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The Farm Act's Regional Equity Provision

Impacts on Conservation Program Outcomes

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The Farm Act's Regional Equity Provision: Impacts on Conservation Program Outcomes

Cynthia Nickerson, Marc Ribaudo, and Nathaniel Higgins

Abstract

The 2002 and 2008 Farm Acts increased funding for conservation programs that provide financial assistance to farmers to implement conservation practices on working farmland. Along with seeking cost-effective environmental benefits, these programs have a goal of spreading conservation funding equitably across States. The 2002 and 2008 Farm Acts strengthened this allocative goal by setting a minimum threshold for conservation funding for each State—one that exceeds historical funding for some States—for enrolling agricultural producers in specified conservation programs. This study uses conservation program data to examine evidence of the impacts of the Regional Equity provision of the 2002 Farm Act, and explores the tradeoffs that can occur among conservation program goals when legislation gives primacy to fund allocation. The study found that cross-State shifts in funding reduced the acres receiving conservation treatment for many resource problems, but increased the net economic benefits from treatments on some of them. Overall impacts on the types of producers enrolled were small.

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Summary

Federal working-land and farm and grazing land protection programs have long allocated program funding among States. In 2002, the Regional Equity provision of the Farm Security and Rural Investment Act (the 2002 Farm Act) further emphasized the allocative goal by redirecting some funding to States that historically had received only limited assistance under these programs. The Regional Equity provision mandated that each State receive at least $12 million per year between 2003 and 2007 for enrolling eligible producers in four conservation programs (the 2008 Farm Act increased the threshold to $15 million). This provision may sometimes work at cross purposes to the programs' environmental and economic goals of helping farmers adopt cost-effective conservation practices.

What Is the Issue?

Because overall program budgets were not augmented to cover the minimum allocation requirement, the provision shifted funding from States that exceeded the threshold to those below it. The provision clearly affected the amount of conservation funding allocated to each State in each program. However, because conservation programs have multiple goals, it is difficult to predict the effects that promoting allocative goals may have on progress toward other program goals. Key questions are whether agricultural producers enrolled as a result of such legislation treat similar environmental problems and whether their conservation actions provide environmental benefits as cost effectively as actions undertaken by other producers, and also if particular types of farmers stand to gain or lose. This study analyzes program data from the 2004-06 period when the 2002 Farm Act was in effect. Data from the Environmental Quality Incentives Program (EQIP) and the Wildlife Habitat Incentives Program (WHIP)—the two programs with the most detailed data—are used to determine whether the required reallocations of funds affected the ability of those conservation programs to achieve environmental goals cost effectively.

What Did the Study Find?

The analysis revealed that the Regional Equity provision's $12 million threshold requirement had unequal impacts across States. Also, it altered the environmental and economic outcomes differently in EQIP and WHIP, in ways that were not always consistent across years. Major impacts evident from the study were:

- **The Regional Equity provision reduced the number of acres that received treatment for many resource problems in EQIP, but this did not always result in a decline in net economic benefits.** Changes in physical measures (such as acres receiving conservation treatment) are not always correlated with economic measures (the net economic benefits from conservation treatment), so it is important to measure both types of impacts in determining the tradeoffs arising from new policies. For instance, in EQIP, even though the cross-State shifts in enrollment induced by the provision decreased the number of acres treated for soil productivity and other soil erosion issues, in some years these cross-

State shifts generated additional net economic benefits from improved soil productivity and reduced sedimentation (net economic benefits are calculated as gross benefits from conservation treatment minus treatment costs). This occurred when conservation actions benefited more people and when the producers in States that received increased funding (in order to reach the $12 million minimum) provided these benefits more cost effectively than producers in the remaining States. However, for grazing productivity and water conservation issues, the Regional Equity provision reduced both the number of acres receiving treatment and the corresponding net economic benefits from treatment in each of the 3 years studied.

- **Impacts differed among programs subject to the Regional Equity requirements.** In WHIP, the funding reallocation resulted in relatively large losses of both acres treated and net wildlife-related benefits (at least for the impacts the authors were able to measure in the continental United States), suggesting the provision may be having an overall negative impact on that program. Because each program targets different environmental problems at different costs, reducing the reallocations that occur in WHIP as a result of the Regional Equity provision and increasing reallocations that occur in the other three programs might increase overall net economic benefits from the four programs subject to the provision.

- **The 2002 Regional Equity provision had only a small impact on participation by types of producers that are offered more favorable enrollment terms in EQIP to encourage their involvement.** The study found that the Regional Equity provision reduced the number of livestock producers and increased the number of beginning and limited-resource producers enrolled in EQIP. However, the decrease in livestock producers was small and did not affect EQIP's ability to meet a legislated requirement that 60 percent of program funding be devoted to livestock-related practices.

- **The Regional Equity provision's fixed minimum funding threshold means that any decreases in total program budgets will be borne largely by States that exceed that threshold.** Because the Regional Equity provision is designed as a fixed set-aside and requires that each State receive at least the threshold amount of funding, any cuts in total program funds must be absorbed by States that receive more than the minimum funding. In contrast, program budget reductions would be shared by all States if the Regional Equity provision instead required that each State receive at least a certain percentage of total program funding. In the latter case, as total program budgets change, the funding for each State would change in proportion to the State's specified funding share.

How Was the Study Conducted?

This study uses conservation program contract data from 2004 to 2006 to identify the environmental, economic, and distributional implications of the Regional Equity provision within EQIP and WHIP, including the ability of the programs to deliver certain net benefits and the effect on enrollment patterns of certain producer groups over the period. Contract data were not available for the Farm and Ranch Lands Protection Program and the Grassland Reserve Program, the other two conservation programs subject to the Regional Equity provision. The analysis recognizes that the lowest ranked ("marginally accepted") contracts are the most vulnerable to policy-induced budget shifts. The authors used data on these contracts, including the costs incurred, acres treated, and resource concerns addressed—along with estimates of technical assistance costs and spatially heterogeneous data on the benefits of treating environmental problems arising from agricultural production—to estimate the impacts of the Regional Equity provision. Identifying the marginal contracts was particularly important because the lowest ranked contracts were more likely to address lower priority problems at higher cost. Due to limited data on the benefits of conservation treatment, not all conservation activity could be included in the analysis of economic impacts; our findings are illustrative of the tradeoffs that occur from implementing the Regional Equity provision. Also, the estimates of net benefits were limited to program activity in the continental United States.

Introduction

Over the past 20 years, most Federal assistance for conservation activities on agricultural land has been directed toward taking environmentally sensitive farmland out of production and enrolling it in the Conservation Reserve Program (CRP). Increasingly, however, Federal programs have sought to improve the environmental performance of active farms. Programs such as the Environmental Quality Incentives Program (EQIP) and Wildlife Habitat Protection Program (WHIP) have provided financial assistance to producers to implement conservation practices and adopt more environmentally friendly management practices. The Farm and Ranch Lands Protection Program (FRPP) and the Grassland Reserve Program (GRP) provide funds to permanently restrict conversion of farmland and grazing land to more environmentally damaging uses and, in the case of GRP, to restore native grasslands.[1] The 2002 Farm Security and Rural Investment Act (referred to here as the 2002 Farm Act) increased the combined spending for these four programs almost 400 percent to about $5.7 billion over the 6 years from 2002 to 2007. The Food, Conservation, and Energy Act of 2008 (hereafter called the 2008 Farm Act) authorized further funding increases, projected by the Congressional Budget Office to be almost $9.0 billion over the 5-year period from 2008 to 2012.[2]

[1]Farm legislation refers to the FRPP as the Farmland Protection Program.

[2]Source of the 2002 Farm Act spending amounts is from the Office of Budget Policy and Analysis; 2008 Farm Act spending estimates are from the Congressional Budget Office.

The increase in funding for conservation on working lands has resulted in farmers' receiving more conservation assistance through programs that, by design, allocate program funds broadly across the country. USDA's Natural Resources Conservation Service (NRCS), the agency that administers the working-land conservation programs, allocates program funding to State NRCS offices based on conservation and other criteria. These State offices set priorities regarding which environmental problems will receive treatment and make enrollment decisions. Many State offices allocate funding and program decisions to sub-State (county, township, or watershed) offices. In contrast, in the CRP general signups in which most enrollments occur, applications are pooled nationally and enrollment decisions are made at the Federal level. Although some CRP funds are targeted to particular locations, most CRP program funds are awarded on the basis of expected environmental benefit and cost criteria that do not give particular consideration to location.

A decentralized program structure that furthers allocative goals can also help achieve environmental and economic goals. For example, when environmental problems arising from agricultural production are localized and the benefits and costs of treatment vary across the area, decentralized decisionmaking can benefit local jurisdictions economically because it lets them set priorities and determine solutions based on local needs and preferences (Peltzman and Tideman, 1972). Local decisionmaking would not necessarily advance the distributional goals of some conservation programs, however, such as ensuring that producers with different income levels and farming focuses have the opportunity to participate. Distributional goals, which target funds to particular types of farmers based on production characteristics, are distinguished from allocative goals, which are defined on the basis of geography.[3]

[3]Of the working-land and land protection programs discussed here, only EQIP contains legislated provisions that target funding by producer type.

Recent legislative actions have furthered allocative goals in conservation programs. In the 2002 and 2008 Farm Acts, the Regional Equity provisions have required that each State receive a minimum amount of funding through, collectively, EQIP, WHIP, FRPP, and GRP.[4] The 2002 Farm Act set the minimum funding threshold at $12 million, and the 2008 Farm Act increased it to $15 million. The provision did not include an allowance to increase annual program budgets to cover these additional payments to States that historically had received lower levels of funding. Those States that had been receiving a higher amount continue to receive it if overall program funds permit; to ensure, however, that all States receive at least the required minimum annual funding, USDA reallocates conservation funds, when necessary, among States in the affected programs.

The Regional Equity provision affects multiple programs, so implementing it may involve a broader set of tradeoffs with other program goals than requirements that affect a single program. Each year since it was first passed in 2002, the provision has resulted in reallocation of funds, in each of the four targeted programs, from States that exceeded the minimum threshold to those that did not. This provision allows additional lower priority applications to be enrolled in States that are allocated more funds and prevents lower priority applications from being enrolled in the other States. Funding reallocations across States can affect program outcomes in ways that are difficult to predict because a program's applications that are viewed as low priority in one location could be viewed as higher priority, or not a priority at all, in another location. Program outcomes could change because the characteristics of the applications—and the environmental problems the operators agree to treat—differ across areas (that is, spatially) and across conservation programs. Agricultural operations across the United States are diverse, with both the types of production and characteristics of farms varying geographically. The severity of environmental problems arising from agricultural problems also varies geographically, as does the willingness of operators to implement conservation practices to address them (Lambert et al., 2006; Caswell et al., 2001; Claassen et al., 2001). Local government priorities in each conservation program vary geographically as well. Collectively, these variations mean that operators in different locations will face different incentives to enroll in conservation programs.

If programs initially were strictly designed to enroll producers who could provide the most environmental benefits for the least cost, we might expect the tradeoff from expanding participation in selected geographic areas or for particular producers to reduce the cost effectiveness of conservation programs. Cost effectiveness can decline when program changes result in fewer benefits for a given expenditure or in the same level of benefits at a higher cost. However, policy changes to strengthen allocative goals may not necessarily occur at the expense of economic goals. Conservation programs are not designed to single-mindedly maximize environmental benefits, but instead attempt to satisfy multiple goals. As a result, reallocating program funds can have impacts that are hard to predict. Whether a policy change entails a tradeoff between the cost-effective delivery of environmental benefits and other program goals depends on the relative values of benefits and costs provided by the contracts that ultimately are, and are not, funded as a result of the legislated change.

[4]The term "State" used in this report includes the Pacific Basin territories and Puerto Rico.

The literature provides little guidance on this question. Two recent ERS analyses found that efforts to further distributional goals may have increased conservation program costs. One study considered the impact of discontinuing competitive bidding in EQIP—the option to bid down payments to improve chances of enrollment (Cattaneo et al., 2005). Bidding was discontinued in 2002 in EQIP because it was perceived as favoring large and well-established producers over small and limited-resource farmers. This mandated change affected program costs: the average payment for implementing structural conservation practices was 35 percent of cost when bidding was allowed (1996-2002), but after bidding was discontinued, producers received the minimum Government cost-share of at least 50 percent, and many producers received the maximum cost-share of 75 percent (Cattaneo et al., 2005).[5] ERS analysis of post-2002 enrollment patterns revealed that they did not shift appreciably to States that—by some estimates—may be likely to generate higher levels of environmental benefits (Hansen and Ribaudo, 2008), which suggests that discontinuation of bidding may have reduced EQIP's ability to provide benefits in the most cost-effective manner (an economic goal). Another study found that because beginning and limited-resource farmers enrolled in EQIP receive favorable payment terms, they tend to receive larger payments per practice, even though they tend to treat fewer acres or install smaller structural practices. But they also operate more environmentally sensitive land than other participating farmers, have different conservation priorities, and receive different levels of payments (Nickerson and Hand, 2009). The differences among farmers who currently participate suggest that economic and environmental outcomes could change if more of these farmers were enrolled.

[5]The 2002 Farm Act allowed States to contribute up to 90 percent of the cost of structural practices (e.g., fences, lagoons, and vegetative buffers) incurred by beginning or limited-resource producers.

The Regional Equity provision furthered allocative goals, described in the following section, that already existed in the working-land programs. To determine how the provision's stipulations for allocating funds affected program results, the authors examined data that help identify impacts on key program outcomes. This report describes the design structure of working-land conservation programs that allows them to accommodate allocative goals, and analyzes the impacts on conservation program outcomes of the Regional Equity provision that further these goals. The authors examine several key issues. First, we analyze the effects of the Regional Equity-induced funding reallocations on the number and types of contracts that were enrolled. We then evaluate the tradeoffs that occurred in terms of the resource problems that were ultimately treated. We use these findings to shed light on whether the Regional Equity provision reduced the ability of working-land programs as a group to achieve environmental and economic goals—by providing environmental benefits cost effectively—over the 2004-06 period. We also consider the impact of the Regional Equity provision on distributional goals by considering its effects on enrollments of livestock producers and beginning and limited-resource producers in EQIP—groups that are given favorable enrollment terms to encourage their participation. We use a methodological approach that identifies characteristics of contracts most susceptible to such changes, which is particularly important in decentralized programs that allow for priority setting and enrollment decisions at a local level. Policymakers have a limited set of levers for affecting change in conservation programs, which increases the importance of understanding the potential tradeoffs from changes in programs that seek multiple goals simultaneously.

Allocative Goals in Working-Land and Land Protection Programs

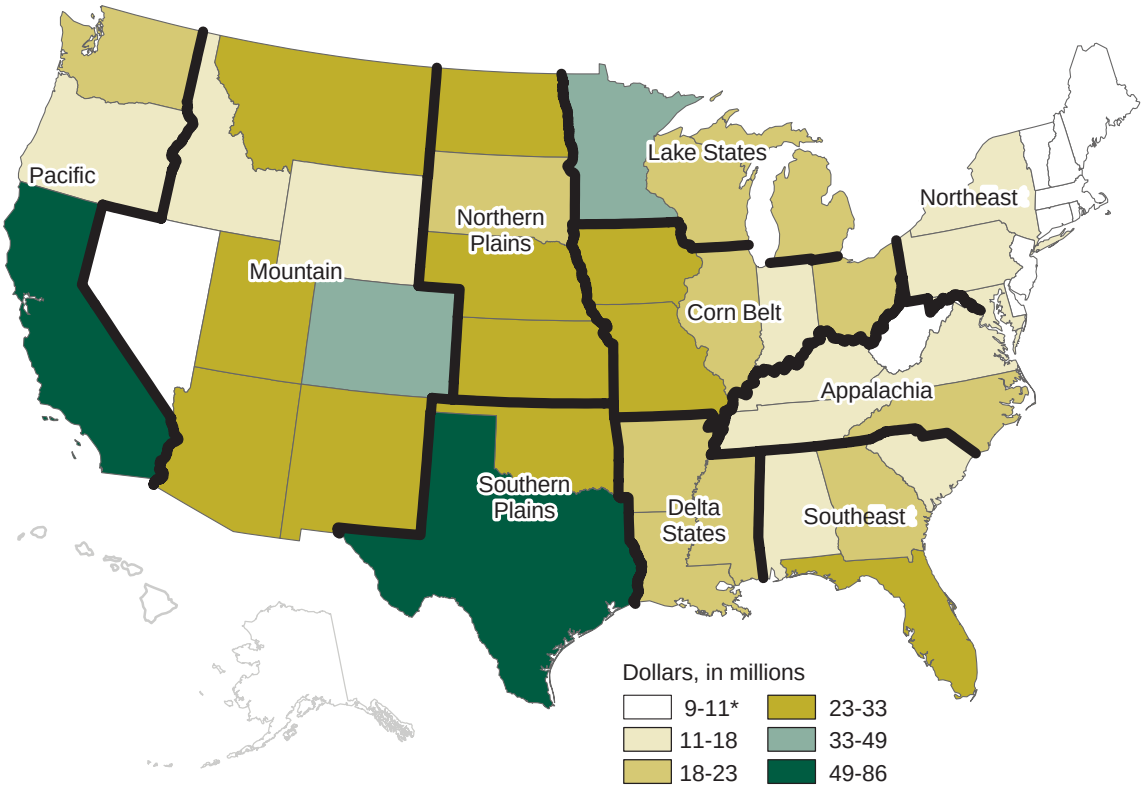
Along with environmental and economic goals of providing benefits cost effectively, regional funding allocation considerations have historically played an important role in the design of working-land and farm and grazing land protection programs. Since the inception of the programs, financial and technical assistance funds to address a variety of environmental problems have been made available to producers in all 50 States through EQIP, WHIP, FRPP and GRP (fig.1).

In EQIP, WHIP, FRPP, and GRP, determining the funding each State NRCS office will receive involves two steps. First, in each program, most funds available for financial assistance are allocated using indicators reflecting national priorities in farm legislation.[6,7] The specific types of indicators vary across programs (Appendix A). NRCS weights each indicator based on an assessment of the relative importance of the corresponding resource issue. Indicator weights are adjusted from time to time as new information or issues come to light. Second, funds for each indicator are then allocated to State NRCS offices based on the extent of the environmental concern that the indicator represents in each State. For example, if land condition is a program indicator, States with higher percentages of poor quality land will receive a larger percentage of the funds allocated to the land condition indicator.

[6]Nearly a third of EQIP program funding is used for technical assistance to assist producers with conservation practice implementation. These funds have typically been allocated to States in proportion to the amount of financial assistance the States were awarded.

[7]NRCS reserves a small portion of funds for special reasons, such as performance incentive awards.

Figure 1
Initial funding for EQIP, WHIP, GRP, FRPP, 2006 (pre-Regional Equity reallocations)



EQIP - Environmental Quality Incentives Program; WHIP = Wildlife Habitat Incentives Program; GRP Grassland Reserve Program; FRPP = Farm and Ranch Lands Protection Program.
*In 2006 only, NRCS administratively lowered the Regional Equity threshold from $12 to $11 million.

Source: ERS analysis of NRCS fund allocation data. Map excludes funds allocated to Puerto Rico and the Pacific Basin.

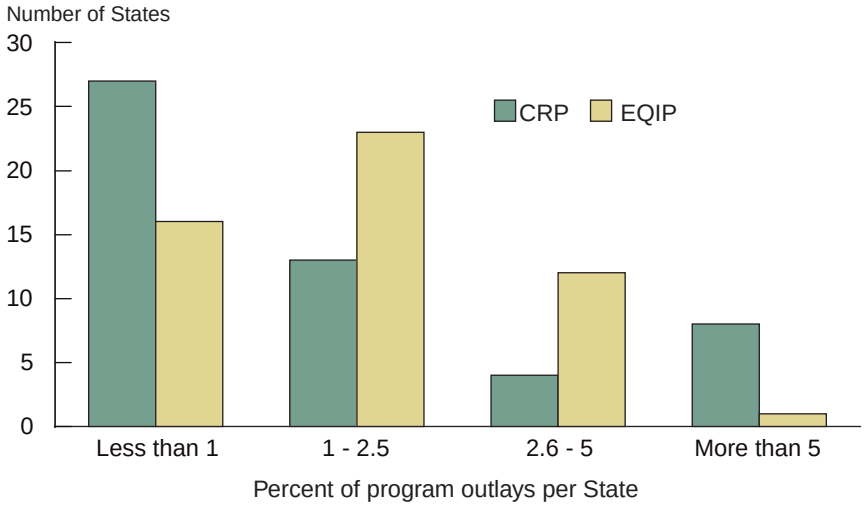
In each program, the total allocation of financial assistance funds for each State is the sum of the State allocations for each of the indicators. Allocating funds to States based on the *relative* extent and impairment of resources, rather than on *absolute* quantities, ensures that at least some funds from each program will be allocated to each State NRCS office (at least, for those indicators that are present in the State).

When allocative goals are sought, conservation funds in working-land and farm and grazing land protection programs tend to be less geographically concentrated among States than they would be otherwise. For example, in the Conservation Reserve Program, in which broad distribution of funds is not an explicit element of program design (applications are pooled nationally and prioritized on the basis of expected environmental benefits and costs), more than 56 percent of program outlays were concentrated in eight States in 2006. Each of these eight States individually accounted for more than 5 percent of outlays (fig. 2).[8] In contrast, in EQIP, a decentralized program, only one State was allocated more than 5 percent of program funding in 2006. The eight States receiving the largest allocations in EQIP accounted for 33 percent of total funding that year.

Even when conservation funding is allocated across States, program outcomes might not change substantially if all States had the same environmental priorities and agreed to fund the same conservation practices at the same cost. But State-level priorities and decisions differ. These differences have an important bearing on which producers choose to apply for funding, as well as which are enrolled and receive conservation payments. The discretion given to local NRCS offices in these programs introduces variations that make the impacts of national legislation on program outcomes harder to predict.

[8]The CRP does place a 25-percent cap on cropland enrolled in any one county, but there is no explicit enrollment cap at the State level.

Figure 2
Comparative distribution of program funding to States, 2006



CRP = Conservation Reserve Program; EQIP = Environmental Quality Incentives Program.

Sources: USDA-FSA CRP summary data; USDA-NRCS EQIP summary data.

The Regional Equity Provision: Did Implementation Induce Environmental, Economic, or Distributional Tradeoffs?

An analysis of the Farm Act's Regional Equity provision reveals how tradeoffs can arise from furthering allocative goals in conservation programs. Although minimum funding thresholds were set in the 2002 and 2008 Farm Acts at $12 million and $15 million, respectively, the Regional Equity provision did not dictate how the required minimum thresholds were to be met. During the 2004-06 period that we analyzed, USDA's Natural Resources Conservation Service (NRCS) determined how funds for the four programs would be reallocated to meet the requirement and the programs in which reallocations would occur.[9] During this period, only in 2005 did reallocations occur in all four affected programs (table 1). In 2004, NRCS reallocated funds within EQIP, GRP, and FRPP to meet the requirement. In 2006, funding was not appropriated for GRP, so reallocations occurred only within EQIP, WHIP, and FRPP.

The reallocation that occurred within each program also varied each year. In EQIP, declining funds (in both total dollars and percentage of funding) were set aside specifically for States below the funding threshold over the 2004-06 period, while in the other three programs an increasing percentage of funds was set aside. Most of the reallocations occurred through EQIP, but in 2006, WHIP and FRPP were particularly impacted by the Regional Equity provision: 22 and 38 percent of the Regional Equity reallocations occurred through these programs, even though the programs represented only 4 and 8 percent of the combined program budgets, respectively.[10]

Over the 2004-06 period, the Regional Equity provision tended to shift program funds to 12 States—mostly the smaller States in the Northeast, but also to Nevada, Alaska, and Hawaii (fig. 3). We define "Regional Equity States" (RE States) as the States that were initially below the minimum funding threshold and were then reallocated more conservation funds, and the "non-Regional Equity States" (non-RE States) as the remaining States.

State Funding Levels Will Not Always Be Equally Affected by Changes in Overall Program Budgets

With its minimum allocations based on a fixed amount, the Regional Equity Provision has broad implications for which States gain or lose funding when overall conservation program budgets change. In the absence of the Regional Equity provision, declines or increases in overall program budgets would generally be shared equally by all States in proportion to their funding share. In the presence of the Regional Equity provision, however, overall program budget reductions will be absorbed by the majority of States whose allocated funding exceeds the minimum threshold amount, since States with funding levels at the fixed threshold are required to receive at least the threshold amount. As program budgets rise, States whose funding exceeds the threshold share in the increase, and fewer reallocations are necessary to assure that the other States are allocated the minimum required by the Regional Equity provision. If budgets become large enough that the Regional Equity provision no longer forces reallocation (all States' budgets exceed the

[9]To implement the requirements of the Regional Equity provision, during 2004-06, NRCS took several steps: NRCS estimated which States were likely to be below the threshold, and by how much; NRCS withheld an amount equal to this expected shortfall from program budgets and allocated the remainder to States using the programs' allocation criteria; and NRCS then reallocated withheld funds to the underfunded States according to need.

[10]The choice of which conservation programs are used to satisfy the Regional Equity requirement can affect the ultimate impact of the provision on program outcomes. ERS analysis (not reported here) revealed that it is possible to implement the Regional Equity provision by reallocating funds solely within EQIP because its budget is much larger than the other programs. Doing so would result in States' receiving combined funding levels (from all four programs) that are not strikingly different from the current method. However, because States would receive different amounts through each individual program and because each program targets different environmental problems at different costs, such a strategy would likely result in different environmental benefit and cost tradeoffs.

Table 1
Funding levels and Regional Equity adjustments

Fiscal Year		EQIP	WHIP	GRP	FRPP	Total
2004	**Total initial Financial Assistance (FA) funding[1]**	$661,005,400	$27,800,000	$54,059,400	$84,833,000	$827,697,800
	Percent of total initial FA funding for all 4 programs	80%	3%	7%	10%	100%
	Amount of FA funds reallocated to Regional Equity States	$31,476,600	$0	$4,489,700	$8,640,000	$44,606,300
	Share of Regional Equity funds reallocated through program	71%	0%	10%	19%	100%
	Percent of programs' initial FA funding affected by reallocations	5%	0%	8%	10%	
	Number of Regional Equity States[2]	14	0	14	10	
	Number of non-Regional Equity States[2]	38	0	38	42	
2005	**Total initial FA funding[1]**	$691,525,000	$33,050,000	$65,960,000	$106,700,000	$897,235,000
	Percent of total initial funding for all 4 programs	77%	4%	7%	12%	100%
	Amount of funds reallocated for Regional Equity - FA	$25,500,000	$6,240,000	$9,790,000	$12,000,000	$53,530,000
	Share of Regional Equity funds reallocated through program	48%	12%	18%	22%	100%
	Percent of programs' initial FA funding affected by reallocations	4%	19%	15%	11%	
	Number of Regional Equity States[2]	14	13	13	12	
	Number of non-Regional Equity States[2]	38	39	37	40	
2006	**Total initial FA funding[1]**	$697,100,000	$29,170,000	$0	$66,040,000	$792,310,000
	Percent of total initial funding for all 4 programs	88%	4%	0%	8%	100%
	Amount of funds reallocated for Regional Equity - FA	$18,700,000	$10,270,000	$0	$17,460,000	$46,430,000
	Share of Regional Equity funds reallocated through program	40%	22%	0%	38%	100%
	Percent of programs' initial FA funding affected by reallocations	3%	35%	0%	26%	
	Number of Regional Equity States[2]	13	12	0	12	
	Number of non-Regional Equity States[2]	39	40	0	40	

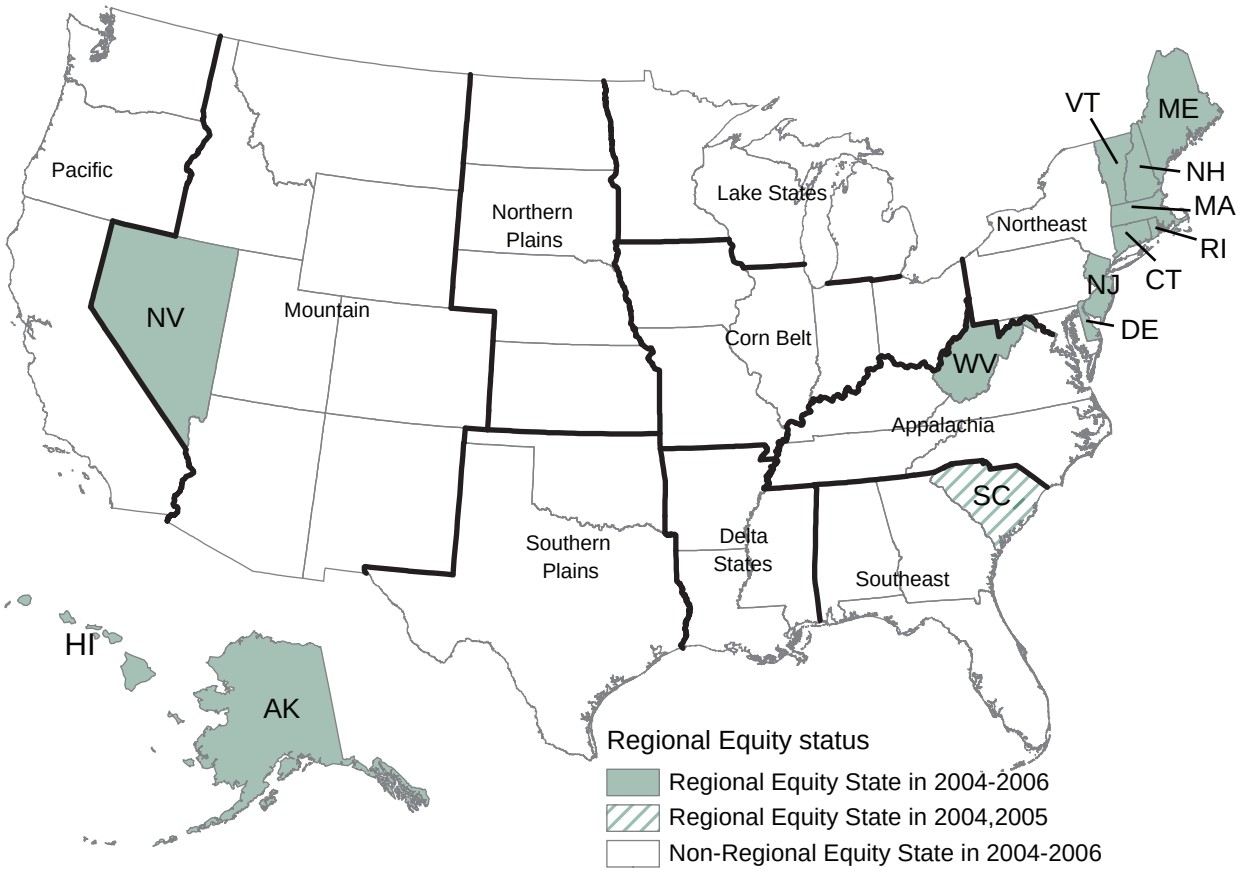
EQIP=Environmental Quality Incentives Program; WHIP=Wildlife Habitat Protection Program; GRP=Grassland Reserve Program; FRPP=Farm and Ranch Lands Protection Program.
[1]Analysis is limited to initial funding allocations for financial assistance. Performance bonus funding is excluded.
[2]Regional Equity (non-Regional Equity) States are those that benefited (did not benefit) from the RE provision.
The number of RE and non-RE States includes Pacific Basin and Carribean. South Carolina became a non-RE State in EQIP in 2006. Maine became a non-RE State in WHIP, in 2006.

Source: NRCS data on Regional Equity allocations.

threshold), all States will share in the budget increase in proportion to their funding shares.

These unequal impacts of budget changes under the Regional Equity provision's fixed set-asides contrast with the impacts of set-asides that advance distributional goals in EQIP. These other set-asides are specified as proportional amounts, such as the 60 percent of the program budget set aside for livestock practices, 5 percent for beginning farmers and ranchers, and 5 percent for socially disadvantaged farmers and ranchers. In these cases, the amounts ultimately reserved for targeted groups vary in proportion to

Figure 3
Regional Equity status



Note: "Regional Equity State" means State received funds from other States due to the Regional Equity requirement. South Carolina did not receive additional Wildlife Habitat Incentives Program (WHIP) funds in any year; Maine did not receive WHIP funds in 2006.

Source: ERS analysis of NRCS fund allocation data. Map excludes Puerto Rico, an RE 'State' in 2004-2006.

program budget changes, so all groups are relatively equally affected by overall funding changes.

Participation Patterns Differ Between RE and Non-RE States

Conservation program participation patterns differ between Regional Equity and non-Regional Equity States, suggesting that Regional Equity-induced funding shifts can impact program outcomes in ways that are hard to predict.

The programs subject to the Regional Equity provision depend on producers' volunteering to participate—to implement conservation practices, restore grassland, or sell an easement—in exchange for program payments. The requirements imposed by the Farm Act's Regional Equity provision result in some States' receiving additional conservation money to meet the minimum funding threshold even when producer interest in participating and demand for program funding in those States is not strong. For example, in 2004 in EQIP, to meet the Regional Equity requirements, funds were shifted away from non-RE States that had, on average, three times more demand for program funds than RE States. In other programs, however, the Regional

Equity provision resulted in more funding being allocated to States where producer interest in participating was higher. In FRPP, funds were shifted *toward* RE States with more than twice the average demand (demand is measured in terms of the dollars associated with unfulfilled contract applications). States with excess demand by producers experience the greatest competition for program funds, and they are the places where programs may have the greatest opportunity to achieve a given level of benefits at the least possible cost.[11]

If little variation exists across States in the types of environmental problems treated and in the costs and benefits of the contracts funded within each program, satisfying an allocative objective by shifting program funds between RE and non-RE States will have little effect on program outcomes. However, several considerations suggest impacts of shifting funds are likely to be nontrivial. The four affected programs (EQIP, WHIP, FRPP, and GRP) are designed to address a variety of agriculturally related environmental issues, and the severity of these problems varies across the country. For example, water conservation has historically been a concern in the Western United States, where drought-related problems exist, and reducing fertilizer and nutrient runoff has been a concern throughout the country, especially in areas such as the Corn Belt and Chesapeake Bay watershed, where water quality problems impact local economies (see, for example, Bockstael et al., 1989, Leggett and Bockstael, 2000, and Secchi et al., 2007).

State NRCS offices have had considerable flexibility in working-land programs in determining which resource problems will receive priority in any given year, as well as flexibility with payment rates for practices that are cost-shared, and these priorities can vary even across neighboring States. Producers vary across States in their willingness to adopt particular practices and in terms of the costs they face even when adopting the same practice. The social benefits of conservation treatment can also vary across States; some types of benefits are highest when actions are concentrated in high-population States (Hansen and Ribaudo, 2008; Feather et al., 1999). Taken together, the variation in environmental problems, State-level priorities, producer preferences, and costs and benefits suggests that shifting funds from one State to another could result in very different conservation outcomes.

Summary statistics for two programs, EQIP and WHIP, suggest that by several measures—including costs, types of practices, and resource problems receiving treatment—a shift in program funds between RE States and non-RE States would result in different types of contracts being funded. In terms of costs, the Regional Equity provision has shifted funds to States with higher contract payments on average, although in both groups of States wide variation exists.[12] These average contract payments ranged from about $24,000 to $29,000 per contract in RE States over 2004-06, while in non-RE States they ranged from about $15,000 to $18,000 (table 2). In WHIP, RE States funded contracts that were twice as large, on average, due primarily to large contract payments in Alaska and Hawaii.

One reason contract payments were higher in RE States was that those States tended to reimburse participants for cost-shared practices at a higher rate than non-RE States. EQIP and WHIP provide cost-share assistance to producers who install structural practices (e.g., manure storage, irrigation systems,

[11]Even in programs like EQIP that seek to maximize benefits, many States consider cost in enrollment decisions—so competition for limited funding could induce producers to choose to implement less costly conservation practices.

[12]The coefficient of variation (CV) is above 1.45 for both RE and non-RE States in each year. The CV is a measure of the variation in a population, and values exceeding one are typically considered high-variance.

Table 2
Characteristics of Regional Equity and non-Regional Equity States

		EQIP		WHIP	
	Fiscal year	RE States	non-RE States	RE States	non-RE States
		Dollars			
Average payments - all contracts	2004	$23,400	$15,000	-	-
	2005	$22,500	$15,300	$16,700	$8,500
	2006	$28,800	$17,800	$23,600	$8,900
Cost-share rates[1]		*Percent of Contracts[1]*			
50% cost-share rate	2005	28%	52%	3%	18%
51 - 74% cost-share rate	2005	19%	30%	22%	28%
75% cost-share rate	2005	39%	13%	75%	54%
> 75% cost-share rate	2005	14%	5%	0%	0%
Practice type					
Structural only	2006	41%	51%	33%	46%
Management only	2006	31%	26%	48%	34%
Structural and management	2006	28%	24%	18%	19%
Spending by resource concern		*Percent of contract costs*			
Soil condition	2006	8%	8%	0%	0%
Soil erosion	2006	14%	17%	18%	9%
Domestic animals	2006	8%	11%	0%	1%
Plant condition	2006	17%	16%	6%	3%
Water quantity	2006	11%	13%	2%	2%
Water quality	2006	37%	29%	3%	2%
Air quality	2006	3%	3%	0%	0%
Fish and wildlife	2006	3%	3%	72%	84%

EQIP = Environmental Quality Incentives Program; WHIP = Wildlife Habitat Incentives Program.
[1]Some contracts contain multiple practices cost-shared at different rates, and for these contracts the (weighted) average cost-share rate falls between the standard 50%, 75%, or 90% rates.

Source: ERS analysis of NRCS contract data.

fencing, and field-edge vegetative buffers) and financial assistance to those adopting conservation-compatible management practices like nutrient management and prescribed grazing. In EQIP, the largest proportion of contracts in RE States received cost-share payments for structural practices at a 75-percent rate, while in non-RE States most contracts were cost-shared at a 50-percent rate. In WHIP, three-quarters of the contracts in RE States received a 75-percent cost-share rate compared with half of contracts in non-RE States that received that rate.

The higher average cost of contracts in RE States suggests that fewer contracts may have been funded across all States in EQIP and WHIP because of the Regional Equity provision. However, higher costs do not necessarily mean that program benefits were reduced. RE States tended to fund contracts with producers who agreed to address more resource concerns and adopt more practices. Further, in EQIP, the RE States tended to fund more contracts that implemented combinations of practices—that is, more producers in RE States agreed to implement both structural and management practices to address environmental concerns. Implementing a group of

practices, as in a conservation system, can be more effective at addressing environmental problems than single practices (e.g., Lerch et al., 2005; Berry et al., 2003).

The resources receiving priority, as measured by costs incurred for treating problems, differ somewhat between the RE and non-RE States. In 2006 in EQIP, the largest share of contract funds in both groups of States was devoted to treating surface water quality problems, with RE States spending 37 percent of funds on these issues compared with 29 percent in non-RE States (spending patterns in previous years were similar). In addressing other issues, the share of funds spent by both groups of States was more similar (table 2). Due to WHIP's narrower focus on species and habitat protection, it is not surprising that, in both groups of States, most WHIP funds are spent on fish and wildlife issues—72 percent and 84 percent of costs in RE and non-RE States, respectively—although different species may benefit in different States (table 2). Also, a greater share of contract costs in the RE States was incurred to treat soil erosion—18 percent compared with 9 percent in non-RE States.

The Regional Equity Provision Entailed Economic and Environmental Tradeoffs

The differences between conservation program contracts and the general types of practices adopted in the RE versus non-RE States are indicative of some of the likely impacts of the Regional Equity provision. However, it is the specific characteristics of the additionally enrolled contracts in RE States, and of the applications that did not receive funding in non-RE States, that ultimately determine the economic and environmental tradeoffs resulting from enactment of the Regional Equity provision. These characteristics also determine whether tradeoffs occurred between allocative and distributional objectives, such as whether certain producer types gained or lost conservation funding.

Data on specific contracts funded through EQIP and WHIP, coupled with an understanding of the fund allocation formulas used by the conservation programs, demonstrate some of the environmental, economic, and distributional impacts of the Regional Equity provision over the 2004-06 period in those programs. Our analysis recognizes that the lowest ranked contracts ("marginal contracts") are the most vulnerable to the funding shifts resulting from Regional Equity reallocations. We estimated which marginal contracts were affected by the Regional Equity-induced changes in State budgets, and the characteristics of these marginal contracts formed the basis for our estimates of environmental and economic tradeoffs of the Regional Equity provision (see box, "Methods").

Using a methodology that relies on information from the marginal contracts to estimate the effects of provisions furthering an allocative goal has a number of advantages. By definition, the marginal contracts are those least preferred for enrollment, which means they are less likely to address the resource concerns of highest priority to the jurisdiction, or they do so at higher cost. An analysis of contract data reveals that the marginal contracts in States that benefited from the Regional Equity reallocations have different characteristics than nonmarginal contracts. Using more aggregated data, such

Methods

To estimate the effects of the Regional Equity provision, we used the programs' Federal funding allocation formulas to approximate how States' funding for financial assistance changed due to the Regional Equity provision. In the RE States, the Regional Equity provision expanded State funding to bring them to the $12 million threshold, so the contracts affected by the provision were those funded with the additional money. In these States we identified the "marginal" contracts using the ranking score of each application, and assumed those applications ranked lowest were the additional contracts. In the non-RE States, the RE provision reduced State budgets, resulting in some applications' remaining unfunded. Because the Regional Equity provision was enacted during a period of increasing program budgets and high producer demand for conservation funding, we assumed that the changes in State-level budgets induced by the provision did not affect producers' incentives or decisions to apply to the conservation programs.

Ideally, data on proposed practices and the acres and resource issues to be treated would be available from a review of all conservation program applications, and these data could be used to characterize how outcomes would have changed if additional applications had been funded in the non-RE States. However, such data are available only on contracts that received funding. In the absence of applicant data, several alternatives exist for proxying the practices and actions applicants would be willing to undertake if additional funds were available to increase enrollments. One alternative is to assume that previously unfunded applicants' parcels have similar characteristics to the entire farmland population. Using simulations coupled with program cost data, we could estimate, on average, how many acres applicants would be willing to treat, for which resource concerns, and at what cost. However, this strategy may not be ideal in programs like EQIP and WHIP, which, our analyses show, enroll a non-homogenous set of contracts in any given year (see Appendix B). We used a different strategy, one that assumes an expanded budget would enroll land that most closely resembles a much narrower segment of farmland: the applications that got funded but were of the lowest priority for enrollment—those contracts that were ranked just slightly higher than rejected applications. Assuming similarity between these two groups implies that producers with low-priority contracts that were accepted and those that just missed being accepted have similar expectations about the profitability of implementing particular practices to mitigate particular physical effects.* By comparing the characteristics of marginal contracts in the RE States to those in the non-RE States, we were able to discern how acres receiving treatment, the types of physical effects receiving treatment, practice types and costs, and participant types were affected by the Regional Equity provision.

* This approach also assumes that a sufficient amount of acreage remains that needs treatment for the resource concerns that were addressed by the marginally accepted contracts. EQIP and WHIP have historically had a large backlog of applications, so it is plausible that an adequate supply of land needing treatment exists.

as the characteristics of the "average" contract—which is tempting because it would involve simpler calculations—can be misleading for policy analysis (see Appendix B). Our method also takes into account the variation in local priorities afforded by the decentralized structure of working-land programs. Other methodological approaches are less able to accommodate this variation, which is likely to have important impacts on local enrollment incentives and program outcomes.

Our analysis involved three steps to identify environmental and economic impacts of the Regional Equity provision:

- First, to estimate environmental impacts, we used the data on marginal contracts affected by the Regional Equity provision to estimate the change in the number of acres that received treatment for various environmental problems as a result of the funding shifts across States.
- Second, to estimate economic impacts, we analyzed the costs of treating environmental problems associated with the contracts affected by the Regional Equity provision (see Appendix C). Because the goal of the economic analysis was to compare changes in treatment costs to changes in benefits from the treatment effort, the cost analysis was limited to the subset of conservation treatment activities for which benefit estimates were available. These were activities undertaken to reduce erosion from wind and water (to improve onsite soil productivity and water and air quality and reduce sedimentation); to improve grazing productivity, water conservation, wildlife habitat, and pheasant-hunting opportunities; and to create wetlands. EQIP and WHIP contracts address more issues than this limited set of activities, but a lack of information on the benefits of treating other issues meant a substantial portion of conservation activity was excluded from our analysis. In EQIP, 24-50 percent of contract costs mapped to these nine benefit categeories over the study period; in WHIP, 56-75 percent did so (see box, "Conservation Activities Linked to Environmental Benefits").
- Finally, for each category of conservation treatment we considered, we combined per acre cost and benefit data with estimates of the number of acres treated in the watershed in 2004-06 to find out whether the changes in conservation treatment resulting from the Regional Equity provision resulted in additional net benefits or costs (see Appendix D for a description of the studies from which the earlier benefit estimates were derived).

The Regional Equity Provision Affected the Number of Acres Treated

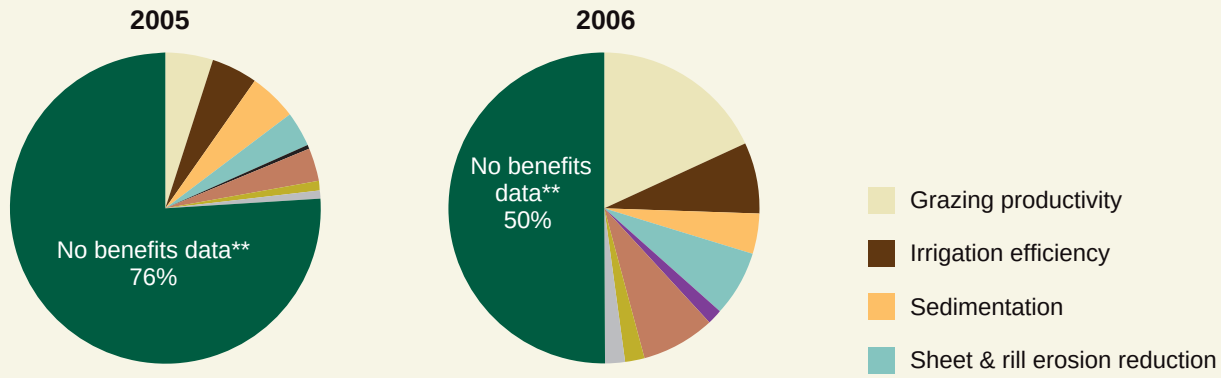
Estimates of the acres receiving treatment reveal that the impacts of the Regional Equity provision differed over the study period (see Appendix C for methods used to estimate acres subject to treatment). In 2004 and 2005, the shifts in funding from the non-RE States to the RE States resulted in net losses in the acres receiving conservation treatment for a number of environmental problems in EQIP and, in 2005 and 2006, also for WHIP. For example, in EQIP in 2004, over 70,000 fewer acres received treatment for grazing productivity, sedimentation, and water quality problems and over 200,000 fewer acres were enrolled for water quantity issues (fig. 4).[13] In

[13]In some cases, the same acres received treatment for more than one resource concern, so adding up the net gains and losses in acres across categories would likely overstate the net effect of the Regional Equity reallocations on the total number of acres treated.

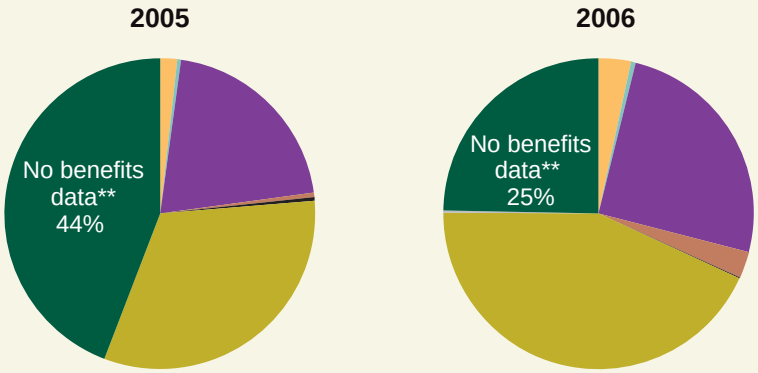
Conservation Activities Linked to Environmental Benefits

Conservation programs provide a wide range of environmental and social benefits. While important, many of these benefits are difficult to quantify in monetary terms that enable a comparison to program costs. Due to limited data on the benefits of conservation treatment, a relatively small proportion of contract costs for EQIP were included in the economic analysis of Regional Equity impacts. In 2004 and 2005, only 24 percent of the costs of marginal contracts—those contracts affected by the Regional Equity provision—were incurred to treat problems for which benefit estimates were available (see the EQIP contract costs figure below). In 2006, 50 percent of contract costs were related to the nine benefit categories. In WHIP in 2005, 56 percent of marginal contract costs were related to the seven benefit categories addressed by that program, compared with 75 percent in 2006 (see the figure). There could be a number of reasons for the difference in the amount of conservation activity associated with measurable benefits in 2006. Local government priorities can change yearly, as can the financial incentives producers have to address particular resource problems. We found reasonable consistency across years between conservation practices and the resource problems that local field offices indicated were associated with particular resource concerns (see Appendix C). In all years, the analyses were limited to program activity in the contiguous 48 States. Because benefit estimates are not available for any resource issues in Alaska and Hawaii or the territories, all costs associated with contracts funded in these places were excluded from our analysis.

EQIP contract costs by benefit category—contracts affected by RE provision



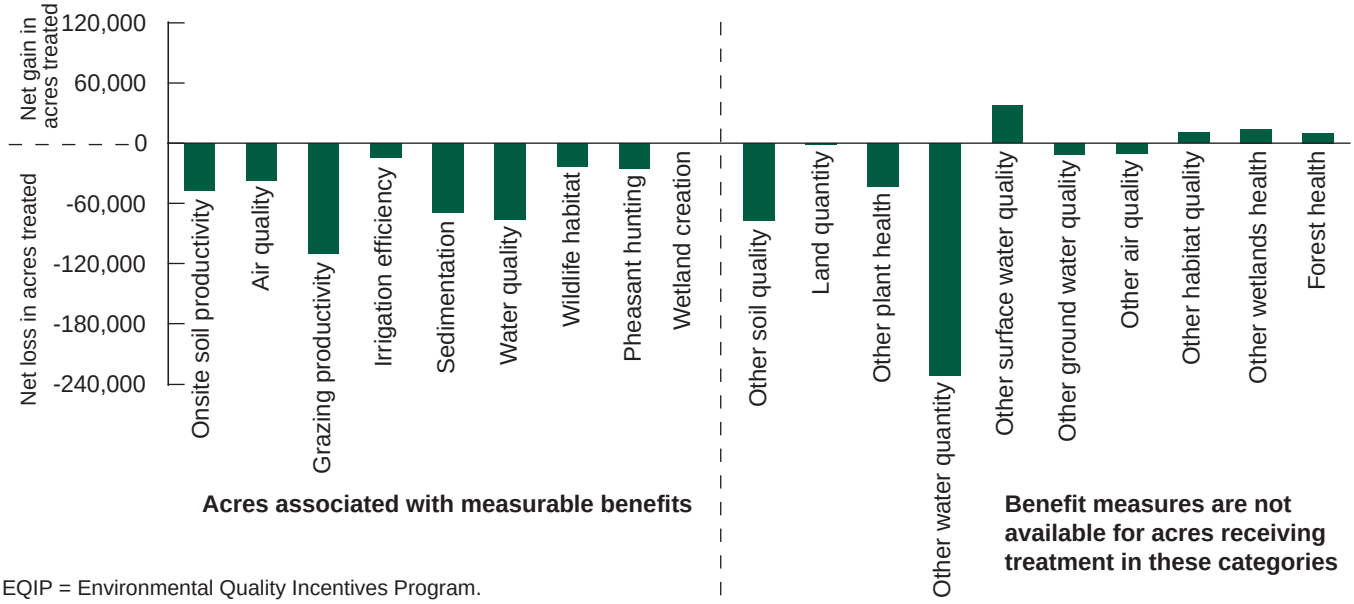
WHIP contract costs by benefit category—contracts affected by RE provision



**Includes all costs of contracts affected by RE provision in Alaska, Hawaii, Pacific Basin Territories, and Puerto Rico.

Source: ERS analysis of NRCS contract data.

Figure 4
EQIP 2004: estimated net gain/loss in acres treated due to Regional Equity provision



EQIP = Environmental Quality Incentives Program.

Source: ERS analysis of NRCS administrative data.

2005, except for reductions in the amount of land receiving treatment for grazing productivity issues, the net changes in acres receiving treatment were not as dramatic in EQIP (fig. 5). In 2006, however, the Regional Equity real-locations resulted in significant net gains in treated acres for plant and soil condition issues in EQIP (fig. 6).

In WHIP, program funding levels were significantly lower than in EQIP, and fewer resource concerns were treated. The biggest impacts were net losses of 20,000 to 55,000 acres treated each year for pheasant-hunting and wildlife habitat (figs. 7 and 8).

Costs and Benefits Vary Between Contracts Funded in RE States Versus Contract Applications in non-RE States

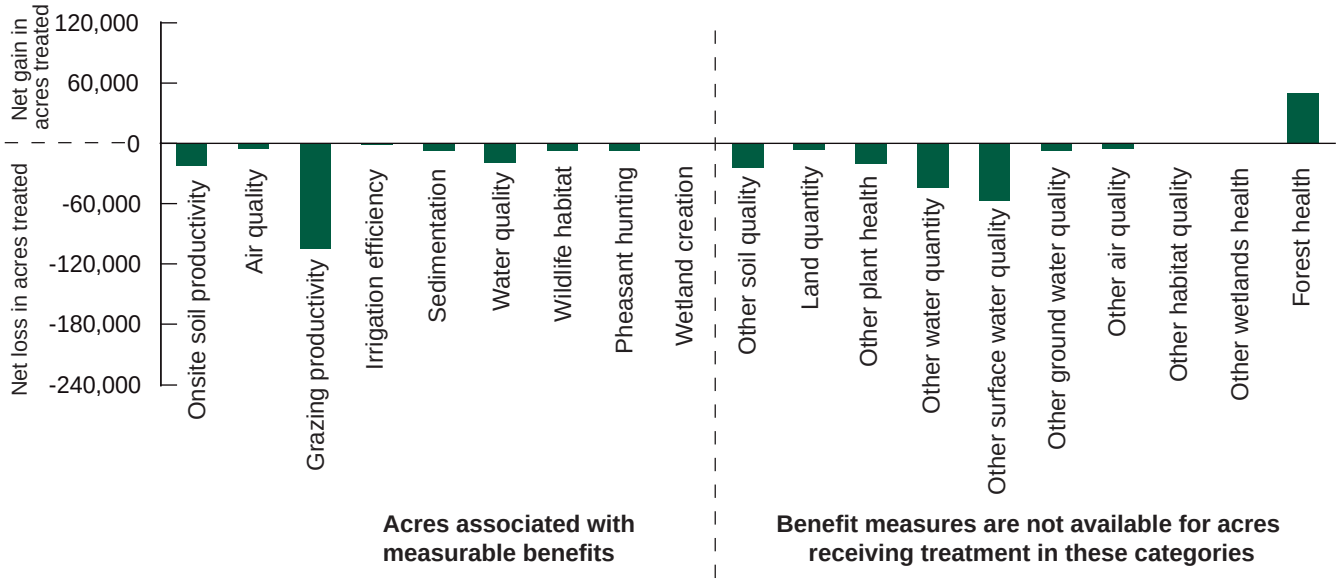
An analysis of per acre treatment costs for the selected resource concerns revealed that contracts funded with Regional Equity funds in RE States had higher per acre costs than the contracts that would have been funded, in the absence of Regional Equity restrictions, in non-RE States (table 3).[14] This finding held throughout the 3-year study period, in both EQIP and WHIP, almost without exception.[15] Costs varied over a wide range, however. In some cases, the maximum cost per acre estimate exceeded the mean per acre estimate by several thousand dollars in the RE States, due to the installation of some expensive practices (e.g., micro-irrigation systems, waste storage facilities, and ponds), along with implementation of a broad combination of structural, vegetative, and management practices. In some cases, Regional Equity funds were used to install less typical practices at a high cost per acre, such as shellfish aquaculture management systems.

[14]Another important consideration was technical assistance costs (TA). The contract data contain information on the financial assistance (FA) costs of implementing practices, but do not identify which practices or resource issues required TA. TA costs are not insignificant outlays—in EQIP between 2004 and 2006, TA costs represented about 21 percent, 24 percent, and 28 percent of the *total* program budgets, respectively. In WHIP, TA costs were 22 percent and 28 percent in 2005 and 2006, respectively. We assumed that TA was necessary for meeting nondegradation standards, so in developing the per acre cost estimates we increased the costs to reflect TA based on these overall portions of the budget (e.g., in EQIP in 2006, TA represented an overall 40 percent of FA costs, so 40 percent was added to the cost of contracts in that year).

[15]The one exception was that, in WHIP, the marginal contracts in RE States provided sheet and rill erosion reduction benefits at a lower cost per acre.

Figure 5

EQIP 2005: estimated net gain/loss in acres treated due to Regional Equity provision

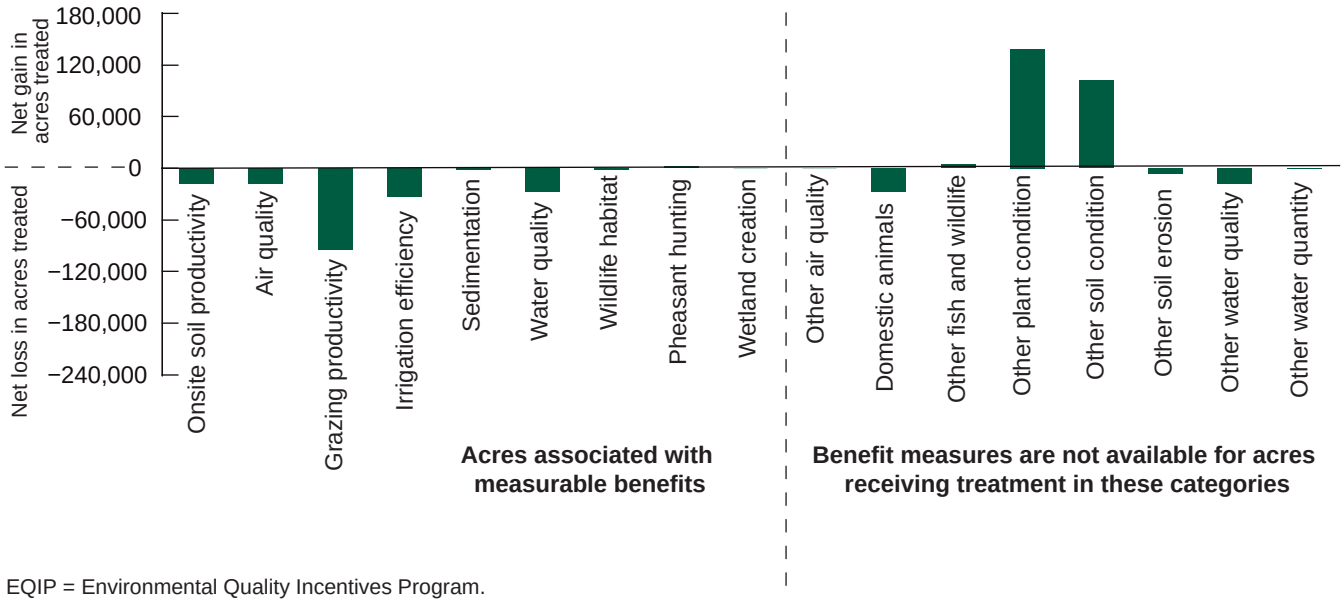


EQIP = Environmental Quality Incentives Program.

Source: ERS analysis of NRCS administrative data.

Figure 6

EQIP 2006: estimated net gain/loss in acres treated due to Regional Equity provision

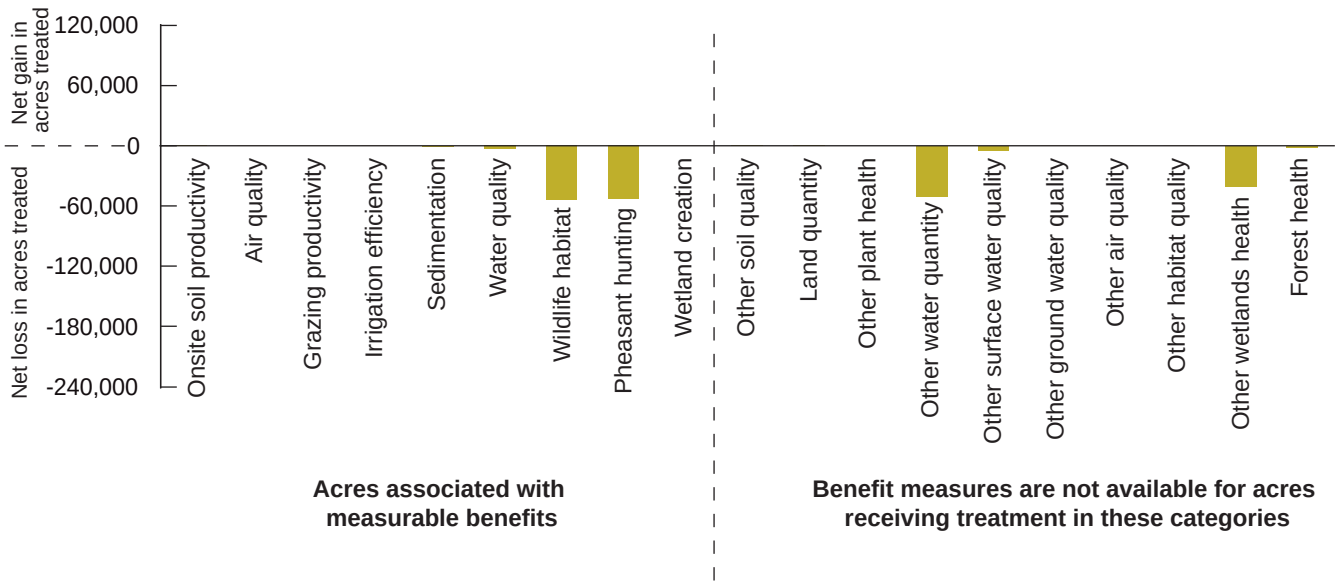


EQIP = Environmental Quality Incentives Program.

Source: ERS analysis of NRCS administrative data.

Figure 7

WHIP 2005: estimated net gain/loss in acres treated due to Regional Equity provision

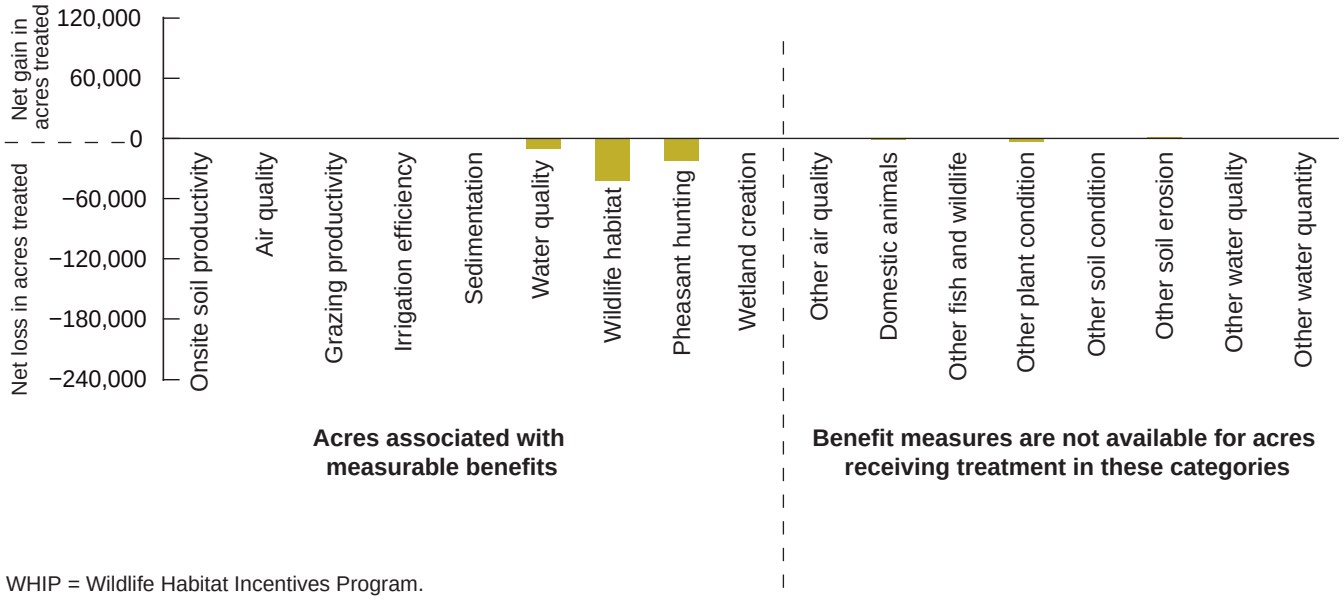


WHIP = Wildlife Habitat Incentives Program.

Source: ERS analysis of NRCS administrative data.

Figure 8

WHIP 2006: estimated net gain/loss in acres treated due to Regional Equity provision



WHIP = Wildlife Habitat Incentives Program.

Source: ERS analysis of NRCS administrative data.

Table 3

EQIP contract costs per acre by benefit type - 'marginal' contracts affected by the Regional Equity provision, 2006[1]

	Onsite soil productivity benefits	Air quality benefits	Grazing productivity benefits	Irrigation water conservation benefits	Sedimentation benefits	Water quality benefits	Wildlife habitat benefits	Pheasant hunting benefits	Wetland creation benefits
	Average contract cost per acre[2]								
RE States	$207.26	$180.81	$359.52	$785.25	$311.97	$574.84	$511.91	$451.95	-
Non-RE States	58.94	27.77	54.88	142.03	73.97	100.26	39.8	50.09	-
	Standard deviation								
RE States	339.6	148.68	582.64	1,224.42	450.7	1,024.29	843.29	711.8	-
Non-RE States	174.27	46.13	90.11	235.21	143.27	225.64	54.77	121.33	-
	Minimum contract cost per acre[3]								
RE States	0.07	0.07	1.46	0.37	1.73	1.54	1.36	4.67	-
Non-RE States	0.1	0.2	0.7	0.14	0.1	0.3	0.51	0.51	-
	Maximum contract cost per acre								
RE States	1,513.08	507.88	2,154.63	5,354.42	1,759.24	4,968.55	3,407.07	1,958.09	-
Non-RE States	1,217.43	192.82	490.73	760.05	639.93	1,348.83	186.92	646.56	-

EQIP = Environmental Quality Incentives Program.
[1]Table includes costs associated with mitigating those physical effects for which monetary estimates of benefits exist.
[2]The costs per acre used to create these descriptive statistics were the contract cost per acre at the watershed level.
[3]Many contracts treated multiple resource concerns, and in those cases contract costs were divided among the resource concerns. This contributes to the small minimum cost per acre estimates.
Source: ERS analysis of NRCS contract data.

The benefits from conservation treatment also appeared to vary between RE and non-RE States, at least for the subset of conservation activities for which benefit estimates were available. Regionally varying estimates of benefits that were drawn from a number of studies reveal that the average per acre benefits from reducing sedimentation and increasing water quality were higher in RE than non-RE States (table 4). (See Appendix D for a description of the studies from which the benefit estimates were derived.) This suggests that shifting conservation efforts to RE States to mitigate these problems could produce greater conservation benefits. The benefits from creating wetlands are an order of magnitude higher than the other benefits, because wetlands generate a whole set of benefits, including improved water quality, wildlife habitat, and recreational opportunities. Though wetland-related benefits are likely to vary by area, regional estimates were not available.

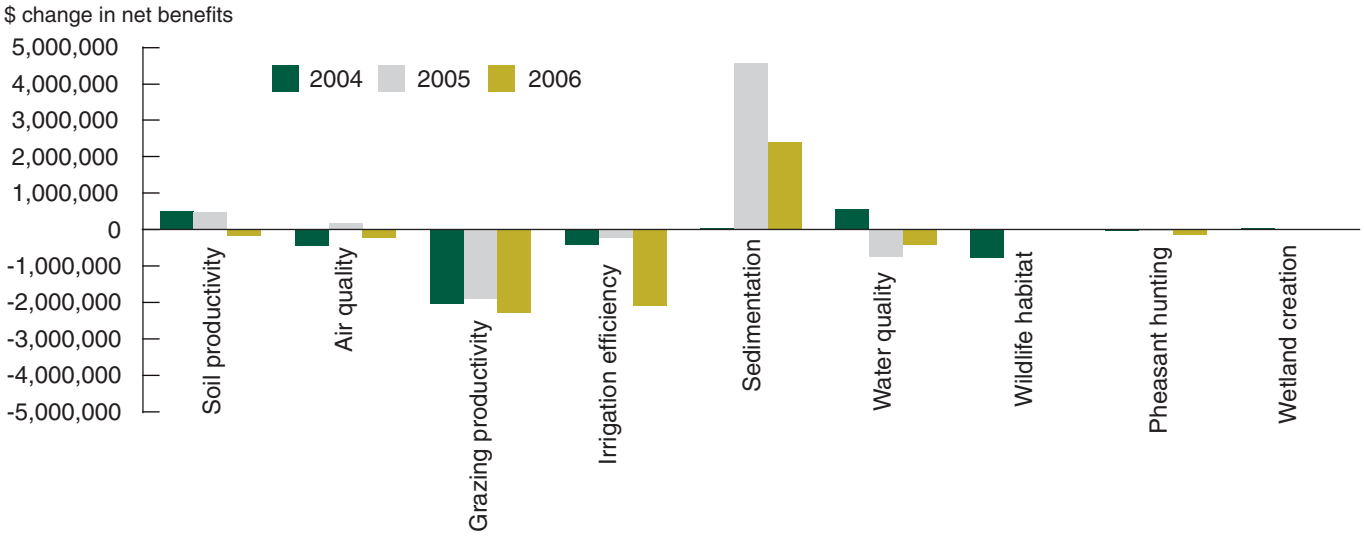
Despite reducing the number of acres that received treatment for many resource problems, the RE provision increased the net benefits from treating some of them (net benefits are calculated as gross benefits minus costs). The RE provision allowed EQIP to generate an estimated additional $4.5 million and $2.4 million in sedimentation reduction benefits in 2005 and 2006, and an estimated additional $490,000 in soil productivity benefits in 2004 and 2005 (fig. 9). These changes occurred because the acres that were treated in RE States (in those treatment areas for which we have benefit measures) generated higher levels of benefits than the acres that would have received treatment in the non-RE States, due partly to higher surrounding population levels that benefit from improved environmental conditions. In terms of grazing productivity benefits, the RE provision generated net losses of about $2 million yearly. The effects also varied by year. For the nine categories of environmental issues considered, the RE provision collectively resulted in losses of net benefits in EQIP of about $2.5 million in 2004, a gain of $2.3 million in net benefits in 2005, and losses of $3 million in 2006.

Table 4
Average benefits from conservation measures (in 2004 dollars)

	Benefits from reduced erosion from wind and water					Other benefits			
	Onsite soil productivity benefits	Air quality benefits	Sedimentation	Water quality	Grazing productivity	Irrigation water conservation	Wildlife viewing	Pheasant hunting	Wetland creation
	Dollars per acre								
RE States	$3.43	$1.82	$32.27	$16.83	$9.03	$2.61	$19.60	$0.06	$550.00
Non-RE States:									
Appalachia	3.83	-	24.14	14.43	12.00	-	23.47	0.16	50.00
Corn Belt	5.49	-	11.89	11.90	10.49	0.75	25.38	4.04	550.00
Delta	1.53	-	12.64	5.46	13.22	5.54	22.81	0.20	550.00
Mountain	0.09	3.87	$0.98	0.23	3.33	14.31	0.73	0.19	550.00
NE & Lake States	3.54	0.04	18.99	15.62	9.44	-	25.69	2.66	550.00
Northern Plains	0.74	1.68	2.64	1.87	5.24	2.98	3.55	1.92	550.00
Pacific	0.51	2.02	5.08	4.67	5.57	19.19	0.32	-	550.00
Southeast	1.79	-	19.78	7.54	12.64	2.86	23.31	-	550.00
Southern Plains	0.51	1.95	5.87	3.41	6.36	4.68	15.12	0.08	550.00

RE = Regional Equity Provision.
Note: Benefit measures are not available for Alaska, Hawaii, Puerto Rico, Pacific Basin Countries, and the Caribbean.
Source: Source: See Appendix D.

Figure 9
Effects of the Regional Equity provision on selected net benefits in EQIP[1]

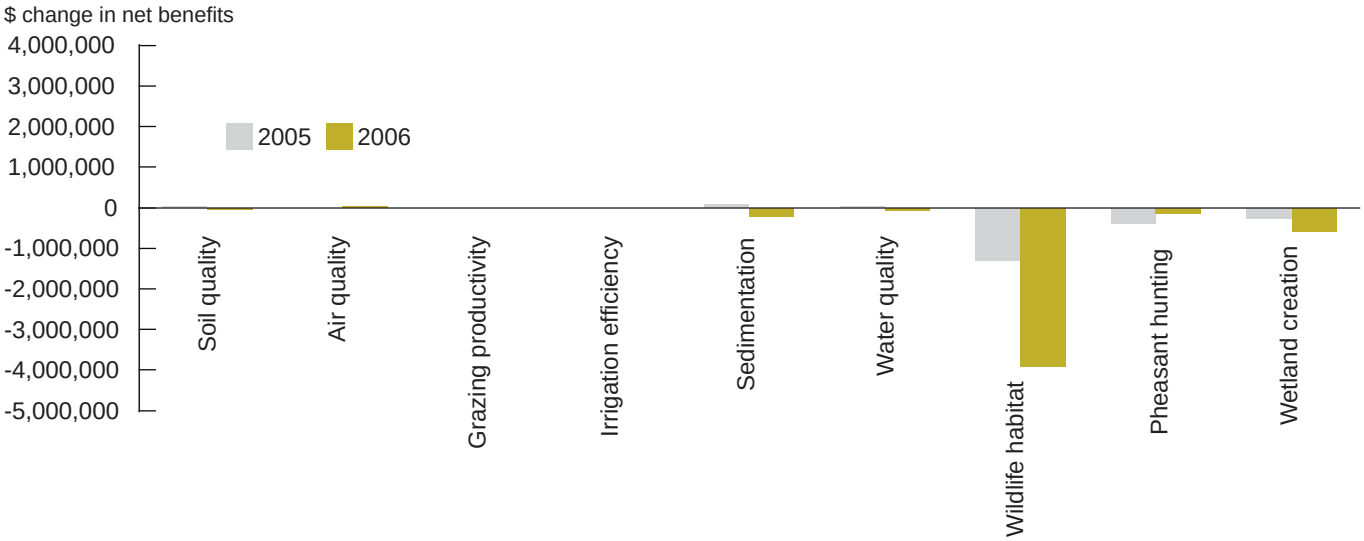


[1]Includes only the conservation activity funded through Environmental Quality Incentives Program (EQIP) in the continental U.S. for which estimates of the benefits of treatment are available in dollar terms.

Source: ERS analysis of NRCS administrative data.

In WHIP, for the nine environmental categories considered, the Regional Equity provision generated losses of net benefits of about $1.8 million in 2005 and $4.9 million in 2006 (WHIP was not affected by the Regional Equity provision in 2004) (fig. 10). The contracts enrolled in several States addressed different resource concerns between the 2 years, which contributed to this large difference. The measurable losses in net benefits in WHIP were also larger than those in EQIP in 2006, even though WHIP is a smaller

Figure 10
Effects of the Regional Equity provision on selected net benefits in WHIP[1]



[1]Includes only the conservation activity funded through Wildlife Habitat Incentives Program (WHIP) in the continental U.S. for which estimates of the benefits of treatment are available in dollar terms.

Source: ERS analysis of NRCS administrative data.

program in terms of overall program funding. These cross-program effects might have been different, however, if data constraints had not prevented analysis of the impacts on net benefits for the full set of conservation activity in both programs. Benefit measures were available for more conservation activity in WHIP than in EQIP, so more EQIP activity was excluded from our analyses (see box, "Conservation Activities Linked to Environmental Benefits" and fig. 6).

These analyses reveal that the Regional Equity provision resulted in a number of tradeoffs that were likely to affect the ability of the programs to provide environmental benefits cost effectively. They also reveal that the direction and magnitude of environmental and economic impacts of the Regional Equity provision are resource specific. For grazing productivity and water conservation issues in EQIP and wildlife and pheasant-hunting habitat in WHIP, the funding shifts across States reduced both the amount of land receiving treatment and the net benefits from treatment, at least during the 3-year period we studied. For most other resource issues, there were reductions in the amount of land receiving treatment, but the economic impacts were negligible or positive. The differing impacts across programs also suggest that the way an allocative policy is implemented may be an important determinant of the collective environmental and economic impacts.

The Regional Equity Provision Is Compatible With Distributional Goals of Working-Land Programs

The Regional Equity provision does not appear to work at cross-purposes with distributional goals in working-land programs. In addition to environmental, economic, and allocative goals, EQIP is designed to provide favorable treatment for certain types of operations and producers. Because targeted producers who participate in EQIP are not distributed equally among States and States do not always prioritize them for enrollment, the minimum funding allocations of the Regional Equity provision could have unintended impacts on participation by targeted producers. For example, by law, at least 60 percent of overall EQIP funding must be used for livestock-related conservation practices (USDA treats all practices implemented by livestock producers as livestock related (USDA, 2003)). Our analyses of payments by producer type suggest the 60-percent threshold would have been satisfied with or without the Regional Equity provision: Livestock operators received between 66 and 71 percent of EQIP funding annually after the Regional Equity funding reallocations occurred. Satisfying the Regional Equity provision reduced the number of livestock contracts, but only by an estimated 1.5 percent, or 500-700 contracts annually over the 2004-06 period.

Beginning farmers and farmers with limited financial resources also receive special attention in EQIP. The 2002 Farm Act authorized these producers to receive higher cost-share reimbursement rates (up to 90 percent of practice installation cost compared with a 75-percent maximum rate for other producers). The 2008 Farm Act authorized additional favorable payment terms, expanded eligibility for favorable terms to socially disadvantaged farmers, and required that beginning farmers and socially disadvantaged producers have access to at least 5 percent of program funds. Over the 2004-06 period, a larger proportion of contracts in the RE States were held by beginning and limited-resource producers, and while the Regional Equity reallocations allowed more of them to be enrolled, the impacts were small—an average of 100 additional contracts were written with these producers annually over the 2004-06 period. The funding shifts also had no appreciable impact on the overall EQIP funding received by beginning farmers, which averaged 11-12 percent of financial assistance annually over the 2004-06 period.

Conclusions

Allocative goals established by congressional legislation play an important role in the design of U.S. conservation programs for working lands. In conservation programs such as EQIP, WHIP, FRPP, and GRP, program funds are allocated to State program offices, where decisions are made about which resource problems will receive priority and which applications are accepted—either at the State or sub-State level. In EQIP, State offices can delegate these decisions, as well as the authority to choose payment rates and the conservation practices that will be funded, to local (sub-State) NRCS offices. This decentralized structure results in broad distribution of conservation funds, with producers in neighboring jurisdictions potentially having different incentives for enrollment.

How these legislative provisions are structured can have broad implications for which groups or regions are affected by program changes. In particular, policies that require *fixed* set-asides for particular regions result in disproportional impacts of program budget changes. For example, the Regional Equity provision guarantees that each State NRCS office is allocated funding equal to or greater than the fixed threshold ($12 million annually through EQIP, WHIP, FRPP, and GRP combined in the 2002 Farm Act, raised to $15 million in the 2008 Farm Act). If overall program funding were to fall, and there were no Regional Equity provision, each State NRCS office would experience a reduction in conservation program funding in proportion to the share of the budget that State normally receives. With a binding Regional Equity provision, however, a decline in overall program funding would be absorbed by the subset of States without protected funding. As program budgets rise, the impact of the Regional Equity provision on the States without protected funding is reduced. Alternatively, when set-asides are specified as a *proportion* of overall funding—such as the mandated 60-percent set-aside for livestock practices or the 5-percent set-aside for beginning farmers—the funding reserved for targeted groups is scaled up and down proportionally as budgets change.

When legislation applies to programs that already seek to achieve environmental, economic, distributional, and allocative goals, it is difficult to predict the direction and magnitude of potential tradeoffs when new legislation furthering an allocative goal is layered on top. Our analysis suggests the Regional Equity provision of the 2002 Farm Act resulted in a number of tradeoffs with other program goals. Meeting the requirement meant that each program agency had to shift funds among States. This changed the number and mix of producers who were accepted into the program in different States. While the provision did increase conservation funding for the dozen or so States that historically had received limited amounts through Federal conservation programs, it resulted in declines in the number of acres receiving EQIP funding to treat most environmental problems. The funding shifts also resulted in increased treatment costs per acre for many environmental projects funded by EQIP and WHIP. However, the shifts also resulted in more conservation activity being given to States where the benefits per acre from treatment were higher because more people benefited from the conservation activity undertaken by producers. In some cases, the increase in the per acre benefits was greater than the increase in treatment costs. For example,

the Regional Equity provision decreased the net benefits (calculated as gross benefits minus costs) from improving grazing productivity by about $2 million annually over the 2004-06 period in EQIP, but increased the net benefits from reducing sedimentation problems by $4 million in 2005 and over $2 million in 2006.[16] While the Regional Equity provision's overall impact on benefits provided by the affected conservation programs could not be estimated because of data limitations, the patterns we found clearly show that the provision affects program benefits.

When program agencies have flexibility for implementing legislation, an understanding of the economic, environmental, allocative, and distributional impacts of alternative implementation options can guide the decisionmakers' choice of a strategy that minimizes the losses of benefits from all affected programs. The Regional Equity provision reduced net benefits from addressing environmental problems in WHIP in the 2 years of our study when WHIP was subject to the provision's requirements, but the impacts in EQIP were more mixed. Impacts may not be correlated with program size; even though WHIP is smaller than EQIP in terms of overall funding, in 2006 the net losses to WHIP that we could measure with existing data were one-and-a-half times larger.

Policymakers face important decisions about how to use conservation program funds to deliver environmental benefits in a cost-effective manner. In conservation programs that are also designed to achieve distributional goals, it is not immediately apparent what impact a policy change to further allocative goals will have on a program's cost effectiveness or the amount of land receiving treatment. As analysis of the effects of the Regional Equity provision demonstrates, even when the amount of land receiving treatment decreases, net environmental benefits could increase if conservation activity shifts to places that provide more benefits. Because the environmental and economic characteristics of farms participating in conservation programs vary widely, understanding the characteristics of the contracts affected by a policy change—the conservation choices, treatment costs, and value of benefits provided by treatment—is necessary to determine the impacts of policy changes on all program goals in working-land programs.

[16]Conservation programs fund activities that can increase the amenity, scenic, and recreational value of agricultural land in ways that are not easily expressed in dollar terms. These values can be higher when more people have access to the amenities (Feather et al., 1999), which suggests that shifting program activity to higher population States can increase these nonmarket benefits.

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Appendix A. Allocative Goals in Working-Land and Land Protection Programs

In U.S. working-land and land protection programs, each program uses a unique set of design options that allow allocative as well as environmental, economic, and distributional goals to be met.

The Environmental Quality Incentives Program (EQIP)

EQIP is USDA's major conservation program for working lands. It provides funding for conservation activities that address a wide range of resource issues, including soil quality, water quality, air quality, greenhouse gases, water and energy conservation, and wildlife habitat. All agricultural producers engaged in crop and livestock production are eligible to apply, as long as they comply with highly erodible land (Conservation Compliance) and wetland (Swampbuster) conservation requirements and do not exceed specified income levels.

EQIP has a long history of operating as a decentralized program with allocative goals. EQIP was enacted in 1996 and combined the conservation functions of four preexisting programs. One of its predecessors, the Agricultural Conservation Program (ACP), allocated program funds to State NRCS offices almost from its inception in 1936, with the goal of targeting funds to specific practices in all counties (Mercker, 1936). In 1996, the newly formed EQIP continued to allocate funds to State NRCS offices, based on conservation priorities. However, emphasis shifted to enrolling producers in locally determined "priority areas" facing the greatest environmental problems, rather than distributing enrollments across counties. In 2002, the practice of targeting enrollments to priority areas was eliminated, due primarily to producer dissatisfaction with the limited opportunities for enrollment outside priority areas (USDA, 2003).

In recent years, 31 indicators have been included in the mechanism used to allocate financial assistance across State NRCS offices. These indicators are of two types: (1) indicators measuring resource availability in the State (e.g., acres of grazing land and wetland) and (2) indicators measuring the extent of resource impairments (e.g., acres of highly erodible cropland, and the potential for pesticide runoff) (table A.1) (U.S. GAO, 2006). NRCS weights each indicator based on an assessment of the relative importance of the corresponding resource issue. In 2006, the 31 resource indicators were each allocated between 0.5 and 6.2 percent of financial assistance funds. Funds for each indicator were then allocated to each State NRCS office based on the extent and impairment of the indicator in the State.

Since 2002, EQIP has given States wide flexibility in awarding contracts within their allocated funds, allowing States to target enrollments to meet their individual needs. Some States pool all applicants and make enrollment decisions at a State level, while others allocate all funds to sub-State NRCS offices that make the enrollment decisions. Some States adopt a mixture of these two approaches, retaining a portion of funds at the State level for specific resource concerns and allocating remaining funds to local NRCS offices. Each jurisdiction can have unique point systems for ranking and

Table A.1
Indicators and weights used to allocate EQIP funds to States, 2006

Indicators for resource issues	Weight
Acres of nonirrigated cropland	3.2
Acres of irrigated cropland	4.3
Acres of Federal grazing land	0.5
Acres of non-Federal grazing land	4.3
Acres of forestlands	1.1
Acres of specialty cropland	3.2
Acres of wetlands and at-risk species habitat	4.6
Acres of bodies of water	3.2
Livestock animal units	5.8
Animal waste generation	5.8
Waste management capital cost	3.5
Acres of American Indian tribal lands	3.3
Number of limited resource producers	5
Acres of grazing land lost to conversion	0.8
Air quality nonattainment areas	1.4
Acres of pastureland needing treatment	5.5
Acres of cropland eroding above T	6.2
Acres of fair and poor rangeland	6.2
Acres of forestlands eroding above T	1.4
Acres of cropland and pastureland soils affected by saline and/or sodic conditions	2.6
Miles of impaired rivers and streams	3.6
Potential for pesticide and nitrogen leaching	1.3
Potential for pesticide and nitrogen runoff	1.7
Ratio of livestock animal units to cropland	1.7
Number of concentrated animal feeding operations	2.8
Ratio of commercial fertilizers to cropland	0.9
Wind erosion above T	4.2
Phosphorus runoff potential	3.9
Riparian areas	0.8
Carbon sequestration	3.6
Coastal zone land	3.6
Total	100

Note: T is the soil loss tolerance factor (tolerable rate of soil erosion).
EQIP = Environmental Quality Inventives Program.
Source: GAO, 2006.

enrolling contracts, unique sets of conservation practices that are eligible for funding, and different payment rates (although since 2002, payment rates for conservation practice installation have been constrained by law to between 50 and 75 percent of practice cost, but up to 90 percent for beginning and limited-resource farmers). This means that producers in neighboring jurisdictions (even within the same State) can face different incentives for enrolling in EQIP. Since 2007, locally developed point systems have been required to assign a positive weight to national resource priorities (though the weights assigned to national issues need not be the same as those used to allocate funds to States). In addition to the relative weights of resource problems, many State and sub-State NRCS offices also consider contract cost in their rankings.

EQIP is subject to a number of Farm Act provisions for meeting distributional goals that target funds to specific producer types. At EQIP's inception, Congress mandated that 50 percent of funds be used to address resource issues on livestock and poultry operations, and this set-aside was raised to 60 percent in 2002. In 2002, the Farm Act granted favorable payment terms to beginning farmers and limited-resource producers, which were extended to socially disadvantaged farmers in 2008. The 2008 Farm Act requires that 5 percent of EQIP funds first be made available to beginning farmers, and another 5 percent to socially disadvantaged producers. States consider the set-aside requirements when designing their application processes, but because these requirements are easily met, there has been no national requirement for each State to set aside a particular percentage of funds.

Wildlife Habitat Incentive Program (WHIP)

WHIP was implemented in 1996 to assist landowners with developing or improving wildlife habitat on agricultural land. As in EQIP, NRCS allocates WHIP funds to State NRCS offices to achieve allocative goals and grants States flexibility to tailor the program to meet their individual needs. The funding allocated to each State is based on major wildlife-related resource priorities identified in Farm Act legislation (table A.2). Unlike EQIP applications, all WHIP applications are pooled and ranked at the State level, although, as with EQIP, States develop their own wildlife habitat priorities, sets of conservation practices that can receive funding, and application-ranking criteria. These ranking criteria include the expected longevity of the habitat to be created, parcel size and use, proximity to other, similar habitat (agglomeration benefit), cost, and any funding from other sources (USDA-NRCS, 2004b). As with EQIP, the State priorities and associated weights may differ from national priorities upon which the State allocations were based.

Table A.2
Factors and weights used to allocate WHIP funds to States

Resource concerns	Weight
At-risk wildlife species	20
At-risk wildlife species native habitat	20
Non-Federal acres	10
Total non-Federal acres enrolled in CRP, GRP, WRP	10
Declining grasslands needing restoration	8
Declining forestland needing restoration	7
Declining wetlands needing restoration	7
Aquatic species	8
At-risk aquatic species	10
Total	100

WHIP = Wildlife Habitat Incentives Program; CRP = Conservation Reserve Program; GRP = Grassland Reserve Program; WRP = Wetlands Reserve Program.
Source: GAO, 2006.

Grassland Reserve Program (GRP) and Farm and Ranch Lands Protection Program (FRPP)

GRP and FRPP provide payments to purchase easements to prevent the conversion of grassland (GRP) and farmland (FRPP) to other uses. Like EQIP and WHIP, these programs are decentralized and have made funds broadly available to producers in all States since program inception (in 1996 for FRPP, and 2002 for GRP). In both FRPP and GRP, State program offices use program funds and make enrollment decisions based on USDA State and national resource priorities. However, applications must be sponsored by a local entity willing to contribute a portion of the easement cost (i.e., a land protection program established by a State or local government or nongovernmental organization). These entities submit parcels for consideration that satisfy their own program goals, so ultimately the easements funded through FRPP and GRP reflect a combination of national, State, and local priorities.

In FRPP, NRCS has historically made program fund allocations to States based on the amount of farmland previously converted to developed uses in the State, the risk of further farmland conversions, estimates of landowner interest in selling easements in FRPP, and the financial contributions and historical performance of cooperating entities that sponsor landowner enrollments.[17]

In GRP, the two agencies responsible for program administration, NRCS (for easements) and USDA's Farm Services Agency (for rental agreements), typically allocate program funding to States based on the number of grazing operations, pasture, and range acres under threat of conversion, and biodiversity considerations.[18] These funds are used to purchase easements, to fund long-term rental agreements to maintain grassland cover, and to provide cost-sharing assistance to restore or install grassland.

[17]Farm and Ranch Lands Protection Program, Final Rule, Federal Register, Vol. 68, no 95, Page 26461-26478, May 16, 2003. Online at http://edocket.access.gpo.gov/2003/03-12064.htm

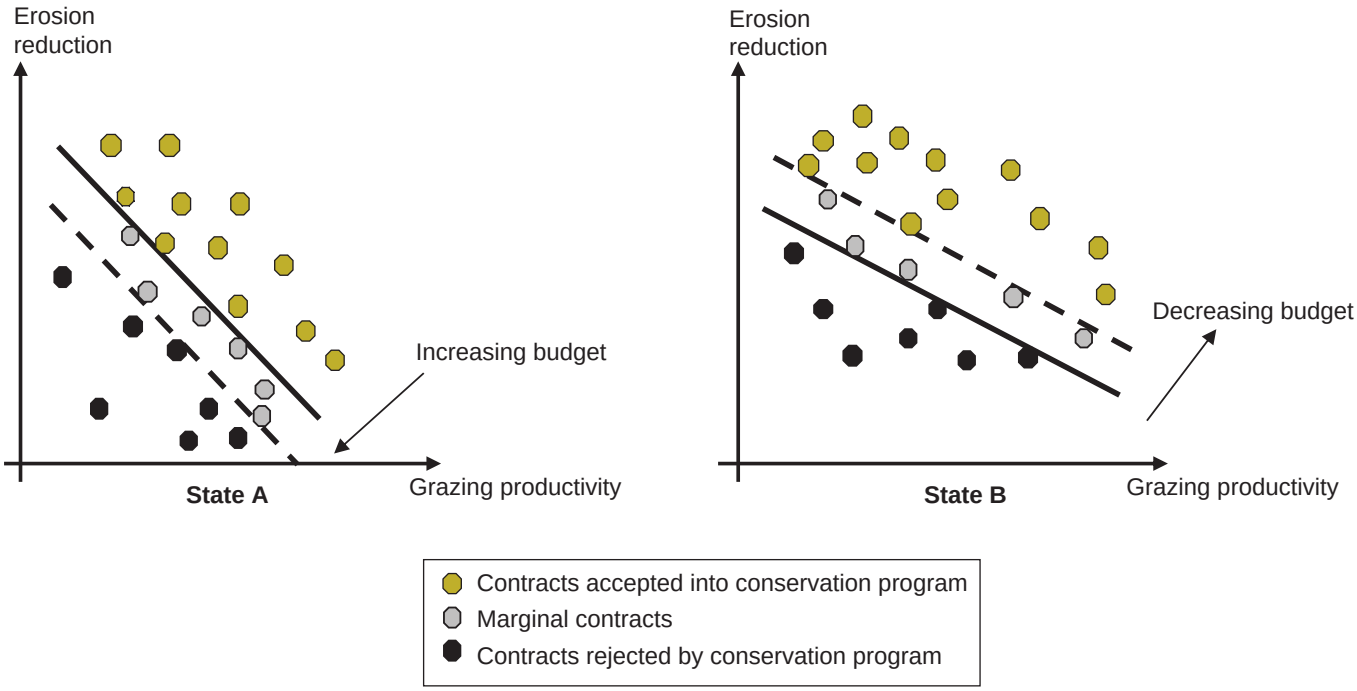
[18]Grassland Reserve Program Final Rule, Federal Register, Vol 69, no 99, Page 29181-29182, May 21, 2004. Online at http://frwebgate1.access.gpo.gov/cgi-bin/PDFgate.cgi?WAISdocID=418564507624+5+2+0&WAISaction=retrieve.

Appendix B. Marginal Contracts

It may be tempting to estimate the impacts of policy changes based on aggregate measures like the "average" contract. However, as the following analyses reveal, the characteristics of conservation program contracts vary by priority. The underlying differences suggest that estimating impacts of policy changes based on the resources or size of the area treated by the "average" contract can be misleading. We use a small (10-percent) increase in conservation program budgets as an example to demonstrate how different estimated impacts might be.

As program budgets or other program factors change, funds allocated to each State will change. Marginal contracts (the lowest priority contracts that received program funding) and marginally rejected applications (unfunded applications with scores just below those of the marginal contracts) will be most affected by these budget changes. Figure B.1 illustrates how hypothetical changes in State allocations affect marginal contracts and applications that offer to treat two problems: erosion and grazing productivity. Each dot represents a score based on the application's expected reduction in erosion and improvement in grazing productivity, and each dot's coordinates in the figure depend on the extent to which the producer agrees to treat each problem. The solid line represents the amount of erosion reduction and grazing improvements that can be funded with the available budget; it can be thought of as a cutoff line. For simplicity, unit costs of treating erosion and grazing lands are assumed to be the same for all producers. The olive-green dots have the highest scores and are funded contracts (accepted offers), given

Figure B.1
Increasing program budgets allow more contracts to be funded



Source: USDA, Economic Research Service. Adapted from Cattaneo et al., 2006.

the available budget. The black dots have the lowest scores and are rejected applications. The gray dots, those closest to the cutoff line, are the marginal contracts and marginally rejected applications. If the budget increases slightly (cutoff line moves closer to the origin, as in State A's figure), applications with the next highest scores would be funded—they become the marginal contracts. When budgets decline slightly (as in State B's figure), the marginal contracts no longer receive funding—they become "marginally rejected." The positions of the dots vary between the two States depicted in the figure, reflecting the idea that the mix of problems that producers agree to treat varies across States. The locations and slopes of the budget lines reflect, respectively, the variation in the size of State budgets and the different priorities States place on treating different problems. The impacts that relatively small program changes will have on program outcomes will depend largely on the characteristics of marginal contracts and marginally rejected applications in each State—the number of acres producers agree to treat, the payment producers are willing to accept, and the environmental benefits they are willing to provide. However, when legislation represents a major overhaul of a program, the incentives that producers face will change, and consideration of how the set of producers who apply to a program may change in response (the number and positions of the dots in the graphs) will be important.

When conservation programs are decentralized and allow for multiple jurisdictions to make enrollment decisions, as in EQIP and WHIP, multiple ranking tools will be at work in each program. In EQIP, many ranking tools can exist within each State. This decisionmaking structure means that marginal contracts, and marginally rejected applications, will exist for each application pool—potentially yielding a set of marginal contracts and applications that vary widely in terms of resource problems and costs of treatment.

How Do Marginal Contracts Differ From Higher Priority Contracts?

Because of the diversity in the resource problems that producers face, the flexibility producers have in deciding which problems to treat, and the few limitations on eligibility for working-land conservation programs, contracts enrolled in these programs can vary in many ways. State agencies administering conservation programs also affect the characteristics of enrolled contracts through the conservation priorities the agencies establish. The process for prioritizing applications in a conservation program suggests that differences are likely to exist between those of higher priority for enrollment and those of lower priority. An obvious difference is that higher priority contracts are more likely to address higher priority resource concerns. They may also be more likely to address these issues at lower cost, at least in jurisdictions that consider per acre treatment costs in the prioritization process. Whether the contract addresses concerns arising from livestock operations, or aids particularly disadvantaged producer types, may also differ by contract priority.

Comparing the characteristics of marginal to higher priority contracts in EQIP and WHIP—the financial and cost-share assistance received, the types of practices implemented, and the resource concerns addressed—illustrates how these contracts vary in programs treating environmental problems on working lands. We identified contracts as marginal or not using the contract's ranking score and information about which contracts were pooled and ranked against

each other in the selection process, information which is included in the program administrative data maintained by NRCS.[19] We defined low-priority contracts as those that ranked the lowest in each funding pool, which, in total, comprised 10 percent of program funds. Highest priority contracts were those that ranked the highest and comprised 10 percent of program funds.

Marginal contracts differ from higher priority contracts in a number of ways. For example, marginal contracts in EQIP received significantly smaller (in a statistical sense) contract payments compared with the highest priority contracts (table B.1). A regional-level analysis reveals that this pattern held, almost without exception, across USDA production regions and over the 3-year period 2004-06. Contract payments on marginal contracts were lower because these contracts tended to receive both lower rates of cost-share assistance and smaller financial assistance payments. In EQIP, participants receive cost-share assistance to help offset part of the cost of installing structural or vegetative practices, and financial assistance to adopt more environmentally friendly management practices.[20] In 2006, the average rate for cost-shared practices was 57 percent and 61 percent for marginal and high-priority contracts, respectively (table B.1).

Low- and higher priority contracts also differ based on the amount of land that receives treatment and types of practices producers agree to implement. Analysis of 2006 EQIP contract data reveals that the typical lowest priority contract treated fewer acres compared with higher priority contracts, ranging from 5 percent fewer acres treated for water quality issues to 84 percent fewer acres for fish and wildlife issues. Most EQIP contracts involve implementation of a single *type* of practice—in 2006, about 70 percent of all EQIP contracts implemented only structural, vegetative, or management practices (fig. B.2). Of these contracts, low-priority contracts tended to implement strictly structural or vegetative cost-shared practices more frequently than higher priority contracts did (50 percent versus 41 percent), while more of the highest priority contracts included combinations of practice types. Installing conservation "systems" involving multiple practices may be the most efficient way to treat a variety of resource problems (Lerch et al., 2005; Berry et al., 2003).

Table B.1
Characteristics of EQIP contracts by priority, 2006

Characteristic	Marginal contracts	Highest priority contracts	Difference
Average contract payment, dollars	$11,795	$15,720	-$3,925**
Average percentage rate for cost-shared practices	0.57	0.61	-0.04**
Average incentive payment, dollars	$2,707	$3,231	-$524**
Number of practices, average	2.63	3.4	-0.77**
Size of commonly adopted practices:			
Fencing, feet	4,216	5,992	-1,776**
Nutrient management, acres	400	341	59**
Pasture and hay planting, acres	51	79	-28**

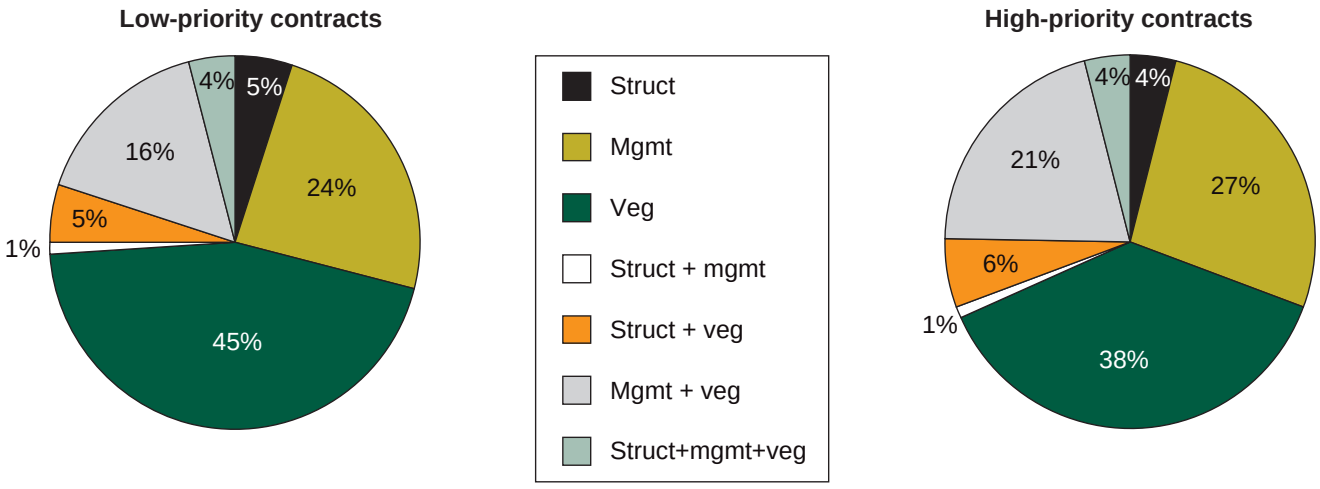
**Difference is significant at a 95% confidence level.
EQUIP = Environmental Quality Incentives Program.

Source: USDA-NRCS administrative data for EQIP, 2006.

[19]Ranking scores reflect the agency's numerical determination of the priority for enrolling a particular contract with funds from a particular pool, and higher ranking scores imply higher priority. In a few instances, groups of contracts were assigned to one of three priority categories (priority = 1st, 2nd, or 3rd). We assigned ranks to the lowest priority contracts based on costs, consistent with the ranking approach in Kansas and Mississippi (the two States with the most contracts ranked on a priority basis). When a contract was missing a ranking score, we used regression analysis to predict the ranking score based on contract characteristics, but because the decision and ranking processes are so decentralized, this effort was not successful even at a State level. Thus, we assigned the average ranking score from contracts within the relevant funding pool to unranked contracts.

[20]In this report we define structural practices as practices with a 15-year life that are likely to treat multiple fields (lagoons, ponds, etc). Vegetative practices include vegetative filter strips, buffers, and small structural practices that are likely to treat single tracts/fields. Management practices include, for example, integrated pest management, nutrient management, and conservation tillage.

Figure B.2
Percent of EQIP contracts by practice type and priority



Types of practices defined:
Struct = large structural practices with a 15-year life; Mgmt = management; Veg = vegetative practices and small structural practices treating single tracts/fields.

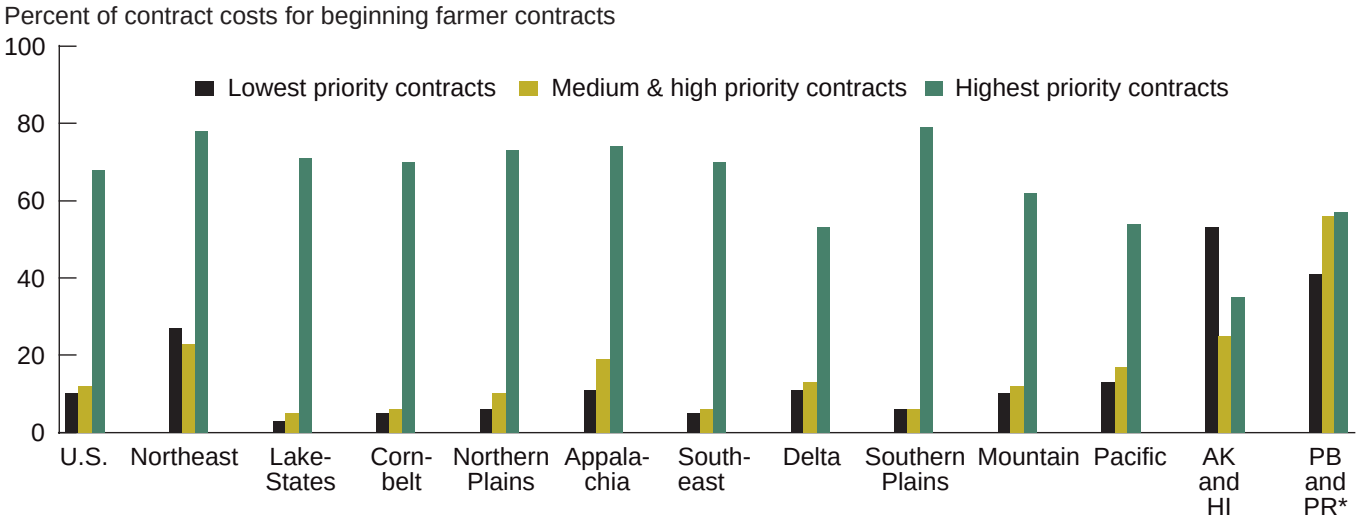
Source: ERS analysis of NRCS administrative data.

In recent years, policymakers have sought to improve participation rates by certain producer groups in EQIP. For example, the 2002 and 2008 farm legislation provided for higher levels of financial assistance and other measures to reduce barriers to participation by beginning farmers and limited-resource producers (the 2008 Farm Act includes favorable terms for socially disadvantaged farmers, as well). The 2006 enrollment data suggest beginning and limited-resource farmers and ranchers tend to get enrollment priority in EQIP. When viewed from a national level, 68 percent of payments on high-priority contracts are made on contracts held by beginning farmers and ranchers, while just 10 percent of payments to low priority contracts are received by these farmers (fig. B.3). Payment patterns are similar for limited-resource producers.

Marginal Contracts: Implications of Differences for Program Analysis

Knowledge about the many ways in which lower and higher priority contracts differ can be particularly important for understanding the environmental, economic, distributional, and allocative impacts of policy changes, as well as for estimating how program administration requirements (such as staffing and provider needs for technical assistance) might change in response. Taking this variation into account is important even for relatively small program changes. For example, in EQIP, if estimates of impacts of a 10-percent budget increase on contract numbers were based on the "average" contract size rather than the smaller size of marginal contracts, the number of additional contracts enrolled would have been understated by 42 percent. Further, estimates of the number of acres receiving treatment for plant conditions, soil erosion, soil conditions, and fish and wildlife problems would be

Figure B.3
Proportion of contract payments to beginning farmers in EQIP, 2006



PB = Pacific Basin Countries; PR = Puerto Rico.
EQIP = Environmental Quality Incentives Program.

Source: ERS analysis of NRCS administrative data.

overstated by more than 40 percent, because marginal contracts tend to treat fewer acres than the average contract.

Understanding differences among contracts by producer type is also important, especially when certain producers require additional technical or other types of Government assistance. The average EQIP payment to all livestock producers was about $21,120 in 2006, while payments for livestock producers with marginal contracts were about half as large. If the impacts of a 10-percent budget increase were based on the size of the "average" contract and livestock contracts continued to receive 66 percent of any additional funding (the proportion of all funding received by this producer group nationally), the number of new livestock contracts that could be enrolled with a 10-percent budget increase would be underestimated by about 45 percent. The number of contracts with beginning and limited resource farmers would also be underestimated by 25 percent, if similar assumptions about contract sizes were made.

Appendix C. Methodology for Estimating Acres Receiving Treatment and the Costs per Acre of Treating Resource Concerns

The EQIP and WHIP data we used to estimate treatment costs included the cost of implementing each practice, identifiers for the fields where each practice was to be installed, indicators of physical effects to be treated, and information on how many acres were receiving treatment under the contract, as identified by local NRCS field offices. We used these locally determined links between costs and environmental problems to estimate watershed-level costs of treatment. The advantage of using the locally determined links is that they incorporate the natural variation in practice costs across different States, which depend on local priorities and circumstances.

Agricultural producers address resource concerns by implementing conservation practices that mitigate the underlying physical effects of production. For example, pasture and hay planting and fencing are practices often used to mitigate overgrazing, a physical effect that addresses the resource concern of the productivity of grazing land. Often more than one practice is used to address a physical effect. Also, some practices, like fencing, can mitigate multiple physical effects (e.g., overgrazing and streambank erosion) that address more than one resource concern (such as grazing productivity and water quality). In developing our cost estimates, we accounted for both the multiple-practice and multiple-resource concerns evident in the data.

The study's primary goal in developing the cost estimates was to do so in such a way that the costs could ultimately be compared to benefits for addressing particular resource concerns. Three factors were important: (1) linking the physical effects to resource concerns (such as water quality or grazing productivity) to develop cost estimates of addressing the concern; (2) identifying which costs were incurred to mitigate which physical effects (such as soil erosion or grazing land health); and (3) grouping practices based on the years of benefits that they were likely to generate.

In fiscal years 2004 and 2005, NRCS field offices could assign practices to as many as 76 physical effects, depending on the environmental problem the practice was expected to treat. In 2006, NRCS changed and expanded the list to include 82 physical effects. For our analysis, we grouped the physical effects by resource-concern categories for which we had benefit estimates (see Appendix D for a description of benefit estimates). For 2004-2005, 28 of the 76 physical effects were mapped to resource concern categories for which benefit estimates existed; in 2006, 17 of 82 physical effects were mapped. Table C.1 identifies which subsets of physical effects linked to which resource concerns. Although the physical effects receiving treatment differed somewhat during the study period, we reviewed the data and found reasonable consistency across years between the practices that were associated with particular resource concerns.[21]

In some cases, the practice-to-physical-effect links in the data appeared tenuous—for example, ponds were identified as reducing wind erosion in some contracts. In such cases, we imposed restrictions on the data. We paid particular attention to large structural practices (e.g., creating ponds, waste

[21]This method puts greater reliance on the NRCS field office judgments about which resource concerns a practice is actually intended to address. An alternative method, which might ensure more consistency across years, would be to impose a strict mapping between practices and the resource concerns they are intended to address. However, this alternative would limit the spatial variability in the data as well as the ability of practices to address multiple resource concerns. The spatial variability in this study is particularly important because we are distinguishing effects of the Regional Equity provision among different States.

Table C.1
Physical effects included in benefit categories

Resource concerns	Physical effects receiving treatment	
	Fiscal 2004, 2005	Fiscal 2006
Benefits from reduced erosion from wind and water		
Onsite soil productivity benefits	Sheet and rill erosion reduction, reduction in irrigation-induced soil erosion	Sheet and rill erosion reduction, reduction in irrigation-induced soil erosion
Air quality benefits	Reduction in wind erosion and particulate pollution	Reduction in wind erosion and particulate matter less than 10 micrometers in diameter
Sedimentation reduction benefits	Reduction in damage from sediment deposition and erosion from roadsides and construction sites; reduction in shoreline and streambank erosion; reduction in sediment deposition	Reduction in damage from sediment deposition and erosion from road sides and construction sites; reduction in shoreline and streambank erosion; improvement in capacity of conveyances from reducing sediment deposition
Water quality benefits	Reduction in surface water salinity, sediment and eutrophication, heavy metals, pesticides, acid rain problems, and temperature extremes; reduction in bioaccumulation of toxins; improvement in water for fish and wildlife	Reduction in surface water salinity, sediment and turbidity, heavy metals, pesticides, petroleum and harmful temperatures; rectifying inadequate water for fish and wildlife
Grazing productivity benefits	Reduction in noxious and invasive plants, improvement in rangeland site stability	Improvement in quantities and quality of feed/forage/plants, reduction in noxious and invasive plants, improvement in rangeland site stability and hydrologic cycle
Irrigation efficiency benefits	Improvement in water supply for irrigated land	Improvement in efficiency of water use on irrigated land
Wildlife viewing benefits	Improving population imbalances and species diversity, reduction in loss/degradation of riparian habitat/vegetation, reduction of nonindigenous plant or animal species	Improving population imbalances, food, space, and populations of threatened and endangered species and species of concern
Hunting benefits	Reduction in loss/degradation of forest or grass cover and habitat fragmentation	Improving cover/shelter for wildlife and reducing habitat fragmentation
Wetland creation benefits	Reduction of significant hydrological modification	Reduction in excessive subsurface water

Source: USDA-NRCS administrative data for Environmental Quality Incentives Program (EQIP) and Wildlife Habitat Incentives Program (WHIP).

storage facilities, etc.) that were associated with unlikely physical effects and that would have the most significant effects on net benefit estimates. In addition to restrictions on links between large structural practices and particular physical effects, the primary restrictions we imposed were on the types of practices related to wetland creation and grazing productivity issues (e.g., we assumed practices funded through WHIP were not intended to mitigate grazing land productivity issues).

To identify the costs of mitigating physical effects, we used the contract data to link practices both to the fields on which they were installed and to the indicators of physical effects expected to be mitigated by those practices (we

assumed that practices completely addressed the identified physical effects on all fields where the practice was installed). This yielded cost estimates that varied by practice, year, and field level. Most practices were installed on a single field, but in some cases they were installed on many fields. In 2004 and 2005, 79 percent and 87 percent of EQIP contract items were coded to three or fewer physical effects, with 46 percent and 66 percent of contract items coded to just one physical effect in those years.

In generating contract-specific cost estimates, we identified whether the physical effect was mitigated using one of seven different practice types or combinations of types: large structural practices, management practices, vegetative practices, large structural plus management practices, large structural plus vegetative practices, management plus vegetative practices, or all three types (large structural plus vegetative plus management practices).[22] Distinguishing by practice type allowed us to match costs to varying streams of benefits, based on the varying lengths of the useful lives of the practices.

[22]We define vegetative practices to include small structural practices that are likely to treat particular fields or tracts, as opposed to large structural practices that are more likely to treat physical effects on all fields.

When estimating the per acre cost of addressing a resource concern, we had to account for the fact that multiple practices could be applied to the same field without double-counting the acres treated. In cases where practices addressed a single resource concern, we estimated the contract cost per acre (CPA) of addressing resource concern *r* with all practices of type *P* by summing up the costs of each practice c^p over the *t* years implemented, and dividing by the number of acres *a* the practices are estimated to treat on *j* fields (contract subscripts are suppressed to simplify notation):

$$CPA^{rP} = \frac{\sum_{t} \sum_{p=1}^{P} c_t^{rp}}{\sum_{j^P} a_{j^P}}$$

Ideally, data would be available on the number of acres treated by individual practices (a). Because acreage data are only available at the contract level, we estimated the acreage treated by each practice on field j (a_j) by allocating the total acres treated by the contract across all the fields that were subject to treatment by <u>any</u> practice. Some practices within a contract may be implemented on fewer fields than others, so total treated acres (*TTA*) are divided by the maximum number of fields receiving treatment by *any* practice in the contract:

$$a_j = TTA/argmax(j),$$

which assumes all fields treated by a contract are of equal size.

The above formulas assume that practices are implemented to address a single resource concern. In some cases, practices address multiple physical effects that map to multiple resource concerns. These cases raise the question of how to allocate practice costs across multiple concerns. Most practices are implemented to address a primary physical effect, so a reasonable strategy would be to allocate some costs to that effect. For this analysis, we allocated practice costs by apportioning them equally across the physical effects being mitigated by the practice.

As a sensitivity check, we also analyzed how outcomes would change if practice costs and treated acres were allocated entirely to the "primary" physical effect treated by the practice. We estimated the primary effect based on which physical effect each practice treated most frequently. We calculated the primary physical effect by practice within each State, which maintained spatial variation across States in the practice-physical effect mappings. With costs for addressing physical effects calculated this way, our estimates of the impacts of the Regional Equity provision on net benefits differed from our results when we apportioned costs equally across all physical effects being addressed by the practice, but not in any predictable way. The net benefits for some resource concerns increased, while others decreased up to several hundred thousand dollars. This suggests that assumptions about how costs are allocated when multiple resource concerns are treated can affect the outcomes.

Accounting for Outliers in the Data

One issue that arose in calculating the cost per acre for each resource concern was that for some contracts, the cost per acre estimates were unreasonably high or low. In large part, these outliers were due to inconsistencies in how field offices entered data on the acres that received treatment. The primary problem was that the number of acres on which the practice was installed was reported as "treated acres." For example, a riparian buffer *installed* on 0.2 acres was listed as *treating* 0.2 acres, when it actually treated (prevented soil erosion from leaving) a 20-acre field. This type of inconsistency resulted in cost per acre estimates that were unreasonably high. In other cases, certain practices were recorded as treating tens of thousands of acres. While possible, practices treating such large acreages are not typical, and they result in unreasonably low cost per acre estimates. Because calculations of average per acre costs at aggregated levels are affected by outliers, we used median per acre costs, or the per acre estimates for which half the observations lie below the estimate and half lie above (when the per acre cost estimates are arranged in order of magnitude).

Summarizing per Acre Costs to the Watershed Level

To be consistent with benefit estimates that varied across watersheds (8-digit Hydrologic Unit Codes, or HUCs delineated by the U.S. Geological Survey), we summarized the cost data to the watershed level. For each resource concern r and practice group p, we calculated the watershed level cost per acre as the median cost per acre of contracts in that HUC that treat resource concern r with practice group p. We also used the median number of acres treating resource concern r, multiplied by the number of contracts treating resource concern r, to estimate the number of acres receiving treatment.

Appendix D. Benefit Estimates

The benefits from addressing resource concerns were estimated for each contract. We estimated these by linking the physical effects addressed in each contract to different benefit categories for which benefit values are available from the literature (see Appendix C, table C.1, for a description of how physical effects were mapped to benefit categories). These categories include benefits associated with erosion reduction (soil productivity, dust, sedimentation, water quality), improved water management (irrigation efficiency), grazing land productivity, and habitat creation and improvement (hunting, wildlife viewing, wetlands). Most of the procedures and data behind the benefit estimates are the same as those used in the benefit assessment of the Conservation Security Program (USDA, 2004a).

Benefit estimates for each category were available at several different geographic levels (Hydraulic Unit Code, State, farm production region, or national). GIS procedures were used to aggregate benefits to the State level. Benefits were placed on a per ton of erosion or per acre basis, depending on the category. Benefits from Environmental Quality Incentives Program contracts were estimated by applying the per unit values to the amount of erosion reduced or the number of acres treated.

Benefits From Reduced Erosion

Benefits from reduced water and wind erosion were obtained from Hansen and Ribaudo (2008), who provide economic measures of soil conservation benefits for a variety of benefit categories, representing benefits from reduced sedimentation, improved water quality, improved air quality, and improved soil productivity. Benefits are provided in terms of dollars per ton of erosion reduced, by county and the U.S. Geological Survey's 8-digit Hydrologic Regions (although the benefits for sub-State units are often assigned the per ton benefit estimated at a State or regional level).

In the case of erosion reductions, contract data did not contain any information on baseline erosion rates or the expected change in the rates. We assumed that practices adopted for the purpose of reducing erosion would achieve a reduction equal to the difference between the HUC-wide average erosion rate (tons per acre) on cropland eroding at T and more than T. T is the "acceptable" level of erosion as defined by NRCS (in tons per acre) and a standard target for erosion control practices. Cropland already at or near T would not need conservation practices to control erosion. We estimated HUC-wide average erosion rates with data from the National Resources Inventory on cropland with an erosion rate greater than T, and used this information to convert the benefits from reducing erosion on a per ton basis to a per acre basis.

Benefits From Improved Water Management

Benefits from improved water management represent the reduced cost to the farmer of water used in irrigation. Estimates of annual per acre water savings were obtained from NRCS (USDA-NRCS, 2004a). In that study, the assumption was made that improved water management reduces water use by about

13 percent. Potential per acre benefits were calculated using data on irrigation water use, water source (surface or ground), and irrigation water costs.

Benefits From Improved Grazing Productivity

Improved land management can increase the productivity of grazing lands. We used per acre productivity benefit estimates developed by NRCS at the multistate level for an analysis of the Conservation Security Program (USDA- NRCS, 2004a). Benefit estimates were developed by varying the national per acre values ($15.01 for pasture, $5.00 for grazing) across HUCs, based on relative soil productivity measures obtained from the NRI. Separate benefits were calculated for rangeland and pastureland. Where watersheds contained both rangeland and pastureland, we calculated the benefits for the HUCs as the weighted average benefit. We used the number of acres in rangeland and pastureland in the watershed, estimated using 1997 NRI data, as weights.

Benefits From Improved Hunting Opportunities

Improving wildlife habitat can produce hunting and wildlife-viewing benefits. We obtained estimates of the value of improved pheasant hunting from a study by Feather, Hellerstein, and Hansen (1999). Their study derived estimates by applying a Random Utility Model of pheasant hunter behavior (Hansen, Feather, and Shank, 1999). Recreation data for the model were from the 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, and land-use data were taken from the 1992 NRI. For purposes of the present study, we reduced the benefit estimates by 50 percent, on the assumption that land remaining in production would generate half the benefits of land that is retired in the Conservation Reserve Program (CRP) (USDA-NRCS, 2004a).

Benefits From Wildlife Viewing

The 1999 study by Feather, Hellerstein, and Hansen estimated the impact of the CRP on nonconsumptive, wildlife-oriented recreation. In that study, data from the Hunting and Fishing Survey (U.S. Department of the Interior and U.S. Department of Commerce, 1993, 1997) were used to estimate how improvements in habitat affected the number of trips people took to view wildlife and the value of a trip in each region. Results were reported on a basis of per acre of-land in the CRP. Several studies have shown that a number of practices funded through EQIP have benefited wildlife, including irrigation water savings practices (which benefited the arctic grayling fish species in Montana and Wyoming), conservation tillage (which benefited nesting birds) and rangeland practices (which benefited the prairie grouse) (e.g., Riley 2004; Martin and Forsyth 2003; Lokemoen and Beiser, 1997; and Jahn and Schenck 1991).

Benefits From Wetland Creation

Wetland restoration can provide habitat for wildlife species that support recreational activities, such as hunting and fishing, and commercial activities such as fishing and trapping. Wetlands also have a nonuse value, primarily for the viewing of wildlife that depend on wetlands for nesting, cover, and

food. We applied annualized recreation, commercial, and nonuse values for wetlands of $550 per acre based on values reported in the literature (Heimlich et al., 1998).

Applying Benefit Estimates to Practices

Table 4 reports the annual per acre benefit estimates used to estimate the impacts of the Regional Equity provision on net benefits. We took into account that the practices implemented under an EQIP or WHIP contract produce benefits over multiple years, and using a 7-percent discount rate, we calculated the present value of the benefit stream for each contract. We allowed the length of the benefit stream to depend on the types of practices (management or structural) and the length of the contract (Table D.1). We applied estimates of practice lives reported by NRCS (2004): structural practices generate a 15-year stream of benefits, vegetative practices (buffers) generate a 10-year stream, and management practices generate a 4-year stream. No benefits were assumed to be generated in the initial year of implementing the practice establishment. An implicit assumption with this approach is that installed practices mitigate physical effects to a nondegradation level. If they do not, the benefits ascribed to the practices will be overstated.

Many participants agree to implement a suite of practices to mitigate a single physical effect. We assumed that all the practices would need to be in place in order for the contract to generate all of the benefits from conservation treatment. If, for example, both structural and management practices were used to mitigate a physical effect on the same land unit, we assumed that both types of practices were necessary to treat the land to a nondegradation level. For contracts that combined structural and management practices, we assumed that benefits from structural practices were reduced by 25 percent once the management practices ended after 3 years. For contracts that combined structural and vegetative practices, we assumed that benefits from structural practices were reduced by 25 percent once the vegetative practices finished their useful life after year 10. If both vegetative and management practices were implemented, we assumed that the benefits from vegetative practices were reduced by 25 percent once the management practices were no longer implemented (after 4 years). If all three types of practices were implemented, we assumed that total benefits were reduced by 15 percent between years 4 and 10 when the management practice was no longer implemented, and by 25 percent when only the structural practice was in place after year 10.

Table D.1

Portion of benefits generated by contract type, by year

	Practice type						
	Struct.	Mgmt.	Veg.	Struct. + Mgmt.	Struct. + Veg.	Mgmt.+ Veg.	Struct+Mgmt+Veg
Benefits in year 1	0	0	0	0	0	0	0
Benefits in year 2	1	1	1	1	1	1	1
Benefits in year 3	1	1	1	1	1	1	1
Benefits in year 4	1	1	1	1	1	1	1
Benefits in year 5	1		1	0.75	1	0.75	0.85
Benefits in year 6	1		1	0.75	1	0.75	0.85
Benefits in year 7	1		1	0.75	1	0.75	0.85
Benefits in year 8	1		1	0.75	1	0.75	0.85
Benefits in year 9	1		1	0.75	1	0.75	0.85
Benefits in year 10	1		1	0.75	1	0.75	0.75
Benefits in year 11	[1]			0.75	0.75		0.75
Benefits in year 12	1			0.75	0.75		0.75
Benefits in year 13	1			0.75	0.75		0.75
Benefits in year 14	1			0.75	0.75		0.75
Benefits in year 15	1			0.75	0.75		0.75

Note: A value equal to 1 means full benefits are assumed to be generated in that year.

Types of practices defined:
Struct = Large structural practices with a 15-year life.
Mgmt = Management.
Veg = Vegetative practices and small structural practices treating single tracts/fields.

Source: ERS analysis of NRCS contract data.