Conservation Reserve and Conservation Compliance Programs: Implications for Resource Adjustment

by William H. Meyers,
Leland Thompson, and Patrick C. Westhoff

Working Paper 89-WP 45
July 1989

Center for Agricultural and Rural Development
Iowa State University
Ames, Iowa 50011

William H. Meyers is professor of economics and associate director, CARD; Leland Thompson is a postdoctoral research associate; and Patrick C. Westhoff is a postdoctoral research associate, CARD.

This paper was presented at the NCR-151 Regional Research Symposium on Surplus Capacity and Resource Adjustments in American Agriculture, January 23-24, 1989, in St. Louis, Missouri.

Contents

Figures

Abstract

Conservation Titles of the 1985 Food Security Act lead to agricultural market and resource use adjustments. This study explores how the Conservation Reserve Program (CRP) and the Conservation Compliance (CC) Program influence land use, commodity markets, input and technology use, production costs, and the environment. In the case of the Conservation Reserve Program, CARD/FAPRI commodity models are used to generate a baseline and to evaluate the impacts of increasing the amount of land in the reserve. In the case of the Conservation Compliance Program, the CARD ARIMS model is used to generate a baseline without the program and then to evaluate the impacts of imposing erosion restrictions consistent with the conservation compliance provisions.

Lower stocks and higher commodity prices would be consequences of expanding the CRP. Resource adjustments associated with conservation compliance can be protracted and may be costly. Insofar as CRP reduces production and strengthens prices, it also can have the effect of increasing the intensity of input use in the remaining planted area. Conservation compliance clearly influences cropping patterns and choices of technology, as well as rates of soil erosion. While production cost increases of 2-4 percent seem relatively small, this could mean as much as 6-15 percent decline in net farm income.

Introduction

During the formation of the Food Security Act of 1985, an alliance was formed between farm interest groups and environmental groups to support new provisions in legislation under the conservation title (Title XII). The two most important elements of this title are the Conservation Reserve Program and the Conservation Compliance Program.

This paper explores the impacts of these programs on resource adjustment. The conservation reserve program (CRP) has impacts on land use and commodity markets as well as on the environment. Similarly, the conservation compliance (CC) provisions of the 1985 act will influence land use, input use, tillage practices, and production costs.

This paper reviews the impacts of these conservation programs on resource adjustment by comparing a baseline projection, or reference run, to an alternative scenario. In the case of the CRP, a multimarket commodity model (CARD 1989) is used to generate a baseline projection and to evaluate the impacts of increasing the amount of land in the CRP. In the case of the CC program, the CARD Agricultural Resources Interregional Modeling System (ARIMS) (English et al. 1989) is used to generate a baseline without the program and then to evaluate the impacts of imposing the CC provisions.

The Conservation Reserve Program

In the Food Security Act of 1985, Congress mandated the secretary of agriculture to carry out the CRP on highly erodible cropland and to remove a total of 40-45 million acres over the five years of the program. Although the focus of the legislative language is on conservation and improvement of soil and water resources, this program also has become part of the total supply management strategy of the government.

To participate in the program when there is an announced sign-up period, farmers place bids with the government indicating the rental rate at which they would put cropland into the CRP. If a bid is accepted, the farmer signs a ten-year contract to keep the land out of production, and the government provides 50 percent of the cost of establishing a cover crop on the CRP land. Lowest bids are accepted first within each area, and not more than 25 percent of the land in a single county can be enrolled in the program without special approval.

During the first six sign-ups from March 1986 to August 1988, 25.5 million acres were enrolled. Approximately 60 percent of the enrollment up to that time was from the Plains and Mountain states (Figure 1). Nearly a third of the land enrolled by 1988 came out of the wheat base (Figure 2).

FAPRI Baseline Projections

Recent Food and Agricultural Policy Research Institute (FAPRI) projections for U.S. and world agriculture (FAPRI 1989) assume that 40 million acres will be enrolled in the program by 1990/91. It remains to be seen whether program managers can induce this amount of land into the reserve, but this is the minimum acreage for the CRP targeted by the 1985 act.

To estimate the regional and commodity distribution of future enrollment, rules were established to estimate future sign-up for the CRP. The proportion of new enrollment coming from any state is varied according to the state's proportion of eligible highly erodible cropland that has not yet enrolled and according to the state's proportion of current CRP enrollment. It is also assumed that the distribution of enrollment by crop within each state remains the same as it has been in the past. Because the future enrollment is likely to include a higher quality of land than that enrolled in the past, it is assumed that the government will have to raise the acceptable rental rate by an average of 25 percent on future sign-ups in order to achieve the 40-million-acre target.

On the basis of these assumptions, it appears that future enrollment depends more heavily on sign-up in the Corn Belt and less heavily on the Mountain and Northern Plain states (Figure 3). By implication, a relatively larger share of the new enrollment would come out of corn and soybean area and relatively less would come out of wheat area.

An important aggregate effect of the expansion of the CRP is that a larger proportion of idle acreage in the future will be in long-term programs, with a smaller proportion in annual acreage reduction programs (Figure 4). In crop years 1987/88 and 1988/89, the CRP accounted for only one-fourth to one-third of total idled acreage. From 1990 onward, it is expected that the CRP will account for two-thirds or more of the idled acreage in the United States. This would make it more difficult to adjust the acreage reduction programs quickly in the event of a drought, as was the case when rates were drastically reduced in 1989. Generally this would lead to a production environment in which the excess production capacity is more insulated from the market, and the potential for market strength and price variability is increased. In spite of the continued idling of relatively large areas of land, the real commodity prices in the FAPRI projections are flat or declining slightly over the next decade.

Impacts of a CRP Expansion

Environmental groups, farm interest groups, and Congress all are generally pleased with the way the CRP has worked. Some proposals have already been made for an expansion of the CRP in future legislation. The potential effects of such an expansion are evaluated by increasing the CRP by an additional 20 million acres over the period of 1989/90 to 1991/92 (FAPRI 1988). The impact of this change in the level of CRP provides some insights into the impact of the current CRP program on land use and commodity markets.

Of the total 20-million-acre expansion in the CRP, 15 million acres are estimated to come from the eight major program crops (Figure 5). Planted area in these crops declines by about 6 million acres in the long run. One reason for the diluted effect of the increased CRP on planted acreage is that the annual acreage reduction programs nearly disappear as prices increase and participation rates decline. The net effect of these adjustments is that total acreage planted and idled for the major program crops increases by more than 3 million acres (Figure 6).

The consequences of lower plantings and production are lower stocks and higher commodity prices. Crop prices increase by about 10 percent in the long run (Figure 7). Corn and soybean prices increase proportionally more than other commodities, because a high proportion of the increase in CRP acreage occurs in the Corn Belt rather than in the Great Plains. After a delay of approximately two years, the index of livestock prices begins to increase and eventually exceeds the baseline by about 4 percent as a consequence of the higher feed grain prices (Figure 8).

Although deficiency payments decrease as a consequence of higher crop prices, these savings are approximately offset by increases in the cost of the CRP. The net effect is a relatively small estimated impact on the cost of government programs, including the CRP (Figure 9).

For similar reasons, government payments to farmers don't change substantially, since lower deficiency payments are offset by higher payments for CRP acreage. However, receipts from livestock and crop marketings increase as a consequence of higher market prices. The net effect on income is, therefore, a net increase of 3-6 billion dollars annually over the years following the implementation of CRP expansion (Figure 10).

It is important to note that this scenario was evaluated off a predrought baseline in which there were larger stocks available to buffer the tighter markets that result from the increase in the CRP acreage. Given a postdrought baseline, it is to be expected that the increased CRP would result in even tighter market conditions and certainly in more potential for price volatility.

The Conservation Compliance Program

In addition to programs for the complete removal of highly erodible cropland from production, the 1985 Food Security Act includes conservation compliance. The CC discourages production of crops on highly erodible cropland if the land is not adequately protected from soil erosion. Production on highly erodible cropland without a locally approved soil conservation plan may prevent the operator from receiving agricultural commodity program benefits. With the assistance of Soil Conservation Service (SCS) guidelines and personnel, annual conservation plans must be developed by 1990 and implemented fully by 1995. Without this compliance, a farmer is ineligible for commodity program benefits.

Conservation planning entails implementation of resource management systems. A resource management system combines conservation and management practices, conditioned on the primary use of the land, to protect, restore, and improve the soil resource base by meeting acceptable soil loss rates or water quality standards (USDA 1987).

Conservation treatment systems implemented on the farm soil resource base are designed to control the greater of the erosive forces (water or wind) so that estimated erosion does not exceed a designated soil loss tolerance level for the dominant farm soil. Conservation systems are erosion control components of resource management systems and are the minimum standard for compliance with the 1985 Food Security Act (cross-compliance) provisions linking conservation to farm commodity program benefits.

ARIMS Assumptions and CC Scenarios

The Agricultural Resources Interregional Modeling System is a large-scale national linear programming model and several supporting data sets and models (English et al. 1987, 1989). The set of models simulates economic activity in seven sectors of U.S. agriculture: crop production, livestock production, pasture/range production, irrigation requirement and costs, land availability, final and intermediate commodity transportation, and demand. Exogenous national and export demand projections are from FAPRI (1988) commodity market models. The ARIMS finds the least-cost method of producing for a specified set of demands, given technology and land base availability.

The policy analysis involves comparing the long-run equilibria for different sets of CC policy conditions (Atwood et al. 1989). These are final, or equilibrium, outcomes. No attempt is make to describe the path from the baseline situation to the solution of the model given all of the alternative policy scenarios.

The baseline to which other alternatives are compared simulates a continuance of current farm policy through 1990. A 45-million-acre conservation reserve is taken out of the cropland base by 1990 for all scenarios. Included in the baseline and all CC scenarios are crop acreage change constraints and upper bounds on adoption of conservation practices. The crop acreage constraints reflect distortion from the competitive least-cost allocation, which occurs mainly due to commodity programs. These constraints are set to require at least 80 percent of the 1985/1986 average crop acres by producing region. Tillage constraints reflect likely adoption rates by 1990. These restrictions are rationalized on the basis of institution factors that affect the adoption decisions not being modeled.

There are two erosion restriction scenarios in this analysis. Baseline assumptions are maintained; however, the CC scenarios evaluate a 10-ton per acre soil loss restriction and a 5-ton per acre soil loss restriction. These erosion restrictions reflect the CC rules of the 1985 Food Security Act. For this study it is assumed that the erosion restrictions are mandatory for all land uses generating excessive erosion levels. The model can choose the crop-practice-land type of combination to meet the mandatory erosion restriction while satisfying other constraints and demands for commodities.

It is important to note that ARIMS is formulated to use land resources in eight land groups based on capability class. As a result, the model may choose to idle some less productive, more erosive land groups and concentrate production activities on more productive land. This would imply that ARIMS may find optimal solutions that are more efficient than empirically observed production practices or production patterns that are not necessarily available in reality.

Impacts of Conservation Compliance

The conservation titles of the 1985 Food Security Act formulate land use policies that influence resource adjustments with respect to how producers use available capacity and how intensively they use the land resource unit. Conservation compliance rules imply adjustments in which land is used and in which production technologies and practices are used on the land. Where the CRP takes land out of production, the adjustment is clear and straightforward for the producer. Compliance decisions, however, mean producers must adjust cropping patterns and technologies, evaluate available input substitutions, and apply management skills needed to protect soil resources and maintain crop performance. The implication is that resource adjustments associated with CC can be protracted and costly.

Erosion restrictions imposed on the model formulation reduced per acre soil erosion in both scenarios as compared to that of the baseline. For the nation as a whole, soil loss averaged 7.4 tons per acre in the baseline. Erosion rates were reduced by 32 percent and 45 percent, respectively, for the 10-ton and 5-ton restricted scenarios (Figure 11). Regional impacts of soil loss restrictions indicated that in regions where per acre soil losses associated with wind and water action were highest, erosion reductions were greatest. Soil erosion from water action (sheet and rill) was greatest in the Southeast, while wind erosion was the primary concern in the Plains and Mountain states.

Acres of cropland in production of all crops increased in both CC scenarios compared to the baseline (Figure 12). Expanded use of cropland in the 10-ton scenario amounted to 0.5 percent above the baseline, which is 1.5 million acres. For the 5-ton scenario, expanded use of cropland was 0.3 percent, or approximately 1 million acres. The additional land in production came from a mix of available capacity in potential cropland, highly erodible land going into idle land categories, and less erodible land coming out of idle land categories. The use of double cropping increased in the 5-ton scenario as a practice to control erosion.

Total costs were greater in meeting erosion restrictions while still satisfying national commodity demand. Total costs included crop costs, livestock costs, transportation, and land improvement costs. Compared to the baseline, total costs were 2.2 percent higher for the 10-ton scenario and 3.9 percent higher for the 5-ton (Figure 13). Increases in the crop production costs were somewhat greater still, at 3.3 percent for the 10-ton scenario and 6.1 percent for the 5-ton restriction level. These higher production costs were in part attributable to the higher costs of applying conservation treatments relative to conventional cropping methods. Some increase was due to production on expanded acreage.

Estimates indicate that with the imposition of CC there would be some increase in the level of applied inputs. National estimates for fertilizer applications show nitrogen fertilizer increased approximately 5.6 percent in the 5-ton scenario (Figure 14). This can be attributed to both more intensive application levels and more intensive annual use of crop acres by double cropping. Overall, application rates of pounds of nitrogen per acre increased approximately 5.2 percent. In the Corn Belt and Northern Plains, the percentage increase was slightly greater than national levels. Conservation practices typically show a substitution of pesticide inputs for machinery and labor inputs to production.

Conservation treatments employed to meet erosion restrictions required shifts to alternative cropping practices. National estimates for the use of conservation practices (Figure 15) indicate that while straight row practices are normally the dominant cropping method, there was a shift of 25-50 million acres toward contour and strip cropping systems. The use of strip cropping patterns was the dominant strategy used to meet erosion limits, and there was a 39-million-acre increase in this practice. These conservation practices are sometimes used in combination with soil-saving tillage practices. Given limits on allowable erosion, less fall plowing and more spring plowing and conservation tillage methods are indicated (Figure 16). For both erosion restriction scenarios, however, there was a lower use of zero tillage methods. The zero tillage practice is at some disadvantage compared to other conservation systems, because it carries higher costs of applied inputs and its limited seed bed preparation makes achievement of high yields more difficult.

Resource Adjustment Implications

The results of the analysis indicate that both the CRP and the CC provisions in the 1985 Food Security Act have resource adjustment implications. Because of the bidding system used to implement the CRP and the emphasis on idling erodible cropland, land idled in the CRP comes more heavily from certain regions of the country (Plains states) and from certain crops (wheat). This differs from the annual acreage reduction programs, which are based on a certain percentage of participants' base acres regardless of location. Insofar as the CRP reduces production and strengthens prices, it also can have the effect of increasing the intensity of input use in the remaining planted area. Policymakers hope that the long-run nature of the CRP will result in these CRP lands being removed from production permanently. To encourage this result, producers are encouraged to take steps that would move the land permanently into other uses, such as tree crops or wildlife habitats. Under the CRP, a permanent shift in the land-use pattern does not yet appear to be occurring.

The CC provisions are still at an early stage of implementation. If the relative benefits of commodity programs continue to decline and the CC plans mandated by the government appear to be too costly, producers may decide not to participate in government programs, thus avoiding the CC provisions. The results of the analysis indicate that conservation compliance clearly influences cropping patterns and choice of technologies, as well as rates of soil erosion. While production cost increases of 2-4 percent seem relatively small, the percentage decline in net farm income could be more than twice as large.

The impact of conservation compliance will, of course, come to depend on how many producers continue as participants in government programs. Ultimately it will also depend on how the provisions are implemented and enforced, a process which is still evolving. It is unlikely that in its current form, CC provisions will have as important an impact on resource adjustment as does the CRP. However, other, more stringent provisions could be adopted as a consequence of political pressures from environmental interests. As indicated in the analysis, a widespread program of this type would be expected to influence cropping patterns, tillage practices, and the profitability of production in different areas of the country.

Figure 1: Spring 1988 CRP Enrollment
25.53 Million Acres

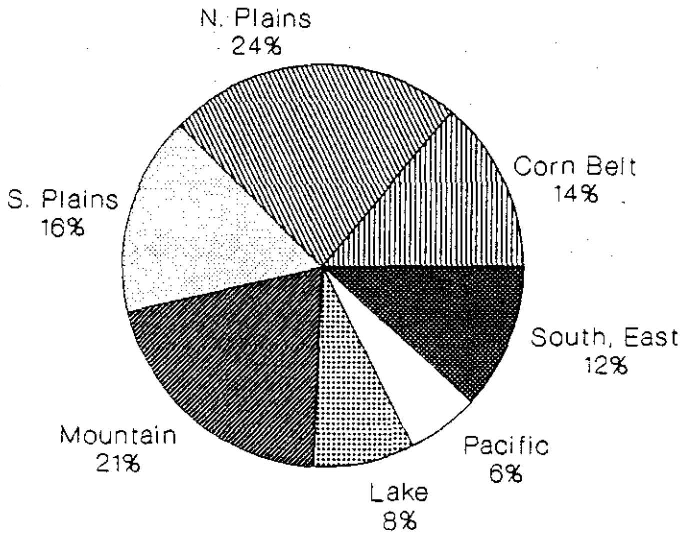


Figure 2: CRP Enrollment by Crop
1990/91 Total: 40 Million Acres

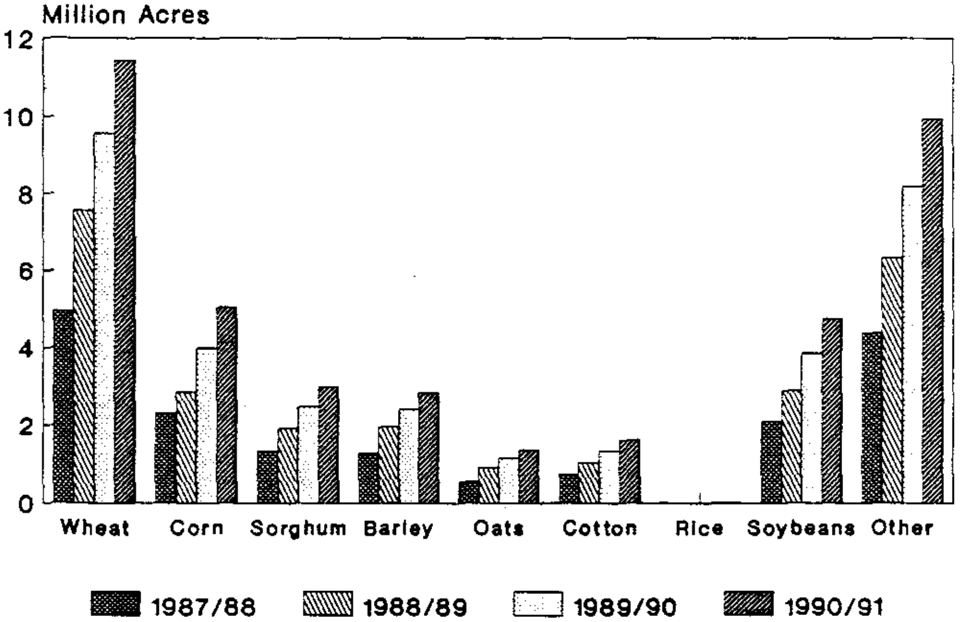


Figure 3: Future CRP Enrollment
14.47 Million Acres

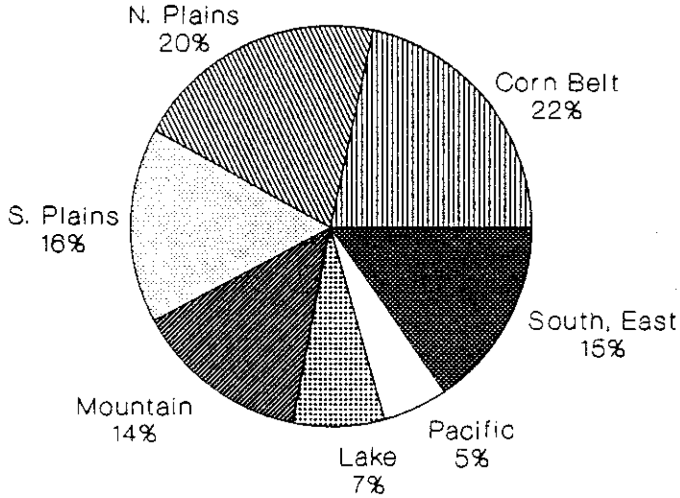


Figure 4: Acres Idled by Gov't Programs
15 Principal Crops

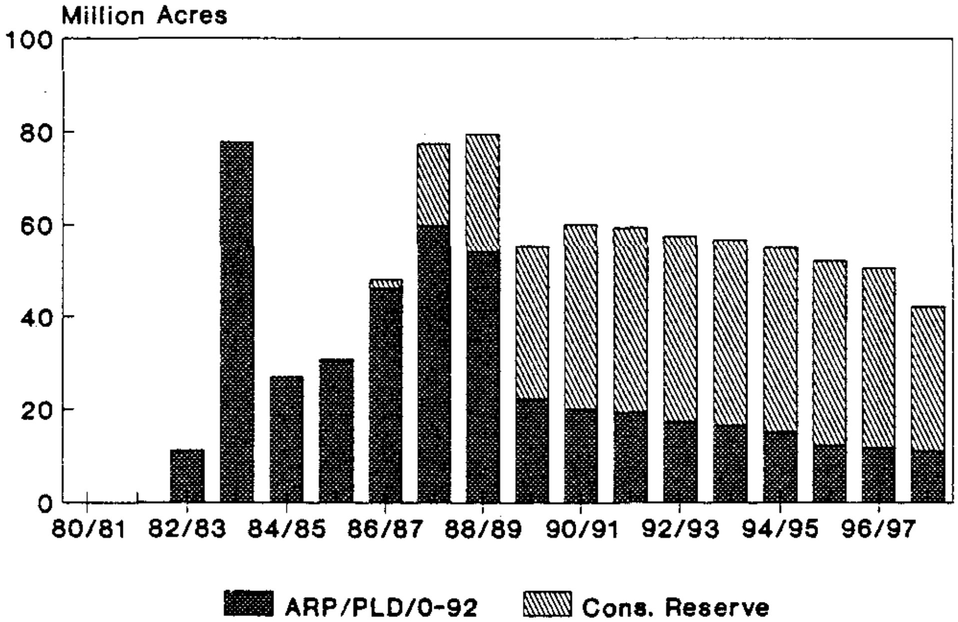


Figure 5: Change in Area Planted for 8 Major Crops
(CRP - Base)

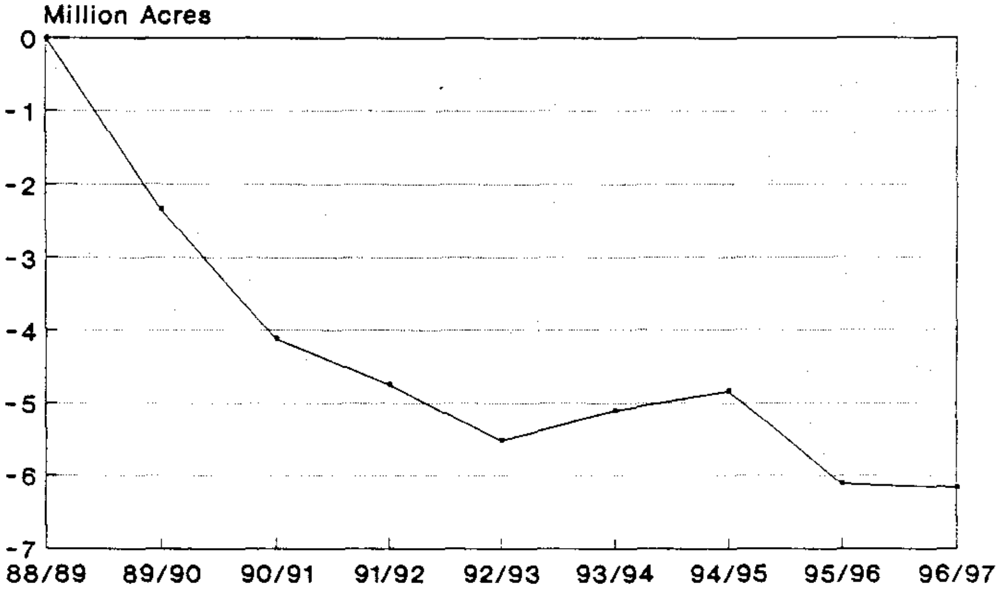


Figure 6: Change in Total Area Planted and Idled for 8 Major Crops
(CRP - Base)

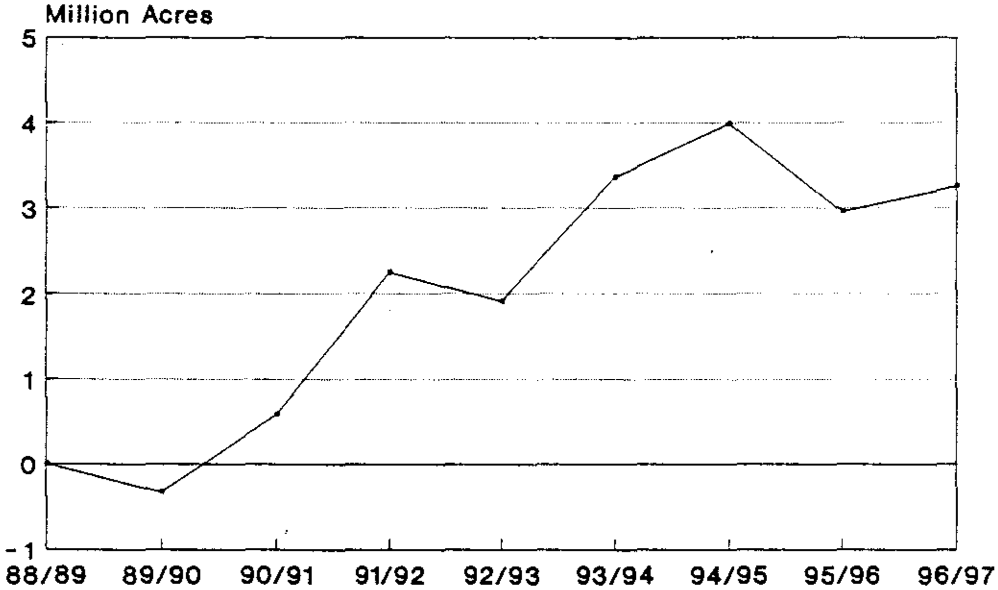


Figure 7: Percent Change in Price Index for 8 Major Crops
(CRP - Base)

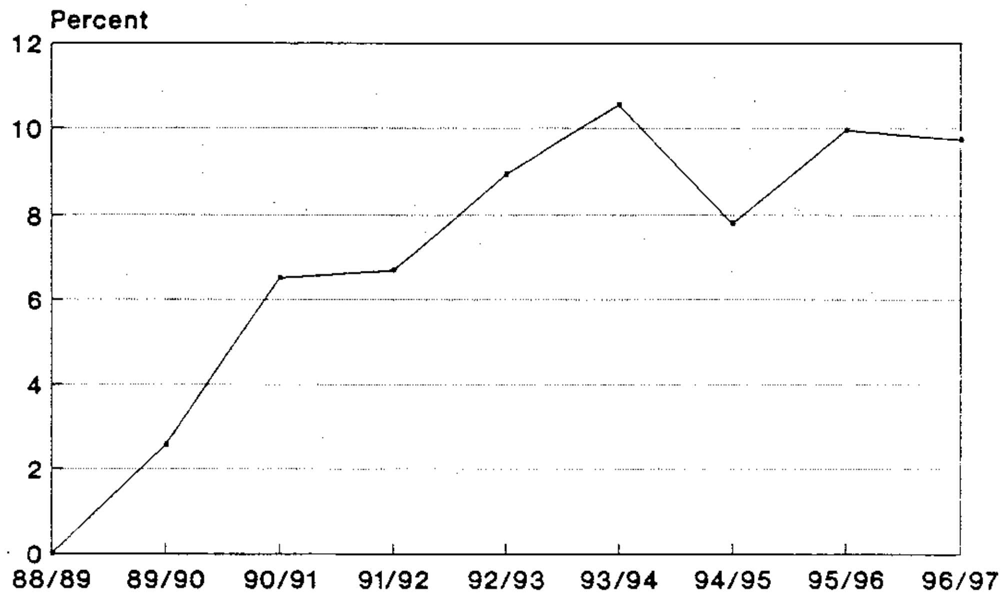


Figure 8: Percent Change in Price Index for 5 Livestock Products
(CRP - Base)

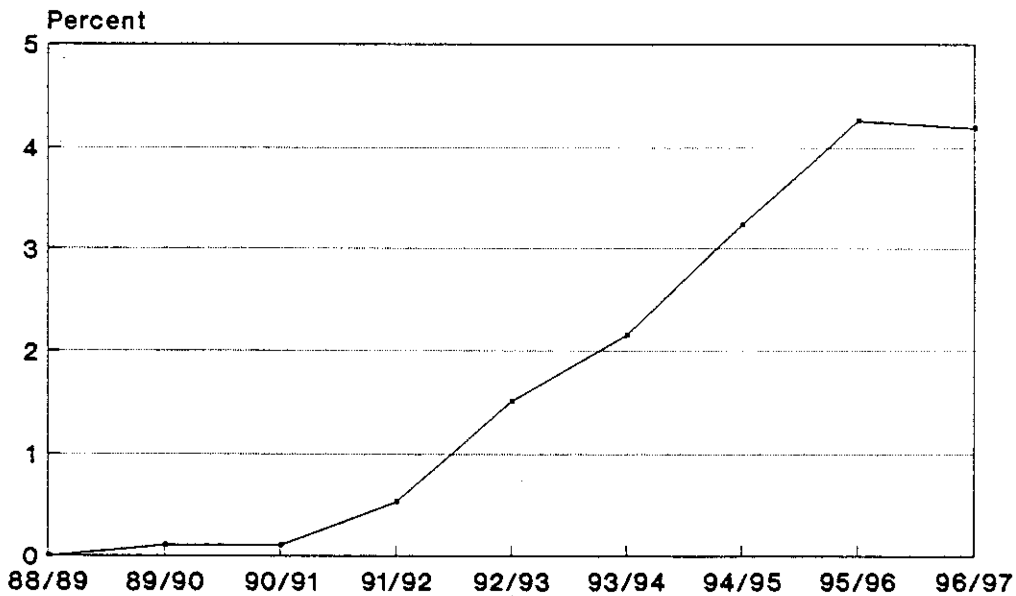


Figure 9: Change in Total Government Costs
(CRP - Base)

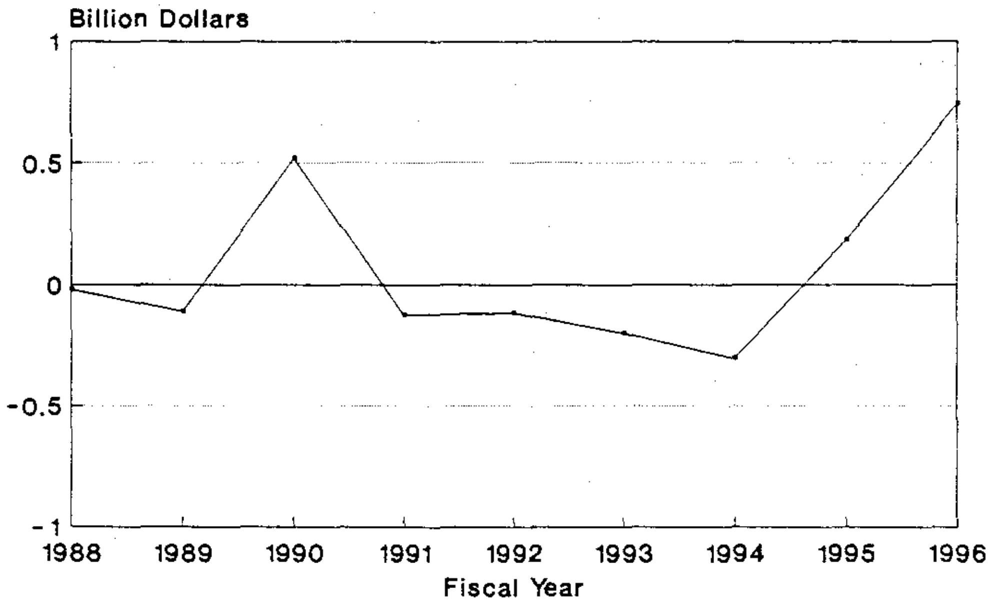


Figure 10: Change in Net Farm Income
(CRP - Base)

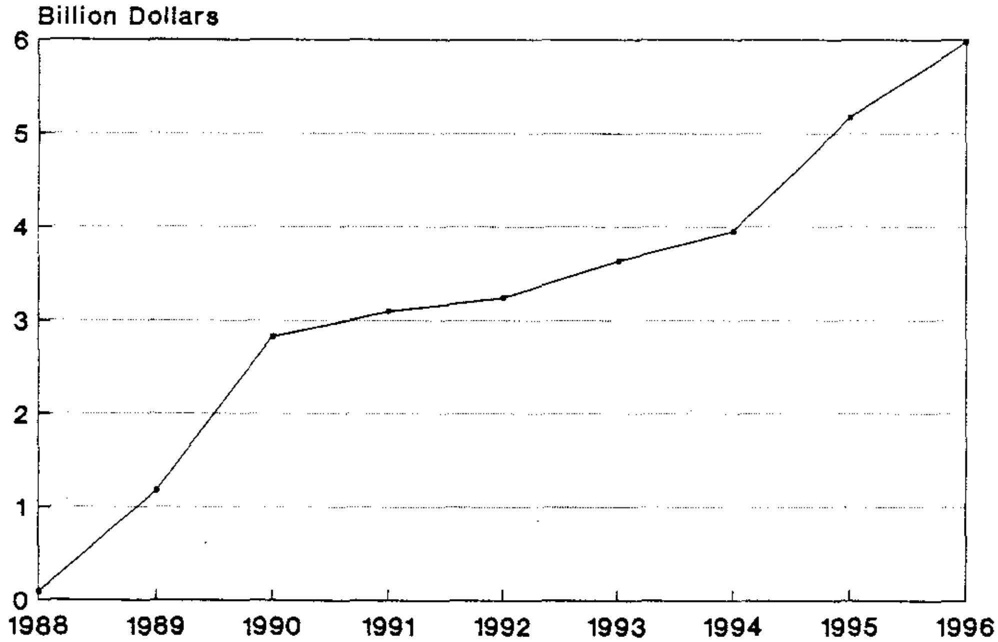
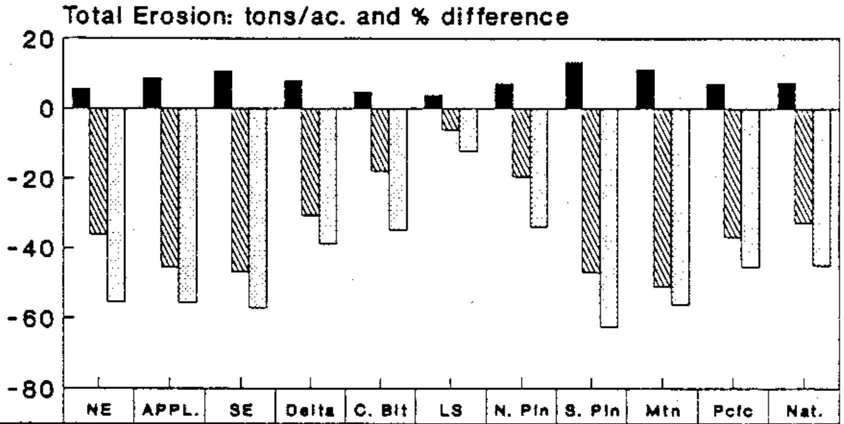


Figure 11: Total Soil Loss Per Acre

Conservation Compliance Scenarios



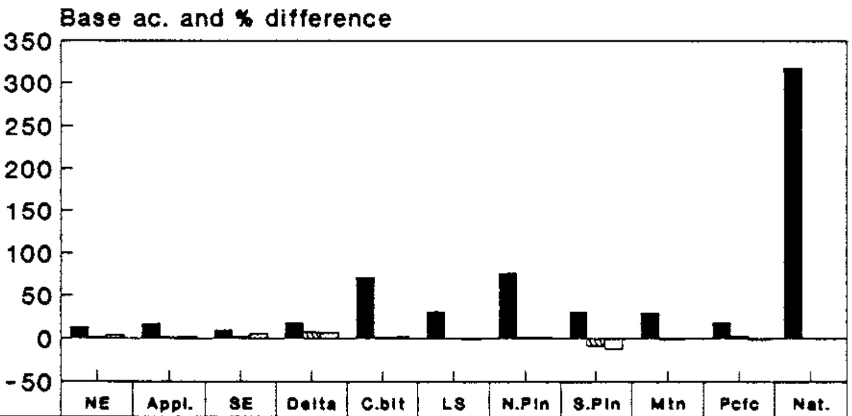
	NE	APPL.	SE	Delta	C. Blt	LS	N. Pln	S. Pln	Mtn	Pcfc	Nat.
Base: tons/ac.	5.5	8.7	10.7	8	4.7	3.8	7.1	13.3	11.2	7	7.4
10-ton %	-36.1	-45.5	-46.9	-30.5	-17.8	-6.1	-19.5	-47.1	-51	-36.7	-32.8
5-ton %	-55.4	-55.6	-57	-38.8	-34.7	-12.2	-33.9	-62.5	-56.1	-45.3	-45.1

USDA Production Regions

Base: tons/ac. 10-ton % 5-ton %

Figure 12: Land in Production

Conservation Compliance Scenarios



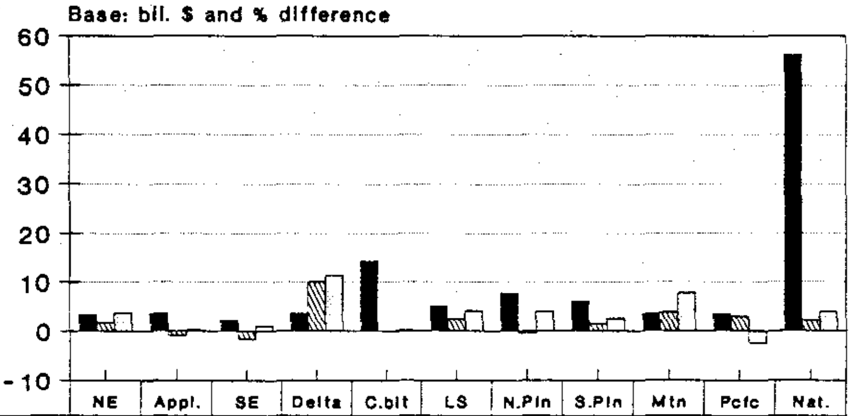
	NE	Appl.	SE	Delta	C.blt	LS	N.Pln	S.Pln	Mtn	Pcfc	Nat.
Base: mil. ac.	13	17.1	10.1	18.2	71.5	31.3	76.8	30.7	30.4	19.1	318.1
10-ton %	1.6	1.8	2.1	7.9	1.3	0.2	1.2	-8.1	-1.6	3.1	0.5
5-ton %	4.1	2.5	5.2	6.6	2	-0.6	1.2	-12.1	0	-1.1	0.3

USDA Production Regions

Base: mil. ac. 10-ton % 5-ton %

Figure 13: Total Production Costs

Conservation Compliance Scenarios



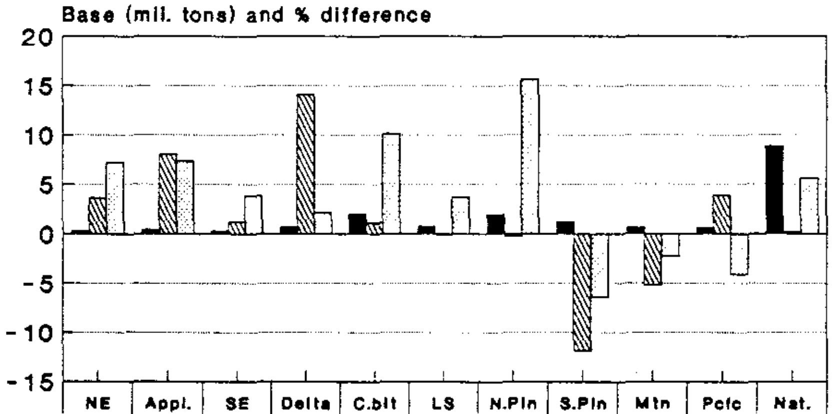
	NE	Appl.	SE	Delta	C.blt	LS	N.Pln	S.Pln	Mtn	Pcfc	Nat.
Base: billion $	3.3	3.6	2.2	3.6	14.3	5	7.8	6	3.6	3.4	56.2
10-ton %	1.8	-1	-1.8	9.9	0	2.4	-0.5	1.5	3.8	2.9	2.2
5-ton %	3.7	0.2	1	11.3	0.1	4.1	4	2.5	7.8	-2.5	3.9

USDA Production Regions

Base: billion $ 10-ton % 5-ton %

Figure 14: Nitrogen Fertilizer Use

Conservation Compliance Scenarios



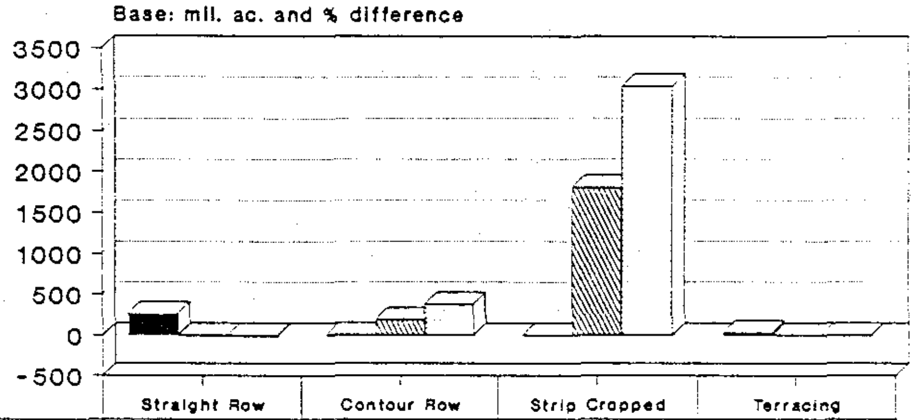
	NE	Appl.	SE	Delta	C.blt	LS	N.Pln	S.Pln	Mtn	Pcfc	Nat.
Base (mil. tons)	0.27	0.43	0.32	0.69	2	0.74	1.9	1.2	0.64	0.61	8.9
10-ton %	3.6	8	1.2	14.1	1.1	-0.1	-0.3	-11.9	-5.2	3.9	0.2
5-ton %	7.2	7.3	3.8	2.1	10.1	3.7	15.6	-6.4	-2.3	-4.1	5.6

USDA Production Regions

Base (mil. tons) 10-ton % 5-ton %

Figure 15: Use of Conservation Practices

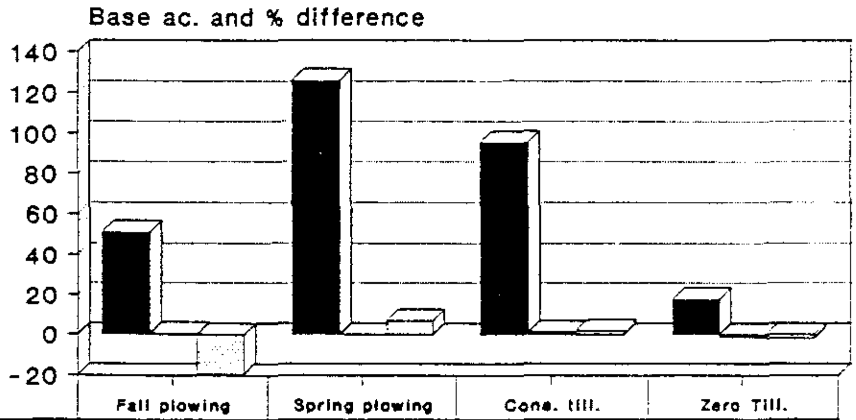
Conservation Compliance Scenarios



	Straight Row	Contour Row	Strip Cropped	Terracing
Base: mil ac.	257.1	4.4	1.3	27.3
10-ton %	-11.3	187.2	1800	-4.3
5-ton %	-21	378.3	3043.3	-5.9

Figure 16: Use of Tillage Practices

Conservation Compliance Scenarios



	Fall plowing	Spring plowing	Cons. till.	Zero Till.
Base: mil. acres	51.1	125.8	95.4	17.8
10-ton %	0.6	0.2	1.4	-1.2
5-ton %	-19.2	7.2	2.1	-1.9

References

Atwood, Jay D., Klaus Frohberg, Stanley R. Johnson, Thyrele Robertson, and Leland Thompson. 1989. "National and Regional Implications of Conservation Compliance." Forthcoming CARD staff report, Center for Agricultural and Rural Development, Iowa State University, Ames, Iowa.

CARD. 1989. "An Overview of the CARD/FAPRI Modeling System." Forthcoming technical report, Center for Agricultural and Rural Development, Iowa State University, Ames, Iowa.

English, Burton C., Elwin G. Smith, Jay D. Atwood, Stanley R. Johnson, and George E. Oamek. 1989. "Resource Conservation Act Analysis: An Overview of the CARD Agricultural Resource Interregional Modeling System." Forthcoming CARD technical report, Center for Agricultural and Rural Development, Iowa State University, Ames, Iowa.

English, Burton C., Elwin G. Smith, and George E. Oamek. 1987. "An Overview and Mathematical Representation of the National Agricultural Resource Interregional Modeling System." Unpublished staff paper, Center for Agricultural and Rural Development, Iowa State University, Ames, Iowa.

FAPRI. 1989. "FAPRI U.S. and World Agricultural Outlook, Summary and Tables, February 1989." Food and Agricultural Policy Research Institute, University of Missouri-Columbia, and Iowa State University, Ames, Iowa.

FAPRI. 1988. "Policy Scenarios with the FAPRI Commodity Model." Working Paper #88-WP41 (December 1988). Center for Agricultural and Rural Development, Iowa State University, Ames, Iowa.

United States Department of Agriculture. 1987. "ASCS Background Information: Conservation and Environmental Protection Programs." Agricultural Stabilization and Conservation Service. BI No. 5.