# Benefit Cost Analysis of the 2002 EQIP Farm Bill Provisions

Jay Atwood[1]

Lynn Knight[2]

Andrea Cattaneo[3]

Peter Smith[2]

*Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Montreal, Canada, July 27-30, 2003*

*[1]USDA, NRCS, Temple, TX ; [2]USDA, NRCS, Washington, DC ; [3]USDA, ERS, Washington, DC*

 *The authors thank David Buland, Anthony Esser, John Stierna, Letitia Toomer, Douglas Vik, and Jan Whitcomb, for their support and insightful comments as members of the USDA EQIP Benefit Cost Assessment team.*

## *Abstract*

Benefit and cost estimates for the Environmental Quality Incentives Program (EQIP) are given. The 2002 Farm Bill increased EQIP funding five fold and allows a broader scope of participation. Estimates for seven classes of environmental benefits and the sensitivity of those estimates to program implementation alternatives are included.

## *Introduction*

Under the 2002 Farm Act, funding for the Environmental Quality Incentives Program (EQIP) was increased five-fold, and key provisions were revised to allow broader participation. EQIP was first funded by the 1996 Farm Act at a level of $200 million per year. The program aims to achieve environmental benefits by providing technical, financial, and educational assistance to farmers with working farmland used for agricultural production. Key features of the original EQIP were that 50 percent of the funds were to be used to address to livestock concerns, states were to establish priority areas which would receive a large portion of the funds, potential participants were allowed to revise (bid down) their required cost share proportion so as to increase the probability of being selected, no participant could receive more than $50,000 in total funding, and large confined animal feeding operations (CAFOs) were excluded from animal waste facility cost share. The 2002 Farm Act increased funding to $5.8 billion over a six-year period, allowed CAFOs to receive animal waste facility cost share, increased to 60% the share of funds to be used to address to livestock concerns, increased the level of allowable funding per participant, and removed the priority area and bid-down provisions.

This paper is based on the Benefit Cost Assessment (BCA) required by Federal regulations prior to establishment of final rules for implementation of a new program. The BCA compares a recommended implementation strategy to the continuation of the old program, and to a variety of possible implementation alternatives. This study is valuable for not only providing guidance for program implementation and improvement, but also for establishing a consistent methodology whereby Benefit Cost assessments of similar programs can be efficiently produced.

The paper discusses how the estimated Benefit Cost (BC) ratios of 2.5 relative to federal funds and 1.5 relative to total cost compare vis-à-vis those for the old program. Ratios of 3.4 and 1.4 for continuance of the old program indicate a more efficient use of federal funds in the old program, but this came at a higher cost to the

economy and a greater share of the burden rested upon farmers installing conservation practices. Another aspect of the new EQIP program that is addressed in the paper is the interaction with other regulations. In this respect, the release of the Environmental Protection Agency´s (EPA) final rule for waste treatment on CAFOs in December of 2002 had a considerable impact on the benefits attributable to EQIP. Since waste management practices will have to be adopted to comply with regulations, the benefits accruing to EQIP cost shared practices on those CAFOs can no longer be attributed to the EQIP program. That ruling lowers the BC ratios to 2.4 relative to federal funds and 1.4 relative to total cost.

In addition to the overall program BC ratios, separate estimates were produced for 7 classes of practices, grouped by the type of environmental benefit produced. For the animal waste treatment practice class, individual estimates were produced for four operation size classes. As expected, the BC estimates vary widely across the practice and size classes, and also for alternative program implementation strategies. A summary of these findings will be useful in highlighting effects of alternative EQIP program decisions yet to be made, as well as serving as input to future legislative debate on conservation programs for working lands.

The procedures for the BCA were as follows. First, data for historically funded practices were obtained, practices assigned to benefit classes, and average per-unit total cost, cost share, and benefit levels calculated. Second, assumptions for the proportion of funds used for technical assistance versus financial assistance, discount and inflation rates, benefit streams over time, and proportion of funds to be allocated to each benefit class and/or operation size class were developed. Third, the BC estimates were produced. Finally, the sensitivity of the BC estimates to changes in these assumptions and other alternatives for program implementation were examined.

In developing this benefit cost analysis for EQIP, the regulation and policy guidance for implementing EQIP in 1996 was considered a baseline. In addition, changes to EQIP, as outlined in the 2002 Farm Act, have been implemented via a Notice of Fund Availability (NOFA) issued in fiscal year 2002. This revision of the program was also used as a basis for comparison; hence a two-tiered approach to the cost-benefit analysis. In order to estimate potential program impacts, several alternatives or variations of EQIP as outlined in the NOFA have been evaluated. Costs and benefits have been quantified where possible. Costs and benefits that could not be adequately or accurately quantified are discussed qualitatively. The result section of the paper is structured according to the following two tiers:

- **Tier One :** The baseline for comparison is the historical EQIP as established in the 1996 Federal Agricultural Improvement and Reform Act. The baseline reflects historical funding levels projected forward along with existing policy. Alternative One consists of EQIP as defined in the 2002 NOFA. The NOFA alternative reflects increased funding levels, no buy-down provision[1], the elimination of priority areas, and maximum payment limitation of $450,000, with a payment cap of 50 percent cost-share for any practices with an actual cost exceeding $100,000, and the inclusion of large confined animal feeding operations (CAFOs). These are the most significant changes in the program legislation in terms of economic costs and benefits.
- **Tier Two:** For the second tier of the cost-benefit analysis, the baseline (EQIP 2002 as outlined in the NOFA) is compared to three alternatives. Comparison of these alternatives represents sensitivity analyses of potential policy impacts of EQIP implementation. The following is a brief description:
    - Alternative One - Varying AFO/CAFO funding allocation by size class
    - Alternative Two - Varying payment limitation between $50,000 and $450,000
    - Alternative Three - Varying methods of environmentally targeting funds such as a spatial evaluation process of farmers' applications, allocating funds by resource concerns, varying cost-share rates by practice, and other options.

The paper concludes by describing briefly the outcome, in terms of expected benefits and costs, of the provisions in the Final Rule for EQIP. This is to highlight the process followed by USDA in determining what implementation provisions to include in the Final Rule. The starting point in the decisionmaking process was the rule as outlined by a strict interpretation of the legislation and the NOFA. After that, the evaluation of feasible alternatives informed potential provisions to include in the Final Rule, and once the Final Rule was formulated, the Benefit-Cost analysis was completed by taking into consideration the additional provisions relative to the NOFA.

This study is valuable both for providing guidance for program implementation and improvement, and for offering insight in how changes in program design affect benefits and costs of agri-environmental programs. The

[1] The buy-down provision of the old EQIP allowed producers to improve the offer index of their applications by reducing the amount of cost share funds they would expect.

complexity of developing a BCA in the case of conservation programs on working lands is recognized, and hopefully the paper will contribute to development of consistent BC assessments of similar programs in the future.

## *Practice Costs, Benefits, and EQIP Fund Shares by Resource Concern*

The Benefit Cost analysis classified practices implemented for EQIP from 1996 through the first quarter of 2002, according to the category of benefits that they were expected to produce, and then evaluated each set of benefits separately. The seven benefit classes to which the practices were assigned were: 1) improved water quality from treating animal waste; 2) sheet and rill erosion reduction; 3) grazing land improvement; 4) water savings from improved irrigation water use efficiency; 5) wind erosion reduction and air quality improvements; 6) fertilizer use efficiency improvements linked to better non-animal waste nutrient management; and 7) wildlife habitat improvement. In addition, animal waste treatment benefits and costs were analyzed separately for operations with less than 300 animal units (AU), 300 to 500 AU, 500 to 1000 AU, and greater than 1000 AU. Determination of per-unit benefits for these practice classes involved development of practice life estimates and use of per-unit benefit estimates from government studies of similar programs.

For these categories of benefits, except for animal waste, the installed practices were used to calculate per-unit cost share and total cost, then all the contracted practices (not necessarily installed) were used to calculate benefit categories of overall EQIP cost share. Data for the costs of animal waste treatment were taken from the USDA CNMP Cost and Capability Assessment. The "installed practices" data were used for calculating cost share because it included the total costs reported by the producers.

**Sheet and Rill Erosion (USLE) Reduction**

Table A1 lists the practices that were classified as reducing sheet and rill soil erosion when applied either by themselves or in combination with each other. A few of these practices used to prevent soil eroded from a land area from leaving the area are not reported in acreage units, therefore assumptions were used to convert the units of treatment (generally linear feet, as in feet of terraces) to acres treated. It was assumed that on average, 1.5 practices were applied per acre. With these calculations, by the first quarter of 2002, these practices had been implemented on 887 thousand acres.

Table A1 indicates that historically these practices received 8.4 percent of EQIP cost share funds and had an average cost share of $27.81 per acre while the average total cost was $63.81 per acre (excluding the cost of government provided technical assistance). Note that these costs are not an "annual" cost, but rather a "contract" cost and reflect the total cost of applying the practice as contracted, i.e., perhaps the sum of costs over three or four years. The data indicate the most prevalent practices in terms of acres protected were Residue Management associated with use of No-Till, Strip Till, and Mulch Till. The most extensive practices in terms of EQIP expenditures for erosion reduction were Reduced Till Residue Management and Terracing, accounting for 67 percent of the expenditure in this natural resource concern category.

The original EQIP program funded 23 practices that had a primary effect of reducing sheet and rill erosion, with an average practice life of 5.1 years. EQIP program data indicated that these practices cost $85.08 per acre with a historical cost share average of $27.81, that 8.4 percent of overall program funds went to these practices, and that erosion reductions were 8.6 tons per acre per year. The total benefit estimate of $43.00 per acre per year was based on the 8.6 ton per acre erosion reduction and benefit estimates of $4.30 per ton from ERS studies of the Conservation Reserve Program (CRP), and $0.70 per ton for on-site saved soil productivity and nutrients. With the data from Feather *et al*. (1999) and Claassen *et al.* (2001), the per-acre benefit estimate for USLE reductions is calculated to be, in per-acre annual benefits, $0.86 for saved soil productivity, $5.16 from reduced loss of nutrients, and $36.98 from improved water quality, for a total of $43.00.

The benefits estimates used from Feather et al. (1999) were mostly accounted for by: (i) public works cost reduction for sediment based on a 45 million acre CRP with soil erosion reductions of 750 million tons per year, $3,029 million; (ii) recreation, $8,676 million, estimated partially based on CRP enrollments of 45 million and 34 million acres, depending upon the type of recreation benefit derived. In a study of alternative ways of providing incentives to farmers for environmental improvements, Claassen *et al*. (2001) estimated benefits for both the CRP and for Conservation Compliance. For CRP they found 406 million tons of erosion reduction annually, but this they explained was likely an underestimate for several reasons. Using 33 million acres, the mid-point of the range of 30 to 36 million acres enrolled since program inception, the per-acre reduction is 12.3 tons per acre. Feather et al. (1999) reported a greater reduction, however, one must consider that it was based on original program estimates when enrollment priority was given to erosion reductions. Claassen *et al.* reported benefits of $694 million per year

for reduced soil erosion and $704 million per year for improved wildlife habitat. The total of $1,398 million annual benefits is equivalent to $3.44 per ton of rate reduction, or $42.31 per acre.

For on site productivity losses, two major components were included: first, the loss in productive value as the topsoil is eroded away; secondly, the value of the lost nitrogen and phosphorus fertilizer carried away with the topsoil. In the ERS Agricultural Resource and Environmental Indicators (AREI, 1997) publication a methodology for valuing productivity losses from erosion is given. In general terms, that method assumes linear productivity decreases as the topsoil layer of is eroded away.

**Grazing Land Productivity Improvements**

Table A2 shows a list of EQIP practices classified as having an impact on grazing land productivity, accounting for 3.2 million acres of implemented treatment. Since it is rare that only single grazing related practices are installed, it was assumed that the average treated acre would use 1.5 of the listed practices. Average cost share and total cost were $19.46 and $55.24, for an average cost share of 35.2 percent. The share of these practices in overall EQIP funding was 21.4 percent. Note that as in the case of the USLE reduction, some practices were in non-acre units and a conversion factor was used to estimate the number of non-acre units used to treat an average acre. For grazing land, the practices counted were those resulting in increased forage production. Practices expected to provide benefits in other environmental areas (such as wildlife habitat and water quality) are partly accounted for in the other benefit categories. Some practices were assumed "associated" with practices directly benefiting productivity improvements and were included, such as fencing and land clearing. The practices included in this benefit category were estimated to account for 21.4 percent of EQIP funds under the old program.

Namken and Flanagan (2000) report that practices such as these resulted in an average productivity increase of 1.3 Animal Unit Months (AUMs) per acre, and that the AUMs were valued at $11.10 each, resulting in per acre value of $14.43. The $14.43 value was updated from year 2000 to year 2002, assuming 2 percent inflation per year, which results in a 2002 grazing land improvement benefit of $15.01 per acre. It is probable that many of these practices were implemented in situations where the primary and or secondary purposes were something other than improved forage production, such as for wildlife habitat or water quality enhancement; however, those benefits could not be accounted for.

**Irrigation Water Savings**

Table A3 shows the practices assigned to the benefit category of irrigation water savings. Under the old program these practices accounted for 15.9 percent of the funds. The program treated 4.5 million acres (implemented No. Units) with a cost share of $14.12 per acre and total cost of $40.61 per acre. Table A3 shows that a large set of practices reported in units rather than by acres, but it can be assumed that these practices were "associated" with the per-acre practices. Therefore, their costs were added to the sum of costs across treated acres. Analysis of NRCS agency Performance Resource Management System (PRMS) data indicated that historical EQIP irrigation practices had resulted in a net savings of 5.41 acre-inches per acre.

Presumably, any water saved would be available for alternative uses such as by municipalities, utility generation, and wildlife habitat enhancement. Therefore, a possible value that could be assigned to the saved water is the price that competing uses would be willing to offer. Since those prices are not available, the saved water was valued conservatively at the average that the farmers have paid or expended to obtain the water. It is assumed that the farmers could achieve a net reduction in irrigation water used by any or all of the following three methods:

- Convert from irrigation to dryland production;
- Convert to a crop or land use requiring smaller applications of water; and
- Maintain the same crop, but improve irrigation efficiency.

The ERS AREI publication reported 29.8 million acres irrigated with groundwater having acquisition cost of $32/acre foot and 15.1 million acres irrigated with off-farm surface water at $41/acre foot, including supply cost and variable cost. The weighted average value of the water is then $35.03. Updating for four years of inflation at 2% to update, from 1998 to 2002, results in an estimated cost of $37.91/acre foot. Given the 5.41 acre-inch savings per year reporte in the PRMS and assuming a 20 percent loss in storage and transmission, this results in an annual per-acre benefit of $13.68.

**Air Quality**

Data on the link between agricultural practices and air quality sufficient to support a national level benefit assessment are limited to the benefits arising from erosion control and the resulting improvement in air quality. Other practices funded through EQIP are expected to contribute to air quality improvements even though the

benefits could not be numerically quantified for this study. These other non-quantified beneficial effects include dust control in animal feeding operations and reductions in the emissions of NOx, organic compound, and ozone precursor and depleters through both improved animal feeding practices and crop nutrient management. In addition, the wildlife habitat and range improvement practices are expected to increase carbon sequestration while the residue and tillage practices associated with erosion control are expected to reduce oxidation of carbon from cropland, and in some cases, actually increase carbon sequestration on those lands.

Table A4 shows the practices assigned to the benefit category of reducing wind erosion and improving air quality. These practices historically accounted for 5.8 percent of EQIP cost share funds and had an average total cost of $25.25 per acre, with $8.64 of cost share. Reduced tillage is a practice that greatly reduces wind erosion, however, the beneficial effects vary greatly across the U.S., and are greatest in the dryer regions. To reflect the fact that some acreage of reduced tillage practices occur in areas where wind erosion is not a problem, only the reduced tillage practices in the Pacific, Southern and Northern Plains and Mountain regions were assumed to provide air quality benefits. The proportion of national reduced tillage acres (Crop Residue Management Survey) occurring in these regions (43 percent) was calculated and used as a factor to reduce treated acreage in Table A4. This level of funding has provided treatment to an estimated 2.7 million acres.

The key element in the air quality benefits analysis is the estimate by Ribaudo and others (1989) that the CRP program provided a U.S. average of $25 per acre in NPV of benefits due to reduced soil erosion (improved air quality). The estimates ranged from $0 in the Appalachia, Corn Belt, Delta States, and Lake States, up to $52 in the Mountain states. The Ribaudo study included the effects of "particulate-related costs imposed on those who live or work downwind from blowing soil. Such costs include increased cleaning and maintenance for businesses and households, damages to nonfarm machinery, and adverse health effects" (Ribaudo et al., p. 422). For the EQIP program assessment, it was assumed that where applied, the practices listed in Table A4 provide the same level of benefits to air quality (same levels of erosion control and reduction in offsite damages) as did the CRP. The $25 per acre value from Ribaudo et al. is updated with data from the consumer price index for the years of 1988 to 2001. During that period the index increased from 118.3 to 177.1 (a 1982-84 average base), for a percent increase of 49.7. Therefore, the per-acre NPV is $37.43. However, to insert this in the worksheet using the same methodology as for the other categories of benefits, that NPV value of $37.42 was analyzed assuming a 10-year horizon at a 7.0 percent discount rate, which resulted in $4.98 per acre per year.

**Non-Animal Waste Nutrient Management**

For improved nutrient management, only one practice applies: "590 nutrient management". Treated acres totaled 4.4 million. Analysis of EQIP historical data showed that 72 percent of this practice's acres (i.e., 3.2 million acres) were for nutrient management not associated with land application of animal waste. The average cost share for this practice was $2.96 per acre while the total cost was $6.11 per acre. Non-animal waste nutrient management practices accounted for 3 percent of the 1996-2001 program funds and were estimated to account for 1.9 percent of the EQIP funds under the 2002-2007 program. The benefit estimate was based on fertilizer savings as described below.

Since many producers tend to over apply fertilizers, on-farm benefits associated with nutrient management are assumed to be the result of cost savings through the reduction of purchased mineral fertilizer inputs. Available information documenting reductions in nutrient use associated with the adoption of nutrient management practice in accordance with NRCS standards is somewhat limited. Some individual states have interviewed producers to obtain this information, however the sample size is relatively small, and not necessarily geographically distributed. Here we relied on a 1998 Economic Research Service study (Christensen *et al*., 1998) that surveyed 890 producers in 16 states.

Developing a composite application rate of those who adopt nutrient management according to NRCS standards compared to those producers who do not follow NRCS 590 results in the net reductions in application rates reported in Table 1.

**Table 1 Reduced Corn Fertilizer Input Costs per Acre with Adoption of Nutrient Management According to NRCS Standards**

| Item | Non Adopters | Adopted NRCS 590 Standard | Net Reduction Due to Adoption of NRCS 590 | Price Per Unit of Input ($/acre) | Cost Savings ($/acre) |
|---|---|---|---|---|---|
| Nitrogen (lbs.) | 155 | 130 | 25 | 0.15 | 3.73 |
| Phosphorus (lbs.) | 58 | 53 | 5 | 0.25 | 1.23 |
| Potash (lbs.) | 84 | 71 | 13 | 0.13 | 1.74 |
| Total Savings | | | | | 6.70 |

Prices for nutrients applied to cropland can vary based on the form in which the nutrients are applied. Anhydrous ammonia, for example, is less expensive than other forms of nitrogen. Nitrogen is the nutrient that exhibits the greatest price variation between commonly applied forms of the input. For the purposes of this

analysis, prices of nutrients are set based on data from the National Agricultural Statistics Service (NASS, 2002). The prices per unit are derived from the national average cost per ton of various commercial product prices based on the percentage of nutrient contained in a ton. Only mineral fertilizers that were applied as a single nutrient were used to determine nutrient price values. For the purposes of this analysis, nitrogen is valued at $0.149 per pound (based on the national average price for anhydrous ammonia[2]), phosphorus at $0.246 per pound (based on the national average price for super phosphate), and potash at $0.134 per pound (based on the national average price for 0-0-62). These estimated per pound benefits translate into per acre cost savings shown in the last column of Table 1.

**Wildlife Habitat**

Table A5 shows that practices benefiting wildlife habitat improvement accounted for 5.5 percent of EQIP cost share funds historically. As in the case of irrigation, a subset of practices whose units could not be converted to acres was associated with the per-acre practices. Their costs were included in the computations. The average cost share was $9.83 per acre while the total cost was $21.58 per acre. Table A5 defines the average life of the practices and the benefit stream over time, similarly to those of the previously discussed benefit categories.

The Environmental Quality Incentives Program is designed to provide multiple levels of beneficiary impacts to the environment through the implementation of conservation practices and systems. As stated in legislation describing EQIP purposes, benefits include positive impacts to wildlife. Generally, the Environmental Quality Incentives Program focuses on erosion and water quality environmental concerns in areas where significant natural resource problems exist. However, these issues have a direct impact on wildlife and the conservation practices often provide important habitat[3]. The program also provides opportunities for direct assistance with wildlife habit management and wetland habitat management. Fish and wildlife benefits accrue based on the types of practices installed with the EQIP. The primary practices are conservation buffer practices, fencing, ponds, upland wildlife habitat management and wetland restoration and management.

---

[3] Gray, Randall; "EQuiPping Your Partners" Bird Conservation, Issue 11, 1999

A review of available literature indicates that a great deal has been written about the values of wildlife conservation (Gibilisco and Filipek,). The National Survey of Fishing, Hunting, and Wildlife Associated Recreation conducted by the U.S. Dept. of the Interior, Fish and Wildlife Service contains extensive data on expenditures relating to the availability of wildlife-based activities.

For the purpose of this analysis, benefits are calculated based on results from an ERS study described in Feather *et al*. Benefits are based on *use values*, or the value derived from directly using the resource. Specifically, benefits are calculated 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 converting land to CRP. Hunters and wildlife viewers benefit from increased wildlife populations through the creation of suitable habitat for birds, small game, and large game, by restoring grassland or forest cover (Feather, p. 10). The model also incorporates travel costs, landscape diversity, and population density.

Limitations associated with calculating benefits for EQIP based on the CRP, are summarized in the following matrix:

| CRP | EQIP |
|---|---|
| • Land retired from production | • Land remains in agricultural production |
| • Minimum contract length of 10 years | • Average contract length based on historical participation is 4-6 years |
| • Emphasis on marginal land | • Emphasis on productive land with treatment needs |

Practices beneficial to wildlife, primarily those that improve cover, are listed in Table A5 based on the projected number of acres in future program implementation years. The annual benefits for improved wildlife habitat considered here involve two components: improved wildlife viewing ($10.02) per acre and improved pheasant hunting ($2.36) per acre. These benefit estimates were reduced 50 percent to account for factors such as expected lower per-acre benefits on "working" lands versus retired lands, different spatial proximity of EQIP lands compared to CRP lands, shorter contract length, etc.

A number of practices benefit wildlife populations by reducing soil erosion and improving aquatic habitat, however these benefits are already quantified in the water quality section of the analysis. Impacts of many other

practices that may be managed for wildlife are not included. These include pasture and hay land planting, fencing, and ponds. Other recreational activities are not covered such as nature walking, or big game hunting. In addition, *nonuse values* are not quantified, nor were values given to the existence of an environmental resource even though it is not currently used, such as existence value bequest value, or option value (Smith, 1996).

For purposes of this analysis, benefits accruing to wildlife purposes are calculated for three specifically defined uses. Although the resulting benefits are high, they are based on actual expenditure or use data for the identified recreational purposes, and the surplus resulting from EQIP. There are significant benefits for other uses that are not quantified, small, and large game hunting, for example. Benefits that are more difficult to quantify are also not included. The benefits are non-monetary and include values given to existence of resources not currently used.

**Estimating the Benefit Cost Ratios – Additional Assumptions**

Table 2 lists some parameters that are held constant across all categories of benefits for the benefit cost ratio calculations and referenced by the worksheet tables of this assessment:

1. The historical average cost of providing Technical Assistance (TA) has been estimated to be equal to 26 percent of EQIP funds;
2. Practice cost share was assumed to continue at historical levels for the continuation of the 1996 program, to be 75 percent for the program envisioned immediately after the 2002 Farm Act, and to be somewhere in between the previous two cases for the Final Rule version of the 2002 program;
3. To account for increasing of the share of EQIP funds devoted to livestock *waste treatment* to 50 percent for the new program scenarios, the shares of EQIP funds for each of the other benefit categories was reduced to 64.4 percent of what it had been;
4. For land treatment practices the varying contract lengths and flow of benefits over time were explicitly accounted for as previously described; for ease of calculation they were repeated in this table;
5. A discount factor of 7 percent was used for calculating Net Present Values of cost and benefit streams to reflect the time value of money, and an inflation factor of 2 percent was also assumed;
6. EQIP fund availability is as shown in Table 2, with the Klamath valley and irrigation water savings designated funds considered as an "add-on" to the overall pool of funds for EQIP. For 2002, $2.25

million of the Klamath funds will be distributed. It was assumed that the remainder of the funds would be evenly distributed over the remaining 5 years of the program; and

7. A scenario of continuing old rules with a level funding of $200 million per year was used as the benchmark for this analysis.

**Table 2. Key assumptions and constants used throughout the benefit cost spread sheet analysis**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Proportion of EQIP for Technical Assistance | 0.26 | | | | | | |
| Proportion of EQIP for Cost Share | 0.74 | | | | | | |
| | USLE Reduction | Grazing Productivity | Water Savings | Wind Erosion | Non-waste Nutrient | Wildlife Habitat | Livestock-related |
| Historical share of funds | 0.084 | 0.214 | 0.159 | 0.058 | 0.030 | 0.055 | 0.400 |
| Share of funds (according to 2002 legislation/NOFA) | 0.054 | 0.138 | 0.102 | 0.037 | 0.019 | 0.036 | 0.613 |
| Share of funds: Final EQIP rule | 0.064 | 0.117 | 0.121 | 0.032 | 0.023 | 0.030 | 0.613 |
| Historical cost share | 0.33 | 0.35 | 0.35 | 0.34 | 0.48 | 0.46 | 0.63 |
| Cost share (according to 2002 legislation/NOFA) | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| Cost share: Final EQIP Rule 2002 | 0.65 | 0.55 | 0.65 | 0.55 | 0.65 | 0.55 | 0.65 |
| Proportion of full benefits over 10 years by benefit class | | | | | | | |
| (funds contracted in year 1): | USLE Reduction | Grazing Productivity | Water Savings | Wind Erosion | Non-waste Nutrient | Wildlife Habitat | |
| Average Practice Life | 5.1 | 12.4 | 18.3 | 7.8 | 5.0 | 12.8 | |
| Year 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Year 2 | 0.9 | 1.0 | 1.0 | 0.7 | 1.0 | 0.5 | |
| Year 3 | 1.0 | 1.0 | 1.0 | 0.8 | 1.0 | 0.7 | |
| Year 4 | 1.0 | 0.9 | 1.0 | 0.8 | 1.0 | 0.8 | |
| Year 5 | 0.9 | 0.9 | 1.0 | 0.9 | 0.5 | 0.9 | |
| Year 6 | 0.8 | 0.8 | 1.0 | 0.8 | 0.3 | 1.0 | |
| Year 7 | 0.7 | 0.8 | 1.0 | 0.7 | 0.2 | 0.9 | |
| Year 8 | 0.6 | 0.7 | 1.0 | 0.7 | 0.1 | 0.9 | |
| Year 9 | 0.5 | 0.7 | 1.0 | 0.6 | 0.0 | 0.9 | |
| Year 10 | 0.5 | 0.6 | 1.0 | 0.5 | 0.0 | 0.9 | |
| Combining stream of benefits and discount factors | 5.11 | 5.63 | 6.44 | 4.78 | 3.42 | 5.38 | |
| Discount factor plus 1.0 (7.0%) | 1.070 | | | | | | |
| Composite 10 year discount factor (7.0%) | 7.515 | | | | | | |
| Anticipated Inflation Rate (2.0%) | 1.020 | | | | | | |
| Combined discount & inflation plus 1 (9.0%) | 1.090 | | | | | | |
| Composite 10 year discount factor (9.0%) | 6.995 | | | | | | |

Table 2 (continued). Key assumptions and constants used throughout the benefit cost spread sheet analysis

| **EQIP Program Funds (millions):** | | | |
|---|---|---|---|
| **year** | New | Irrigation Water Savings | Old |
| 2002 | 400 | 27.25 | 200 |
| 2003 | 700 | 54.55 | 200 |
| 2004 | 1000 | 69.55 | 200 |
| 2005 | 1200 | 69.55 | 200 |
| 2006 | 1200 | 69.55 | 200 |
| 2007 | 1300 | 69.55 | 200 |
| Total | 5800 | 360 | 1200 |

| **Resource totals (Agricultural Statistics, 2001):** | |
|---|---|
| Used for crops | 348,701,000 |
| Used for grazing | 647,677,000 |
| Irrigated land in farms | 55,058,000 |

**Per unit benefits used in analysis**

| | ($/Acre) | | | | | | ($/AU) |
|---|---|---|---|---|---|---|---|
| | USLE Reduction | Grazing Productivity | Water Savings | Wind Erosion | Non-waste Nutrient | Wildlife Habitat | Livestock-related |
| **Benefit per acre (in base analysis)** | 43 | 15.01 | 13.68 | 4.98 | 6.7 | 6.19 | 46.63 |

In addition, the interpretation of the stream of individual practice benefit values in tables A1-A5 is the proportion of full benefits occurring in the year indicated. It was assumed that no benefits would occur in the first year, since during that year the contract would likely not be finalized until mid-year and implementation would start at some time after that.

## Land Treatment Benefit Cost Ratios

Tables 3 and 4 show the estimated benefits and costs for the land treatment benefit categories under the old program and new program scenarios. Note that for the new program relative to the old, the benefits and treated acres do not all expand at the same proportion due to the differing cost share percent across practices for the old program (uniformly 75% for the new program). Also, note that even though per-acre total treatment cost is unchanged, the BC ratios relative to total cost decrease since with a higher cost share while the Technical Assistance (TA) percent of EQIP funds remains constant, the TA per unit treated is increased. The major findings are given in the following lists. A more detailed discussion of selected benefit categories follows the lists.

**Table 3. Calculation of Benefit Cost ratios for EQIP funded land treatments, by benefit category for old program**

| | Benefit Categories[a] | | | | | | |
|---|---|---|---|---|---|---|---|
| Fund Year | USLE Reduction | Grazing Productivity | Irrigation Water Savings | Wind Erosion | Non-waste Nutrient | Wildlife Habitat | Selected[c] Totals |
| Analytical Parameters[b] | | | | | | | |
| Share of EQIP funds | 0.084 | 0.214 | 0.159 | 0.058 | 0.030 | 0.055 | 0.600 |
| Benefit per acre | 43.00 | 15.01 | 13.68 | 4.98 | 6.70 | 6.19 | |
| Total Cost per acre | 63.81 | 55.24 | 40.61 | 25.25 | 6.11 | 21.58 | |
| Cost Share per acre | 20.86 | 19.46 | 14.12 | 8.64 | 2.96 | 9.83 | |
| EQIP Cost Share Funds: 2002-2007 ($mill/yr.): | 12.4 | 31.7 | 23.5 | 8.6 | 4.4 | 8.2 | 88.8 |
| Total ($million) | 74.7 | 190.0 | 141.1 | 51.4 | 26.6 | 49.2 | 533.0 |
| Total Acres Treated: | 3,408,496 | 9,297,672 | 9,512,189 | 5,668,735 | 8,570,189 | 4,763,107 | 41,220,389 |
| NPV (2002) Total Benefits | 639,697,907 | 670,768,948 | 715,574,824 | 115,265,132 | 167,342,919 | 135,351,031 | 2,444,000,761 |
| NPV (2002) EQIP Cost | 85,763,043 | 218,217,651 | 162,061,541 | 59,073,289 | 30,601,185 | 56,498,968 | 612,215,676 |
| NPV(2002) Total Cost | 106,706,377 | 271,506,402 | 201,636,970 | 73,498,986 | 38,073,994 | 70,296,016 | 761,718,745 |
| Net Benefits over EQIP Cost | 553,934,864 | 452,551,297 | 553,513,283 | 56,191,843 | 136,741,734 | 78,852,063 | 1,831,785,084 |
| Net Benefits over Total Cost | 532,991,529 | 399,262,546 | 513,937,854 | 41,766,146 | 129,268,925 | 65,055,015 | 1,682,282,016 |
| Benefit Cost Ratios: | | | | | | | |
| For EQIP Funds | 7.5 | 3.1 | 4.4 | 2.0 | 5.5 | 2.4 | 4.0 |
| For Total Cost | 6.0 | 2.5 | 3.5 | 1.6 | 4.4 | 1.9 | 3.2 |

[a]Benefits may be added across columns (categories) since some practices provide benefits in several categories, but adding across for costs would result in double counting;

[b]Other key parameters are listed in Table 2.

[c]This total involves double counting of costs to the extent that treated acres for a given practice are included in more than one benefit category.

Table 3 shows under continuance of the old program the following is estimated to occur:

- 3.4 million acres would be newly treated for USLE reduction, generating $640 million in total benefits, or $533 million in net benefits over total cost;
- 9.3 million acres of grazing land would be newly treated, generating $671 million in total benefits, or $272 million in net benefits over total cost;
- 9.5 million acres of irrigated land would be newly treated, generating $716 million in total benefits, or $514 million in net benefits over total cost;

- Wind erosion would be reduced on 5.7 million acres, providing total benefits of $115 million, or $42 million in net benefits over total cost, and BC ratios of 2.0 and 1.6 relative to EQIP funds and total costs;
- Total fertilizer savings valued at $167 million, or $129 million in net savings over total cost would be generated on 8.6 million acres through improved nutrient management;
- Total wildlife benefits of $135 million, or $65 million in net benefits over total cost, would be generated on 4.8 million acres of crop and grazing land;
- Land treatment overall would account for 60% of EQIP cost share funds, treating 41.2 million acres, and generating $2.4 billion in total benefits, or $1.7 billion in net benefits over total cost.

Table 4 shows that under the new program the following is estimated to occur:

- 4.6 million acres would be newly treated for USLE reduction, generating $827 million in total benefits, or $506 million in net benefits over total costs;
- 13.4 million acres of grazing land would be newly treated, generating $934 million in total benefits, or $118 million in net benefits over total costs;
- 24.8 million acres of irrigated land would be newly treated, generating $1,803 million in total benefits, or $694 million in net benefits over total cost;
- Wind erosion would be reduced on 8.0 million acres, providing total benefits of $156 million, or $-64 million net benefits over total cost;
- Total fertilizer savings valued at $321 million, or net benefits over total cost of $206 million would be generated on 17 million acres through improved nutrient management;
- Total wildlife benefits of $244 million, or net benefits over total cost of $33 million, would be generated on 8.9 million acres of crop and grazing land;
- Land treatment overall would account for 38.7% of EQIP cost share funds, treated 76.7 million acres, and generated a total of $4.3 billion in benefits, or $1.5 billion in net benefits over total cost..

**Table 4. Calculation of Benefit Cost ratios for EQIP funded land treatments, by benefit category for re-authorized program (NOFA)**

| | Benefit Categories[a] | | | | | | |
|---|---|---|---|---|---|---|---|
| Fund Year | USLE Reduction | Grazing Productivity | Irrigation Water Savings | Wind Erosion | Non-waste Nutrient | Wildlife Habitat | Selected[c] Totals |
| Analytical Parameters[b] | | | | | | | |
| Share of EQIP funds | 0.054 | 0.138 | 0.102 | 0.037 | 0.019 | 0.036 | 0.387 |
| Benefit per acre | 43.00 | 15.01 | 13.68 | 4.98 | 6.70 | 6.19 | |
| Total Cost per acre | 63.81 | 55.24 | 40.61 | 25.25 | 6.11 | 21.58 | |
| EQIP Cost Share Funds: 2002-2007 ($mill/yr.): | 16.0 | 40.8 | 57.5 | 11.0 | 5.7 | 10.6 | 141.7 |
| Total ($million) | 232.4 | 591.3 | 799.1 | 160.1 | 82.9 | 153.1 | 2018.9 |
| Total Acres Treated: | 4,574,842 | 13,446,541 | 24,757,906 | 7,964,476 | 17,047,884 | 8,912,573 | 76,704,222 |
| NPV (2002) Total Benefits | 826,607,740 | 933,943,514 | 1,802,986,535 | 155,912,257 | 320,478,350 | 243,829,121 | 4,283,757,516 |
| NPV (2002) EQIP Cost | 257,171,161 | 654,352,796 | 889,205,006 | 177,138,612 | 91,761,462 | 169,419,190 | 2,239,048,226 |
| NPV(2002) Total Cost | 320,606,714 | 815,759,819 | 1,108,542,241 | 220,832,802 | 114,395,956 | 211,209,257 | 2,791,346,789 |
| Net Benefits over EQIP Cost | 569,436,579 | 279,590,718 | 913,781,528 | -21,226,354 | 228,716,888 | 74,409,931 | 2,044,709,290 |
| Net Benefits over Total Cost | 506,001,026 | 118,183,695 | 694,444,294 | -64,920,545 | 206,082,394 | 32,619,864 | 1,492,410,728 |
| Benefit Cost Ratios: | | | | | | | |
| For EQIP Funds | 3.2 | 1.4 | 2.0 | 0.9 | 3.5 | 1.4 | 1.9 |
| For Total Cost | 2.6 | 1.1 | 1.6 | 0.7 | 2.8 | 1.2 | 1.5 |

[a]Benefits may be added across columns (categories) since some practices provide benefits in several categories, but adding across for costs would result in double counting;

[b]Other key parameters are listed in Table 2.

[c]This total involves double counting of costs to the extent that treated acres for a given practice are included in more than one benefit category.

Reductions in water-induced erosion produced the largest net benefits of $394 over EQIP costs, and $373 over total cost overall for the old program scenario (Table 3). The net benefits for the new program are estimated to be $363 million relative to EQIP funds and $300 million relative to total costs (Table 4) for USLE reduction. These practices are estimated to receive 8.4 percent of EQIP funds under the old program and 5.4 percent under the new program. These high net benefits are driven primarily by the large erosion reductions found for EQIP practices, 8.6 tons per acre per year. A possible caveat to this analysis is that the estimate of benefit per ton is a national average. EQIP treated acres were only a very small proportion of national acreage. However, under the assumption that EQIP funds were used first in the situations where benefits would be largest, perhaps our estimates are low. Also, not accounted for in the benefit estimate with the old program scenario are the non-cost share practices that

producers often included in their contracts to increase their score and chances of being funded. Total benefits for land treatment are discussed in the final summary, in combination with the animal waste treatment benefits. Table 5 illustrates the percent of resources treated historically and in the old and new alternatives.

The relatively small proportions of the resource being treated, except for irrigated land supports the assumption that benefits and costs per unit of treatment can be considered constant for the level of treatment considered. Even with the irrigation water, the reduction in use per-acre is a fraction of average use per acre, so it is unlikely the price of water would be affected.

**Table 5. Estimate of land resource units treated according to EQIP benefit category**

| | Historical EQIP (Implemented as of Q1, 2002) | Previous rules and funding at $200 million per year for 2002-2007 | Rules and Funding According to the 2002 Legislation |
|---|---|---|---|
| Cropland, total | 348,701,000 | 348,701,000 | 348,701,000 |
| Treated for USLE reduction | 1,182,274 | 3,408,496 | 4,574,842 |
| % of total | 0.34 | 0.98 | 1.31 |
| Treated for wind erosion reduction (air quality) | 2,688,003 | 5,668,735 | 7,964,476 |
| % of total | 0.77 | 1.63 | 2.28 |
| Treated for Non-waste nutrient management | 4,568,111 | 8,570,189 | 17,047,884 |
| % of total | 1.31 | 2.46 | 4.89 |
| Irrigated Land, total | 55,058,000 | 55,058,000 | 55,058,000 |
| Treated for net irrigation water reduction | 4,582,244 | 9,512,189 | 24,757,906 |
| % of total | 8.32 | 17.28 | 44.97 |
| Grazing Land, total | 647,677,000 | 647,677,000 | 647,677,000 |
| Treated for grazing productivity | 3,165,652 | 9,297,672 | 13,446,541 |
| % of total | 0.49 | 1.44 | 2.08 |
| Crop and Grazing land, total | 996,378,000 | 996,378,000 | 996,378,000 |
| Treated for wildlife habitat improvement | 1,621,295 | 4,763,107 | 8,912,271 |
| % of total | 0.16 | 0.48 | 0.89 |

**Animal Waste Treatment**

The analysis of animal waste treatment was handled differently in one important aspect than were the other benefit categories. Since there is flexibility at the state level for the allocation decision of funds to different size

categories of animal feeding operations (AFOs), it was not possible to know in advance what the mix of size categories would be. The treatment costs differed greatly on a per animal unit (AU) basis across the size categories. Consequently, the analysis was performed separately for each size category, under the assumption that one percent of the EQIP funds would be allocated to that category. In order to develop an estimate of the overall benefits of the EQIP program, assumptions were made about how the funds could be distributed across different size classes of AFOs for the two main scenarios. For the old program, the 22.5 percent of total EQIP funds used for animal waste treatment were split equally across the three smaller size categories. For the new program, it was assumed that 50% of the EQIP funds are split equally across all four size categories. The estimates of the number of AUs, AFOs, and the cost of treatment for the alternative scenarios in this analysis are all taken from the USDA Comprehensive Nutrient Management Plan (CNMP) Cost and Capability Assessment.

The 2002 EQIP legislation mandates that 60% of EQIP funds will be spent on livestock related issues. It also eliminates the prohibition against funding for large confined feeding operations (CAFOs). A joint USDA and EPA policy initiative establishes the objective that all AFOs will implement Comprehensive Nutrient Management Plans (CNMPs). Consequently, it is expected that as much as 50% of total EQIP funds may be devoted to waste management handling for animal feeding operations (AFOs).

In the past, the question of double counting of benefits of EQIP has been raised (Powell and Wilson, 1997), i.e., should the benefits accruing from the EQIP expenditure be attributed to the regulatory requirements or to EQIP, since the management change would have to happen with or without the EQIP assistance. Since this analysis is by AFO size class, the benefits attributable to the EPA CAFO regulations can be separated from the benefits of EQIP. Benefits from treating the >1000 AU class are attributed to the EPA CAFO rule rather than EQIP.

EPA conducted a benefit assessment of their proposed CAFO regulatory changes (U.S.EPA, 2001). The approach converted monetary benefit estimates to a per-animal unit basis and then applied those per-unit estimates to the number of animal units estimated to be treated with the EQIP funds.

**EPA Estimate of Benefits from CAFO Animal Waste Treatment**

The EPA study was not a comprehensive estimate of all benefits expected to result from animal waste treatment, but rather an inclusion of the major categories of benefits for which data and methodology were

available.[4] The categories of benefits included, and the range of benefits across the EPA alternatives (annual, 1999 dollars) accruing from each category were:

- Improvements in water quality and suitability for recreational activities ($5 to 145 million);
- Reduced incidence of fish kills (up to just over $1 million);
- Improved commercial shell fishing ($2 to 3 million); and
- Reduced contamination of private wells ($70 to 77 million).

Since the definition of animal units and CAFOs differed between the USDA and EPA studies, the first step in this analysis was to compare the differing estimates of number of CAFOs between the EPA and USDA studies, as shown in Table 6. The estimates are very similar for all classes except the class representing operations with less than 300 animal units, which were not addressed in the EPA benefits estimate.

The second step was to make an assumption about how the additional treated AFOs were distributed across the size classes (Table 7). This assumption was necessary because the EPA report only gave the total number of

[4] EPA proposed eight different alternatives or scenarios for ways that the CAFO related regulations could be changed to reach more of the animal feeding operations whose animal waste is responsible for water quality problems. Here we present only those results that are relevant to the benefit measure adopted in the benefit cost analysis. This consists of EPA Scnario 2/3 incorporating a baseline assuming that CAFOs include all AFOs with over 1,000 AUs, as well as AFOs with fewer AUs that meet certain requirements, and including above and beyond the baseline dry poultry and immature swine and heifer operations, and a set of rules for identifying CAFOs among the AFOs having size between 300 and 1000 AUs. The reader should consult the full Benefit Cost assessment for a complete overview of the EPA analysis as it relates to EQIP.

CAFOs to be regulated. The basic assumption was that in all scenarios, the remainder of the large CAFOs (over 1000 AUs) would all be treated, and that the additional AFOs would come from the 300 to 1000 AU class. The third step was to calculate from the EPA data the additional percent of each size class that would be "newly" regulated under each scenario, as shown in Table 7. Note that Table 7 also shows the EPA estimated benefits for their alternative scenarios.

**Table 6. Comparison of EPA, CAFO, and USDA estimates of number of livestock feeding operation**

| | Number of Operations | | | |
|---|---|---|---|---|
| Size Class | EPA | USDA | Number of Animal Units[a] (USDA) | USDA AU per AFO |
| > 1000 | 12,850 | 11,398 | 22,788,043 | 1999.3 |
| 500 to 1000 | | 15,614 | 5,584,475 | 357.7 |
| 300 to 500 | | 17,354 | 4,272,773 | 246.2 |
| 300 to 1000 | 28,150 | | | |
| < 300 | 334,740 | 212,835 | 17,115,899 | 80.4 |
| Total | 375,740 | 257,201 | 49,761,190 | |

Source: U.S. EPA, 2001; USDA, 2002

[a]Note, both these studies used the official EPA Animal Unit (AU) definitions.

The fourth step was to apply the percent of newly regulated AFOs to the number of AUs by class from the USDA study (EPA did not report the number of AUs), and then divide the EPA benefit estimates by the number of newly regulated AUs to get an estimate of benefits per AU. The USDA study found that in a given year, the acreage receiving manure at the N-agronomic standard was approximately equal to that receiving manure at the P-agronomic standard. Consequently, the simple average of the N-standards and P-standards were calculated. This resulted in a per-AU benefit estimate of $30.23 per year.

Table 7. Calculation of benefits per animal unit from the EPA proposed CAFO rule study

| | All AFOs | Regulated CAFO Operations[a]: |
|---|---|---|
| CAFO Size Class: | | |
| Total | 375,740 | 33,500 |
| > 1000 AU | 12,850 | 12,850 |
| 300 to 1000 AU | 28,150 | 8,240 |
| < 300 AU | 334,740 | 0 |
| Benefits ($million, annualized)[b]: | | |
| N-Standard | | 48.9 |
| P-Standard | | 172.7 |
| Additional Percent of all AFOs Regulated: | | |
| > 1000 AU | | 3.42 |
| 300 to 1000 AU | | 29.27 |
| AUs regulated (EPA percent multiplied by USDA estimate of AUs in class): | | |
| > 1000 AU | | 780,291 |
| 300 to 1000 AU | | 2,885,390 |
| Total | | 3,665,681 |
| Benefits ($/AU/year): | | |
| N-standard | | 13.34 |
| P-standard | | 47.11 |
| Simple Average[c] | | 30.23 |

[a]The EPA study gave only the total number of CAFOs; we made the assumption about distribution by class.
[b]We calculated the simple average of range endpoints given in EPA study.
[c]The USDA Cost and Capability Assessment indicates that in each year, of the acreage receiving manure, approximately equal proportions will receive it at the N and P standards.

**Determination of Animal Waste Treatment Costs by AFO Size Class.**

Our estimates of the number of AFOs in each size class, the number of animal units per AFO, and of the average treatment costs for these AFOs are all taken from the USDA (2002) *CNMP Cost and Capability Assessment Study* (CCAS). The CCAS utilized a farm-level micro model based on data from the Census of Agriculture to estimate the joint distribution of livestock production and land available for waste application. The model also included routines for estimating the cost of the more commonly used animal waste treatment practices for each farm. Although many new technologies may have a varying effect on potential treatment costs, it takes

time for the majority of farmers to be willing to implement unfamiliar technologies. Therefore, using traditional treatment practices for these analysis likely results in conservative cost estimates. The analysis included provision for off-farm distribution of animal waste within the same county, if other farms had land available for waste application.

The new EQIP program provides up to 75 percent cost sharing for CNMP costs. It also limits the amount of financial assistance at $450,000 per operation over the life of the 2002 Farm Act (6 years). The CCAS employed a micro modeling technique to evaluate each individual farm and then aggregate the results upwards. Consequently, animal waste production, land application opportunities, and associated costs were all evaluated on a farm-by-farm basis. The limit on funding was found to affect a significant number of operations. The main findings (Tables 8 & 9) include:

- Of the 257,201 Animal Feeding Operations (AFOs), about 1 percent—2,993 farms—are expected to have CNMP costs eligible for EQIP funding of $450,000 or more in the absence of the payment cap. 64 percent of these farms are CAFOs under present regulations (more than 1,000 EPA animal units).
- Of the 11,398 CAFO farms, about 17 percent are expected to have CNMP costs eligible for EQIP funding of $450,000 or more in the absence of the payment cap.
- This 1 percent of farms accounts for 30 percent of the animal units on all AFOs.
- The largest share of these farms is in the West (Pacific states and Mountain states), where 12 percent of AFOs are expected to have CNMP costs eligible for EQIP funding above the $450,000 cap.
- Almost 6 percent of fattened cattle AFOs are expected to have CNMP costs eligible for EQIP funding above the $450,000 cap, followed by 5 percent of turkey AFOs, 2.3 percent of layer-pullet AFOs, and 2 percent of swine AFOs (Table 9). About 70 percent of fattened cattle animal units are produced on AFOs that are expected to have CNMP costs eligible for EQIP funding above the $450,000 cap.
- Expected CNMP costs per farm for these 2,993 farms averages $138,000 per year per farm over a 10-year period. Under EQIP rules, 75 percent of this amount would be eligible for cost sharing, averaging about $100,000 per year per farm. With the $450,000 cap, these farms would still receive about half of the cost share funds they would have received had there not been a cap, on average.

Historically, 22.5% of EQIP funds were utilized for animal waste treatment practices.

Table 8 presents the finding of the analysis of farm level animal waste treatment costs. Note the following important facts:

- There are 11,398 AFOs in the largest class compared to 212,835 in the smallest class;
- The average sizes seem to be outside of the class size range definitions, but that is due to the mix of EPA and USDA animal unit definitions;
- The per-animal unit costs for the smallest farm size ($43.01) are more than double those of the largest class ($20.44)
- The technical assistance (TA) costs are also much smaller per- animal unit for the largest size of operations than for the smallest.
- The TA estimate shown in Table 8 is from the CCAS team, and is independent of the TA share of EQIP assumption used in this assessment.

Table 9 summarizes the characteristics of the farms where the fund limitation will play a role. The results differ across regions of the U.S., showing that the regions with the largest number of AFOs where the funding limits occur are the Mountain States (2.3 percent exceeding) and the Southern Plains (1.9 percent exceeding). The Delta, Lake States, and Corn Belt have the smallest percents exceeding (0.8, 0.2, and 0.4 percent). Additional analysis of the effect of alternative funding cap levels is given in a later section of the paper.

**Table 8. Derivation of animal waste treatment cost by animal feeding operation (AFO) size class**

| | Size Classes (No. AUs per operation): | | | | |
|---|---|---|---|---|---|
| | >1000 | 500-1000 | 300-500 | <300 | Total |
| Number of AFOs: | | | | | |
| No funding cap farms | 9,472 | 15,155 | 17,083 | 212,498 | 254,208 |
| Funding cap farms | 1,926 | 459 | 271 | 337 | 2,993 |
| All | 11,398 | 15,614 | 17,354 | 212,835 | 257,201 |
| | | | | | 0 |
| Total Animal Units | 22,805,451 | 5,598,295 | 4,288,797 | 21,200,208 | 53,892,751 |
| Average Size | 2000.8 | 358.5 | 247.1 | 99.6 | |
| Total CNMP costs, annualized over 10 year cost recovery period | | | | | |
| no cap farms | 196,738,793 | 168,328,297 | 156,957,371 | 881,652,778 | 1,403,677,239 |
| cap farms | 269,340,827 | 53,555,680 | 30,972,343 | 30,172,165 | 384,041,015 |
| all | 466,079,620 | 221,883,977 | 187,929,714 | 911,824,943 | 1,787,718,254 |
| Per AFO: | | | | | |
| no cap farms | 20,771 | 11,107 | 9,188 | 4,149 | 45,215 |
| cap farms | 139,845 | 116,679 | 114,289 | 89,532 | 460,344 |
| all | 40,891 | 14,211 | 10,829 | 4,284 | 70,215 |
| Per AU (all farms): | 20.44 | 39.63 | 43.82 | 43.01 | |
| EQIP eligible cost (75% of CNMP cost for no cap farms, 450,000 per farm for cap farms) | | | | | |
| no cap farms | 147,554,095 | 126,246,223 | 117,718,028 | 661,239,584 | 1,052,757,929 |
| cap farms | 115,325,777 | 27,484,181 | 16,227,043 | 20,179,017 | 179,216,018 |
| all | 262,879,872 | 153,730,403 | 133,945,072 | 681,418,601 | 1,231,973,948 |
| Per AFO: | 23,064 | 9,846 | 7,718 | 3,202 | |
| EQIP eligible cost (old rules, 75% cost share, $50,000 cap): | | | | | |
| average farm, annualized 10 year, 7.0% | 0 | 6,653 | 6,653 | 3,213 | |
| EQIP eligible CNMP costs for capped farms, assuming no cap (75% of CNMP cost) | | | | | |
| | 2,324,978,616 | 110,226,597 | 21,074,825 | 12,500,660 | 2,468,780,698 |
| CNMP cost NOT covered because of cap for capped farms | | | | | |
| | 2,209,652,839 | 82,742,416 | 4,847,781 | -7,678,357 | 2,289,564,680 |
| TA hours per AFO | 154 | 128 | 146 | 110 | |

Source: Review Draft NRCS CNMP Cost and Capability Assessment, August 8, 2002.

**Table 9. Definition of livestock operations having EQIP eligible CNMP costs large enough that the funding cap of $450,000 is limiting**

| | Number of farms | Percent of AFOs | Percent of animal units |
|---|---|---|---|
| By farm size: | | | |
| >1000 EPA animal units | 1,926 | 16.9% | 61.8% |
| 500-1000 EPA animal units | 459 | 2.9% | 5.6% |
| 300-500 EPA animal units | 271 | 1.6% | 2.5% |
| <300 EPA animal units | 337 | 0.2% | 0.5% |
| | | | |
| By USDA Farm Production Region: | | | |
| Appalachian states | 538 | 2.3% | 18.7% |
| Corn belt states | 252 | 0.4% | 8.9% |
| Delta states | 96 | 0.8% | 6.0% |
| Lake states | 111 | 0.2% | 6.3% |
| Mountain states | 184 | 2.3% | 47.1% |
| Northeast | 357 | 1.1% | 8.2% |
| Northern plains | 319 | 1.2% | 44.6% |
| Pacific states | 761 | 9.5% | 40.8% |
| Southeast | 172 | 1.3% | 10.3% |
| Southern plains | 203 | 1.9% | 60.1% |
| | | | |
| By Dominant Livestock Type: | | | |
| Fattened cattle | 578 | 5.7% | 70.8% |
| Milk cows | 1265 | 1.6% | 13.4% |
| Swine | 629 | 1.9% | 20.8% |
| Turkeys | 221 | 6.9% | 29.0% |
| Broilers | 62 | 0.4% | 3.6% |
| Layers/pullets | 188 | 3.5% | 20.0% |
| Confined heifers/veal | 45 | 1.1% | 18.4% |
| Small farms with confined livestock types | 5 | 0.0% | 6.0% |
| | | | |
| All farms | 2,993 | 0.9% | 27.2% |

**Treatments and Benefits by AFO Size Class for each 1% Share of EQIP Funds**

Tables 10 and 11 show the treatment that would be possible with the old and new programs in each AFO size class if it were to receive 1% of the total EQIP funds. Each state will have flexibility in allocating the EQIP funds across the size categories and this 1% approach allows individual BC ratios to be calculated for each class. Additionally, this approach will allow the exploration of how different

allocations across the classes affect the total treatment possible. Note that the specification for the "old" scenario is not strictly consistent with the "new" scenario for accounting for the funding cap. Since alternative estimates could not be obtained from the CCAS, the approach for the two middle size classes was to calculate what the annualized cost would be that would add up to the old program's $50,000 funding limit (which was less than 50 percent of the total cost of the systems). For the smallest class, 50% of the total cost was used as the cost share amount.

Larger farms are more likely to face additional cost for off-farm transport of animal waste. However, even with those large off-farm transport costs, larger farms had much lower waste treatment costs on a per-AU basis than did smaller farms.

For analysis purposes, it was assumed that in the year that funds are made available, they are also expended. The stream of benefits is assumed to start in that initial year and continue for a 10-year period. The costs are capitalized over a 10-year period. With these assumptions, the costs and benefits are converted to a NPV based on year of funding allocation. A second step then calculates the NPV of costs and benefits of the 6-year program, based on 2002. Tables 10 and 11 show these calculations.

Table 10 shows that under the old program, a one percent of the EQIP funding to each of the size classes would have the following effects:

- for the "500-1000" class, 1.1% of the AFOs and AUs would be treated, generating benefits of $19 million, and net benefits of $9.2 million and $248 thousand relative to EQIP funds and total costs;
- for the "300-500" class, 1.0% of the AFOs and AUs would be treated, generating benefits of $13 million, and net benefits of $3.3 million and -1.9 million relative to EQIP funds and total costs;
- for the "<300" class, 0.2% of the AFOs and AUs would be treated, generating benefits of $11 million, and net benefits of $1.1 million and $-1.6 million relative to EQIP funds and total costs; and
- for all the classes together, with allocation of one percent of EQIP funding to each size class, 0.3% of the AFOs and AUs would be treated (with 3% of total EQIP funding), generating benefits of $43 million, and net benefits of $13.6 million and $-3.2 million relative to EQIP funds and total costs.

**Table 10. AFOs treated and Benefit Cost ratios for a 1% share of EQIP funding per size class, old program continuing**

| | AFO Size Classes (number of AUs) | | | |
|---|---|---|---|---|
| | 500-1000 | 300-500 | <300 | Total[a] |
| AFOs newly treated first year | 30 | 30 | 61 | 120 |
| Total AFOs treated over 6 year program | 169 | 178 | 368 | 714 |
| Percent of total AFOs treated | 1.1 | 1.0 | 0.2 | 0.3 |
| AUs newly treated each year | 10,613 | 7,315 | 6,105 | 24,033 |
| Total AUs treated over 6 year program | 63,677 | 43,891 | 36,630 | 144,199 |
| Percent of AUs treated over 6 year program | 1.1 | 1.0 | 0.2 | 0.3 |
| NPV of 10 year benefit stream for each program year: | 3,719,128 | 2,563,512 | 2,139,412 | 8,422,053 |
| NPV of 6 year program benefits discounted to 2002: | 18,968,288 | 13,074,420 | 10,911,426 | 42,954,133 |
| NPV of Costs (for each class since based on 1% of EQIP): | | | | |
| EQIP Funds | 9,779,303 | 9,779,303 | 9,779,303 | 29,337,908 |
| Total Costs, including TA | 18,719,924 | 14,967,421 | 12,534,498 | 46,221,843 |
| Net Benefits over EQIP Funds | 9,188,985 | 3,295,117 | 1,132,123 | 13,616,226 |
| Net Benefits over Total Costs | 248,363 | -1,893,002 | -1,623,072 | -3,267,710 |
| Benefit Cost Ratio relative to EQIP Funds[a] | 1.9 | 1.3 | 1.1 | 1.5 |
| Benefit Cost Ratio relative total cost[a] | 1.0 | 0.7 | 0.6 | 0.9 |

Parameters:

Water quality benefits per AU ($30.23) and nutrient value for crops ($16.40) 46.63

[a]Benefits, Costs, and Benefit Cost ratios for "Total" column are based on 3% of EQIP funds, 1% for each of 3 classes.

**Table 11. Animal Feeding Operations (AFOs) treated and Benefit Cost ratios for a 1% share of EQIP funding per class, new program**

| | Size Classes (No. AUs per operation): | | | | |
|---|---|---|---|---|---|
| | >1000 | 500-1000 | 300-500 | <300 | Total[a] |
| AFOs newly treated each year of program: | | | | | |
| 2002 | 17.1 | 40.0 | 51.0 | 123.0 | 231 |
| 2003 | 29.3 | 68.6 | 87.6 | 211.1 | 397 |
| 2004 | 41.0 | 96.1 | 122.6 | 295.6 | 555 |
| 2005 | 48.3 | 113.1 | 144.3 | 347.8 | 653 |
| 2006 | 47.3 | 110.9 | 141.4 | 341.0 | 641 |
| 2007 | 50.3 | 117.8 | 150.2 | 362.1 | 680 |
| Total | 233.3 | 546.5 | 697.1 | 1680.6 | 3157.4 |
| Percent of total AFOs treated by class | 2.0 | 3.5 | 4.0 | 0.8 | 1.2 |
| Total Animal Units (AUs)Treated | 466,772 | 195,938 | 172,279 | 167,398 | 1,002,387 |
| Percent of AUs treated by class | 2.0 | 3.5 | 4.0 | 0.8 | 1.9 |
| NPV of 10 year stream of benefits for each years funds: | | | | | |
| 2002 | 0[a] | 5,026,355 | 4,419,426 | 4,294,210 | 13,739,991 |
| 2003 | 0 | 8,623,648 | 7,582,349 | 7,367,517 | 23,573,514 |
| 2004 | 0 | 12,077,938 | 10,619,536 | 10,318,651 | 33,016,125 |
| 2005 | 0 | 14,209,339 | 12,493,572 | 12,139,590 | 38,842,500 |
| 2006 | 0 | 13,930,725 | 12,248,600 | 11,901,558 | 38,080,883 |
| 2007 | 0 | 14,795,704 | 13,009,134 | 12,640,544 | 40,445,382 |
| NPV of 6 year program benefits discounted to 2002: | | | | | |
| | 0 | 56,411,047 | 49,599,454 | 48,194,146 | 154,204,647 |
| NPV of 1% of EQIP funds including TA: | 45,055,231 | 45,055,231 | 45,055,231 | 45,055,231 | 180,220,922 |
| NPV of total costs including TA: | 74,148,485 | 61,741,350 | 60,224,685 | 57,781,670 | 253,896,189 |
| Net Benefits over EQIP Funds | -45,055,231 | 11,355,816 | 4,544,224 | 3,138,915 | -26,016,276 |
| Net Benefits over Total Costs | -74,148,485 | -5,330,303 | -10,625,231 | -9,587,525 | -99,691,543 |
| Benefit Cost Ratio relative to EQIP Funds[b] | 0.0 | 1.3 | 1.1 | 1.1 | 1.6 |
| Benefit Cost Ratio relative to total cost[b] | 0.0 | 0.9 | 0.8 | 0.8 | 1.1 |

Parameters:

| | |
|---|---|
| Sum of water quality benefits per AU ($30.23) and nutrient value for crops ($16.40) | 46.63 |
| Average cost share under new rules | 0.75 |

[a]Benefits resulting from assumed 2002 CAFO implementation are not accounted for. Technically, since they occur before the promulgation of EPA's CAFO rule, they can be contributed to the EQIP program.

[b]Benefits, Costs, and Benefit Cost ratios for "Total" column are based on 4% of EQIP funds, 1% for each of 4 classes.

Table 11 shows that under the new program, a one percent of the EQIP funding to each of the size classes would have the following effects:

- for the ">1000" class, 2.0% of the AFOs and AUs would be treated, generating no additional economic benefits that can be attributed to the EQIP program, due to these farms already under regulation by EPA's CAFO rule. This results in net benefits of $-45 million and $-74 million relative to EQIP funds and total costs;
- for the "500-1000" class, 3.5% of the AFOs and AUs would be treated, generating benefits of $57 million, and net benefits of $11.3 million and $-5.3 million relative to EQIP funds and total costs;
- for the "300-500" class, 4.0% of the AFOs and AUs would be treated, generating benefits of $50 million, and net benefits of $4.5 million and $-10.6 million relative to EQIP funds and total costs;
- for the "<300" class, 0.8% of the AFOs and AUs would be treated, generating benefits of $48 million, and net benefits of $3.1 million and $-9.6 million relative to EQIP funds and total costs; and
- for the all classes together, with allocation of one percent of EQIP funding to each size class, 1.2% of the AFOs and 1.9% of AUs would be treated (with 4% of total EQIP funding), generating benefits of $154 million, and net benefits of $-26 million and $-99.7 million relative to EQIP funds and total costs.

## *Old Program, New Program, and Implementation Options*

***Tier One - Comparison of 1996 EQIP to EQIP as Outlined in the NOFA***

The EQIP Benefit Cost Analysis compares the EQIP program created in 1996 ("old program") with those changes associated with the 2002 program implemented through the NOFA. Additionally, several alternatives associated with the final rule were then compared with the NOFA.

Table 12 shows a summary across benefit categories of the estimated benefits and costs associated with EQIP for 1996 rules and the 2002 NOFA. Note that in contrast to the derivation of animal waste benefits in the body of the report, based on an allocation of 1.0 percent of EQIP funding per size class, here the total assumed allocation of EQIP funds to livestock waste treatment is used. For the 1996 rules scenario each of the three smallest classes receives 7.5% of the funding, and under the NOFA and Final Rule scenarios, each of the four classes receives 12.5% of the funding. As noted before, the benefits accounted for in this analysis do not take into consideration every practice that is eligible for EQIP support, and even for the practices considered not necessarily all the benefits were accounted for. Consequently, these benefit estimates should be considered as conservative lower bound estimates. In addition, in this study several practices historically funded by EQIP were not assigned to the quantifiable benefit categories, although their full costs were. Therefore, it was assumed that their benefits were on average the same as those practices analyzed within the quantifiable benefit categories.

Under the 1996 program, the benefits are estimated to be $3.4 billion, with $0.3 billion coming from waste treatment and $2.4 billion from identified land treatment practices, and $0.6 billion coming from

other non-categorized practices, yielding net benefits of $2.4 billion, and a BC ratio of 3.4 relative to EQIP funds, and net benefits of $979 million and a BC ratio of 1.4 relative to total cost.

Two alternatives are presented for the 2002 NOFA scenario based upon different accounting of benefits and costs associated with the treatment of large CAFOs by the EQIP program. Although §1466.20 of the rule states "NRCS will give additional consideration to contracts that will help the producers comply and exceed requirements of environmental laws, such as EPA's Concentrated Animal Feeding Operations (CAFO) regulatory requirements", benefits or costs for the treatment of these CAFOs cannot be claimed by the EQIP program due to the promulgation of the CAFO regulation. However, since the legislation states that part of the intent of the program is to help producers meet regulations it is highly likely that EQIP program funds will be used to do so. Therefore the two scenarios for accounting benefits accrued to CAFO treatment can be enlightening.

Under the NOFA, regardless of CAFO scenarios, $4.3 billion in benefits could be expected from land treatment. Ranking total land treatment benefits under the NOFA from highest to lowest, irrigation improvement and water savings treatment generates the highest total benefits ($1.8 billion), followed by grazing improvement ($934 million), USLE, or soil erosion reductions ($827 million), non-animal waste nutrient management on cropland ($320 million), wildlife habitat improvement practices ($244 million), and air quality improvement practices ($156 million).

If benefits and costs associated with treating large CAFOs are accounted for, the total benefits of the EQIP program are estimated to be $8.9 billion under NOFA. This is composed of $0.8 to 1.0 billion (depending on CAFO assumption) from non-categorized practices, and $1.7 billion in benefits are directly attributed to the treatment of large CAFOs, regardless of whether the EQIP program or the EPA CAFO rule claims these benefits. With CAFO benefits claimed, net benefits over EQIP funds are estimated to be $4.4 billion, and a BC ratio of 2.0 relative to EQIP costs, and net benefits of $2.3 billion and a BC ratio of 1.3 relative to total (including private) cost.

**Table 12. Summary of estimated EQIP Benefits and Costs ($ million).**

| | | Rules and Funding According to the 2002 Legislation and NOFA | |
|---|---|---|---|
| | **1996 EQIP with $200 million per year 2002-2007** | Include CAFO Benefits & Costs[b] | Exclude CAFO Benefits & Costs[c] |
| **Benefits:** | | | |
| Animal Waste Management (Total)[a] | 322 | 3,608 | 1,928 |
| By Operation Size Class (AUs): | | | |
| >1000[b] | 0 | 1,680 | 0 |
| 500 - 1000 | 142 | 705 | 705 |
| 300 - 500 | 98 | 620 | 620 |
| <300 | 82 | 602 | 602 |
| Land Treatment Total | 2,444 | 4,284 | 4,284 |
| USLE Reductions | 640 | 827 | 827 |
| Grazing Improvement | 671 | 934 | 934 |
| Irrigation Improvement/ Water Savings | 716 | 1,803 | 1,803 |
| Air Quality Improvements | 115 | 156 | 156 |
| Non-waste Nutrient Management | 167 | 320 | 320 |
| Wildlife | 135 | 244 | 244 |
| Benefits from non-analyzed practices[d] | 587 | 1,005 | 791 |
| **Grand Total Benefits** | 3,353 | 8,897 | 7,003 |
| **Costs:** | | | |
| EQIP Funds | 978 | 4,480 | 3,917 |
| Total Costs[e] | 2,374 | 6,600 | 5,673 |
| **Benefit Cost (BC) Ratios:** | | | |
| BC relative to EQIP funds | 3.4 | 2.0 | 1.8 |
| BC relative to total cost | 1.4 | 1.3 | 1.2 |
| Net Benefits over EQIP funds | 2,375 | 4,417 | 3,086 |
| Net Benefits over total cost | 979 | 2,296 | 1,329 |

[a]Assumes 7.5% of EQIP funds for each small livestock class in "Old" and 12.5% for each class in "New".

[b]Benefits and costs of treating Large CAFO benefits and costs are accounted for, even though the benefits are attributable to the EPQ CAFO rule rather than EQIP.

[c]Benefits and Costs of large CAFOs not accounted for.

[d]Assumes that benefits per EQIP dollar for practices not assigned to a benefit category are on average the same as the practices analyzed.

[e]Total costs are calculated based on 74% of EQIP funds for cost sharing and 26% of EQIP funds for Technical Assistance (TA). Note that the costs here are not the sum of costs from analysis of individual benefit categories, since that would involve double counting.

The effect of excluding both the benefits and costs of treating large CAFOs was also evaluated, as shown in the final column of Table 12. Although it was assumed in the chosen option for program implementation that 12.5 percent of EQIP funds would be spent for the treatment of large CAFOs, this was an assumption and actual implementation may differ. This scenario of excluding both costs and benefits from the large CAFOs is helpful when comparing overall program performance under the final rule to performance under the 1996 rule. Note that with this exclusion, the estimates of Net Benefits are smaller because a considerable stream of benefits was generated from treatment of AUs in CAFOs; however, the net benefits are still higher than the estimates for the continuation of the 1996 program.

The final analysis is based upon the assumption that benefits and costs for the treatment of large CAFOs cannot be claimed by the EQIP program due to the promulgation of the CAFO regulation. Since the livestock producers must do the work to meet the new EPA CAFO rule, public EQIP funds spent on these CAFOs simply replaces the private dollars the livestock producers would otherwise spend in doing the same job. The difference in EQIP funds between the second and third column of Table 1a ($563 million) are those costs due to helping large CAFOs comply with federal regulations. This can be described as a transfer payment between public and private sectors.

The difference between the net benefits estimates of the 1996 and Final Rule scenarios is due to three factors:

- *scale effect* associated with increased funding;
- *practice mix effect* as a larger share of funds are allocated to livestock waste treatment and efficiencies; and
- *cost effect*, since with cost share buy down eliminated, the government cost per treated unit is most likely increased and fewer units treated per dollar of EQIP funds.

Analysis suggests that implementation of EQIP outlined in the NOFA would provide substantial benefits and would help achieve program objectives of solving identified natural resource concerns while optimizing environmental benefits.

The option to include large AFOs, elimination of priority areas and discussion of increased payment limitation are discussed in detail in Tier Two of the benefit-cost analysis. Other proposed changes in EQIP are not quantified in this analysis due to lack of available data necessary to accurately evaluate effects. These include potentially shorter average contract lengths because single practices will be allowed

and contracts may terminate one year after completion of the last practice, allowing multiple contracts per tract of land, and providing higher cost share rates for limited resource producers or beginning farmers.

***Tier Two - NOFA Compared to Policy Options***

A brief summary of the alternatives presented in the Benefit Cost assessment report are presented below. Readers interested in the details of these alternatives should consult the NRCS website where the full Benefit Cost assessment will be posted shortly.

**Alternative One: Alternatives to AFO/CAFO Funding**

EPA has already claimed benefits and costs accrued from the regulation of larger CAFOs through its CAFO rule. To the extent that one federal agency has claimed these benefits and costs, another agency cannot claim these same benefits and costs as well. Therefore, assuming compliance to the EPA CAFO rule, no additional environmental or economic benefits may be claimed through EQIP for assisting large, regulated CAFOS in complying with the EPA CAFO rule. However, if larger CAFOs are funded through EQIP, costs must be accounted for through the EQIP program. This results in using EQIP to fund large CAFOs adding cost to the EQIP program without accruing additional environmental benefits. Due to this conflict, the scenario achieving the greatest net benefits is that which allocates to the three smaller categories, each getting a third of the funding.[5] These net benefits total $314 million and -$421 million for EQIP funds and total costs. Conversely, the allocation based on share of total animal units, the largest size class would receive 42 percent of the funding and would achieve much lower net benefits of $-814 million and $-1.8 billion for EQIP funds and total costs. Looking strictly at the cost side of the equation, some efficiency is lost because it costs more per animal unit to treat the smaller size class CAFOs than the large farms. Additionally, a new program purpose of the EQIP program is to assist producers to comply with these regulations.

The strategy generating the highest net benefits over EQIP funds and highest overall BC ratio (of the six alternatives evaluated) is to treat the three smallest size categories of AFOs. That strategy would result

[5] A way of addressing the problem would be to consider funds spent in assisting producers to comply with the EPA rule as transfer payments. The total funds to be spent in compliance with the EPA CAFO rules would be the same, so for every EQIP dollar spent for this purpose, private producer funds would be saved. Another alternative, which we adopt in summarizing the final results, is to either include or exclude *both* benefits and costs associated with EQIP funds for CAFOs.

in treatment of 9.4 million AUs, although treating proportionate to the share of total animal units would result in the treatment of 15.8 million animal units with the same total amount of funding. The more that funds are shifted towards the larger AFOs, the larger the number of AUs treated, the lower the TA cost, however less environmental benefits can be attributed directly to the EQIP program.

It could be expected that the between 17% (9.4 million) and 29% (15.8 million) of total animal units could be treated through the EQIP program.

A desirable strategy might be to focus the funds on the 500 to 1000 and 300 to 500 classes. The largest class are already under regulation and should be more able to arrange and afford private financing of the required animal waste management than the smaller classes, and the per-AU treatment cost of the smallest class is much higher that for the middle size classes. In addition, it could be expected that incrementally greater benefits could be accrued with the next largest farm size category. Decisions should also take account of social considerations, as well as the TA component in terms of the estimate of hours required for the CNMP implementation. The more the funds are shifted towards the larger operations, the lower the TA requirement on a per-AU and on a per-AFO basis.

**Alternative Two: Payment Limits Between $50,000 and $450,000**

Although actual payment depends on the specific conservation system applied and the cost share rate, an assumed or artificial limit on payments can be used to analyze comparative environmental benefit. Data in the benefit-cost analysis suggests that while the various payment limitations do not have great bearing on the total number of farms that would be affected by the caps, a significant number of animal units could be eligible for funding without payment limitations at the higher cap levels.

At the $450,000 payment limitation level, only 1% of the remaining livestock farms would still be capped in the costs of implementing animal waste-related conservation practices. However, those large farms control 27 percent of the animal units. These represent the largest farms with the highest total costs, but lowest cost per animal unit.

Although there are relatively few additional farms that would be funded as payment limitations increase, these farms have a large number of animal units. Increasing the payment limitation from $50,000 to $100,000 would allow an additional 9 million animal units to be eligible for funding under the

payment limitation. Increasing the payment limitation from $300,000 to $450,000 would only increase the number of animal units by fewer than 3 million.

At $50,000, only 33 percent of the livestock farms' animal units would be eligible for funding without reaching the cap. At $100,000, half of the nation's animal units would qualify for EQIP funding without reaching the cap, and at the $450,000, almost three quarters of the nation's animal units would qualify for EQIP funding without reaching the payment limitation cap.

Although legislation allows a maximum payment of $450,000 per participant, it is assumed that the Agency and states may set lower limitations if necessary based on local market, cultural or economic conditions. The economic analysis indicates that there is no economic gain associated with imposing lower payment limitations. Since the larger farms represent those with the highest number of animal units and greatest cost efficiencies per animal unit, the program benefits by allowing full participation up to the payment maximum.

**Alternative Three: Alternative Application Evaluation Procedures to Ensure Cost-Effective, Targeted Fund Allocation**

Under the previous program, 65 percent of funds were allocated to geographically-targeted areas. The Proposed/Final Rule eliminates the process of designating funds to conservation priority areas. There is concern that this will have a negative impact on the potential environmental benefits because funds may not be targeted to specific geographic areas, and the environmental effects of practice implementation will be diluted by scattering cost share assistance over a much broader area.

Six options for environmentally targeting EQIP funds were compared in this alternative. Results of these comparisons indicate that if technical assistance costs are constant, then adopting some form of spatial evaluation, varying cost share by practice effectiveness, or allocating funds with a formula based on priority resource concerns could all have positive effects on total benefits.

In the case of varying fund allocations to emphasize a particular resource concern, the share of total funds allocated in the NOFA was increased by 5 percent for one category and decreased by 1 percent for the other benefit categories identified in this analysis, with the exception of animal waste. The results of these changes indicate that targeting non-animal waste related nutrient management concerns would yield the greatest net benefits relative to EQIP funds ($1.1B), compared to net benefits of $620 Million for the NOFA. When compared to the NOFA, net benefits would increase if shares of funding were increased for soil erosion reduction or non-waste nutrient management, but not in the case of the other resource

concerns. When compared to the NOFA, total net benefits would decrease if grazing land productivity or wind erosion categories were to receive an increased share of funds. Although targeting by resource concern can have overall positive effects on benefits, emphasizing one particular resource concern may overlook the relationships between natural resource effects, and fail to capitalize on them.

In the case of varying cost share levels by practice, the National priorities are emphasized by reducing the cost share rates for practices that have primary impacts in the other benefit categories. For purposes of this analysis, it is assumed that the average cost share for EQIP is 75 percent in the NOFA. This rate is decreased to 60 percent (mild) and to 50 percent (aggressive) for erosion reduction, grazing productivity, and wildlife habitat improvement. The results indicate that pursuing National priorities with a cost share mechanism can increase total benefits by 8 percent in the "mild" scenario, and by 10 percent for the more aggressive scenario. This rule allows flexibility at the state level to provide higher cost-share rates for practices that impact local resource concerns while reducing cost-share rates for practices that do no optimize benefits at the local level.

In addition to these methods, a holdback of funds for distribution based upon an objective comparison of States using performance criteria can be a useful tool that could increase net benefits and increase program efficiency. Data suggest that in spite of the removal of the requirement for geographically based priority areas other approaches to targeting of EQIP funds to the most critical natural resource concerns are feasible and will have positive effects on total program benefits. This will ensure that environmental benefits are optimized and program objectives are met, but without excluding participation by persons outside of a designated boundary.

**The Final EQIP Rule – Major features and effects**

Decisions leading to the final rule were made after consideration of all comments on the proposed rule and a review of their effects on program benefits and costs. Program benefits and costs under alternative scenarios were available to guide decision makers in the main body of this report. Decision makers reviewed these alternatives as the final rule was defined.

In particular, the final rule incorporates a scenario with the following features:

1) 25% of livestock funds are allocated to each AFO/CAFO size class;

2) a $450,000 payment ceiling to any program participant over a 6 year period;

3) a maximum average cost share rate of 65% on any practice;

4) National Priority targeting that implies lower cost share rates (55%) for practices linked to grazing, wind erosion, and wildlife habitats (although the benefits computed for the latter two do not match the specifications in the rule preamble for air quality and at-risk species);

5) fund allocation that varies as a function of cost-share (practice/benefit categories with higher priorities are the ones with higher cost share rates); and

6) a spatial evaluation process that improves benefits by 10% in all categories except grazing.

The new EQIP program in the final rule has a substantial beneficial effect on the environment compared to continuation of the 1996 program, and that effect is enhanced under the Final Rule, compared to the NOFA. A total of 96.1 million acres of agricultural land are expected to be treated over the six years of the program with the Final Rule, compared to 76.7 million acres under the NOFA. This includes 70.3 million acres of cropland, 15.5 million acres of grazing land (pasture and rangeland), and 10.3 million acres for wildlife habitat improvement. Resource treatment increases compared to the 1996 rules include an additional 2.9 million acres for sheet and rill water erosion (USLE) reduction, 3.5 million acres for wind erosion, 14.7 million acres for non-waste nutrient management, 22.0 million acres for net irrigation water reduction, 6.2 million acres for grazing productivity, and 5.5 million acres for wildlife habitat will occur on the landscape. Also, an additional 31 thousand animal feeding operations (5.6 million animal units) are expected to be treated under the new program, as compared to continuing the old program, excluding CAFO treatments (34 thousand animal feeding operations and 11.4 million animal units if the CAFOs are included. Also, compared to the 1996 rules, an additional 12.8 million animal units and 39,468 animal feeding operations will be treated, and water induced soil loss from agricultural land decreases by 24.5 million tons/year.

Under the NOFA, regardless of CAFO scenarios, $4.3 billion in benefits could be expected from land treatment; this value increases to $5.8 billion for the Final Rule. Ranking total land treatment benefits under the Final Rule from highest to lowest, irrigation improvement and water savings treatment generates the highest total benefits ($2.5 billion), followed by USLE, or soil erosion reductions ($1,243 million), grazing improvement ($1,078 million), non-animal waste nutrient management on cropland ($482 million), wildlife habitat improvement practices ($309 million), and air quality improvement practices

**Table 13. Estimated EQIP Benefits and Costs ($ million) –Final Rule.**

| | Rules and Funding According to the 2002 Legislation and NOFA | | Final EQIP rule | |
|---|---|---|---|---|
| | Include CAFO Benefits & Costs[b] | Exclude CAFO Benefits & Costs[c] | Include CAFO Benefits & Costs[b] | Exclude CAFO Benefits & Costs[c] |
| **Benefits:** | | | | |
| Animal Waste Management (Total)[a] | 3,608 | 1,928 | 4,085 | 2,405 |
| By Operation Size Class (AUs): | | | | |
| >1000[b] | 1,680 | 0 | 1,680 | 0 |
| 500 - 1000 | 705 | 705 | 871 | 871 |
| 300 - 500 | 620 | 620 | 773 | 773 |
| <300 | 602 | 602 | 761 | 761 |
| Land Treatment Total | 4,284 | 4,284 | 5,828 | 5,828 |
| USLE Reductions | 827 | 827 | 1,243 | 1,243 |
| Grazing Improvement | 934 | 934 | 1,078 | 1,078 |
| Irrigation Improvement/ Water Savings | 1,803 | 1,803 | 2,519 | 2,519 |
| Air Quality Improvements | 156 | 156 | 198 | 198 |
| Non-waste Nutrient Management | 320 | 320 | 482 | 482 |
| Wildlife | 244 | 244 | 309 | 309 |
| Benefits from non-analyzed practices[d] | 1,005 | 791 | 1,263 | 1,049 |
| **Grand Total Benefits** | 8,897 | 7,003 | 11,176 | 9,282 |
| **Costs:** | | | | |
| EQIP Funds | 4,480 | 3,917 | 4,480 | 3,917 |
| Total Costs[e] | 6,600 | 5,673 | 7,620 | 6,626 |
| **Benefit Cost (BC) Ratios:** | | | | |
| BC relative to EQIP funds | 2.0 | 1.8 | 2.5 | 2.4 |
| BC relative to total cost | 1.3 | 1.2 | 1.5 | 1.4 |
| Net Benefits over EQIP funds | 4,417 | 3,086 | 6,696 | 5,365 |
| Net Benefits over total cost | 2,296 | 1,329 | 3,555 | 2,656 |

($198 million). The Final Rule, by pursuing national priorities, obtains considerably greater benefits from irrigation improvements and soil erosion reduction than the NOFA scenario. However, the tradeoff is a proportionately smaller emphasis on benefits from grazing improvements.

If benefits and costs associated with treating large CAFOs are accounted for, the total benefits of the EQIP program are estimated to be $11.2 billion under Final Rule and $8.9 billion under NOFA. For the Final Rule, $1.0 to 1.2 billion (depending on CAFO assumption) comes from non-categorized practices, and $1.7 billion in benefits are directly attributed to the treatment of large CAFOs, regardless of whether the EQIP program or the EPA CAFO rule claims these benefits. With the Final Rule and CAFO benefits

claimed, net benefits over EQIP funds are estimated to be $6.7 billion, and a BC ratio of 2.5 relative to EQIP costs, and net benefits of $3.6 billion and a BC ratio of 1.5 relative to total (including private) cost.

## Conclusions

This benefit cost analysis represents a comprehensive study of alternative ways to implement the new EQIP authorities contained in the 2002 Farm Act. The best available data bases, including selected data on EQIP experiences, and economic and natural resource effects analytical models were used in its development.

The analysis addressed several issues critical to decision making in the development of the final rule. These included the impacts of selected alternatives concerning: (1) fund allocations among different sized livestock facilities; (2) payment ceiling limits; (3) maximum cost share rates; (4) National priority targeting; (5) variable cost-share rates to address higher priority problems; and (6) a spatial evaluation process to improve benefits.

Natural Resources Conservation Service decision makers reviewed the findings of the analysis and chose a combination of the elements described in the report as they formulated the final rule. For example, the significant benefits achievable by focusing on reducing water erosion and sedimentation from otherwise excessive levels on agricultural land resulted in it becoming a National priority. In addition, a definition of cost effectiveness was introduced in the final rule and will be used at the state and local level for selecting conservation practices and emphasizing their adoption.

The benefits and costs of the final rule are described in the final column of Table 13. Excluding CAFO benefits and costs, it is estimated that $2.4 billion in benefits will result from pollution control at animal waste treatment facilities. Another $5.8 billion in benefits will result from land treatment activities. It is estimated that another $1.0 billion dollars in benefits will arise from practices that were not specifically analyzed such as pest management. In total, $9.3 billion in benefits will result from implementation of the final rule. Total costs of implementation amount to $6.6 billion, with $3.9 billion from EQIP funds and $2.7 billion from private sources.

## *References*


AREI. 2003. Agricultural Resources and Environmental Indicators, 2000. Agricultural Handbook Number AH722. U.S. Dept. Agriculture, Economic Research Service.

Bergstrom, John C., Kevin J. Boyle, Charles A. Job, and Mary Jo Kealy. 1996. "Assessing the economic benefits of ground water for environmental policy decisions." Water Resources Bulletin, April 32,2

Christensen, Lee, S. Daberkow, W. McBride. 1998. "Nutrient Management Decisions by U.S. Corn Producers-Some Results from the 1996 Agricultural Resource Management Study" paper presented at AAEA annual meeting, Salt Lake City, UT, August 2-5, 1998.

Claassen, Roger, LeRoy Hansen, Mark Peters, Vince Breneman, Marca Weinberg, Andrea Cattaneo, Peter Feather, Dwight Gadsby, Daniel Hellerstein, Jeff Hopkins, Paul Johnston, Mitch Morehart, and Mark Smith. 2001. Agri-Environmental Policy at the Crossroads: Guideposts on a Changing Landscape. U.S. Dept. Agriculture. Economic Research Service, Agric. Econ. Rep. No. 794.

Crutchfield, Stephen R., Joseph C. Cooper, and Daniel Hellerstein. 1997. Benefits of Safer Drinking Water: The Value of Nitrate Reduction. Washington D.C.,U.S. Dept. Agric. Econ. Res. Serv.,June,Agric. Econ. Rep. No. 752

Crutchfield, Stephen R., Peter M. Feather, and Daniel R. Hellerstein. 1995. The Benefits of Protecting Rural Water Quality. An Empirical Analysis. U. S. D. A. Economic Research Service, January, Agric. Econ. Rept. No. 701.

Economic Research Service. 2002. Agricultural Resources and Environmental Indicators, 2000. U.S.D.A. Economic Research Service, online publication available at: http://www.ers.usda.gov/Emphases/Harmony/issues/arei2000/arei2000.htm

Economic Research Service. 2001. Structural and Financial Characteristics of U.S. Farms, 2001 Family Farm Report, Ag. Info. Bull. #768, http://www.ers.usda.gov/publications/aib768/

Feather, Peter, Daniel Hellerstein, and LeRoy Hansen. 1999. Economic Valuation of Environmental Benefits and the Targeting of Conservation Programs. The Case of the CRP. U. S. Dept. Agriculture, Economic Research Service, April ,Agri. Info. Bulletin No. 778.

Gibilisco, C. and, G.M. Filipek; The Economic Benefits of Wildlife-Watching activities in Washington; Washington Department of Fish and Wildlife, Wildlife Management Program, Washington, pp 15.

Namken, Jerry C., and Mitch L. Flanagan. 2000. "Conservation of Private Grazing Lands Program: Benefit-Cost Analysis." Staff Report, U.S. Dept. Agriculture, Natural Resources Conservation Service.

NASS. 2002. Agricultural Prices. U.S. Department of Agriculture, National Agricultural Statistics Service.

Powell, Mark R. and James D. Wilson. 1997. "Risk Assessment for National Resource Conservation Programs." Discussion Paper 97-49. Resources for the Future, Washington, DC.

Ribaudo, Marc O. 1986. Reducing Soil Erosion: Offsite Benefits. U.S.Dept. Agric., Economic Research Service, September, Agr. Econ. Rep. No. 561

Ribaudo, Marc O. 1989. Water Quality Benefits From the Conservation Reserve Program. AER-606. U.S. Dept. Agriculture, Econ. Res. Serv., Feb.

Ribaudo, Marc O. and Daniel Hellerstein. 1992. Estimating Water Quality Benefits: Theoretical and Methodological Issues. U. S. Dept. Agric.. Economic Research Service,September,Tech. Bull. No. 1808

Ribaudo, Marc O., Steven Piper, Glenn D. Schaible, Linda L. Langner, and Daniel Colacicco. 1989. "CRP What economic benefits?" J. Soil and Water Conservation, September-October.

Smith, K. *Estimating Economic Values for Nature: Methods for Nonmarket Valuation*. 1996. Edward Elgar, Cheltenham, UK

U.S. Dept. of Agriculture. 1989. The Second RCA Appraisal. Soil Water, and Related Resources on Nonfederal Land in the United States. Analysis of Condition and Trends. Soil Conservation Service, Washington, DC.

U.S. Dept. of Agriculture. 1997a. "Environmental Quality Incentives Program Environmental Risk Assessment, Final. Prepared by the Natural Resources Conservation Service, February 11.

U.S. Dept. of Agriculture. 1997b. "Conservation Reserve Program Environmental Risk Assessment." Prepared by the Farm Service Agency, February.

U.S. Dept. of Agriculture. 1997c. "Benefit Cost Analysis of the Environmental Quality Incentives Program (EQIP) as Formulated for the Final Rule." Natural Resources Conservation Service, Washington DC.

U.S. Dept. of Agriculture 2002 "Cost and Capability Assessment of Comprehensive Nutrient Management Planning Guidelines," Draft, Natural Resources Conservation Service, Washington, DC.

U.S. EPA. 1990. The Economics of Improved Estuarine Water Quality: An NEP Manual for Measuring Benefits. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, EPA 503/5-90-001

U.S. EPA. 1992. Framework for Ecological Risk Assessment. EPA/630/R-92/001. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

U.S. EPA. 2001. Environmental and Economic Benefit Analysis of Proposed Revision to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations. U.S. Environmental Protection Agency, Office of Water, EPA-821-R-01-002.

**Table A1. Historical EQIP data on practices reducing water induced sheet and rill soil erosion (USLE).**

| | | | Approved Contracts | | | Implemented Contracts (excludes contract units not cost shared) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Practice Definition | Units | Contracts | Units | Cost Share | Contracts | Units | Cost Share | Total Cost | Acre Divisor | Total Cost/ac | Acres[b] Protected |
| 329A | Residue Management, No-Till and Strip Till | AC | 29,828 | 2,549,677 | 18,826,296 | 8,892 | 493,323 | 8,034,476 | 14,953,683 | 1 | 30.31 | 493,323 |
| 600 | Terrace1 | FT | 9,878 | 84,207,035 | 18,291,508 | 4,141 | 19,399,362 | 8,410,459 | 21,690,701 | 435.6 | 487.05 | 44,535 |
| 342 | Critical Area Planting1 | AC | 12,849 | 425,935 | 6,588,314 | 4,618 | 175,419 | 2,685,059 | 25,361,525 | 1 | 144.58 | 175,419 |
| 329B | Residue Management, Mulch Till | AC | 17,815 | 2,895,192 | 5,972,819 | 221 | 377,827 | 127,302 | 156,033 | 1 | 0.41 | 377,827 |
| 340 | Cover Crop | AC | 13,151 | 777,327 | 3,777,254 | 2,791 | 102,135 | 1,345,112 | 4,889,644 | 1 | 47.87 | 102,135 |
| 328 | Conservation Crop Rotation | AC | 89,139 | 13,436,125 | 3,370,572 | 15,725 | 218,859 | 1,767,221 | 2,929,007 | 1 | 13.38 | 218,859 |
| 344 | Residue Management, Seasonal | AC | 54,571 | 8,231,184 | 1,484,099 | 10,526 | 198,042 | 835,521 | 3,261,113 | 1 | 16.47 | 198,042 |
| 393 | Filter Strip1 | AC | 5,470 | 266,446 | 1,305,333 | 916 | 51,047 | 313,326 | 542,999 | 1 | 10.64 | 51,047 |
| 386 | Field Border | FT | 3,668 | 14,668,441 | 833,822 | 893 | 1,020,219 | 292,900 | 414,942 | 66 | 26.84 | 15,458 |
| 327 | Conservation Cover1 | AC | 3,706 | 294,805 | 640,065 | 764 | 6,026 | 177,324 | 342,513 | 1 | 56.84 | 6,026 |
| 393A | Filter Strip2 | AC | 394 | 57,989 | 348,953 | 100 | 34,406 | 88,692 | 122,740 | 1 | 3.57 | 34,406 |
| 330 | Contour Farming | AC | 13,724 | 2,034,659 | 302,132 | 3,514 | 27,448 | 164,729 | 191,882 | 1 | 6.99 | 27,448 |
| 329C | Residue Management, Ridge Till | AC | 1,294 | 151,645 | 231,111 | 4,286 | 7,782 | 127,302 | 156,033 | 1 | 20.05 | 7,782 |
| 585 | Contour Strip-cropping | AC | 567 | 37,175 | 214,194 | 148 | 7,043 | 63,888 | 99,574 | 1 | 14.14 | 7,043 |
| 586 | Strip-cropping | AC, Field | 304 | 24,599 | 200,474 | 68 | 4,426 | 82,294 | 116,475 | 1 | 26.32 | 4,426 |
| 716 | Anion Polyacrylamide (PAM) Ero. Cont. | ac. | 238 | 23,333 | 178,408 | 81 | 7,022 | 94,952 | 152,688 | 1 | 21.74 | 7,022 |
| 332 | Contour Buffer Strips | AC | 140 | 3,815 | 59,687 | 32 | 1,668 | 27,560 | 30,940 | 1 | 18.55 | 1,668 |
| 311 | Alley Cropping | AC | 397 | 1,485 | 47,033 | 0 | 0 | 0 | 0 | 1 | 0.00 | 0 |
| 342A | Critical Area Planting2 | AC | 45 | 27,717 | 31,597 | 8 | 13 | 5,169 | 8,911 | 1 | 685.46 | 13 |
| 331 | Contour Orchard and Other Fruit Area | AC | 298 | 1,294 | 23,421 | 23 | 63 | 3,309 | 5,741 | 1 | 91.13 | 63 |
| 758 | Strip - Intercropping | ac. | 5 | 851 | 9,672 | 5 | 851 | 9,672 | 9,672 | 1 | 11.37 | 851 |
| 327A | Conservation Cover2 | AC | 43 | 1,464 | 8,107 | 11 | 18 | 3,703 | 5,247 | 1 | 291.50 | 18 |
| 741 | Vegetative Buffer Strips | ac. | 6 | 8 | 1,140 | 2 | 1 | 396 | 396 | 1 | 396.00 | 1 |
| Totals | | | 257,530 | | 62,746,011 | 57,765 | 22,133,000 | 24,660,366 | 75,442,459 | | | 1,182,274 |
| Average per acre (based on implemented) | | | | | | | | 20.86 | 63.81 | | | |
| | Total Program Cost Share | | | | 746,281,930 | | | | | | | |
| | USLE Reducing Practice Share of Tota | | | | 0.084 | | | | | | | |

**Table A2. Historical EQIP data on practices benefiting grazing productivity**

| Practice | Definition | Units | Approved | | | | Implemented (excludes contract units not cost shared) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Number Contracts | Number Units | Cost Share | Acre Divisor[a] | Number Contracts | Number Units | Acres Protected | Cost Share | Total[b] Cost |
| 382 | Fence | FT | 34,095 | 106,459,403 | 52,126,285 | 66.00 | 11907 | 35,354,090 | 535,668 | 18,092,862 | 51,812,234 |
| 512 | Pasture and Hay Planting | AC | 29,687 | 1,628,256 | 33,796,511 | 1.00 | 12034 | 537,735 | 537,735 | 13,777,560 | 30,255,077 |
| 314 | Brush Management | AC | 19,931 | 2,233,018 | 27,002,129 | 1.00 | 7055 | 586,419 | 586,419 | 11,053,384 | 37,565,149 |
| 614 | Trough or Tank | NO. | 24,449 | 15,532,432 | 18,189,413 | 12.50 | 9097 | 6,845,038 | 547,603 | 6,814,304 | 27,596,069 |
| 528A | Prescribed Grazing | AC | 133,063 | 91,771,580 | 15,030,305 | 1.00 | 27980 | 1,625,790 | 1,625,790 | 7,421,948 | 16,923,590 |
| 550 | Range Planting | AC | 4,943 | 417,877 | 5,611,698 | 1.00 | 1607 | 116,180 | 116,180 | 1,564,645 | 2,999,409 |
| 574 | Spring Development | NO. | 3,847 | 52,482 | 4,244,140 | 0.05 | 1490 | 15,687 | 313,740 | 1,480,194 | 4,610,798 |
| 575 | Animal Trails and Walkways | AC | 1,168 | 693,612 | 1,864,507 | 1.00 | 445 | 286,893 | 286,893 | 727,051 | 1,127,536 |
| 472 | Use Exclusion | AC | 10,432 | 955,917 | 1,013,697 | 1.00 | 1744 | 151,409 | 151,409 | 375,976 | 1,540,034 |
| 762 | Planned Grazing System | ac. | 2,302 | 3,177,840 | 288,958 | 1.00 | 509 | 33,317 | 33,317 | 126,288 | 187,655 |
| 548 | Grazing Land Mechanical Treatment | AC | 458 | 147,468 | 238,444 | 1.00 | 93 | 7,505 | 7,505 | 64,484 | 89,600 |
| 510 | Pasture and Hayland Management | AC | 10,805 | 1,215,627 | 167,781 | 1.00 | 2315 | 5,777 | 5,777 | 49,616 | 64,102 |
| 460 | Land Clearing | AC | 51 | 2,014 | 78,667 | 1.00 | 12 | 442 | 442 | 43,459 | 98,979 |
| | Totals | | | 224,287,526 | 159,652,535 | | | | 3,165,652 | 61,591,771 | 174,870,232 |
| | Grazing Share (percent) of Total EQIP | | | | 0.214 | | | | | | |
| | Average annual costs per acre | | | | | | | | | 19.46 | 55.24 |

**Table A3. Historical EQIP practices benefiting irrigation efficiency**

| Practice Code and Name | | Units[a] | Approved | | | Implemented (excludes contract units not cost shared) | | | | Per-Acre | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Number of Contracts | Number of Units | Cost Share | Number of Contracts | Number of Units | Cost Share | Total Cost | Cost Share | Total Cost |
| 442 | Irr System Sprinkler | no & ac | 6361 | 2114925 | 35,486,577 | 3033 | 1,095,216 | 21,333,028 | 51,316,580 | 19.48 | 46.86 |
| 441 | Irr System MicroIrr | no & ac | 2104 | 3816732 | 11,444,309 | 853 | 1,160,412 | 5,770,473 | 22,464,719 | 4.97 | 19.36 |
| 449 | Irr Wat Management | AC | 46167 | 6158377 | 3,459,929 | 6509 | 280,271 | 1,540,054 | 3,954,249 | 5.49 | 14.11 |
| 466 | Land Smoothing | AC | 556 | 175259 | 995,004 | 176 | 56,363 | 399,721 | 938,839 | 7.09 | 16.66 |
| 462 | Precision Land Forming | AC | 112 | 351100 | 324,875 | 34 | 248,861 | 178,833 | 379,716 | 0.72 | 1.53 |
| 640 | Water spreading | AC | 64 | 75901 | 111,095 | 20 | 31,394 | 42,788 | 88,081 | 1.36 | 2.81 |
| 744 | Land Grading | ac. | 15 | 4310 | 32,284 | 4 | 2,074 | 19,432 | 43,437 | 9.37 | 20.95 |
| 738 | Soil Salinity Control | ac. | 110 | 31731 | 21,927 | 12 | 240 | 9,944 | 21,787 | 41.43 | 90.78 |
| 746 | Rice Wat Control | ac. | 97 | 7183 | 19,987 | 31 | 1,778 | 10,463 | 10,629 | 5.88 | 5.98 |
| 743 | Improved Wat Application | ac. | 542 | 43344 | 12,380 | | | | | | |
| Associated Practices[b] | | | | | | | | | | | |
| 430 D | Irr Wat Convey. Pipeline, High-Press. | FT | 7,358 | 15,815,978 | 28,287,002 | 3786 | 8,573,324 | 14,804,144 | 35,659,902 | | |
| 430 E | Irr Wat Convey. Pipeline, Low- | FT | 3,905 | 11,655,732 | 17,274,490 | 2060 | 5,723,846 | 9,556,878 | 26,277,786 | | |
| 430 H | Irr Wat Convey. Pipeline, Rigid Gated P | FT | 2,998 | 7,544,620 | 7,718,745 | 1531 | 4,529,418 | 3,811,504 | 10,234,957 | | |
| 428 A | Irr Wat Convey. Ditch and Canal Lining1 | FT | 954 | 1,358,793 | 6,396,408 | 534 | 681,355 | 3,812,972 | 17,022,515 | | |
| 447 | Irr System, TailWat Recovery | NO. | 625 | 1,762,769 | 2,667,454 | 197 | 1,025,220 | 1,243,479 | 10,881,891 | | |
| 443 | Irr System Surface and Subsurface | no &a | 3,108 | 8,388,224 | 1,762,810 | 849 | 3,996,757 | 937,008 | 2,432,310 | | |
| 436 | Irr Storage Reservoir | no&a | 187 | 2,613,186 | 1,272,561 | 95 | 1,498,048 | 715,371 | 2,261,284 | | |
| 552 B | Irr Regulating Reservoir | NO. | 80 | 298,208 | 299,448 | 35 | 107,777 | 168,995 | 1,404,015 | | |
| 430 C | Irr Wat Convey. Pipeline, Nonreinforced | FT | 37 | 67,797 | 249,748 | 15 | 12,623 | 97,307 | 159,404 | | |
| 388 | Irr Field Ditch | FT | 185 | 531,332 | 249,101 | 56 | 144,527 | 82,263 | 141,224 | | |
| 430 A | Irr Wat Convey. Pipeline, Aluminum Tubi | FT | 78 | 105,668 | 242,431 | 28 | 35,571 | 102,647 | 206,665 | | |
| 430 F | Irr Wat Convey. Pipeline, Steel | FT | 180 | 28,786 | 98,536 | 62 | 8,809 | 40,602 | 117,901 | | |
| 320 | Irr Canal or Lateral | FT | 45 | 127,583 | 75,910 | 15 | 40,914 | 25,552 | 50,316 | | |
| 428 B | Irr Wat Convey. Ditch and Canal Lining2 | FT | 10 | 65,080 | 40,827 | 3 | 38,338 | 14,014 | 23,882 | | |
| | Totals[c] | | 59,236 | 21,167,084 | 118,543,838 | 11,521 | 4,582,244 | 64,717,472 | 186,092,089 | | |
| | Averages | | | | | | | 14.12 | 40.61 | | |
| | Total EQIP cost share approved (Table A1 EQIP History) | | | | 746,132,579 | | | | | | |
| | Share for practices shown | | | | 0.159 | | | | | | |

## Table A4. Historical EQIP data on practices benefiting air quality

| | | | | | | | Implemented Practices (excludes contract units with zero cost share): | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Practice Definition | Units | Acre[a] divisor | Wind Area[b] Prop. | Approved Cost Share | Cost Share * wind area | Contracts | Units | Acres | cost share | total cost | Total Cost per acre |
| 329A | Res. Man., No-Till and Strip Till | AC | 1 | 0.43 | 18,826,296 | 8,095,307 | 8,892 | 493,323 | 493,323 | 8,034,476 | 14,953,683 | 30.31 |
| 342 | Critical Area Planting1 | AC | 1 | 1 | 6,588,314 | 6,588,314 | 4,618 | 175,419 | 175,419 | 2,685,059 | 25,361,525 | 144.58 |
| 329B | Residue Management, Mulch Till | AC | 1 | 0.43 | 5,972,819 | 2,568,312 | 4,286 | 377,827 | 377,827 | 2,732,861 | 4,699,092 | 12.44 |
| 550 | Range Planting | AC | 1 | 1 | 5,611,698 | 5,611,698 | 1,607 | 116,180 | 116,180 | 1,564,645 | 2,999,409 | 25.82 |
| 612 | Tree/Shrub Establishment | AC | 1 | 1 | 4,296,547 | 4,296,547 | 1,542 | 890,227 | 890,227 | 1,614,216 | 3,474,921 | 3.90 |
| 380 | Windbreak/Shelterbelt Establishment | FT | 66 | 1 | 4,265,777 | 4,265,777 | 1,888 | 4,267,734 | 64,663 | 1,445,988 | 2,677,947 | 41.41 |
| 340 | Cover Crop | AC | 1 | 1 | 3,777,254 | 3,777,254 | 2,791 | 102,135 | 102,135 | 1,345,112 | 4,889,644 | 47.87 |
| 328 | Conservation Crop Rotation | AC | 1 | 1 | 3,370,572 | 3,370,572 | 15,725 | 218,859 | 218,859 | 1,767,221 | 2,929,007 | 13.38 |
| 705 | Air Management | ac. | 1 | 1 | 1,799,593 | 1,799,593 | 378 | 8,902 | 8,902 | 429,597 | 885,214 | 99.44 |
| 344 | Residue Management, Seasonal | AC | 1 | 0.43 | 1,484,099 | 638,163 | 10,526 | 198,042 | 198,042 | 835,521 | 3,261,113 | 16.47 |
| 650 | Windbreak/Shelterbelt Renovation | FT | 66 | 1 | 736,379 | 736,379 | 258 | 516,084 | 7,819 | 244,583 | 398,367 | 50.95 |
| 327 | Conservation Cover1 | AC | 1 | 1 | 640,065 | 640,065 | 764 | 6,026 | 6,026 | 177,324 | 342,513 | 56.84 |
| 329C | Residue Management, Ridge Till | AC | 1 | 0.43 | 231,111 | 99,378 | 221 | 7,782 | 7,782 | 127,302 | 156,033 | 20.05 |
| 422 | Hedgerow Planting | FT | 33 | 1 | 216,182 | 216,182 | 54 | 98,127 | 2,974 | 28,597 | 563,364 | 189.46 |
| 586 | Strip-cropping | AC, Field | 1 | 1 | 200,474 | 200,474 | 68 | 4,426 | 4,426 | 82,294 | 116,475 | 26.32 |
| 392 | Field Windbreak | FT | 66 | 1 | 136,832 | 136,832 | 31 | 77,048 | 1,167 | 26,718 | 36,969 | 31.67 |
| 609 | Surface Roughening | AC | 1 | 1 | 55,281 | 55,281 | 878 | 5,855 | 5,855 | 31,928 | 55,243 | 9.44 |
| 589B | Cross Wind Strip-cropping | AC | 1 | 1 | 38,029 | 38,029 | 110 | 2,940 | 2,940 | 15,788 | 21,635 | 7.36 |
| 342A | Critical Area Planting2 | AC | 1 | 1 | 31,597 | 31,597 | 8 | 13 | 13 | 5,169 | 8,911 | 712.88 |
| 422A | Herbaceous Wind Barriers | FT | 66 | 1 | 15,202 | 15,202 | | | 0 | | | 0.00 |
| 704 | Agroforestry Planting | ac. | 1 | 1 | 13,384 | 13,384 | 1 | 40 | 40 | 6,620 | 8,826 | 220.65 |
| 589C | Cross Wind Trap Strips | AC | 1 | 1 | 10,910 | 10,910 | 25 | 223 | 223 | 4,765 | 6,548 | 29.36 |
| 758 | Strip - Intercropping | ac. | 1 | 0.43 | 9,672 | 4,159 | 5 | 851 | 851 | 9,672 | 9,672 | 11.37 |
| 327A | Conservation Cover2 | AC | 1 | 1 | 8,107 | 8,107 | 11 | 18 | 18 | 3,703 | 5,247 | 291.50 |
| 589A | Cross Wind Ridges | AC | 1 | 1 | 1,721 | 1,721 | 12 | 2,293 | 2,293 | 1,721 | 2,293 | 1.00 |
| Total | | | | | 58,337,915 | 43,219,237 | | | 2,688,003 | 23,220,880 | 67,863,651 | |
| Share in total EQIP Cost Share | | | | | | 0.058 | | Average per acre costs | | 8.64 | 25.25 | |

**Table A5. Historical EQIP practices benefiting wildlife**

| Practice Code and Name | Units | Approved: Number Contracts | Approved: Number Units | Approved: Cost Share | Implemented[a]: Number Contracts | Implemented[a]: Number Units | Implemented[a]: Cost Share | Total Cost |
|---|---|---|---|---|---|---|---|---|
| 412 Grassed Waterway | AC | 10,743 | 3,424,746 | 13,147,345 | 4597 | 1,228,041 | 6,360,695 | 13,566,131 |
| 612 Tree/Shrub Establishment | AC | 4,423 | 1,668,399 | 4,296,547 | 1542 | 890,227 | 1,614,216 | 3,474,921 |
| 645 Upland Wildlife Habitat Management | AC | 59,787 | 38,615,102 | 2,444,495 | 10701 | 152,516 | 957,803 | 2,359,986 |
| 666 Forest Stand Improvement | AC | 4,841 | 302,133 | 2,128,501 | 759 | 13,102 | 544,410 | 1,197,087 |
| 657 Wetland Restoration | AC | 457 | 101,367 | 1,258,953 | 126 | 7,890 | 460,075 | 1,594,337 |
| 338 Prescribed Burning | AC | 3,322 | 768,820 | 1,170,328 | 614 | 58,873 | 234,302 | 359,879 |
| 327 Conservation Cover1 | AC | 3,706 | 294,805 | 640,065 | 764 | 6,026 | 177,324 | 342,513 |
| 391 Riparian Forest Buffer1 | AC | 4,040 | 203,975 | 410,637 | 599 | 46,155 | 124,289 | 191,489 |
| 644 Wetland Wildlife Habitat Management | AC | 8,340 | 970,136 | 364,580 | 1152 | 23,941 | 166,132 | 321,395 |
| 322 Channel Vegetation | AC | 210 | 59,046 | 233,803 | 32 | 5,171 | 14,912 | 43,479 |
| Associated Practices: | | | | | | | | |
| 580 Streambank and Shoreline Protection | FT | 3,057 | 3,651,616 | 9,043,292 | 941 | 794,267 | 3,249,540 | 7,441,466 |
| 380 Windbreak/Shelterbelt Establishment | FT | 4,776 | 10,520,008 | 4,265,777 | 1888 | 4,267,734 | 1,445,988 | 2,677,947 |
| 386 Field Border | FT | 3,668 | 14,668,441 | 833,822 | 893 | 1,020,219 | 292,900 | 414,942 |
| 650 Windbreak/Shelterbelt Renovation | FT | 663 | 1,633,870 | 736,379 | 258 | 516,084 | 244,583 | 398,367 |
| 422 Hedgerow Planting | FT | 385 | 749,969 | 216,182 | 54 | 98,127 | 28,597 | 563,364 |
| 392 Field Windbreak | FT | 207 | 579,940 | 136,832 | 31 | 77,048 | 26,718 | 36,969 |
| Totals (Acres Treated sum excludes those with FT units) | | | | 41,327,538 | | 1,621,295 | 15,942,484 | 34,984,272 |
| Per-acre Costs | | | | | | | 9.83 | 21.58 |
| These practices share of EQIP Cost Share | | | | 0.055 | | | | |
| Total EQIP Approved Cost Share | | | | 746,132,579 | | | | |

Acreage total is sum of practice acres divided by 1.50 to reflect that under the EQIP program, most acres would receive at least two of these practices.

[a] Excludes contract units with zero cost-share.