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Conservation and Erosion Control Costs in the United States

George A. Pavelis

Public and private expenditures for erosion control in the United States are estimated for the period 1950-1987. The total amount of erosion control expenditures is estimated to be \$1.4 billion in 1987, up from \$0.5 billion in 1950. The increase in expenditures is due to a combination of factors, including an increase in the number of acres of cropland, an increase in the amount of cropland that is eroded, and an increase in the cost of erosion control. The increase in the cost of erosion control is due to an increase in the price of materials and labor, and to an increase in the amount of erosion control that is required. The increase in the amount of erosion control that is required is due to an increase in the amount of cropland that is eroded, and to an increase in the amount of cropland that is protected by erosion control. The increase in the amount of cropland that is eroded is due to an increase in the amount of cropland that is planted, and to an increase in the amount of cropland that is eroded by wind and water. The increase in the amount of cropland that is protected by erosion control is due to an increase in the amount of cropland that is planted, and to an increase in the amount of cropland that is eroded by wind and water.

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ABSTRACT

Public and private expenditures for agricultural conservation in general and for soil erosion control in particular are developed from agency reports, other secondary materials, and farm-level interview surveys. The object was to provide baseline information for 1983 needed for an ERS benefit-cost study of erosion control. In 1983, the national cost of erosion control in the United States totaled about \$1 billion. This was 43 percent of the \$2.4 billion spent for all natural resource conservation efforts in agriculture. About 50 percent (\$493 million) of the total costs of erosion control in 1983 was incurred by farm and ranch owners and operators, about 9 percent (\$92 million) by State and local governments, and 42 percent (\$423 million) by USDA agencies via congressional appropriations.

Keywords: Conservation, soil conservation, conservation farming, conservation improvements, natural resources.

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This review of public and private conservation costs in recent years, focusing on the year 1983, was a component of efforts in an Economic Research Service project to define the scope and magnitude of resource conservation concerns in agriculture, both in general and with specific reference to soil erosion problems and their control.

Preparation of this report was facilitated by the cooperation of various offices and individuals in USDA and elsewhere. Information from all eight USDA conservation agencies was made available to the Soil Conservation Service for ongoing Resource Conservation Act evaluations and for this special ERS study. Special appreciation is extended to Peter Tidd and Gene Hanchett of the Conservation Planning and Application Division, SCS. They freely provided required budget and other statistical data covering all USDA and State conservation agencies. The manuscript was also reviewed in draft by Dennis Burns and James Lewis of SCS. Other SCS staff assisting with data or suggestions were Gerald Root and Richard Reed. Priscilla Wright, Larry Walker, and Tom Browning of the Agricultural Stabilization and Conservation Service also provided information and/or reviewed the draft report. Their assistance is also appreciated.

Special thanks go to ERS colleagues Ralph Heimlich, William Anderson, and Marc Ribaud as compatriots on the "Scope" section of general ERS research on the benefits and costs of soil conservation in the United States. Valuable suggestions were also received from other members of the ERS study group, including Dan Colacicco, Linda Lee, and Roger Strohhahn. Within ERS, Gary Taylor, Velmar Davis, Ira Branson, and Dwight Gadsby critiqued the manuscript. Word processing was by Linda G. Allen, Marie Alexander, Wanda D. Nelson, and Marlene Radloff.

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SUMMARY

This report summarizes recent private and public expenditures for agricultural conservation, with a primary focus on soil conservation. In this review, 'soil conservation' refers specifically to soil erosion control as the quantitative aspect of conservation.

A first difficulty in examining natural resource conservation costs is to separate the costs of conserving the use of some fixed available supply of a resource from costs of increasing its availability through resource development. Public programs involving natural resources are typically called "conservation" programs, but most involve development and upgrading objectives as well as preservation and regulated use. The general conservation expenditures given here reflect these multiple objectives but the information is then narrowed to soil erosion control. Following are some highlights:

- o In 1984, expenditures on all agricultural conservation by farmers, other private interests, State and local government agencies, and Federal (largely USDA) agencies totaled \$2.4 billion. These expenditures were \$32 million (1.4 percent) less than in 1983 in current dollars. Farmer and other private expenditures were just under \$1 billion, 43 percent of the total (table 1).
- o While States, counties, and other local agencies have been steadily increasing their conservation budgets, from \$224 million in 1983 to \$247 million in 1984, USDA appropriations for conservation have recently decreased sharply, both in current and inflation-adjusted dollars. Between 1983 and 1984, the total USDA conservation budget decreased from \$1.2 to \$1.1 billion, by about 8.4 percent (\$100 million) in current dollars. Because inflation in 1984 averaged about 4.6 percent across the relevant items, in real terms the decrease in the overall USDA conservation budget between 1983-84 was actually 12.5 percent (\$148 million). See tables 1 and 2.
- o In 1983, private and public expenditures specifically for soil erosion control in the United States totaled slightly over \$1 billion. This was about 43 percent of the \$2.4 billion spent on all natural resource conservation efforts in agriculture.

This information is in tables 2 and 8. The next several highlights are also from table 8.

- o Nearly 50 percent (\$493 million) of the total expenditures for soil erosion control in 1983 was incurred by farm and ranch owners and operators. Another 9 percent (\$92 million) represented contributions of State and county governments and local soil conservation and other resource districts. About 42 percent (\$423 million) came from congressional appropriations via USDA conservation agencies.
- o About 17 percent of the soil erosion control expenditures in 1983 were either for erosion control organized on a watershed or similar project basis (\$49 million), various research and development programs (\$43 million), or data collection and analysis activities (\$74 million). Overall, State agencies appeared to carry about one-third and USDA agencies two-thirds of the \$167 million total cost of such associated programs. About \$840 million were spent privately and publicly for erosion control on farms.

- o The \$840 million for erosion control activities on individual farms was divided \$670 million (80 percent) for the cost of installing new conservation practices and improvements, \$146 million (17 percent) for technical design help or extension-type assistance, and \$24 million (3 percent) for normal maintenance and repair of existing soil conservation improvements.
- o Farmowners and operators covered virtually all costs of maintaining conservation measures installed before 1983. They also contributed about 74 percent (\$469 million) of the total cost of installing new conservation systems and improvements. Their net share of onfarm erosion control costs, after allowing for technical assistance and cost-sharing contributions of public agencies, came to \$493 million. This was 58 percent of the total national direct cost of erosion control on farms.
- o The leading region in terms of soil conservation costs in 1983 was the Corn Belt with \$120 million, accounting for over 15 percent of the total for all States. The Appalachian region was next with \$94 million (12 percent), followed by the Southeast and Southern Plains. Both ranged around \$88-89 million or about 11 percent each. A State-regional listing of expenditures is in table 9.
- o Leading States in terms of soil conservation expenditures in 1983 were Texas (\$67 million), Iowa (\$38 million), North Carolina (\$33 million), California (\$32 million), and Minnesota (\$31 million).

Conservation and Erosion Control Costs in the United States

George A. Pavelis

INTRODUCTION

This report reviews private and governmental expenditures for agricultural conservation, with special reference to erosion control (soil conservation) activities in 1983. The information was necessary to define the current scope of soil erosion problems and recent efforts to control them, as an aid to ERS assessments of the benefits and costs of selected USDA erosion control programs.

Any review of major conservation programs quickly indicates that the U.S. Department of Agriculture (USDA) has had a heavy and direct involvement in agricultural conservation since the early 1930's, when a national awareness of the importance of the proper use of farmland had been aroused by a soil scientist, Hugh Hammond Bennett, and others. In 1933 Bennett was appointed to head the newly-created Soil Erosion Service in the Department of the Interior. In 1935 it was transferred under Bennett to the Department of Agriculture and shortly became the Soil Conservation Service.

In examining recent conservation spending by USDA, other institutions, and farmers, one also realizes that what is considered "spending" has been influenced strongly by broad and somewhat elusive concepts of the term "conservation" itself. For example, there appears to be a tendency in the public mind to equate public conservation costs with so-called cost-sharing subsidies and only with respect to USDA programs. Although these have been important methods for encouraging farmers to manage soil and other farm resources more carefully, they have not been the only or most significant institutional incentives for improved soil and water resource management.

Many concepts of conservation tend to go considerably beyond a preservationist view, and sometimes encompass almost any efforts to rationally manage soil, water, woodlands, wetlands, range and other natural resources of agricultural importance. It is consequently necessary to scrutinize all available information on agricultural conservation expenditures in order to estimate spending on erosion control.

Conservation has different meanings to different societies and people, depending on their planning horizons and associated preferences for present versus future satisfaction, on their respective positions in the hierarchy of decisionmaking, production, and consumption, and on how they may relate their individual with group or social interests. Probably the most popular and pragmatic concept of conservation is embodied in a definition suggested in 1936 by Alfred J. Wright

of the Ohio State University: "As parts of the environment come into the service of humankind we call them resources. Literally, any attempt to slow the exploitation of these resources is conservation" (23, p. 1). Wright noted that the United States has historically thought of conservation as being concerned with shortages of resources. Because the Nation was initially well endowed with resources, conservation achieved national importance only as the country became relatively fully developed, and then only at certain times and with respect to certain resources.

Recent events in agriculture tend to support Wright's observation on the intermittent character of conservation in the public consciousness. However, the connection with resource scarcity is less clear. The more likely connection for agriculture is a tendency to link the problems of managing excess current production capacity with perceived future scarcities of soil or other natural resources, although the two are not necessarily related. For example, the belief on the part of legislators that it is simpler to conserve soil when crops associated with rapid soil erosion are in surplus has been given by Schaller as one reason why soil conservation will likely be a dominant issue in farm legislation debates (9). This suggests that soil conservation, whatever its real implications for preserving future production capacity, may not be considered by policymakers as an objective in itself. Rather, it may be seen as a convenient and easily defended means of achieving other more pressing shortrun objectives, such as limiting current production or reducing the cost of commodity programs.

These time-related objectives argue for a fairly specific economic definition, not only to help in unearthing and interpreting conservation expenditures, but also in evaluating the benefits and costs of ongoing or proposed new conservation programs. Heady's concept is both succinct and sufficient: ". . . we refer to the optimum rate of using (any) resource service over time; efficiency is denoted as much by using as by the storing of resources and resource services" (5, p. 764).

The idea that use and nonuse are both involved in resource allocation over time is also the basis of Ciriacy-Wantrup's concepts of "conservation" and "depletion" (1, p. 52). He considers an increase in the physical rate of resource utilization between any two time intervals (years) to be depletion and a decrease to be conservation. Letting x_t be the quantity of resource x used in period t , then conservation would occur if $(x_t - x_{t-1}) < 0$, and depletion if $(x_t - x_{t-1}) > 0$. A neutral condition would exist should x_t be the same as x_{t-1} .

Within such efficiency criteria, production possibilities for competing products produced at different times must still be related to what Heady calls "choice indicators." The relevant indicator is the public preference function, as reflected by unregulated prices; i.e., the free market, or by regulated prices and special legislation as the expressed will of the people (5, p. 766). The fact that individual and public interests and decisions often diverge is important but does not require that conservation as a process be defined differently for each decisionmaker.

Land for the most part is a "stock" and location-specific resource. Held and Clawson have defined management options for such types of resources in more detail (6). Raindrop impacts, runoff, and wind as natural forces must either be counteracted or dissipated if soil displacement is to be reduced. This helps

1/ Underscored numbers in parentheses identify items in References.

explain why few conservation recommendations and/or programs can be described and justified without involving the basic soil sciences, hydrology, cover selection, farming practices, engineering structures, and economics. Reducing water-induced erosion, for example, is really a problem in water management, and water management may have substantial benefits in its own right in addition to reducing soil erosion.

In examining conservation costs, one must statistically disentangle costs of conserving the use of some fixed available supply of a resource from those intended to increase its availability through processes of resource development. Public programs involving natural resources are typically called "conservation" programs, but most involve development and upgrading objectives as well as preservation and regulated use. This is especially true of Federal programs, where the enabling legislation and appropriations may specifically combine developmental and preservation objectives.

The general expenditures discussed first reflect these multiple objectives. Attention then focuses on soil erosion control. The statistics consider sources of funds, performing groups or agencies, major types of activities, and different resource concerns, in particular the control of soil erosion. Recent trends are indicated by comparing dollar outlays for 1979, 1983, and 1984.

GENERAL CONSERVATION EXPENDITURES

In 1984, expenditures on all agricultural conservation by farmers, State and local government agencies, and Federal (largely USDA) agencies totaled close to \$2.4 billion. They were \$32.2 million (1.4 percent) less than in 1983. Aggregate estimates for 1979, 1983, and 1984 are in table 1.

The aggregate conservation outlay from private and all governmental sectors presently runs about 3 percent of gross farm product (GFP), which was \$78.8 billion in 1984. GFP can be regarded as the farm-sector contribution to the gross national product (GNP). Records on the income and other components of GFP are maintained by ERS, published in various USDA reports, and also supplied to the Department of Commerce for publication as part of the official National Income and Product Accounts (22).

The National Income and Product Accounts also provide a basis for adjusting (indexing) for inflation in comparing conservation expenditures from different sources and for different years. Indexed Federal appropriations for conservation fell by 5.3 percent (\$64.7 million) between 1983 and 1984. But State and local government agencies appropriated 6 percent (\$12.5 million) more for use in 1984 than in 1983 (table 2).

Because comparable statistics on farmer and other private outlays are not yet available for 1984, such comparisons are not made for the private sector. Indexed private outlays in table 2 are assumed to be at least the same in 1984 as in 1983. Other USDA research indicates that, over the period 1935-80, non-federal public and farmer expenditures for conservation about equaled Federal expenditures (8).

The Federal proportion of national expenditures for conservation activities has declined substantially over the last several years. Federal agencies accounted for 46 percent of the indexed outlays in 1984 versus 54 percent for private and nonfederal governmental spending (table 2).

Table 1--Agricultural conservation expenditures in the United States in 1979, 1983, and 1984, by private and public sources

Source	Expenditures or appropriations			Share of total 1984
	1979	1983	1984	
	-- Million dollars --			Percent
Private expenditures or contributions <u>1/</u>	--	949.4	993.0	43
Conservation system farm costs <u>2/</u>	--	703.9	736.3	32
Structures and land improvements <u>3/</u>	--	245.5	256.7	11
New construction (55 percent)	--	131.4	137.4	6
Repair and maintenance (45 percent)	--	114.1	119.3	5
Public appropriations <u>4/</u>	1,199.5	1,406.2	1,330.4	57
State and local governments	151.2	223.6	246.9	11
State	--	98.7	132.2	6
Local	--	124.9	114.6	5
Federal	1,048.3	1,182.6	1,083.5	46
Non-USDA agencies <u>5/</u>	2.5	2.7	2.4	<u>7/</u>
USDA agencies <u>6/</u>	1,045.8	1,179.9	1,081.1	46
Totals, all sources	--	2,355.6	2,323.4	100.0

-- = Not available on same basis as 1983 and 1984 data.

1/ Includes small amounts for contributions by private individuals, organizations, and commercial institutions. These were about \$96.7 and \$94.5 million in 1983 and 1984, respectively. Contributions by State and counties to local conservation or other resource districts are included under public appropriations. Data composited from the ERS Farm Expenditure Survey for 1983 and the SCS Conservation Technical Assistance Evaluation of 1983, the 1979 Farm Finance Survey, and other sources (16, 20, 21). Excludes \$162.4 million in landclearing expenditures, \$212.8 million for drainage improvements, and \$317.7 million for irrigation water supply improvements and equipment. Irrigated land improvements for water conservation are included.

Continued--

Footnotes, table 1 -- continued

- 2/ Represents annual costs of continuing conservation cropping and vegetative management systems; an unknown portion represents the cost of special tillage and other equipment essential for conservation farming. Estimate for 1984 is the 1983 figure inflated by the prices-paid U.S. index averaged for seed, fertilizer, chemicals, fuel, and farm machinery other than tractors, which increased 4.6 percent between 1983 and September 1984 (18).
- 3/ Division between new construction versus repair from the ERS Farm Expenditure Survey. Inflation to 1984 actual dollars based on the implicit price deflator for nonresidential farm improvements and structures as published in the Survey of Current Business (22).
- 4/ Includes allocations to and subsequent disbursements by local soil and water or other resource conservation districts.
- 5/ Includes some soil and water conservation program activities of the Bureau of Reclamation and Bureau of Land Management in the Department of the Interior. Direct estimates for 1979 and 1984 not available. Figures for 1979 and 1984 assume the same percentage change in outlays between 1979-83 and 1983-84 as for USDA agencies.
- 6/ Estimates for 1979 developed from data in 1980 RCA appraisal by USDA (12, pp. 270-271). For comparability with 1983 and 1984, the USDA total for 1979 does not include about \$158 million in emergency Farmers Home Administration (FmHA) loans. All other conservation related FmHA loan allocations are included. Estimates for 1983 and 1984 from budget reports for FY 1985 for USDA, from Senate hearings on the FY 1984 budget (10), and from budget verifications supplied December 1984 by the Appraisal and Program Development Division, Soil Conservation Service.
- 7/ Less than 0.5 percent.

Table 2--Changes in agricultural conservation expenditures in the United States in 1979, 1983, and 1984, in constant 1983 dollars, by private and public sources

Source	:Expenditures or appropriations:			Share of : total 1984	: Average annual increase or decrease, 1979 to 1984	
	: 1979	: 1983	: 1984		: Percent	: Million dollars
	: -- Million 1983 dollars --			: Percent	: Million dollars	: Percent
Private conservation on farms	: --	: 949.4	: <u>1/</u> 949.4	: 43	: --	: --
Conservation system farm costs	: --	: 703.9	: 703.9	: 32	: --	: --
Structures and land improvements	: --	: 245.5	: 245.5	: 11	: --	: --
New construction (55 percent)	: --	: 131.4	: 131.4	: 6	: --	: --
Repair and maintenance (45 percent)	: --	: 114.1	: 114.1	: 5	: --	: --
Public appropriations	: 1,550.9	: 1,406.2	: 1,270.6	: 57	: -56.0	: -3.9
State and local governments <u>2/</u>	: 192.6	: 223.6	: 236.1	: 11	: 8.7	: 4.2
Federal	: 1,357.9	: 1,182.6	: 1,034.5	: 46	: -64.7	: -5.3
Non-USDA agencies <u>3/</u>	: 3.2	: 2.7	: 2.3	: <u>5/</u>	: -.2	: -6.4
USDA agencies <u>4/</u>	: 1,354.7	: 1,179.9	: 1,032.2	: 46	: -64.5	: -5.3
Totals, all sources	: --	: 2,355.6	: 2,220.0	: 100	: --	: --

-- = Not applicable, not available, or negligible.

- 1/ Assumed to be the same in constant-dollar or real terms in 1984 as in 1983. Actual dollars for 1984 shown in table 1.
- 2/ Indexed to 1983 dollars according to the simple average of implicit price deflators for public conservation and development structures and compensation of State and local government employees as published in the Survey of Current Business (22).
- 3/ Non-USDA Federal costs indexed to the simple average of implicit price deflators for public conservation and development structures and compensation of Federal civilian employees.
- 4/ Indexed to 1983 dollars by 26 agency programs, 13 of which involve financial assistance in the form of cost-sharing, direct construction, or loans. Details by programs are in table 6.
- 5/ Less than 0.5 percent.

Such resource-related activities as landclearing, farmland development through drainage, and investments in new irrigation systems are not included in these general conservation expenditures. For this review, the emphasis is on conserving existing resources used for agriculture, not additions to the resource base accomplished via land reclamation or other forms of development.

Further, since about 1956, USDA has had a policy of not providing cost-sharing or other financial assistance for resource development activities intended to increase crops in excess supply, particularly if there are important environmental offsite impacts. To the extent water-use efficiency can be improved on existing irrigated lands, USDA does provide technical assistance and limited cost-sharing for improved land preparation and water recovery systems, but not for basic equipment purchases or water supply development. Technical and financial assistance are both barred for the clearing and/or draining of certain areas jointly classified as wetlands by USDA's Soil Conservation Service (SCS) and the Fish and Wildlife Service in the Department of the Interior. Dating from 1962, these policies have been reinforced in subsequent executive orders and interagency agreements.

DEPARTMENT OF AGRICULTURE APPROPRIATIONS

While State, county, and other local agencies have been steadily increasing their conservation budgets, USDA appropriations for conservation have decreased, both in actual and indexed dollars. Between 1983 and 1984, the total USDA conservation budget decreased by about 8.4 percent (\$98.8 million) in actual or current dollars (table 1). Inflation in 1984 averaged about 4.6 percent across the relevant items. So in real terms, the decrease in the overall USDA conservation budget between 1983-84 was actually 12.5 percent or \$147.7 million. The decrease between 1979 and 1984 averaged \$64.5 million or 5.3 percent per year (table 2).

Preliminary indications are that conservation appropriations for USDA have decreased further between 1984 and 1985, being down by at least another \$70 million or 6.7 percent in actual dollars. The overall decline for USDA between 1979 and 1985 has been nearly \$393 million or 29 percent. If inflation in 1985 averages 4.6 percent as it did in 1984, the real decline in USDA conservation outlays between 1984 and 1985 will be about 11 percent.

Over the past 5 years the USDA has redirected, or "targeted," its conservation programs toward those resource concerns considered to be the most urgent as identified in the National Conservation Program (NCP) and other plans mandated by the Soil and Water Resources Conservation Act of 1977 (13, 17). Soil erosion control was identified as having the highest priority in this but is commonly referred to as "RCA." Two other leading national priorities under the RCA and related mandates were identified as water conservation and upstream flood damage reduction through watershed protection programs.

Conservation Agencies in USDA

Within USDA there are eight different agencies whose missions directly or indirectly involve soil and other agricultural conservation topics. Individual agency conservation appropriations for 1979, 1983, and 1984 appear in table 3. Under continuing RCA activities, USDA agencies cooperate in reporting conservation budgets. This is coordinated by SCS and is a useful supplement to the official budget process.

In 1984, SCS accounted for 59 percent of USDA conservation spending, compared to 54 percent in 1979. The Agricultural Stabilization and Conservation Service (ASCS) with its Agricultural Conservation Program (ACP) and other cost-share programs

Table 3--USDA conservation appropriations for 1979, 1983, and 1984 in constant 1983 dollars, by agencies, with annual changes from 1979 to 1984

Conservation agencies	Appropriations by year			Share of total 1984	Average annual increase or decrease, 1979 to 1984	
	1979	1983	1984		Million dollars	Percent
	Million 1983 dollars			Percent	Million dollars	Percent
Agricultural Research Service (ARS)	56.3	63.5	60.9	5.9	0.9	1.6
Agricultural Stabilization and Conservation Service (ASCS)	423.5	249.3	233.7	22.7	-37.9	-11.
Cooperative State Research Service (CSRS)	21.4	28.0	26.2	2.5	1.0	4.2
Economic Research Service (ERS)	3.5	2.9	7.3	.7	<u>2/</u> .3	6.5
Extension Service (ES)	15.2	15.9	15.3	1.5	<u>3/</u>	.1
Farmers Home Administration (FmHA)	91.0	83.1	58.2	5.6	-6.6	-8.6
Forest Service (FS)	19.7	16.6	17.2	1.7	-.5	-2.6
Soil Conservation Service (SCS)	724.1	720.6	613.4	59.4	-22.1	-3.3
Total conservation appropriations	1,354.7	1,179.9	1,032.2	100.0	-64.5	-5.

1/ Indexing to 1983 dollars explained in note 4/, table 2.

2/ Increase rates for ERS based on \$4.8 million for 1984 rather than \$7.3 million, to allow for a broader interpretation of conservation-related economics research in 1984 than in 1979 or 1983 in RCA reports.

3/ Less than \$50,000 per year.

accounted for another 23 percent, down from the 31 percent for ASCS in 1979. Appropriations for all agencies but ARS, CSRS and ERS have significantly declined in real terms over the last 5 years. The decreases have been concentrated in ASCS, SCS, and the Farmers Home Administration (FmHA) as the leading conservation agencies (table 3).

Functional Areas and Resource Concerns

Conservation expenditures can also be examined from a functional or type-of-activity viewpoint. Seven major functional activities have been defined for interagency reporting and planning in USDA (table 4). The areas reflect the basic nature of the activity as well as particular agency responsibilities. Appropriations for 1979, 1983, and 1984 as indexed to 1983 price and cost levels for the seven types of activities are in table 4. Loan and emergency programs are shown as undistributed items. Loans are repaid and emergency program funds are not programmed in advance.

Comparisons of fund allotments among the functional activities show that technical assistance, research and development, data collection, and various monitoring efforts have not declined as rapidly as onfarm financial assistance and project construction programs. In part, this reflects greater emphasis on soil and moisture conservation as such, which is mostly an onfarm problem. But it also reflects increased efforts by SCS to have more cooperating farmers implement as well as arrange for conservation plans, and SCS efforts to actively seek out prospective new cooperators. The overall real decrease in the SCS budget averaged 3.3 percent (\$22 million/year) between 1979 and 1984 (table 3). Nevertheless, between 1979 and 1984, SCS and other USDA agencies had increased their funding for onfarm technical assistance activities by nearly \$21 million, an average gain of \$4.2 million per year (table 4).

Erosion Control (soil conservation)

To help identify the current level of spending devoted specifically to soil erosion control or conservation, the eight USDA conservation agencies have apportioned their appropriations among soil erosion control and eight other specific resource concerns for each program and/or budget line item. The nine concerns are listed in table 5. Appropriations for individual agency programs in 1983 and 1984 are in table 6.

The inflation-adjusted expenditures for 1979, 1983, and 1984 in table 5 permit comparisons over time of the emphasis given various topics and resource concerns. Substantially greater attention to soil erosion control occurred in virtually all USDA conservation programs between 1979 and 1984. Soil conservation activities accounted for 43 percent of the Department's conservation budget in 1984, compared with 30 percent in 1979.

Recognition of two other primary RCA national priorities, water conservation and upstream flood damage reduction, is also evident in comparing expenditures among resource concerns. For example, in 1979, water quality improvement and rural community conservation activities of USDA together represented nearly 26 percent of all USDA conservation expenditures. By 1984, their combined share had fallen to 10 percent. Reduced expenditures in these and other areas permitted more attention to soil conservation as the top priority, as well as protect programs involving water conservation and flood damage reduction.

Table 4--Changing distributions of USDA conservation appropriations for fiscal years 1979, 1983, and 1984, in constant 1983 dollars, by type of program activities

Types of activities 1/	Appropriations by year			Share of total		Average annual increase	
	1979	1983	1984	1979	1984	or decrease, 1979 to 1984	
	Million 1983 dollars 2/			Percent		Million dollars	Percent
Onfarm technical assistance/extension	265.6	274.9	286.4	20	26	4.2	1.5
Onfarm installation (cost-sharing) 3/	419.0	270.6	254.9	30	25	-32.8	-9.5
Associated project construction	255.9	324.5	198.4	19	20	-11.5	-5.0
Associated research and development	97.8	107.2	107.5	7	10	1.9	1.9
Associated data collection and analysis	103.1	97.1	87.7	8	9	-3.1	-3.2
Subtotals, distributed appropriations	1,141.4	1,074.3	934.9	84	90	-41.3	-3.9
Add: Conservation loan programs 4/	91.0	83.1	58.2	7	6	-6.6	-8.5
Emergency conservation programs 4/	122.3	22.5	39.1	9	4	-16.6	-20.4
Total conservation appropriations	1,354.7	1,179.9	1,032.2	100	100	-64.5	-5.3

1/ Types of activities correspond to functional areas as generally defined for agency reporting of financial data for the National Conservation Program and annual reports prepared under the 1977 Soil and Water Resources Conservation Act (RCA).

2/ Indexing to 1983 dollars explained in note 4/, table 2. Actual dollar appropriations for 1979 from 1980 RCA analysis (12, pp. 270-271). Actual appropriations for 1983 and 1984 provided December 1984 by the SCS Appraisal and Program Development Division as supplied by eight Department conservation agencies for the 1984 annual RCA appraisal.

3/ Data for cost-sharing programs reflect substantial reductions in USDA administrative expenses between 1979 and 1983-84.

4/ Programs not lending themselves to year-to-year comparisons; also see note 4/, table 5.

Table 5--Changing distributions of appropriations among national resource concerns in USDA conservation programs for fiscal years 1979, 1983, and 1984

National resource concerns <u>1/</u>	:Distribution of appropriations:			Shares of total		: Average annual	
	: 1979	: 1983	: 1984	: 1979	: 1984	: increase or	: decrease,
	: Million 1983 dollars <u>2/</u>			: Percent		: Million	: dollars
							: Percent
Soil erosion control (NP) <u>3/</u>	: 405.3	423.0	432.2	30	43	5.4	1.3
Water conservation (NP)	: 146.4	129.2	106.5	11	10	-8.0	-6.2
Flood damage reduction (NP)	: 161.1	201.7	124.8	12	12	-7.3	-5.0
Pasture and range improvement (SL)	: --	--	62.9	--	6	<u>5/</u>	<u>5/</u>
Water quality improvement (SL)	: 171.7	--	63.3	13	6	-21.7	-18.1
Community/urban conservation (SL)	: 170.6	--	45.0	13	4	-25.1	-23.4
Wildlife habitat improvement (SL)	: 42.3	--	28.0	3	3	-2.9	-2.9
Energy conservation (SL)	: 26.0	--	36.3	2	4	-2.1	-6.9
Organic waste management (SL)	: 18.0	--	10.7	1	1	-1.5	-9.9
Unallocable among concerns <u>4/</u>	: --	320.4	25.2	--	2	<u>6/</u>	<u>6/</u>
Subtotal, distributed appropriations	: 1,141.4	1,074.3	934.9	84	91	-41.3	-3.9
Add: Undistributed programs <u>5/</u>	: 213.3	105.6	97.3	16	9	-23.2	-17.0
Total Conservation Appropriations:	1,354.7	1,179.9	1,032.2	100	100	-64.5	-5.3

-- = Not specified as a priority concern in 1979 or not individually estimated in 1979 and/or in 1983 allocations.

Footnotes on next page.

Footnotes for table 5:

- 1/ Resource concerns as specified in the National Conservation Program (NCP) and prescribed for agency distribution (13, pp. 30-32). A similar set of concerns was used to distribute 1979 appropriations in the initial (1980) RCA analysis (12, pp. 270-271).
- 2/ Indexing to 1983 dollars explained in note 3/, table 2. Actual appropriations for 1979 from 1980 RCA analysis (12, pp. 270-271). Actual appropriations for 1983 and 1984 supplied December 1984 by the SCS Appraisal and Program Development Division as officially reported to it by all USDA conservation agencies.
- 3/ National concerns prioritized at the national level in the National Conservation Program (NCP) are indicated by NP; those national concerns to be prioritized at the State and local levels are indicated by SL.
- 4/ Includes nonemergency and nonloan program amounts not allocated by the reporting agencies. Some amounts for such programs were allocated to specific resource concerns.
- 5/ Loan programs of FmHA and emergency conservation operations of ASCS and SCS are not distributed by resource concern in this comparison; such distributions were reported for the initial (1980) RCA analysis, but were not distributed among resource concerns in 1983 and 1984 RCA allocations.
- 6/ Changes not computed individually but reflected in total.

Approximate funding levels for fiscal years 1983 and 1984 for the various USDA conservation programs, arranged by types of functional activities, are shown in table 6. Also indicated is the extent to which each program was concerned with soil conservation. This information is the baseline for a more detailed look at the present costs of soil conservation in the United States. The focus is on the year 1983, the basis of the ERS benefit-cost analysis of selected soil conservation programs.

SOIL CONSERVATION MEASURES IN 1983

Some descriptive information on the current extent and character of conservation measures on farms in 1983 and newly installed in 1983 is needed to put costs in an operational perspective. Selected comparisons with 1982 and 1984 conditions are added where appropriate.

Soil conservation in the United States is a mixture of private initiative and public programs. Individual farmers and ranchers implement many conservation practices without any financial assistance from public agencies. However, they have also taken advantage of public cost-sharing arrangements and public planning assistance, plus a variety of educational and research information on the advantages and costs of conservation practices. Their taxes help pay for these programs. Soil conservation is consequently best regarded and analyzed as an interconnected set of philosophies and actions by individual farmowners and operators, quasi-public organizations such as soil conservation districts, State and local government, and USDA agency personnel.

Types of Erosion Control Measures

For this review, soil conservation measures were divided into two general types: conservation farming practices and soil conservation improvements. Soil conservation farming practices typically entail nonenduring or optionally continued erosion control strategies and techniques, such as soil-conserving crops and rotations, various forms of reduced tillage (including no tillage), stripcropping, contour farming, and temporary protective cover on cropland.

Soil conservation improvements involve measures of an enduring or at least semi-permanent nature once installed. They normally require shifting to a different land use, a major alteration of the land surface, or perhaps an engineering structure. Examples include conversions of cropland to permanent pasture, grass waterways, terraces designed for erosion control, windbreaks, sediment retention structures, concrete drops and gully checks, and tree planting to control erosion.

These two classes of soil conservation measures -- practices and improvements -- were defined with reference to various conservation practices administratively identified in USDA cost-sharing programs. About 16 national measures for preventing soil loss are listed as ACP practices; 10 are listed under USDA's Great Plains Conservation Program. However, some measures for sediment reduction, as well as for water quality improvement and forestry, may also be important for erosion control and must be considered in estimating total soil conservation costs.

Conservation Practices and Improvements in 1983

The two-way classification of soil conservation measures by practices and improvements is useful for describing the current status of soil conservation on U.S. farms and trends in practice selection related to overall economic conditions for farmers (see fig. 1 and table 7).

Table 6--Total USDA conservation and erosion control appropriations in fiscal years 1983 and 1984,
by type of activities and programs 1/

Activities and programs <u>2/</u>	: Appropriations, FY 1983		:Appropriations, FY 1984 <u>3/</u>		:1984 totals		
	:Program	: Erosion control	:Program	: Erosion control	: in current	: dollars	
	:totals	:	:totals	:	:	:	
	: Million dollars	: Pct.	: Million dollars	: Pct.	: Million	: dollars	
A. Onfarm technical assistance and extension	: 274.9	: 137.7	: 50	: 286.4	: 143.5	: 50	: 299.6
Conservation technical assistance (SCS)	: 251.4	: 130.7	: 52	: 262.9	: 137.1	: 52	: 275.0
Extension information and education (ES)	: 15.9	: 6.8	: 43	: 15.3	: 6.3	: 41	: 16.0
Cooperative forestry management (FS)	: 7.6	: 0.2	: 3	: 3.9	: 0.1	: 1	: 8.6
B. Onfarm installation costs (cost-share programs)	: 270.6	: 177.1	: 65	: 254.9	: 179.5	: 70	: 267.5
Conservation administration (ASCS)	: 38.0	: 25.8	: 68	: 33.3	: 20.9	: 63	: 24.9
Agricultural Conservation Program (ASCS)	: 190.0	: 131.1	: 69	: 181.0	: 137.0	: 76	: 190.0
Forest Incentives Program (ASCS)	: 12.5	: 12.5	: 100	: 11.9	: 13.9	: 100	: 12.5
Water Bank Program (ASCS)	: 8.8	: 0.0	: 0	: 8.4	: 0.0	: 0	: 8.8
Great Plains Conservation Program (SCS)	: 21.3	: 7.7	: 36	: 20.3	: 7.7	: 38	: 21.3
C. Onfarm maintenance and repair <u>4/</u>	: --	: --	: --	: --	: --	: --	: --
D. Associated new project conservation	: 324.5	: 35.3	: 11	: 198.4	: 28.0	: 14	: 207.9
Small watershed development operations (SCS)	: 246.7	: 22.9	: 9	: 143.1	: 14.3	: 10	: 150.0
Other project-type programs (SCS)	: 77.8	: 12.4	: 16	: 55.3	: 13.7	: 25	: 57.9
E. Associated research and development	: 107.2	: 26.1	: 25	: 107.5	: 36.1	: 34	: 112.4
Agricultural research (ARS)	: 63.5	: 8.9	: 14	: 60.9	: 15.4	: 25	: 63.7
Cooperative State research (CSRS)	: 28.0	: 14.0	: 50	: 26.3	: 13.1	: 50	: 27.5
Plant materials centers (SCS)	: 3.8	: 2.0	: 53	: 3.8	: 2.0	: 58	: 4.0
Resource economics research (ERS)	: 2.9	: 0.2	: 7	: 7.4	: 4.4	: 59	: 7.7
Forest watershed management research (FS)	: 9.0	: 1.2	: 13	: 9.1	: 1.2	: 13	: 9.5
F. Associated data collection and analysis	: 97.1	: 46.8	: 49	: 87.7	: 44.8	: 51	: 91.7
Soil surveys (SCS)	: 51.4	: 28.3	: 55	: 51.2	: 26.8	: 52	: 53.5
Inventory and monitoring (SCS)	: 19.5	: 11.1	: 57	: 13.8	: 9.0	: 65	: 14.4
Resource and program appraisals (SCS)	: 6.0	: 2.3	: 38	: 4.1	: 1.5	: 37	: 4.3
Other data and analysis activities <u>5/</u>	: 20.2	: 5.1	: 31	: 18.6	: 7.3	: 39	: 19.5

Continued--

Table 6--Total USDA conservation and erosion control appropriations in fiscal years 1983 and 1984, by type of activities and programs 1/--Continued

Activities and programs <u>2/</u>	: Appropriations, FY 1983		: Appropriations, FY 1984 <u>3/</u>		: 1984 totals		
	: Program : Erosion control	: Program : Erosion control	: Program : Erosion control	: Program : Erosion control	: in current	: in current	
	: totals :	: totals :	: totals :	: totals :	: dollars	: dollars	
	: Million dollars	: Pct.	: Million dollars	: Pct.	: Million dollars	: Million dollars	
Total distributed appropriations (add A thru F)	: 1,074.3	423.0	39	934.9	431.7	46	979.1
Add: Undistributed appropriations <u>6/</u>	: 105.6	--	--	97.3	--	--	102.0
Conservation loan programs (FmHA)	: 83.1	--	--	58.2	--	--	61.0
Emergency conservation programs (ASCS, SCS)	: 22.5	--	--	39.1	--	--	41.0
Total conservation appropriations	: 1,179.9	--	--	1,032.2	--	--	1,081.1

-- = not available or not applicable.

- 1/ Data compiled from information supplied by the SCS Appraisal and Program Development Division, and as reported to it by the eight USDA conservation agencies for the annual 1984 RCA report as required by the 1977 Soil and Water Resources Conservation Act (RCA).
- 2/ Types of activities generally correspond to functional areas as used for compiling agency financial data for RCA. Terminology slightly modified for this review.
- 3/ Appropriations for 1984 deflated (indexed) to 1983 dollars; indexing procedure explained in note 4/, table 2. Total nondeflated current dollar appropriations for 1984 are given in the final column.
- 4/ Heading C (onfarm maintenance and repair) is not applicable to USDA and so is omitted from this table. It is included in summary tables 8 and 9. Project conservation includes Resource Conservation and Development Program, flood prevention operations, and watershed planning activities, all administered by SCS.
- 5/ Includes river basin investigations, snow surveys, and water supply forecasting activities, all in SCS.
- 6/ Undistributed appropriations limited to loan programs of FmHA and emergency conservation-related programs of ASCS and SCS. Allocations among erosion control and other resource concerns is dependent on immediate needs and exigencies.

FARM PRODUCTION REGIONS

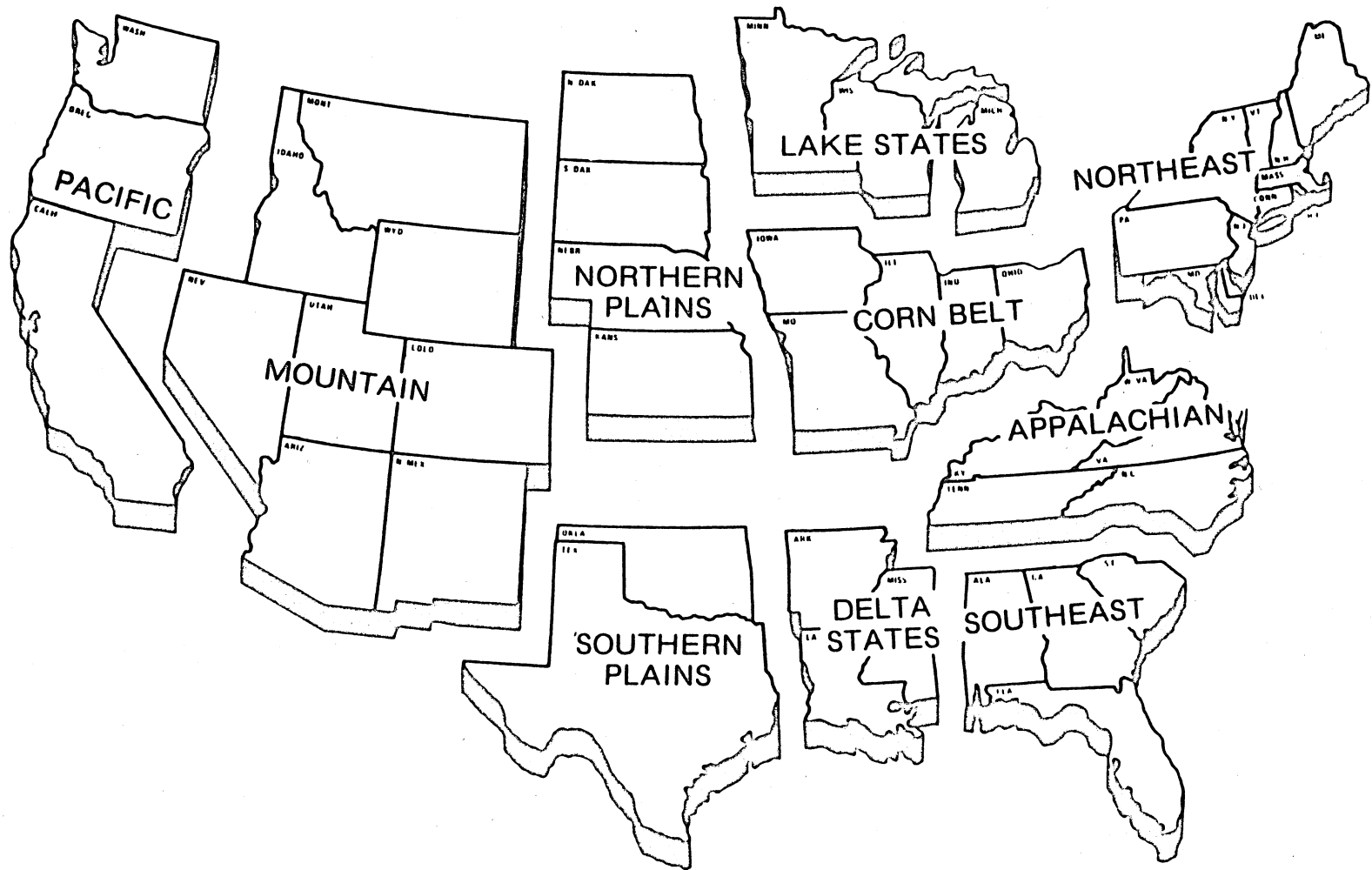


Figure 1

Table 7--Soil conservation measures in place and newly applied in the United States in 1983, by regions

Regions	Conservation farming practices				Soil conservation improvements			
	Cropland : protective cover	No-till : conservation farming	Other : reduced tillage	Contour and strip cropping	Terraces, all types	Grass waterways	Diversions, all types	Pasture and range protection
Measures in place, 1983:	<u>1,000 acres</u>							
Northeast	559	1,111	1,326	1,826	121	174	115	95
Lake States	3,892	387	5,070	3,647	188	555	356	49
Corn Belt	2,405	2,900	21,852	3,988	2,614	1,217	406	323
Northern Plains	3,796	1,221	17,083	13,496	12,793	1,587	2,545	2,516
Appalachian	796	1,930	2,308	311	443	157	200	1,017
Southeast	183	782	1,811	570	1,456	159	60	109
Delta States	19	419	1,179	31	39	14	19	99
Southern Plains	75	210	5,085	3,651	5,532	99	1,712	10,635
Mountain	35	501	4,093	7,277	585	131	331	1,005
Pacific Coast	182	141	2,049	550	82	3	869	263
Totals, 48 States	11,942	9,602	61,856	35,347	23,853	4,096	6,613	18,152
Measures newly applied, 1983:								
Northeast	92	145	98	102	3	25	25	23
Lake States	2,479	172	523	27	18	18	81	21
Corn Belt	1,395	778	1,076	59	178	20	61	55
Northern Plains	2,863	198	805	587	504	48	33	120
Appalachian	83	435	148	31	84	28	66	216
Southeast	33	57	265	4	20	4	1	35
Delta States	10	42	98	14	18	--	25	20
Southern Plains	301	4	155	9	171	27	133	1,166
Mountain	21	117	125	97	3	25	20	377
Pacific Coast	7	4	64	7	1	--	47	8
Totals, 48 States	7,284	1,952	3,357	937	1,000	195	492	2,041
	<u>Percent</u>							
Percentage increase, 1982-83:	61	20	5	3	4	5	7	11

Sources: See (3, 16). According to the CITC, in 1983 Alaska had 8,000 and Puerto Rico 41,000 acres of conservation tillage.

Regional and State information on the measures or practices in place and newly adopted in 1983 was obtained in the Farm Production Expenditures Survey (FE survey) conducted by USDA economics agencies (16). With regard to conservation tillage, however, data from the FE survey are used in conjunction with survey data from the Conservation Tillage Information Center (CT survey) to develop composite national and regionalized estimates of no-till and other forms of reduced tillage (3, 16). The FE survey data were developed from personal interviews with a randomized sample of about 12,000 farmers in 1983. The CT data are built up from estimates requested from around 3,000 SCS district conservationists consulting with county extension specialists and other local agency personnel.

As of 1983 for the country as a whole, no-till and other variations of conservation or reduced tillage on cropland appeared to be the single most important soil conservation practice in terms of area involved, totaling 71.5 million acres (table 7, top section). In both the FE and CT surveys, conservation tillage was defined as any planting and tillage system where at least 30 percent of the previous crop's residue is retained on the surface when planting the new crop. The FE survey indicated that about 21 percent of the farmers who planted crops in 1983 also practiced conservation tillage (7).

Composite FE and CT survey information indicates that in 1983 about 2.8 percent (9.6 million acres) of land used for crops involved no tillage. Reduced tillage was involved on another 18.5 percent (61.9 million acres). Conservation tillage was thus practiced on at least 20 percent of the 335 million acres used for crops in 1983 (3, 4, 16). The importance and cost-significance of this increasingly popular conservation practice in crop production will be noted further on.

The second most common conservation farming system practice in 1983 was contour farming and stripcropping (35.3 million acres). It was followed by two improvements: terracing (23.9 million acres) and soil erosion control on pasture and rangelands (18.2 million acres). These estimates are from the FE survey alone. Such information was not requested in the CT survey.

Combined findings from the 1983 FE and CT surveys for all conservation measures are consolidated for the 10 major U.S. farm production regions in table 7 (top section). Conservation tillage (no-till and reduced tillage) was the most common practice in all regions other than the Mountain States.

Contouring or stripcropping as well as no- or reduced-tillage were widely adopted in both the Northeast and Mountain regions. As expected, the Northern Plains and Mountain States led in the area stripcropped or strip-fallowed: 13.5 million and 7.3 million acres, respectively.

Terracing is a permanent soil conservation measure. Farmers and ranchers in the Northern Plains reported 12.8 million terraced acres (primarily in Kansas and Nebraska). Adding in Oklahoma and Texas, the Plains appeared to contain about 75 percent of the all terraced land in the United States in 1983. Most of the rest was in the Corn Belt and Southeast regions.

The Plains States also accounted for about 75 percent of the range and pasture land protected from soil erosion (13.2 million acres). This includes 10.6 million acres in the Southern Plains States of Texas and Oklahoma.

Measures Newly Applied in 1983

Conservation Farming Practices

Soil conservation practices newly applied in 1983 are also identified by regions in table 7 (lower section). According to the FE survey, the conservation farming practice most widely newly adopted in 1983 was providing protective cover to cropland. Roughly 7.3 million acres were involved. This was a 61-percent increase over the amount of cropland so protected in 1982 and a third more than the total of all other soil conservation farming system practices newly applied on cropland. The Lake States, Corn Belt, and Northern Plains accounted for over 90 percent of the cropland given protective cover. Because these are leading producing regions for wheat and feed grains, the dramatic increase in cropland given temporary protective cover may reflect wide participation in the payment-in-kind (PIK) program under which participating farmers were required to place idled cropland in conservation uses. The erosion control and other conservation benefits of the PIK program were analyzed in a previous ERS study (2).

In 1983, about 937,000 new acres were contoured and/or stripcropped. Stripcropping can also include strip fallow. As expected, the bulk of the national increase (73 percent, 684,000 acres) occurred in the Northern Plains and Mountain States, although a significant gain was also registered in the Northeast region. The national increase of 3 percent was lower than for other conservation farming practices. Already widely used, contouring and stripcropping would not be expected to change radically from year to year, even with substantial reductions in planted acreage similar to those resulting from the 1983 PIK program.

Despite large reductions in planted crops under the 1983 PIK program, the acreage in no-till crops, according to composited FE and CT survey data, jumped by 20 percent (2 million acres) between 1982 and 1983. The area with reduced tillage rose by 5 percent (3.4 million acres). These increases in conservation farming were concentrated in the Lake States, Corn Belt, and Northern Plains, but were also important in the Appalachian and Southeast States.

Findings of the two surveys with regard to pronounced shifts toward conservation tillage in 1983 are reinforced by official ACP reports for 1982 and 1983 (15). Limited cost-sharing assistance under ACP was provided for shifting to conservation tillage systems on 916,000 acres. This was an increase of 27 percent over 1982. This percentage gain is similar to that calculated from the FE and CT surveys, both of which covered all new conservation tillage. Considering ACP program reports and the surveys, one sees that some cost sharing under ACP appears to have been received for about 20 percent of the new acreage on which conservation tillage was practiced in 1983.

Conservation Tillage and Cropland Use

The new significance of conservation tillage as a major farming practice in the United States can be underscored by two simple tabulations based on composited FE and CT survey data combined with official USDA estimates of land used for crops for 1982, 1983, and 1984 (3, 4, 16, 19). The PIK program, aimed at reducing the acreage of wheat, feed grains, and other surplus crops, was operational in 1983.

The first tabulation gives total U.S. acreages of conservation tillage in relation to acreages used for crops:

	<u>1982</u>	<u>1983</u>	<u>1984</u>
Acres used for crops, millions	386	335	370
Acres of conservation tillage, millions	66	72	97
Percentage for conservation tillage	17.1	21.3	26.2

While 51 million fewer acres were used for crops acres in 1983 than in 1982, conservation tillage was practiced on 6 million more acres than in 1982. Also, in 1984, the area used for crops recovered to 96 percent of its pre-PIK (1982) level, while conservation tillage was practiced on 25 million more acres than in 1983, or on over 26 percent of all planted cropland. Much of the 1983-84 increase in conservation tillage probably involved land taken out of surplus crops in 1983 and then returned to production in 1984.

The second tabulation gives the percentage changes in the area of land used for crops and the cropland on which conservation tillage was practiced in the United States during 1982, 1983, and 1984.

	<u>1982-83</u>	<u>1983-84</u>	<u>1982-84</u>
Acres used for crops, percent change	-13	10	-4
Acres of conservation tillage, percent change	12	35	47

These percentage changes reinforce the trends described above. Adding the 1982-84 interval (the last column) statistically though partially removes the influence of the 1983 PIK program. Despite a 4-percent decrease in crop-use acres between 1982 and 1984, the acres conservation-tilled had increased 47 percent. About a fourth of this relative gain occurred in conjunction with (not necessarily because of) the 1983 PIK program, and three-fourths between 1983 and 1984. These proportional relationships further suggest that farmer investments in conservation farming systems in 1984 were significantly higher than in 1983. The availability of more specific data on this point will require revisions in the farmer conservation expenditures in 1984 shown in tables 1 and 2. Additional details on the extent to which no-till and several variations of reduced-tillage were practiced for different crops and in the different States and regions are available in annual survey reports of the CTIC (3).

Soil Conservation Improvements

A possible consequence of the PIK program on permanent soil conservation improvements relates to the establishment of permanent vegetation on cropland. Information on this for 1983 is not available from either the FE or CT surveys. But, according to ACP reports, in 1983, the measure was cost-shared on 964,000 new acres, compared with 714,000 new acres in 1982. This was an increase of 35 percent. It occurred despite a 6-percent decrease in the U.S. average rate of cost-sharing per acre.

According to the FE survey, protection of pasture and rangeland from erosion was the leading soil conservation improvement newly applied in 1983 (table 7, lower section). About 2 million acres were involved; Oklahoma and Texas together accounted for 1.2 million acres. This is an understatement, however, as ACP data

indicate that at least 2.7 million acres of U.S. pasture and western grazing lands were protected. Large areas of rangelands were protected under ACP cost-sharing agreements in Texas, Montana, New Mexico, the two Dakotas, and Nebraska.

According to the FE survey, about 1 million acres were newly terraced in the United States in 1983. This was an increase of 4 percent over 1982. The Plains States accounted for two-thirds of the new terraces. The area terraced under ACP cost-sharing rose by 20 percent, from 427,000 acres in 1982 to 513,000 acres in 1983. The average cost-share rate rose by 9 percent, from about \$41 to \$45 per acre.

SOIL CONSERVATION COSTS IN 1983

Table 8 summarizes various elements of private and public soil conservation costs in 1983. The information relates in a general way to the soil conservation practices and improvements just discussed.

Private and Public Costs

In 1983, private and public expenditures on (or costs of) soil conservation in the United States totaled slightly over \$1 billion. This was about 43 percent of the \$2.4 billion spent on all natural resource conservation efforts in agriculture. Nearly 50 percent (\$492.8 million) of the total costs of soil conservation in 1983 was incurred by farm and ranch owners and operators. Another 9 percent (\$91.8 million) represented contributions of State and county governments and local soil conservation and other resource districts. About 42 percent (\$423 million) came from congressional appropriations via USDA conservation agencies.

About 17 percent of soil conservation spending in 1983 was either for erosion control organized on a watershed or similar project basis (\$49.4 million), various research and development programs (\$43.4 million), or data collection and analysis activities (\$74.4 million). Overall, State agencies appeared to carry about one-third and USDA agencies two-thirds of the \$167.2 million total cost of such associated programs (table 8, items D, E, F). After allowing for these activities, one finds about \$840.6 million were spent in reducing soil erosion on farms (table 8, item G).

The \$840.4 million in soil conservation costs in 1983 attributable to conservation activities on individual farms was divided \$634.2 million (81 percent) for the cost of installing new conservation practices and improvements, \$132.7 million (16 percent) for technical design help or extension-type assistance, and \$23.7 million (3 percent) for normal maintenance and repair of existing soil conservation improvements. Farmowners and operators covered virtually all maintenance cost. They also contributed about 74 percent (\$469.1 million) of the total cost of installing new conservation systems and improvements. Their net share of onfarm erosion control costs, after allowing for technical assistance and cost-sharing contributions of public agencies, came to \$492.8 million. This was 58 percent of the total national direct cost of soil conservation on farms (see line G, table 8).

Conservation Practice and Improvement Costs

The total private and public cost of initiating new conservation farming systems in 1983 was about \$404.4 million, compared with \$229.8 million for installing permanent soil conservation improvements and structures (table 8, lines Ba and Bb). Farmers incurred 89 percent (\$360 million) of the conservation farming

Table 8--Private and public expenditures for soil conservation in the United States
in 1983, by functional activities and sources of funds

Soil conservation activities	Farm	State &	Federal	Total,	Farm	State &	Federal
	owners/ operators	local agencies	(USDA)	all sources	owners/ operators	local agencies	(USDA)
	--Million dollars, 1983--			--Percent of item, 1983--			
A. Onfarm technical assistance/extension	--	9.0	123.7	132.7	--	7	93
B. Onfarm installation costs	469.1	23.8	141.3	634.2	74	4	22
a. Conservation farming practices <u>1/</u>	360.0	6.2	38.2	404.4	89	2	9
b. Soil conservation improvements <u>2/</u>	109.1	17.6	103.1	229.8	47	8	45
1. Financially unassisted installation	316.7	--	--	316.7	100	--	--
a. Conservation farming systems	302.8	--	--	302.8	100	--	--
b. Soil conservation improvements	13.9	--	--	13.9	100	--	--
2. Financially assisted installation	152.4	23.8	141.3	317.5	47	8	--
a. Conservation farming systems	57.2	6.2	38.2	101.6	56	6	38
b. Soil conservation improvements	95.2	17.6	103.1	215.9	44	8	48
3. Assisted installation, by programs							
Agricultural Conservation Program (ACP)	122.1	--	126.5	248.6	49	--	51
Forest Incentives Programs (FIP)	8.3	--	10.2	18.5	45	--	55
Great Plains Program (GPCP)	2.5	--	4.6	7.1	35	--	65
State and local programs	19.5	23.8	--	43.3	45	55	--
C. Onfarm maintenance and repair	23.7	--	--	23.7	100	--	--
D. Associated project conservation <u>3/</u>	--	14.1	35.3	49.4	--	29	71
E. Associated research and development <u>3/</u>	--	17.3	26.1	43.4	--	40	60
F. Associated data collection/analysis <u>3/</u>	--	27.6	46.8	74.4	--	37	63

Continued--

Table 8--Private and public expenditures for soil conservation in the United States in 1983, by functional activities and sources of funds--Continued

Soil conservation activities	Farm	State &	Federal	Total,	Farm	State &	Federal
	owners/ operators:	local agencies:	agencies: (USDA)	all sources:	owners/ operators:	local agencies:	agencies: (USDA)
	--Million dollars, 1983--				--Percent of item, 1983--		
G. Subtotal, onfarm soil conservation (1 & 2 below)	492.8	32.8	314.8	840.4	58	4	38
1. Allocable to State level (add A, B, C) <u>4/</u>	492.8	32.8	265.0	790.6	62	4	34
2. Unallocable to State level <u>5/</u>	--	--	49.8	49.8	--	--	100
Technical assistance/extension programs	--	--	14.0	14.0	--	--	100
Installation assistance programs	--	--	35.8	35.8	--	--	100
H. Subtotal, associated activities (add D, E, F)	--	59.0	108.2	167.2	--	35	65
Total soil conservation expenditures (add G, H)	492.8	91.8	423.0	1,007.6	49	9	42

-- = Not available or not applicable.

1/ Includes such practices as cover crop protection, contour farming, stripcropping, reduced and no-till cultivation, and soil-conserving crop rotations.

2/ Includes such enduring or permanent measures as permanent vegetative cover establishment, grass waterways, terraces, diversions, grazing land protection, windbreak establishment, sediment retention structures, streambank protection, and tree planting to minimize erosion.

3/ Includes only aspects of these activities specifically concerned with monitoring the extent of and/or reducing soil erosion.

4/ Includes onfarm expenditures allocable to a State level.

5/ Expenditures benefiting more than one State, such as technical and research centers, general administration, and other funds not disbursed among activities A, B, and C.

system costs, while State and local agencies contributed 2 percent (\$6.2 million) and USDA agencies 9 percent (\$38.2 million). For permanent soil conservation improvements, farmers invested \$109.1 million, 47 percent of the total. State and local agencies contributed \$17.6 million (8 percent) and USDA agencies \$103.1 million (45 percent). Farmers and ranchers also spent \$23.7 million for maintaining improvements installed in earlier years.

UNASSISTED VERSUS ASSISTED SOIL CONSERVATION

In looking at the costs of soil conservation through erosion control, it is necessary to distinguish those measures that farmers and ranchers finance on their own, without any cost-sharing help from public agencies, from the measures that they install with at least some financial help. Probably because statistics for the latter could be obtained fairly readily from public agencies, little information has heretofore been developed on independently financed soil conservation on farms. Such a distinction was made, however, in a recent SCS evaluation of its technical assistance program for 274 sample counties (20). The same general approach was followed for this review. Installation costs have been separated this way in table 8.

Conservation Farming Practices

In 1983, farmers and ranchers invested \$360 million in new soil conserving farming practices, plus \$109.1 million in permanent soil conservation improvements, for a total of \$469.1 million in new soil conservation measures. They spent at least another \$23.7 million on maintaining existing improvements. However, about 75 percent (\$302.8 million) of the total immediate cost to the Nation of farmers adopting conservation practices (\$404.4 million) was incurred by individual farmers without any financial assistance. Adding to this amount their own share of cost where some assistance was provided by public agencies, farmers incurred nearly 90 percent (\$360 million) of the national cost (\$404.4 million) of conservation farming systems begun in 1983.

Soil Conservation Improvements

The national cost of installing permanent soil conservation improvements on farms in 1983 was about \$229.8 million, of which 47 percent (\$109.1 million) was borne by owners and operators, 8 percent (\$17.6 million) by State and local agencies, and 45 percent (\$103.1 million) by USDA agencies.

Owners and operators appear to utilize public cost-sharing assistance programs much more in installing permanent soil conserving improvements than in converting to conservation farming systems. Nearly 88 percent of the owner/operator share (\$95.2 million) of all investments in improvements (\$109.1 million) was made with proportional cost-sharing by USDA or other public agencies. Public cost-sharing disbursements to farmers in 1983 were \$120.7 million for permanent improvements installed compared with \$44.4 million for conservation farming and cropping systems. The conservation farming and cropping systems include no-till, reduced tillage, and other strategies that may reduce production costs as well as conserve soil.

PUBLIC SUPPORT OF SOIL CONSERVATION

In 1983, publicly provided onfarm technical assistance, extension, and similar activities accounted for about \$146.7 million, or 13 percent of all national soil conservation costs (table 8). The total of \$146.7 million for technical assistance was obtained by adding to the \$132.7 million in State and Federal costs allocable

among States (line A), an additional \$14 million for regional technical centers and other overhead Federal costs (under item G2). SCS technical assistance operations attributable to soil conservation as such accounted for \$130.7 million. ES and FS contributions were an additional \$6.8 million and \$200,000 respectively. Direct technical assistance for soil conservation provided by State and local agencies was valued at \$9.0 million, about 7.3 percent of the SCS share.

As of 1983, at least 17 States had enacted legislation also permitting cost-sharing for soil conservation on private lands (17). It is difficult to relate appropriations for such purposes with soil conservation accomplished in a particular year. However, it is estimated that in 1983 the States and a few local governments contributed at least \$23.8 million toward the cost of installing soil conservation improvements on farms. Some States also provide tax credits and other incentives to farmers for soil conservation, including credits for purchasing conservation tillage equipment.

The legislated public cost-sharing programs of USDA still account for most (85 percent) of the public cost of soil conservation on farms. In 1983, the public cost came to \$165.1 million, while the cost to farmowners and operators came to \$360 million. This was 74 percent of all installation expenditures.

The cooperative and voluntary nature of USDA cost-sharing programs for soil conservation is revealed by comparing private-public cost distributions for the various programs. It appears that public agencies may contribute more than half of total installation costs in the case of soil conservation improvements, as opposed to practices for water quality and conservation, animal waste management, and other resource concerns.

The private-public distributions of soil conservation costs under USDA's ACP, Forest Incentives Program (FIP), and Great Plains Conservation Program (GPCP) have been estimated in table 8. These programs should be viewed in the context of the substantial additional investments made by farmowners and operators without public assistance. In fact, an early rationale for establishing public cost-sharing for soil conservation was to demonstrate to farmers the benefits of adopting soil conservation management practices on their own (11).

Public cost-sharing assistance for soil conservation on farms has been primarily for permanent improvements. These tend to be more costly on a per-acre basis than conservation farming systems. While farmers in 1983 invested more than twice as much for soil conservation farming systems than for permanent soil conservation improvements, \$360 million versus \$109.1 million, the amount they did spend on permanent improvements represented 87 percent of all private soil conservation investments made under cost-sharing arrangements.

Ranked by the cost-share disbursements specifically for soil conservation in fiscal year 1983, the principal mechanisms for private/public cooperation are ACP of ASCS (\$126.5 million), various State and local programs (\$23.8 million), FIS (\$10.2 million), and the GPCP (\$4.6 million). USDA's experimental Rural Clean Water Program was undoubtedly important also, but specific allocations for erosion control practices installed in 1983 were not available for this review.

COSTS BY REGIONS AND STATES

Within certain limitations, an accounting of national erosion control expenditures in a given period can be applied to States, counties, and other defined areas. Obvious exceptions are activities that apply to the country at large, to

more than one State or region, or perhaps to more than a single period (year). For this review, national soil conservation expenditures for the United States in 1983 have been examined with regard to whether they could be allocable to at least a State level. For example, while the estimated national cost of soil conservation in 1983 was over \$1 billion, \$167.2 million of this went for associated project activities, research and technology development, and data collection activities. Another \$49.8 million went toward supporting regional technical service centers, administering technical and financial assistance programs, and other amounts not allocated among States (table 8).

After deducting the items just noted, the net cost in 1983 of soil conservation on U.S. farms allocable to a State level comes to \$790.6 million. Of this net cost, 62 percent (\$492.8 million) was paid by farmowners or operators, and about 4 percent (\$32.8 million) by State and local organizations and agencies. About one-third (\$265 million) was spent by USDA conservation agencies. As to the nature of soil conservation activity on farms, 17 percent (\$132.7 million) was for public technical assistance, and \$634.2 million was for installing new conservation farming systems and improvements. About 3 percent (\$23.7 million) went toward maintaining improvements that had been installed before 1983. This likely underestimates maintenance and repair expenses, however, because no reports were available for nine of the 48 contiguous States covered in the 1983 FE survey (16).

Soil conservation costs for 1983 were also obtained in this review for States and major farm production regions. In table 9 total expenditures are first allocated among major functional activities, such as technical assistance, actual installation, and maintenance. The same totals are then divided with respect to farmowners and operators, State and local agencies, and USDA agencies as the major participants in soil conservation and sources of required funds. Expenditures not allocable to a State and regional level are shown as addenda in table 9. This is necessary to completely account for all national costs of soil conservation in 1983.

The leading region in terms of soil conservation costs in 1983 was the Corn Belt with \$119.6 million, or over 15 percent of the total for all States. The Appalachian region was next with \$94.1 million (12 percent), followed by the Southeast and Southern Plains. They ranged around \$88-89 million or about 11 percent each.

Leading States for total soil conservation expenditures in 1983 were Texas (\$67.3 million), Iowa (\$38.0 million), North Carolina (\$33.4 million), California (\$32.2 million), and Minnesota (\$30.6 million). These same States also led in expenditures by farmowners and operators. The leading States for Federal expenditures were Texas (\$24.5 million), Iowa (\$12.7 million), Illinois (\$10.6 million), Kansas (\$10.3 million) and Georgia (\$9.2 million).

Such rankings with regard to expenditures on soil conservation in 1983 do not consider differences in the size, agricultural diversity, and farm economies of the different regions and States. But the information does provide a statistical foundation for gauging the extent to which the activities correlate with the physical and economic magnitude of soil erosion problems and the potential benefits from continued conservation efforts in different sections of the United States.

Table 9--Costs of Soil Conservation in the United States in 1983, by states, major activities and sources of funds

State and Region	By major Technical assistance/extension	onfarm installation costs	activities Maintenance and repair	By major Farm owners and operators	sources of State and local agencies	funds Federal agencies (USDA)	Totals by activities or funds 1/
	\$Thousands			\$Thousands			\$Thousands
ME	672	5,879	169	4,849	46	1825	6,720
NH	626	1,829	52	1,449	42	1016	2,507
VT	660	3,622		2,836	45	1401	4,282
MASS	643	2,629	170	2,405	44	993	3,442
RI	205	477		397	14	271	682
CONN	379	1,430	25	1,210	26	598	1,834
NY	2,937	16,904	152	13,184	199	6550	19,933
NJ	1,027	7,934	108	6,338	660	2071	9,069
PA	3,139	9,288	429	6,534	213	6109	12,856
DEL	292	1,739		1,513	20	498	2,031
MD	1,167	5,325	8	3,981	695	1824	6,500
Northeast	11,747	57,056	1,113	44,696	2004	23156	69,856
MICH	3,435	14,917	257	11,382	233	6993	18,608
WIS	2,934	18,579	581	13,211	2310	6573	22,094
MINN	3,610	26,639	353	19,862	3044	7697	30,603 -5
Lake States	9,979	60,135	1,191	44,455	5,587	21,263	71,305
OHIO	4,059	13,570	388	9,812	275	7930	18,017
IND	4,494	12,538	214	8,540	305	8401	17,246
ILL	5,061	16,859	2,745	13,645	344	10676	24,665
IOWA	6,185	28,917	2,901	21,122	4144	12737	38,003 -2
MO	5,385	12,995	3,247	10,874	1859	8894	21,627
Corn Belt	25,184	84,879	9,495	63,993	6,927	48,638	119,558
N DAK	2,523	10,703	15	7,417	171	5653	13,241
S DAK	2,268	9,723	153	6,904	154	5086	12,144
NEBR	3,970	21,896	1,006	15,212	4020	7640	26,872
KANS	5,185	14,422	507	8,026	1771	10313	20,110
No. Plains	13,946	56,744	1,681	37,559	6,116	28,692	72,367
VA	3,043	13,317	684	10,681	658	5705	17,044
W VA	2,228	3,620		2,148	151	3549	5,848
N C	4,340	28,767	320	23,340	1726	8361	33,427 -3
KY	4,492	11,405	103	7,133	305	8562	16,000
TENN	4,346	16,148	1,302	12,622	747	8427	21,796
Appalachian	18,449	73,257	2,409	55,924	3,587	34,604	94,115
S C	2,386	21,479	151	17,902	902	5212	24,016
GA	4,465	19,147	58	14,150	303	9217	23,670
FLA	1,972	15,206	61	12,253	385	4601	17,239
ALA	4,112	19,988	74	14,786	279	9109	24,174
Southeast	12,935	75,820	344	59,091	1,869	28,139	89,099

-- CONTINUED

Table 9--Costs of Soil Conservation in the United States in 1983, by states, major activities and sources of funds--Continued

State and Region	By major onfarm activities			By major sources of funds			Totals by activities or funds 1/
	Technical assistance/extension	Onfarm installation costs	Maintenance and repair	Farm owners and operators	State and local agencies	Federal agencies (USDA)	
MISS	3,814	15,158	143	11,168	259	7688	19,115
ARK	3,067	13,069	14	10,566	208	5376	16,150
LA	2,737	14,083	1	11,022	186	5613	16,821
Delta States	9,618	42,310	158	32,756	653	18,677	52,086
OKLA	3,882	15,771	1,418	12,770	263	8038	21,071
TEX	11,041	51,786	4,536	42,118	749	24496	67,363 - 1
So. Plains	14,923	67,557	5,954	54,888	1,012	32,534	88,434
MONT	1,100	7,835		6,243	75	2617	8,935
IDAHO	1,268	10,367	95	8,958	438	2334	
WYO	863	5,156		4,392	59	1568	6,019
COLO	1,632	13,103		11,202	111	3423	14,736
N MEX	1,640	9,248	20	7,912	111	2885	10,908
ARIZ	477	1,916	37	1,614	32	784	2,430
UTAH	390	9,310	47	8,194	628	924	9,746
NEV	111	699	11	628	8	185	821
Mountain	7,481	57,634	210	49,143	1,462	14,720	65,325
WASH	2,042	13,504	182	11,548	138	4042	15,728
OREG	2,346	12,567	9	9,970	159	4793	14,922
CALIF	1,643	29,621	954	26,596	3123	2499	32,218 4
Pacific	6,031	55,692	1,145	48,114	3420	11334	62,868
48 states	130,293	631,084	23,700	490,619	32,637	261,757	785,013
ALAS	476	335	0	217	32	562	811
HAW	834	1,304	0	859	57	1,222	2,138
P.R./V.I.	1,097	1,541	0	1,105	74	1,459	2,638
Subtotal, to regions 2/	132,700	634,264	23,700	492,800	32,800	265,000	790,600
Unallocable to regions 3/	14,000	35,800	0	0	0	49,800	49,800
Subtotal, onfarm conservation	146,700	670,000	23,700	492,800	32,800	314,800	840,400
Associated activities 4/	0	0	0	0	59,000	108,200	167,200
Total soil conservation costs	146,700	670,000	23,700	492,800	91,800	423,000	1,007,600

1/ Small discrepancies in sums by activities versus sources due to rounding.

2/ Includes above expenditures identifiable with or allocable to a State and/or region.

3/ Includes technical and installation assistance and related administrative costs benefiting more than one State or region.

4/ Includes project conservation, research and development, and data collection activities.

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