EVALUATING THE BENEFITS OF CONSERVATION COMPLIANCE IN THE COW CREEK WATERSHED LATAH COUNTY, IDAHO

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INTRODUCTION

The conservation compliance provision was included in the Food Security Act of 1985 to encourage farmers to control soil erosion in the United States. This provision requires farmers to use approved conservation practices on highly erodible lands, and it also prohibits payment of benefits to farmers who produce agricultural commodities on such lands without using these practices. Farmers who do not comply will be cut off from all federal price support loans, deficiency payments, payment in kind programs, ACP payments, farm storage facility loans, Federal crop insurance, disaster payments, new loans made, insured or guaranteed by the Farmers Home Administration (FmHA) if that loan would be used for a purpose that contributed to excessive erosion of highly erodible land, and payments for the storage of CCC owned commodities [5].

Farmers with "highly erodible" land were required to develop and file a farm plan with the USDA Soil Conservation Service (SCS) by December 31, 1989. "Highly erodible" land was defined as lands in the SCS Land Capability Classes IIIe, IVe, VIe, and VIIe which account for 95 percent of total erosion from land eroding at more than 15 tons per acre [12]. Implementation of these plans must have begun after January 1, 1990, or two years after the land involved has been mapped and classified by the SCS. Farmers must have completed the implementation process by January 1, 1995 in order to maintain their farm program status. A majority of farmers are developing farm plans. In northern Idaho and eastern Washington, the participation rate has been in excess of 85 percent. Factors affecting participation are that bankers, lawyers, and conservation districts support it, and that all forms of government payments are dependent upon conservation compliance after 1990.

The political pressure to include conservation compliance has come from a variety of sources. First, farmers who have organized Soil and Water Conservation Districts that have historically been concerned with soil erosion supported it. Second, environmental groups have worked to make conservation compliance a requirement for passage of any farm legislation. Thirdly, the general public is concerned about the questions being raised over the quality of the environment. All of these interests came together in 1985 and passed the Food Security Act of 1985. These same forces will be supporting the passage of the 1990 farm bill, and it appears that the pressures for compliance will increase in the future.

OBJECTIVES

The objectives of this study are to evaluate the general economic impacts that the Food Security Act of 1985's "Conservation Compliance" requirement will have on agriculture. The intent is to assess the impacts that the conservation plans which farmers are required to put into place will have on the environment and on farmers. The following specific objectives are addressed:

1. The evaluation of the economic impacts of conservation scenarios on reducing erosion and sedimentation in the Cow Creek watershed.
2. Developing estimates of the reduced damages resulting from the implementation of conservation compliance.
3. Determining the ratio of benefits generated by the conservation planning process vs the cost of government programs.

METHODOLOGY

A technique for estimating the economic benefits related to the off-farm damages caused by sedimentation was developed. This study extends the work of Clark et.al.[3], by using their inferences to estimate economic impacts at the farm and watershed level. The procedures were to develop an erosion profile of a representative farm, and to infer from the results of Clark et.al. the economic contribution which this farm and the Cow Creek watershed make toward improving environmental quality by adopting conservation plans [3].

The data used in this study were obtained from various sources. The off-site damage values were based on values developed by Clark et.al. in "Eroding Soils: The Off Farm Impacts" [3]. Information on conservation practices and scenarios was obtained from the Idaho State Office of SCS [11]. The information on the Cow Creek watershed was taken from Berglund and Michalson "Economics of the Five Point Program in Latah County"[1], and Brooks and Michalson "An Economic Evaluation of Best Management Practices in the Cow Creek Watershed, Latah County, Idaho"[2]. Other information used in this study was obtained from unpublished reports and interviews with Soil Conservation Service personnel in the Pacific Northwest.[1]

A sediment delivery ratio of 30 percent was used to estimate the amount of eroded soil delivered to streams and other water bodies [8]. The off-site damages resulting from sedimentation were updated from the 1980 data base provided by Clark et.al to 1987 using the producer price index [6]. The estimated costs of off-site damages were calculated by multiplying the average value of cropland's share by the number of tons of soil delivered to Cow Creek [3].

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1 Unpublished data and reports U.S. Army Corps of Engineers, Walla Walla District Office, and D. K. McCool and M. Molnau. "Completion Report Palouse Erosion Control Project." Preliminary, November 20, 1978.

STUDY AREA

The Cow Creek watershed is located in Latah County in Northern Idaho. The study area includes approximately 21,000 acres (8,268 hectares) located in the southwestern corner of Latah County (Figure 1) [2]. Both of these counties are located in northern Idaho. Approximately 20,000 acres (7,874 hectares) of the land is cropland. Precipitation in the watershed averages 23.4 inches (594 millimeters) yearly, which permits annual cropping [9]. The growing season for the area ranges from 91 to 159 days depending upon the year and location in the watershed [9]. In the winter the temperature averages 32 degrees Fahrenheit (zero degrees Celsius), and in the summer the average daily temperature is 63 degrees Fahrenheit (17.2 degrees Celsius) [9].

The topography of this watershed ranges from relatively flat low lying land areas to steep hill sides [8]. Approximately 40 percent of the land area has slopes ranging from 0 to 7 percent. Twenty five percent of the land area ranges from 8 to 15 percent. Another 25 percent ranges from 16 to 25 percent. The remaining 10 percent has slopes ranging from 26 to 40 percent.[2]

A 1,050 acre representative wheat pea farm in the Cow Creek watershed was selected as the study farm. In the

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2 Personal communication from S. Vera, Conservation Officer, Latah County, Idaho.

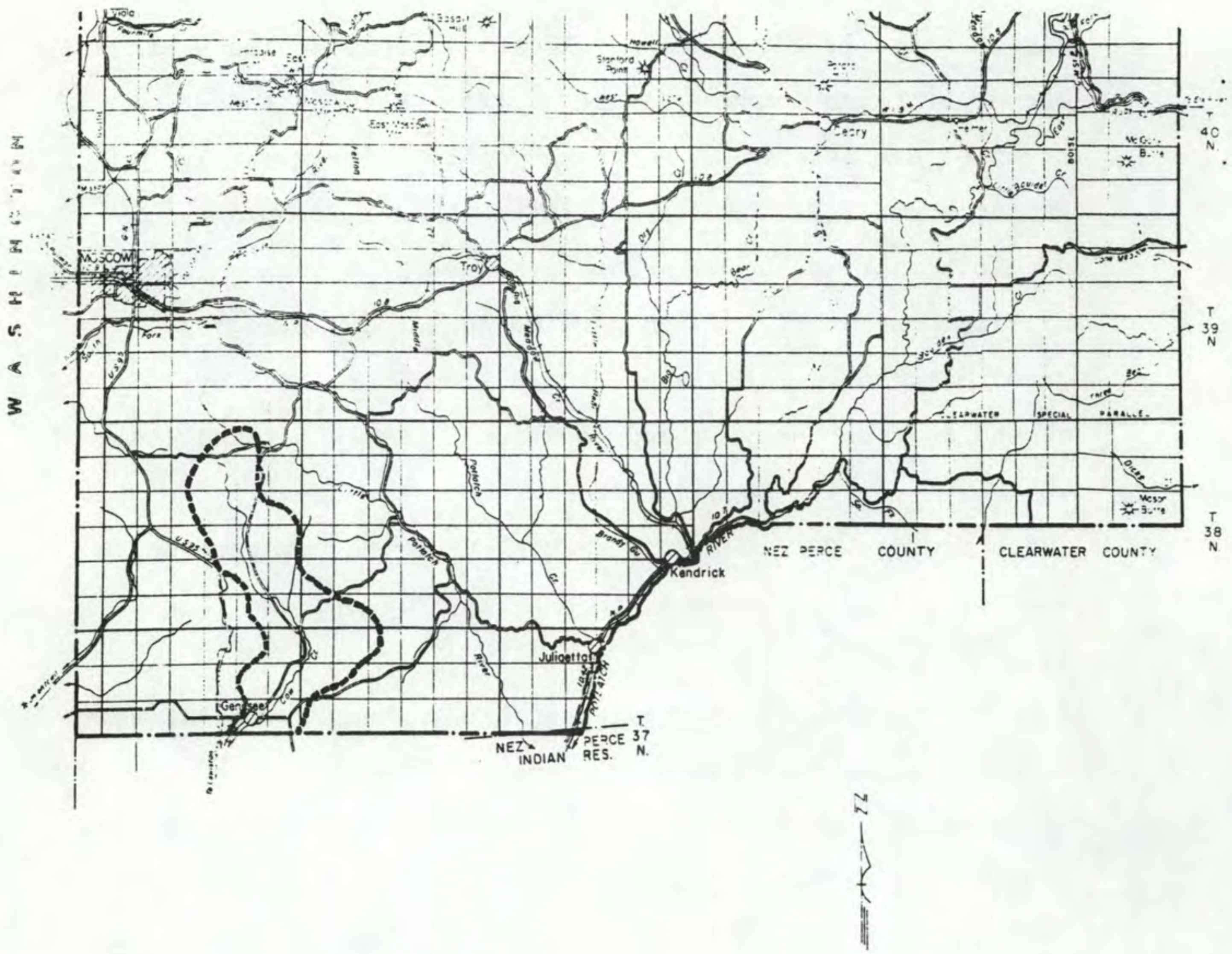

Fig. 1. Cow Creek watershed study area in southern Latah County.

following analysis, a wheat-pea rotation was assumed. The cropland farmed was 1,000 acres with a normal complement of farm machinery. The conservation practices evaluated were conventional farming, conservation tillage, crop residue management, divided slopes/stripcropping, and no-till seeding of wheat, and logical combinations of these practices.

SOIL LOSS ANALYSIS

The soil loss estimates used were estimated using the Modified - Universal Soil Loss Equation (M-USLE) developed specifically for the Pacific Northwest [4]. These soil loss estimates are subject to a 50 percent error [13]. The soil loss tolerance ("T") used to control soil erosion in the Cow Creek watershed was 5 tons of erosion per acre. The "T" value is defined as the maximum amount of soil erosion which can occur without reducing the soils capacity to support sustained crop production [12]. In field planning practice, reducing soil losses below 7.5 tons per acre technically meets the SCS "T" requirements because the USLE calculations are subject to a 50 percent error term. [13].

Table 1 indicates the relationship between tillage practices and soil losses from erosion. This table itemizes average erosion rates calculated for the representative farm and for the watershed as a whole. The average soil loss for a given farm operation becomes a function of the type and number of tillage and conservation practices along with the

Table 1. Estimated average erosion rates for selected practices in the Cow Creek watershed on a representative 1000 acre farm.

Wheat/pea rotation	Percent Slope 0-7	8-15	16-25	26-40
	(Tons per acre)			
1. Conventional farming	8.1	17.4	22.0	30.7
2. Conservation tillage				
a. CT	4.6	13.1	17.2	23.0
b. CRU	3.0	6.1	6.9	9.2
c. CRU+CS	2.4	4.9	6.5	8.8
d. CRU+SC	1.8	3.7	5.5	7.4
3. No-till				
a. NT	1.1	4.5	6.0	7.6

Legend: CT = Conservation tillage,
CRU = Crop residue use,
CS = Cross slope farming,
SC = Divided slopes/Stripcropping, and
NT = No-till.

Source: Idaho Field Office Technical Guide Appendix 1, Section III, June 1987.

crop rotation used on the farm. In this study the primary emphasis is placed on the role of tillage practices. Conventional farming, conservation tillage, crop residue use, cross slope farming, and no-till are practices which can be used on all of the cropland farmed. Divided slopes and stripcropping on the other hand are only applicable under given conditions of steepness of slope for selected fields. In this study divided slopes could be used on a maximum of 60 percent of the cropland. Divided slopes/stripcropping and no-till were used on the 10 percent of the cropland with slopes greater than 25 percent. The soil loss scenarios used in this study were developed by the SCS for conditions in Northern Idaho [11].

In Table 1 soil loss estimates are shown in part 1 for conventional farming {CF} which includes the use of heavy tillage implements which leave very little residue on the soil surface after planting. In part 2 of Table 1, the conservation practices are shown. Conservation tillage {CT}, was defined as any tillage and planting system that maintains some residue on the soil surface. Crop residue use {CRU}, was defined as conservation tillage where at least 30 percent of the residue is left on the soil surface. The amount of residue maintained on the soil surface varied with the steepness of slope [8]. Cross slope farming {CS}, was defined as farming across the fields following the contour of the land as closely as practical. Strip cropping/divided slopes {SC}, was designed to divide fields into sub-fields to shorten slope lengths. Part 3 of the table indicates the soil losses under no-till farming {NT} in the area. Soil losses are shown in the table for average slope lengths and steepness. This procedure follows the approach used by SCS in their FSA conservation compliance planning process.

Estimated average soil losses for each practice are as follows: 1) conventional farming, 17.3 tons per acre; 2) conservation tillage, 11.7 tons per acre; 3) crop residue management, 5.4 tons per acre; 4) cross slope farming, 4.9 tons per acre; 5) strip cropping/divided slopes, 4.8 tons per acre; and 6) no-till, 3.8 tons per acre.[3]

In Table 2, 11 conservation scenarios are compared to conventional farming. The farm land evaluated included 400 acres with an average slope of 4 percent and slope lengths of 500 feet; 250 acres with a 11 percent average slope and slope lengths of 200 feet; 250 acres with a 20 percent average slope and slope lengths of 200 feet; and 10 percent with 32 percent average slope and slope lengths of 150 feet [11].

The reduction in estimated soil loss between conventional farming and conservation tillage is shown in Table 2. The average soil loss under conventional farming

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3 USDA-ASCS. Program Provisions and Payment Rates for 1978 Through the Current Year. Exhibit 5 (par. 6, 465, 466, 682) por 1978 Through the Current Year. Exhibit 5 (par. 6, 465, 466, 682) p-Pa (Rev. 8), 1-26-90.

Table 2. Comparisons of the success of alternative conservation practices in controlling soil erosion on a representative Cow Creek farm.

		Representative Farm	
Scenarios (practices)		(tons/ac)	(tons)
1.	Conventional farming	17.3	17,300
2.	CT	11.7	11,700
3.	CRU	5.4	5,400
4.	CRU + CS	4.9	4,900
5.	CRU + SC	4.8	4,800
6.	NT	3.8	3,800
7.	CT 65%, CRU 35%	7.5	7,500
8.	CT 40%, CRU 50% & CRU+CS 10%	6.0	6,000
9.	CT 40%, CRU 25%, CRU+CS 25%, & CRU+ SC10%	5.7	5,730
10.	CT 40%, CRU 25%, CRU+SC 35%	5.3	5,290
11.	CT 40%, CRU 25%, NT35%	5.6	5,625
12.	CT 40%, CRU+CS 50% NT 10%	5.2	5,200

Legend: CT = Conservation tillage,
CRU = crop residue use,
CS = cross slope farming,
SC = divided slopes/stripcropping, and
NT = no-till.

amounted to 17,300 tons for the representative farm, or 17.3 tons per acre. Under conservation farming, estimated soil loss declined to 11,700 tons for the farm , or 11.7 tons per acre. The net soil saving amounted to 5,600 tons for the farm, or 5.6 tons per acre. The use of conservation tillage has a significant influence on soil erosion, however more erosion control is necessary if SCS "T" tolerances are to be met.

Table 2 also provides the scenarios for combinations of practices, conservation tillage and crop residue use, crop residue use, cross slope farming, divided slopes/ stripcropping, and no-till, compared to conventional farming. In the scenarios presented, soil loss was reduced from 11.7 tons per acre to as low as 3.8 tons per acre. All scenarios with the exceptions of conventional farming and conservation tillage meet the SCS "T" standard of 5 tons per acre allowing for the error term of 50 percent. Any combination except the two listed above would represent a marked improvement in managing soil erosion in the area. A further point is that not all the conservation tillage practices should necessarily be applied on every acre farmed. Divided slopes/stripcropping and no-till practices are usually only applied on steeper lands. A variety of options have been developed by SCS which meet the "T" tolerance criteria.

Sedimentation estimates are shown in Table 3. The general results appear much the same as for Table 2. The sedimentation values were based on a 30 percent delivery ratio obtained from the "Palouse Cooperative River Basin Study"[8]. The reduction in sedimentation in this study varied from a high of 5.2 tons per acre under conventional farming scenario to a low of 1.2 tons per acre under the no-till scenario. Most of the scenarios presented in this paper reduce sedimentation to less than half of that under conventional farming. Although no tolerance level is defined for sedimentation as there is for erosion, it was assumed that the magnitude of the reduction follows the same pattern as that for erosion. Given the above conservation practice scenarios, it is reasonable to expect that an improvement in water quality would follow implementation of such practices.

The magnitude of potential sedimentation reduction occurring from the implementation of the recommended conservation practices is impressive. Under conventional farming average annual sedimentation was estimated to be 5,200 tons per farm. Using scenario 9, which does not rely on no-till, sedimentation could be reduced to 1,700 tons for the farm. If the most effective no-till scenario were used, an additional reduction to 600 tons of sediment per farm could be achieved (5,300 tons under CF compared to 1,100 tons under NT).

Table 3. Comparisons of the success of alternative conservation practices in controlling soil sedimentation a representative Cow Creek farm

	Representative Farm	
Practices used	(tons/ac)	(tons)
1. Conventional farming	5.2	5,200
2. CT	3.5	3,500
3. CRU	1.6	1,600
4. CRU + CS	1.5	1,500
5. CRU + SC	1.4	1,400
6. NT	1.1	1,100
7. CT 65%, CRU 35%	2.3	2,300
8. CT 40%, CRU 50% & CRU+CS 10%	1.8	1,800
9. CT 40%, CRU 25%, CRU+CS 25% & CRU+ SC10%	1.7	1,700
10. CT 40%, CRU 25%, CRU+SC 35%	3.6	3,600
11. CT 40%, CRU 25%, NT 35%	1.6	1,600
12. CT 40%, CRU+CS 50% NT 10%	1.5	1,500

Legend: CT = Conservation tillage,
CRU = crop residue use,
CS = cross slope farming,
SC = divided slopes/stripcropping, and
NT = no-till.

OFF SITE DAMAGES

The data provided by The Conservation Foundation was updated and projected through 1987 [3]. Customized estimates were developed for the Cow Creek watershed based on the data in the "Clark et.al." study, and estimates were made on the appropriate level of cost sharing for all conservation practices. The updating of these data was done using the Producer Price Index [6]. Information provided in these publications was used to estimate the appropriate cost-shares for the conservation practices described in the soil loss section of this paper. These estimates were updated through 1987.

Table 4 summarizes the estimated in-stream and off-stream damages resulting from soil erosion on U.S. cropland. The first row of this table is the 1980 estimate made by Clark et.al. [3]. The later years were estimated using the producer price index to reflect both absolute and relative increases in the amount of erosion/sediment damage generated on an annual basis. The aggregate damages are shown under total damages and they increase from $2.21 billion in 1980 to a maximum of $2.5 billion in 1987. See figure 2 for a graphical display of these costs.

The changes in value also follow the movement of the national economy over this time period. The estimated national average damages per acre ranged from $5.35 per acre

Figure 2. Estimated off-site damages to U.S. cropland, 1980-87.

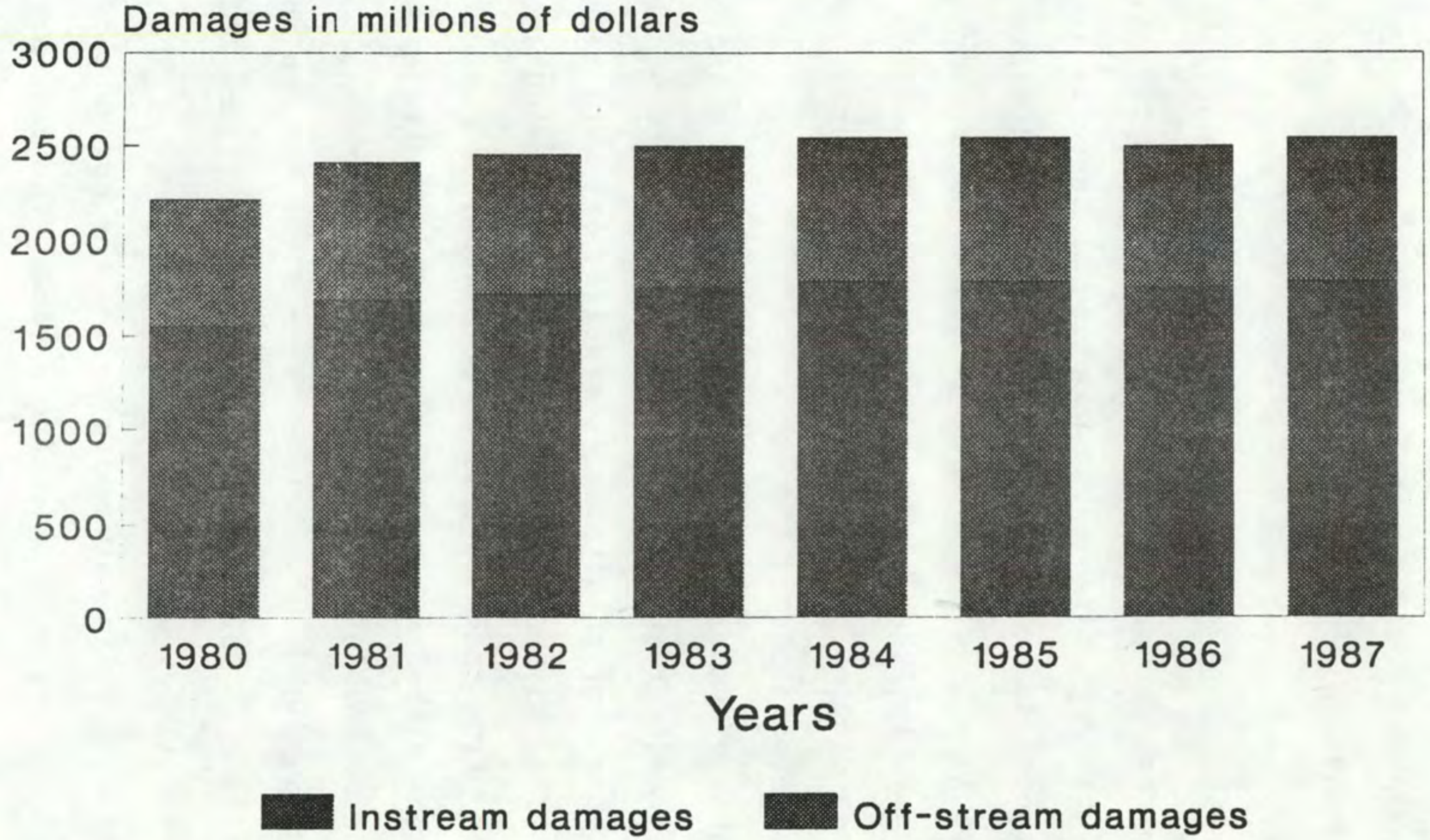

Table 4. Estimated in-stream and off-stream damages resulting from soil erosion in the U.S., cropland share: 1980-1987.

Year	Producer Price Index	In-stream damages ($ Mill)	Off-stream damages ($ Mill)	Total damages ($ Mill)	Avg. damages ($/ac)	Avg. cost ($/ton)
1980	100	$1,550	$660	$2,210	$5.35	$1.15
1981	109	$1,690	$719	$2,409	$5.83	$1.25
1982	111	$1,721	$733	$2,453	$5.94	$1.27
1983	113	$1,752	$746	$2,497	$6.04	$1.29
1984	115	$1,783	$759	$2,542	$6.15	$1.32
1985	115	$1,783	$759	$2,542	$6.15	$1.32
1986	113	$1,752	$746	$2,497	$6.04	$1.29
1987	115	$1,783	$759	$2,542	$6.15	$1.32

Source: E. H. Clark, J.A. Haverkamp, and W. Chapman. Eroding Soils The Off Farm Impacts. The Conservation Foundation, 1985.

in 1980 to a maximum of $6.15 in 1987. These estimates do not include any consideration for outdoor recreation values which may be as great or greater than those reported here.

The next step was to estimate how much the damages caused by eroding soils could be reduced by using conservation practices. Average annual soil losses were estimated to be 1.926 billion tons per year [3]. The average cropland farmed was estimated to be 413 million acres [3]. The costs estimated in the Clark study for the cropland share were $2.2 billion or $1.14 per ton of sediment in 1980 [3]. This value was inflated to $1.31 in 1987 using the producer price index, see Table 4. The basis of the values used in the Clark et.al. study included instream damages to recreation, water storage facilities, navigation, and other instrean uses [3]. In addition, this study also included off-stream effects such as flood damages, damages to water conveyances facilities, water treatment facilities, and other off-strem uses [3].

The data shown in Table 5 are the potential savings which would result from the application of conservation practices. They represent the difference between conventional farming and the use of conservation practices. The annual potential benefits in terms of reduced damages related to reducing soil erosion range from $1.82 to $4.67 per acre in 1980, to a projected $2.10 to $5.38 per acre in 1987. The reduced damages are economic benefits generated from the use of conservation practices.

Table 5. Estimated value of erosion benefits based on estimated sediment damages.

Practice	Estimated sediment reduced in tons per acre (1)	Estimated damages per acre (2)	Estimated reduced damages per acre (3)	Capitalized values of damages per acre (4)
1. Conventional Farming	5.2	$6.82	$0.00	$0.00
2. CT	3.5	$4.59	$2.23	$44.60
3. CRU	1.6	$2.10	$4.72	$94.40
4. CRU & CS	1.5	$1.97	$4.85	$97.00
5. CRU & SC	1.4	$1.84	$4.98	$99.60
6. NT	1.1	$1.44	$5.38	$107.60
7. CT 65%, CRU 35%	2.3	$3.02	$3.80	$76.00
8. CT 40%, CRU 50%, & CRU+CS 10%	1.8	$2.36	$4.46	$89.20
9. CT 40%, CRU 25%, CRU+CS 25%, & CRU+SC 10%	1.7	$2.23	$4.50	$91.80
10. CT 40%, CRU 25%, & CRU+SC 35%	3.6	$4.72	$2.10	$42.00
11. CT 40%, CRU 25%, & NT 35%	1.6	$2.10	$4.72	$94.40
12. CT 40%, CRU+CS 50%, & NT 10%	1.5	$1.97	$4.85	$97.00

Legend: CT = Conservation Tillage
CRU = Crop residue use,
CS = Cross slope farming,
SC = Stripcropping/divided slopes, and
NT = No-till.

With conservation compliance provisions of the Food Security Act of 1985 the government may be acquiring an easement by requiring that certain selected conservation practices be used. Farmers participating in the federal farm program are now required to develop conservation plans and to have them implemented by 1995. Alternatively, the federal government could buy a conservation easement requiring that stated conservation practices would have to be used on identified cropland. If such an easement were purchased, it would be incumbent upon the landowner to use the conservation practice either for a stated period of time, or in perpetuity. The implications of this approach are that the future value of farmland would reflect any increased costs or enhanced benefits related to the conservation compliance easement.

The capitalization formula was used to estimate the value of the reduced erosion and sedimentation based on the estimated instream and off-stream impacts discussed above. This formula is shown below:

$$V = R/I$$

Where V = the value of the easement,

R = the expected rent derived from the reduced erosion and sedimentation damages, and

I = the discount rate (or the selected # interest rate used).

The values estimated using this formula represent a one time payment based on the value of the reduced erosion and sedimentation. The discount rate used was an estimated real interest rate of 5.0 percent. This was in turn based on the current (1987) Farm credit System long term loan rate for farm land of 9.75 percent.[4] This interest rate was obtained from the Farm Credit System Land Bank located in Lewiston Idaho. The real rate was estimated by deducting the estimated annual rate of inflation from the lending rate to get the real rate of interest. The estimated rate of inflation was 4 percent in 1987 [11]. Subtracting the rate of inflation from the loan rate resulted in a 5.0 percent real discount rate.

The range of benefits for conservation practices are shown in Table 5 along with the average estimated tons of sediment delivered to Cow Creek for each practice. The body of the table contains the estimated value of the reduced sedimentation. These values were estimated by comparing conventional tillage with the other soil conservation practices. The estimated values for the reduction of costs related to soil erosion in 1987 are shown in column 3 of Table 5. These values ranged from a low of $2.10 per acre for conservation tillage, to a high of $5.38 per acre for no-till. The greater the value in Table 5 the greater the reduction in soil erosion and sedimentation.

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4. Personal communication from loan officer of the Farm Credit system Land Bank located in Lewiston Idaho.

These estimates show the sediment reduction in tons per acre, and damages in dollars per acre. In addition, reduced damages were calculated by subtracting the difference between conventional farming and the recommended conservation practices. These values are reported in column 3. The last column in the table are the capitalized values of the reduced damages.

Farmers can reduce sedimentation using minimum tillage alone, or by combining it with other practices. The effectiveness of the conservation program depends upon both the type and number of conservation practices used. The following scenarios show the effectiveness of the various conservation practices in controlling sedimentation. Of the options available, 10 met all of the conservation compliance standards set forth in the Food Security Act of 1985 (assuming the 50 percent efficiency factor). Only conservation tillage by itself did not meet the USLE standard "T" value of 5 tons per acre. However, conservation tillage combined with other practices easily met the standards. The net present value estimated in Table 5 may be interpreted as the value of a conservation easement. These values ranged from $44.57 for conservation tillage to $107.50 for no-till shown in column 4. These values may also be interpreted as the value of a one time contractual payment for the implementation of a conservation practice. Such a payment is based on the estimated benefits generated by using these practices.

FARM IMPACTS

Farmers who wish to participate in the government programs have to decide both if and how they want to comply with the conservation compliance requirements. They need to know the most effective conservation scenarios for their situation. The choice of conservation practices is influenced by both capital investment and the additional amount of time a farmer has to spend. The goal of conservation compliance is to control soil erosion to "T" levels, and the scenarios set forth by SCS are an attempt to achieve this goal with the minimum amount of additional cost and effort to farmers.

These benefits range from $44,160 to $107,500 depending upon the combination of practices used. The differences in the conservation practices vary from using conservation tillage to no-till. The conservation tillage by itself does not meet the SCS "T" tolerances, but all of the other practices and combinations of practices do.

The proper interpretation of these values is that by adopting conservation compliance, and its recommended conservation practices, farmers will be contributing a direct economic benefit to society in terms of improved environmental quality, and the costs avoided by making these changes. This benefit would be measured in terms of the improved water quality of receiving waters.

Table 6. Estimated net present value of reduced off-site benefits based on using selected conservation practices to reduce erosion and sedimentation on a representative farm.

Practices used	Representative Farm — Capitalized Values: Dollars per acre	Total dollars
1. Conventional Farming	$0.00	$0
2. CT	$44.60	$44,600
3. CRU	$94.40	$94,400
4. CRU + CS	$97.00	$97,000
5. CRU + SC	$99.60	$99,600
6. NT	$107.60	$107,600
7. CT 65%, CRU 35%	$76.00	$76,000
8. CT 40%, CRU 50% & CRU+CS 10%	$89.20	$89,200
9. CT 40%, CRU 25%, CRU+CS 25% & CRU+SC 10%	$91.80	$91,800
10. CT 40%, CRU 25%, +CRU+SC 35%	$42.00	$42,000
11. CT 40%, CT+CRU 25%, & NT 35%	$94.40	$94,400
12. CT 40%, CT+CRU+CS 50%, & NT 10%	$97.00	$97.000

Legend: CF = conventional farming,
CT = conservation tillage,
CRU = crop residue use,
CS = cross slope farming,
SC = divided slopes/stripcropping, and
NT = no-till.

WATERSHED IMPACTS

The final estimates in this paper refer to the watershed effects of erosion and off-site damages. Table 7 provides estimates of the potential reduction of erosion which could result from the implementation of conservation compliance. The Cow Creek watershed has about 20,000 acres of cropland. Under conventional farming the erosion rates were estimated to average 17.3 tons per acre. The total erosion for the whole watershed under conventional farming was estimated to be 346,000 tons. Under the implementation of conservation compliance this level of erosion could be reduced to levels less than 150,000 tons using the scenarios developed by the SCS. The most effective conservation scenario was the implementation of no-till farming on all lands. This technique reduced the average rate of soil erosion to 3.8 tons per acre. However there were other scenarios in Table 7, three of which reduced erosion to levels under five tons per acre, and 6 scenarios which reduced soil erosion to under 7.5 tons per acre. The only conservation scenario which did not meet the SCS "T" level was conservation tillage.

The levels of reduction in soil losses due to erosion in the watershed would be significant. The erosion reduction levels were reduced to as little as 22 percent of that experienced under conventional farming by the use of

Table 7. Comparisons of the effectiveness of alternative conservation practices in controlling soil erosion in the Cow Creek watershed.

		Soil Loss From The Cow Creek watershed	
		Tons per acre	Total tons
1.	Conventional Farming	17.3	346,000
2.	CT	11.7	223,000
3.	CT + CRU	5.4	107,000
4.	CT + CRU + CS	4.9	99,000
5.	CT + CRU + SC	4.8	97,000
6.	NT	3.8	77,000
7.	CT 65%, CT+CRU 35%	7.5	150,0008
8.	CT 40%, CT+CRU 50% & CT+CRU+CS 10%	6.0	120,000
9.	CT 40%, CT+CRU 25%, CT +CRU+CS 25% & CT+CRU+SC 10%	5.7	115,000
10.	CT 40%, CT+CRU 25%, CT +CRU+SC 35%	5.2	104,000
11.	CT 40%, CT+CRU 25%, NT 35%	5.6	113,000
12.	CT 40%, CT+CRU+CS 50% NT 10%	5.2	104,000

Legend: CT = conservation tillage,
CRU = crop residue use,
CS = cross slope farming,
SC = divided slopes/stripcropping
NT = no-till planting

Note: Numbers in table may not add due to rounding.

the no-till scenario. More typical erosion reductions were in the range of 28 to 43 percent of that under conventional farming. The potential for improvement in reducing soil losses is great under the SCS conservation scenarios.

The contribution of erosion to sediment damages is shown in Table 8. It was assumed that the sediment delivery ratio was 30 percent, and the same percentage levels apply to the sediment reduction as to erosion as discussed above [5]. The amount of sediment delivered to Cow-Creek and other water bodies under conventional farming was estimated at 104,000 tons. Under no-till this was reduced to 23,000 tons. Generally for the other scenarios the amount of sediment deposited in water bodies was reduced to between 29,000 tons and 45,000 tons, with the exception of conservation tillage which again was not as effective as the other scenarios. Conservation tillage reduced the amount of sediment delivered to Cow Creek to 70,000 tons, compared to 23,000 tons for the no-till scenario [6]. Conservation tillage does not provide adequate protection on those lands which have slopes in excess of 20 percent, and this is reflected in the table. However, conservation tillage is an effective form of conservation on slopes which are less than 20 percent.

Table 8. Comparisons of the effectiveness of alternative conservation practices in controlling sedimentation in the Cow Creek watershed.

Practices used	Cow Creek watershed (tons/ac)	(tons)
1. Conventional farming	5.2	104,000
2. CT	3.5	70,000
3. CT + CRU	1.6	32,000
4. CT + CRU + CS	1.5	30,000
5. CT + CRU + SC	1.4	28,000
6. NT	1.2	24,000
7. CT 65%, CT+CRU 35%	2.2	44,000
8. CT 40%, CT+CRU 50% & CT+CRU+CS 10%	1.8	36,000
9. CT 40%, CT+CRU 25%, CT +CRU+CS 25% & CT+CRU+SC 10%	1.7	34,000
10. CT 40%, CT+CRU 25%, CT +CRU+SC 35%	1.6	32,000
11. CT 40%, CT+CRU 25%, NT 35%	1.7	34,000
12. CT 40%, CT+CRU+CS 50% NT 10%	1.6	32,000

Legend: CT = conservation tillage,
CRU = crop residue use,
CS = cross slope farming,
SC = divided slopes/stripcropping, and
NT = no-till.

Note: Numbers in table may not add up due to rounding

Table 9 indicates the estimated reduction in the costs of off-site damages resulting from the implementation of the conservation scenarios shown in the preceding tables. The largest reduction in the dollar value for off-site damages was generated by the use of the no-till scenario. This scenario reduced off-site damages by approximately $2.15 million. The range in the reduction of off-site damages varied from approximately $0.85 million to $2.15 million depending upon the scenario considered. Most of the scenarios ranged between $1.5 and $2 million.

ECONOMIC IMPACTS

If farmers in the Cow Creek watershed had participated in conservation compliance in 1987, they would have generated somewhere between $2.10 and 5.38 per acre in annual benefits, or r damages in the Palouse River basin, Table 5. The cost to the taxpayer in 1987 for conservation programs was $0.69 per acre, Table 10. This cost includes LTACP (Long Term Agricultural Conservation Program Contract payments) and ACP payments (Agricultural Conservation Program payments). The total cost of these payments for conservation practices in the Cow Creek watershed was $167,659, or $0.69 in 1987. It was assumed in this analysis that the cost of maintaining the SCS and ASCS offices are overhead costs which would continue with or without the conservation compliance program.

Table 9. Estimated value of off-site benefits based on using selected conservation practices to reduce sedimentation in the Cow Creek watershed.

Practices used	Off-Site Benefits $/acre	$
1. CF	$0.00	$0
2. CT	$44.60	$892,000
3. CT + CRU	$94.40	$1,888,000
4. CT + CRU + CS	$97.00	$1,940,000
5. CT + CRU + SC	$99.64	$1,992,800
6. NT	$107.60	$2,120,000
7. CT 65%, CRU 35%	$76.00	$1,520,000
8. CT 40%, CRU 50% & CRU+CS 10%	$89.20	$1,784,000
9. CT 40%, CRU 25%, CRU+CS 25% & CRU+SC 10%	$91.80	$1,836,000
10. CT 40%, CRU 25%, +CRU+SC 35%	$42.00	$840,000
11. CT 40%, CT+CRU 25%, & NT 35%	$94.39	$1,887,800
12. CT 40%, CT+CR. CT 40%, CT+CRU+CS 50%, & NT 10%	$97.01	$1,940,200

Legend: CF = conventional farming,
CT = conservation tillage,
CRU = crop residue use,
CS = cross slope farming,
SC = divided slopes/stripcropping, and
NT = no-till.

Table 10. Federal Government Conservation payments in Latah County in 1987 (on 245,240 acres in federal farm programs).

Item	Total costs	Per acre costs
ACP contracts	$123,991	$0.51
LTACP contracts	$43,668	$0.18
Total	$167,659	$0.69

Legend: ACP = Agricultural Conservation Program,
LTACP = Long Term Agricultural Conservation Program, and
CRP = Conservation Reserve Program.

Cow Creek watershed farmers would make a contribution varying between $42,000 and $107,500 under conservation compliance in terms of improving environmental quality. The simple benefit/cost ratio for this improvement ranged between 3.04:1.0 and 7.8:1.0. In other words for every dollar that the government puts into agriculture under conservation compliance annually, it receives between $1.40 and $3.60 in environmental quality improvements. Another way to look at this is that the Food Security Act of 1985 has shifted part of the burden of environmental improvement from the public to farmers through the conservation compliance provisions.

SUMMARY AND CONCLUSIONS

The goal of this study has been to evaluate both the environmental and economic impacts of conservation compliance to determine the incidence of benefits and costs of this program. The measure of benefits used was the value of reduced sedimentation resulting from the application of conservation practices under conservation compliance. The costs of compliance were assumed to be absorbed by farmers, and offset by deficiency payments, ACP and LTACP cost sharing, and other special conservation payments available such as CRP.

The Cow Creek watershed in southern Latah County in Idaho was selected as a test area. This area consists of approximately 21,000 acres of farm land, of which approximately 20,000 acres are cultivated. A representative farm of 1,050 acres was selected, of which 1,000 acres was assumed to be in crops. It was also assumed that all of the farms in the watershed would be developing conservation plans as required by the Farm Security Act of 1985.

The results of the study indicated that erosion and sedimentation on the representative farm could be reduced from 17.3 tons per acre under conventional farming practices to under 7.5 tons per acre using recommended SCS practices. The minimum erosion level was achieved under no-till at 3.8 tons per acre. Using these practices would also reduce soil erosion at the watershed level from an estimated 346,000 tons per year to under 150,000 tons per year. The minimum erosion level estimated was 77,000 tons per year estimated when no-till farming was applied on all the land farmed. This represents a maximum annual erosion reduction of 269,000 tons.

In the case of sedimentation, the reduction is comparable and just as impressive. The use of recommended conservation practices would reduce sedimentation from 5.2 tons per acre under conventional farming practices to a low of 1.1 tons per acre under no-till. On a watershed basis sedimentation would be reduced from 104,000 tons under conventional farming practices to a low of 23,000 tons under no-till.

The net present value of reduced benefits on the representative farm ranged from a high of $107,500 for the no-till practice to a low of $44,570 for conservation tillage. For the watershed, the reduced benefits ranged from a low of $2.10 under conservation tillage to a high of $5.38 per acre under the no-till practice. Farmers are potentially providing, under the conservation compliance provisions of the Food Security Act of 1985, environmental benefits ranging annually between $42,000 to $107,500 on the cow creek watershed. The ratio of farmer derived benefits vs federal conservation program costs varied from 0.27:1.0 to 0.68:1.0 over the range of practices evaluated in this study.

The conclusion of this study is that the Food Security Act of 1985 has imposed a form of mandatory conservation compliance on farmers participating in farm programs. The incidence of environmental benefits from conservation compliance returns significant benefits compared to the costs the federal government incurs to provide cost sharing and other conservation programs. Additional research is needed to determine the contribution which farmers are making to conservation compliance. It appears highly likely that the implementation of this program is not costless to the farmers who have had to develop conservation plans and change their farming practices to maintain their farm program status.

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