EFFECT OF THE 1985 FARM BILL PROVISIONS ON FARMERS' SOIL CONSERVATION DECISIONS

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Abstract

Conservation initiatives in the 1985 Farm Bill affected farmers' decisions regarding soil conservation. A farmer survey was conducted and a multi-period mixed-integer programming model was developed to determine an optimal farm plan with choices of crop-tillage combinations and land retirement. Results indicate that farmers' incentives to reduce soil loss in the Sand Mountain region in Alabama are not substantially affected by provisions of the 1985 Farm Bill. The bid price for the Conservation Reserve Program will have to be considerably higher than 1988 levels to provide an incentive to remove land from production.

Key words: soil conservation, conservation reserve program, agricultural commodity programs

INTRODUCTION

The 1985 Farm Bill contains new provisions that are causing farmers to re-evaluate previous decisions regarding soil conservation. While previous farm bills have included little incentive for farmers to conserve soil, provisions of the present Farm Bill that encourage soil conservation include conservation compliance, the Conservation Reserve Program (CRP), the 50/92 Program, the Acreage Reduction Program, and the Optional Paid Land Diversion Program. Faced with these program options, farmers must decide among alternative commodity programs, crop enterprises, and conservation practices. Government policy makers must, in turn, be informed of the potential effectiveness of their programs.

The objective of this study is to discover how the 1985 Farm Bill provisions affect crop mix and conservation decisions. In particular, this study seeks to answer pertinent questions concerning the relationship between agricultural policy and soil conservation, such as how soil losses for commodity program participants in the 1985 Farm Bill differ from soil losses for non-participants, whether the acreage reduction requirements of the commodity programs render these programs unattractive, and what effect decreasing target prices will have on future commodity program participation and resulting crop mix.

To accomplish the objectives of the study, a farmer survey was conducted in the Sand Mountain region of Alabama to identify crops grown, tillage practices used, and associated costs. Survey results were used to develop a multi-period mixed-integer programming model to determine an optimal farm plan for a representative row crop farm.

REVIEW OF LITERATURE

Agricultural policies are believed to have had mixed effects on soil erosion. Programs that are thought to have encouraged soil erosion include those that have encouraged increased acreage of erosive crops, either by decreasing risk or increasing net returns. These programs include dairy subsidies, export promotions, price supports, target prices, and federal crop insurance (Osteen). However, some program provisions may reduce erosion. These provisions include the conservation compliance provisions, acreage reduction programs, and the Conservation Reserve Program (CRP).[1]

Some economic studies have used optimal control theory to analyze soil erosion through time. Pope *et al.* (1983a) showed that Iowa farmers who treated all future generations equally would conserve soil to the tolerance level, while those who were unconcerned about future generations would not conserve soil.

Another application of optimal control theory involved a study in the Palouse Wheat-Pea area of Washington, in which it was determined that intensive wheat production through time could be economically justified as long as good cultural practices (those that prevent the soil from eroding above

[1] The net effects of strict cross-compliance provisions are less certain. Although cross-compliance might result in reduced total erosion on a particular farm, the requirement may reduce producer participation in the farm programs and thus have an adverse affect.

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the tolerance level) were used (Burt). In a subsequent study, McConnell also concluded that good cultural practices should be used in the long run for the benefit of future generations. In these studies, beginning soil depth was assumed to be sufficiently deep so that soil erosion had no large short-run effect on yields and returns. In Alabama, however, the topsoil is already so badly eroded that soil productivity can be greatly affected by soil erosion even in the short run (Hajek and McDaniel).

Several studies have addressed soil loss restriction policies similar to the conservation compliance provision. Pope *et al.* (1983b) found that, for Iowa farms with moderately or highly erodible soils, net returns decreased under soil loss restrictions because conservation practices resulted in lower income. Osteen and Seitz also found decreases in returns under soil loss restrictions on Illinois soils.

In an analysis of the impacts of income support and soil conservation policies across the United States, Boggess and Heady concluded that land retirement programs enrolling a large percentage of qualifying land were more effective at decreasing soil losses than were general soil loss restrictions. Other studies concerning soil loss restrictions analyzed the relationship of both rising energy prices and soil loss restrictions to soil loss (Zinser *et al.*) and the effect on soil loss of externally imposed soil loss restrictions, farmers' risk preferences and their willingness to tolerate soil loss (Kramer *et al.*). In Kramer *et al.*, gross returns were equal among tillage practices, but conservation tillage was considered to be more risky than conventional tillage. Some erosion control programs, such as soil loss restrictions and regulatory erosion constraints, caused significant reductions in income.

Other economic research analyzing soil erosion has focused on the effects of technological progress on soil erosion and the problems associated with variable soil losses. In a recent study, Taylor and Young considered the effect of the interaction between technological progress and soil erosion on future crop yields. Results showed that, where existing topsoils were shallow or a farmer's planning horizon was relatively long, policies were not required to achieve erosion control goals.

Helms *et al.* used simulation modeling and stochastic dominance to analyze alternative tillage systems under both the 1981 and the 1985 far bills. Conservation tillage with government program participation was the preferred strategy for all risk-preference groups under both farm bills. According to Helms *et al.*, farmers would be more likely to adopt a no-tillage practice under the 1981 program than under the 1985 bill.

DATA

Farmers of the Sand Mountain region of Alabama were surveyed to determine input usage and crop yields under different tillage practices. The region, located in Northeast Alabama, is characterized by rolling hills with cropland, pastureland, and woodland. Alabama counties with all or part of their area in the survey region include Jackson, DeKalb, Marshall, Blount, and Cullman.

Farmers were asked to provide information for 1984 through 1986. Input usage data for fertilizer, machinery, chemicals, and labor were obtained, as well as data on yields and crop acreages. Tillage practices were characterized as either conventional, reduced, or no-tillage.[2] For each crop-tillage practice, the surveys were used to calculate average input use, and then the survey results were used to modify budgets of the Alabama Cooperative Extension Service (ACES) to reflect different tillage practices. Yields used in the budgets were the average yields across all three years for each crop-tillage combination. In Table 1, information from the survey is summarized.[3]

In the region, crops grown using conservation practices were generally as profitable as crops grown using conventional practices. While chemical and seed costs were higher for crops grown using conservation practices, machinery costs were higher for conventionally tilled crops. These results are consistent with those of previous studies, in which it was also found that use of no-tillage systems (as opposed to conventional tillage systems) had little or no effect on net returns where good soil-conserving cultural practices were used or where equal yields resulted (Hunter and Keller; Klemme). Although our study and others have found that yields are as good or better for conservation tillage, Belknap and Saupe have pointed out several additional factors that affect farmers' use of conservation tillage in Wisconsin. Farmers using conservation tillage tend to operate larger farms, own rather than rent land, be less risk averse, be involved in farmer organizations and be longer-term planners.

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[2] Conventional tillage involves the use of a chisel plow, a disc harrow, a "do-all," and a conventional cultivator. Reduced tillage involves the use of a chisel plow and a disc harrow. No-tillage involves the use of a no-till planter.

[3] Detailed information on the farmer survey and the resulting crop budgets can be found in Gillespie *et al.*

Table 1. Selected Data Used in Economic Programming Model for Agricultural Tillage Practices in the Sand Mountain Region of Alabama, 1987

Item[a]	Corn Conv Str	Corn Conv Cont	Corn Red Str	Corn Red Cont	Corn No-t Str	Corn No-t Cont	Soyb Conv Str	Soyb Conv Cont	Soyb Red Str	Soyb Red Cont	WSDC Red Str	WSDC Red Cont	WSDC No-t Str	WSDC No-t Cont	Cons Res Prog
Market Returns, $/a															
	90.92	89.49	95.50	94.38	94.73	92.95	69.68	67.25	67.99	66.88	89.06	87.60	86.85	85.54	—
Program Returns, $/a[b]															
1987	108.08	106.93	110.66	109.76	110.60	109.18	—	—	—	—	102.38	101.32	100.78	99.83	50.19
1991	78.00	76.86	81.50	80.60	80.97	79.55	—	—	—	—	88.93	87.87	87.33	86.38	50.19
Soil Loss, ton/a															
	7.9	4.0	6.5	3.3	4.6	2.3	10.6	5.3	7.7	3.9	9.3	4.6	6.6	3.3	0
Labor (hrs/acre)															
Labor 1[c]	0.26	0.29													
Labor 2	0.84	0.92	0.84	0.92	0.35	0.39									
Labor 3	0.82	0.9	0.5	0.55	0.5	0.55	2.18	2.4	1.31	1.44	0.9	0.99	0.64	0.7	0
Labor 4	0.45	0.5	0.45	0.5	0.45	0.5	0.45	0.5	0.45	0.5	0.62	0.68	0.62	0.68	0
Survey Freq. (pct)															
Farmers	29	29	23	23	40	40	43	43	14	14	20	20	20	20	21
Responses	15	15	12	12	21	21	23	23	7	7	11	11	11	11	n.a.

[a]Where Conv = conventional tillage, Red = reduced tillage, No-t = no tillage, Str= straight row, and Cont = contoured. "Market Returns" refers to returns for crops grown outside of government programs. "Program Returns" refers to returns for crops grown under farm program provisions.

[b]Program net returns are reduced by the percentage of required set-aside.

[c]Labor requirements by period. Period 1:Feb. 11 - Mar 31. Period 2: Apr 1 - Apr. 30 Period 3: May 1 - Jun. 30. Period 4: Sept. 1 - Nov. 30. Only minor amounts are required at other times.

METHODS

The survey data were used to develop a multi-period mixed integer programming model capable of analyzing the effects of selected farm program provisions on soil conservation decisions. The 5-year model was based on a multiperiod mixed integer programming model developed by Mims *et al.*[4] In this model, base acreage was calculated as a moving average, and 0-1 mixed integer programming was used to ensure either participation or non-participation in commodity programs.

For our study, this model was expanded to include detailed representation of the conservation provisions of the 1985 Farm Bill. Government programs included in the model are: the basic commodity programs, the 50/92 Program, the Optional Paid Land Diversion Program (OPLD), and the CRP. The basic commodity programs all involve target prices, Acreage Reduction Programs (ARP), conservation compliance restrictions, and limited cross-compliance. Under ARP, a percentage of commodity program land must be idled or set aside. Limited cross-compliance requires that, if one or more commodities are grown in the program, the acreage of any other crop covered by the Farm Bill must not exceed its base acreage, even if it is not enrolled in the program.

The target price projections used in the model were those included in the 1985 Farm Bill, which decrease over the life of the Farm Bill (see Stucker and Collins). The first year of the model planning horizon was assumed to be 1987, a year when the 1985 Farm Bill provisions were fully implemented. Commodity prices in years one through five were held constant at average prices from years 1984 through 1986. Crop prices per bushel were: wheat, $2.89; corn, $2.56; and soybeans, $5.56.[5] Program net returns, therefore, decrease relative to non-pro-

[4] Although CRP is a ten-year program, a five-year planning horizon was used, rather than a longer one, because of considerable uncertainty about the long-run direction of farm programs. Returns to CRP beyond the five-year horizon are discounted and included in the model.

[5] Barring any dramatic changes in the market structure, the 1984-1986 average prices should serve as reasonably good proxies for farmers' expected market prices. In reality, prices will vary over the time horizon. It is recognized that new information, particularly price information, will affect the planning decisions in years two through five. Unfortunately, future prices are impossible to predict with accuracy. Sensitivity analysis was performed on prices and major conclusions of this study were not changed.

gram returns over the five-year period (Table 1). Program net returns for corn and wheat are higher than non-program net returns in the earlier years. However, as target prices decrease, non-program crops have relatively higher net returns because they require no acreage reduction.

An option of the grain programs is the 50/92 Program, which allows the farmer to plant between 50 and 92 percent of permitted base acreage and receive deficiency payments on 92 percent of permitted acreage. The Optional Paid Land Diversion, however, is available only for corn. This program gives the farmer the option to divert a percentage of corn base, in addition to the required set-aside, to conservation uses. A set price per bushel is received, and total payment is based on proven yields, the calculation of which has varied considerably over the last several years. In this study, proven yields are assumed equal to actual yields.

CRP participation requires that the farmer take cropland out of production for ten years and plant vegetative cover which can consist of trees or grass. For each acre of CRP land entered, a percentage of an acre of base is reduced. This percentage is calculated from total base acres divided by total cropland acres. The CRP net returns were set at $50.19 per acre based on the winter, 1987 average bid price of $45.00 in Alabama and a discounted annual value of $5.19 (McKee) for harvested timber after 25 years. Although grass cover was also an option under CRP, tree plantings resulted in higher returns; thus, grass coverage was not incorporated into the model.

The programming model was constructed for a representative 420 acre farm located in the Sand Mountain region. Based on survey findings, the farm had a 190 acre corn base and 160 acre wheat base in year one. Base in subsequent years was calculated as a moving average of crop acreages. Soil on the representative farm was assumed to be a Hartselle fine sandy loam of class IIe with a four percent slope and slope length of 125 feet, a representative soil for this region (Hajek *et al.*).

For the conservation requirement of the 1985 Farm Bill to be met, farmers must reduce erosion to a level at or below that which would occur under the "Alternative Conservation System" defined by the Soil Conservation Service. The Alternative Conservation System for erosion control of the representative farm requires that erosion be reduced to or below a level that would result from instituting the following combination of erosion control practices: crop residue use, contour farming, and a water disposal system defined as whatever practices are necessary to remove concentrated water safely—primarily grassed waterways and/or terracing. The cropping system may include continuous row crops with conventional tillage, as long as the overall soil-loss objective is met.

For a representative row crop farm in the survey region, the Alternative Conservation System would result in average soil losses of approximately 5 tons per acre. [6] In our model, the soil loss restriction was initially set to this level, and then sensitivity analysis was performed.

According to the survey results, commonly grown crops include corn using conventional, reduced, or no-tillage; soybeans using conventional or reduced tillage; and wheat-soybeans double cropped using reduced or no-tillage. All crop-tillage practices can be implemented with either contoured or straight rows. All of these possibilities were included as crop activities in the linear programming model. Labor requirements were calculated from Alabama Cooperative Extension Service machinery coefficients.

A cost of soil loss of 10.6 cents per ton was established in the model. This cost was derived from soil loss and productivity studies by Hajek and McDaniel, who found that when average Alabama soils went from a slightly eroded to a moderately eroded state, crop yields decreased an average of 22 percent. The cost was calculated from returns from the least profitable crop, causing the estimate to be conservative. [7]

MODEL

The objective function of the linear programming model is the maximization of discounted net returns. A 5 percent annual discount rate was used. Table 2 provides a simplified illustration of some of the model's constraints. In this example, there are two program crops (corn no-tillage and corn conventional-tillage) and two non-program crops (corn no-tillage and corn conventional-tillage).

The integer variables INT PROG CORN and INT NPROG CORN represent program participation and non-participation, respectively, in year one. The FREE LIMIT rows serve to exclude non-program

6 Earl Norton, State Resource Conservationist for the Alabama Soil Conservation Service, confirmed these figures for a representative row crop farm with the specified soil type and slope. Soil loss under the Alternative Conservation System would vary somewhat from farm to farm.

7 There is currently not enough information concerning the effects of soil loss on this variety of soil to develop a more sophisticated (e.g. non-linear) equation describing the relationship.

Table 2. Illustration of Matrix Development in Economic Programming Model

	INT PROG CORN	INT NPROG CORN	ACRE RES PROG	PROG CORN CONV CONV	PROG CORN NO-T	PROG CORN	NPROG CORN	DEF PAY	DEF PAY K	DEF PAY X	OPTION OPLD	PROG CORN REG	PLANT BASE ACRE	MKT CORN CONV	MKT CORN NT	SOIL LOSS TRANS	CRP	PLANT 50/92 CORN	50/92	SET ASIDE 50/92	CORN 50/92 CONV	RED BASE CRP	RHS
PROG/NPROG	1	1																					< 1
FREE LIMIT	-10,000													1	1								< 0
BASE LIMIT		-190									1	1										1	< 0
ACRE RED			-1								0.35	0.2								1			= 0
ARP PERCT											0.65	0.8	-1						-1				= 0
PLANT TRAN				-1	-1								1										= 0
TOT PROG				-94	-92.6	1																	= 0
TOT NPROG							1							-94	-92.6						-94		= 0
INCOM TRAN				149.72	142.33	-2.56	-2.56		-1		-27.60			149.72	142.33		-50.19				149.72		= 0
DEF PAYT						-.47		1											-40.65				= 0
TRANS PAY								1	-1	-1													= 0
PAY LIMIT									1														<50,000
SOIL LOSS				4.9	1.6									4.9	1.6	-1					4.9		= 0
CORN 50																		0.5	-1				< 0
CORN 92																		0.92	-1				> 0
LANTRAN																		1	-1	1			= 0
CULTRAN																		1			-1		= 0
BASE RED																	-0.83					1	= 0

Rows:

PROG/NPROG, Restriction for participation/non participation in farm programs
FREE LIMIT, Forbids nonprogram acreage if participation is selected
BASE LIMIT, Restricts program corn acreage to the base (year 1)
ACRE RED, Calculates acreage idled due to farm programs
ARP PERCT, Calculates amount of base acreage available for planting or 50/92
PLANT TRAN, Divides program planted acreage among various cultivation options
TOT PROG, Calculates total production of corn under the regular farm program or optional paid land diversion (OPLD)
TOT NPROG, Calculates total production of corn outside farm program and in 50/92 program
INCOM TRAN, Calculates net income from corn growing
DEF PAY, Calculates deficiency payment on total production
TRAN PAY, Divides deficiency payment into receivable and "excess"
PAY LIMIT, Limites receivable deficiency payment to the payment limit
SOIL LOSS, Calculates net soil loss
CORN 50, Minimum planting requirement under 50/92
CORN 92, Maximum planting under 50/92
LANTRAN, Transfers total 50/92 acreage to plantings and idled land
CULTRAN, Divides planted acres under 50/92 program among various tillage options
BASE RED, Reduces base if CRP is selected

Activities:

INT PROG CORN, 0-1 Integer for program corn
INT NPROG CORN, 0-1 Integer for nonprogram corn
ACRE RES PROG, Acres idled under farm program
PROG CORN CONV, Conventional tillage on corn planted under farm program
PROG CORN NO-T, Notillage on corn planted under farm program
PROG CORN, Total production of corn under regular farm program and OPLD,, all tillage practices
NPROG CORN, Total production of corn outside of farm programs or in 50/92 Program
DEF PAY, Deficiency payment calculated on all eligible production
DEF PAY K, "Receivable" deficiency payment
DEF PAY X, "Excess" deficiency payment beyond payment limitation
OPTION OPLD, The optional paid land diversion program alternative
PROG CORN REG, The regular farm program without optional paid land diversion.
PLANT BASE ACRE, Planted acres under regular farm program and farm program with optional paid land diversion
MKT CORN CONV, Conventional tillage corn, no farm program
MKT CORN NT, No-till corn,, no farm program
SOIL LOSS TRANS, Total soil loss through all paintings
CRP, Acreage in the Conservation Reserve Program
PLANT 50/92 CORN, Acres planted under the 50/92 provisions
50/92, Total acres in the 50/92 program
SET ASIDE 50/92, Acres idled under 50/92 program
CORN 50/92 CONV, Conventionally tilled corn planted in the 50/92 program
RED BASE CRP, Acres of base lost due to participation in Conservation Reserve Program

corn if the INT NPROG CORN non-participation variable is not selected. If non-participation is selected, the large negative coefficient serves as a non-binding constraint and other constraints in the model (land, labor, and soil loss) limit corn. If participation is selected, row BASE LIMIT limits corn acreage enrolled in the regular program (PROG CORN REG) and the program with optional paid diversion (OPTION OPLD) to the 190 acre base.

Total acreage idled (ACRE RES PROG) through the regular program, the optional paid land diversion program, and the 50/92 program is calculated in row ACRE RED. Similarly, the amount of acreage remaining for planting (PLANT BASE ACRE) or the 50/92 program (50/92) is summed in row ARP PERCT. Row PLANT TRAN divides planted acreage in the farm program among the various cultivation alternatives (no-till and conventional tillage shown here).

An initial deficiency payment on all eligible production is calculated with row DEF PAYT. This deficiency payment is divided into DEF PAY K, which the operator keeps, and DEF PAY X, excess beyond the payment limitation. The payment limitation for government programs, $50,000, is enforced in row PAY LIMIT. The TOT PROG and TOT NPROG rows sum up the total yield for corn. This yield is then multiplied by the price per bushel in the INCOME TRANS row to give gross returns. The total costs per acre are then subtracted from the gross returns in the INCOME TRANS row to give net returns. Although 50/92 corn is in the farm program, yields are summed under TOT NPROG because deficiency payments are calculated differently for 50/92 corn than for other program corn.

The "CRP" activity sets the net returns for the CRP at $50.19 ($45 bid price and $5.19 annual per acre return from tree harvest). The amount of CRP acreage in the first year is held constant in all subsequent years. The first year, 1987, is the only year the farmer can opt to participate in the CRP; for the next ten years, that land is locked into CRP. [8] The PCT BASE REDUCT constraint specifies the percentage of crop base, 83 percent, that must be reduced per acre of land entered in the CRP. Base reduction can be taken either from corn or wheat or any combination of both. In Table 2, however, only corn is depicted.

When the 50/92 option is chosen, constraints CORN 50 and CORN 92 ensure that between 50 and 92 percent of permitted acreage is planted. Constraint LANTRAN divides 50/92 acreage (activity 50/92) into planted (activity PLANT 50/92 CORN) and idled acres (activity SET ASIDE 50/92). In the actual model, the planted acreage can be cultivated conventionally, or under reduced or no-tillage methods. In the illustration, however, only one cultivation option (CORN 50/92 CONV) is depicted. The SOIL LOSS constraint adds up the net soil loss (total soil loss per acre less the rate of soil replenishment) per year in tons. In subsequent years, lost productivity through soil loss is reflected in a reduction in total farm income valued at 10.6 cents per ton of soil lost. (This transfer activity is not shown in Table 2.)

Other constraints in the model, not shown in Table 2, include a limit on total cropland of 420 acres and labor constraints. Labor requirements were specified for four periods per year. It was assumed that the farmer worked full time on the farm. Additional labor could be hired in any period for $4.50 per hour.

RESULTS

The model was first used to analyze the actual 1985 Farm Bill provisions (baseline analysis). Subsequent analyses involved alternative assumptions about (1) program availability, (2) commodity program requirements, and (3) yields. In all cases, 1987 was the first year of the 5-year planning horizon. First year results are of particular interest because, in the "real" world, the crop-mix decision in subsequent years would be modified by additional information as time goes on. Thus, in each subsequent year the initial five-year plan would be modified if prices and program provisions varied from their projected path. The full five-year results, however, are of interest for identifying the potential impacts of current farm programs on future land use.

Under the baseline scenario [9], the optimal year one crop mix consisted of program corn no-tillage straight-row, program wheat double cropped with soybeans reduced-tillage contoured, and soybeans conventional-tillage straight-row. ARP took up 82 acres and Optional Paid Land Diversion (OPLD) accounted for an additional 29 acres. No acreage was

[8] Under the 1985 Farm Bill, entry into the CRP was permitted in subsequent years. However, because of the base reduction provisions, allowing entry into the CRP in any year beyond the first would result in intractable nonlinearities in the model. Because the objective of the model is to maximize profit and because of the nature of mathematical programming models, allowing entry into the CRP in year one only should not present a problem. If the CRP is, indeed, a profitable alternative, it would be selected early.

[9] When limited cross-compliance was not included as a requirement in the analysis, soil loss and net returns did not change significantly.

placed in CRP. The lack of participation in CRP reflects actual conditions in the study area. Although over 80 percent of the cropland in the area was eligible for CRP participation, participation in the CRP was only about 5 percent.

Net returns for 1987 were approximately $43.4 thousand while total government payments were $16.7 thousand. Total five-year discounted net returns were $186.3 thousand. Labor was not hired because the operator's labor was sufficient for the chosen crop mix. The conservation compliance limit of 5 tons/acre was not constraining because crops grown using conservation practices were selected over the less profitable conventionally tilled crops. Soil loss was 4.4 tons/acre. Under the baseline, program participation continued in years two and three. In years four and five, however, the decreasing target price made farm program participation unattractive. Over the five year period, real net returns for crops in the program decreased below net returns for crops not in the program (Table 1).

The baseline results were used to create "index" values for the results of the alternative analyses (Table 3), with soil loss and net returns for year one and the five-year totals for the variables of interest. Baseline results for these variables have an index value of one and index values for the alternatives are multiples of the baseline values.

In the first alternative, no farm program participation was allowed for the model farm. [10] This alternative resulted in all land being planted either to no-tillage straight-row or reduced-tillage contoured corn. Neither soil loss nor net returns decreased by a great margin relative to the baseline. Soil loss decreased to 96 percent of the baseline value while net returns decreased to 92 percent of the baseline value for 1978. Total five-year discounted net returns decreased slightly to an index factor of 0.96. In the last two years of the "no programs" alternative, crop mix was identical to the baseline, that is, farm program participation was not selected in years four and five. Thus, for the representative farm in this study, when no macroeconomic effects are considered, participation in the current farm program with its conservation compliance requirement has little effect on net income or soil loss relative to non-participation.

The small change in net returns and soil loss in the "no programs" alternative resulted because a trade-off exists between land idled through farm programs and less erosive crops without programs. While net returns per planted acre for program corn in 1987 were nearly 50 percent greater than for non-program corn, the 20 percent acreage reduction requirement caused the adjusted farm-wide net returns to be reduced. Thus, soil loss under the "no programs" alternative differed little from the baseline. Although all 420 acres of land were planted to crops in the "no programs" alternative, the less erosive corn crop was grown in place of the more highly erosive wheat-soybeans double cropped and soybeans single cropped.

In the second alternative, ARP was not required and OPLD was not allowed. For this alternative, the conservation compliance provision was also removed. Thus, the results from this trial provide information concerning what the "desired" farm-level soil loss would be if land idling programs were not included in the Farm Bill. In this case, both net returns and soil losses increased significantly. In year one, soil loss increased to 5.6 tons per acre (1.28 times the baseline), slightly more than conservation compliance would allow, and net returns increased by a factor of 1.23 relative to the baseline. The type of crops grown in year one did not change in this analysis, but the number of acres of each crop grown changed relative to the baseline. With no acreage reduction requirement, farm program participation was selected in all five years. Five-year discounted net returns did not show as drastic a change from the baseline as year one net returns, because over the period, corn target prices decreased from $3.03 per bushel in 1987 to $2.63 per bushed in 1991. This low 1991 target price was close to the market price of $2.56. A conclusion to be drawn from this analysis is that, if ARP were discontinued, soil loss would increase 28 percent on typical Sand Mountain region farms. The ARP, therefore, appears to be important in reducing soil erosion for farm program participants.

In a third alternative, target prices were not decreased over time but were kept at 1987 levels. In this case, program participation was not chosen in year one so that the farm could increase the corn base for future years, making 1987 results identical to the "no programs" 1987 results. Total five-year results were of more interest in this particular analysis, since base was increased in years two through five. Five-year discounted net returns increased by an index factor of 1.06 because the more favorable commodity programs provided higher income. Total five-year soil loss decreased relative to the baseline

[10] Caution should be exercised in interpreting these results. Farm programs are assumed to be generally available, but this farm has opted not to participate. A national elimination of farm programs would constitute a major structural shift in the markets, which would have profound effects on price expectations.

Table 3. Soil Losses, Net Returns, and Crop Mixes for Analyses[a]

Scenario	1987 Soil Loss	1987 Net Returns	Five Year Totals Soil Loss	Five Year Totals Discounted Net Returns	Crop Mix 1987[b]
	Index value relative to baseline				
Baseline	1.00	1.00	1.00	1.00	Corn and Wheat Set-Asides, Optional Paid Land Diversion, No-Till Straight-Row Corn, Conventional Straight-Row Soybeans, and Reduced Contoured Wheat-Soybeans Double Cropped.
(1) No Programs	0.96	0.92	0.96	0.96	No-Till Straight-Row and Reduced Contoured Corn.
(2) No Set-Aside or Optional Paid Land Diversion	1.28	1.23	1.13	1.19	No-Till Straight-Row Corn, Reduced Contoured Wheat-Soybeans Double Cropped, and Conventional Straight-Row Soybeans.
(3) No Decreasing Target Prices[c]	0.96	0.92	0.95	1.06	No-Till Straight-Row and Reduced Contoured Corn.
(4) Conservsation Compliance Requirement Decreased to Tolerance Level	0.68	0.99	0.74	1.00	Corn and Wheat Set-Asides, Optional Paid Land Diversion, No-Till Straight-Row and Reduced Contoured Corn, Reduced Contoured Wheat-Soybeans Double Cropped.
(5) Yields Decreased Twenty Percent	0.34	0.58	0.43	0.58	Corn Set-Aside and Optional Paid Land Diversion, Conservation Reserve Program, and Reduced Contoured Corn.
(6) Yields Decreased for No-Till and Reduced Tillage	0.96	0.99	1.17	0.98	Corn and Wheat Set-Asides, Optional Paid Land Diversion, Conventional Contoured Corn, Conventional Straight-Row Soybeans, and Reduced Straight-Row Wheat-Soybeans Double Cropped.

[a]Soil losses and net returns expressed as multiples of the baseline values: 1844 tons of soil loss in 1987, $43,406 net return in 1987, 10,990 tons of soil loss over five years and $186,221 net return for the five-year horizon.

[b]Corn and/or Wheat Set-Aside refers to acreage enrolled in regular farm program and Optional Paid Land Diversion refers to corn in the program with the additional acreage idled.

[c]Programs were not used in year one because corn base was being built on all land for future program use.

because corn acreage increased and acreage of the more erosive wheat-soybeans double cropped and single cropped soybeans decreased. Corn set-aside and OPLD increased each year until 30 percent of the possible acreage was left uncropped. Therefore, if target prices were held constant, farmers would have an incentive to build base acreage. While higher target prices resulted in lower soil loss in this case, this result would only occur if the farmer did not convert previously uncropped land to crops.

In a fourth alternative, the conservation compliance limit was decreased to 3 tons per acre, the tolerance level. Soil losses decreased by 32 percent to an index factor of 0.68. Land was converted to the less erosive reduced-tillage contoured corn and reduced-tillage contoured soybeans. Because net returns differed little by tillage conservation practices, 1987 net returns were 99 percent of baseline net returns. Therefore, if the conservation compliance limit was enforced more tightly at the tolerance level, conservation practices would change but net returns for the representative farm would change very little.

In the fifth alternative, crop yields were decreased by twenty percent to test the effect of significantly lower yields on farmers' decisions to enter the CRP. The choice of a twenty percent reduction was somewhat arbitrary, but nevertheless serves to illustrate the effects of low yields on the decision to enter the CRP. In this scenario, two hundred acres (48 percent of total cropland) entered the CRP. This decrease in land under cultivation decreased soil loss to an index factor of 0.34, or by 66 percent in 1987. CRP land replaced the erosive wheat-soybeans double cropped and single cropped soybeans, and the remaining land was placed in the less erosive reduced-tillage contoured corn. Therefore, poorer yielding cropland will be placed into a soil conserving program, reducing soil losses by a substantial amount.

A sixth alternative set yields at a lower level for no-tillage and reduced-tillage crops, but not for conventional-tillage crops. Because some farmers do find significantly reduced yields with conservation tillage (even though the survey data indicated that, on average, this was not the case), yields were decreased eight percent for reduced tillage and 15 percent for no-tillage. In this analysis, net returns were only slightly lower than the baseline, as contouring rather than conservation tillage practices was employed. Soil losses increased by an index factor of 1.17 over the five-year period because of the use of more highly erosive crops. (Soil loss was actually lower in 1987 because conventional-tillage contoured corn had a lower soil loss than no-tillage straight-row corn.)

Finally, sensitivity analyses were run to test under what conditions farmers would participate in the OPLD, the 50/92 program, and the CRP. While the OPLD was selected in the baseline, neither CRP nor 50/92 was chosen. Sensitivity analyses on OPLD indicated that it would continue to be selected for the representative farm until the per bushel payment rate dropped below $1.50. Producers with high variable costs, however, would be willing to participate even at low per bushel payment rates.

For the representative farm, under the baseline, CRP would only be selected if returns were at or above $93 per acre. These high net returns perhaps could be achieved by leasing hunting rights, although it is doubtful that hunting rights could be leased for $40 per acre (Pope and Stoll). Alternatively, a higher valuation of the opportunity costs of operators' labor could result in CRP being selected at lower levels of returns. The lack of enrollment of land into the CRP in the region was reflected in a Soil Conservation Service report which showed only two to three percent of cropland in the region enrolled by October, 1986. Some other areas of Alabama had enrollment rates of up to 25 percent by that date. The 50/92 program would be profitable only if the farmer's market receipts did not cover variable costs.

CONCLUSIONS

For the representative farm in this study, the 1985 Farm Bill did not appear to have a large effect on total erosion. Soil loss on the representative farm was nearly the same under the no program participation scenario as under the baseline. When program participation was not allowed, the less erosive conservation tillage corn was grown on all 420 acres. When programs were allowed, cropland was planted in more erosive crops but the non-eroding set-aside acreage balanced out total soil erosion. Therefore, it appears that the commodity program in the 1985 Farm Bill neither significantly increases nor decreases soil erosion on a per-farm basis.

A trade-off also exists for net returns. While program participation raises net income per planted acre, the required set-aside acreage causes total net income to fall to nearly the no program participation level. Therefore, set-aside percentages should be small enough for commodity programs to be economically attractive but large enough to keep commodity programs from encouraging high soil erosion or providing excessive net returns.

Decreasing target prices could cause farmers to discontinue program use in the near future. While deficiency payments will increase net returns on planted acres, set-aside acreage will cause total net income for program crops to fall below that of non-program crops.

Conservation compliance will not greatly affect Sand Mountain farmers' cropping practices. The conservation compliance standard enforced during the period of this study did not greatly affect soil conserving behavior because the conservation practices already used by most farms surveyed met the standard. Crops using conservation cultural practices were more profitable than those using conventional cultural practices. While conservation compliance standards may cause some farmers who were not previously using conservation practices to convert to these practices, the profit motive would probably have eventually led to conversion. Conservation compliance would affect soil losses only if the standards were stricter, for example, at the tolerance level of 3 tons per acre. Although tightening the soil loss restrictions affected soil loss on the representative farm, net returns did not suffer greatly because alternative low-erosion cultivation practices were nearly as profitable as the more highly erosive ones.

Of the supply control programs, Optional Paid Land Diversion (OPLD) is attractive while the 50/92 program and the Conservation Reserve Program (CRP) are unattractive to farmers in the region.

OPLD is profitable due to the associated high per-bushel returns. Also, soil loss is reduced because more land is diverted from program crop use to a conserving use. The 50/92 program is attractive only to farmers whose market receipts do not cover variable costs. CRP is attractive only to the following farmers: (1) those who can receive more than $93.00 in net returns per acre from CRP participation, perhaps partially through the selling of hunting rights, (2) those who put a high value on operator's labor, and (3) those who farm low-yielding land.

Overall, results suggest that provisions of the 1985 Farm Bill do not significantly reduce soil losses on farms in the Sand Mountain region. Clearly, to understand the effects of commodity programs in conservation practices in the Southeast would require an investigation analysis of a similar array of factors in several different physical environments. The model, therefore, was not intended to be representative of all farms in the southeastern United States. Specific results may vary greatly based on physical environment, but the authors hope this article communicates the diversity of considerations faced by farmers in deciding on conservation practices. Policy makers and extensionists should benefit from an understanding of the interaction of these considerations.

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