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Sodbusting: Land Use Change and Farm Programs

OTHER REPORTS ON FARM LEGISLATION

Other USDA reports providing background for 1985 farm bill discussions deal with the major program commodities, the farm industries that produce them, and the farm programs under which they are produced. These reports are available from EMS Information, rm. 0054 South Bldg., USDA, Washington, D.C. 20250; (202) 447-7255. They include Honey (AIB-465), Wool and Mohair (AIB-466), Wheat (AIB-467), Tobacco (AIB-468), Peanuts (AIB-469), Rice (AIB-470), Corn (AIB-471), Soybeans (AIB-472), Oats (AIB-473), Dairy (AIB-474), Sorghum (AIB-475), Cotton (AIB-476), Barley (AIB-477), and Sugar (AIB-478).

Background papers are also available on Federal Credit Programs for Agriculture (AIB-483), History of Agricultural Price Support and Adjustment Programs, 1933-84 (AIB-485), The Current Financial Condition of Farmers and Farm Lenders (AIB-490), A Summary Report on the Financial Condition of Family-size Commercial Farms (AIB-492), Foreign Exchange Constraints to Trade and Development (FAER-209), Financial Constraints to Trade and Growth: The World Debt Crisis and Its Aftermath (FAER-211), Possible Economic Consequences of Reverting to Permanent Legislation or Eliminating Price and Income Supports (AER-526), Do USDA Farm Program Participants Contribute to Soil Erosion? (AER-532), Analysis of Policies to Conserve Soil and Reduce Surplus Crop Production (AER-534), and the Impacts of Policy on U.S. Agricultural Trade (ERS Staff Report No. AGES840802).

SODBUSTING: LAND USE CHANGE AND FARM PROGRAMS. Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 536.

ABSTRACT

Farmers converted 11.1 million acres of land to cropland between 1979 and 1981, but only 1.9 million acres were both highly erodible and planted to program crops. Although concern about sodbusting focuses on the Great Plains, such conversion has been occurring in all regions. Analysis of costs and returns indicates that farm programs do provide an incentive to convert highly erodible land to cropland. Participation in price support and subsidized loan programs would have made net returns on 384,000 acres of highly erodible land profitable in 1982. Proposed legislation would remove such incentives, but the proposed system for identifying highly erodible land does not precisely identify new cropland with high potential for excessive erosion.

KEYWORDS: Land conversion, land use, sodbusting, soil erosion, program effects

FOREWORD

In 1985, Congress will consider new farm legislation to replace the expiring Agriculture and Food Act of 1981. Proposals restricting eligibility for farm program benefits for crops grown on newly plowed, highly erodible land are being considered. This report provides background information for consideration of such proposals, including estimates of the extent and location of cropland conversion in recent years, conversion's impact on soil erosion, and the economics of crop production on highly erodible new cropland with and without farm program benefits. The intent is to provide background information which may be useful in developing new farm legislation in 1985.

This report was prepared by Ralph Heimlich of the Natural Resource Economics Division.

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SUMMARY

Plowing up land to grow erosive crops, popularly known as sodbusting, is not adding greatly to current soil losses, but may lead to increased erosion in the future, according to a study of recently converted land.

Extent. The amount of land converted to cropland in the recent past has not been large. Farmers converted 11.1 million acres from other uses to crops between 1979 and 1981. This was less than 3 percent of all cropland in 1982.

Although attention has centered on the Great Plains, conversion to cropland has occurred in every region. In 1979-81, 20 percent of the land converted to cropland was in the Corn Belt, and between 10 and 15 percent each was in the Northern Plains, Mountain, Appalachian, and Southern Plains regions.

Proposed Legislation. Legislation proposed to curb sodbusting would deny all benefits to farmers who grow supported crops on highly erodible new cropland. This study estimates that the legislation would apply to only a small share of new cropland, since only 1.9 million acres of the 11.1 million acres converted in 1979-81 were both classified as highly erodible and used to grow major farm program crops.

Erosion Potential. Most newly converted land does not have high erosion potential, contrary to the sodbuster image. However, 1 acre in 5 was classified highly erodible, compared with 1 acre in 10 for cropland generally. Current erosion rates for new cropland are comparable with those for other cropland; new cropland accounted for 2.6 percent of total acres in 1982 and 2.9 percent of the estimated soil loss. However, considering the greater erosion potential of new cropland, more intensive use in the future could boost actual erosion rates.

The method for classifying land used in the proposed sodbuster legislation was not originally designed to identify land with high erosion potential. Of cropland converted in 1979-81, 2.3 million acres would have been classified highly erodible under current proposals. Yet, according to a more objective measure of erodibility, less than half of those acres had high potential for excessive erosion and more than 1 million acres with high erosion potential would have not have been classified highly erodible.

Sodbusting Economics. Would loss of benefits curb sodbusting? The study estimated that program benefits in 1982 would have made returns to variable costs (excluding overhead, interest, and land costs) positive on only 384,000 acres of the 1.9 million acres subject to sodbuster provisions. Much of this land was in the Southern Plains and Northern Plains States. One million acres of the remaining land under sodbuster provisions would have been profitable to crop despite loss of benefits, and 470,000 acres would have shown a loss even with benefits.

Prospects. The decline in farm prices after 1981 may herald decreased conversion to cropland, and conditions favorable to land conversion are not likely to recur in the near future. Nevertheless, prohibiting farm program subsidies on highly erodible cropland recently converted from other uses would remove incentives for conversion and would ensure greater consistency between conservation and commodity support programs. However, for such legislation to be effective, more precise identification of highly erodible land than that now proposed would be needed.

Sodbusting: Land Use Change and Farm Programs

INTRODUCTION

The role of farm program benefits in conversion of highly erodible land for crop production is a topic of public concern. This report examines recent trends in conversion to cropland, the extent of soil erosion on newly converted land, and the likely impact of current farm programs and proposed "sodbuster" legislation on conversion.

In the 1970's, strong export demand for farm commodities led to near-record utilization of the U.S. cropland base (16) 1/. The intensity of cropland use increased and land that had not recently been cropped was brought into production. Increased agricultural production resulted in high soil erosion rates, documented in the findings of the 1977 National Resources Inventory (NRI) and the 1980 Resource Conservation Assessment (RCA) (34, 35). The conflict between production goals and conservation goals in USDA farm programs was a persistent theme in public participation meetings and a public opinion poll conducted in conjunction with the 1980 RCA (10).

Of particular concern in the early 1980's was conversion of land for crop production in the face of growing crop surpluses. Such newly converted cropland was perceived to be more erodible than existing cropland and it was presumably of marginal productivity. The label "sodbusting" has adhered to this process because of conversion from rangeland to cropland in the western Great Plains (14). Government price-support and credit programs were presumed to be an important factor in the decision to convert land to crop uses. Critics argued that farm programs should not be available for erodible newly converted cropland in view of conservation and set-aside programs to remove such land from crop production.

In response to the sodbusting problem, legislation was introduced in 1984 to deny farm program benefits to operators who convert erodible land to crop production. Senate (S.663) and House (H.R.3457) versions in the 98th Congress were similar and were tabled for further study as Congress ended. A similar sodbuster provision is included as the conservation title (title XV) of the Agricultural Adjustment Act of 1985.

The sodbuster proposals are designed "To prohibit the payment of certain agriculture incentives to persons who produce certain agricultural commodities on highly erodible land" (H.R.3457). Under the proposals, an operator would become ineligible for price-support payments, farm storage facility loans, crop insurance, disaster payments, and insured or guaranteed loans for any crop year in which an annual crop was produced on a field which is

1/ Underscored numbers in parentheses refer to sources cited in the References section at the end of the report.

predominantly highly erodible. In the legislation, highly erodible land is defined to be land in land capability classes IVe, VIe, VII, and VIII (see box), or any other land SCS determines would have an average erosion rate higher than those classes. An operator would retain eligibility if the land were cropped between 1973 and 1984, already planted before enactment, or planted using a conservation system conforming to technical standards set forth by the Soil Conservation Service (SCS).

This report investigates the implications of sodbuster legislation by assuming it had been enacted in the early 1980's. The extent and location of recent conversion to cropland in total and on highly erodible land are analysed. Erosion from recently converted land is estimated, and the degree to which the proposals' definition of "highly erodible" accurately identifies land that should not be cropped is evaluated. Finally, the economics of new conversion are examined and the likely effects of proposed sanctions are evaluated.

LAND CAPABILITY CLASSIFICATION

USDA uses a land capability classification system that groups soils on the basis of their ability to produce common cultivated crops and pasture plants without diminishing soil productivity (35). Each group is denoted by a capability class and a modifying subclass. Land capability classes are designated by Roman numerals I through VIII, indicating progressively greater limitations and narrower choices for practical use:

- Class I soils have few limitations that restrict their use;
- Class II soils have moderate limitations that reduce the choice of plants;
- Class III soils have severe limitations that reduce the choice of plants;
- Class IV soils have very severe limitations that reduce plant choice;
- Class V soils are not likely to erode but have other limitations on use;
- Class VI soils have severe limitations that make them generally unsuitable for cultivation;
- Class VII soils have very severe limitations that make them unsuitable for cultivation;
- Class VIII soils have limitations that preclude them from commercial crop production.

Capability subclasses are soil groups within one class, designated by adding a small letter to the class numeral. The letter shows the main limitation or risk associated with crop production:

- e soils' main limitation is risk of erosion unless protected;
- w soils have a wetness problem that interferes with plant growth;
- s soils are limited by shallow depth, droughtiness, or stones;
- c soils are limited by a climate that is too cold or too dry.

Thus, a soil classed IIIe, for example, is severely limited as to choice of plants that can be grown because of the hazard of excessive erosion.

EXTENT AND LOCATION OF RECENT CONVERSION

Despite recent concern over conversion of land for crop uses, the general trend in post-war cropland use is stable. Total cropland decreased less than 1 percent between 1949 and 1982 and cropland used for crops in 1982 was equal to the 1949 high of 387 million acres (11, 16). Cropland used for crops decreased until 1969, and then increased. Between 1975 and 1982 cropped land increased 19 million acres (5.2 percent). In 1984, 370 million acres were used for crops, returning to the level of the late 1970's.

The small movements in U.S. cropland totals mask conversions to and from cropland. Analysis of these shifts requires data that record the actual change in land use. Several such "point-based" data sets are available. The Land Ownership Survey (LOS) was conducted on a subsample of the 1977 National Resources Inventory (NRI) points. Data from the LOS and several follow-on surveys pertain to land conversion activity between 1975 and 1977 (6, 7, 24, 25). The 1982 NRI collected information on the use of land in 1982 and the three prior years. The analysis in this section draws heavily on these two sources (see appendix 1).

Based on these sources, more than 20 million acres were converted to cropland between 1975 and 1981, or 4.8 percent of the 421 million acres of cropland reported in the 1982 NRI (table 1). Another 6 million acres were converted from cropland to other uses over the period, leaving a net conversion of about 14 million acres, or 3.3 percent of total cropland.

The estimates of conversion reported here are probably conservative. The 14 million acres converted on net is seven-tenths of the net conversion reported by Frey and Hexem for 1975 through 1982 (11). Lack of data for 1978 and possible underestimation of land converted in the LOS may account for this difference (see appendix 1).

Trends in Land Conversion

Average net conversion during 1979-81 was about equal to that during 1975-77, about 2.3 million acres of new cropland per year (table 1). Average annual conversion to cropland increased from about 3 million acres per year to 3.7 million acres. At the same time, conversion of cropland to other uses also

Table 1--Land conversion, United States, 1975-77 and 1979-81

Converted	1975-77 1/		1979-81 2/		Total	
	Total	Average annual	Total	Average annual	Total	Average annual
	1,000 acres					
To cropland	9,119	3,040	11,169	3,723	20,288	3,381
From cropland	1,868	623	4,228	1,409	6,096	1,016
Net	7,251	2,417	6,941	2,314	14,162	2,465

1/ LOS follow-on data.
2/ 1982 NRI crop history and land-use data.

increased from 623,000 acres per year to 1.4 million acres. Thus, while average net addition to cropland fell slightly, almost 1.5 million more acres a year were involved in the conversion process.

Annual data for net conversion to cropland and components of change are graphed in figure 1. Conversion of land to cropland increased dramatically between 1975 and 1976. Annual conversion remained at this high level, dipping only slightly in 1979. Conversion appears to be increasing, based on the 1979-81 trend. The initial burst in conversion to cropland was accompanied by a sharp drop in removal of land from production, accentuating net additions to cropland. However, conversions to cropland between 1976 and 1979 were offset by removals, as were the most recent additions to cropland.

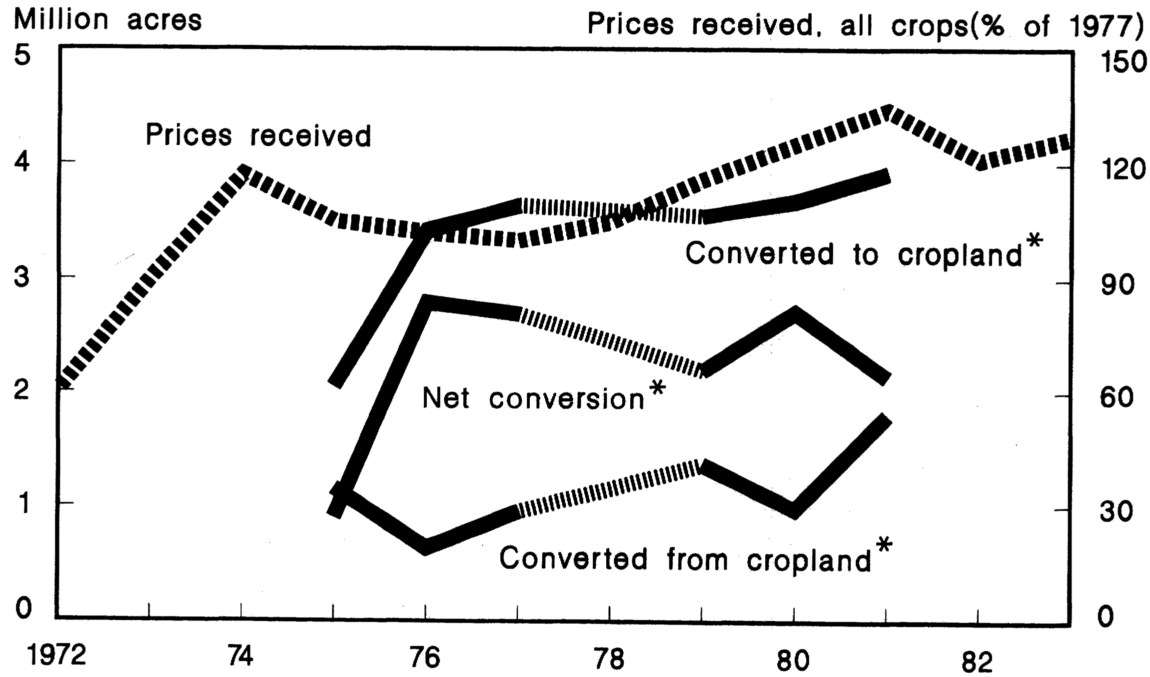
Congruence between relative price levels for agricultural crops and conversion of land for crop production is suggested in figure 1. Conversion to cropland lagged price movements by 2 to 2 1/2 years throughout the latter half of the 1970's. However, conversion from cropland in 1981 appears to have anticipated the downtrend in crop prices, possibly due to rapid increases in production costs that outstripped commodity price increases between 1978 and 1981. The decline in prices received after 1981 may herald decreased conversion to cropland.

Sources and Uses of New Cropland

The majority of land converted to cropland in both periods came from pasture, range, or idle uses where little effort was needed to begin crop production (fig. 2). Pasture and rangeland were the most important sources of new cropland, accounting for between 64 and 84 percent. Land removed from crop production reverted largely to pasture, range, and idle land. These uses

Figure 1

Components of Conversion to Cropland in Relationship to Crop Price Changes, 1975-77 and 1979-81



*No data for 1978; values are interpolated.

accounted for about 80 percent of land retired in both periods, and serve as a pool of ready land resources which can be moved into and out of crop production as changing price conditions dictate.

About half of the new cropland was used for row crop production in each of the two periods covered by the data (fig. 2). Slightly less of the new land went for row crops in 1979-81 than in the earlier period. Corn and soybeans were the principal row crops in both periods, but both were less important in the later period (table 2). About a quarter of new cropland was used to produce close-grown crops in both periods. The proportion of new cropland used for close-grown crops was higher in the later period and the increase occurred in new cropland planted to wheat. New cropland in summer fallow rotation nearly doubled, partly reflecting the fallow rotation required in dryland wheat production. The proportion of new cropland in hay crops was larger in the later period as well.

Location of New Cropland

Conversion of land to crop production occurred in all regions of the United States since 1975 (table 3). The distribution of land converted to cropland remained relatively stable between 1975 and 1981.

The term "sodbusting" conveys the notion of plowing up virgin grasslands, some of which has occurred recently in the Great Plains. However, proposed sodbuster legislation will apply to any land converted for crop production that has not been cropped in recent years.

Between 1975 and 1977, the largest concentrations of cropland development were in the Northern Plains, Appalachian, and Mountain regions (fig. 3), accounting for slightly more than a quarter of all land converted to cropland. The smallest proportion of conversion occurred in the Northeast and Lake States. When viewed in relation to the existing cropland base in each region, the amount of land in the Appalachian, Southeast, Delta, Mountain, and Pacific

Figure 2

Sources and Uses of Newly Converted Cropland

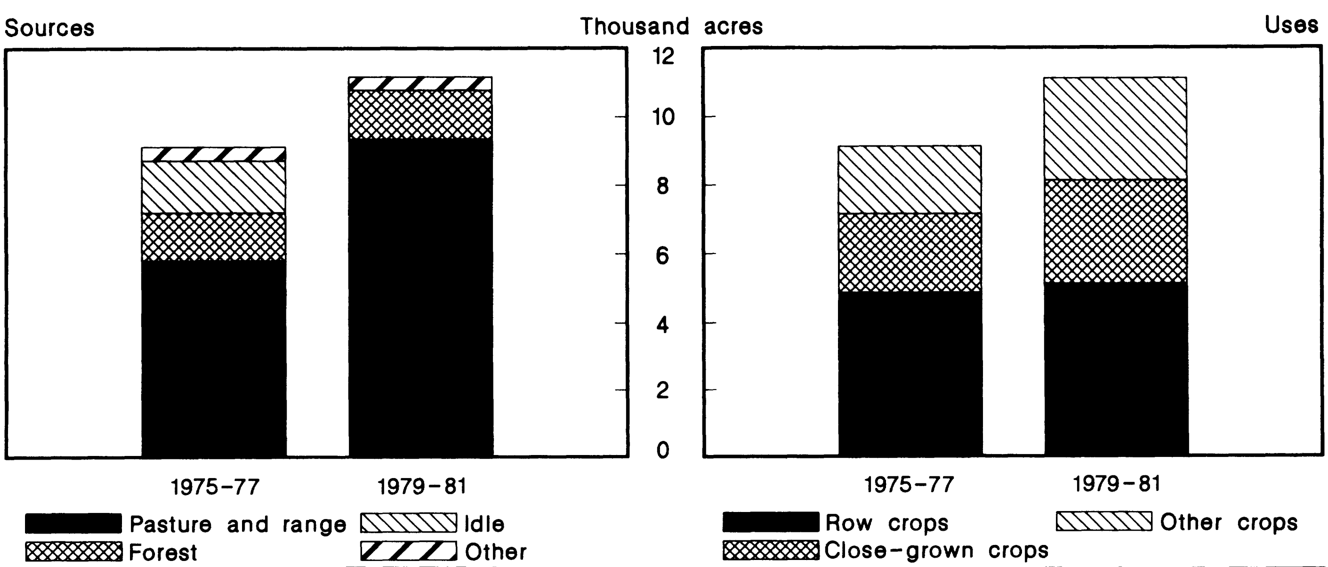


Table 2--Crop use of land converted to cropland, United States, 1978 and 1982

Crop use	1978		1982	
	1,000 acres	Percent	1,000 acres	Percent
Row crops:				
Corn	2,025	22.2	2,305	20.8
Soybeans	1,603	17.6	1,631	14.7
Sorghum	328	3.6	514	4.6
Cotton	97	1.1	216	1.9
Other	796	8.7	445	4.0
Subtotal	4,849	53.2	5,111	46.0
Close-grown:				
Wheat	1,434	15.7	2,012	18.1
Other	862	9.4	1,001	9.0
Subtotal	2,296	25.1	3,013	27.1
Summer fallow	325	3.6	666	6.0
Hay crops	900	9.9	1,333	12.0
Other and not reported	749	8.2	988	8.9
Total	9,119	100.0	1/11,111	100.0

1/ Net of 58,000 acres converted into and out of cropland between 1979 and 1982.

Table 3--Conversion to cropland by farm production region, United States, 1975-77 and 1979-81

Region	1975-77 1/		1979-81 2/	
	1,000 acres	Percent	1,000 acres	Percent
Northeast	284	3.1	382	3.4
Lake States	692	7.6	615	5.5
Corn Belt	903	9.9	2,169	19.6
Northern Plains	1,358	14.9	1,548	14.0
Appalachian	1,186	13.0	1,205	10.9
Southeast	937	10.3	908	8.2
Delta	947	10.4	992	9.0
Southern Plains	883	9.7	1,178	10.6
Mountain	1,183	12.9	1,381	12.5
Pacific	746	8.2	699	6.3
Total	9,119	100.0	3/11,077	100.0

1/ LOS follow-on data.
2/ 1982 NRI crop history and land-use data.
3/ Excludes 35,000 acres converted in Puerto Rico and the Virgin Islands.

regions converted to crop use was more than proportional to those regions' shares of total U.S. cropland. The Corn Belt, with 22 percent of total U.S. cropland in 1977, added only 10 percent of the new cropland, the smallest proportion of any region.

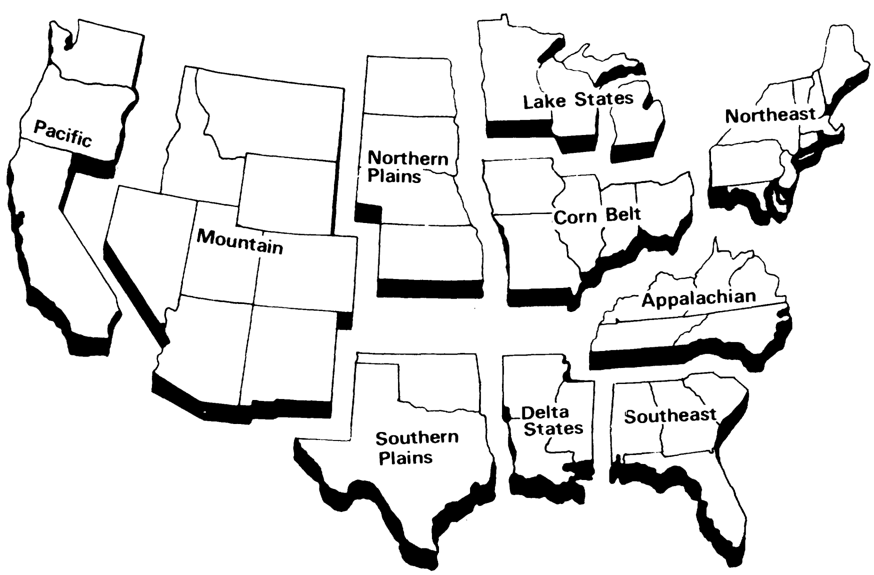
This situation changed in 1979-81, when the largest percentage of new conversion occurred in the Corn Belt. The Northern Plains and Mountain regions were the next most important regions for cropland conversion. The percentage of conversion occurring in the Appalachian, Southeast, and Pacific regions declined somewhat from the earlier period. The Northeast and Lake States regions represented an even smaller portion of total conversion than previously. With respect to total cropland in 1982, the same five regions added more than proportionally to their cropland.

Data on land converted from crop uses by region is available only for 1979 to 1981 (table 4). Net conversion to cropland was highest in the Corn Belt, Northern Plains, Mountain, and Delta regions, where conversion from cropland was less than proportional to total cropland. As these data do not include conversion of cropland to urban uses, net conversion in the heavily populated Northeast, Lake States, and Pacific regions was probably even less than shown in table 4.

Estimates of gross conversion arrived at here for the Great Plains are in rough accord with independent estimates made in the field. Estimates of rangeland conversion to cropland were made by SCS and others in the Great Plains in response to concerns over sodbusting (3, 21). These estimates cover a variety of time periods in the late 1970's and early 1980's and include various definitions of change, so they are not completely comparable to NRI estimates. SCS estimates of about 3.8 million acres of rangeland conversion in the Northern Plains compare with a total of 2.9 million acres between 1975 and 1981 (table 3). Estimates for Colorado, Wyoming, and Montana total 2.3 million acres, compared with 2.6 million acres for the entire Mountain region.

Figure 3

Farm Production Regions



EROSION AND ERODIBILITY ON NEW CROPLAND

A principal public concern with sodbusting is the belief that the land being converted to cropland contributes more to erosion than the existing cropland base. Since the crops grown on the newly converted land are highly erosive compared with pasture, range, and forest uses, increased erosion undoubtedly results from land conversion. The real issue is whether new cropland is more erodible than the existing cropland base.

Erosion Rates

The average erosion rate on newly converted cropland of 8.1 tons per acre per year (TAY) was only slightly greater than the 7.4 TAY recorded for all cropland. Stated another way, the new cropland made up 2.6 percent of all cropland and accounted for 2.9 percent of total erosion from cropland in 1982. It does not appear from this evidence that all newly converted cropland has more erosion than existing cropland (table 5).

Most of the new cropland had no wind erosion problem, and only about one-fourth of it had water (sheet and rill) erosion rates in excess of acceptable limits. Newly converted cropland had lower wind erosion rates than existing cropland, and slightly higher water erosion rates.

Fewer conservation practices were used on new cropland than on cropland generally (table 6). No conservation practices were applied on almost three-quarters of new cropland, while no conservation practices were used on only 64 percent of all cropland. Conservation tillage was used on only 12 percent of

Table 4--Net conversion to cropland by farm production region, 1979-81

Region	To cropland		From cropland		Net	
	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent
Northeast	382	3.4	303	7.3	79	1.1
Lake States	615	5.5	303	7.3	312	4.5
Corn Belt	2,169	19.6	699	16.8	1,470	21.2
Northern Plains	1,548	14.0	326	7.9	1,222	7.7
Appalachian	1,205	10.9	549	13.2	656	9.5
Southeast	908	8.2	499	12.0	409	5.9
Delta	992	9.0	187	4.5	805	11.6
Southern Plains	1,178	10.6	496	12.0	682	9.8
Mountain	1,381	12.5	438	10.6	943	13.6
Pacific	699	6.3	347	8.4	352	5.1
Total	11,077	1/100.0	4,147	2/100.0	6,930	100.0

1/ Excludes 35,000 acres converted in Puerto Rico and the Virgin Islands.
2/ Excludes 30,000 acres converted in Puerto Rico and the Virgin Islands.
Source: 1982 NRI.

Table 5--Wind and water erosion rates in 1982 on land converted to cropland, United States, 1979-81

Erosion rate	New cropland		All cropland	
	Wind erosion	Water erosion	Wind erosion	Water erosion
TAY 1/	1,000 acres			
Less than 5	10,123	8,087	355,167	327,093
5-13	629	1,887	44,124	66,443
14-24	206	561	11,300	14,924
25 or more	153	576	8,856	10,987
Total	11,111	11,111	2/419,447	419,447
	Percent			
Less than 5	91.1	72.8	84.7	78.0
5-13	5.7	17.0	10.5	15.8
14-24	1.8	5.0	2.7	3.6
25 or more	1.4	5.2	2.1	2.6
Total	100.0	100.0	100.0	100.0

1/ Tons per acre per year.
2/ The 1982 cropland estimate is about 2 million acres less than the amount reported in previous NRI published summaries because some sample points were reclassified from pastureland to cropland.

Table 6--Erosion control practices in 1982 on land converted to cropland, United States, 1979-81

Practice	New cropland		All cropland	
	1,000 acres	Percent	1,000 acres	Percent
No practice	8,190	73.7	268,388	64.0
Conservation tillage	1,384	12.5	76,580	18.2
Contour plowing	302	2.7	8,838	2.1
Diversion	47	.4	1,090	.2
Field windbreak	13	.1	3,367	.8
Grass waterway	180	1.6	7,353	1.8
Contour strip	25	.2	1,825	.5
Wind strip	77	.7	6,915	1.6
Terrace	100	.9	3,439	.8
Combinations of--				
2 practices	661	6.0	26,719	6.4
3 practices	132	1.2	14,933	3.6
Subtotal	2,921	26.3	151,059	36.0
Total	11,111	100.0	410,447	100.0

Source: 1982 NRI.

new cropland, compared with use on more than 18 percent of all cropland. Cropping intensity was lower on the new land compared with existing cropland. New cropland had a smaller proportion of acreage in erosive row crops and close-grown crops than the percentage on all cropland, but the proportions of new cropland planted to sorghum, other row crops, other small grains, and other crops were higher than for all cropland.

The cause of the slightly higher erosion on cropland recently converted from noncropland uses is not clear from the data presented. On the one hand, fewer conservation practices were employed on the new land than on existing cropland, which would result in higher erosion. Conversely, less erosive crops were grown on new cropland, tending to produce less erosion. Only a direct measure of the inherent erodibility of the land brought into production would show whether the land itself was highly erodible or whether the land was being managed abusively.

Highly Erodible New Cropland

Sodbuster proposals would bar benefits to farmers who plow up highly erodible land. Erosion rates reflect the underlying potential for erosion due to physical features, such as slope and rainfall patterns, and the current management of the land. Erodibility reflects only potential for erosion and does not consider current crops or practices used. Thus, land can be "highly erodible" and not have high current erosion rates. An issue related to the erodibility of new cropland is how well this category of land, comprising certain land capability classes, captures new cropland with potential erosion problems. The 1982 NRI data provide information on land classes and erodibility needed to find answers to both issues.

About 2.4 million acres of new cropland, or 21.2 percent, were highly erodible according to the land capability class definition (table 7). However, fully 80 percent of this highly erodible new cropland eroded at less than 5 TAY from wind processes and 52 percent had less than 5 TAY of sheet and rill erosion. More newly converted land classed not erodible had water erosion above 5 TAY than that classified highly erodible according to the definition. Even if the highly erodible definition were expanded to include new cropland in class IIIe, as some propose, only 18.5 percent of new cropland would be both highly erodible and have actual erosion rates above 5 TAY. A quarter of the new cropland classed as highly erodible under this more inclusive definition would erode at less than 5 TAY.

Highly erodible new cropland had an average erosion rate from wind and water sources of 17.9 TAY, more than three times the 5.5 TAY of the remaining newly converted land. However, the 52 percent of highly erodible new cropland with water erosion rates less than 5 TAY had a combined erosion rate (wind and water) of only 7.1 TAY, while the remaining 48 percent had an average combined erosion rate of 29.7 TAY.

The highest proportion of highly erodible new cropland occurred in the Mountain region (table 8). Almost equally high proportions occurred in the Corn Belt and Northern Plains regions. A third of new cropland in the Mountain and Pacific regions was highly erodible according to the capability class definition. The Lake States, the Northeast, and the Southeast had the least highly erodible new cropland. Highly erodible land made up the smallest proportion of total new cropland in these regions.

Table 7--Wind and water erosion rates in 1982 on land converted to cropland, United States, 1979-81

Erodiblity definition	Total	Wind erosion, TAY 1/				Water erosion, TAY 1/			
		Less than 5	5-13	14-24	25 or more	Less than 5	5-13	14-24	25 or more
	1,000 acres								
Not highly erodible	8,761	8,192	381	139	49	6,864	1,371	299	227
Highly erodible	2,350	1,931	248	67	104	1,223	516	262	349
Total	11,111	10,123	629	206	153	8,087	1,887	561	576
	Percent								
Not highly erodible	78.8	73.7	3.4	1.2	0.4	61.8	12.3	2.7	2.0
Highly erodible	21.2	17.4	2.3	.6	1.0	11.0'	4.7	2.3	3.2
Total	100.0	91.1	5.7	1.8	1.4	72.8	17.0	5.0	5.2

1/ Tons per acre per year.
Source: 1982 NRI.

Table 8--Highly erodible new cropland by land capability class definition, United States, 1979-81

Region	Highly erodible	Total	Regional distribution	National distribution
	1,000 acres		Percent	
Northeast	48	382	20.2	10.5
Lake States	38	614	6.2	1.6
Corn Belt	422	2,169	19.5	18.2
Northern Plains	397	1,548	25.6	17.1
Appalachian	244	1,205	20.2	10.5
Southeast	83	908	9.1	3.6
Delta	125	992	12.6	5.4
Southern Plains	260	1,178	22.1	11.2
Mountain	485	1,381	35.1	21.0
Pacific	213	699	30.5	9.2
Total	2,315	1/11,077	20.9	100.0

1/ Excludes 35,000 acres converted in Puerto Rico and the Virgin Islands.

Another way to assess the precision of the capability class definition is to compare it with an alternative classification. A scheme for classifying land's inherent erodibility based on parameters of the Universal Soil Loss Equation (USLE) (2) was applied to 1977 cropland (17). Three erodibility classes were defined by separating relatively unchanging physical factors in the equation (RKLS) from those factors under the control of the farm operator (CP). (See appendix 2.)

In table 9, land converted to cropland between 1979 and 1981 is cross-classified according to the scheme outlined above and on the basis of the capability class definition. Only 19 percent of the new cropland was highly erodible according to this alternate definition. However, the capability class definition captured only 8.8 percent, less than half, of this land. More than 12 percent of new cropland classed as moderately erodible or nonerodible by the alternate definition was included in the capability class definition of highly erodible land.

Both definitions show that about the same proportion of new cropland was highly erodible, but less than half of this amount was identified in common by both systems. The acreage in dispute was larger than the acreage agreed to be highly erodible.

Comparing the new cropland with all cropland, one finds that both measures of inherent erodibility indicate that new cropland was more erodible than existing cropland. The proportion of new cropland meeting the capability class definition of highly erodible land was twice (21.2 percent) that for all cropland. According to the USLE-based classification, 19 percent of the new land is highly erodible, compared with only 7.1 percent for all cropland. Less of the new land is nonerodible, but a smaller percentage of the moderately erodible new land is managed above tolerable soil loss limits.

Thus, new cropland had slightly higher erosion rates than existing cropland, with water erosion being more important than wind erosion. New cropland was farmed less intensively than existing cropland, but with fewer conservation practices applied. According to the capability class definition, about 20

Table 9--Erodibility classes by land capability class definition on land converted to cropland, United States, 1979-81

Erodibility definition	Erodibility class				
			Moderately erodible		
	Total	Nonerodible	Below T value	Above T value	Highly erodible
	1,000 acres				
Not highly erodible	8,761	2,692	3,852	1,086	1,131
Highly erodible	2,350	484	616	270	980
Total	11,111	3,176	4,468	1,356	2,111
	Percent				
Not highly erodible	78.8	24.2	34.6	9.8	10.2
Highly erodible	21.2	4.4	5.6	2.4	8.8
Total	100.0	28.6	40.2	12.2	19.0

Source: 1982 NRI.

percent of the new cropland was highly erodible, but a large portion of this land did not have high erosion rates. Classification of new cropland by use of an alternate scheme based on erodibility measured with USLE parameters showed that the capability class definition does not precisely identify new cropland with high potential for excessive soil erosion.

ECONOMICS OF SODBUSTING

The notion that the subsidies provided to crop producers under farm programs should not be paid to those producing program crops on highly erodible land is central to the concept of sodbuster legislation. For sodbuster proposals to have an appreciable effect on conversion of highly erodible land, this land must be marginal in the sense that Government subsidies make the difference between profit and loss on newly converted land. If this is correct, elimination of program eligibility for highly erodible land should cause it to go out of production as unsubsidized revenues fall below costs of production.

Impact on Net Returns

Despite incomplete data, the economics of land conversion can be examined empirically. Ideally, one would identify new cropland owners who participate in farm programs, quantify the benefits they received, and subtract them from net returns on the crops grown to determine if program benefits were critical to the profitability of such land. Unfortunately, there is no ready source of data on participation by owners of new cropland and little information on yields, production costs, or net returns by land capability class on a consistent nationwide basis. In the absence of such data, this analysis used a less empirical economic engineering approach. Returns were estimated using data developed for the ERS-CARD Model, an ERS version of the Iowa State University linear programming model (19). Prices and costs were adjusted to reflect full participation in price-support and credit programs. The difference between returns with and without program participation showed the importance of farm program subsidies for new cropland generally, and for the subset of highly erodible new cropland in particular.

The ERS-CARD LP model contains crop activities for seven major program crops grown on six different land groups in each of 105 producing areas. The results of a baseline model run were summarized for the 10 USDA farm production regions by crop and land group. Summarized results were used to calculate the average yield and production cost for each of the seven crops on each of the six land groups in each region.

The six land groups categorized land on the basis of both productivity and erodibility. In a rough way, they combined elements of both the capability class and USLE-based definitions of erodibility. Group 1 includes land that is both highly productive and nonerodible. Group 2 includes wet or stony soils with relatively low productivity, but low erodibility. Land in groups 3, 4, and 5 is moderately productive and is differentiated by erodibility on the basis of physical factors (RKLS, see app. 2), with land in groups 4 and 5 being highly erodible. Group 6 includes land in capability classes VI, VII, and VIII, which is low in productivity and moderately to highly erodible.

Two-thirds of the cropland converted between 1979 and 1981 was in the seven major program crops covered by budgets in the ERS-CARD LP model (table 10). Only 1.9 million (26 percent) of these 7.4 million acres in major crops were highly erodible. However, this accounted for two-thirds of all highly erodible new cropland (groups 4, 5, and 6).

While much pasture and rangeland can be easily brought into production, conversion of some land to crop use entails costs. Of the 9.1 million acres of new cropland reported in the LOS follow-on survey, 34 percent required clearing of trees or brush and 12 percent needed stone or fencerow removal (24). Beyond simple clearing, 20 percent required leveling, another 20 percent needed to be drained, and 15 percent was irrigated. Estimates of clearing costs vary from $40-$267 per acre (5, 13, 24). Needed drainage, liming, leveling, and irrigation costs are additional. Considering the wide variation in improvements needed and the uncertain basis for estimating costs, no conversion costs were charged against gross revenues in the analysis. While the absolute profitablity of some new cropland was accordingly overstated, the relative profitability of this land with and without farm program participation was not affected.

Returns to New Cropland without Programs

At season-average prices prevailing in 1982, slightly less than one-fifth of the new cropland planted to the seven crops produced negative returns to variable costs, that is, production costs excluding costs of land, farm overhead, taxes, insurance, and interest on long-term debt (table 11). Corn and cotton together accounted for 74 percent of new cropland with negative net returns. The largest regional share of new land with negative net returns (42 percent) occurred in the Southern Plains, followed by the Southeast (14 percent) and Northern Plains (11 percent). Cotton was the least profitable crop on new cropland, with 94 percent of the new acres planted to cotton yielding negative net returns. Oats, corn, and barley were next, with about a third of new acres in these crops operating at a loss. Less than 5 percent of new acres planted to soybeans, wheat, and sorghum were unprofitable.

Table 10--Acreage in major program crops of land converted to cropland, by land group, United States, 1982

Crop	Total	Land group 1/					
		1	2	3	4	5	6
		1,000 acres					
Barley	261	3	103	111	1	1	42
Corn	2,405	71	702	842	359	180	251
Cotton	213	31	65	71	0	2	44
Oats	359	4	122	125	36	26	4
Sorghum	514	8	162	228	35	22	59
Soybeans	1,629	46	770	380	230	95	108
Wheat	2,010	54	538	1,039	123	71	185
Subtotal	7,391	217	2,462	2,796	784	397	735
Other crops	3,720	88	1,442	1,223	296	114	556
Total	11,111	305	3,904	4,019	1,080	511	1,291

1/ Land groups are defined as follows: 1 = LCC I; 2 = LCS c,s,w; 3 = LCC II, III, IV e with RKLS less than 50; 4 = LCC II, III e with RKLS greater than 50; 5 = LCC IV e with RKLS greater than 50; 6 = LCC VI, VII, and VIII.
Source: 1982 NRI.

Only about 850,000 acres of new cropland in major program crops with negative returns to variable costs were in highly erodible soil groups 4, 5, and 6. Returns to highly erodible land were $28.7 million, about 12 percent of the total, and averaged $33 per acre. Almost one-quarter of the new land with operating losses was in the wet or stony soils of group 2. About 63 percent of new land in group 6 yielded negative net returns, while only 12 percent of group 1 had negative returns. On highly erodible land, negative returns were 45 percent on group 4 land, 10 percent on group 5, and 63 percent on group 6.

Effect of Farm Programs on Revenues and Costs

Farm programs influence farmers' decisions to plant by supporting prices and increasing revenues, or by subsidizing costs of production. Crop insurance or disaster payments influence farm decisions by reducing risk, which may raise

Table 11--Land converted to cropland with negative returns to variable costs without programs, by major crop and farm production region, 1982

Region	Total	Barley	Corn	Cotton	Oats	Sorghum	Soybeans	Wheat
				1,000 acres				
Northeast	30	0	11	0	19	0	0	0
Lake States	37	11	22	0	4	0	0	0
Corn Belt	102	0	67	0	10	0	25	0
N. Plains	153	6	122	0	24	0	1	0
Appalachian	133	0	126	0	7	0	0	0
Southeast	184	0	144	8	5	0	16	11
Delta	28	0	0	17	0	0	0	11
S. Plains	569	38	300	133	51	9	2	36
Mountain	49	0	0	25	11	13	0	0
Pacific	55	26	0	18	2	0	0	9
Total	1,340	81	792	201	133	22	44	67
				Percent				
Northeast	2.2	0	.8	0	1.4	0	0	0
Lake States	2.8	.9	1.6	0	.3	0	0	0
Corn Belt	7.6	0	5.0	0	.7	0	1.9	0
N. Plains	11.4	.4	9.1	0	1.8	0	0	0
Appalachian	9.9	0	9.4	0	.5	0	0	0
Southeast	13.7	0	10.7	.6	.4	0	1.2	.8
Delta	2.1	0	0	1.3	0	0	0	.8
S. Plains	42.6	2.8	22.5	9.9	3.8	.7	.2	2.7
Mountain	3.6	0	0	1.9	.8	.9	0	0
Pacific	4.1	1.9	0	1.3	.2	0	0	.7
Total	100.0	6.0	59.1	15.0	9.9	1.6	3.4	5.0

Source: 1982 NRI.

expected revenues if the premium subsidy is sufficiently large. Program effects analyzed included price support payments and operating loan subsidies. Crop insurance and disaster payments were not analyzed (see box).

CROP INSURANCE AND DISASTER PROGRAMS

Several farm programs do not directly support prices or reduce costs, but help reduce risk associated with crop production. Among these are crop insurance under the Federal Crop Insurance Corporation (FCIC) or its reinsurance programs, Agricultural Stabilization and Conservation Service (ASCS) disaster payments, and Farmers Home Administration (FmHA) emergency disaster loans.

Crop insurance is gradually replacing disaster payments, but substantial payments were still made in 1982 (see below). Almost all disaster payments in 1982 were paid in the Southern Plains region. Disaster payments for cotton ranged as high as $16 per acre in Georgia and were $11 per acre in Texas (27). The distribution of emergency loans was similar to the distribution of crop insurance indemnities paid. More than half of total risk-reducing subsidies were paid in the Delta and Southern Plains regions. These programs reduce risks associated with crop production, thereby raising the expected revenue from farming and providing a positive incentive to bring land into production. This incentive extends to highly erodible new cropland and, to the extent that highly erodible land is riskier to crop than less erodible land, may be a stronger incentive on such land. Data for a more quantitative assessment of yield variability by land groups or the subsidy value per acre are not available.

Crop insurance and disaster payments, by farm production region, 1982

Region	FCIC indemnities paid	ASCS disaster payments	FmHA emergency loans 1/	Total
		1,000 dollars		
Northeast	2,066	4	19,904	21,974
Lake States	16,057	26	20,388	36,471
Corn Belt	26,254	281	15,128	41,663
N. Plains	49,890	76	20,139	70,105
Appalachian	32,309	20	51,333	83,662
Southeast	74,968	4	110,841	185,813
Delta	131,782	1	158,604	290,387
S. Plains	59,620	37,895	106,837	304,352
Mountain	18,866	3,089	26,639	48,594
Pacific	49,768	5	36,115	85,888
Total	461,580	141,401	565,928	1,168,909

1/ Data are for 1983.
Source: Agricultural Statistics, 1983; (32).

The primary effect of commodity programs is the direct subsidy of crop prices available to operators who participate in these programs. There is a direct price support effect for participating farmers and an indirect effect on the market as a whole (29). Since the acreage of new cropland in program crops was small, ranging from 1.3 to 3.9 percent of total crop acreage in 1982, participation of new cropland in price support programs was assumed to have no influence on regional market prices.

After new land is added to the base acreage, price support programs can effectively raise crop prices to one of two levels (table 12). The farmer receives the loan rate by forfeiting a crop to the Commodity Credit Corporation (CCC) or entering it into the farmer-owned reserve (22). However, by meeting any required acreage reductions, a farmer can receive a deficiency payment which effectively raises the revenue per unit to the target price. In this analysis, net returns to variable costs of production under all options were calculated for yields in each land group using the average ERS-CARD model production cost per acre for each region. Farmers were assumed to take the higher of the regional season-average market price and the loan rate or target price. Required acreage reductions were subtracted from new cropland acreage in calculating aggregate net returns.

Subsidized interest rates on loans through the Farmers Home Administration (FmHA) are the most important cost-reducing program benefits considered in sodbuster proposals (table 13). Interest subsidies on FmHA operating loans were analyzed as the principal cost-reducing benefit of credit programs that could be directly tied to highly erodible new cropland. Both farmownership and storage facility loans, when available, are associated with the entire farm operation and cannot readily be identified with new cropland recently brought into production. Likewise, emergency loans, available only in counties designated as disaster areas, cannot be directly associated with highly erodible new cropland.

Subsidized interest rates for FmHA operating loans in 1982 were 0.85 percent lower than loans from production credit associations (PCA's) and 3.35 percent lower than loans from rural banks. Rural banks and PCA's held about 60 percent and 40 percent, respectively, of outstanding nonreal estate loans in

Table 12--Target, loan, and season-average prices for major program crops, United States, 1982

Crop	Unit	Price: Target	Price: Loan	Price: Season-average	Production under support	Required acreage reduction
		Dollars per unit			Percent	
Barley	Bu.	2.60	2.08	2.09	17.0	4
Corn	Bu.	2.70	2.55	2.32	18.9	3
Cotton	Lb.	.7100	.5708	.5760	42.0	11
Oats	Bu.	1.50	1.31	1.45	1.5	0
Sorghum	Bu.	2.60	2.42	2.22	28.8	4
Soybeans	Bu.	NA	5.02	5.48	17.6	0
Wheat	Bu.	4.05	3.55	3.39	23.1	7

NA = Not applicable.
Source: Agricultural Statistics, 1983.

1982, not including those financed by FmHA. The weighted interest rate differential of 2.38 percentage points between subsidized and unsubsidized sources was applied to operating capital per acre from Federal Enterprise Data System (FEDS) budgets for 1982 to determine the per-acre subsidy attributable to reduced interest on operating capital (table 14). Operating loan subsidies would have ranged from $0.16 per acre on oats in the Mountain region to $3.57 per acre on cotton, also in the Mountain region. The highest subsidies were for cotton and corn and the lowest for oats and barley.

Returns to New Cropland with Program Participation

The largest estimate of the impact of farm programs on profitability of new cropland resulted when it was assumed that operators had participated in price support programs in 1982 whenever the supported price was above the season-average price, and that they had obtained FmHA loans for all operating capital. New cropland with negative returns to variable costs dropped to 865,000 acres, only 12 percent of new cropland in program crops and 8 percent of all new cropland brought into production between 1979 and 1981.

Table 13--Subsidized loans to individuals under farm programs, by source, United States, 1982

Source	New loans	Amount outstanding
	1,000 dollars	
FmHA:		
Farmownership	664,528	5,852,702
Soil and water	20,231	297,737
Operating	1,276,512	2,499,344
Emergency	2,038,617	10,029,769
CCC:		
Storage facility and equipment	96,205	1,209,639

Source: Agricultural Statistics, 1983.

Table 14--Operating capital and FmHA operating loan subsidy, by crop, United States, 1982

Crop	Operating capital		Subsidy	
	Average	Range	Average	Range
	Dollars per acre			
Barley	17.29	11.50- 23.82	0.42	0.27-0.57
Corn	61.52	46.51- 86.46	1.47	1.11-2.06
Cotton	82.49	38.06-150.09	1.96	.91-3.57
Oats	13.05	6.93- 20.93	.32	.16- .50
Sorghum	30.31	18.64- 56.05	.72	.44-1.33
Soybeans	28.56	19.23- 39.37	.68	.46- .94
Wheat	36.29	22.14- 54.42	.86	.53-1.30

Sources: FEDS budgets; Agricultural Statistics, 1983.

Of the 1.3 million acres with negative net returns under market conditions, 35 percent (475,000 acres) would have been profitable had they benefited from both price support and subsidized loan programs (table 15). Returns to variable costs of production on all 7.4 million acres of new cropland in the seven major program crops rose to $367.7 million, averaging almost $50 per acre. Subtracting returns without program participation yielded an estimate of $125.8 million in price support and operating loan subsidies on new cropland, or an average of $17 per acre of new cropland for program participation in these crops. Subsidies from both programs would have ranged from $0.71 per acre for oats to $26.50 per acre for corn. This assumed that CCC commodity loans were not repaid, so that the producer received the loan rate on crops forfeited.

About 70 percent of new cropland which became profitable by assuming program participation was in corn in 1982. Oats and barley were the next most

Table 15--Land converted to cropland made profitable by farm programs, by major crop and farm production region, 1982

Region	Total	Barley	Corn	Cotton	Oats	Sorghum	Soybeans	Wheat
				1,000 acres				
Northeast	0	0	0	0	0	0	0	0
Lake States	12	11	1	0	0	0	0	0
Corn Belt	2	0	2	0	0	0	0	0
N. Plains	16	6	10	0	0	0	0	0
Appalachian	4	0	4	0	0	0	0	0
Southeast	61	0	49	1	0	0	0	11
Delta	13	0	0	2	0	0	0	11
S. Plains	360	22	266	15	43	9	2	3
Mountain	4	0	0	3	0	1	0	0
Pacific	3	0	0	2	0	0	0	1
Total	475	39	332	23	43	10	2	26
				Percent				
Northeast	0	0	0	0	0	0	0	0
Lake States	2.5	2.3	.2	0	0	0	0	0
Corn Belt	.4	0	.4	0	0	0	0	0
N. Plains	3.4	1.3	2.1	0	0	0	0	0
Appalachian	9.9	0	9.4	0	.5	0	0	0
Southeast	12.8	0	10.3	.2	0	0	0	2.3
Delta	2.7	0	0	.4	0	0	0	2.3
S. Plains	75.8	4.6	56.0	3.2	9.0	1.9	.4	.7
Mountain	8	0	0	.6	0	.2	0	0
Pacific	.7	0	0	.5	0	0	0	.2
Total	100.0	8.2	69.9	4.9	9.0	2.1	.4	5.5

Source: 1982 NRI.

important crops. Slightly more than 40 percent of the land planted to corn that was unprofitable in 1982 under market prices would at least have covered variable costs with farm program subsidies. Very little soybean acreage became profitable under price supports because market prices were generally above support levels in 1982. Conversely, despite support prices more than 20 percent higher than market prices, most of the unprofitable cotton acreage remained unprofitable.

Three-quarters of the new cropland that would have been profitable, assuming operator participation in both programs, was located in the Southern Plains. The majority of this land was in corn production in 1982. Corn production in the Southeast was also potentially profitable with all program benefits. Relatively few acres became profitable under farm programs in the Mountain and Northern Plains regions, where so much attention on sodbusting has been focused.

Only 468,000 acres of new cropland in major program crops had negative returns to variable costs in highly erodible land groups 4, 5, and 6, assuming program participation. Program subsidies would have raised returns to variable costs above zero on 384,000 acres of highly erodible land, or 45 percent of the unprofitable highly erodible land under market prices. Benefits of price-support and loan programs on the 1.9 million acres of highly erodible land in program crops totaled $32.2 million, or $16.79 per acre. By crop, subsidies on highly erodible new cropland to program participants would have ranged from $1 per acre for oats to $28.08 per acre for corn.

Previous Studies of Sodbusting Economics

Little relevant research has been undertaken regarding the economics of land conversion in the context of incentives provided by commodity programs. Research directly applicable is geographically specific to sodbusting in the Western Great Plains. Other research into comparative range and crop economics, expansion of the cropland base, and cross-compliance (consistency between conservation and commodity programs) sheds only indirect light on the current topic.

Watts, Bender, and Johnson (36) simulated conversion of Montana rangeland to wheat production to illustrate the incentives provided by farm programs and income tax provisions. Farm programs were assumed to result in a 50-cent-per-bushel higher price for wheat as a proxy for calculation of exact benefits. No attempt was made to estimate differences between highly erodible and other land as defined in the proposals. The study found that Federal tax provisions, especially capital gains treatment, may provide powerful incentives for conversion by operators who do not plan to retain ownership of the land. Farm program provisions provide positive but smaller incentives for conversion, and may enhance the selling price if the new owner is also eligible for farm programs. Subsidies of $14.80, $11.39, and $18.23 per acre for capital gains, investment tax credit, and farm program benefits, respectively, were estimated at a marginal tax rate of 20 percent.

Huszar and Young (20) reported on a survey of landowners who converted highly erodible land in Weld County, Colorado. Survey results indicated that the relative economics of cattle and wheat enterprises was an important factor influencing conversion. Financial factors such as capital gains on converted land, continued or increased credit availability on cropland as opposed to range, and encouragement by creditors were also rated as important in motivating conversion. Least important to the respondents were crop insurance, disaster payments, price supports, or subsidized loans. Participation in such programs supported this response, since only between 14 and 47 percent of eligible respondents participated in farm programs. The relative economics of livestock and crop enterprises has been identified as a major incentive to conversion in the Great Plains (3, 20, 36). Wight, Gee, and Kartchner (37), drawing on earlier work by Gee (12), showed that small grain production generally provided higher returns than cattle production under most yield-price scenarios. Gustafson (15) noted that increased feed grain exports in the early 1970's reversed favorable grain prices enjoyed by cattle producers. Ranchers were squeezed into crop production through increased feed costs and more favorable opportunities in crop production. U.S. cattle numbers declined to 110.9 million in 1979, then peaked at 115.6 million in 1982 before higher grain prices again pushed up slaughter rates.

Studies of potential cropland undertaken during the agricultural expansion of the 1970's focused on conversion to cropland under expected future prices. Shulstad and May (31), reporting on their work in the Mississippi Delta and on that of Amos and Timmons in Iowa, showed that conversion potential was sensitive to conversion costs, yields, and prices. They found that soils providing the greatest return to conversion also had the highest soil loss after conversion. Increased erosion rates on newly converted land ranged from 8.5 to 14 TAY in the Delta and from 15.4 to 98 TAY in Iowa. Heimlich and Ogg (18) found that increases in cropland conversion in eastern North Carolina were concentrated on wet soils and were apparently in response to higher commodity prices. Net returns to corn and soybeans on these soils were negative before 1974, positive under higher prices prevailing in the mid-1970's, and again turned down as prices dropped in the late 1970's.

Consistency between commodity programs and soil erosion goals on existing cropland is an issue related to sodbusting which has generated a substantial literature. Ogg and Zellner (28) argued that there has not been a close correspondence between areas with high participation in farm programs and areas with large percentages of highly eroding cropland. They point to the Delta and High Plains as examples of high erosion areas where there is little or no participation by farmers in price support, crop insurance, or subsidized loan programs. The High Plains did have substantial participation in disaster programs, but these programs have been phased out. Cross-compliance would provide little leverage on soil conservation activity in such areas. Osteen (29) examined specific provisions of farm programs and assessed the incentives provided to plant crops that increase soil erosion. He concluded that most programs do promote production of erosive crops, but could not quantify the amount of incentive or the acreage affected. Reichelderfer (30) sampled about 3,000 1982 NRI points from 68 counties at which erosion and program participation data were gathered. She found that 46 percent of operators on land eroding above 5 TAY participated in commodity programs. High erosion in the study areas also occurred more frequently on land financed by the FmHA or PCA's than by commercial sources. Extrapolating study results to the entire Nation, Reichelderfer concluded that a majority of U.S. cropland erodes below 5 TAY and is operated by nonparticipants.

Dinehart and Libby (8) estimated program participation benefits for a sample of 390 farmers for 1977-79. They found that benefits ranged from less than $5 to more than $25 per acre per year, but that more than 75 percent of participants got less than $5 dollars per acre. They concluded that cross-compliance would not provide much incentive for conservation. Batie and

Grumbach (1) estimated program benefits for 76 farms, which averaged just under $5 dollars per acre per year. Reviewing these and other analyses of cross-compliance, Clark (4) concluded that cross-compliance offers more potential for eliminating inconsistencies among programs than it does for achieving soil conservation.

A broader view of sodbuster legislation looks to economics for justification as well. Ebenreck (9) put forth three arguments in favor of such legislation, two of which are economic. Off-site impacts of water and wind erosion and long-term degradation of soil productivity are consequences to society of converting new land to crop production that may be economically important. Many of the participants in a symposium on plowing fragile grasslands organized by Laycock (23) expressed similar views of society's right to restrain such activity. These social and ethical perspectives, although not buttressed with quantitative estimates of damages, add weight to the inconsistency argument for sodbuster legislation.

CONCLUSIONS

Empirical analyses presented in this report support four major conclusions regarding proposed sodbuster legislation.

First, the total amount of land converted to cropland in the recent past was not large, and the amount of land subject to sodbuster provisions was even smaller. Eleven million acres were converted to cropland between 1979 and 1981, about 2.6 percent of total cropland. Of this, only 7.4 million acres were used to grow major program crops. Between 2.1 and 2.3 million acres were "highly erodible," depending on the definition used. Only 1.9 million acres of newly converted cropland were both highly erodible and used to grow program crops, and thus ineligible for benefits under proposed legislation. This amounted to 17 percent of newly converted cropland, and less than one-half of 1 percent of total U.S. cropland, as measured in the 1982 NRI.

Second, although attention on sodbusting has centered in the Great Plains, conversion to cropland has occurred in all regions. About one-quarter of total conversion in 1979-81 occurred in the Great Plains, but almost a fifth of new conversion occurred in the Corn Belt. The Appalachian, Delta, and Mountain regions each had about a tenth of total conversion to cropland. The Mountain, Corn Belt, and Northern Plains regions were the most important with regard to highly erodible new cropland. However, three-fourths of the highly erodible new cropland which would be profitable under farm program subsidies was in the Great Plains.

Third, the definition of "highly erodible" land used in the proposals does not precisely identify new cropland with high potential for excessive erosion. Of the highly erodible new cropland converted in this period, only 20 percent had wind erosion rates and 48 percent had sheet and rill (water) erosion rates greater than 5 TAY. An alternative classification based on parameters of the Universal Soil Loss Equation identified about the same number of acres as highly erodible, but less than half of these acres were identified in common by both systems. More new cropland with high erosion potential was missed by the capability class definition than was correctly captured by it.

Finally, farm program benefits would have made a difference between profitable and unprofitable operation of highly erodible new cropland in program crops in

1982. Returns to variable costs would have become positive on 475,000 acres of new cropland in program crops if operators had participated in price support and loan programs. More than 80 percent of these acres were highly erodible. Although actual program participation on newly converted cropland is not known, farm programs would have provided an average subsidy of nearly $17 per acre for conversion of highly erodible land to cropland.

Conditions favorable to land conversion during 1975-81 are not likely to recur in the immediate future. Nevertheless, prohibiting farm program subsidies on highly erodible cropland recently converted from other uses would remove potentially large incentives to bring such land into production. Removing eligibility for farm program subsidies on such land would insure greater consistency between USDA commodity and conservation objectives. For such a restriction to be effective, however, more precise identification of highly erodible lands than that provided by current proposals would be required.

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APPENDIX 1. DATA SOURCES

This study is based on two sets of data that record changes in land use at the same points. A brief description of each data source is given here. The listed references provide further information on data collection and processing.

The 1978 Landownership Survey (LOS) was conducted as part of USDA's Resource Economics Survey series, a 12-part package of interrelated surveys of the ownership and use of land resources in the 48 conterminous States and Hawaii.

The first part of the package, the Soil Conservation Service's 1977 National Resource Inventory (NRI), provided data on the use and quality of land. The second part, the 1978 LOS, provided information on landowners. The 1978 LOS also contained questions concerning land use changes that were used to identify prospective respondents for follow-on questionnaires. The follow-on surveys on additions to cropland and cropland acreage reduction in the 1975-77 period are the relevant data for this report (25).

The 1977 NRI and 1978 LOS were linked. The NRI was a point sample of the U.S. land area, stratified on the basis of 160-acre units. Three randomly selected points were inventoried in each of 70,000 sampled land units. The owner of the first sampled point in each land unit was sent a mail questionnaire. Nonrespondents were recontacted by telephone. Follow-on surveys in response to screening questions in the LOS were sent to a subsample of respondents. Of the 36,710 usable questionnaires obtained in the LOS, 4,058 positive responses to the cropland addition question were received. A total of 2,399 follow-on questionnaires were sent and 1,033 owners responded with data on cropland addition. Positive responses to the cropland reduction screening question numbered 1,523, of which 1,487 were sent questionnaires and only 388 responded with data (6, 7).

The second data set is the crop history data gathered in the 1982 NRI. Three randomly selected points were inventoried in each of nearly 350,000 sampling units of approximately 160 acres. For each of the 841,860 resulting points, the specific type of vegetative cover and land use at the time of the inventory and the use in the 3 preceding years were recorded. When combined with soil erosion parameters collected at the same point, this information provided a useful data set. A total of 7,350 sample points recorded a change from noncrop use in 1979, 1980, or 1981 to cropland use in 1982. Change from cropland to noncrop use was observed on 2,813 sample points (33).

APPENDIX 2. A TAXONOMY OF CROPLAND ERODIBILITY

Soil erosion is not measured, but is estimated by use of an empirical equation derived from more than 10,000 plot-years of basic runoff data at 49 U.S. locations (38). The Universal Soil Loss Equation (USLE) predicts average annual soil loss in runoff as the product of physical and management factors:

$$A = RK(LS)CP$$

where: A = computed average annual soil loss per unit area, usually tons per acre per year (TAY);

R = the rainfall runoff factor accounting for the number of rainfall erosion index units in the average year;

K = the soil erodibility factor, measuring the soil loss rate per erosion index unit for the specific soil;

LS = the topographic factor, accounting for the effects of slope steepness and length, relative to a 9-percent, 72.6-foot reference slope;

C = the cover and management factor, accounting for the specific crop and management relative to tilled continuous fallow;

P = the support practice factor, accounting for the effects of contour plowing and strip-cropping relative to straight-row plowing up and down the slope.

Tolerable soil loss is defined as the maximum rate of annual soil loss that may occur and still permit a high level of crop productivity to be maintained indefinitely. Tolerance (T) values range from 2 to 5 TAY, but more than 70 percent of cropland has a T value of 5 TAY.

A useful classification of erodiblity is derived from the fundamental distinction between the physical components of soil erosion, such as rainfall, soil texture, and topography, and the managerial components embodied in the product of the C and P factors. Land which will erode above the tolerable limit even if the best management is applied to it is classed "highly erodible." On the other hand, land that will not erode above tolerance, even if managed abusively, is termed "nonerodible." The residual can erode above or below tolerance, depending on the management applied to it.

Values of the product CP corresponding to "best" and "worst" management are a matter of current technology, which has been improving since agriculture began.

Taking 0.1 as a reasonable lower limit for intensive cultivated cropping and the observed maximum of 0.7 for the upper limit yields the following classification scheme:

Erodibility class	Definition
Nonerodible	RKLS is less than or equal to 7.
Moderately erodible	
Managed below tolerance	RKLS is greater than 7; A is less than or equal to 5.
Managed above tolerance	RKLS is between 7 and 50; A is greater than 5.
Highly erodible	RKLS is greater than or equal to 50; A is greater than 5.

Source: (2).

A version of this classification scheme, adjusting for the soil loss tolerance value (T), has been adopted by the RCA Fragile Soils Work Group as the definition of erodible soils for use in the 1985 Resource Conservation Appraisal (26).

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