Web Appendix C
Conservation Benefits, Installation Costs, and Land Rental Rates

The data used to analyze correlation among conservation benefits, conservation costs, and agricultural land rental rates come from a number of sources including:

- The Natural Resource Conservation Service (NRCS) Work Load Assessment (WLA);
- Environmental Quality Incentives Program (EQIP) contract data;
- National Resource Inventory (NRI) point data files;
- 1997 Census of Agriculture;
- An ERS database of estimates – drawn from previous studies – of a wide range of benefits that are likely to flow from soil erosion reduction and the wildlife benefits of establishing conservation cover from partial field practices such as grassed waterways and filter strips;
- Rental rate data developed for the Conservation Reserve Program (CRP) and Grassland Reserve Program (GRP).

C.1 Resource Concerns

Data on acres that require the application of one or more conservation practices to address a resource concern is from the WLA. For each county, the WLA provides the acreage of various land types (e.g., cropland, pasture) that require the application of practices for various resource concerns. A total of 573 million acres of cropland and grazing land have some treatable resource concern (Table C.1).

Table C.1. Summary of WLA data on resource concerns by land type and resource concern

	Resource concerns					
Land type	Soil erosion	Nutrient & pest mgmt	Irrigation water	Grazing	Wildlife	Totals
			million acres			
Cropland	162	35.8	42.6	1.4	6	247.8
Grazing land	55.8	12.9	2.1	235.6	18.8	325.2
Totals	217.8	48.7	44.7	237	24.8	573

To adapt WLA data for use in comparing benefits and costs, several adjustments were necessary. First, separate estimates of wind and water erosion concerns were needed. This report assumes that the proportion of acres needing treatment for wind erosion is roughly equal to the proportion of acres with wind erosion in excess of the soil loss tolerance, or "T" level. A similar procedure is used to determine the number of acres that were assigned a water erosion concern. Data on wind and water erosion is from the 1997 NRI. To allocate other resource concerns among non-irrigated and irrigated cropland, it is assumed that resource concerns are distributed proportionately among irrigated and non-irrigated cropland, by county. Data on irrigated and nonirrigated cropland is obtained from the 1997 Census of Agriculture.

C.2 Conservation Practice Installation Costs

Conservation practice installation costs are estimated from EQIP data for 1996-2001. The cost of addressing a given resource concern is the average cost of installing or adopting practices that are typically used to address it. Practices are grouped according to the physical processes they affect, i.e., practices that reduce water erosion are grouped together, etc. Groupings are similar to those used in *Environmental Quality Incentives Program: Benefit-Cost Analysis* (USDA, NRCS, 2003). To address a resource concern, producers would be required to address one or more of these physical processes. The average per-acre cost of practices used to address various physical effects is calculated from a subset of 33 of the practices most frequently used in EQIP contracts.

To estimate the average cost of installing or adopting conservation practices used to address specific resource concerns, total practice cost is used. For structural practices, total cost is the cost-share paid divided by the cost-share rate. For management practices, total cost is estimated as the maximum allowed incentive payments, obtained by dividing payment amount by the proportion of the maximum that is actually paid to the producer. While the maximum payment rates are designed by NRCS to approximate local costs, there remains considerable uncertainty about the actual costs of applying management practices. Nonetheless, these rates are the best available proxy for the cost of applying management practices.

For some practices, the extent of application is described in units other than acres. For example, the extent of terraces cost-shared is described in terms of linear feet. For these practices, conversion factors developed for the EQIP benefit-cost analysis are used to convert units into acres treated.

Although the data are identified to counties, NASS Agricultural Statistics Districts (ASDs) were used as the basic unit for averaging costs. Historically, EQIP has not been a large program and many counties include only a small number of EQIP contracts. Thus, a larger, multicounty area is likely to provide more reliable estimates of practice installation cost while also capturing spatial variation in conservation costs. ASDs were selected for this purpose because they are sub-State areas defined along county lines. Within each ASD, the average cost of practices addressing specific resource concerns is the acre-weighted sum of practices generally used to address the resource concern.

C.3 Benefits of Conservation

The benefits generated by the application of conservation practices are estimated using benefits transfer techniques. Benefit estimates were drawn from the literature and applied using additional data and physical process models. For example, water quality benefits are typically expressed in terms of damage reduction per ton of soil erosion reduction. These benefits can be applied on a per-acre basis using estimates of potential erosion reduction derived from the NRI.

C.3.1 Water Quality

Control of water erosion can improve water quality. Benefits generally grouped under the rubric "water quality" actually represent a wide range of distinct benefits, including water-based recreation, loss of reservoir storage capacity due to silt buildup, dredging costs for navigation, and additional water treatment costs for both drinking and industrial use. Increased benefits to water-based recreation from reduced soil erosion are based on estimates by Feather and Hellerstein (1997). Hansen et al. (2002) estimate the cost of soil erosion based on the cost of downstream dredging to maintain navigation channels. Other benefits are based on Ribaudo (1990).

Benefit estimates from these studies are in dollars per ton of soil conserved. To convert these figures to dollars per acre, likely water erosion reductions were estimated using historical data from NRI. Within a watershed (8-digit hydrologic cataloguing unit), expected erosion reduction due to practice application is estimated as the acre-weighted average erosion reduction on NRI points where: (1) erosion was above the soil loss tolerance (T) level in 1992; (2) erosion was reduced by 25 percent or more between 1992 and 1997; and (3) the erosion rate was below 1.25*T in 1997.[13] The same procedure is used to estimate erosion reductions for both cropland and grazing land.

[13]The factor of 1.25 accounts for the soil-erosion tolerance allowed producers.

C.3.2 Air Quality

Control of wind erosion can improve air quality. Benefits generally grouped under the rubric "air quality" include, among other things, decreased cleaning costs due to dust accumulation and health effects. Like water benefits, data is provided on the basis of benefits per ton of soil conserved. These benefit estimates are converted to a per-acre basis using a procedure analogous to that outlined above for water erosion. Ribaudo et al. (1990) developed regional measures of the cost of particulate pollution caused by wind erosion. The cost model is estimated using contingent valuation techniques and data from a survey of households in New Mexico (Huszar and Piper, 1986). Benefit estimates are provided per ton of soil conserved. Per-ton estimates are converted to a per-acre basis using procedures analogous to those used for water erosion.

C.3.3 Soil Productivity

Conservation of soil depth preserves soil productivity. Soils can also lose productivity, in the short run, when nutrient or other costly production inputs are lost with the soil. Reductions in soil erosion will increase the future productivity of farmland and reduce the loss of soil nutrients that can be washed away with the soil. For this study, average losses in soil productivity and nutrients per ton of soil erosion are derived from Ribaudo et al. (1990).

C.3.4 Wildlife Habitat

Benefits used for the calculations in this report are based on an ERS study described in Feather et al. (1999). Benefits are based on *use values*, or the value derived from directly using the resource – specifically for wildlife viewing and pheasant hunting. Although improvements in wildlife habitat benefit a number of avian species, the demand for pheasant hunting was easier to quantify based on existing recreational data. The ERS model evaluates the quantity and quality of the cover available for specific avian species, then estimates the surplus resulting from enrolling land in CRP. Since establishing grassland or forest cover creates suitable habitat for birds, small game, and large game, hunters and wildlife viewers then benefit from these increased populations. The model also incorporates travel costs, landscape diversity, and population density. There are limitations associated with using benefits estimated for the CRP in the context of a working-land program. However, most of the practices that generate wildlife benefits in the working-land context produce wildlife cover similar to that found on CRP land. Grassed waterways, windbreaks, and similar practices generate wildlife benefits in much the same way CRP would. Nonetheless, this report addresses any difference by reducing the wildlife benefits estimated to be generated through CRP by 50 percent.