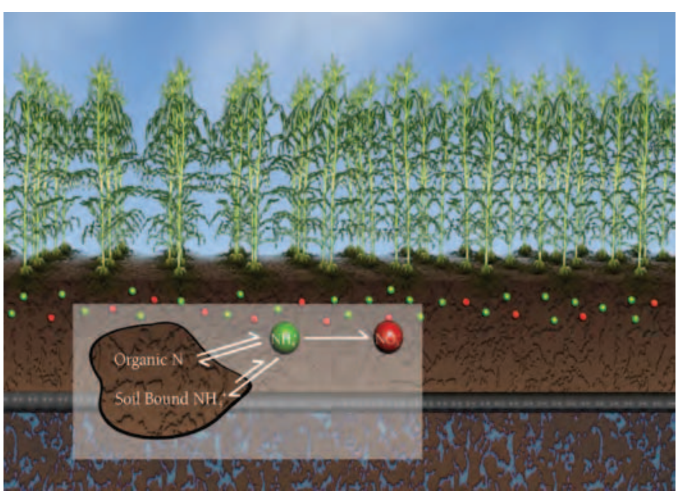


Figure 2. Partial representation of nitrogen transformations in tile drained cropland illustrating nitrate formation by nitrification of ammonium in well drained soil (not all nitrogen transformations are shown).

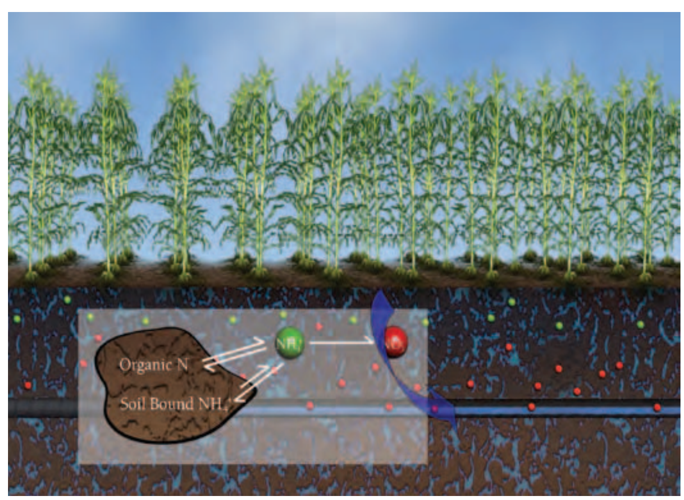


Figure 4. Simplified representation of nitrogen transport in tile drained cropland illustrating continued nitrate leaching and transport with infiltrating water following a rain event.

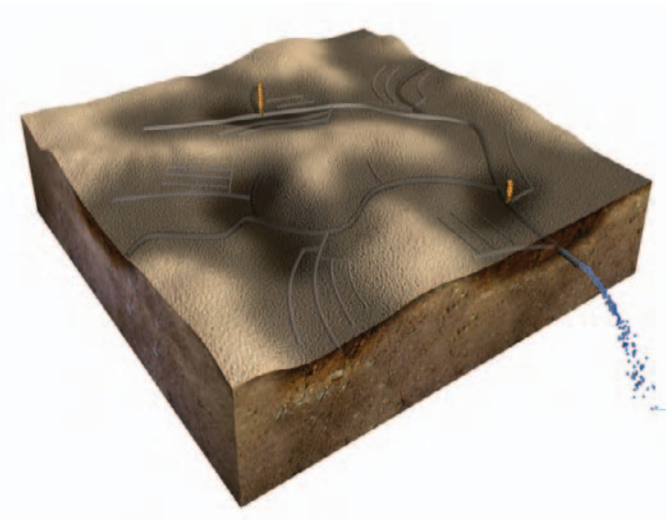


Figure 5. Illustration of tile drainage for a typical agricultural landscape of the western Corn Belt in Central Iowa.

A Performance-Based Approach to Wetland Restoration

Over the past 10 years, the Iowa State University Wetlands Research Group has worked to extend the application of performance forecast models to siting, design, and assessment of wetland restorations in agricultural watersheds (Crumpton and Baker, 1993; Crumpton and others, 1995; Baker and others, 1997; Crumpton, 2001). Mass balance analysis and ecosystem modeling are used to integrate work over spatial and temporal scales ranging from short-term process studies in experimental wetland mesocosms to long-term analysis and modeling of watersheds. Results from experimental wetlands were used to develop a general model of nitrate loss for wetlands receiving non-point source nitrate loads. This model was calibrated and validated against field data for research sites in Illinois and Iowa. The nitrate loss model was then combined with a hydraulic loading model to simulate nitrate loading and loss for wetlands in agricultural watersheds. The combined model was integrated into a watershed scale framework for evaluating the hydrologic and water quality benefits of wetland restorations. This approach is efficient, robust, and scalable and can be used for both hindcasting and performance forecast modeling. The approach has been used for a number of watersheds in central Iowa and southern Minnesota. Results demonstrate wetlands can be effective in nitrate reduction at the watershed scale, but only if they are appropriately positioned and designed to achieve that function (Crumpton, 2001).

The importance of landscape position is illustrated by examining model simulations of two distinct scenarios for wetland restoration in Walnut Creek Watershed, a tile-drained agricultural watershed typical of the western Corn Belt in central Iowa (Crumpton, 2001). As evidenced by the extent and distribution of hydric soils, the landscape was historically rich in wetlands (fig. 8). The upper part of the watershed is nearly level with poorly defined surface drainage channels and numerous depressions that were drained for agriculture. Most of the land is now planted in corn and soybeans, but there are opportunities for wetland restoration throughout the watershed. In the first restoration scenario, referred to as the conventional approach, small wetland basins at the terminus of drainage networks were selected for restoration. This reflects the most common landscape position observed for 538 restorations in the region surveyed by Galatowitsch (1993). In the second scenario, referred to as the watershed approach, sites for wetland restorations were selected to intercept drainage from larger collector tiles. Although wetlands occupied the same total area as in the first scenario, wetlands intercepted an order of magnitude greater volume of tile drainage.

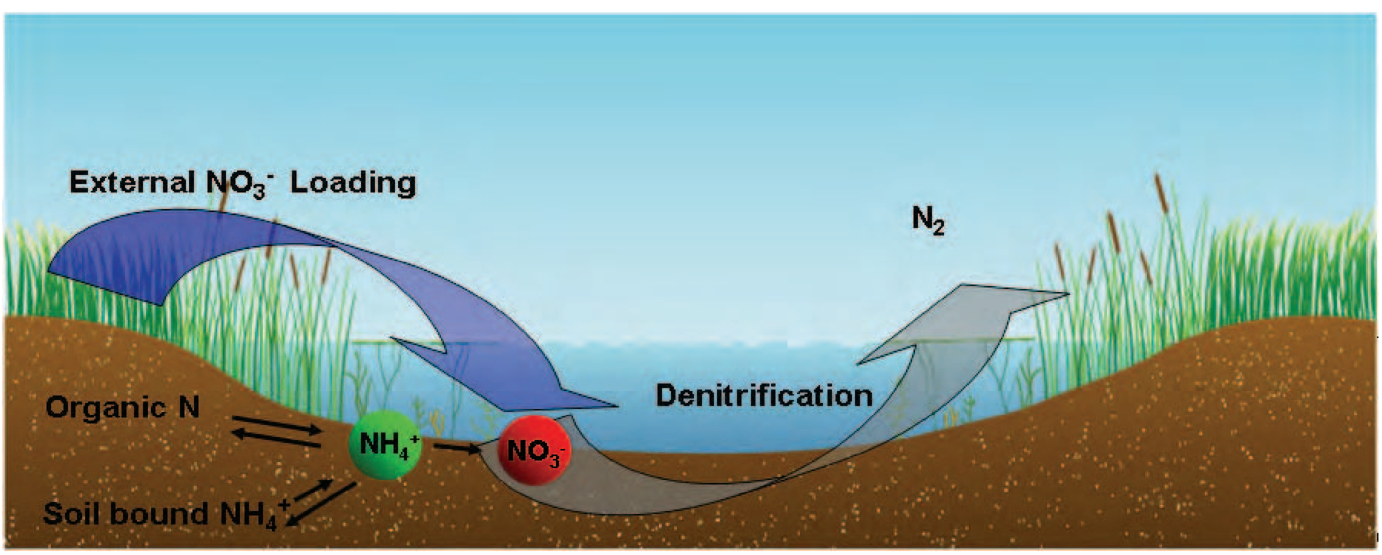


Figure 6. Simplified representation of nitrogen transformations in wetlands illustrating the increased importance of denitrification in wetlands receiving significant external nitrate loads (not all transformations are shown).

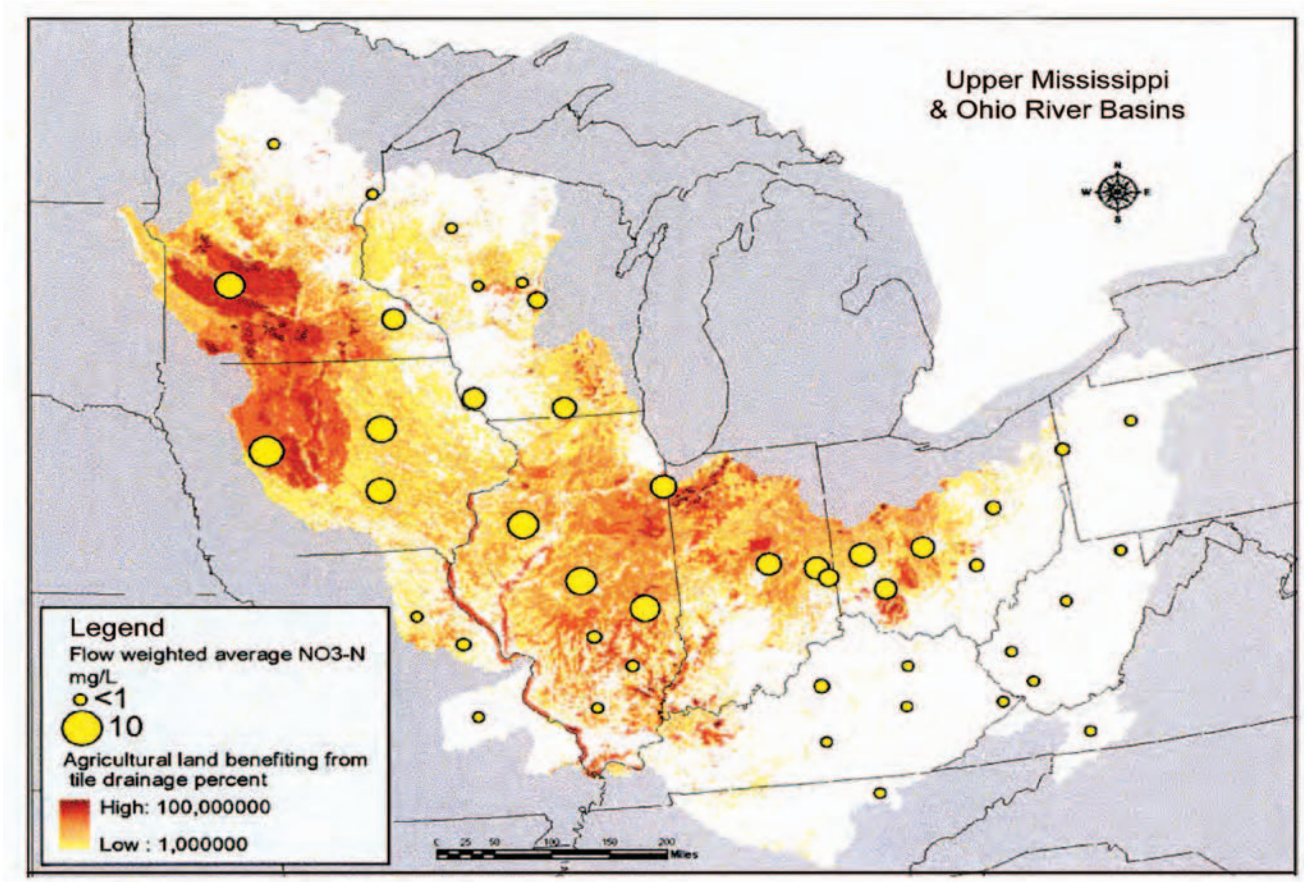


Figure 7. Land potentially benefiting from agricultural drainage in the Upper Mississippi and Ohio River drainages and average stream nitrate-nitrogen concentrations for selected watersheds. Derived from NRCS STATSGO soil properties and USGS NASQAN data.

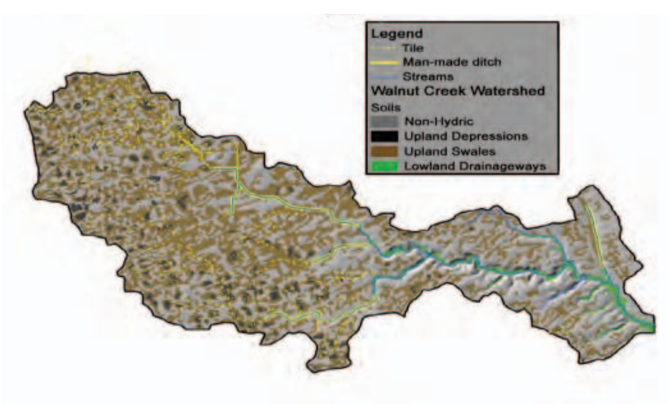


Figure 8. Current surface and subsurface drainage systems in Walnut Creek watershed and presettlement distribution of wetlands estimated from hydric soils (upland depressions, upland swales, and lowland drainageways). Soil distribution derived from the Iowa Cooperative Soil Survey.

Using the conventional approach, wetlands would remove less than 4% of the annual nitrate load exported from the watershed (fig. 9). In contrast, wetlands sited using a watershed approach would remove 70% of the nitrate load they received and reduce annual nitrate load exported from the watershed by 35% (fig. 9). These results suggest commonly used criteria for wetland restorations are inadequate for water quality purposes and emphasize the need for performance-based approaches to wetland siting and design.

This work elucidated the benefits and limitations of wetland restorations for nutrient reduction in tile-drained landscapes and provided the research foundation for the Iowa Conservation Reserve Enhancement Program (CREP). The Iowa CREP was created by the Iowa Department of Agriculture and Land Stewardship, in partnership with the U.S. Department of Agriculture, as a targeted, performance-based strategy for nitrate reduction in tile-drained landscapes. The program provides incentives to landowners to voluntarily establish wetlands strategically located and designed to remove nitrate from tile-drainage water from cropland areas. Performance forecast models were used to guide development of program criteria for the Iowa CREP based on a nitrate reduction target of 40%–90%. Model simulations suggested relatively small areas of wetlands intercepting tile drainage could remove up to 70% of the nitrate in tile drainage water.

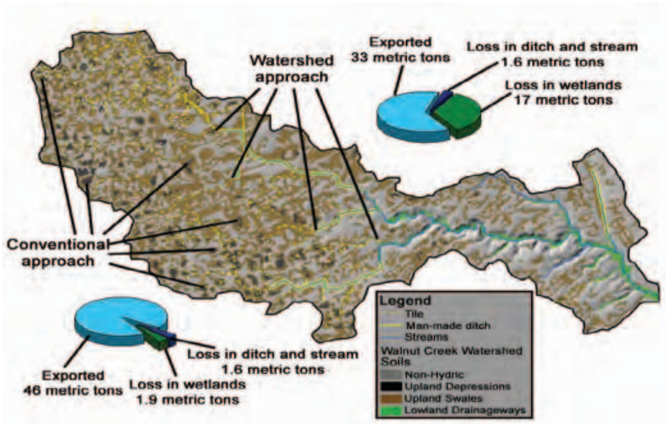


Figure 9. Annual nitrate mass balance for Walnut Creek watershed under alternative wetland restoration scenarios (conventional approach versus watershed approach).

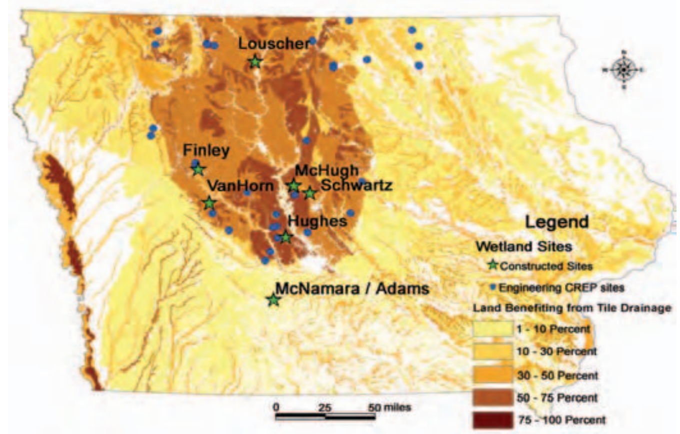


Figure 10. Land potentially benefiting from agricultural drainage in Iowa and locations of constructed and engineered CREP wetlands. Drainage estimate derived from NRCS STATSGO soil properties.

Performance-Based Assessment of Restored Wetlands

The Iowa CREP is a performance-based program, and nitrate reduction is not simply assumed based on wetland acres enrolled, but will be calculated based on the measured performance of CREP wetlands. As an integral part of the Iowa CREP, a representative subset of wetlands will be monitored, and mass balance analyses will be performed to document nitrate reduction. This will also allow further refinement of modeling and analysis tools used in siting and design of CREP wetlands.

During all or part of the 2003 and 2004 crop seasons, five wetlands were monitored for the Iowa CREP. These include Van Horn Wetland, Upper McLaughlin Wetland, Lower McLaughlin Wetland, Finley Wetland, and Hughes Wetland (fig. 10). By design, the wetlands selected for monitoring fully span the 0.5%–2.0% range of wetland/watershed area ratios approved for Iowa CREP wetlands. In fact, the wetlands span a slightly broader range, from 0.36% to 2.2%. They span a broad range of incoming nitrate nitrogen concentrations, from less than 10 mg/l to over 30 mg/l. The wetlands provide a broad spectrum of those factors most affecting wetland performance: hydrolgoic loading rates, residence times, nitrate concentrations, and nitrate loading rates.

For close interval monitoring of nitrate nitrogen concentrations wetlands were instrumented with automated samplers that collected daily composite water samples at wetland inflows and outflows. In addition, grab samples were collected from planned inflows to four additional CREP wetlands constructed in 2004 (Louscher Wetland, McNamara/Adams Wetland, Schwartz Wetland, and Triple I Wetland). These samples were used to estimate the flow weighted average nitrate concentration that could be expected for these wetlands post-construction and enabled mass balance modeling of nitrate loading and removal by wetlands constructed but not operational in 2004. Flow rates were estimated from data from nearby U.S. Geological Survey river gauging stations adjusted to represent the drainage area of the wetland.

Despite significant variation with respect to average nitrate concentrations and loading rates, the wetlands display similar seasonal patterns. Nitrate concentrations and mass loads are highest during high flow periods in spring and early summer, and decline with declining flow in late summer and early fall. The patterns in nitrate concentration and flow for Van Horn Wetland illustrate the variability in hydraulic and nutrient loading that can be expected for wetlands receiving non-point source loading from agricultural areas (fig. 11). Mass balance models must adequately represent these variations in load and in hydraulic residence time distributions in wetlands in order to provide realistic performance forecast projections.

Mass balance modeling was used to estimate nitrate loading and removal for Van Horn wetland. Van Horn Wetland was completed in 1996, and while predating the Iowa CREP, this wetland meets CREP criteria and provides a longer term

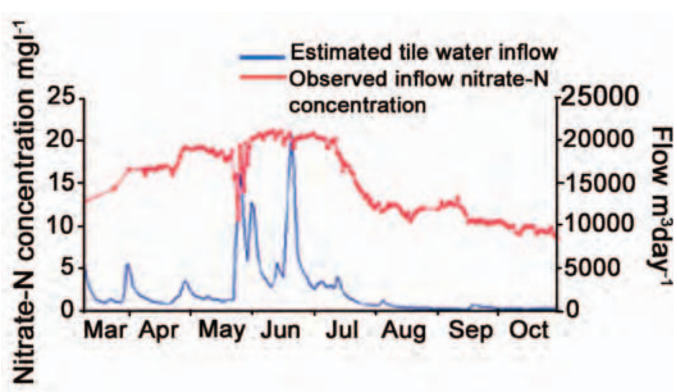


Figure 11. Observed nitrate concentrations and flow rates at inflow to Van Horn Wetland in 2004.

data set for performance modeling and evaluation. Nitrate concentrations measured at the Van Horn wetland inflows and outflows in 2004 are illustrated in fig. 12, along with the range of outflow concentrations predicted for this wetland by mass balance modeling with 2004 inputs and forcing functions. The correspondence between measured and modeled outflow concentrations is quite reasonable.

Mass balance modeling was also used to hindcast annual nitrate loads and nitrate removal for this wetland over the 10-year period from 1990 to 1999. Recognizing the wetland was not completed until 1996, this analysis is intended only to illustrate expected performance over a representative 10-year period, if the wetland had been constructed prior to the beginning of that period. Figure 13 illustrates flow rates, annual mass nitrate loading to the wetland, annual mass nitrate removal by the wetland, and annual percent nitrate removal by the wetland as predicted by mass balance modeling (in this case used for hindcast modeling). For comparison, the mass nitrate loading to the wetland, mass nitrate removal by the wetland, and percent nitrate removal by the wetland observed during the 2003 and 2004 sampling periods are also presented, and illustrate reasonably good correspondence between observed and modeled performance of the wetland.

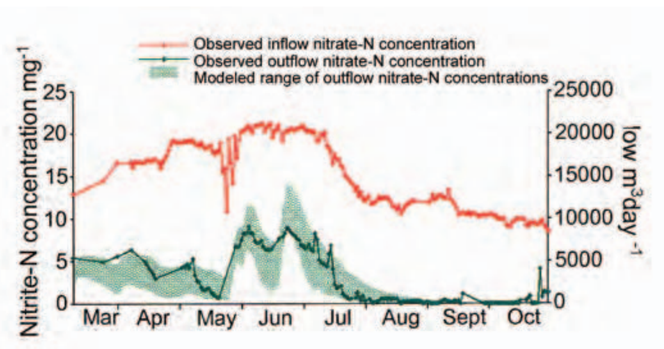


Figure 12. Modeled and observed nitrate concentrations for Van Horn Wetland in 2004.

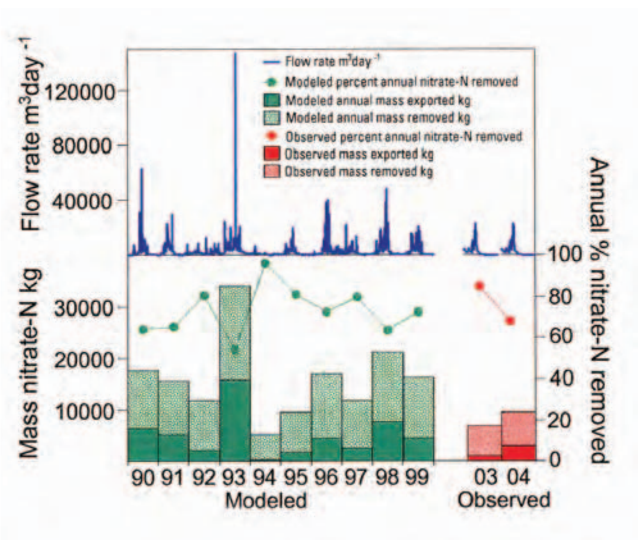


Figure 13. Percent nitrate removal and nitrate mass balance for Van Horn Wetland modeled for 1990–1999 (annual) and observed for 2003 and 2004 (field season).

The same mass balance modeling approach was used to estimate nitrate loading and removal for six CREP wetlands constructed in 2003 and 2004 (Finley Wetland, Hughes Wetland, Louscher Wetland, McNamara/Adams Wetland, Schwartz Wetland, and Triple I Wetland). For wetlands constructed prior to 2004, close interval monitoring in 2003 and 2004 provided estimates of flow weighted nitrate concentrations at wetland inflows. For wetlands constructed in 2004, grab samples during spring high flow periods were used to estimate flow weighted nitrate concentrations at wetland inflows. Mass balance modeling was used to hindcast annual nitrate loads and nitrate removal for each of these six wetlands over the 10-year period from 1990 to 1999. Recognizing that wetlands were not completed until 2003 and 2004, this analysis is intended only to illustrate expected performance over a representative 10-year period, if the wetlands had been constructed prior to the beginning of that period.

Despite spanning a wide range of loading rates and nitrate concentrations, the wetlands behaved predictably with respect to nitrate removal efficiency. Figure 14 illustrates nitrate removal efficiency of the wetlands as represented by average percent nitrate removal by each wetland over the 10-year hindcast period. For comparison, percent nitrate removal by Van Horn Wetland and Finley Wetland measured in 2004 is also presented in fig. 14. These two wetlands have wetland/watershed area ratios near the lowest (Van Horn) and Highest (Finley) ratios approved for Iowa CREP wetlands. The comparison illustrates reasonably good correspondence between observed and modeled performance of the wetlands. The percentage decline in nitrate concentration was directly related to wetland/watershed area ratio. These are expected patterns. Percent removal is related to hydrologic loading rate and residence time distributions, which are, at least in part, a function of wetland area/watershed area ratios.

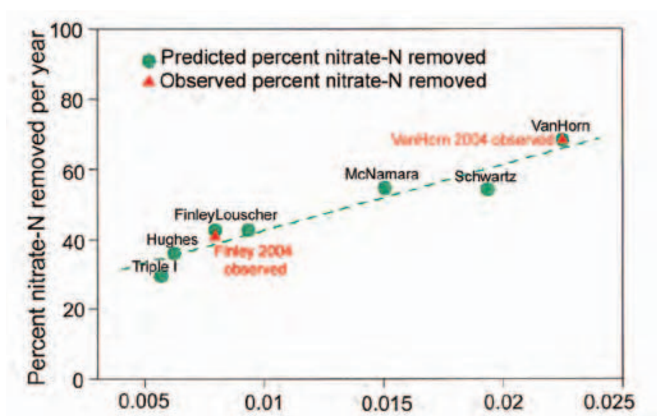


Figure 14. Predicted and observed percent nitrate removed as a function of wetland/watershed area ratio.

In contrast to percent removal, mass removal is not a simple function of wetland/watershed area ratios (fig. 15). Mass removal is a more complex function of hydrologic loading rate and nitrate concentrations (among other things). It is interesting to note the wetland with the lowest percent decline in nitrate (Triple I at 30%) and the wetland with the highest percent decline in nitrate (Van Horn wetland at 68%) removed a similar mass of nitrate nitrogen per area of wetland (150–180 g/m^2). Wetlands with similar percent nitrate removal such as Hughes and Louscher (37%–43%) removed such different amounts of nitrate per area of wetland (285 versus 570 g/m^2). Mass removal is a complex function of hydrologic and nitrate loading rates, underscoring the value of performance forecast models in planning wetland restorations and for optimizing wetland restoration criteria.

Assessing Opportunities for Performance-Based Wetland Restoration in the Upper Mississippi Basin

How much could nitrate loads be reduced if wetland filters were established on tile drainage systems throughout the Upper Mississippi River Basin, and what guidance can be provided to maximize the benefits for the investment made? As part of an ongoing project, we are using performance forecast modeling to estimate the total nitrate reduction that could be achieved by strategically restoring wetlands in tile-drained regions across the Upper Midwest. This is based on an estimate of the extent of tile-drained areas across the Corn Belt, which is the major source of nitrate loading and candidates for wetland restorations to intercept tile drainage. For those areas, we are estimating both the total mass reduction of nitrate loading and the percentage reduction of nitrate loading that could be achieved using wetlands to intercept tile drainage. In addition, we are estimating total nitrate reduction that could be achieved separately within each of the major subbasins as a function of total wetland area restored within each basin. This is important since not only does extent of tile drainage vary among the subbasins, but also efficacy of wetlands intercepting tile drainage probably varies among the subbasins. This is because several primary determinants of wetland performance vary longitudinally across the Upper Midwest, including volume and timing of “runoff,” nitrate concentration, and temperature. Our preliminary analyses suggest these would result in a roughly five-fold range in mass nitrate removal per acre of wetland restored for different areas of the region. A secondary objective of the project is to develop guidance for siting and design criteria that could maximize nitrate reduction benefits of wetlands and that can be applied across the region rather than just within a narrow geographic area. An example of the latter is the wetland/watershed area ratio criteria developed for the Iowa CREP. These criteria cannot simply be extrapolated to other areas. We are working to develop guidance for transferable criteria that can be adapted to different geographic areas and programs.

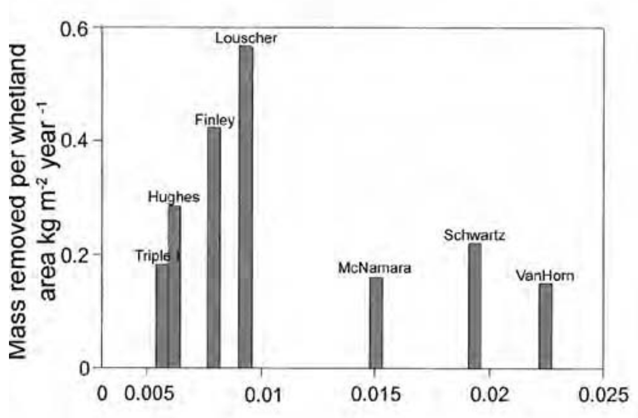


Figure 15. Predicted mass nitrate removed per area of wetland as a function of wetland/watershed area ratio.

Acknowledgments

This work was supported in part by the Iowa Department of Agriculture and Land Stewardship and the U.S. Department of Agriculture. I would like to acknowledge Jana Stenback and Brad Miller both for their contribution to this work and their assistance in preparing the manuscript. I would also like to acknowledge John Petersen (www.petersenart.com), Fabian De Kok-Mercado, and Maria Sibbel for assistance with artwork.

References Cited

Baker, J.L., Mickelson, S.K., and Crumpton, W.G., 1997, Integrated crop management and off-site movement of nutrients and pesticides, *in* Hatfield, J.C., Buhler, D.B., and Stewart, B.A., eds., Weed biology, soil management, and weed management, Advances in soil science: Boca Raton, Florida, CRC Press, p. 135–160.

Crumpton, W.G., 2001, Using wetlands for water quality improvement in agricultural watersheds: The importance of a watershed scale perspective: Water Science and Technology, v. 44, no. 11–12, p. 559–564.

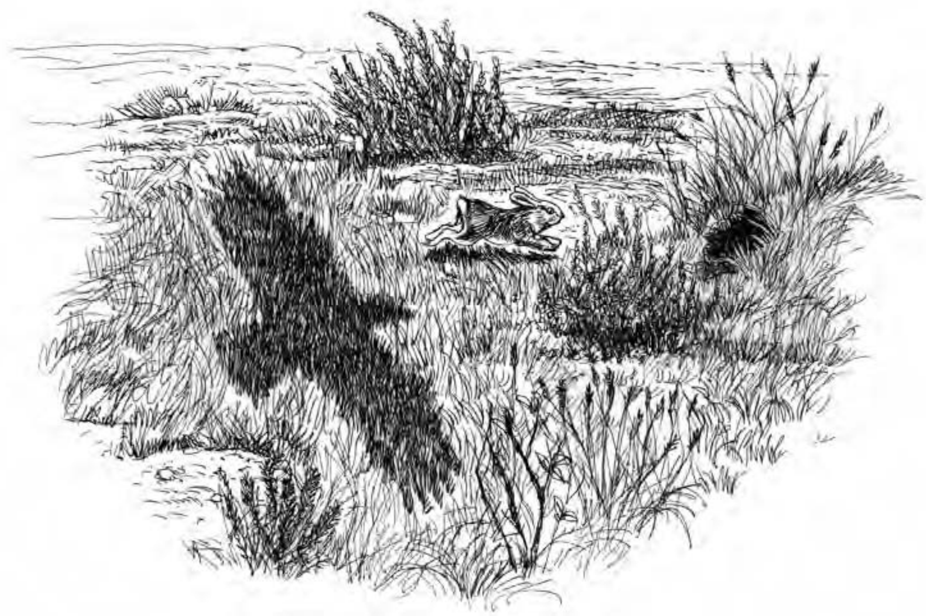
Crumpton, W.G., and Baker, J.L., 1993, Integrating wetlands into agricultural drainage systems: Predictions of nitrate loading and loss in wetlands receiving agricultural subsurface drainage: Proceedings of the International Symposium on Integrated Resource Management and Landscape Modification for Environmental Protection, ASAE pub. 1393, p. 118–126.

Crumpton, W.G., Baker, J.L., Owens, J., Rose, C., and Stenback, J., 1995, Wetlands and streams as off-site sinks for agricultural chemicals: Clean Water-Clean Environment, 21st Century (vol. I), Pesticides, American Society of Agricultural Engineers, pub. 295, p. 49–53.

Galatowitsch, S.M., 1993, Site selection, design criteria and performance assessment for wetland restorations in the prairie pothole region: Ames, Iowa State University, Ph.D. dissertation, 124 p.

Neely, R.K., and Baker, J.L., 1989, Nitrogen and phosphorous dynamics and the fate of agricultural runoff *in* van der Valk, A.G., ed., Northern Prairie Wetlands: Iowa State University Press, Ames, 400 p.

Terry, D.C., and Kirby, B.J., 1997, Commercial fertilizers 1997: Report prepared by AAPFCO and The Fertilizer Institute, Washington, D.C., 42 p.



Session VII. Appendices

Appendix A. Results of the 2004 Conservation Reserve Program Conference Questionnaire

By Mark W. Vandever, U.S. Geological Survey

Introduction

The Conservation Reserve Program (CRP) has evolved since its inception and continues to do so. An important element in continued refinement of the CRP is attention to how the program affects participants, environmental quality, agricultural interests, and rural communities. In June of 2004, the U.S. Department of Agriculture (USDA), Farm Service Agency (FSA) and the U.S. Department of the Interior (USDI), U.S. Geological Survey (USGS) co-sponsored a national conference on the CRP in Fort Collins, Colorado. The purpose was to apply science-based analysis to inform producers, legislators, budget overseers, and other decision-makers on how best to manage CRP, minimize taxpayer costs, and maximize agricultural and environmental benefits. The conference registration package contained a questionnaire to be filled out and returned either during or shortly after the conference commenced. The questionnaire was created to help identify the unique perspectives brought to the conference by its participants and to help the FSA refine the CRP to better meet local and regional needs.

Methods

After initial response rates were calculated, it was determined to offer those who did not respond to the questionnaire another chance to reply. The questionnaire and a postage-paid return envelope were mailed to the 213 official participants. Of the 213 official conference participants, 124 (58%) responded to the questionnaire (table 1). The questionnaire was designed Likert-style with questions that tried to approximate the same level of significance for each respondent. For most questions, respondents were asked to express either agreement or disagreement or satisfied or not satisfied on a five-point scale. Personal employment information was garnered and used to differentiate opinions from vested parties in the future. Data entry and summary statistics were completed using Systat 10.0 statistical software (SPSS, Evanston, Illinois). The questionnaire was pre-tested by six persons either deeply involved or very familiar with the CRP to insure questions were clearly understood and to determine approximate time needed to complete it.

Results

Below is a summary of questionnaire results followed by Attachment I containing the questions with confidence intervals (95%). Respondent responses (%) in the text have been rounded to the nearest whole number.

Participants were given eight categories to choose which best described their affiliation and were asked to write more specifically the agency or company they worked for. The groups with the highest number of responses were from federal (32%) and state (23%) employees (table 1).

Administration of the Conservation Reserve Program

To help identify issues related to administration of the program, several questions were asked to help determine opinions and attitudes. Results show that both the quantity and quality of technical assistance provided by the NRCS/FSA are close around the "satisfactory" rating with a higher percentage rating below "satisfied" (≥38%) than above (≤31%) (table 2).

When asked to rank how the NRCS/FSA enforces landowner compliance on several key issues, more than a quarter of respondents evaluated enforcement somewhat weakly (table 3). Forty-two percent of respondents believed that NRCS/FSA enforcement of emergency use compliance was not strong enough, while over half (52%) believed that USDA guidelines for releasing land for emergency use were adequate (table 4). Establishing a successful cover on CRP land can be difficult due to many environmental factors, but is necessitated by program rules. Just under half (47%) the respondents believed NRCS/FSA enforcement of cover establishment was neither too strong nor weak, while the rest split almost evenly between leaning more strongly (27%) and more weakly (26%). Nearly 46% of respondents believed NRCS/FSA enforcement of cover maintenance was too weak while 16% believed it to be too stringent.

Of the 22% of respondents who listed other important enforcement issues (question #6, Attachment I), weed control (noxious, brush control, tree invasion) and Swampbuster violations were the most common issues believed not properly addressed. Two participants stated "overall there is a general lack of enforcement" and "…enforcement is almost non-existent." One participant noted, "I don't feel enforcement is the best use of tax payer dollars."

Table 1. Questionnaire respondents' affiliation (n = 124).

Employed by	Percent
Federal government	31.5
State government	22.6
Environmental/conservation	16.1
Agribusiness	12.1
Commodity/producer	8.1
Academia	5.6
No answer	2.4
Other	1.6

Table 2. Percent of questionnaire responses rating satisfaction with quantity and quality of service provided by NRCS/FSA regarding CRP lands.

Response	Quantity (n = 116)	Quality (n = 117)
Very satisfied	4.3	4.3
	17.2	26.5
Satisfied	38.8	30.8
	34.5	33.3
Not satisfied	5.2	5.1

Table 3. Percent of questionnaire responses rating respondent opinion on the level of compliance rule enforcement provided by NRCS/FSA regarding CRP lands.

Response	Emergency use (n = 118)	Cover establishment (n = 116)	Cover maintenance (n = 116)
Strongly	5.1	5.2	2.6
	16.9	21.6	13.8
Neutral	35.6	47.4	37.9
	25.4	19.0	28.4
Weakly	16.9	6.9	17.2

Table 4. Percent of questionnaire responses rating U.S. Department of Agriculture guidelines for releasing CRP lands for emergency use (n = 115).

Too flexible		Adequate		Too stringent
11.3	17.4	52.2	16.5	2.6

When asked about administration and management on five major types of CRP land uses, the majority of respondents (>34%) believed it should be at the state level (table 5). If responsibilities were shared, duties combined between state and local parties had the greatest response rate ranging between 8% for emergency haying/grazing and 3% for biomass production. Managed use and periodic disturbance were issues respondents strongly believed should be defined and administered at the state level (42%). Conversely, there was weak support for administering and managing these issues on a national level (≤8%). Administration and management of biomass and tree production were issues respondents believed strongest on the state level (34%) or on the national level as well (29% and 24%) respectively.

Land Uses

Currently, CRP participants are not allowed to disturb land enrolled in the CRP via cutting or grazing vegetation, except under emergency conditions. When asked if participants should be routinely allowed to use the practices listed in table 6 in return for decreased rental rates, opinions fell into three major groups. A majority of respondents believed routine grazing or recreational use for decreased rental payments were favorable (59% and 63%, respectively). Routinely haying or growing vegetation for biomass production had respondents closely split between agreeing (45% and 38%, respectively) or disagreeing (40% and 33%). Tree production for decreased rental rates had the strongest amount of disagreement at 43%.

Respondent opinions differed between the two types of emergency uses. Respondents were split (48%) that haying should be applied only during declared emergencies or more frequently with environmental and wildlife objectives applied (table 7). Grazing only during declared emergencies was supported by 37% of respondents, but a majority believed routine grazing should be an available option (60%). Less than 4% of respondents believed haying and grazing should never be a CRP management option.

Environmental and Wildlife Objectives

All croplands proposed for enrollment in CRP must go through an evaluation to assess potential environmental and economic benefits. An Environmental Benefits Index (EBI) has been developed using a combination of six factors to assess land up for enrollment. Overall, 47% of respondents were satisfied or strongly satisfied with the current EBI's ability to identify land with the greatest environmental benefits (table 8). Over one third of respondents (34%) were either dissatisfied or strongly dissatisfied with the current EBI.

Over half of respondents (≥50%) believed the EBI weighing the six determining factors shown in table 9 as adequate. Between 21% and 34% of respondents thought that wildlife, water, erosion, and enduring benefits were factored too lowly into the EBI equation. A majority of respondents (≥50%) believed that air quality and cost sharing were adequately weighted , while greater than 25% believed they were weighted too highly.

Respondents were asked how effective current guidelines are at addressing environmental and wildlife objectives (table 10). Respondents overwhelmingly believed reductions in soil erosion were effectively addressed by the program (92%). Over 70% of respondents believed the CRP addressed improving soil quality, but 8% felt it was to some extent ineffective in meeting this conservation objective. Surface water quality was thought to be improved under current CRP guidelines by 80% of respondents, but improvement of ground water quality was thought to be at least somewhat effective (54%). Thirty-six percent of respondents had a neutral opinion

Table 5. Percent of questionnaire responses categorizing appropriate level of administration and management regarding CRP lands.

	Administration and management of these CRP land uses should predominately be at:				
Level	Emergency haying/ grazing (*n* = 123)	Managed use (*n* = 120)	Periodic disturbance (*n* = 122)	Biomass production (*n* = 115)	Tree production (*n* = 116)
National	15.4	8.3	7.4	28.7	24.1
Regional	11.4	17.5	13.9	18.3	18.1
State	37.4	41.7	41.8	33.9	34.5
Local	16.3	16.7	23.0	10.4	9.5
National/regional	1.6	1.7	0.8	1.7	1.7
National/state	3.3	1.7	0.0	0.9	1.7
National/local	0.8	0.8	1.6	0.9	1.7
National/regional/state	0.8	0.0	1.6	0.0	0.9
National/state/local	0.0	0.8	0.8	0.9	0.0
Regional/state	2.4	0.8	0.8	0.0	0.9
Regional/state/local	1.6	1.7	1.6	0.9	0.9
State/local	8.1	6.7	6.6	2.6	5.2
All levels	0.8	1.7	0.0	0.9	0.9

Table 6. Percent of questionnaire responses regarding routine use of CRP lands for decreased rental rates.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Haying (*n* = 122)	22.1	23.0	14.8	22.1	18.0
Grazing (*n* = 123)	27.6	31.7	15.4	15.4	9.8
Biomass production (*n* = 120)	17.5	20.8	28.3	17.5	15.8
Recreation (n = 121)	39.7	23.1	20.7	7.4	9.1
Tree production (*n* = 120)	15.8	15.0	26.7	21.7	20.8

Table 7. Percent of questionnaire responses regarding emergency use with decreased rental rate on CRP lands.

	Never	Only for declared emergencies	Routinely, but consistent with environmental and wildlife objectives
Haying (*n* = 124)	4.0	47.6	48.4
Grazing (*n* = 123)	2.4	37.4	60.2

Table 8. Percent of questionnaire responses rating satisfaction with Environmental Benefits Index (EBI) (*n* = 119).

	Strongly satisfied	Satisfied	Neutral	Dissatisfied	Strongly dissatisfied
Current EBI	9.2	37.8	18.5	29.4	5.0

regarding any improvement in water quality brought by the program. Respondents thought current CRP guidelines are at least somewhat effective in addressing desirable changes in wildlife populations (75%) and improving wildlife habitat (78%). A majority of respondents felt the program addressed air quality somewhat effectively (50%), whereas 42% of respondents had a neutral opinion. Over half of respondents felt state level conservation priority areas were at least effectively addressed (51%) while 16% felt they were somewhat ineffectively addressed.

Over 91% of respondents agreed specific environmental objectives should continually be targeted in distribution of CRP enrollments (table 11).

In addition to effects the CRP has on soil, water, air and wildlife, removal of farmland from production initiates a sequence of economic effects that may affect local

Table 9. Percent of questionnaire responses ranking how the current Environmental Benefits Index (EBI) factor is weighted.

Factor	Max points	Too low	Adequate	Too high
Wildlife (*n* = 116)	100	29.3	53.4	17.2
Water (*n* = 116)	100	20.7	74.1	5.2
Erosion (*n* = 116)	100	21.6	70.7	7.8
Enduring benefits (*n* = 114)	50	34.2	54.4	11.4
Air quality (*n* = 117)	45	14.5	60.7	24.8
Cost share (*n* = 117)	150	7.7	50.4	41.9

Table 10. Percent of questionnaire responses ranking effectiveness of current CRP guidelines at addressing environmental and wildlife objectives.

	Effective		Neutral		Ineffective
Reductions in soil erosion (*n* = 121)	56.2	35.5	5.0	3.3	0.0
Desirable changes in wildlife populations (*n* = 121)	29.8	45.5	12.4	9.9	2.5
Improved wildlife habitat (*n* =120)	30.8	47.5	10.0	8.3	3.3
Improved surface water quality (*n* = 120)	30.8	49.2	14.2	3.3	2.5
Improved ground water quality (*n* = 120)	24.2	30.0	35.8	8.3	1.7
Improved air quality (*n* = 121)	21.5	27.3	42.1	6.6	2.5
Improved soil quality (*n* = 119)	37.0	33.6	21.8	5.9	1.7
State level conservation priorities (*n* = 119)	15.1	36.1	32.8	9.2	6.7

Table 11. Percent of questionnaire responses answering if specific environmental objectives should continued to be targeted by the CRP (*n* = 115).

Yes	No
91.3	8.7

communities (Hines and others, 1991). Economic impacts of CRP enrollment vary widely and may result from the current distribution of CRP land and current economic conditions in local communities and economies. When asked if the CRP has hurt the local economy, 68% of respondents disagreed or strongly disagreed while 48% agreed or strongly agreed that the CRP had helped the local economy (table 12). A majority of respondents (78%) believed the CRP had not taken too much cropland out of production and indeed provided economic stability for those enrolled in the program (83%). Respondents to this questionnaire showed the greatest variability when asked if the CRP had hurt agribusiness. While the majority to some extent disagreed (42%), 31% had neutral opinions and 27% agreed the program had negative effects on agribusiness. The majority of respondents overwhelmingly disagreed or strongly disagreed the CRP has caused a decline in rural population (73%).

Future Administration of the Program

At the time of the June 2004 conference, total enrollment in CRP acres was at 34.7 million acres (14 million ha). Over half (55%) of the questionnaire respondents believed the acreage enrolled should be greater while 12% believed it should be decreased (table 13).

Typically, CRP contracts are for no less than 10 and no more than 15 years duration. A series of scenarios was posed to participants asking what changes, if any, should be made to the length of contracts. Greater than 50% of respondents believed that longer, or permanent, contracts should be emphasized (table 14). Seventeen percent believed emphasis should be on more short-term contracts. Given the choice to choose contract length, 36% of respondents believed there should be more options in contract length while 20% believed there should be less flexibility.

Table 12. Percent of questionnaire responses regarding opinions on how the CRP has affected people and business (n = 124).

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The CRP has taken too much cropland out of production	7.3	4.0	10.5	34.7	43.5
The CRP has hurt the local economy	8.9	7.3	16.1	31.5	36.3
The CRP has provided economic stability to those enrolled in the program	32.3	50.8	13.7	1.6	1.6
The CRP has helped the local economy	14.5	33.1	38.7	7.3	6.5
The CRP has hurt agribusiness	8.1	19.4	30.6	25.8	16.1
The CRP has caused a decline in rural population	9.7	6.5	11.3	28.2	44.4

Table 13. Percent of questionnaire responses defining the size of the CRP (n = 121).

Smaller in size	About the same	Larger in size
11.6	33.1	55.4

A technical service provision in the 2002 Farm Bill was added to help landowners prepare and implement conservation plans according to NRCS guidelines. This provision would make available non-federal government and private sector providers of technical assistance. On December 8, 2004 the NRCS announced release of the final rule allowing USDA to certify third parties who can provide conservation technical services to the nation's farmers and ranchers (http://www.nrcs.usda.gov/news/). Conference participants were asked if they believed technical service providers (TSP's), also known as third party providers, were needed or if the current (as of June 2004) system was sufficient (table 15). Sixty-four percent of respondents agreed or strongly agreed that TSP's are needed. In addition, a majority of respondents (58%) disagreed or strongly disagreed that the current system is sufficient to carry the workload.

With the 2007 Farm Bill approaching, many management and implementation issues will need to be reevaluated, discussed, and defined. Conference participants were given a series of statements about management and implementation issues and asked how they should be prioritized before the next Farm Bill. Overall, the majority of respondents ranked each issue as either a priority or high priority (table 16). Emphasis on conservation priority areas and monitoring of wildlife/environmental impacts were ranked highest priorities at 52% and 44%, respectively. Respondents rated all other issues as at least a priority (≥59%) to not a priority (≤18%). Integration of managed/periodic use on CRP lands and integration of conservation practices into working lands were not identified as being a priority by respondents (18% and 16%, respectively).

Table 14. Percent of questionnaire responses emphasizing length of CRP contract.

	Less	Same	More
Shorter term (n = 110)	32.7	50.0	17.3
Longer term (n = 113)	9.7	38.9	51.3
Permanent (n = 113)	16.8	25.7	57.5
Greater emphasis on contracts of variable length (n = 105)	20.0	43.8	36.2

Table 15. Percent of questionnaire responses regarding opinions on technical service providers (TSPs) (n = 121).

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
TSP's are needed	28.1	36.4	13.2	12.4	9.9
The current system is sufficient	6.6	13.2	22.3	28.9	28.9

Recent Environmental and Wildlife Changes

Recent changes brought by the 2002 Farm Bill permit cutting hay and grazing livestock on CRP land to meet long-term habitat management objectives. This managed use or periodic disturbance is a fundamental aspect of native and seeded grassland ecology, as it affects vegetation spatial patterns, structure, and species composition (Allen and others, 2001). When asked which of the following periodic

Table 16. Percent of questionnaire responses rating management and implementation issues for 2007 Farm Bill.

	High priority		Neutral		Not a priority
Emphasis of conservation priority areas (*n* = 122)	52.5	24.6	13.1	6.6	3.3
Adjustment of rental rates (*n* = 122)	30.3	36.1	26.2	2.5	4.9
Integration of managed/periodic use (*n* = 122)	29.5	32.0	20.5	13.1	4.9
Monitoring of wildlife/environmental impacts (*n* =123)	43.9	32.5	18.7	1.6	3.3
Monitoring of economic impacts (*n* = 121)	20.7	38.0	29.8	5.0	6.6
Integration of conservation into working lands (*n* = 121)	29.8	36.4	18.2	6.6	9.1

or managed disturbances should be allowed, support for-and-against periodic haying were similar with 45% agreeing and 40% disagreeing about use of this management practice (table 17). Opinions about periodic grazing were the most similar with 38% agreeing, 28% neutral and 33% disagreeing with its potential use. Mowing and disking were managed disturbances that the greatest percent of respondents agreed with (≥60%). Burning, the management tool that entails the most advanced site preparation and other precautions, had the greatest respondent disagreement about its use 42%, but over half (56%) either agreed or were neutral on the subject.

The CRP has targeted improvement of environmental amenities such as soil and water quality since inception of the program. As the program's direct impacts became more evident, more environmental objectives have been identified. For instance, carbon sequestration and wildlife habitat are now issues of greater priority. Respondents were asked to rank 5 environmental objectives of the CRP from a high priority to not a priority (table 18). Greater than 60% of respondents ranked soil erosion, water quality, and wildlife habitat as a high priority while 6% or less ranked them as a low priority. Two percent of respondents ranked wildlife habitat as not a priority. Wind erosion was considered a priority with 78% respondents ranking it higher than a low priority. The largest difference of opinion came from ranking carbon sequestration, with 24% of respondents ranking it a high priority, 30% a low priority, and 10% not a priority. Overall, over half (57%) of

Table 17. Percent of questionnaire responses regarding allowing periodic or managed disturbances (*n* = 122).

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Haying	22.1	23.0	14.8	22.1	18.0
Mowing	27.9	32.0	15.6	15.6	9.8
Grazing	17.2	20.5	27.9	17.2	15.6
Disking	39.3	23.0	20.5	7.4	9.0
Burning	15.6	14.8	26.2	21.3	20.5

Table 18. Percent of questionnaire responses prioritizing environmental objectives for the future.

	High priority		Low priority		Not a priority
Soil erosion (*n* = 123)	61.0	33.3	5.7	0.0	0.0
Water quality (*n* = 122)	67.2	29.5	2.5	0.8	0.0
Wildlife habitat (*n* = 122)	62.3	27.0	4.9	3.3	2.5
Wind erosion (*n* = 123)	42.3	35.8	13.8	4.9	3.3
Carbon sequestration (*n* = 122)	23.6	32.5	29.3	4.1	9.8

respondents ranked carbon sequestration as more than a low priority. Seventy-four percent of respondents believed there should be greater emphasis on regional prioritization or targeting of CRP enrollment to address environmental objectives.

Summary of Respondent Thoughts and Written Comments

Question #23 asked "what is the issue of greatest importance that should be addressed to improve administration or management of the CRP?" Overall, 65% of participants responded to this question. Although not statistically weighted, most responses addressed wildlife and management issues. Wildlife concerns ranged from "maximizing wildlife benefits through mid-contract management" to "too much emphasis is being put on wildlife habitat" and "CRP should go back to being a soil and water protection program." A number of respondents believed the CRP should "target areas with threatened or endangered species, ducks and pheasants are not threatened or endangered." One participant simply stated "maintenance and management of enrolled CRP acres should meet whatever the priority objective is for the area in which the acreage is enrolled" while another noted "one size fits all does not address the variety of species of wildlife and the need of the grass."

Several respondents wrote there is a lack of dialogue between FSA and state/regional resource management offices. Another noted communication between FSA and NRCS on technical issues related to management needed to increase. The issue of mid-contract management rallied several respondents. One wrote "better training on mid-term management should be provided to USDA office staff," while two others quipped "mid-contract management is critical for improved wildlife habitat" and "mid-contract management should focus on maximizing wildlife benefits and not increase forage value."

Almost one-quarter of the written opinions commented on what level the administration and management of the CRP should be at. Collectively, more authority at the local and state levels was sought. One respondent wrote, "CRP could achieve better results with fewer acres by targeting better acres through local and state/regional prioritization." Another noted "Everybody talks about 'grass roots' support – let it happen." One person stated that local control would be ideal, but that "….my experience is that they tend to be dominated by producers and their special interests."

The EBI prompted a lot of responses in relation to wetlands. Remarks such as "wetland considerations must be included in the EBI as it was prior to signup 26" or "wetlands need to be a part of CRP again for more points on the EBI" were common. Comments on how points are allocated ranged from specific concerns such as "allow only 10 EBI points for introduced grasses," or "EBI should give greater weight to wildlife benefits" to a more generalized "Not a vanilla-one EBI fits all approach." One person commented there should be "Less EBI consideration for enduring benefits, air quality, and cost share", while another said "….modify the EBI to reflect a non-bias split of 3 major concerns – soil, water, and wildlife." One respondent wanted to scrap the EBI altogether and added "The EBI was a nice try but is no better than methods used in the early days of the program. The EBI treats every field independently when we have known for many years that this is not the case."

Comments concerning third party technical service providers mostly reflected that the NRCS/FSA is busy with an "overwhelming workload" and that "TSP's are an important part of existing conservation programs." Several people noted that "FSA must be funded and staffed adequately" instead of adding TSP's or that "…. FSA is in charge but they lack the technical expertise to perform the job properly." One person cautioned "…the not to exceed rates are way too low and are preventing potential TSP's from coming to the table" while another commented "Technical service costs need to decrease." Others noted "TSP's are ripping the taxpayers off w/o providing any jobs in local communities" and "A concern is the conflict of interest issue with the TSP's."

Summary

The rationale for the conference questionnaire was to take advantage of the large assembly of experts familiar with the program and acquire information on their opinions and knowledge about administrative, environmental, and personal effects of the CRP. The CRP was created to establish long-term, resource conserving covers on farmland. Soil, water, air, and wildlife have all been affected by the 34.8 million acres (14 million ha) of land set aside as of September 2004 (http://www.fsa.usda.gov/pas/). The CRP has significant influence on participants, environmental quality, agricultural interests, and rural communities.

Overall, respondents were slightly more satisfied than not with the quality and quantity of technical assistance provided by the NRCS/FSA offices. Although not asked the identical question, these results were not as positive as Allen and Vandever (2003) found in their survey where CRP participants had a greater overall appreciation for the quality and quantity of assistance furnished by the program.

Administration and management of the CRP is widely believed to be more appropriate at local levels. Respondents repeatedly favored control at the state and local levels over that of broader national control. Many believed this approach has the greatest chance for success and may help the CRP accomplish local and national conservation objectives while garnering greater future support (Hughes and others, 1995). Periodic disturbance, which is linked to improving habitat for wildlife, was thought best administered at state and local levels by 58% of respondents. Weber and others (2002) found greater emphasis was needed at landscape levels to meet wildlife objectives.

Management and disturbance of CRP lands has become an issue of substance. Grazing, burning, haying, or mowing induces an immediate impact on wildlife habitat. These impacts are not necessarily negative and may improve desired vegetation over short time scales. Periodic disturbance of CRP grasslands can set back succession, increase vegetation diversity, and enhance habitat quality (McCoy and others, 2001). While prescribed fire abruptly removes plant material, it can increase grass quality, suppress weeds, and improve wildlife habitat (http://ianrpubs.unl.edu/range/). Luttschwager and others (1994) concluded haying CRP grasslands only has negative effects on nesting cover lasting through the early parts of the following year. In contrast, Allen and others (2001) found presence of legumes increased while noxious weeds decreased in response to periodic haying of CRP grasslands in the Northern Plains. Renner and others (1995) reported haying effects may last throughout the following growing season affecting habitat quality for late-nesting species. Less than half of the respondents agreed haying should be allowed in other than emergency circumstances. Routine haying consistent with environmental and wildlife objectives held the same support as haying only for declared emergencies (48%).

The majority of respondents (>59%) agreed routine grazing should be allowed coupled with a decreased rental rate or with a prescription that is consistent with environmental and wildlife objectives. Less than half of respondents (38%) agreed that periodic grazing (without a decrease in rental rates) should be permitted. This drop in support implies respondents were more willing to allow grazing of CRP lands coupled with a decreased in rental rate, but there is confusion between prescribed grazing with implied environmental and wildlife objectives, and grazing for periodic disturbance. This difference could be due to unclear wording of the question or confusion and relative newness of the recent changes in the 2002 Farm Bill permitting livestock grazing on CRP land. While 62% of respondents defined wildlife habitat as a high priority, achieving those objectives via grazing and haying may not be the most acceptable or popular tool.

The EBI weighs six important factors in determining acceptance of land into the CRP. The General Accounting Office (2002) found at least half of their survey respondents believed that protecting or improving wildlife habitat in CRP lands needs to be emphasized and that the CRP was more than effective in improving wildlife habitat. The USDA lists 18.2 million acres (7.4 million ha) as land with vegetative covers best suited for wildlife (http://www.fsa.usda.gov/pas/). Questionnaire respondents believe the EBI does an adequate job emphasizing wildlife and almost 4 out of 5 believe current guidelines address improving wildlife habitat. Except for cost sharing, the EBI was found to adequately weigh the determining factors by over half of the respondents.

Soil and water quality have been targeted by the CRP since its inception. As of fiscal year 2003, erosion of soil was reduced by 446 million tons because of CRP (http://www.fsa.usda.gov/pas/). A large majority of respondents (>70%) believe the EBI targets these abiotic factors and the CRP is effective under current guidelines at improving soil conservation.

As the rural populations and number of farms in the U.S. continue to decline (Dahlberg, 1992), economic and rural issues related to the CRP have become intertwined. A survey by Leistritz (2002) found that community and agricultural leaders believed demand for inputs such as fuel, fertilizer, and machinery were lessened because of the CRP leading to lost income for farm supply and service industries. Twenty-seven percent of CRP conference respondents held similar beliefs, while 42% believed the CRP had not hurt agribusiness. The General Accounting Office (2002) found 58% of respondents to this investigation believed the CRP had positive effects on rural community economies. Similar beliefs were held by CRP conference questionnaire respondents with almost half (48%) agreeing the CRP has helped local economies, while 16% believed the program had hurt local economies. Respondents overwhelmingly believe the CRP has provided economic stability to those enrolled in the program.

By the sheer response rate (58%) to the questionnaire and to question #23 (65%) it is evident people have a vested interest in bettering and extending the CRP into the future. The fact that over 200 people traveled to the CRP conference at a time when travel authorization and budgets can be tight alone merits recognition of the importance given to this conservation program. While little could be found in the negative arena, much could be said about keeping the program as is or making slight adjustments to fine tune administration of the program.

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References Cited

Allen, A.W., Cade, B.S., and Vandever, M.W., 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, v. 56, no. 2, p. 120–125.

Allen, A.W., and Vandever, M.W., 2003, A national survey of Conservation Reserve Program (CRP) participants on environmental effects, wildlife issues, and vegetation management on program lands: Biological Science Report No. 2003-001, U.S. Geological Survey, Fort Collins, CO, 51 p.

Dahlberg, K.A., 1992, The conservation of biological diversity and U.S. agriculture: goals, institutions, and policies. Agriculture, Ecosystems and Environment, v. 42, p.177–193.

Farm Service Agency, 2005, Conservation Reserve Program fiscal year summary: http://www.fsa.usda.gov/pas/.

General Accounting Office, 2002, Agricultural conservation: state advisory committees' views on how USDA programs could better address environmental concerns: U.S. General Accounting Office, Washington, D.C., 76 p.

Hines, F., Sommer, J.E., and Petrulis, M.F., 1991, How the CRP affects local economies: Agricultural Outlook, p. 30–34.

Hughes, J.S., Hoag, D.L., and Nipp, T.E., 1995, The Conservation Reserve Program: A survey of research and interest groups: Council for Agriculture, Science and Technology, Ames, IA, Special Publication, no. 19, 44 p.

Leistritz, F.L., Hodur, N.M., and Bangsund, D.A., 2002, Socioeconomic impacts of the Conservation Reserve Program in North Dakota: Rural America, v. 17, no. 3, p. 57–65.

Luttschwager, K.A., Higgins, K.A., and Jenks, J.A., 1994, Effects of emergency haying on duck nesting in Conservation Reserve Program fields, South Dakota: Wildlife Society Bulletin, v. 22, no. 3, p. 403–408.

McCoy, T.D., Kurzejeski, E.W., Burger Jr., L.W., and Ryan, M.R., 2001, Effects of conservation practice, mowing, and temporal changes on vegetation structure on CRP fields in northern Missouri: Wildlife Society Bulletin v. 29, no. 3, p. 979–987.

Natural Resources Conservation Service, 2004, USDA releases technical service provider assistance final rule: http://www.nrcs.usda.gov/news/.

Renner, R.W., Reynolds, R.E., and Batt, B.D., 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, v. 60, p. 221–229.

University of Nebraska, Institute of Agriculture and Natural Resources, 2004, Grassland management with prescribed fire: http://ianrpubs.unl.edu/range/.

Weber, W.L., Roseberry, J.L., and Woolf, A., 2002, Influence of the Conservation Reserve Program on landscape structure and potential upland wildlife habitat: Wildlife Society Bulletin v. 30, no. 2, p. 888–898.

Confidence Intervals (95%) for Responses to the 2004 Conservation Reserve Program Conference Questionnaire

Part I: Personal Information

Please CIRCLE the category and ADD the agency or company that best describes your affiliation:

Federal government	State government	Environmental/conservation	
31.5	22.6	16.1	
43.4–20.2	33.9–12.9	26.6–8.0	
Agribusiness	Academia	Commodity/producer	Other
12.1	5.6	8.1	1.6
21.7–5.1	13.4–1.3	16.7–2.6	7.3–0.0

No Answer = 2.4 8.6–0.1

Part II: Administration of the Program

1) Using the scale below circle your evaluation of the quantity of technical assistance provided by the NRCS/FSA regarding CRP lands:

Very satisfied		Satisfied		Not satisfied
4.3	17.2	38.8	34.5	5.2
11.4–0.7	27.6–9.0	50.8–27.0	46.4–23.2	12.6–1.1

2) Using the scale below circle your evaluation of the quality of technical assistance provided by the NRCS/FSA regarding CRP lands:

Very satisfied		Satisfied		Not satisfied
4.3	26.5	30.8	33.3	5.1
11.3–0.7	37.9–16.4	42.4–20.0	45.1–22.2	12.5–1.1

3) Give your evaluation of how the NRCS/FSA enforces compliance of emergency use:

Strongly				Weakly
5.1	16.9	35.6	25.4	16.9
12.4–1.1	27.2–8.8	47.4–24.2	36.7–15.5	27.2–8.8

4) Give your evaluation of how the NRCS/FSA enforces compliance of cover establishment:

Strongly				Weakly
5.2	21.6	47.4	19.0	6.9
12.6–1.1	32.5–12.3	59.3–34.9	29.6–10.3	15.0–2.0

5) Give your evaluation of how the NRCS/FSA enforces compliance of cover maintenance:

Strongly				Weakly
2.6	13.8	37.9	28.4	17.2
8.8–0.1	23.6–6.5	49.9–26.2	40.0–18.0	27.6–9.0

6) List any enforcement issues that you feel are important but not included above:

No answer = 78.2 Answer 21.7

85.7–68.4 31.1–13.8

7) How would you rate the USDA's guidelines for releasing land for emergency use?

Too flexible		Adequate		Too stringent
11.3	17.4	52.2	16.5	2.6
20.6–4.7	27.9–9.1	63.9–39.4	26.9–8.4	8.9–0.1

8) Administration and management of these CRP land uses should predominately be at the: (check more than one if duties should be shared.)

Level	Emergency haying/ grazing	Managed use	Periodic disturbance	Biomass production	Tree production
National	15.4 26.3–7.1	8.3 17.6–2.5	7.4 16.2–2.0	28.7 41.4–17.1	24.1 36.6–13.4
Regional	11.4 21.4–4.4	17.5 28.8–8.5	13.9 24.4–6.1	18.3 29.9–9.0	18.1 29.8–8.8
State	37.4 50.2–24.8	41.7 54.6–28.5	41.8 54.5–28.8	33.9 46.9–21.5	34.5 47.6–21.9
Local	16.3 27.2–7.7	16.7 27.9–7.9	23.0 34.8–12.8	10.4 20.5–3.7	9.5 19.3–3.1
National/regional	1.6 7.7–0.0	1.7 7.9–0.0	0.8 6.2–0.0	1.7 8.1–0.0	1.7 8.1–0.0
National/state	3.3 10.3–0.2	1.7 7.9–0.0	0.0 0.0–0.0	0.9 6.5–0.0	1.7 8.1–0.0
National/local	0.8 6.2–0.0	0.8 6.3–0.0	1.6 7.7–0.0	0.9 6.5–0.0	1.7 8.1–0.0
National/regional/state	0.8 6.2–0.0	0.0 0.0–0.0	1.6 7.7–0.0	0.0 0.0–0.0	0.9 6.5–0.0
National/state/local	0.0 0.0–0.0	0.8 6.3–0.0	0.8 6.2–0.0	0.9 6.5–0.0	0.0 0.0–0.0
Regional/state	2.4 9.0–0.1	0.8 6.3–0.0	0.8 6.2–0.0	0.0 0.0–0.0	0.9 6.5–0.0
Regional/state/local	1.6 7.7–0.0	1.7 7.9–0.0	1.6 7.7–0.0	0.9 6.5–0.0	0.9 6.5–0.0
State/local	8.1 17.2–2.4	6.7 15.4–1.6	6.6 15.1–1.6	2.6 9.6–0.1	5.2 13.5–0.9
All levels	0.8 6.2–0.0	1.7 7.9–0.0	0.0 0.0–0.0	0.9 6.5–0.0	0.9 6.5–0.0

Part III: Land Uses

9) Should CRP participants be allowed to routinely use these practices in return for decreased rental rates?

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Haying	22.1 32.9–13.0	23.0 33.8–13.6	14.8 24.5–7.3	22.1 32.9–13.0	18.0 28.3–9.8
Grazing	27.6 38.8–17.6	31.7 43.1–21.0	15.4 25.2–7.8	15.4 25.2–7.8	9.8 18.3–3.9
Biomass production	17.5 27.7–9.3	20.8 31.5–11.9	28.3 39.7–18.0	17.5 27.7–9.3	15.8 25.8–8.0
Recreation	39.7 51.4–28.0	23.1 34.0–13.8	26.7 31.3–11.8	7.4 15.5–2.4	9.1 17.6–3.4
Tree production	15.8 25.8–8.0	15.0 24.8–7.4	20.7 37.9–16.6	21.7 32.4–12.5	20.8 31.5–11.9

10) Presently, haying and grazing are allowed under emergency conditions for financial penalty. How frequently should these options be available?

	Never	Only for declared emergencies	Routinely, but consistent with environmental and wildlife objectives
Haying	4.0 10.2–0.8	47.6 58.4–36.4	48.4 59.1–37.1
Grazing	2.4 7.9–0.2	37.4 48.3–26.8	60.2 70.3–48.6

Part IV: Environmental and Wildlife Objective

11) The environmental benefits index (EBI) is based on six factors (wildlife enhancement, water quality, soil erosion, enduring benefits, air quality, and cost) used to evaluate and rank land offered for enrollment. How satisfied are you that the current EBI identifies land with potential to achieve environmental benefits?

	Strongly satisfied	Satisfied	Neutral	Dissatisfied	Strongly dissatisfied
Current EBI	9.2 17.9–3.5	37.8 49.6–26.3	18.5 28.9–10.0	29.4 40.9–18.9	5.0 12.3–1.1

12) Currently, the EBI weighs the CRP enrollment with the following maximum points. Please select whether the relative number of points are too low, adequate, or too high:

Factor	Max points	Too low	Adequate	Too high
Wildlife	100	29.3 40.2–19.4	53.4 64.4–41.6	17.2 26.9–9.5
Water	100	20.7 30.8–12.2	74.1 83.0–62.7	5.2 12.1–1.3
Erosion	100	21.6 31.8–12.9	70.7 80.0–59.1	7.8 15.5–2.8
Enduring benefits	50	34.2 45.4–23.6	54.4 65.3–42.4	11.4 20.1–5.1
Air quality	45	14.5 23.7–7.5	60.7 71.0–48.8	24.8 35.3–15.6
Cost share	150	7.7 15.4–2.8	50.4 61.4–38.7	41.9 53.1–30.7

13) The CRP is the USDA's largest environmental program. Under the current guidelines, how effective is the CRP at addressing these environmental and wildlife objectives?

	Effective		Neutral		Ineffective
Reductions in soil erosion	56.2 67.1–44.0	35.5 46.9–24.6	5.0 11.9–1.2	3.3 9.5–0.4	0.0 0.0–0.0
Desirable changes in wild-life populations	29.8 41.2–19.3	45.5 57.1–33.4	12.4 21.7–5.6	9.9 18.6–3.9	2.5 8.5–0.1
Improved wildlife habitat	30.8 42.4–20.2	47.5 59.2–35.2	10.0 18.8–4.0	8.3 16.7–2.9	3.3 9.8–0.4
Improved surface water quality	30.8 42.4–20.2	49.2 60.8–36.8	14.2 23.8–6.8	3.3 9.8–0.4	2.5 8.5–0.1
Improve ground water quality	24.2 35.2–14.6	30.0 41.5–19.4	35.8 47.5–24.5	8.3 16.7–2.9	1.7 7.2–0.0
Improved air quality	21.5 32.2–12.4	27.3 38.5–17.2	42.1 53.9–30.3	6.6 14.4–1.9	2.5 8.5–0.1
Improved soil quality	37.0 48.8–25.5	33.6 45.3–22.5	21.8 32.7–12.7	5.9 13.5–1.5	1.7 7.2–0.0
State level conservation priorities	15.1 25.0–7.5	36.1 47.9–24.8	32.8 44.4–21.8	9.2 17.9–3.5	6.7 14.6–2.0

14) Should specific environmental objectives continue to be targeted in distribution of CRP enrollment?

Yes = 91.3 96.0–83.1	No = 8.7 16.2–3.6

15) The idling of millions of acres of cropland under the CRP has affected virtually all citizens in some manner. These impacts may occur both on and off the farm, locally and nationally. How do you feel about each of the following statements?

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The CRP has taken too much cropland out of production	7.3 15.1–2.3	4.0 10.7–0.7	10.5 19.2–4.4	34.7 46.2–23.7	43.5 55.1–31.7
The CRP has hurt the local economy	8.9 17.2–3.3	7.3 15.1–2.3	16.1 26.0–8.4	31.5 42.8–20.9	36.3 47.8–25.1
The CRP has provided economic stability to those enrolled in the program	32.3 43.6–21.6	50.8 62.2–38.6	13.7 23.1–6.6	1.6 7.0–0.0	1.6 7.0–0.0
The CRP has helped the local economy	14.5 24.1–7.2	33.1 44.5–22.3	38.7 50.3–27.3	7.3 15.1–2.3	6.5 14.0–1.9
The CRP has hurt agri-business	8.1 16.2–2.8	19.4 29.7–10.8	30.6 42.0–20.2	25.8 36.8–16.1	16.1 26.0–8.4
The CRP has caused a decline in rural population	9.7 18.2–3.8	6.5 14.0–1.9	11.3 20.2–4.9	28.2 39.4–18.1	44.4 55.9–32.5

Part V: Future Administration of the Program

16) Currently, the CRP is at 34.7 million acres. Should the amount of acreage enrolled in the CRP be:

Smaller in size = 11.6 20.0–5.4	About the same = 33.1 43.9–22.9	Larger in size = 55.4 65.9–43.7

17) Typically, participants enroll in CRP contracts for 10 to 15 years. Should the CRP emphasize the use of a different length of contract?

	Less	Same	More
Shorter term	32.7 44.1–22.1	50.0 61.3–37.9	17.3 27.3–9.3
Longer term	9.7 18.1–4.0	38.9 50.3–27.8	51.3 62.5–39.4
Permanent	16.8 26.6–9.1	25.7 36.4–16.2	57.5 68.3–45.4
Greater emphasis on contracts of variable length	20.0 30.6–11.3	43.8 55.6–31.8	36.2 47.9–24.9

18) Technical Service Providers (TSP's) or Third Party Providers help landowners prepare conservation plans and ensure the use of proper conservation practices to meet federal standards. Which of the following describe your feelings about TSP's or Third Party Provider assistance?

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
TSP's are needed	28.1 39.4–17.9	36.4 48.0–25.0	13.2 22.7–6.2	12.4 21.7–5.6	9.9 18.6–3.9
The current system is sufficient	6.6 14.4–1.9	13.2 22.7–6.2	22.3 33.1–13.1	28.9 40.3–18.6	28.9 40.3–18.6

19) Looking forward, how should these CRP management and implementation issues be prioritized before the next Farm Bill?

	High priority		Neutral		Not a priority
Emphasis of conservation priority areas	52.5 63.8–40.1	24.6 35.6–15.0	13.1 22.5–6.1	6.6 14.3–1.9	3.3 9.6–0.4
Adjustment of rental rates	30.3 41.7–19.8	36.1 47.7–24.8	26.2 37.3–16.3	2.5 8.4–0.1	4.9 12.0–1.1
Integration of managed/periodic use	29.5 40.9–19.1	32.0 43.4–21.2	20.5 31.0–11.7	13.1 22.5–6.1	4.9 12.0–1.1
Monitoring of wildlife/environmental impacts	43.9 55.5–32.0	32.5 44.0–21.7	18.7 29.0–10.3	1.6 7.0–0.0	3.3 9.6–0.4
Monitoring of economic impacts	20.7 31.3–11.8	38.0 49.7–26.5	29.8 41.2–19.3	5.0 12.1–1.1	6.6 14.4–1.9
Integration of conservation into working lands	29.8 41.2–19.3	36.4 48.0–25.0	18.2 28.5–9.8	6.6 14.4–1.9	9.1 17.6–3.4

Part VI: Recent Environmental and Wildlife Changes

20) Grazing or haying on fully established CRP land, in the absence of a weather–related emergency is now an option. This periodic disturbance or managed use is tied to the end of the primary nesting season and is meant to be used as a tool to increase diversity and quality of wildlife cover. Which of the following periodic or managed disturbances should be allowed?

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Haying	22.1 38.2–17.0	23.0 40.9–19.1	14.8 26.4–8.5	22.1 28.3–9.8	18.0 17.5–3.4
Mowing	27.9 39.1–17.7	32.0 31.0–11.7	15.6 31.0–11.7	15.6 27.3–9.1	9.8 23.5–6.7
Grazing	17.2 49.4–26.3	20.5 48.5–25.6	27.9 23.5–6.7	17.2 15.3–2.4	15.6 10.9–0.7
Disking	39.3 43.4–21.2	23.0 39.1–17.7	20.5 27.3–9.1	7.4 23.5–6.7	9.0 17.5–3.4
Burning	15.6 73.7–50.6	14.8 37.3–16.3	26.2 15.3–2.4	21.3 5.6–0.0	20.5 8.4–0.1

21) In the past, these environmental objectives have been targeted. Using present guidelines prioritize how these environmental objectives should be targeted for the future.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
TSP's are needed	28.1 39.4–17.9	36.4 48.0–25.0	13.2 22.7–6.2	12.4 21.7–5.6	9.9 18.6–3.9
The current system is sufficient	6.6 14.4–1.9	13.2 22.7–6.2	22.3 33.1–13.1	28.9 40.3–18.6	28.9 40.3–18.6

22) Should there be more emphasis on regional prioritization (e.g., targeting) of CRP enrollment to address environmental objectives?

Yes– 74.2
82.4–63.8

No–25.8
35.7–17.1

Your Thoughts:

23) In your opinion, what is the issue of greatest importance that should be addressed to improve administration or management of the CRP?

Answered = 64.5 73.7–53.8

Not Answered = 35.4
45.6–25.8

Appendix B. Conservation Reserve Program Overview and Enrollment Summary, April 2004

By Alex Barbarika, Skip Hyberg, Jim Williams, and Jean Agapoff, Farm Service Agency, Washington, D.C.

Conservation Reserve Program Overview and Enrollment Summary April 2004

Farm Service Agency
U.S. Department of Agriculture

ACTIVE CONTRACTS, APRIL 2004

Sign-up Type	Contracts	Farms	Acres	Annual Rental Payments b/ ($Million)	($/Acre)
General	394,498	261,597	31,902,160	$1,391	$43.59
Continuous					
Non-CREP	220,009	139,472	2,133,591	$191	$89.43
CREP	36,755	24,604	580,326	$70	$121.33
Subtotal	256,764	160,452 a/	2,713,917	$261	$96.25
Farmable Wetland	7,027	5,724	108,066	$13	$119.36
Total	658,289	388,586 a/	34,724,144	$1,665	$47.95

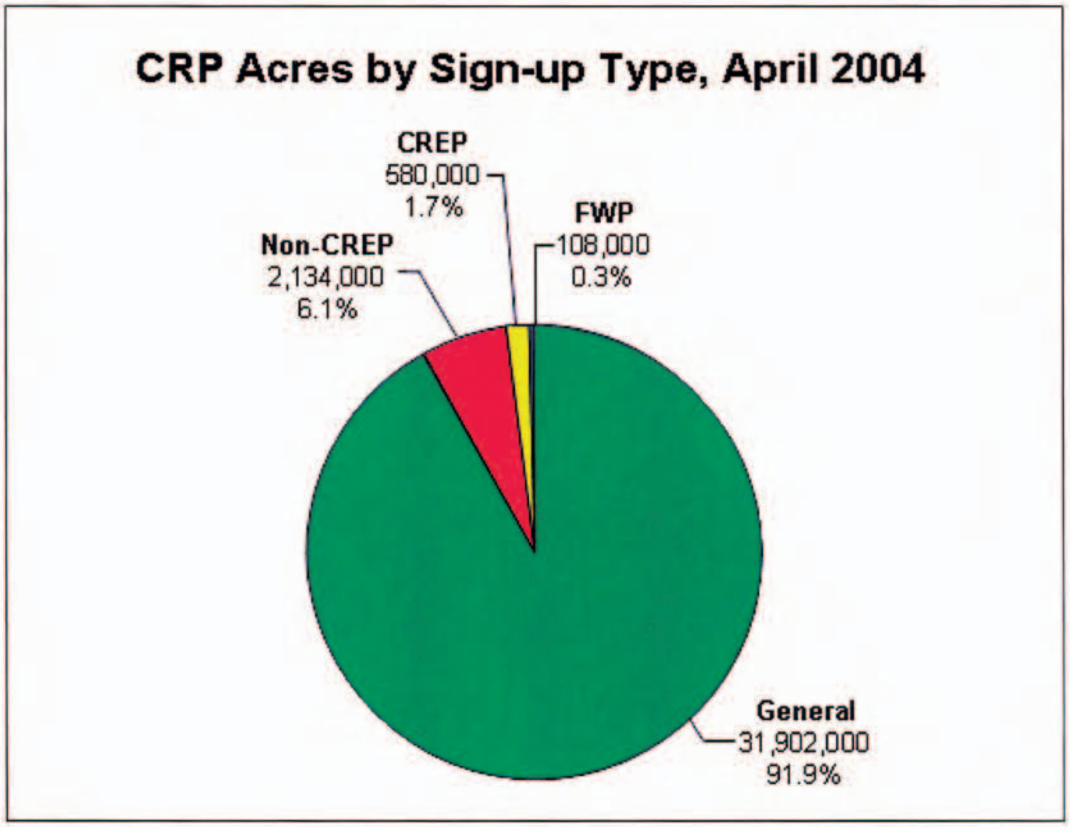
Note: Not including 13,904 acres in contracts with invalid expiration year (before 2004).

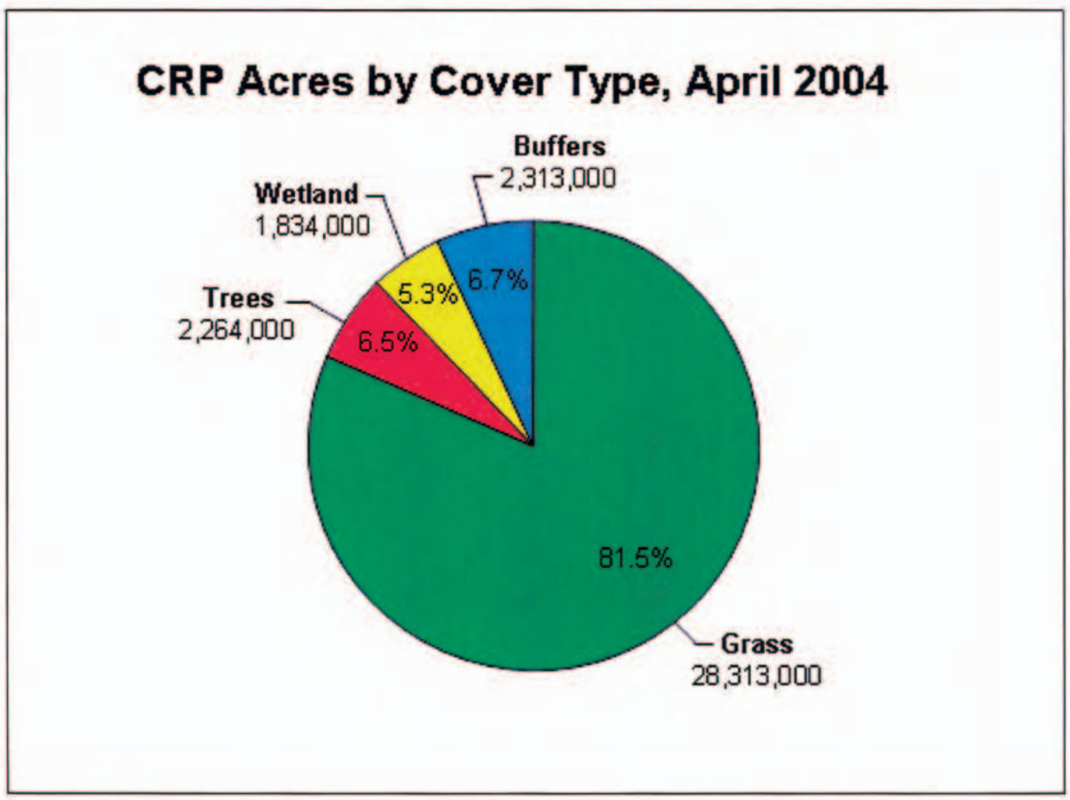
a/ Number of farms not additive across sign-up types because a farm may participate in multiple sign-up types.
b/ Approximates FY 2005 payments, before adjustments for haying/grazing, non-compliance, terminations, part-year contracts, and contracts not yet recorded.

Conservation Reserve Program
Performance Goals and Indicators
FY 1999 - FY 2003

Goal/Indicator	Units	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003
Increase the number of acres enrolled in CRP and expand CREP						
Overall CRP enrollment	Mil. Ac.	29.8	31.4	33.6	33.9	34.1
General sign-up (competitive) enrollment	Mil. Ac.	28.9	30.2	32.0	31.8	31.6
Continuous (including CREP) enrollment	Mil. Ac.	0.9	1.2	1.6	2.1	2.5
Tree plantings	Mil. Ac.	2.2	2.5	2.9	3.1	3.2
National conservation priority area enrollment[1]	Mil. Ac.	6.9	7.2	7.8	8.0	8.1
CREP enrollment	Mil. Ac.	0.03	0.08	0.19	0.36	0.5
Approved CREP agreements	#	8	12	18	24	26
Reduce soil erosion, protect water and air quality, restore wetlands, and improve wildlife habitat						
Soil Erosion						
Reduced soil erosion[2]	Mil. Tons	N/A	407	428	447	446
Water & Air Quality						
Reduced sheet and rill erosion[2]	Mil. Tons	N/A	166	178	215	214
Reduced wind erosion[2]	Mil. Tons	N/A	241	250	232	232
Reduced nitrogen applications	1,000Tons	553	605	634	681	655
Reduced phosphorus applications	1,000Tons	80	87	97	104	103
Conservation buffers	Mil. Ac.	1.2	1.3	1.7	2.1	2.3
Carbon sequestered in soil and vegetation	Mil. Metric Tons	14.5	15.2	16.1	16.3	17
Wetlands						
Restored wetlands[3]	Mil. Ac.	1.3	1.5	1.7	1.7	1.8
Wildlife Habitat						
Land with vegetative covers defined as best suited for wildlife[4]	Mil. Ac.	12.4	16.6	18.2	18.1	18.2
Sensitive wildlife ecosystem restorations[5]	Mil. Ac.	1.3	2.1	2.6	3.3	3.5

[1] Includes land in the Chesapeake Bay, Great Lakes, Long Island Sound, Prairie Pothole, and Long Leaf Pine priority areas.
[2] Estimates assume land would be erode at 1982 rates (before CRP enrollment).
[3] Includes adjacent upland buffers.
[4] Plantings that generally meet multiple seasonal (e.g., nesting cover, winter cover) requirements for wildlife of local or regional concern.
[5] Including, but are not limited to, wetland restoration, wildlife corridors, riparian buffers, longleaf pines, and rare and declining habitats.


CRP Acres by Sign-up Type, April 2004
CREP
580,000
1.7%
FWP
108,000
0.3%
Non-CREP
2,134,000
6.1%
General
31,902,000
91.9%


CRP Acres by Cover Type, April 2004
Buffers
2,313,000
Wetland
1,834,000
Trees
2,264,000
5.3%
6.7%
6.5%
81.5%
Grass
28,313,000

CONSERVATION RESERVE PROGRAM OVERVIEW[1]

INTRODUCTION

Under the voluntary Conservation Reserve Program (CRP), the U. S. Department of Agriculture (USDA) establishes contracts with agricultural producers to retire highly erodible and other environmentally sensitive cropland and pasture. During the 10- to 15-year CRP contract period, cropland is converted to grass, trees, wildlife cover, or other conservation uses. Enrollment provides environmental benefits, including improvement of surface water quality, creation of wildlife habitat, preservation of soil productivity, protection of groundwater quality, and reduction of offsite wind erosion damages. The program also assists farmers by providing a dependable source of income and reducing commodity surpluses and provides a transition period for farmers to convert environmentally sensitive cropland to other uses. The program was first established by the Food Security Act of 1985 and later amended by the Food, Agriculture, Conservation, and Trade Act of 1990 and the Federal Agriculture Improvement and Reform Act of 1996, and the Farm Security and Rural Investment Act of 2002.

PROGRAM DESCRIPTION

The CRP is administered by USDA's Farm Service Agency with technical assistance from USDA's Natural Resources Conservation Service and Forest Service, and from technical service providers. Participants receive annual rental payments during the contract period and half the cost of establishing conservation covers. There are 2 primary ways for farmers and ranchers to participate in CRP: general sign-up and continuous sign-up. Conservation Reserve Enhancement Program (CREP) and Farmable Wetland Program enrollments operate under continuous sign-up provisions.

<u>General Sign-up.</u> Producers with eligible lands compete nationally for acceptance based on an environmental benefits index (EBI) during specified enrollment periods. Producers may submit offers below soil-specific maximum rental rates to increase EBI rankings.

<u>Continuous Sign-up.</u> Producers with eligible lands may enroll certain high priority conservation practices, such as filter strips and riparian buffers, at any time during the year without competition. In addition to annual rental payment and cost-share assistance, many practices are eligible for additional annual and one-time up-front financial incentives.

<u>Conservation Reserve Enhancement Program (CREP).</u> Under CREP agreements, Federal/State partnerships implement projects designed to address specific environmental objectives through targeted CRP enrollments. Sign-up is held on a continuous basis, "general" sign-up practices may be included, and additional financial incentives are provided.

<u>Farmable Wetland Program.</u> Producers enroll small non-flood plain wetlands under modified continuous sign-up provisions.

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[1] For additional information, contact Alex Barbarika (202) 720-7093 or Alexander.Barbarika@usda.gov.

LEGISLATIVE HISTORY

Year	Legislation	Description
1985	Food Security Act of 1985	Required enrollment of 40 to 45 million acres by 1990.
1990	Food, Agriculture, Conservation, and Trade Act of 1990	Extended enrollment authority to 1995
1992, 1993	Appropriations and Omnibus Budget Reconciliation Acts	Reduced enrollment authority to 38 million acres.
1996	Federal Agriculture Improvement and Reform Act of 1996	Extended enrollment authority to 2002 and capped enrollment at 36.4 million acres.
2001	FY 2001 Appropriation Act	Established Farmable Wetlands Pilot Program
2002	Farm Security and Rural Investment Act of 2002	Extended enrollment authority to 2007 and increased enrollment cap to 39.2 million acres.
2003	Emergency Wartime Supplemental Appropriations Act, 2003	Authorized use other USDA conservation program funding for technical assistance.

PROGRAM OPERATION HIGHLIGHTS

Year(s)	Activity
1986-1989	• Sign-ups 1-9 conducted, 33.9 million acres enrolled. • Eligibility primarily based on erosion and erodibility potential. • Rental payments subject to State or sub-State maximum acceptable rental rates (not pre-announced).
1988-1989	• Eligibility expanded to include: Cropland bordering water body or wetland. Cropped wetlands. Cropland subject to scour erosion.
1990-1993	• Sign-ups 10-12 conducted, 2.5 million acres enrolled. • Eligibility changed to include: National conservation priority areas (Chesapeake Bay, Long Island Sound, and Great Lakes watersheds). State water quality priority areas (USDA or EPA/State designated watersheds). Additional high priority conservation practices. • Cropped wetland eligibility canceled. • Provisions for competitive enrollment based on cost and environmental benefits : Soil-specific maximum rental payment rates (not pre-announced). "Black box" environmental benefits index (EBI).
1995	• 1-year extensions offered for contracts expiring 9/30/1995. • Early-contract termination offered for selected contracts. • Sign-up 13 conducted, enrolling 684,000 acres approved for enrollment, using revised "open" EBI and pre-announced maximum soil rental rates.
1996	• 1-year extensions offered for contracts expiring 9/30/1996. • Early-contract termination offer continued. • Continuous sign-up began for selected high-priority conservation practices: Non-competitive enrollment, with added financial incentives. Additional practices, wellhead protection areas, and marginal pasture.

1997	• General sign-up provisions revisions including: Prairie pothole National conservation priority area established. Eligibility of cropped wetlands reinstated. EBI revised to include wildlife habitat, air quality, and enduring benefits factors. Wildlife habitat given priority equal to water quality and soil erosion benefits. • General sign-up 15 conducted, 16.7 million acres enrolled. • General sign-up 16 conducted, 5.9 million acres enrolled. • FY 1997 continuous sign-up 14 conducted (561,000 acres enrolled). • Conservation Reserve Enhancement Program (CREP) established: Targeted enrollment under State/Federal partnership. Additional financial incentives, States provide 20-percent of total costs First CREP agreement, with Maryland, signed October 20, 1997. • Administration establishes 4-million-acre continuous sign-up goal among strategies in joint USDA/Environmental Protection Agency "Clean Water Action Plan".
1998	• General sign-up 18 conducted, 4.8 million acres enrolled; longleaf pine National conservation priority area added. • FY 1998 continuous sign-up 17 conducted (218,000 acres enrolled).
1999	• General sign-up 20 conducted, 2.3 million acres enrolled. • FY 1999 continuous sign-up 19 conducted (268,000 acres enrolled).
2000	• FY 2000 continuous sign-up 21 conducted (119,000 acres enrolled). • Sign-up 21 ended in June when additional continuous sign-up enhancements adopted: Up-front signing incentive payments (SIP) and practice incentive payments (PIP). Increased maintenance payment allowance. Updated marginal pastureland rental payment rates. • FY 2000 continuous sign-up 22 began in June (209,000 acres enrolled).
2001	• 1-year extension of contracts expiring 9/30/2001. • FY 2001 continuous sign-up 23 conducted (468,000 acres enrolled). • Farmable Wetlands Pilot Program implemented: Limited to 500,000 acres in 6 States. Farmed and prior converted wetlands of 5 acres or less.
2002	• 1-year extension of contracts expiring 9/30/2002. • FY 2002 continuous sign-up 24 conducted (440,000 acres enrolled). • 2002 Farm Bill enacted May 13, 2002.
2003	• FY 2003 continuous sign-up 25 conducted (251,000 acres enrolled). • Environmental Impact Statement completed (January 10, 2003), Record of Decision published in Federal Register (May 8, 2003). • Interim Rule incorporating 2002 farm bill provisions and long-term policy published in Federal Register (May 8, 2003). • General sign-up 26 conducted, 2.0 million acres accepted. • Sign-up 25 ended in June when new marginal pasture eligibility provisions implemented: Non-tree covers allowed. Wetland buffers and wildlife habitat practices added. • FY 2003 continuous sign-up 27 began in June (180,000 acres enrolled as of April 2004). • Bottomland hardwood tree initiative adopted. • Wetland restoration (CP23) made eligible for continuous sign-up. Acreage must be located in flood plain.

CRP Enrollment and Outlay History

Fiscal Year	Cumulative Enrollment 1/	Rental Payments 2/	Cost-Share Payments 3/	Incentive Payments 4/	Tech. Asst. Outlays 5/	Total Outlays
	(Million Acres)	(Million Dollars)				
1986	2.0	$0	$0	$0	$8	$8
1987	15.4	$410	$246	$0	$41	$697
1988	24.0	$756	$282	$0	$56	$1,094
1989	29.2	$1,149	$181	$0	$86	$1,416
1990	32.8	$1,390	$118	$0	$0	$1,508
1991	33.2	$1,590	$41	$0	$10	$1,641
1992	34.1	$1,613	$39	$0	$10	$1,662
1993	35.1	$1,652	$32	$0	$0	$1,684
1994	35.0	$1,722	$14	$0	$0	$1,736
1995	35.0	$1,729	$4	$0	$0	$1,733
1996	33.5	$1,721	$1	$0	$9	$1,731
1997	32.8	$1,677	$8	$0	$61	$1,746
1998	30.1	$1,597	$96	$0	$53	$1,746
1999	29.8	$1,320	$115	$0	$56	$1,491
2000	31.4	$1,343	$132	$10	$35	$1,520
2001	33.6	$1,397	$150	$78	$32	$1,657
2002	33.9	$1,528	$143	$114	$20	$1,805
2003	34.1	$1,573	$99	$100	$55	$1,827
Total		$24,167	$1,701	$302	$532	$26,702

1/ Acres under contract at end of fiscal year. Acreage before 1994 estimated based on originally approved contracts and active contract data as of 1994.
2/ Rental payments in a fiscal year apply to acres under contract in the previous fiscal year. Includes miscellaneous adjustments and adjustments for haying/grazing usage.
3/ Cost-share payments are made after cover establishment work is done. For contracts beginning in a given year, payments can occur over several years.
4/ Signing and Practice Incentive payments for continuous sign-up enrollment.
5/ Technical assistance outlays are generally paid to NRCS and FS in the year sign-ups are held. About 90 percent of outlays have gone to NRCS and about 10 percent to FS.

Continuous CRP Enrollment Since Inception
Through April 2004 (1,000 Acres)

	---By Sign-up Year---				---Cumulative---			
FY	Non-CREP	CREP	FWP	Total	Non-CREP	CREP	FWP	Total
1997(#14)	561	0	0	561	561	0	0	561
1998 (#17	203	14	0	217	764	14	0	778
1999 (#19)	221	45	0	266	985	59	0	1,044
2000 (#21/22)	258	66	0	324	1,243	125	0	1,368
2001 (#23)	298	142	27	467	1,541	267	27	1,835
2002 (#24)	230	165	45	440	1,771	432	72	2,275
2003 (#25/27)	288	116	26	430	2,059	548	98	2,705
2004 (#28)	74	33	9	117	2,133	581	108	2,822
Total	2,133	581	108	2,822				

CRP Sign-up Periods and Eligibility Criteria				
Sign-up	Type	Dates	Criteria 1/	Acres Contracted 2/
1	General	March 3-14, 1986	A-B	753,668
2	General	May 5-16, 1986	A-B	2,771,660
3	General	August 4-15, 1986	A-C	4,703,379
4	General	February 9-27, 1987	A-D	9,478,599
5	General	July 20-31, 1987	A-D	4,442,719
6	General	February 1-19, 1988	A-F	3,375,364
7	General	July 18-31, 1988	A-F	2,604,901
8	General	February 6-24, 1989	A-H	2,462,382
9	General	July 17-August 4, 1989	A-H	3,329,893
10	General	March 4-15, 1991	A-C, E, G, I-K	475,175
11	General	July 8-19, 1991	A-C, E, G, I-K	998,211
12	General	June 15-26, 1992	A-C, E, G, I-K	1,027,444
13	General	September 11-22, 1995	E, G, I-K	683,390
14	Continuous	September 3, 1996 - September 30, 1997	L	560,406
15	General	March 3-28, 1997	G, K, M-O	16,535,147
16	General	October 14 - November 14, 1997	G, K, M-P	5,854,128
17	Continuous	October 1, 1997 - September 30, 1998	L, Q	216,681
18	General	October 26, - December 11, 1998	G, K, M-P, R	4,750,726
19	Continuous	October 1, 1998 - September 30, 1999	L, Q	266,224
20	General	January 18 - February 11, 2000	G, K, M-P, R	2,249,912
21	Continuous	October 1, 1999 - April 6, 2000	L, Q	118,719
22	Continuous	April 7 - September 30, 2000	L, Q	204,830
23	Continuous	October 1, 2000 - September 30, 2001	L, Q	467,842
24	Continuous	October 1, 2001 - September 30, 2002	L, Q, S	439,647
25	Continuous	October 1, 2002 - May 5, 2003	L, Q, S	251,252
26	General	May 5, 2003 - June 13, 2003	K, N, P, R	1,805,920
27	Continuous	May 6, 2003 - September 30, 2003	L, Q, S, T	179,615
28	Continuous	October 1, 2003 - 3/	L, Q, S, T	116,766

1/ <u>Eligibility Criteria:</u>

A Land capability classes 6 - 8
B Land capability classes 2 - 5 with predicted average annual erosion rate greater than 3T
C Land capability classes 2 - 5 with predicted average annual erosion rate greater than 2T and with gully erosion
D Land with EI ≥ 8 and predicted average annual erosion rate greater than T
E Land for filter strips alongside wetlands, streams, or other water bodies
F Land for tree planting-eligible when 1/3 of field meets criteria A or Class 2-5 soil with predicted average

annual erosion rate greater than 2T

G Land having evidence of scour erosion caused by out-of-bank water flows

H Wetland as follows:

- cropped wetland of at least 6 acres
- a field of which 1/3 or more is cropped wetland
- a field of 6 to 9 acres on which wetlands are present

I Land in designated national conservation priority areas

- Chesapeake Bay Region
- Great Lakes Region
- Long Island Sound Region

Land in designated State water quality priority areas

- Public wellhead protection area established by EPA
- Hydrologic Unit Areas approved by the Secretary
- Land located in areas designated as Clean Water Act "319" priority areas

J Lands to be established in specified eligible practices, including filter strips, riparian buffers, windbreaks, grass waterways, and salt tolerant grasses

Wetland eligibity suspended

K Land with an EI $\geq$ 8, regardless of the predicted annual erosion rate relative to T

L Eligible for continuous sign-up beginning with sign-up 14:

- Land identified as suitable for field windbreaks, grass waterways, shallow water areas for wildlife, contour grass strips, shelterbelts, living snow fences, salt tolerant vegetation, filter strips, or riparian buffers
- Marginal pasture land suitable for riparian buffers devoted to trees for water quality purposes.
- Land within a wellhead protection area established by EPA

M Land classified as highly erodible land (HEL) according to conservation compliance provisions.

N Land in designated national conservation priority areas

- Chesapeake Bay Region
- Great Lakes Region
- Long Island Sound Region
- Prairie Pothole Region

Land in designated State water, air, or wildlife quality priority areas

O Wetlands, including associated acreage, expiring Water Bank lands, and land serving as buffers for non-cropped wetlands

P Land to be established in rare and declining habitat

Q Land suitable for cross wind trap strips

R Land in the Long Leaf Pine national conservation priority area

S Wetland and buffer acreage according to Farmable Wetland Program provisions

T Flood plain wetland restoration, including bottomland hardwood tree plantings

2/ Acreage for sign-ups 1-13 based on initially approved contracts. Acreage for sign-ups 14-28 based on active contracts as of April 2004.

3/ Sign-up 28 incomplete.

CRP Practice and Payment Provisions, April 2004 1/						
Practice		Signup Type 2/	Annual Rental Pmt. 3/	Annual Maint. Allow. 4/	Signing Incentive Pmt. 5/	Practice Incentive Pmt. 6/
CP1	Introduced grasses and legumes - new seedings	General	SRR	$5/Ac.	No	No
CP2	Native grasses - new seedings	General	SRR	$5/Ac.	No	No
CP3	New softwood trees (not longleaf pine)	General	SRR	$5/Ac.	No	No
CP3A	New longleaf pine	General	SRR	$5/Ac.	No	No
CP3A	New hardwood trees	General	SRR	$5/Ac.	No	No
CP4	Wildlife habitat	General	SRR	$5/Ac.	No	No
CP5	Field windbreaks	Contin.	SRR+20%	$7/Ac.	Yes	Yes
CP6	Diversions	General	SRR	$5/Ac.	No	No
CP7	Erosion control structures	General	SRR	$5/Ac.	No	No
CP8	Grass waterways	Contin.	SRR+20%	$5/Ac.	Yes	Yes
CP9	Shallow water areas for wildlife	Contin.	SRR	$5/Ac.	No	Yes
CP10	Existing grasses and legumes	General	SRR	$5/Ac.	No	No
CP11	Existing trees	General	SRR	$5/Ac.	No	No
CP12	Wildlife food plots	General	SRR	None	No	No
CP15	Contour grass strips	Contin.	SRR	$5/Ac.	No	Yes
CP16	Shelterbelts	Contin.	SRR	$7/Ac.	Yes	Yes
CP17	Living snow fences	Contin.	SRR	$7/Ac.	Yes	Yes
CP18	Salinity reducing vegetation	Contin.	SRR	$5/Ac.	No	Yes
CP21	Filter strips (grass)	Contin.	SRR+20%	$10/Ac.	Yes	Yes
CP22	Riparian buffers (trees)	Contin.	SRR+20% 7/	$10/Ac.	Yes	Yes
CP23	Wetland restoration	General	SRR	$5/Ac.	No	No
CP24	Cross wind trap strips	Contin.	SRR	$5/Ac.	No	Yes
CP25	Rare and declining habitats	General	SRR	$5/Ac.	No	No
CP27	Farmable wetland (wetland)	Contin.	SRR+20%	$5/Ac.	Yes	Yes
CP28	Farmable wetland (upland)	Contin.	SRR+20%	$5/Ac.	Yes	Yes
CP29	Wildlife habitat buffer on marginal pasture	Contin.	SRR+20% 7/	$9/Ac.	Yes	Yes
CP30	Wetland buffer on marginal pasture	Contin.	SRR+20% 7/	$9/Ac.	Yes	Yes
CP31	Bottomland hardwood trees	Contin.	SRR	$10/Ac.	No	No
8/	Wellhead protection areas	Contin.	SRR+10%	$10/Ac.	No	Yes

Cost-share payments are provided for all practices except CP10, CP11, and CP12.
1/ Practices enrolled under CREP may be eligible for additional incentives.
2/ General sign-up practices may be enrolled under certain CREP agreements and may be eligible for additional financial incentives.
3/ Soil rental rates (SRR) are soil-specific maximum rental payment rates for predominant soils (up to 3) for the land offered. Beginning with general signup 16, producers offering land for general signup enrollment requesting rental payments below the maximum receive higher EBI scores. Participants in continuous signup receive the maximum allowable rate. Annual incentives of 20% and 10% of annual rental rate are provided as indicated.
4/ For general signup practices, up to $5/acre is allowed. For continuous practices, grass plantings are allowed up to $5/acre, tree plantings are allowed up to $7/acre. For CP21 and CP22, if livestock exclusion practices (alternative water sources or fencing) are implemented, up to $9/acre is allowed, and if livestock exclusion is accompanied by tree plantings, up to $10/acre is allowed.
5/ Signing incentive payments (SIP) implemented in June 2000 are up-front bonus payment of $100 to $150 per acre ($10 per acre times contract length in years).
6/ Practice incentive payments (PIP) implemented in June 2000 equal 40-percent of practice installation cost.
7/ For marginal pasture, a county-specific flat rate is used.
8/ Acreage within EPA-designated wellhead protection area. Various practices may be used.

CRP ENROLLMENT AS OF APRIL 2004
BY SIGNUP AND INITIAL CONTRACT YEAR 1/

ACRES

SIGNUP	BEFORE 1997	1997	1998	1999	2000	2001	2002	2003	2004	2005	TOTAL
1-12	111,740	0	0	0	0	0	0	0	0	0	111,740
13	435,234	159,352	0	0	0	0	0	0	0	0	594,586
14	0	99,117	461,289	0	0	0	0	0	0	0	560,406
15	0	0	16,178,980	356,167	0	0	0	0	0	0	16,535,147
16	0	0	1,775,297	4,078,831	0	0	0	0	0	0	5,854,128
17	0	0	113,044	103,637	0	0	0	0	0	0	216,681
18	0	0	0	0	4,750,726	0	0	0	0	0	4,750,726
19	0	0	0	135,137	131,086	0	0	0	0	0	266,224
20	0	0	0	0	0	2,249,912	0	0	0	0	2,249,912
21	0	0	0	0	106,071	12,648	0	0	0	0	118,719
22	0	0	0	0	33,387	171,443	0	0	0	0	204,830
23	0	0	0	0	0	220,668	247,174	0	0	0	467,842
24	0	0	0	0	0	0	289,461	150,186	0	0	439,647
25	0	0	0	0	0	0	0	198,049	53,203	0	251,252
26	0	0	0	0	0	0	0	0	1,664,077	141,843	1,805,920
27	0	0	0	0	0	0	0	11,448	168,168	0	179,615
28	0	0	0	0	0	0	0	0	114,101	2,665	116,766
ALL	546,974	258,469	18,528,611	4,673,772	5,021,272	2,654,671	536,635	359,683	1,999,549	144,508	34,724,144

NUMBER OF CONTRACTS

SIGNUP	BEFORE 1997	1997	1998	1999	2000	2001	2002	2003	2004	2005	TOTAL
1-12	3,392	0	0	0	0	0	0	0	0	0	3,392
13	10,787	2,217	0	0	0	0	0	0	0	0	13,004
14	0	11,427	22,006	0	0	0	0	0	0	0	33,433
15	0	0	163,821	2,589	0	0	0	0	0	0	166,410
16	0	0	23,739	52,676	0	0	0	0	0	0	76,415
17	0	0	14,315	11,595	0	0	0	0	0	0	25,910
18	0	0	0	0	60,848	0	0	0	0	0	60,848
19	0	0	0	16,996	12,730	0	0	0	0	0	29,726
20	0	0	0	0	0	37,924	0	0	0	0	37,924
21	0	0	0	0	12,221	820	0	0	0	0	13,041
22	0	0	0	0	5,543	16,444	0	0	0	0	21,987
23	0	0	0	0	0	27,704	21,376	0	0	0	49,080
24	0	0	0	0	0	0	32,122	11,179	0	0	43,301
25	0	0	0	0	0	0	0	20,080	3,421	0	23,501
26	0	0	0	0	0	0	0	0	34,843	1,662	36,505
27	0	0	0	0	0	0	0	1,619	10,712	0	12,331
28	0	0	0	0	0	0	0	0	11,314	167	11,481
ALL	14,179	13,644	223,881	83,856	91,342	82,892	53,498	32,878	60,290	1,829	658,289

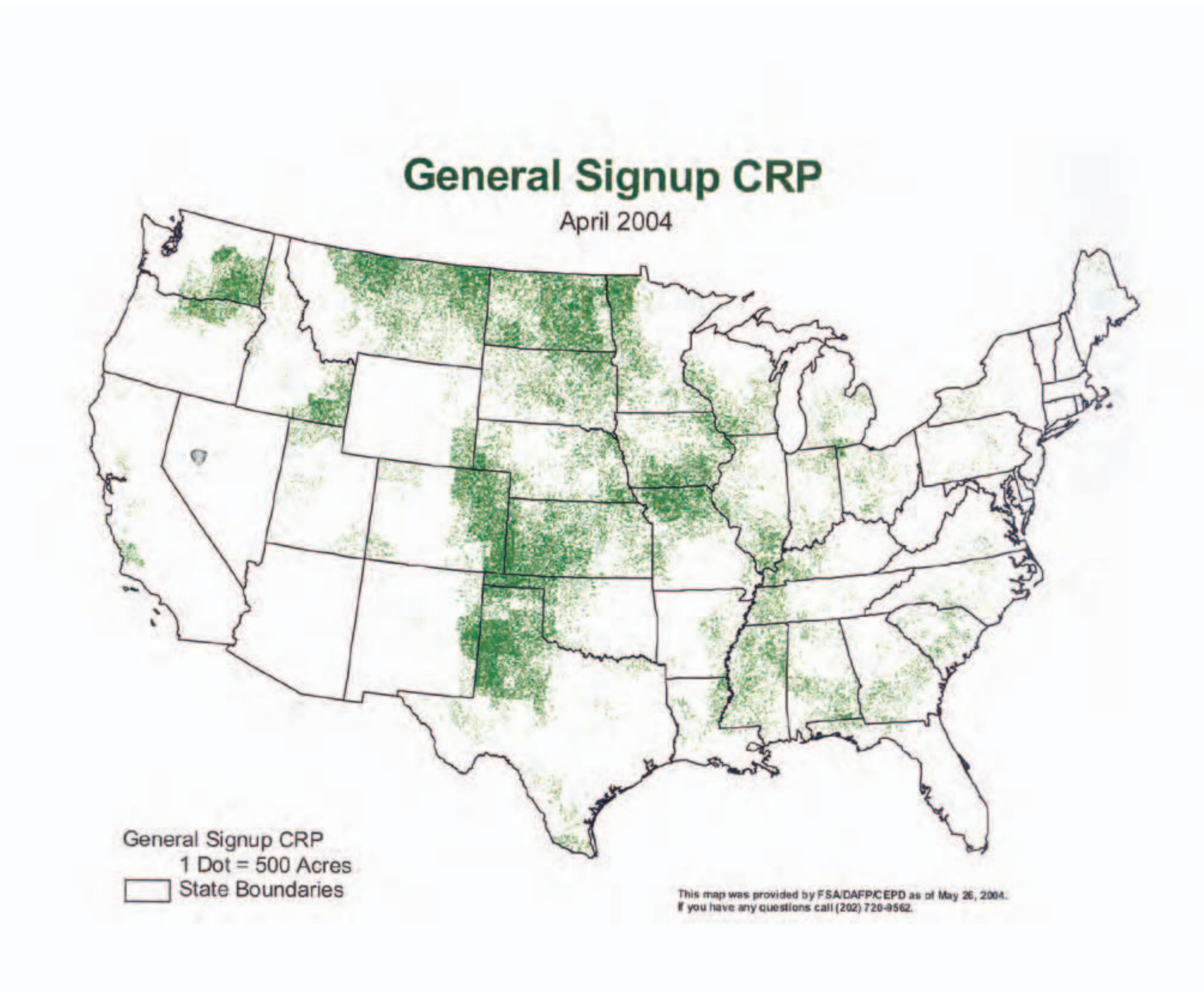
Note: Not including 13,904 acres in contracts with invalid expiration year (before 2004).
1/ For CRP, contract year is the same as fiscal year, which begins October 1.
General Sign-up Numbers: 1-13, 15, 16, 18, 20, 26 (Sign-up 26 data not yet be complete).
Continuous Sign-up Numbers: 14, 17, 19, 21-25, 27, 28 (Sign-up 28 in progress).

CRP ENROLLMENT BY STATE AS OF APRIL 2004
--------TOTAL CRP (ALL SIGN-UPS)--------

STATE 1/	NUMBER OF CONTRACTS	NUMBER OF FARMS	ACRES	ANNUAL RENTAL PAYMENTS 2/ ($1,000)	($/ACRE)
U.S.	658,289	388,586	34,724,144	1,664,861	47.95
ALABAMA	10,157	7,606	484,466	21,814	45.03
ALASKA	64	43	29,524	981	33.24
ARIZONA	*	*	*	*	*
ARKANSAS	3,931	2,449	189,936	9,241	48.66
CALIFORNIA	520	407	147,136	4,622	31.41
COLORADO	12,499	6,072	2,289,555	71,543	31.25
CONNECTICUT	26	24	318	21	66.81
DELAWARE	679	367	7,473	750	100.36
FLORIDA	1,945	1,586	88,207	3,308	37.50
GEORGIA	8,261	6,180	308,832	12,276	39.75
HAWAII	*	*	*	*	*
IDAHO	5,418	3,134	789,006	30,699	38.91
ILLINOIS	64,403	38,070	996,559	101,134	101.48
INDIANA	28,138	17,617	282,931	25,074	88.62
IOWA	90,745	47,870	1,888,571	195,234	103.38
KANSAS	41,372	25,648	2,869,686	111,191	38.75
KENTUCKY	13,648	8,414	333,825	24,615	73.74
LOUISIANA	3,415	2,361	238,108	10,988	46.15
MAINE	844	566	23,359	1,169	50.05
MARYLAND	6,125	3,366	84,253	10,162	120.61
MASSACHUSETTS	17	14	121	13	103.80
MICHIGAN	14,312	8,762	258,200	18,457	71.48
MINNESOTA	54,296	30,430	1,762,824	103,386	58.65
MISSISSIPPI	19,749	13,172	931,264	38,525	41.37
MISSOURI	32,884	20,369	1,553,935	102,766	66.13
MONTANA	17,836	6,640	3,423,007	114,955	33.58
NEBRASKA	24,794	14,624	1,191,164	65,395	54.90
NEVADA	*	*	*	*	*
NEW HAMPSHIRE	17	14	196	10	52.49
NEW JERSEY	136	96	2,406	120	49.96
NEW MEXICO	2,621	1,657	596,093	18,702	31.37
NEW YORK	2,411	1,841	58,381	2,560	43.84
NORTH CAROLINA	7,146	4,785	121,497	7,187	59.16
NORTH DAKOTA	35,143	17,301	3,356,038	110,921	33.05
OHIO	22,869	14,705	275,269	23,051	83.74
OKLAHOMA	8,855	6,112	1,035,874	33,533	32.37
OREGON	3,023	1,701	495,781	23,804	48.01
PENNSYLVANIA	7,116	4,644	151,632	11,604	76.53
PUERTO RICO	20	19	671	60	89.05
SOUTH CAROLINA	8,677	5,166	213,420	7,515	35.21
SOUTH DAKOTA	24,394	12,615	1,456,279	59,449	40.82
TENNESSEE	8,093	5,833	273,102	15,887	58.17
TEXAS	24,068	17,548	3,967,513	139,640	35.20
UTAH	1,037	613	200,279	6,079	30.35
VERMONT	117	98	1,390	107	76.94
VIRGINIA	4,163	3,340	62,041	3,247	52.34
WASHINGTON	10,731	4,410	1,379,378	72,543	52.59
WEST VIRGINIA	152	124	2,292	136	59.45
WISCONSIN	30,321	19,451	621,726	42,690	68.66
WYOMING	1,098	719	280,419	7,689	27.42

* Data witheld because less than 3 contracts.

Note: Not including 13,904 acres in contracts with invalid expiration year (before 2004).
1/ State in which land is located.
2/ Payments scheduled to be made in October 2004. Includes annual incentive and maintenance allowance payments, but not one-time signing and practice incentive payments or payment reductions, such as for lands enrolled less than a full year and lands hayed or grazed.

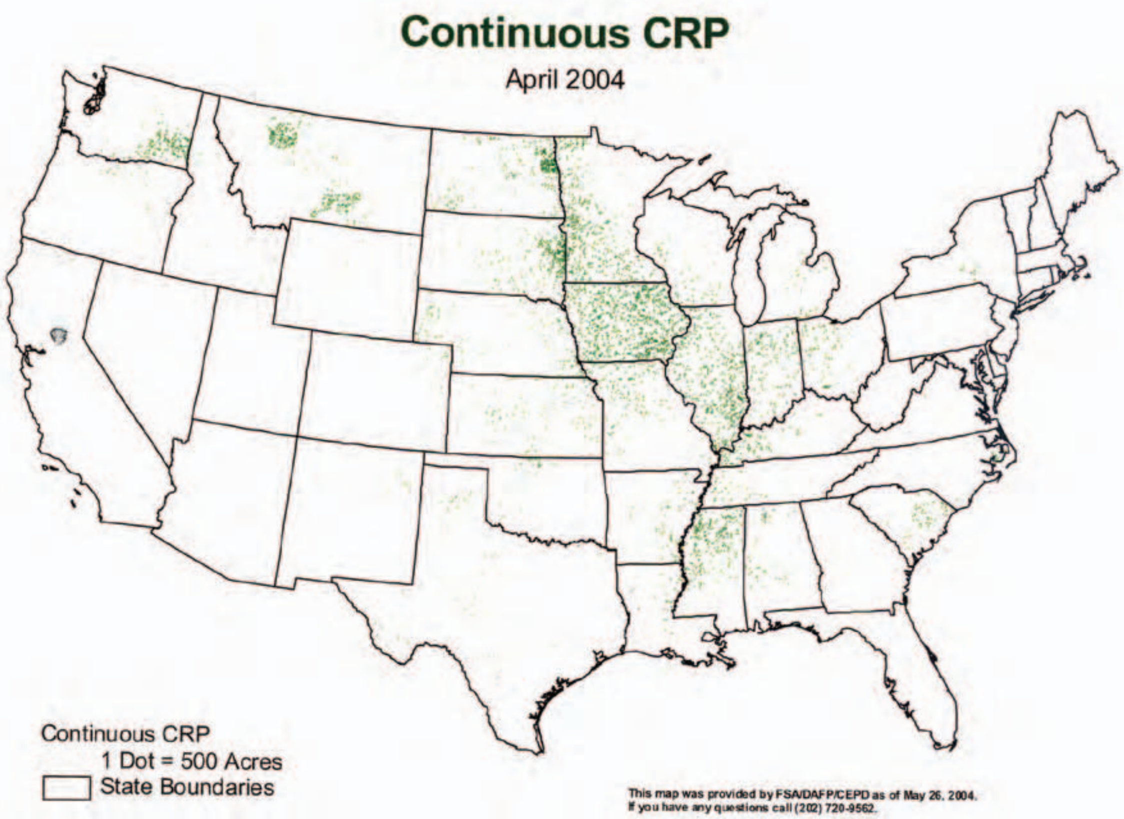

General Signup CRP
April 2004
General Signup CRP
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.

CRP ENROLLMENT BY STATE AS OF APRIL 2004
--------------GENERAL SIGN-UP-----------

STATE 1/	NUMBER OF CONTRACTS	NUMBER OF FARMS	ACRES	ANNUAL RENTAL PAYMENTS 2/ ($1,000)	($/ACRE)
U.S.	394,498	261,597	31,902,160	1,390,754	43.59
ALABAMA	9,188	7,033	457,682	20,460	44.70
ALASKA	58	39	29,321	968	33.00
ARIZONA	*	*	*	*	*
ARKANSAS	2,376	1,672	150,524	6,420	42.65
CALIFORNIA	412	316	138,328	3,831	27.69
COLORADO	11,618	5,781	2,281,757	71,229	31.22
CONNECTICUT	16	16	235	14	61.35
DELAWARE	82	68	1,791	118	65.85
FLORIDA	1,943	1,586	88,139	3,305	37.50
GEORGIA	8,055	6,074	306,921	12,180	39.68
HAWAII	*	*	*	*	*
IDAHO	4,911	2,826	781,013	30,267	38.75
ILLINOIS	23,732	16,813	646,445	51,731	80.02
INDIANA	8,231	6,390	208,150	15,658	75.22
IOWA	33,977	23,835	1,442,078	130,713	90.64
KANSAS	34,763	22,547	2,820,893	108,077	38.31
KENTUCKY	7,140	5,393	281,880	19,364	68.69
LOUISIANA	2,911	2,108	222,406	10,079	45.32
MAINE	719	487	22,996	1,146	49.82
MARYLAND	629	508	12,211	815	66.72
MASSACHUSETTS	7	6	93	10	103.43
MICHIGAN	6,276	4,975	191,714	10,765	56.15
MINNESOTA	26,548	17,581	1,430,800	73,197	51.16
MISSISSIPPI	14,253	10,517	804,560	30,892	38.40
MISSOURI	25,273	17,409	1,468,357	95,172	64.82
MONTANA	16,290	6,242	3,263,685	108,528	33.25
NEBRASKA	15,922	10,482	1,114,242	58,951	52.91
NEVADA	*	*	*	*	*
NEW HAMPSHIRE	1	1	11	1	48.00
NEW JERSEY	89	66	2,224	106	47.77
NEW MEXICO	2,587	1,633	590,994	18,479	31.27
NEW YORK	1,599	1,247	48,720	1,966	40.35
NORTH CAROLINA	4,116	3,233	84,955	3,686	43.39
NORTH DAKOTA	28,269	14,597	3,207,718	104,833	32.68
OHIO	7,051	5,629	214,169	15,495	72.35
OKLAHOMA	8,459	5,873	1,023,214	32,978	32.23
OREGON	2,196	1,291	471,962	21,974	46.56
PENNSYLVANIA	1,811	1,489	58,436	2,341	40.06
PUERTO RICO	20	19	671	60	89.05
SOUTH CAROLINA	5,354	3,741	179,165	5,687	31.74
SOUTH DAKOTA	13,838	7,518	1,298,610	49,535	38.14
TENNESSEE	6,646	5,234	258,697	14,619	56.51
TEXAS	23,160	16,948	3,931,778	138,261	35.17
UTAH	1,019	597	200,108	6,072	30.34
VERMONT	4	4	116	5	39.95
VIRGINIA	1,713	1,411	41,224	1,669	40.47
WASHINGTON	7,422	3,530	1,280,616	64,793	50.59
WEST VIRGINIA	26	22	843	34	40.60
WISCONSIN	22,819	16,183	565,178	36,759	65.04
WYOMING	967	625	276,344	7,511	27.18

* Data witheld because less than 3 contracts.

Note: Not including 13,904 acres in contracts with invalid expiration year (before 2004).
1/ State in which land is located.
2/ Payments scheduled to be made in October 2004. Includes annual maintenance allowance payments, but not payment reductions, such as for lands enrolled less than a full year and lands hayed or grazed.

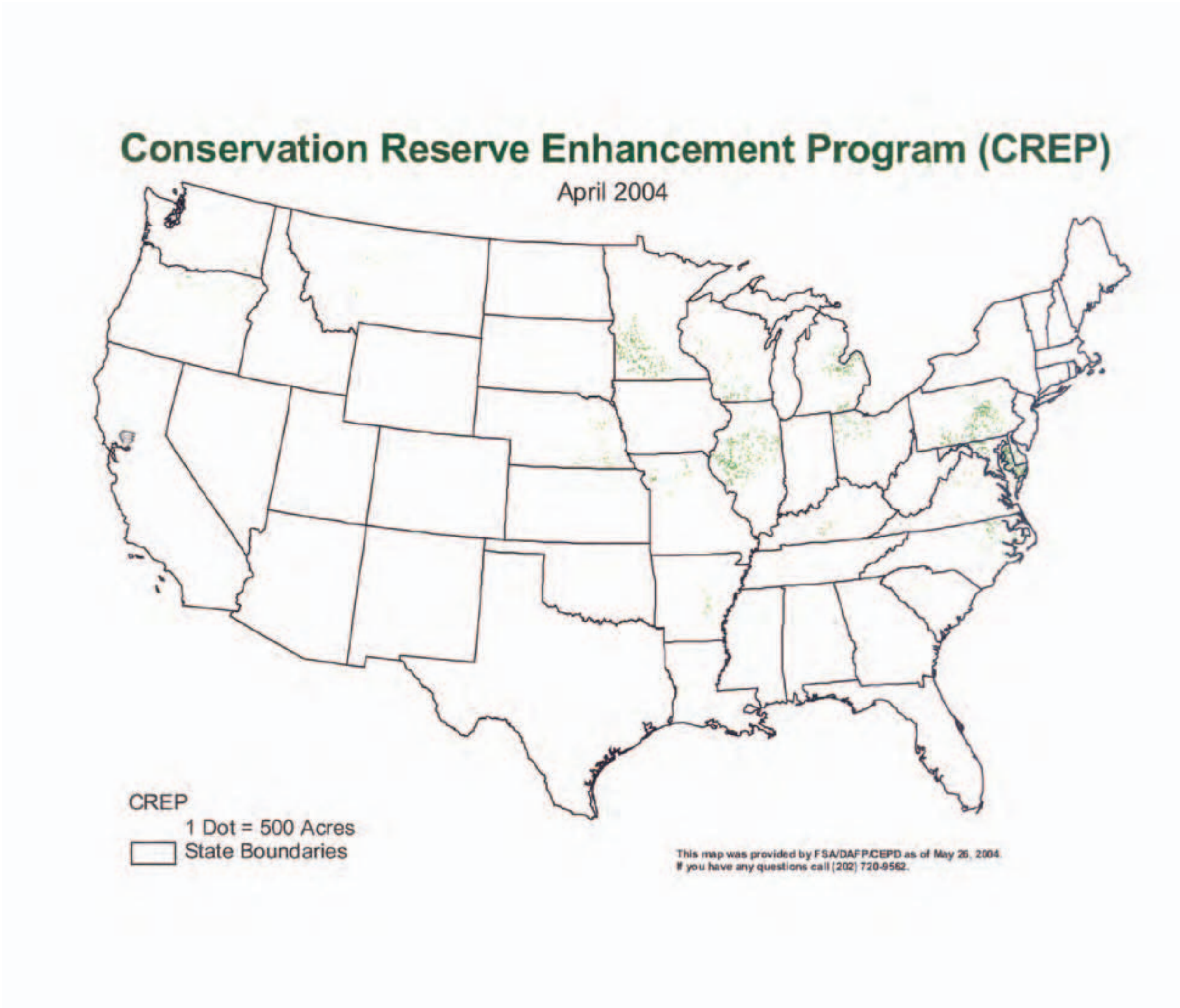

Continuous CRP
April 2004
Continuous CRP
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.

CRP ENROLLMENT BY STATE AS OF APRIL 2004
------------CONTINUOUS NON-CREP 1/-------

STATE 2/	NUMBER OF CONTRACTS	NUMBER OF FARMS	ACRES	ANNUAL RENTAL PAYMENTS 3/ ($1,000)	($/ACRE)
U.S.	220,009	139,472	2,133,591	190,799	89.43
ALABAMA	969	752	26,783	1,354	50.55
ALASKA	6	5	203	14	67.50
ARIZONA	*	*	*	*	*
ARKANSAS	1,352	894	33,486	2,223	66.40
CALIFORNIA	77	63	6,108	441	72.20
COLORADO	881	491	7,798	314	40.32
CONNECTICUT	10	8	83	7	82.32
DELAWARE	182	141	836	66	79.29
FLORIDA	2	2	68	3	39.88
GEORGIA	206	136	1,911	96	50.12
HAWAII	*	*	*	*	*
IDAHO	507	409	7,994	432	54.01
ILLINOIS	35,280	23,182	240,274	31,875	132.66
INDIANA	19,887	12,745	74,594	9,393	125.92
IOWA	53,612	30,800	394,079	55,997	142.10
KANSAS	6,607	4,718	48,776	3,112	63.81
KENTUCKY	6,226	3,776	45,354	4,466	98.47
LOUISIANA	504	362	15,702	909	57.89
MAINE	125	98	363	24	65.04
MARYLAND	522	391	3,097	263	84.78
MASSACHUSETTS	10	8	27	3	105.06
MICHIGAN	4,035	2,479	19,198	1,894	98.66
MINNESOTA	23,299	14,879	223,084	18,454	82.72
MISSISSIPPI	5,496	3,894	126,704	7,633	60.25
MISSOURI	7,386	4,975	72,594	6,473	89.16
MONTANA	1,454	583	152,382	5,721	37.55
NEBRASKA	6,689	4,507	54,538	4,328	79.36
NEVADA	*	*	*	*	*
NEW HAMPSHIRE	16	13	185	10	52.75
NEW JERSEY	47	32	182	14	76.71
NEW MEXICO	34	24	5,099	223	43.72
NEW YORK	684	518	8,295	441	53.19
NORTH CAROLINA	1,298	623	11,935	867	72.62
NORTH DAKOTA	6,241	3,775	136,432	5,551	40.68
OHIO	11,946	8,266	40,593	4,438	109.34
OKLAHOMA	396	308	12,660	555	43.84
OREGON	341	222	11,238	669	59.57
PENNSYLVANIA	393	326	1,086	55	50.59
PUERTO RICO	0	0	0	0	.
SOUTH CAROLINA	3,323	1,965	34,255	1,829	53.38
SOUTH DAKOTA	9,497	6,114	141,208	8,734	61.85
TENNESSEE	1,447	1,075	14,404	1,268	88.05
TEXAS	908	757	35,736	1,379	38.59
UTAH	18	16	172	8	45.60
VERMONT	36	34	331	18	53.70
VIRGINIA	192	171	1,579	77	48.87
WASHINGTON	2,798	1,374	90,279	6,346	70.29
WEST VIRGINIA	40	34	257	12	46.54
WISCONSIN	4,898	3,418	27,535	2,631	95.57
WYOMING	131	108	4,075	177	43.51

* Data witheld because less than 3 contracts.

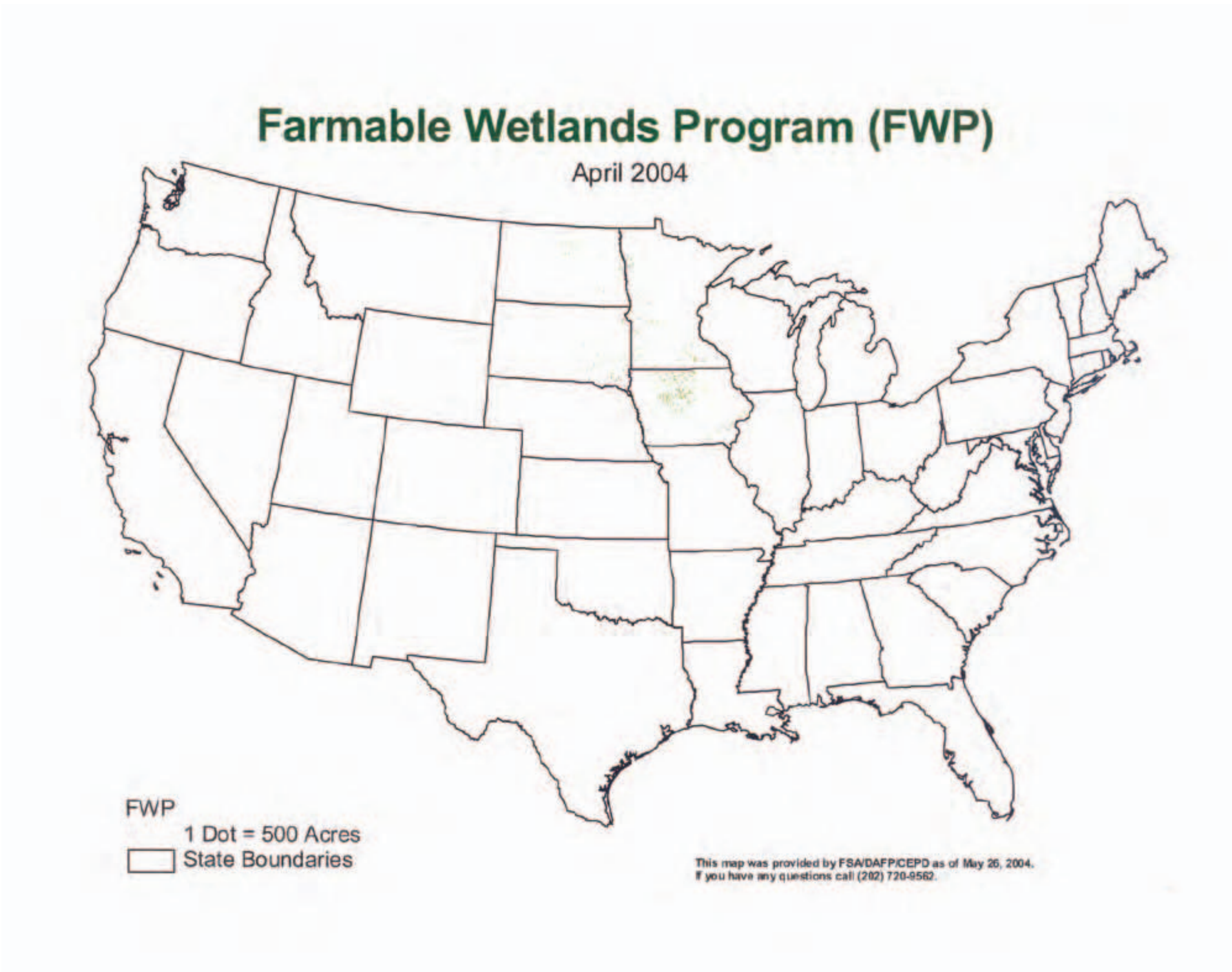
1/ Farmable Wetland enrollment not included.
2/ State in which land is located.
3/ Payments scheduled to be made in October 2004. Includes annual incentive and maintenance allowance payments, but not one-time signing and practice incentive payments or payment reductions, such as for lands enrolled less than a full year and lands hayed or grazed.


Conservation Reserve Enhancement Program (CREP)
April 2004
CREP
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.

CRP ENROLLMENT BY STATE AS OF APRIL 2004
------------------CREP ONLY-------------

STATE 1/	NUMBER OF CONTRACTS	NUMBER OF FARMS	ACRES	ANNUAL RENTAL ($1,000)	PAYMENTS 2/ ($/ACRE)
U.S.	36,755	24,604	580,326	70,409	121.33
ALABAMA	0	0	0	0	.
ALASKA	0	0	0	0	.
ARIZONA	0	0	0	0	.
ARKANSAS	203	132	5,926	598	100.89
CALIFORNIA	31	31	2,700	350	129.69
COLORADO	0	0	0	0	.
CONNECTICUT	0	0	0	0	.
DELAWARE	415	241	4,846	566	116.76
FLORIDA	0	0	0	0	.
GEORGIA	0	0	0	0	.
HAWAII	0	0	0	0	.
IDAHO	0	0	0	0	.
ILLINOIS	5,388	3,940	109,822	17,526	159.58
INDIANA	0	0	0	0	.
IOWA	12	8	190	40	207.73
KANSAS	0	0	0	0	.
KENTUCKY	282	160	6,591	785	119.15
LOUISIANA	0	0	0	0	.
MAINE	0	0	0	0	.
MARYLAND	4,974	3,003	68,945	9,085	131.77
MASSACHUSETTS	0	0	0	0	.
MICHIGAN	4,001	2,138	47,288	5,798	122.61
MINNESOTA	2,590	2,079	83,382	9,281	111.31
MISSISSIPPI	0	0	0	0	.
MISSOURI	225	175	12,984	1,122	86.39
MONTANA	79	29	6,831	701	102.68
NEBRASKA	1,817	1,308	19,315	1,852	95.91
NEVADA	0	0	0	0	.
NEW HAMPSHIRE	0	0	0	0	.
NEW JERSEY	0	0	0	0	.
NEW MEXICO	0	0	0	0	.
NEW YORK	128	103	1,365	152	111.60
NORTH CAROLINA	1,732	1,081	24,608	2,635	107.06
NORTH DAKOTA	74	54	1,480	53	35.47
OHIO	3,871	2,652	20,503	3,118	152.07
OKLAHOMA	0	0	0	0	.
OREGON	486	358	12,580	1,161	92.28
PENNSYLVANIA	4,912	3,038	92,109	9,208	99.97
PUERTO RICO	0	0	0	0	.
SOUTH CAROLINA	0	0	0	0	.
SOUTH DAKOTA	0	0	0	0	.
TENNESSEE	0	0	0	0	.
TEXAS	0	0	0	0	.
UTAH	0	0	0	0	.
VERMONT	77	62	943	85	89.65
VIRGINIA	2,258	1,827	19,238	1,502	78.05
WASHINGTON	511	400	8,483	1,404	165.56
WEST VIRGINIA	86	69	1,192	90	75.56
WISCONSIN	2,603	1,716	29,003	3,299	113.74
WYOMING	0	0	0	0	.

1/ State in which land is located.
2/ Payments scheduled to be made in October 2004. Includes annual incentive and maintenance allowance payments, but not one-time signing and practice incentive payments or payment reductions, such as for lands enrolled less than a full year and lands hayed or grazed.


Farmable Wetlands Program (FWP)
April 2004
FWP
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.

CRP ENROLLMENT BY STATE AS OF APRIL 2004
-------FARMABLE WETLAND PROGRAM--------

STATE 1/	NUMBER OF CONTRACTS	NUMBER OF FARMS	ACRES	ANNUAL RENTAL ($1,000)	PAYMENTS 2/ ($/ACRE)
U.S.	7,027	5,724	108,066	12,899	119.36
ALABAMA	0	0	0	0	.
ALASKA	0	0	0	0	.
ARIZONA	0	0	0	0	.
ARKANSAS	0	0	0	0	.
CALIFORNIA	0	0	0	0	.
COLORADO	0	0	0	0	.
CONNECTICUT	0	0	0	0	.
DELAWARE	0	0	0	0	.
FLORIDA	0	0	0	0	.
GEORGIA	0	0	0	0	.
HAWAII	0	0	0	0	.
IDAHO	0	0	0	0	.
ILLINOIS	3	3	18	2	128.66
INDIANA	20	19	188	23	124.54
IOWA	3,144	2,539	52,223	8,484	162.45
KANSAS	2	1	18	1	54.94
KENTUCKY	0	0	0	0	.
LOUISIANA	0	0	0	0	.
MAINE	0	0	0	0	.
MARYLAND	0	0	0	0	.
MASSACHUSETTS	0	0	0	0	.
MICHIGAN	0	0	0	0	.
MINNESOTA	1,859	1,634	25,558	2,454	96.03
MISSISSIPPI	0	0	0	0	.
MISSOURI	0	0	0	0	.
MONTANA	13	6	109	4	35.35
NEBRASKA	366	325	3,070	264	86.04
NEVADA	0	0	0	0	.
NEW HAMPSHIRE	0	0	0	0	.
NEW JERSEY	0	0	0	0	.
NEW MEXICO	0	0	0	0	.
NEW YORK	0	0	0	0	.
NORTH CAROLINA	0	0	0	0	.
NORTH DAKOTA	559	386	10,408	484	46.54
OHIO	1	1	4	1	120.34
OKLAHOMA	0	0	0	0	.
OREGON	0	0	0	0	.
PENNSYLVANIA	0	0	0	0	.
PUERTO RICO	0	0	0	0	.
SOUTH CAROLINA	0	0	0	0	.
SOUTH DAKOTA	1,059	809	16,462	1,181	71.72
TENNESSEE	0	0	0	0	.
TEXAS	0	0	0	0	.
UTAH	0	0	0	0	.
VERMONT	0	0	0	0	.
VIRGINIA	0	0	0	0	.
WASHINGTON	0	0	0	0	.
WEST VIRGINIA	0	0	0	0	.
WISCONSIN	1	1	10	1	112.63
WYOMING	0	0	0	0	.

1/ State in which land is located.
2/ Payments scheduled to be made in October 2004. Includes annual incentive and maintenance allowance payments, but not one-time signing and practice incentive payments or payment reductions, such as for lands enrolled less than a full year and lands hayed or grazed.

CONTINUOUS/CREP ENROLLMENT ACTIVITY SINCE INCEPTION BY STATE AND SIGN-UP, AS OF APRIL 2004 (ACRES) 1/

SIGN-UP NUMBER	14	17	19	21,22 3/	23	24	25/27 4/	28	TOTAL
SIGN-UP FY	1997	1998	1999	2000	2001	2002	2003	2004	
STATE 2/									
U.S.	560,406	216,681	266,224	323,549	441,292	394,605	404,670	106,490	2,713,917
ALABAMA	326	823	401	4,827	6,262	4,822	7,526	1,795	26,783
ALASKA	0	0	0	40	99	1	63	0	203
ARKANSAS	1,182	1,115	1,070	2,715	5,273	8,082	18,808	1,167	39,412
CALIFORNIA	0	40	0	1,027	2,868	1,119	3,369	385	8,808
COLORADO	717	734	232	1,286	1,074	2,191	983	582	7,798
CONNECTICUT	30	0	37	13	3	0	0	0	83
DELAWARE	383	173	39	1,587	1,085	1,889	354	171	5,682
FLORIDA	68	0	0	0	0	0	0	0	68
GEORGIA	446	503	105	4	179	298	319	57	1,911
HAWAII	*	*	*	*	*	*	*	*	*
IDAHO	559	526	287	1,061	2,677	1,944	837	103	7,994
ILLINOIS	54,399	31,966	59,598	64,179	68,341	39,322	25,052	7,239	350,096
INDIANA	11,099	5,251	6,818	12,850	15,992	11,382	8,859	2,342	74,594
IOWA	55,723	61,796	59,147	62,877	58,035	41,925	39,394	15,372	394,269
KANSAS	8,947	4,587	7,453	4,967	7,059	7,513	6,023	2,226	48,776
KENTUCKY	2,334	3,539	8,083	7,614	10,498	9,889	6,885	3,102	51,946
LOUISIANA	1,701	142	184	320	819	1,845	9,297	1,394	15,702
MAINE	23	44	33	122	94	38	8	1	363
MARYLAND	1,909	6,257	7,386	7,207	12,150	17,520	16,599	3,013	72,042
MASSACHUSETTS	9	13	5	0	0	0	0	0	27
MICHIGAN	2,106	2,080	2,828	3,407	23,256	25,355	6,587	867	66,487
MINNESOTA	49,590	26,628	19,488	29,875	65,963	62,307	44,246	8,370	306,467
MISSISSIPPI	2,035	4,840	5,473	19,862	18,447	20,685	50,102	5,259	126,704
MISSOURI	8,308	9,497	6,564	8,015	20,248	16,433	13,575	2,938	85,578
MONTANA	135,100	7,948	1,034	1,797	2,220	1,180	8,885	1,049	159,214
NEBRASKA	4,322	3,910	4,220	7,024	11,379	10,729	28,112	4,156	73,852
NEW HAMPSHIRE	151	16	0	6	12	0	0	1	185
NEW JERSEY	32	13	33	6	72	10	16	0	182
NEW MEXICO	0	0	0	0	851	2,072	1,388	788	5,099
NEW YORK	336	256	468	1,712	4,135	1,641	1,053	59	9,661
NORTH CAROLINA	67	430	11,736	8,762	5,169	3,086	5,830	1,463	36,543
NORTH DAKOTA	59,188	7,667	21,304	12,104	15,792	10,591	7,018	4,249	137,912
OHIO	11,821	3,261	3,364	8,905	12,423	9,626	9,336	2,361	61,096
OKLAHOMA	7,725	1,264	998	593	1,007	437	437	200	12,660
OREGON	230	490	1,961	2,065	4,195	2,902	9,424	2,550	23,819
PENNSYLVANIA	67	98	63	9,907	20,428	23,438	21,312	17,883	93,196
SOUTH CAROLINA	2,665	9,715	8,469	6,837	3,804	1,342	872	550	34,255
SOUTH DAKOTA	97,864	3,878	3,861	4,412	7,244	8,896	9,900	5,151	141,208
TENNESSEE	1,005	956	717	889	2,320	3,825	3,657	1,035	14,404
TEXAS	5,119	4,551	1,430	1,291	1,786	10,006	8,636	2,915	35,736
UTAH	0	32	0	0	12	23	105	0	172
VERMONT	47	31	62	129	238	520	203	43	1,274
VIRGINIA	214	718	144	3,496	7,809	2,681	4,471	1,285	20,817
WASHINGTON	29,868	5,607	14,213	15,514	13,333	7,506	11,682	1,038	98,762
WEST VIRGINIA	18	14	8	13	138	567	591	100	1,449
WISCONSIN	2,672	4,929	6,828	3,712	5,911	18,167	11,699	2,620	56,538
WYOMING	0	345	78	518	572	801	1,154	608	4,075

* Data witheld because less than 3 contracts.

1/ Farmable Wetland enrollment not included.
2/ State in which land is located.
3/ Sign-up 21 ended and sign-up 22 began in May 2000.
4/ Sign-up 25 ended and sign-up 27 began in May 2003.

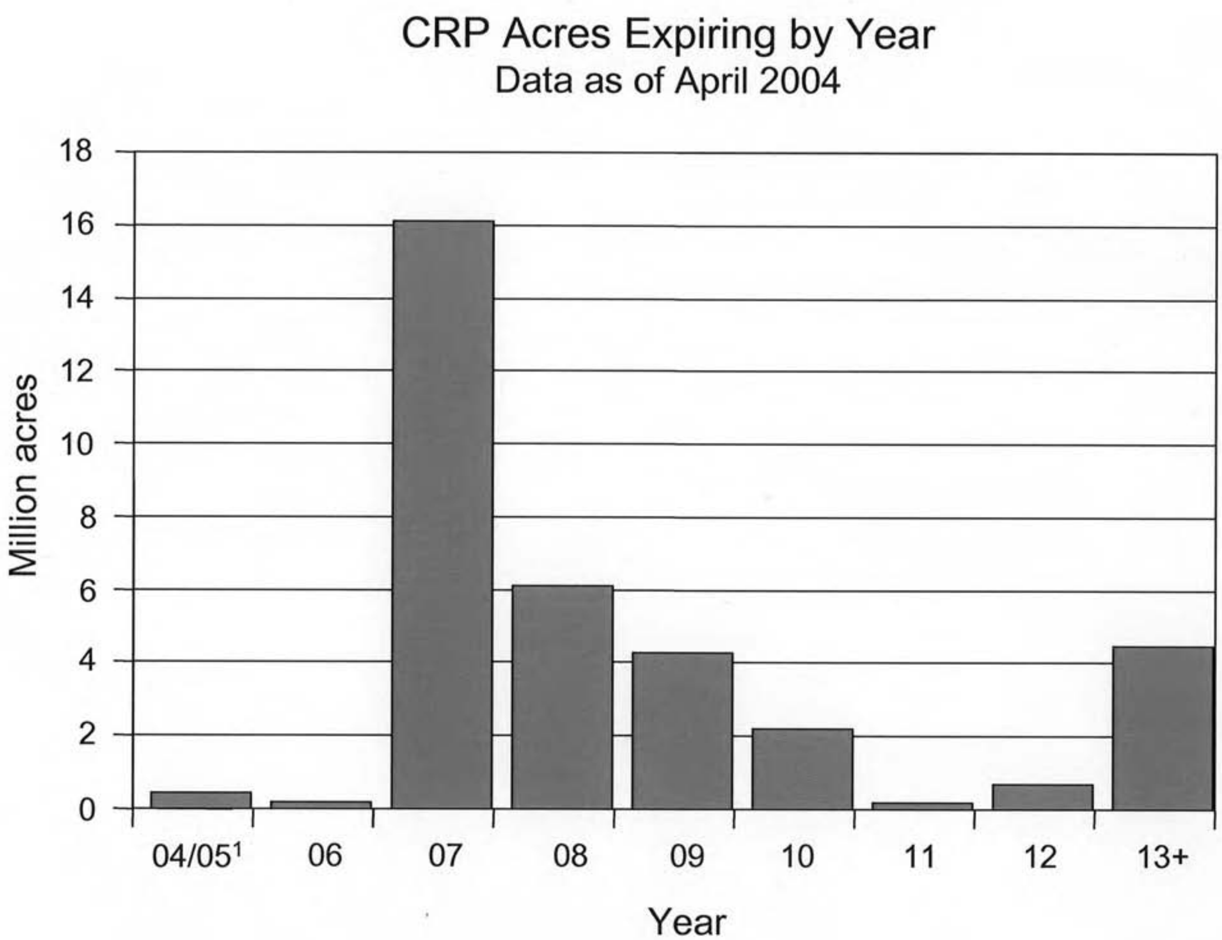
SCHEDULE OF CRP CONTRACT EXPIRATIONS BY STATE AND YEAR OF CONTRACT EXPIRATION, AS OF APRIL 2004 (ACRES)

STATE 1/	2004-2005 2/	2006	2007	2008	2009	2010	2011	2012	2013+
U.S.	443,497	195,644	16,112,450	6,098,439	4,302,594	2,196,109	201,840	723,226	4,450,345
ALABAMA	9,166	2,181	232,203	59,471	29,943	35,806	9,928	7,937	97,830
ALASKA	0	0	24,123	0	4,999	240	5	1	158
ARIZONA	*	*	*	*	*	*	*	*	*
ARKANSAS	3,986	3,221	47,001	8,099	7,431	28,008	1,796	12,560	77,834
CALIFORNIA	2,394	0	99,284	15,853	9,305	6,890	490	1,837	11,083
COLORADO	2,080	1,866	1,356,043	396,013	305,330	116,207	266	957	110,793
CONNECTICUT	0	0	167	34	71	13	3	30	0
DELAWARE	0	0	600	616	659	439	113	199	4,844
FLORIDA	1,970	966	44,205	5,287	6,187	9,454	1,227	1,132	17,779
GEORGIA	7,510	2,137	96,935	16,904	13,483	27,468	6,065	5,081	133,250
HAWAII	*	*	*	*	*	*	*	*	*
IDAHO	3,226	1,443	532,603	70,167	86,300	31,928	873	536	61,929
ILLINOIS	26,110	9,136	189,065	134,743	108,765	92,570	24,883	44,140	367,146
INDIANA	6,167	3,729	74,390	45,820	30,318	22,665	10,752	15,114	73,977
IOWA	62,142	15,013	523,862	361,987	257,121	194,240	36,237	63,869	374,097
KANSAS	11,486	16,903	1,618,262	392,209	358,405	122,533	4,159	9,363	336,364
KENTUCKY	5,830	1,281	135,461	47,699	31,464	38,332	4,279	7,417	62,061
LOUISIANA	2,596	2,335	42,294	9,799	11,816	15,757	2,031	24,037	127,443
MAINE	0	0	15,397	5,192	1,827	613	89	60	181
MARYLAND	1,330	171	6,041	5,876	6,989	3,860	3,186	8,706	48,094
MASSACHUSETTS	47	0	19	14	5	30	5	0	0
MICHIGAN	16,777	2,929	47,407	47,722	24,448	21,709	1,769	2,256	93,182
MINNESOTA	15,981	2,317	399,298	405,263	270,451	83,114	15,734	89,741	480,925
MISSISSIPPI	29,800	21,096	422,931	70,983	68,379	58,061	7,698	39,963	212,352
MISSOURI	51,722	18,550	790,643	188,600	129,653	132,131	3,881	15,629	223,126
MONTANA	32,602	27,595	1,686,531	769,631	521,565	208,137	1,542	3,392	172,012
NEBRASKA	17,502	4,442	562,678	180,463	156,917	83,757	2,867	9,806	172,731
NEVADA	*	*	*	*	*	*	*	*	*
NEW HAMPSHIRE	11	0	105	16	0	6	45	0	13
NEW JERSEY	17	0	1,132	598	127	216	35	12	268
NEW MEXICO	3,425	2,189	536,192	36,882	11,563	526	0	0	5,316
NEW YORK	2,737	169	24,996	11,003	4,511	3,475	117	535	10,837
NORTH CAROLINA	1,981	110	41,145	11,640	10,497	9,367	2,639	986	43,132
NORTH DAKOTA	19,227	11,312	1,719,642	484,689	528,778	156,751	12,858	219,051	203,732
OHIO	6,421	1,078	81,234	35,876	28,525	26,303	5,915	9,231	80,686
OKLAHOMA	5,761	7,327	631,902	175,691	136,628	37,358	548	193	40,465
OREGON	13	1,227	294,866	63,398	38,754	34,709	651	841	61,322
PENNSYLVANIA	4,121	619	31,579	13,042	6,442	2,114	21,092	27,607	45,015
PUERTO RICO	162	0	157	322	0	20	0	10	0
SOUTH CAROLINA	3,497	631	96,719	20,515	11,952	22,075	2,771	6,838	48,422
SOUTH DAKOTA	8,255	6,629	732,142	198,806	228,499	87,275	4,104	38,904	151,664
TENNESSEE	6,677	971	124,890	28,030	22,765	25,845	1,214	2,061	60,649
TEXAS	36,006	9,396	2,064,627	1,018,166	532,057	192,551	1,336	3,546	109,827
UTAH	0	0	142,007	41,271	5,314	8,531	1	20	3,135
VERMONT	0	0	160	8	56	0	9	27	1,131
VIRGINIA	974	134	23,334	6,772	4,941	1,862	999	1,541	21,485
WASHINGTON	3,625	9,392	225,867	539,762	196,818	193,937	4,964	29,450	175,563
WEST VIRGINIA	0	0	513	65	292	0	28	8	1,388
WISCONSIN	29,496	7,149	194,064	125,777	62,044	58,838	2,454	18,223	123,681
WYOMING	666	0	197,697	47,511	30,197	387	184	376	3,401

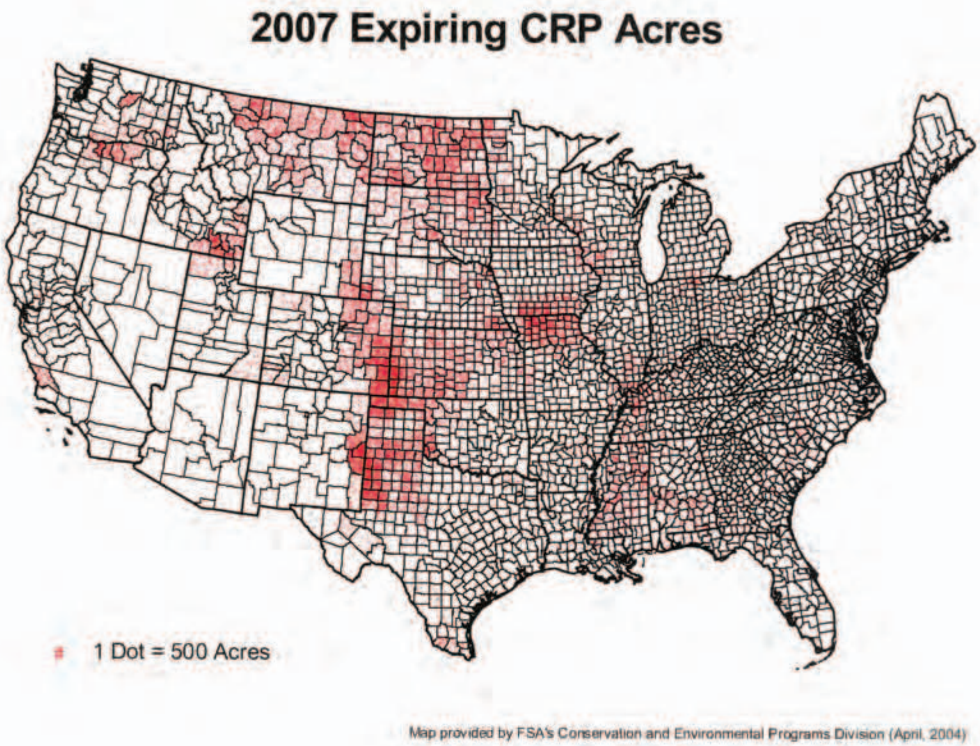
* Data witheld because less than 3 contracts.

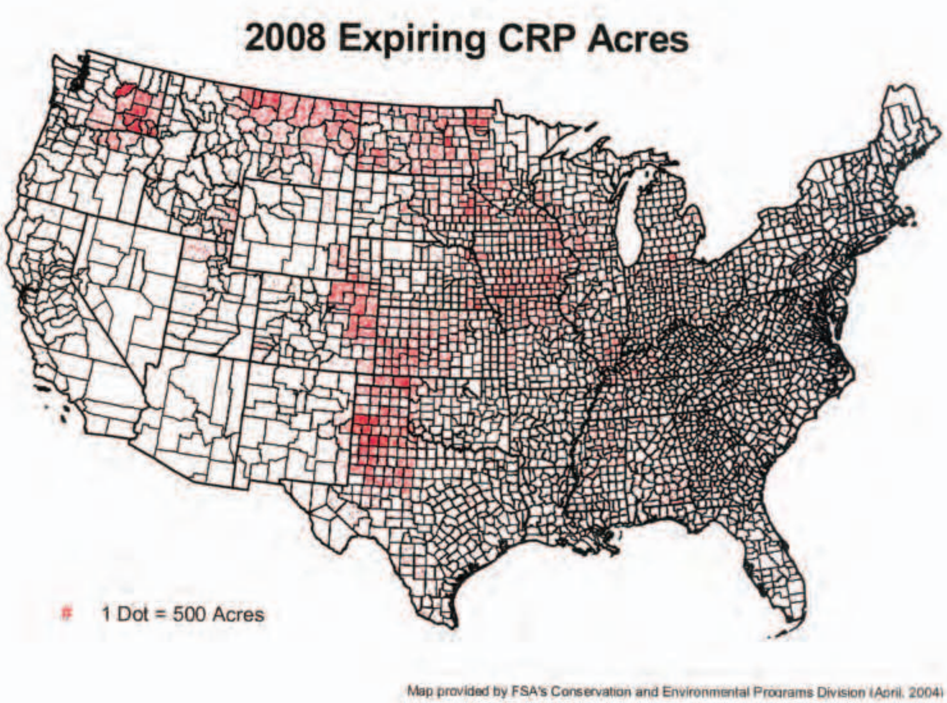
1/ State in which land is located.
2/ Includes 3,126 acres under contracts expiring in 2004.

Note: Contacts expire at the end of the fiscal year (September 30th).



[1]Includes 3,126 acres under contracts expiring in 2004.

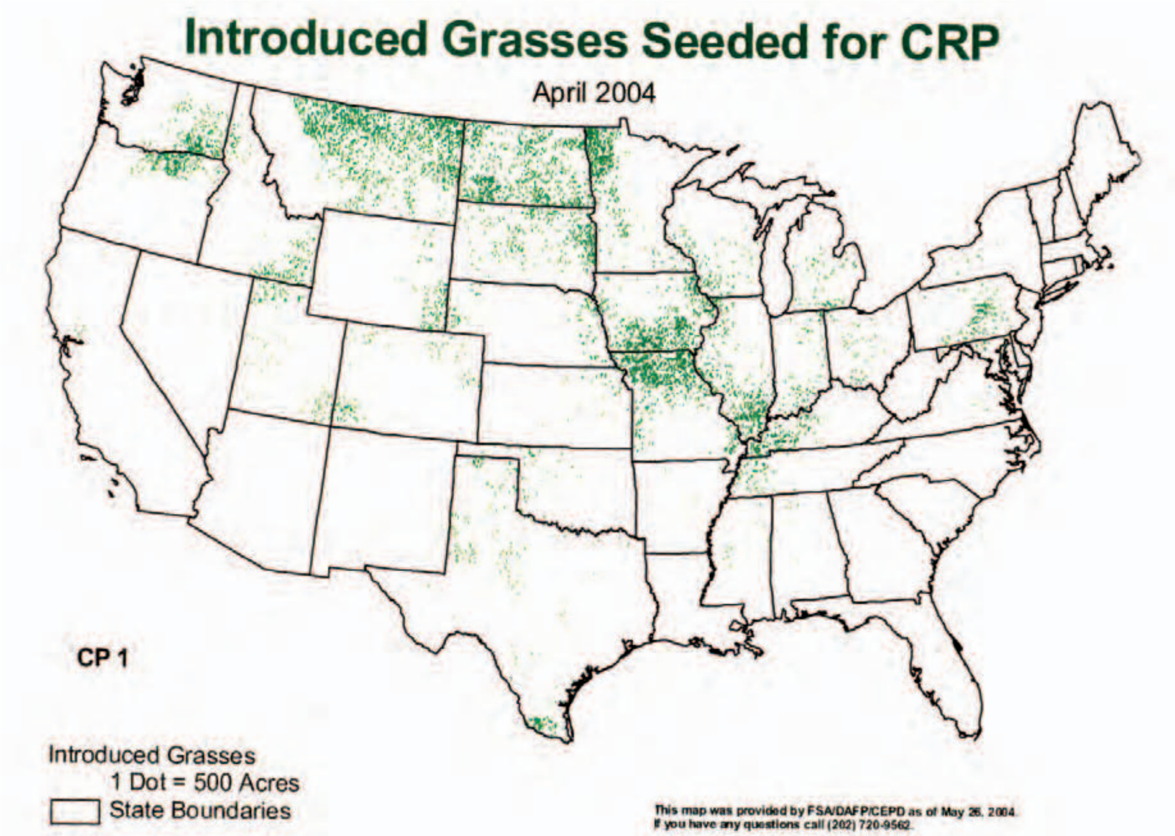

2007 Expiring CRP Acres
1 Dot = 500 Acres
Map provided by FSA's Conservation and Environmental Programs Division (April, 2004)

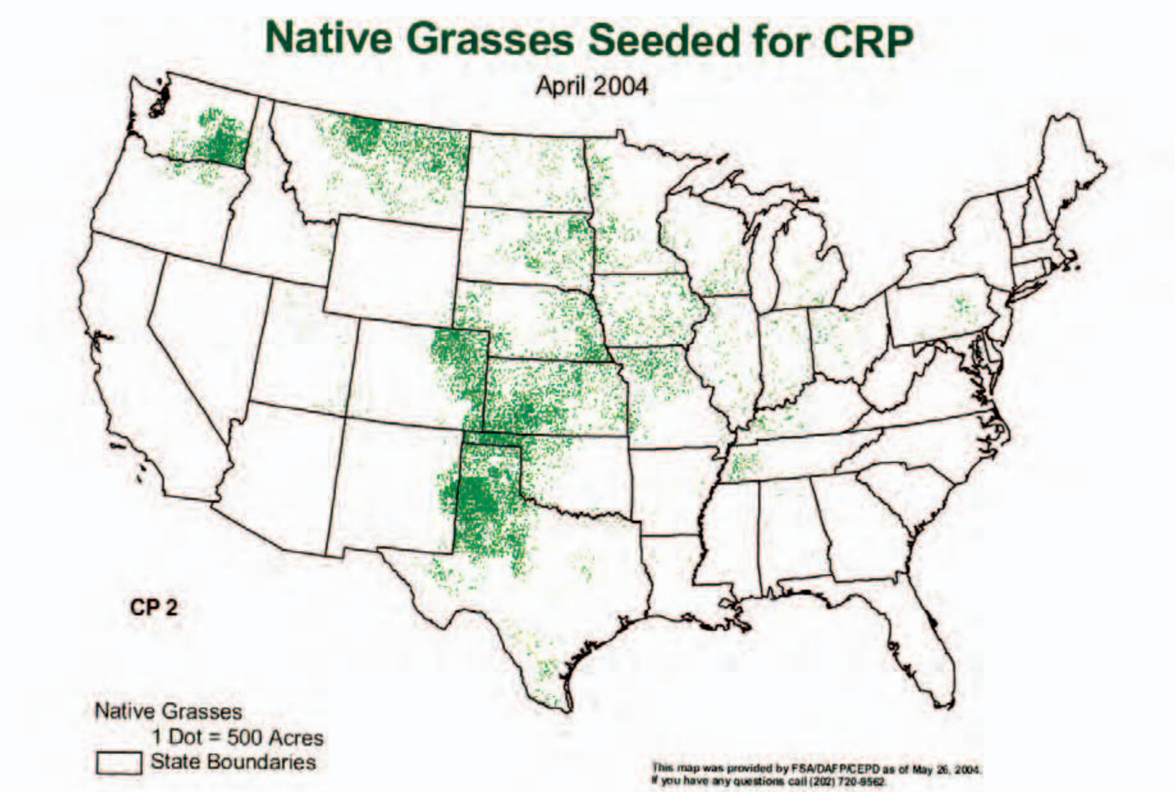

2008 Expiring CRP Acres
1 Dot = 500 Acres
Map provided by FSA's Conservation and Environmental Programs Division (April, 2004)

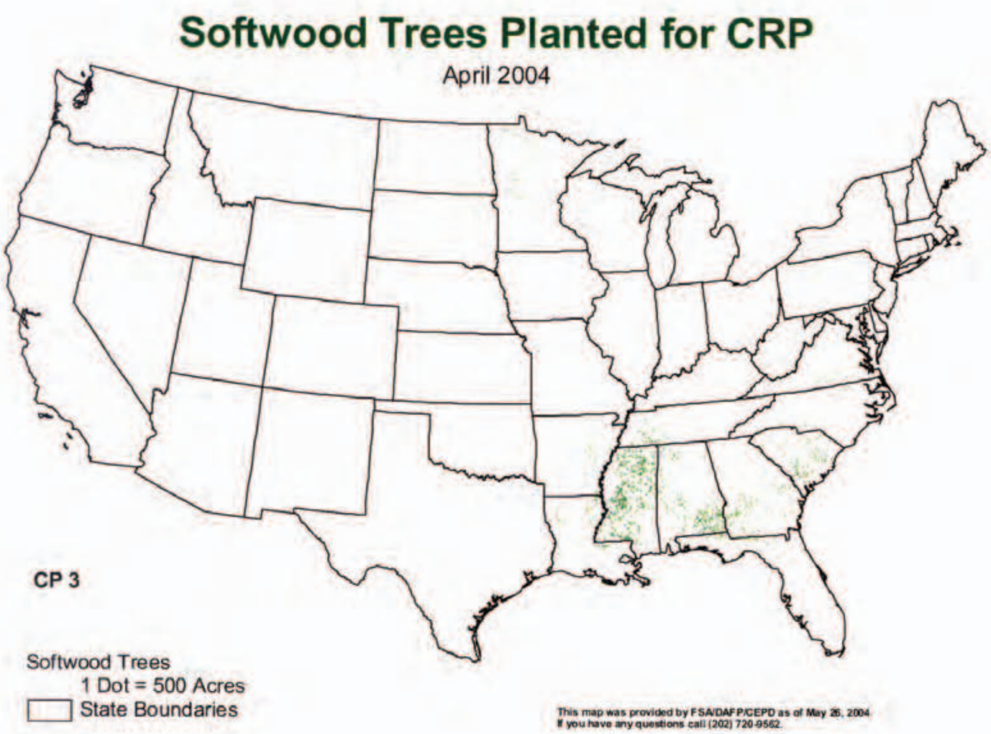
CONSERVATION PRACTICES INSTALLED ON CRP ACREAGE
----BY SIGNUP TYPE, AS OF APRIL 2004 (ACRES)---

PRACTICE	GENERAL SIGNUP	CONTIN. CREP	CONTIN. NON-CREP 1/	FARMABLE WETLAND	TOTAL
CP1 NEW INTROD. GRASSES AND LEGUMES	3,290,239	82,351	73,524	0	3,446,114
CP2 NEW NATIVE GRASSES	6,481,911	54,511	18,472	0	6,554,894
CP3 NEW SOFTWOOD TREES (NOT LONGLEAF)	430,015	336	300	0	430,651
CP3A NEW LONGLEAF PINES	208,439	0	0	0	208,439
CP3A NEW HARDWOOD TREES	513,534	7,925	815	0	522,274
CP4 PERMANENT WILDLIFE HABITAT	2,333,686	36,970	3,012	0	2,373,668
CP5 FIELD WINDBREAKS	893	2,531	64,177	0	67,602
CP6 DIVERSIONS	835	0	0	0	835
CP7 EROSION CONTROL STRUCTURES	654	1	0	0	655
CP8 GRASS WATERWAYS	1,027	486	97,147	0	98,660
CP9 SHALLOW WATER AREAS FOR WILDLIFE	1,950	2,173	44,154	0	48,278
CP10 EXISTING GRASSES AND LEGUMES 3/	15,199,040	8,268	37,482	0	15,244,790
CP11 EXISTING TREES	1,102,553	357	0	0	1,102,909
CP12 WILDLIFE FOOD PLOTS	74,983	1,354	0	0	76,337
CP13 VEGETATIVE FILTER STRIPS	29,672	0	0	0	29,672
CP15 CONTOUR GRASS STRIPS	36	109	74,340	0	74,485
CP16 SHELTERBELTS	376	390	26,893	0	27,659
CP17 LIVING SNOW FENCES	2	0	3,811	0	3,813
CP18 SALINITY REDUCING VEGETATION	0	0	290,121	0	290,121
CP19 ALLEY CROPPING	52	0	0	0	52
CP20 ALTERNATIVE PERENNIALS	15	0	0	0	15
CP21 FILTER STRIPS (GRASS)	0	122,603	819,966	0	942,568
CP22 RIPARIAN BUFFERS	0	131,664	512,529	0	644,193
CP23 WETLAND RESTORATION	1,577,712	90,282	49,127	0	1,717,121
CP24 CROSS WIND TRAP STRIPS	0	38	629	0	667
CP25 RARE AND DECLINING HABITAT	654,535	37,972	0	0	692,508
CP26 SEDIMENT RETENTION	0	5	0	0	5
CP27 FARMABLE WETLAND PILOT (WETLAND)	0	0	0	31,151	31,151
CP28 FARMABLE WETLAND PILOT (UPLAND)	0	0	0	76,916	76,916
CP29 WILDLIFE HABITAT BUFFER (MARG PAST)	0	0	9,758	0	9,758
CP30 WETLAND BUFFER (MARG PAST)	0	0	6,257	0	6,257
CP31 BOTTOMLAND HARDWOOD	0	0	1,077	0	1,077
TOTAL	31,902,160	580,326	2,133,591	108,066	34,724,144

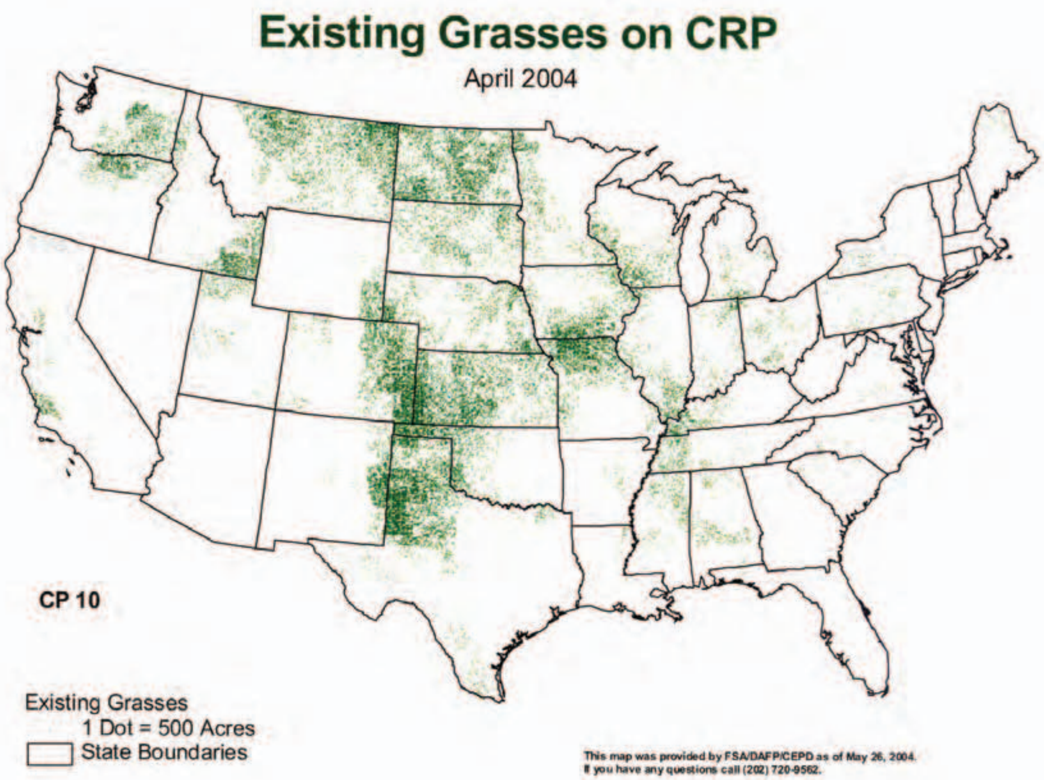
Note: Not including 13,904 acres in contracts with invalid expiration year (before 2004).
1/ Includes 162,219 acres in designated wellhead protection areas.
2/ Includes both introduced grasses, legumes, and native grasses.


Introduced Grasses Seeded for CRP
April 2004
CP 1
Introduced Grasses
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.

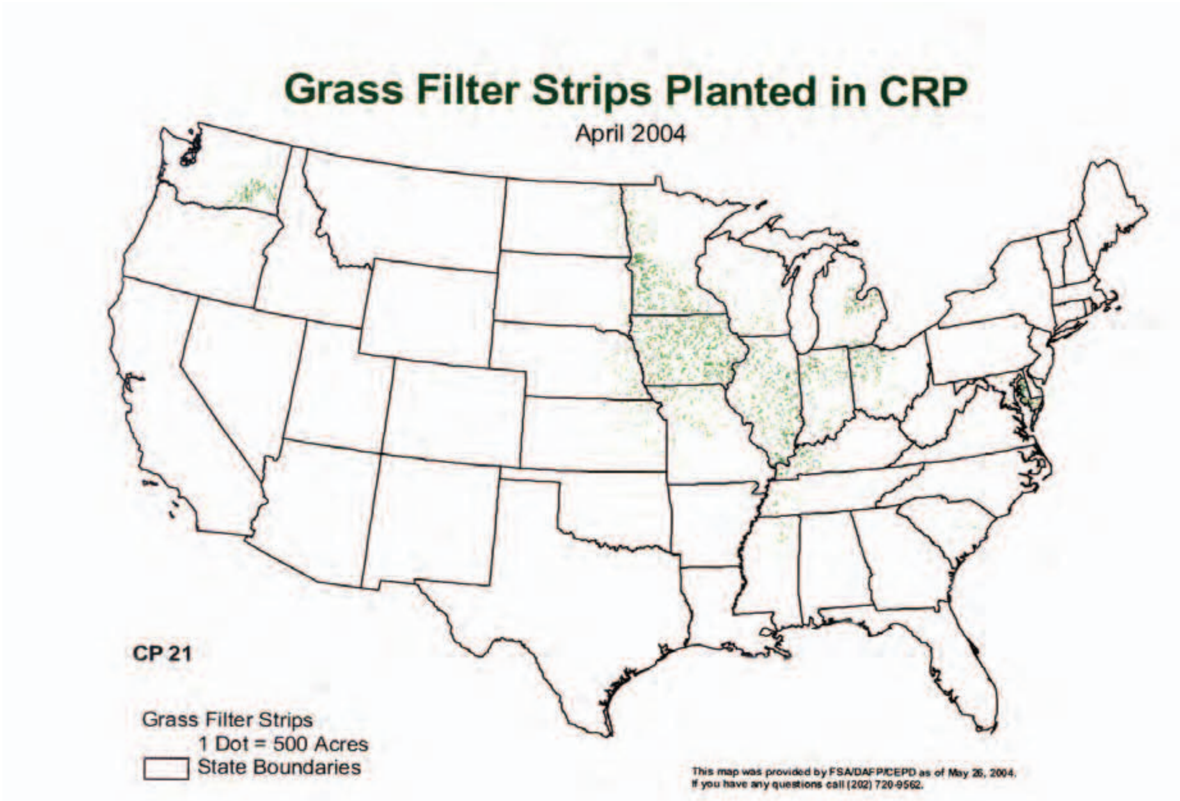

Native Grasses Seeded for CRP
April 2004
CP 2
Native Grasses
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.

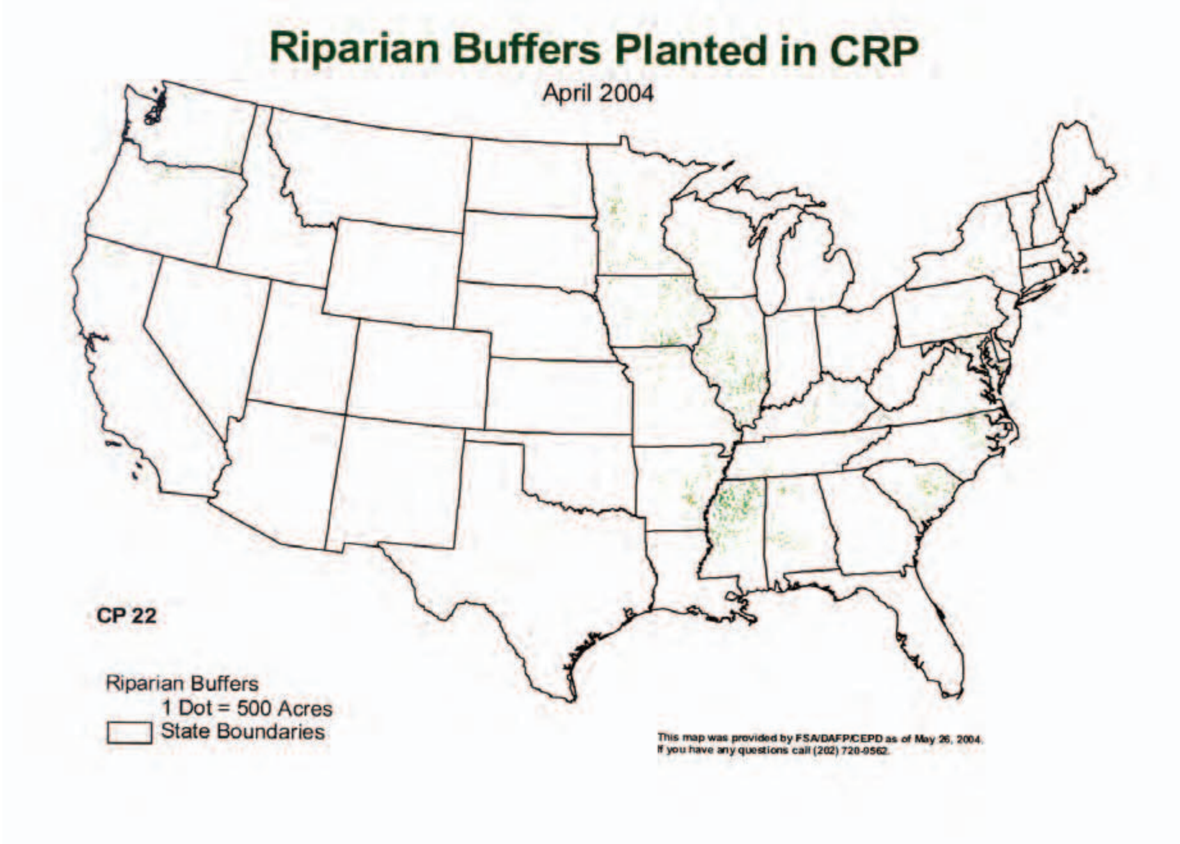

Softwood Trees Planted for CRP
April 2004
CP 3
Softwood Trees
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004
If you have any questions call (202) 720-9562.

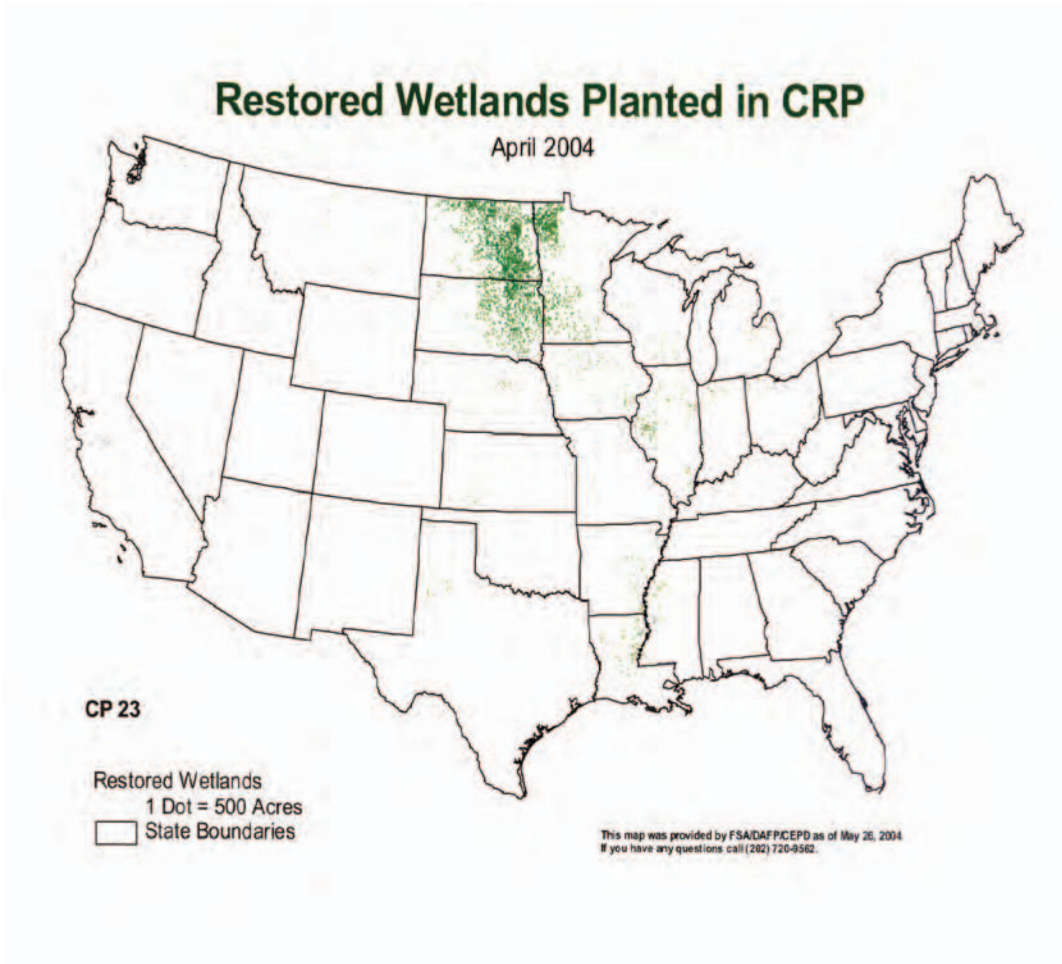

Hardwood* Trees Planted for CRP
April 2004
CP 3A
* Includes Longleaf Pine
Hardwood Trees
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.


Existing Grasses on CRP
April 2004
CP 10
Existing Grasses
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.


Existing Trees on CRP
April 2004
CP 11
Existing Trees
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.


Grass Filter Strips Planted in CRP
April 2004
CP 21
Grass Filter Strips
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.


Riparian Buffers Planted in CRP
April 2004
CP 22
Riparian Buffers
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.


Restored Wetlands Planted in CRP
April 2004
CP 23
Restored Wetlands
1 Dot = 500 Acres
State Boundaries
This map was provided by FSA/DAFP/CEPD as of May 26, 2004.
If you have any questions call (202) 720-9562.

CRP Acres by Conservation Practice, April 2004

STATE	New Planting Introd. Grasses (CP1)	New Planting Native Grasses (CP2)	New Planting Softwood Trees (CP3)	New Planting Hardwood Trees 1/ (CP3)	Wildlife Planting (CP4)	Field Windbreaks (CP5)	Grass Waterways (CP8)
U.S.	3,446,114	6,554,894	430,651	730,713	2,373,668	67,602	98,660
ALABAMA	5,137	3,642	79,823	62,258	10,685	0	47
ALASKA	5,746	0	0	0	11	0	1
ARIZONA	*	*	*	*	*	*	*
ARKANSAS	3,202	3,151	8,925	32,928	3,001	0	23
CALIFORNIA	5,585	956	10	59	759	0	0
COLORADO	48,216	609,659	90	48	248,019	1,150	970
CONNECTICUT	70	34	0	0	0	0	0
DELAWARE	53	23	5	2,942	2,122	0	4
FLORIDA	297	151	12,867	12,567	3,499	0	0
GEORGIA	572	389	36,577	127,714	6,651	0	76
HAWAII	*	*	*	*	*	*	*
IDAHO	89,610	20,100	4,587	66	132,061	552	13
ILLINOIS	180,257	39,508	1,059	51,857	127,426	2,352	25,929
INDIANA	38,896	28,709	756	20,400	14,327	2,020	13,388
IOWA	298,881	147,485	432	16,952	320,434	5,661	26,672
KANSAS	17,851	808,468	141	592	16,067	1,425	7,116
KENTUCKY	88,751	37,871	436	5,958	772	1	3,132
LOUISIANA	142	2,428	20,441	115,762	788	0	53
MAINE	1,377	112	246	1	924	0	25
MARYLAND	11,715	3,482	624	605	2,129	0	208
MASSACHUSETTS	0	0	0	0	0	0	1
MICHIGAN	34,407	18,946	5,045	4,636	26,029	1,670	750
MINNESOTA	245,104	135,990	9,086	26,867	353,821	8,288	4,092
MISSISSIPPI	6,013	457	176,089	119,420	8,435	0	66
MISSOURI	371,431	183,487	546	21,862	6,288	107	1,640
MONTANA	711,457	835,715	117	91	33,666	406	91
NEBRASKA	46,472	357,967	818	1,110	47,859	23,153	1,646
NEVADA	*	*	*	*	*	*	*
NEW HAMPSHIRE	10	0	0	0	0	0	0
NEW JERSEY	1,176	406	16	50	23	8	21
NEW MEXICO	970	182,671	80	0	0	0	0
NEW YORK	5,800	800	627	811	556	11	58
NORTH CAROLINA	2,312	1,670	7,539	10,296	2,965	19	128
NORTH DAKOTA	410,261	67,119	93	348	572,027	3,856	112
OHIO	25,738	28,660	1,391	7,260	44,330	1,998	6,161
OKLAHOMA	19,257	393,201	25	733	3,411	51	308
OREGON	109,362	50,120	2,035	80	12,612	4	77
PENNSYLVANIA	58,080	22,460	277	971	1,681	4	455
PUERTO RICO	108	0	0	91	0	0	0
SOUTH CAROLINA	681	107	30,688	21,034	9,461	57	69
SOUTH DAKOTA	167,217	227,699	756	109	89,571	14,313	1,072
TENNESSEE	31,725	43,191	13,798	3,630	9,290	0	160
TEXAS	110,162	1,640,463	2,120	1,338	38,118	43	1,964
UTAH	57,772	15,003	0	0	774	4	6
VERMONT	0	0	0	0	0	5	1
VIRGINIA	4,259	2,717	4,362	283	1,099	3	36
WASHINGTON	125,098	575,772	1,261	33	184,483	17	514
WEST VIRGINIA	10	22	135	0	0	0	0
WISCONSIN	47,951	56,427	6,712	58,949	10,626	239	1,560
WYOMING	56,919	7,621	12	0	26,715	184	13

* Data witheld because less than 3 contracts.

1/ Includes Long leaf pine plantings.

CRP Acres by Conservation Practice, April 2004, con't

STATE	Shallow Water for Wildlife (CP9)	Existing Grass 1/ (CP10)	Existing Trees 2/ (CP11)	Wildlife Food Plots (CP12)	Contour Grass Strips (CP15)	Shelter-belts (CP16)	Living Snow Fences (CP17)
U.S.	48,278	15,244,790	1,102,909	76,337	74,485	27,659	3,813
ALABAMA	139	115,031	178,740	1,672	188	0	0
ALASKA	5	23,543	0	20	0	0	0
ARIZONA	*	*	*	*	*	*	*
ARKANSAS	908	27,594	57,431	449	0	0	0
CALIFORNIA	143	129,819	50	81	0	0	0
COLORADO	50	1,372,692	230	1,065	444	3,880	39
CONNECTICUT	0	131	0	0	0	0	0
DELAWARE	387	30	56	31	0	0	0
FLORIDA	0	2,153	56,446	154	0	0	0
GEORGIA	28	7,412	124,733	1,821	39	0	0
HAWAII	*	*	*	*	*	*	*
IDAHO	85	529,063	3,007	1,057	64	217	67
ILLINOIS	5,232	250,112	14,358	5,348	1,932	124	30
INDIANA	1,486	88,281	7,874	1,041	204	19	2
IOWA	16,782	590,198	7,188	5,582	29,601	1,814	112
KANSAS	710	1,727,963	1,354	5,123	5,388	554	72
KENTUCKY	2,669	141,113	1,932	1,349	61	0	0
LOUISIANA	707	18,080	40,606	1,723	0	0	0
MAINE	0	19,631	722	2	0	0	0
MARYLAND	1,217	4,182	587	137	0	0	0
MASSACHUSETTS	0	53	0	0	0	0	0
MICHIGAN	1,923	100,457	6,755	1,865	12	79	3
MINNESOTA	969	297,120	20,413	4,785	1,181	3,217	2,782
MISSISSIPPI	729	131,722	345,162	5,014	38	0	0
MISSOURI	2,769	828,067	6,254	3,535	2,417	34	0
MONTANA	21	1,522,826	1,091	2,962	0	254	18
NEBRASKA	203	585,182	3,201	2,448	502	2,048	122
NEVADA	*	*	*	*	*	*	*
NEW HAMPSHIRE	0	0	0	0	0	0	0
NEW JERSEY	3	502	27	10	4	0	0
NEW MEXICO	0	407,156	80	38	0	0	0
NEW YORK	81	38,566	1,277	74	4	0	0
NORTH CAROLINA	3,053	18,338	42,047	59	0	13	0
NORTH DAKOTA	35	1,389,713	1,569	4,306	0	3,418	295
OHIO	823	97,598	5,699	952	19	72	3
OKLAHOMA	93	596,160	434	1,376	2	37	4
OREGON	18	295,742	1,590	210	19	2	0
PENNSYLVANIA	81	55,153	574	827	126	0	0
PUERTO RICO	0	351	121	0	0	0	0
SOUTH CAROLINA	2,093	11,681	102,624	1,035	0	0	0
SOUTH DAKOTA	293	504,309	1,342	8,743	128	11,775	234
TENNESSEE	117	138,603	16,927	355	78	0	0
TEXAS	123	2,127,770	5,951	6,131	251	34	0
UTAH	0	126,527	0	32	0	0	0
VERMONT	0	116	0	0	0	0	0
VIRGINIA	88	13,972	14,346	108	0	0	3
WASHINGTON	65	387,473	1,222	886	30,698	9	0
WEST VIRGINIA	0	667	9	0	0	0	0
WISCONSIN	4,151	337,219	28,806	3,792	1,085	26	28
WYOMING	0	184,719	73	140	1	29	1

* Data witheld because less than 3 contracts.

1/ Includes both introduced and native grasses.
2/ Includes both softwood and hardwood trees.

CRP Acres by Conservation Practice, April 2004, con't

STATE	Salinity Reducing Vegetation (CP18)	Grass Filter Strips (CP21)	Riparian Forest Buffers (CP22)	Wetland Restoration (CP23)	Cross Wind Trap Strips (CP24)	Rare and Declining Habitat (CP25)
U.S.	290,121	942,568	644,193	1,717,121	667	692,508
ALABAMA	0	816	25,563	89	0	510
ALASKA	0	0	198	0	0	0
ARIZONA	*	*	*	*	*	*
ARKANSAS	0	4,695	30,735	16,770	0	0
CALIFORNIA	0	0	4,565	5,109	0	0
COLORADO	138	322	811	982	28	334
CONNECTICUT	0	20	63	0	0	0
DELAWARE	0	1,372	158	288	0	0
FLORIDA	0	0	68	0	0	0
GEORGIA	0	521	1,246	327	0	0
HAWAII	*	*	*	*	*	*
IDAHO	0	1,157	5,891	1,397	0	0
ILLINOIS	6	138,498	100,331	45,031	0	1,663
INDIANA	1	52,411	4,482	6,733	0	27
IOWA	0	231,021	59,753	29,653	41	40,626
KANSAS	2,408	23,766	4,627	4,210	178	240,400
KENTUCKY	0	31,346	11,486	67	0	6,310
LOUISIANA	0	617	3,580	33,164	0	0
MAINE	0	126	193	0	0	0
MARYLAND	0	39,402	16,816	2,173	0	0
MASSACHUSETTS	0	15	5	0	0	0
MICHIGAN	0	39,938	3,063	11,680	0	28
MINNESOTA	6,658	145,419	41,458	326,426	7	91,410
MISSISSIPPI	0	7,409	117,999	11,972	0	0
MISSOURI	0	41,126	24,136	4,661	0	54,321
MONTANA	148,971	116	2,004	4,786	27	158,162
NEBRASKA	1,092	19,782	2,999	15,363	42	75,635
NEVADA	*	*	*	*	*	*
NEW HAMPSHIRE	0	162	23	0	0	0
NEW JERSEY	0	124	21	1	0	0
NEW MEXICO	0	0	5,099	0	0	0
NEW YORK	0	354	9,116	51	0	0
NORTH CAROLINA	0	6,991	24,646	1,383	0	0
NORTH DAKOTA	113,452	7,894	502	770,265	0	0
OHIO	2	45,252	4,132	4,149	4	0
OKLAHOMA	9,181	890	1,345	1,294	0	7,777
OREGON	0	2,179	16,915	464	0	0
PENNSYLVANIA	0	1,572	8,969	370	0	0
PUERTO RICO	0	0	0	0	0	0
SOUTH CAROLINA	0	4,571	27,454	284	0	0
SOUTH DAKOTA	6,747	6,209	2,741	390,773	15	2,599
TENNESSEE	0	8,739	4,973	856	0	0
TEXAS	1,081	1,823	20,055	9,548	257	0
UTAH	0	12	150	0	0	0
VERMONT	0	113	1,156	0	0	0
VIRGINIA	0	3,739	16,668	246	38	0
WASHINGTON	365	49,151	17,795	3,687	14	0
WEST VIRGINIA	0	34	1,415	0	0	0
WISCONSIN	0	22,852	15,238	12,868	0	12,705
WYOMING	20	9	3,531	0	17	0

* Data witheld because less than 3 contracts.

CRP Acres by Conservation Practice, April 2004, con't

STATE	Salinity Reducing Vegetation (CP18)	Grass Filter Strips (CP21)	Riparian Forest Buffers (CP22)	Wetland Restoration (CP23)	Cross Wind Trap Strips (CP24)	Rare and Declining Habitat (CP25)
U.S.	290,121	942,568	644,193	1,717,121	667	692,508
ALABAMA	0	816	25,563	89	0	510
ALASKA	0	0	198	0	0	0
ARIZONA	*	*	*	*	*	*
ARKANSAS	0	4,695	30,735	16,770	0	0
CALIFORNIA	0	0	4,565	5,109	0	0
COLORADO	138	322	811	982	28	334
CONNECTICUT	0	20	63	0	0	0
DELAWARE	0	1,372	158	288	0	0
FLORIDA	0	0	68	0	0	0
GEORGIA	0	521	1,246	327	0	0
HAWAII	*	*	*	*	*	*
IDAHO	0	1,157	5,891	1,397	0	0
ILLINOIS	6	138,498	100,331	45,031	0	1,663
INDIANA	1	52,411	4,482	6,733	0	27
IOWA	0	231,021	59,753	29,653	41	40,626
KANSAS	2,408	23,766	4,627	4,210	178	240,400
KENTUCKY	0	31,346	11,486	67	0	6,310
LOUISIANA	0	617	3,580	33,164	0	0
MAINE	0	126	193	0	0	0
MARYLAND	0	39,402	16,816	2,173	0	0
MASSACHUSETTS	0	15	5	0	0	0
MICHIGAN	0	39,938	3,063	11,680	0	28
MINNESOTA	6,658	145,419	41,458	326,426	7	91,410
MISSISSIPPI	0	7,409	117,999	11,972	0	0
MISSOURI	0	41,126	24,136	4,661	0	54,321
MONTANA	148,971	116	2,004	4,786	27	158,162
NEBRASKA	1,092	19,782	2,999	15,363	42	75,635
NEVADA	*	*	*	*	*	*
NEW HAMPSHIRE	0	162	23	0	0	0
NEW JERSEY	0	124	21	1	0	0
NEW MEXICO	0	0	5,099	0	0	0
NEW YORK	0	354	9,116	51	0	0
NORTH CAROLINA	0	6,991	24,646	1,383	0	0
NORTH DAKOTA	113,452	7,894	502	770,265	0	0
OHIO	2	45,252	4,132	4,149	4	0
OKLAHOMA	9,181	890	1,345	1,294	0	7,777
OREGON	0	2,179	16,915	464	0	0
PENNSYLVANIA	0	1,572	8,969	370	0	0
PUERTO RICO	0	0	0	0	0	0
SOUTH CAROLINA	0	4,571	27,454	284	0	0
SOUTH DAKOTA	6,747	6,209	2,741	390,773	15	2,599
TENNESSEE	0	8,739	4,973	856	0	0
TEXAS	1,081	1,823	20,055	9,548	257	0
UTAH	0	12	150	0	0	0
VERMONT	0	113	1,156	0	0	0
VIRGINIA	0	3,739	16,668	246	38	0
WASHINGTON	365	49,151	17,795	3,687	14	0
WEST VIRGINIA	0	34	1,415	0	0	0
WISCONSIN	0	22,852	15,238	12,868	0	12,705
WYOMING	20	9	3,531	0	17	0

* Data witheld because less than 3 contracts.

CRP Acres by Conservation Practice, April 2004, con't

STATE	Farmable Wetland (CP27)	Farmable Wetland Buffer (CP28)	Wildlife Habitat Buffer 1/ (CP29)	Wetland Buffer 1/ (CP30)	Bottomland Hardwood (CP31)
U.S.	31,151	76,916	9,758	6,257	1,077
ALABAMA	0	0	0	0	13
ALASKA	0	0	0	0	0
ARIZONA	*	*	*	*	*
ARKANSAS	0	0	0	0	28
CALIFORNIA	0	0	0	0	0
COLORADO	0	0	65	0	0
CONNECTICUT	0	0	0	0	0
DELAWARE	0	0	0	0	0
FLORIDA	0	0	0	0	0
GEORGIA	0	0	0	0	0
HAWAII	*	*	*	*	*
IDAHO	0	0	0	0	0
ILLINOIS	7	11	23	0	291
INDIANA	64	124	35	8	80
IOWA	14,625	37,598	3,317	674	1
KANSAS	10	7	0	0	0
KENTUCKY	0	0	0	0	0
LOUISIANA	0	0	0	0	0
MAINE	0	0	0	0	0
MARYLAND	0	0	13	4	0
MASSACHUSETTS	0	0	0	0	0
MICHIGAN	0	0	0	4	11
MINNESOTA	7,506	18,052	673	3,138	0
MISSISSIPPI	0	0	20	0	271
MISSOURI	0	0	117	2	3
MONTANA	39	70	92	0	0
NEBRASKA	1,109	1,961	151	0	0
NEVADA	*	*	*	*	*
NEW HAMPSHIRE	0	0	0	0	0
NEW JERSEY	0	0	0	0	0
NEW MEXICO	0	0	0	0	0
NEW YORK	0	0	51	0	0
NORTH CAROLINA	0	0	0	0	0
NORTH DAKOTA	2,780	7,629	0	0	0
OHIO	1	3	28	0	0
OKLAHOMA	0	0	6	0	42
OREGON	0	0	4,351	0	0
PENNSYLVANIA	0	0	9	7	0
PUERTO RICO	0	0	0	0	0
SOUTH CAROLINA	0	0	0	9	0
SOUTH DAKOTA	5,005	11,456	182	2,410	0
TENNESSEE	0	0	0	0	338
TEXAS	0	0	177	0	0
UTAH	0	0	0	0	0
VERMONT	0	0	0	0	0
VIRGINIA	0	0	24	0	0
WASHINGTON	0	0	142	0	0
WEST VIRGINIA	0	0	0	0	0
WISCONSIN	3	7	12	0	0
WYOMING	0	0	271	0	0

* Data witheld because less than 3 contracts.

1/ Marginal pasture.

Appendix C. Conservation Reserve Program: Planting for the Future—Participant List

Steve Adair, Ducks Unlimited, Inc. Bismarck, ND
Jean Agapoff, USDA Farm Service Agency (FSA), Annadale, VA
Kim Alberty, Agassiz Seed, West Fargo, ND
Sam Albrecht, Society for Range Management, Lakewood, CO
Arthur Allen, U.S. Geological Survey (USGS), Fort Collins, CO
Dale Allen, Michigan State FSA Office, East Lansing, MI
Dan Allen, Allendan Seed Co., Winterset, IA
Duane Asherin, USGS, Fort Collins, CO
Carl Bamert, Bamert Seed Company, Muleshoe, TX
Alex Barbarika, USDA FSA, Washington, DC
Bill Baxter, Nebraska Game & Parks Commission, Lincoln, NE
Sally Benjamin, FSA-CEPD, Washington, DC
Verel Benson, University of Missouri, FAPRI, Columbia, MO
Mike Berg, ICF Consulting, Fairfax, VA
Bill Berry, Buffernotes Newsletter, Stevens Point, WI
Peter Berthelsen, Pheasants Forever, Inc., Elba, NE
Terry Bidwell, Oklahoma State University, Stillwater, OK
Mickey Black, USDA FSA, Jackson, MS
Todd Bogenschutz, Iowa Department of Natural Resources, Boone, IA
Shawn Boyd, National Cotton Council, Memphis, TN
Tracy Boyer, Oklahoma State University, Stillwater, OK
Steve Brady, USDA Natural Resource Conservation Service (NRCS), Fort Collins, CO
Shane Briggs, Colorado Division of Wildlife, Denver, CO
Hal Brockman, USDA Forest Service, Washington, DC
Don Brown, Wood & Huston Bank, Marshall, MO
Debbie Bruce, Illinois Department of Natural Resources, Springfield, IL
Michael Burchell, North Carolina State University, Raleigh, NC
Wes Burger, Mississippi State University, Mississippi State, MS
Bryan Burhans, National Wild Turkey Federation, Edgefield, SC
Brian Cade, USGS, Fort Collins, CO
Jim Call, Minnesota Soybean, Madison, MN
Brenda Carlson, USDA Farm Service Agency, College Station, TX
John Carter III, USDA, Washington, DC
Tom Casadevall, USGS, Lakewood, CO
Frank Casey, Defenders of Wildlife, Washington, DC
Chad Chadwell, USDA FSA, New York City, NY
Steve Chapman, Georgia Forestry Commission, Macon, GA
Gary Churchill, USDA FSA, Dover, AR
Mark Clark, Washington State Conservation, Olympia, WA
Larry Clemens, The Nature Conservancy, Angola, IN
Betty Croker, National Corn Growers Association, Washington, DC
Barth Crouch, Pheasants Forever, Salina, KS
Bill Crumpton, Iowa State University, Ames, IA
Blake Curtis, Curtis & Curtis Seed, Clovis, NM
Marc Curtis, National Association Conservation Districts
Frank Davis, USDA, OCIO: NTIC, Fort Collins, CO
Ben Deeble, National Wildlife Federation, Missoula, MT
Tammy Dennee, Oregon Wheat Growers League, Pendleton, OR
Frank D'Erchia, USGS, Denver, CO
Mike Dicks, Oklahoma State University, Stillwater, OK
Justin Dilges, Applewood Seed Company, Arvada, CO
Otto Doering, Purdue University, West Lafayette, IN
Lisa Drake, Monsanto, Englewood, CO
Larry Dreilling, Media
Pat Dumoulin, National Corn Growers Association, Hampshire, IL
Wayne Edgerton, Minnesota Department of National Resources, St. Paul, MN
David Ernstes, Texas A&M University, College Station, TX
Luke Esch, Baca County Pheasants Forever, Springfield, CO
Pat Esch, Baca County Soil Conservation District, Springfield, CO
Chip Euliss, USGS, Jamestown, ND
Ray Evans, IAFWA, Holts Summit, MO
Terry Fankhauser, National Cattleman's Beef Association, Arvada, CO
Neal Feeken, National Fish and Wildlife Foundation, Fort Snelling, MN
Richard Feyh, Feyh Farm Seed Co., Alma, KS
Carol Finn, USGS, Rolla, MO
Jim Fitzgerald, USDA FSA, Spokane, WA
James Fortner, USDA FSA, Washington, DC
Alison Fox, Senate Minority Staff, Bethesda, MD
Lewis Frank, USDA FSA, Lakewood, CO
Tom Franklin, The Wildlife Society, Bethesda, MD
Rod Fritz, Stock Seed Farms, Inc., Murdock, NE
Bill Fuller, USDA FSA, Manhattan, KS
Mark Gaede, National Association of Wheat Growers, Washington, DC
James Glumpler, Littlefield, TX
Randall Gray, USDA, NRCS, Arlington, VA
Susan Gray, USDA Forest Service, Golden, CO
Kurt Haarmann, Columbia Grain, Portland, OR
Ed Hackett, USDA, NRCS, Wildlife Habitat Management Institute (WHMI), Madison, MS
Wes Harris, University of Georgia, Statesboro, GA
John Hart, Hartwood Natural Resource Consultants, Cheyenne, WY
Paul Harte, USDA FSA, Overland Park, KS
Sue Haseltine, USGS, Reston, VA
Kelly Jo Hayes, Allendan Seed Co., Winterset, IA
Ron Helinski, Wildlife Management Institute, Washington, DC
Daniel Hellerstein, USDA, Economic Research Service/RED, Washington, DC
Malcolm Henning, USDA, Washington, DC
George Hernandez, USDA Forest Service (USFS), Atlanta, GA

Kenneth Herring, Iowa Department of Natural Resources, Des Moines, IA
Jay Hestbeck, USGS, Jamestown, ND
Don Hijar, Pawnee Buttes Seed, Inc., Greeley, CO
Timothy Hobbs, Maine Potato Board, Presque Isle, ME
David Hoge, USFS, Atlanta, GA
Chris Holdgreve, National Grain and Feed Association, Washington, DC
Jennifer Hope, AAFC-PFRA, Regina, Canada
Doug Hovermale, FSA, Indianapolis, IN
David Howell, Quail Unlimited, Stendal, IN
Gerald Hrdina, USDA FSA, Columbia, MO
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Skip Hyberg, USDA FSA, Washington, DC
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Jim Inglis, Pheasants Forever, Upper Sandusky, OH
Craig Jagger, House Agriculture Committee, Washington, DC
Bart James, Ducks Unlimited, Inc., Washington, DC
Barbara Johnson, Congressional Research Service, Vienna, VA
Doug Johnson, USGS-NRWRC, Jamestown, ND
Jillene Johnson, USDA FSA, Washington, DC
Jim Johnson, Montana State University, Bozeman, MT
John Johnson, USDA FSA, Washington, DC
R. Darlene Johnson, USDA, NRCS, Columbia, MO
Rod Johnson, USDA FSA, Eads, CO
Carole Jordan, Kansas Department of Agriculture, Topeka, KS
Jim Jost, USDA FSA, Fargo, ND
Garth Kaste, Kaste Seed, Inc., Fertile, MN
Kendell Keith, National Grain and Feed Association, Washington, DC
Bob Kellogg, USDA, NRCS, Vienna, VA
Larry Kleingartner, National Sunflower Association, Bismarck, ND
Steve Kline, Izaak Walton League, Gaithersburg, MD
Scott Klinger, Pennsylvania Game Commission, Middleburg, PA
Bruce Knight, USDA, NRCS, Washington, DC
Lance Kuester, USFWS, Lakewood, CO
Gary Lamont, USDA, NRCS, NY, Walton
Don Larsen, Washington Department of Fish and Wildlife, Spokane, WA
Murray Laubhan, USGS, Jamestown, ND
Dave Lavway, USDA FSA, Bangor, ME
Tom Lederer, USDA FSA, Washington, DC
Greg Link, North Dakota Game & Fish Department, Bismarck, ND
Jim Little, USDA FSA, Washington, DC
Lois Loop, USDA FSA, Tualatin, OR
Tom Lutgen, Star Seed, Inc., Osborne, KS
Andy Martinez, Monsanto, LaPorte, CO
Tim McCoy, Nebraska Game & Parks Commission, Kearney, NE
Derryl McLaren, USDA FSA, Des Moines, IA
Scott McLeod, Ducks Unlimited, Inc., Bismarck, ND
Steve Melton, USDA FSA, Jackson, MS
Bruce Menzel, USDA, Washington, DC
Jim Michaels, USDA FSA, Washington, DC
Daniel Milchunas, Colorado State University, Fort Collins, CO
Luke Miller, Ohio Division of Wildlife, Columbus, OH
Larry Mitchell, American Corn Growers Association, Washington, DC
Marti Morgan, State Office of Senator Wayne Allard, Greeley, CO
Michelle Motley, USDA, Columbia, MO
Brent Mullis, USDA FSA, Bangor, ME
Michael Musel, Iowa Farm Service Agency, Des Moines, IA
Wayne Myers, Kennedy and Coe, LLC, Greeley, CO
David Nomsen, Pheasants Forever, Alexandria, MN
Frank Oberle, Pure Air Native Seed, Novinger, MO
Matt O'Connor, Pheasants Forever, Hopkinton, IA
Eric Odell, Colorado Division of Wildlife, Fort Collins, CO
Clay Ogg, Environmental Protection Agency (EPA), Washington, DC
Sammy Orange, USDA FSA, College Station, TX
Andrew Ortiz, USDA FSA, Albuquerque, NM
Ruth Ostroff, Central Valley Joint Venture, Sacramento, CA
Don Parrish, American Farm Bureau Federation, Washington, DC
Stacy Peterson, Montana Department of Agriculture, Helena, MT
Jim Phipps, USDA FSA, Vevay, IN
Renee Picanso, USDA, NASS, Lakewood, CO
John Pingry, USDA, NRCS, Madison, WI
Norm Poppe, Applewood Seed Company, Arvada, CO
Charles Potter, Max McGraw Wildlife Foundation, Dundee, IL
Scott Prestidge, Field Representative Westminster, CO
Beverly Preston, USDA FSA, Washington, DC
Mahesh Rao, Oklahoma State University, Stillwater, OK
Mike Ratzlaff, Carlson Prairie Seed Farm, Inc., Newfolden, MN
Greg Reisdorff, USDA, Lincoln, NE
Tom Remington, Colorado Division of Wildlife, Fort Collins, CO
Charlie Rewa, USDA, NRCS, Laurel, MD
Ron Reynolds, USFWS, Bismarck, ND
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Max Richeson, Arrow Seed Co., Inc., Broken Bow, NE
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Pat Sullivan, USDA, ERS, Washington, DC
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Paul Thoroughgood, Ducks Unlimited Canada, Regina, SK
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Wayne Vassar, Sharp Brothers Seed Co., Clinton, MO
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