Appendix 5: Sensitivity Analysis

We test model sensitivity to a number of economic and policy parameters selected for the main analysis:

- The minimum net return (which stands in for transactions cost);
- Environmental index weights; and
- Hurdle rates selected for the *Good Performance* scenario.

For the minimum net return and environmental index weights analyses, we use the *Improved Performance* scenario. In each of these sensitivity analyses, we attempt to hold overall program payments constant at about $15 billion over 5 years ($3 billion per year).

Sensitivity of Minimum Net Return

Producers do not have an economic incentive to participate in a green payments program unless participation results in a minimum return that at least covers transaction costs. These costs could include time and travel involved in filling out applications, verifying existing environmental performance, and working with conservation technicians to develop plans for additional conservation. In our initial analysis, a minimum return of $200 per farm was required to trigger program participation. We tested the sensitivity of model results to higher minimums over an extremely wide range, up to nearly $8,000 per farm.

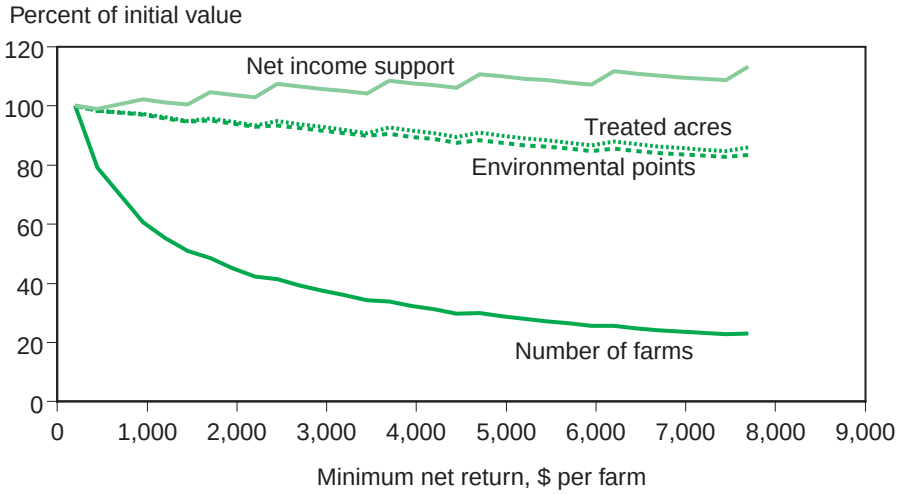
Figure A5.1 shows that higher minimum returns could substantially reduce the number of farms that are estimated to participate, but would make much less difference in terms of treated acreage, environmental points, and net income support. When the minimum net return is $1,000, estimated participation (farms) drops by 40 percent, while change in other measures of program performance are 3 percent or less. Treated acreage and environmental points decline slightly, while overall net income support increases slightly. For larger minimums, the decline in participation slows while treated acreage and environmental points continue to decline slowly and net income support continues to increase slowly.

Sensitivity of Index Weights

Index weights determine the relative importance of various environmental problems and, because payments are based in part on environmental scores, can exert a strong influence on which conservation treatments are actually undertaken. To get some sense of how much index weights influence outcomes, we test the sensitivity of the model to changes in index weights. For the sensitivity analysis, we place each index component (and all associated subcomponents) into one of four categories: soil erosion, water quality, grazing land health, and wildlife habitat (table A5.1). For each category, we re-estimate the model doubling weights in one category while weights in other categories are reduced, in total, by an equal amount. Weights are reduced in proportion to the original weight for each subcomponent. The procedure ensures that the total number of possible points is unchanged and

Figure A5.1

Effect of increasing minimum net return, improved performance scenario



Source: USDA, Economic Research Service.

Table A5.1

Index component grouping for sensitivity analysis

Group	Index components	Combined weight
Grazing land health	Grazing land health	.06
Soil erosion	Wind erosion (cropland)	.60
	Water erosion (cropland)	
Water quality	Nutrient management (cropland)	
	Pest management (cropland)	.54
	Nutrient management and Riparian erosion (grazing land)	
Wildlife habitat	Wildlife habitat (all land)	.60

Source: USDA Economic Research Service.

that the relationship among model subcomponents (ones for which weights are not doubled) is unchanged.

National results show that the effect of doubling index weights for component groups varies. For grazing land health, doubling the component weight would increase the overall number of acres treated and the overall number of environmental points earned (fig. A5.2). More specifically, the number of acres treated for grazing land health would increase from about 125 million with the base weights to about 175 million with the grazing land health index weight doubled. This result follows from the fact that a large acreage is eligible for grazing land health treatment (about 220 million acres; see table A2.1 in appendix 2), but many of those acres would be costly to treat (median WTA is about $50 per acre—the highest of any treatment; see table A3.1 in appendix 3). So, higher payments that come with a higher score make a significant difference in the number of acres treated. The increase in acreage treated and environmental points earned for grazing land health are larger than decreases associated with other treatments (where index weights were reduced).

Table A5.2

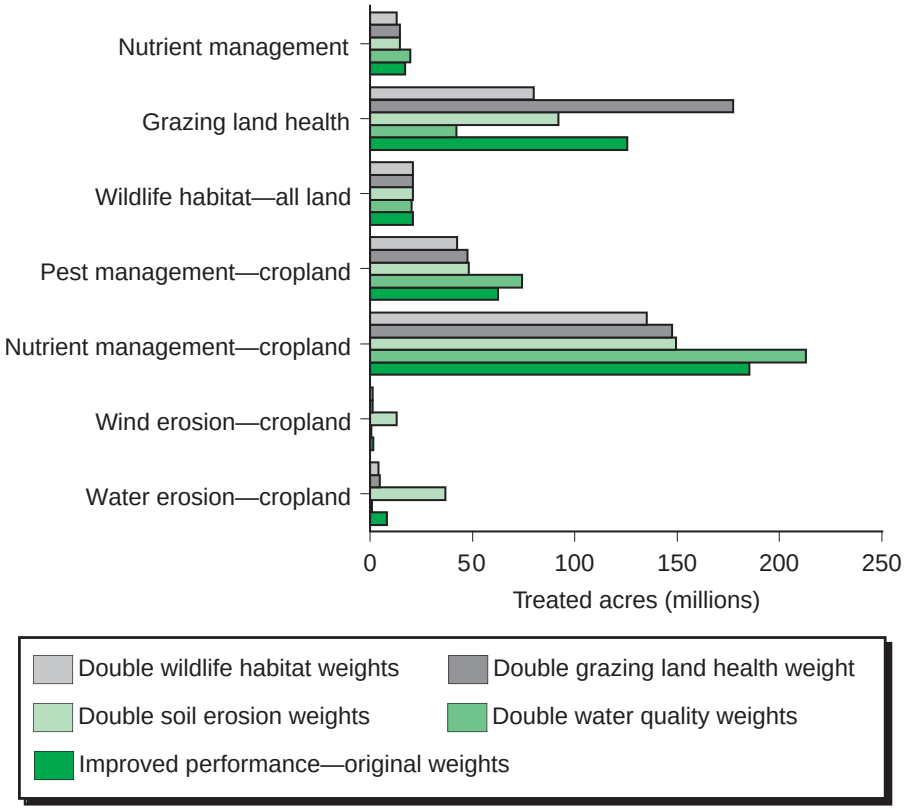
Sensitivity to change in index weights

	Program payments	Number of farms	Net income support	Treated acres	Environmental points
	Million $	*1,000*	*Million $*	*Millions*	*Millions*
Base weights	14,960	1,132	9,088	411	19
Double grazing land health weight	14,858	1,090	8,563	413	23
Double soil erosion weight	15,082	1,104	8,548	375	12
Double water quality weight	14,930	1,173	9,643	370	27
Double wildlife habitat weight	15,066	996	11,350	296	13

Source: USDA Economic Research Service.

Figure A5.2

Treated acres, sensitivity to change in index weights



Source: USDA, Economic Research Service.

In contrast, doubling the weight on the wildlife habitat index components would reduce overall acreage treated and the overall number of environmental points earned. Doubling the wildlife habitat weights would not result in additional treatment because only a relatively small number of acres are eligible for this treatment to begin with (about 20 million acres; see table A2.1) and nearly all of these acres are treated in the *Improved Performance* scenario with the base weights. Meanwhile, reducing other weights would lower payments to other treatments, reducing treated acreage and environmental points.

In terms of net income support, doubling the weight on the grazing land health component would result in a small overall reduction while doubling the wildlife habitat weight would result in an increase of more than $1 billion in net support. Net income support is increased when the wildlife habitat weight is increased because payments to producers who adopt wildlife-related practices increase even if additional acres can't be treated for wildlife-related concerns.

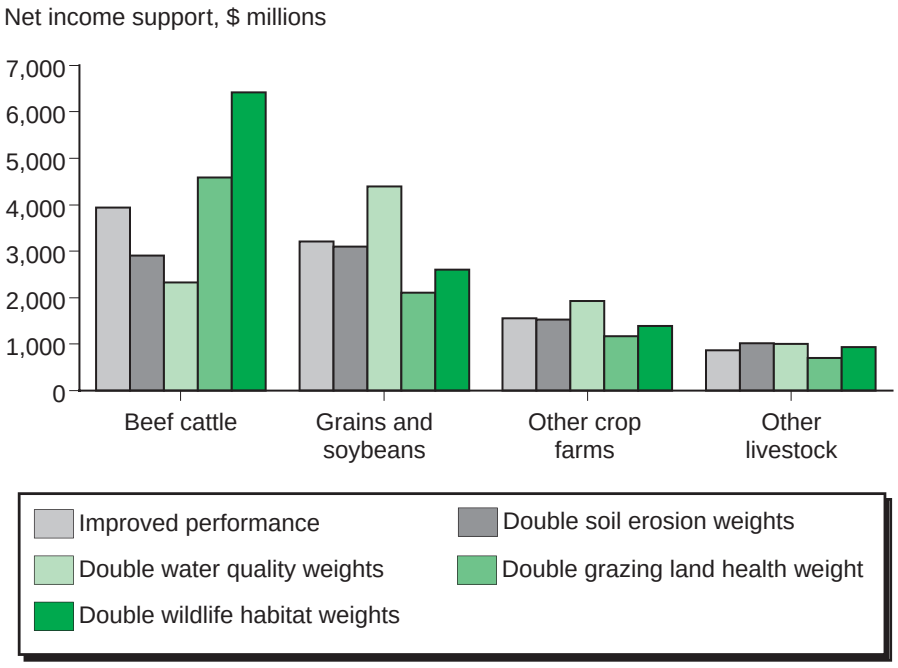
Beef producers gain additional support from increases in the weights for grazing land health and wildlife habitat but lose support when soil erosion or water quality is targeted for increase (fig. A5.3). The situation is different for crop producers: Increases in weight for water quality components increases their income support while increases for grazing land health or wildlife habitat decrease their overall level of income support. Regions with large acreages of grazing land tend to receive greater income support when weights for grazing land health or wildlife habitat are increased (fig. A5.4). Regions with large crop acreages tend to receive more income support when the weight given to water quality is increased.

Sensitivity of Environmental Hurdle Rates

Environmental hurdle rates in the *Good Performance* scenario define environmental performance that is good enough to qualify for some level of payment. Our initial *Good Performance* scenario assumes that hurdle rates are (1) devised on a region-by-region basis and (2) define the hurdle rate in a way that includes farms which account for roughly one-half of all agricul-

Figure A5.3

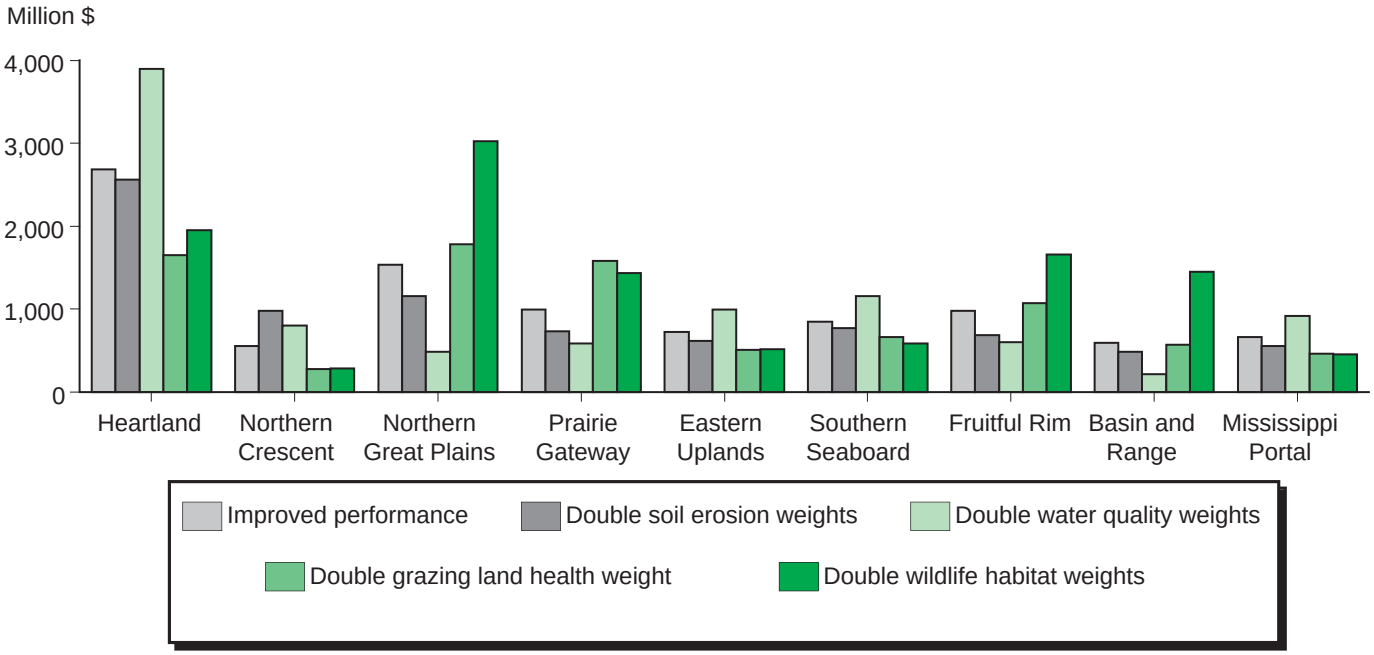
Net income support by scenario and primary commodity—sensitivity to change in index weights



Source: USDA, Economic Research Service.

Figure A5.4

Net income support by scenario and ERS resource region



Source: USDA, Economic Research Service.

tural land. Here, we consider two changes: (1) hurdle rates set for the Nation as a whole and (2) hurdle rates set for varying levels of inclusiveness.

Given a $15 billion budget, the number of participating farms is larger when hurdle rates are calculated at a regional, rather than national level (fig. A5.5). Depending on the level of the hurdle rate (and assuming a $200 minimum per-farm return for participating farms), between 100,000 and 200,000 additional farms participate when hurdle rates are set regionally. As the hurdle rates are adjusted to increase the amount of land in "good actor" status, participation rises with both regionally and nationally defined hurdle rates. As the hurdle rates become increasingly inclusive, participation becomes attractive to a broader group of producers because more producers can participate without taking any additional conservation action or incurring additional cost. Treated acreage, on the other hand, declines rapidly as the hurdle rate becomes more inclusive (fig. A5.6) and more producers can qualify for payments without undertaking additional conservation treatments.

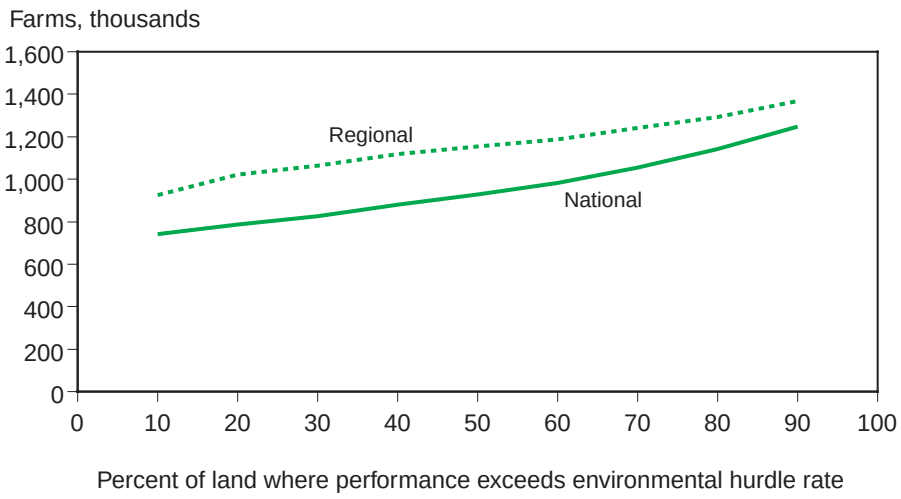
As the budget is increasingly devoted to these good performance payments, less is available for leveraging additional conservation effort. To limit payments to $15 billion, the payment rate must be lower and the number of acres treated declines. Finally, environmental performance, as measured in index points, is largest when hurdle rates are set to include about 30 percent of land but also declines when the environmental hurdle rate is more inclusive (fig. A5.7).

Finally, income support rises as the hurdle become increasingly inclusive (fig. A5.8). Payments for good performance are the key engine of growth for income support. Even as good performance payments rise, however, reduced

conservation treatment activity means that income support associated with the "profit" from conservation treatment declines. As a result, net income support rise less than do good performance payments.

Figure A5.5

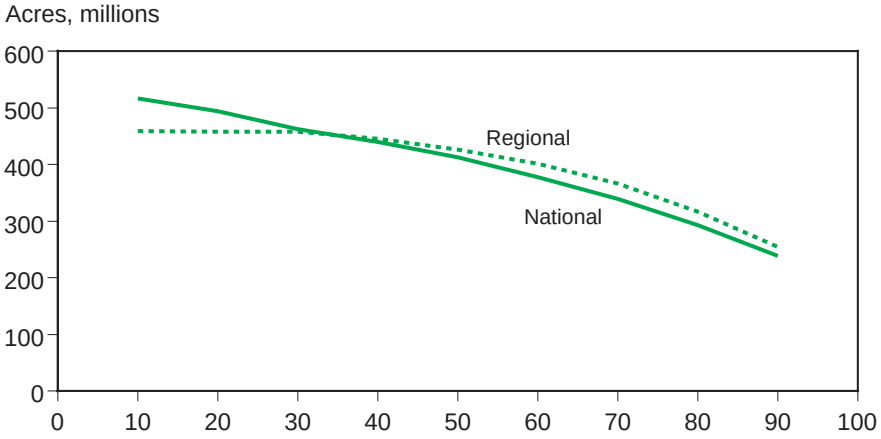
Particpating farms—national and regional hurdle rates



Source: USDA, Economic Research Service.

Figure A5.6

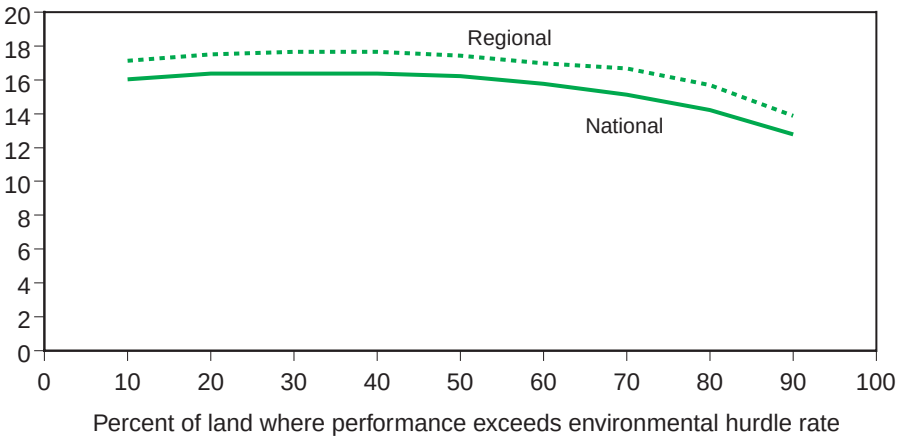
Acres treated—national and regional hurdle rates



Source: USDA, Economic Research Service.

Figure A5.7

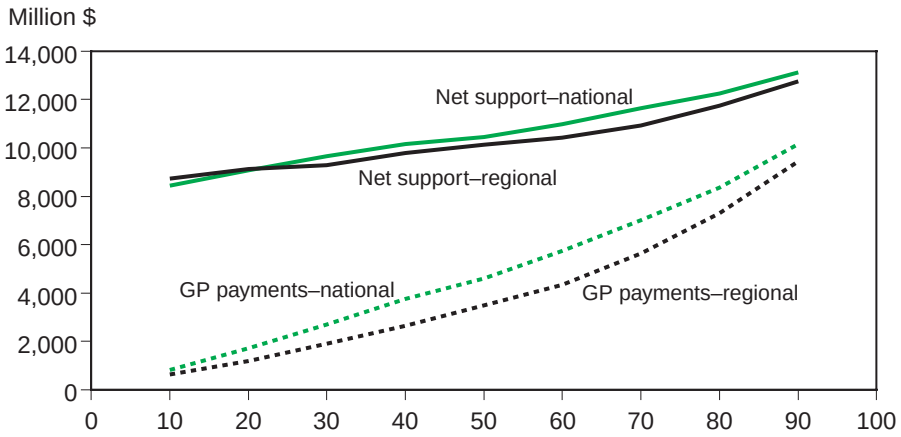
Environmental points—national and regional hurdle rates



Source: USDA, Economic Research Service.

Figure A5.8

Net income support and good performance payments—national and regional hurdle rates



Source: USDA, Economic Research Service.