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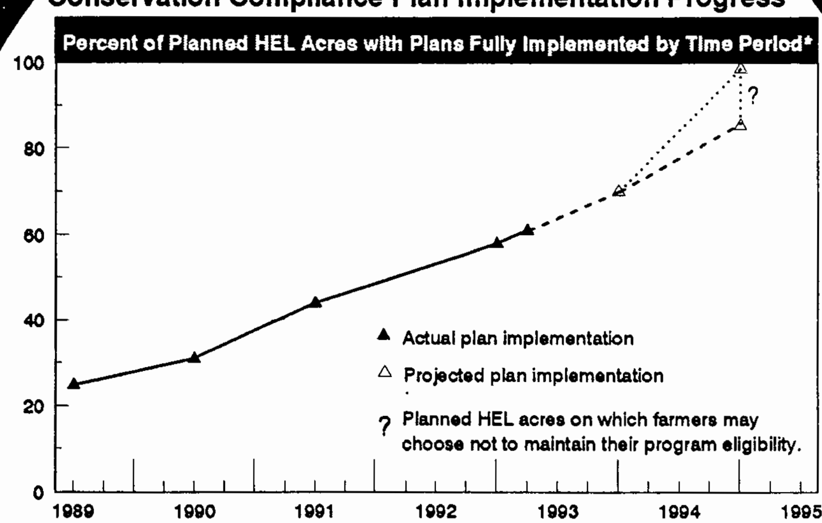
Agricultural Resources

Cropland, Water, and Conservation

Situation and Outlook Report

Conservation Compliance Plan Implementation Progress



* Highly erodible land (HEL) acres with conservation plans in full compliance.

Source: Soil Conservation Service.

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Summary

Agricultural Water Supplies Improve;
Cropland Use Down, Idled Land and Conservation Up

The water supply outlook for the Western States has improved significantly, breaking a 6-year drought. This was largely due to heavy winter precipitation replenishing supplies in the Central Rockies and California. Drought conditions still persist in areas of the Pacific Northwest, Northern Rockies, and Northern Plains. Below-normal summer streamflow and reservoir storage may limit supplies for irrigation and other uses in these areas.

Farmers used an estimated 95 million acre-feet of water for irrigation on nearly 53 million acres of farmland in 1992. Irrigated agriculture continues to dominate the use of water in the United States, accounting for 81 percent of total consumption. Surface water provides 63 percent of irrigation needs and groundwater 37 percent. Farmers' cropping intentions for 1993 suggest little change from 1992 in irrigated area and water use.

Projected cropland used for crops is 335-345 million acres for 1993, likely down from 343 million in 1992. Because of changes in the acreage reduction program requirements, more corn and rice base acres and fewer barley, wheat, and cotton base acres will likely be idled than last year. Overall, 19-22 million acres are expected to be idled under commodity programs, along with over 36 million in the Conservation Reserve Program (CRP). Farmers intend to plant about 103 million acres of feed grains this year, compared to 108 million acres in 1992.

The CRP, after 12 signup periods in 8 years, has temporarily retired from production over 36 million acres of highly erodible and other sensitive cropland, 90 percent of the program's goal. But the CRP's future is linked to potentially limited Federal funding for maintaining or expanding the enrolled acreage beyond the current contracts. As the initial 10-year CRP contracts begin expiring in late 1995, farmers can bring that land back into production.

Under the conservation compliance provisions of the 1985 farm bill, approved conservation plans have been fully applied on about 86 million acres of highly erodible cropland (HEL), 58 percent of the total HEL determinations to date. Another 55 million HEL acres have Soil Conservation Service-approved plans that are in the process of implementation and certification. However, farmers have not requested or accepted conservation plans on 7 million HEL acres, making these farmers ineligible for USDA program benefits. Farmers who do not fully implement an approved plan by January 1, 1995, will lose eligibility for USDA program benefits. So far over 1,500 farms have been found in violation of either the sodbuster or swampbuster provisions and have been denied benefits exceeding $11 million.

Crop residue management (CRM) is the conservation practice called for on 75 percent of the planned HEL acres. Conservation tillage, a form of CRM, was practiced on 89 million acres in 1992 and could exceed 100 million acres in 1993. No-till, the most rapidly growing conservation tillage practice, was used on 28 million acres in 1992 and could reach 37 million in 1993.

The Wetlands Reserve Program has been implemented on a pilot basis in nine States. Farmers' bids to enter land into the program were five times the 50,000 acres accepted, indicating strong producer interest. The President's budget for fiscal year 1994 includes funding for 450,000 acres, with another 500,000 acres proposed for fiscal 1995.

Other recent USDA programs are targeting water quality and food safety concerns. The Water Quality Incentive Projects now number 106 nationwide and the Integrated Farm Management Program has an enrollment totaling nearly 100,000 acres in 32 States. Also, a program begun in 1990, USDA's Water Quality Initiative, has promoted the adoption of improved practices at the farm level in over 200 locations nationwide. The program is also developing or evaluating production systems for improving water quality and gathering new data on pesticide and fertilizer use. Beginning May 10, 1993, applicators of restricted-use pesticides must maintain pesticide product records by field.

Cropland Use Expected Down, Idled Land Up

Increases in cropland idled in annual crop programs and the long term Conservation Reserve Program (CRP) are expected to slightly reduce cropland harvested and used for crops. Little change is expected in the acreage summer fallowed or in crop failure.

An estimated 335-345 million cropland acres are expected to be used for crops in 1993 (table 1). Actual cropland used for crops is likely to be less than last year's 343 million acres. After peaking at 387 million acres in 1981, when no land was idled under Federal programs, cropland used for crops trended down through 1988. Cropland used for crops increased 14 million acres from 1988 to 1989 and declined about 4 million acres from 1989 to 1991. In 1992, cropland used for crops increased 6 million acres, about 2 million above 1989 and 1990.

The decline in cropland used for crops through 1988 was mainly due to increased farmer participation in Federal programs (annual and long-term) aimed at limiting crop production or soil erosion. The annual crop programs also had increasing acreage reduction requirements over much of this period (see box). However, land idled by these programs declined 22 percent (17 million acres) from 1988 to 1989, primarily from decreases in the acreage reduction requirements for wheat and feed grains (except oats) and optional paid land diversion.

Annual program participation, which had been increasing for several years prior to 1988, also declined from 1988 to 1989. From 1989 to 1991, increases in total acreage idled were largely the result of additions to the long term CRP. In 1992, land idled by Federal programs again decreased sharply--below any year since 1986. This decrease was likely the result of smaller Acreage Reduction Program (ARP) requirements for wheat, rice, and feed grains, except oats.

The estimated 1992 cropland harvested--312 million acres--was higher than any year since 1986, due largely to the sharp decline in cropland idled in annual programs. Cropland harvested in 1993 is expected to be slightly less than in 1992, primarily due to a small increase forecast for land idled in Federal programs. Of course, weather and pest conditions during the season could affect acres harvested by increasing crop failure. With ample moisture over most of the country, except areas in the Northwest, changes in cropland summer fallowed are likely to be quite small. However, wet conditions in portions of the midsection of the country and the Southeast may delay, or possibly prevent, planting.

The total land idled by the CRP and the annual Federal crop programs is expected to increase slightly in 1993. Changes in acreage reduction program (ARP) levels, alone, would infer a slight increase in area of program crops--less idling and

Table 1--Major uses of cropland, United States, 1984-93 1/

Cropland	1984	1985	1986	1987	1988	1989	1990	1991	1992 2/	Forecast 1993
					Million acres					
Cropland used for crops	373	372	357	331	327	341	341	337	343	335-345
Cropland harvested 3/	337	334	316	293	287	306	310	306	312	305-315
Crop failure	6	7	9	6	10	8	6	7	8	6-9
Cultivated summer fallow	30	31	32	32	30	27	25	24	23	22-25
Cropland idled by all Federal programs	27	31	48	76	78	61	62	65	55	55-58
Annual programs	27	31	46	60	53	31	28	30	20	19-22
Long-term programs	0	0	2	16	25	30	34	35	35	36
Total, specified uses 4/	400	403	405	407	405	402	403	402	398	395-405
					Million hectares					
Cropland used for crops	151	151	144	134	132	138	138	136	139	136-140
Cropland harvested 3/	136	135	128	119	116	124	125	124	126	123-127
Crop failure	2	3	4	2	4	3	2	3	3	2-4
Cultivated summer fallow	12	13	13	13	12	11	10	10	9	9-10
Cropland idled by all Federal programs	11	13	19	31	32	25	25	26	22	23-24
Annual programs	11	13	19	24	21	13	11	12	8	8-9
Long-term programs	0	0	1	6	10	12	14	14	14	15
Total, specified uses 4/	162	163	164	165	164	163	163	163	161	160-164

1/ Includes the 48 conterminous States. Fewer than 200,000 acres (80,940 hectares) were used for crops in Alaska and Hawaii. 2/ Preliminary. 3/ A double-cropped acre is counted as 1 acre (0.4047 hectare). 4/ Does not include cropland pasture or idle land not in Federal programs that is normally included in the total cropland base. Breakdown may not add to totals due to rounding.

Annual Crop Program Provisions

Crop Acreage Base, for 1993 wheat and feed grains, is the average of the acreage planted and considered planted to each program crop in the previous 5 years. For upland cotton and rice, the crop acreage base in 1993 is the average acreage planted and considered planted for the previous 3 years, with no adjustment for years with zero planted or considered planted acreage.

Acreage Reduction Program (ARP) is a voluntary land retirement program in which farmers reduce their planted acreage of a program crop by a federally specified proportion of the crop acreage base to become eligible for deficiency payments, loan programs, and other USDA commodity program benefits.

0/92 Provision, an optional, Federal acreage diversion program, allows wheat and feed grain producers to devote all or a portion of their permitted acreage to conservation uses or to a minor oilseed crop, sesame, or crambe and, under some conditions, receive deficiency payments. Eight percent of the producer's maximum payment acres must be maintained in conservation uses or other allowable crop use. The payment acreage for 0/92 payments is the difference between the 92 percent of the maximum payment acreage for the crop and the acreage planted, if any, to the program crop.

50/92 Provision, an optional, Federal acreage diversion program, allows upland cotton and rice producers to underplant their permitted acreage and, under some conditions, receive deficiency payments on part of the underplanted acreage. At least 50 percent of the crop's maximum payment acreage must be planted. An additional 8 percent must be designated for conservation use. The maximum 50/92 payment acreage is the difference between the acreage planted and 92 percent of the maximum payment acreage. Minor oilseeds may not be planted on the 50/92 conservation use acres but sesame or crambe may be planted, with producers still qualifying for deficiency payments.

Maximum payment acreage is 85 percent of the crop acreage base for the program crop, less the acreage required to be idled by the ARP. The 15-percent nonpayment acreage before considering the ARP is the "normal flex acreage" defined below.

Normal flex acres (NFA) comprise 15 percent of any participating program crop acreage base not eligible for deficiency payments whether planted to the original program crop or "flexed" (planted) to another crop. However, for both normal and optional flex acres (see below), program crops and oilseeds grown on flexed acres are eligible for price support loans. The flexed acres are also "considered planted" to the program crop, thereby protecting the base history. Crops specifically excluded from production on flexed acres are fruits and vegetables, including potatoes, dry edible beans, lentils, specified types of dry peas, peanuts, tobacco, wild rice, nuts, trees, tree crops, and nonparticipating extra long staple cotton. The planting of any other crop may be excluded by the Secretary of Agriculture.

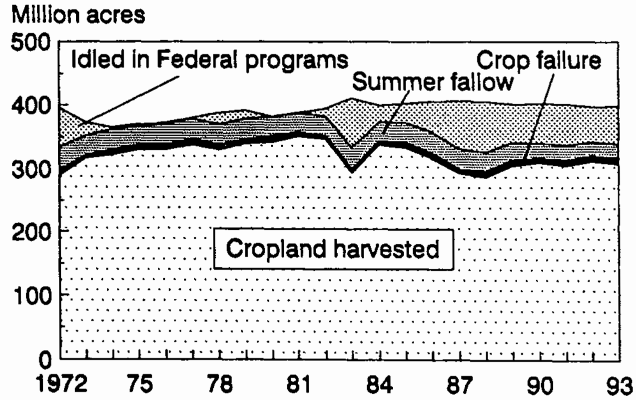
Optional flex acres (OFA) are up to 10 percent of a crop's base acreage beyond the normal flex acres (see above) that can be flexed (planted) to another crop. If planted to the original program crop, these acres are eligible for deficiency payments. If flexed to other program or allowable nonprogram crops, these acres are eligible only for price support loans.

more cropland harvested. However, March planting intentions suggest a considerable reduction in plantings of program crops from expected changes based on ARP levels and CRP enrollment. This would infer an increased area idled. Possible explanations include higher participation in the 0/92-50/92 provisions or larger areas of flex acres not planted to program crops. Normal flex acres not planted accounted for 3.1 million acres in 1991 and 4.5 million in 1992.

The land idled by Federal programs decreased nearly 10 million acres from 1991 to about 55 million acres in 1992 (table 1, figure 1). In 1993, the total cropland idled by the CRP and annual crop programs is expected to be between 55 and 58 million acres. The expected increase from 1992 is due to changes in the ARP requirements and to expected levels of participation in the annual crop programs, including the 0/92-50/92 and other program provisions. Also, another 0.7 million acres of program crop base were tentatively accepted into the CRP for 1993. Still, if realized, the 1993 forecast of cropland idled by Federal programs would be the second smallest since 1986 (the year CRP enrollments began).

Figure 1

Major Uses of U.S. Cropland, 1972-93



Feed Grain Plantings Likely Down in 1993

Based on USDA's Prospective Plantings report, corn, sorghum, and barley acreage is expected to decline in 1993 from last year, while oats plantings may increase slightly. Plantings of all wheat are expected to be nearly identical with 1992.

Planting intentions published in *Prospective Plantings*, released March 31 by the National Agricultural Statistics Service (NASS) were derived from a survey of some 70,000 farm operators during the first 2 weeks of March. Although the total of planting intentions for all wheat is expected to equal last year's (table 2), durum wheat is likely to be down considerably, while winter wheat and other spring wheat are likely to be up somewhat in 1993. The increased oats plantings may

Table 2--Area of selected crops planted and harvested, 1984-92 and planting intentions, 1993

Selected crops	Area of selected crops planted and harvested									Planting intentions
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993 1/
	Million acres									
Selected crops planted:										
Corn	80.5	83.4	76.7	66.2	67.7	72.2	74.2	76.0	79.3	76.5
Sorghum	17.3	18.3	15.3	11.8	10.3	12.6	10.5	11.1	13.3	11.2
Oats	12.4	13.3	14.7	17.9	13.9	12.1	10.4	8.7	8.0	8.1
Barley	12.0	13.2	13.1	10.9	9.8	9.1	8.2	8.9	7.8	7.7
Total, feed grains 2/	122.2	128.2	119.8	106.8	101.7	106.0	103.3	104.7	108.4	103.5
All wheat	79.2	75.6	72.1	65.8	65.5	76.6	77.2	69.9	72.3	72.3
Cotton	11.1	10.7	10.0	10.4	12.5	10.6	12.3	14.1	13.3	13.4
Rice	2.8	2.5	2.4	2.4	2.9	2.7	2.9	2.9	3.2	3.1
Total, major program crops 2/	215.3	217.0	204.3	185.4	182.6	195.9	195.7	191.6	197.2	192.3
Soybeans	67.8	63.1	60.4	58.2	58.8	60.8	57.8	59.2	59.3	59.3
Peanuts	1.6	1.5	1.6	1.6	1.7	1.7	1.8	2.0	1.7	1.7
Sunflower	3.8	3.1	2.0	1.8	2.0	1.8	1.9	2.7	2.2	2.5
Dry edible beans	1.5	1.6	1.7	1.8	1.5	1.8	2.2	2.0	1.6	1.7
Sugarbeets	1.1	1.1	1.2	1.3	1.3	1.3	1.4	1.4	1.4	1.5
All hay 3/	61.4	60.4	62.4	60.1	65.1	63.3	61.4	62.5	59.6	60.3
Tobacco 3/	0.8	0.7	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8
Selected crops planted 2/	353.3	348.5	334.2	310.8	313.6	327.3	322.9	322.2	323.8	320.0
Selected crops harvested	331.0	326.5	307.8	285.8	286.5	302.4	305.7	301.2	304.7	298.4 4/
Percent of planted acres that were harvested	93.7	93.7	92.1	92.0	91.4	92.4	94.7	93.5	94.1	93.3
	Million hectares									
Selected crops planted:										
Corn	32.6	33.8	31.0	26.8	27.4	29.2	30.0	30.8	32.1	31.0
Sorghum	7.0	7.4	6.2	4.8	4.2	5.1	4.2	4.5	5.4	4.5
Oats	5.0	5.4	5.9	7.2	5.6	4.9	4.2	3.5	3.2	3.3
Barley	4.9	5.3	5.3	4.4	4.0	3.7	3.3	3.6	3.2	3.1
Total, feed grains	49.5	51.9	48.5	43.2	41.2	42.9	41.8	42.4	43.9	41.9
All wheat	32.1	30.6	29.2	26.6	26.5	31.0	31.2	28.3	29.3	29.3
Cotton	4.5	4.3	4.0	4.2	5.1	4.3	5.0	5.7	5.4	5.4
Rice	1.1	1.0	1.0	1.0	1.2	1.1	1.2	1.2	1.3	1.3
Total, major program crops	87.1	87.8	82.7	75.0	73.9	79.3	79.2	77.5	79.8	77.8
Soybeans	27.4	25.5	24.4	23.6	23.8	24.6	23.4	24.0	24.0	24.0
Peanuts	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.7	0.7
Sunflower	1.5	1.3	0.8	0.7	0.8	0.7	0.8	1.1	0.9	1.0
Dry edible beans	0.6	0.6	0.7	0.7	0.6	0.7	0.9	0.8	0.6	0.7
Sugarbeets	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
All hay 3/	24.8	24.4	25.3	24.3	26.3	25.6	24.8	25.3	24.1	24.4
Tobacco 3/	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Selected crops planted	143.0	141.0	135.3	125.8	126.9	132.5	130.7	130.4	131.0	129.5
Selected crops harvested	134.0	132.1	124.6	115.7	115.9	122.4	123.7	121.9	123.3	120.8 4/

1/ Source: National Agricultural Statistics Service, "Prospective Plantings," Cr Pr 2-4 (3-93). 2/ Distribution may not add to totals due to rounding. 3/ Area reported for these crops as planted acreage represents area harvested (1984-92) or intended for harvest (1993) as planted acreage is not reported for these crops. 4/ Forecast based on planting intentions and the historical relationship between planting intentions and the acreage of the selected crops harvested.

be for a cover crop on part of the increased corn ARP acres, as oats planted for harvest are expected to be down. For 14 of the principal crops, the aggregate of planting intentions is 320 million acres, down nearly 4 million acres from last year. Feed grains may be down almost 5 million acres from 1992 plantings. This decline is mostly from corn and sorghum acreage.

The 1992 sorghum acreage appeared to be unusually high in several States. More than 1 million acres of sorghum were planted on failed cotton acreage in Texas last year. Therefore, the 1993 sorghum planting intentions are close to the usual level. Also, corn can be planted on sorghum base acres without a loss of sorghum base. With sorghum prices weak relative to corn in recent months, some farmers are likely taking advantage of this option. Only minor changes in planting intentions, up and down, were reported for the other program crops.

For the seven other crops included in table 2, the aggregate planting intentions for 1993 were up 1.1 million acres (less than 1 percent) from 1992. Sunflower planting intentions, however, were up more than 12 percent from last year.

Higher ARP and CRP Acreage Expected

An additional 1.1 million acres were tentatively accepted into the CRP for 1993. This new CRP land, plus higher ARP's for corn and rice, is expected to result in a slight increase in cropland idled in Federal programs in 1993.

An estimated 55-58 million acres of cropland will likely be idled under Federal programs this year, up as much as 3 million from 1992 (table 3). Of this forecast increase, more than 1 million acres is land newly accepted, tentatively, into the CRP for 1993. More than 60 percent of the cropland forecast to be idled by Federal programs in 1993 is enrolled in the CRP.

Reversing the downward trend in program-idled acres between 1987 and 1992, more acres are forecast to be idled by annual crop programs in 1993 than in 1992 (table 3). However, except for last year, fewer acres are forecast to be idled in annual programs in 1993 than any year since 1982. In addition to the increase in land idled by annual programs, nearly 0.7 million of the 1.1 million tentatively accepted into the CRP were base acres of program crops. The 42-45 million base acres forecast to be idled in annual programs and the CRP in 1993, if realized, would be the second fewest since the CRP began in 1986.

All acreage enrolled in the CRP must remain idle for the full 10-year life of the contract. Base acreage in the CRP is preserved and could become eligible for program participation at the end of the contract. However, it could also remain idle without loss of base after expiration of the CRP contract under provisions of the 1990 farm act. A more detailed description of CRP enrollments is presented later in this report.

Commodity Acreage Reduction Requirements

Feed grains In 1993, there are three different ARP requirements among the four feed grain crops, unlike recent years when all except oats had the same requirements (table 4). Participation in the corn program requires a 10-percent ARP, sorghum, 5 percent, and barley and oats, zero percent for 1993.

The ARP requirements for feed grains have varied considerably over the last 4 crop years, generally trending down with the exception of corn this year. This is the result of an expected doubling of ending stocks in the 1992/93 marketing year, compared with the previous year. The 1992/93 projected yearend stocks are the largest since 1987/88, as is the total supply. As a result, the yearend stocks doubled in spite of slight increases in domestic uses and exports. The higher corn ARP for 1993, in conjunction with other program provisions for each of the feed grain crops, may result in increased feed grain base idling of up to 4 million acres above the 20.8 million idled in 1992 (including the CRP).

Wheat There is a zero ARP for participating wheat growers in 1993. The ARP requirements have decreased over the last 3 crop years, but were high in 1991 compared to 1989 and 1990 (table 4). The pattern of ARP requirements reflects the ending stocks of wheat in the preceding marketing year. With the decline in ARP and possible participation in other program provisions, wheat base idled may decline 2-3 million acres from the 17.9 million acres idled last year in the annual programs and the CRP.

Cotton Participation in the upland cotton program in 1993 requires the idling of 7.5 percent of base acres. The cotton ARP requirements have fluctuated considerably in recent years, but are generally lower than 3 or more years ago. Although domestic use has been up in the last 2 years, it has not offset declining exports. As a result, ending stocks have increased annually since 1990/91. With the decline in ARP, and the very small increase indicated in planting intentions for cotton, a decrease of less than 0.3 million base acres idled would be expected from the 3.1 million idled last year.

Rice The 1993 rice program has a 5-percent ARP requirement, the same as in 1991 (table 4). However, to be eligible for loans, purchases, and payments for the 1993 crop, rice producers must not plant more than their base acreage plus possible plantings on flex acres of other program crops. The eligible cropland acreage retired under the ARP must equal

Table 3--Cropland idled under Federal acreage reduction programs, United States, 1984-93

Program and crop	1984	1985	1986	1987	1988	1989	1990	1991	1992 1/	1993 Forecast
					Million acres					
Annual programs, base acres:										
Corn	3.9	5.4	14.2	23.2	20.5	10.8	10.7	7.4	5.2	NA
Sorghum	0.6	0.9	2.9	4.1	3.9	3.3	3.3	2.4	2.0	NA
Barley	0.5	0.7	2.0	3.0	2.8	2.3	2.9	2.1	2.3	NA
Oats	0.1	0.1	0.5	0.8	0.3	0.3	0.2	0.5	0.6	NA
Wheat	18.6	18.8	21.0	23.9	22.5	9.6	7.5	15.6	7.3	NA
Cotton	2.5	3.6	4.0	3.9	2.2	3.5	2.0	1.2	1.7	NA
Rice	0.8	1.2	1.5	1.6	1.1	1.2	1.0	0.9	0.4	NA
Total, annual programs 2/	27.0	30.7	46.1	60.5	53.3	30.9	27.7	30.1	19.5	19-22
Conservation Reserve Program, base acres: 3/										
Corn			0.2	2.3	2.8	3.4	3.8	3.9	4.1	4.3
Sorghum			0.2	1.2	1.9	2.2	2.4	2.4	2.4	2.5
Barley			0.1	1.1	1.9	2.4	2.7	2.8	2.8	2.8
Oats			0.1	0.5	0.9	1.1	1.3	1.3	1.4	1.4
Wheat			0.6	4.2	7.1	8.8	10.3	10.4	10.6	10.9
Cotton			0.1	0.7	1.0	1.2	1.3	1.3	1.4	1.4
Rice			4/	4/	4/	4/	4/	4/	4/	4/
Total, Conservation Reserve Program base acres 2/			1.2	10.0	15.5	19.0	21.8	22.0	22.6	23.3
Total base acres idled 2/	27.0	30.7	47.4	70.5	68.8	49.9	49.5	52.1	42.1	42.3-45.3
Total, nonprogram CRP acres idled			0.7	5.7	8.9	10.9	12.1	12.4	12.8	13.2
Cropland idled under Federal acreage reduction programs	27.0	30.7	48.1	76.2	77.7	60.8	61.6	64.5	54.9	55.5-58.5
					Million hectares					
Annual programs:										
Corn	1.6	2.2	5.7	9.4	8.3	4.4	4.3	3.0	2.1	NA
Sorghum	0.2	0.4	1.2	1.7	1.6	1.3	1.3	1.0	0.8	NA
Barley	0.2	0.3	0.8	1.2	1.1	0.9	1.2	0.8	0.9	NA
Oats	5/	5/	0.2	0.3	0.1	0.1	0.1	0.2	0.2	NA
Wheat	7.5	7.6	8.5	9.7	9.1	3.9	3.0	6.3	3.0	NA
Cotton	1.0	1.5	1.6	1.6	0.9	1.4	0.8	0.5	0.7	NA
Rice	0.3	0.5	0.6	0.6	0.4	0.5	0.4	0.4	0.2	NA
Total, annual programs 2/	10.9	12.4	18.7	24.5	21.6	12.5	11.2	12.2	7.9	7.7-8.9
Conservation Reserve Program: 3/										
Corn			0.1	0.9	1.1	1.4	1.5	1.6	1.7	1.7
Sorghum			0.1	0.5	0.8	0.9	1.0	1.0	1.0	1.0
Barley			5/	0.4	0.8	1.0	1.1	1.1	1.1	1.1
Oats			5/	0.2	0.4	0.4	0.5	0.5	0.6	0.6
Wheat			0.2	1.7	2.9	3.6	4.2	4.2	4.3	4.4
Cotton			5/	0.3	0.4	0.5	0.5	0.5	0.6	0.6
Rice			4/	4/	4/	4/	4/	4/	4/	4/
Total, Conservation Reserve Program 2/			0.5	4.0	6.3	7.7	8.8	8.9	9.1	9.4
Total base acres idled 2/	10.9	12.4	19.2	28.5	27.8	20.2	20.0	21.1	17.0	17.1-18.3
Total, nonprogram CRP acres idled			0.3	2.3	3.6	4.4	4.9	5.0	5.2	5.3
Cropland idled under Federal acreage reduction programs	10.9	12.4	19.5	30.8	31.4	24.6	24.9	26.1	22.2	22.5-23.7

NA = Not available.
1/ Preliminary. 2/ Because of rounding, crop acreages may not sum to the totals. Base acres idled under 0/92 and 50/92 programs from 1986 through 1992 are included in annual program data. However, base acres of feed grains and wheat enrolled in 0/92 and planted to oilseeds in 1991 (0.5 million acres) and in 1992 (0.7 million acres) are not included. 3/ Program began in 1986. Small acreages of peanut and tobacco base were bid into the CRP in addition to the crops listed. 4/ Less than 50,000 acres or 20,235 hectares. 5/ Greater than 20,235 hectares (50,000 acres),

5 percent of a participating farm's rice acreage base. With only a slight drop in planting intentions from last year's planted acreage, the increased ARP would infer an increase in idled base--likely less than 0.2 million acres.

Table 4--Acreage Reduction Program (ARP) requirements for participation by major program crops, 1987-93

Program crops	Proportion of acreage base to be idled						
	1987	1988	1989	1990	1991	1992	1993
				Percent			
Feed grains:							
Corn	20	20	10	10	7.5	5	10
Sorghum	20	20	10	10	7.5	5	5
Oats	20	5	5	5	0	0	0
Barley	20	20	10	10	7.5	5	0
Wheat	27.5	27.5	10	5	15	5	0
Upland cotton	25	12.5	25	12.5	5	10	7.5
Rice	35	25	25	20	5	0	5

Irrigation, Nation's Largest Water Use

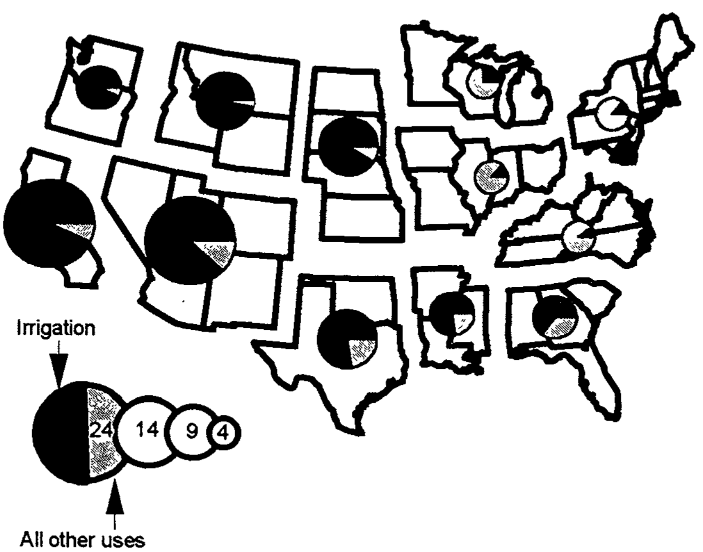
Irrigated agriculture accounts for the greatest share of U.S. freshwater consumptive use, but competition from other sectors is increasing.

Consumptive use of freshwater withdrawn from ground and surface sources in the United States totaled about 105 million acre-feet [1] in 1990 (U.S. Geological Survey). The amount of water consumed varies widely across regions, from less than 2 million acre-feet (maf) in the Appalachian region to over 23 maf in the Southern Pacific region (California). For each region, the amount of water consumed in nonirrigation activities lies within a relatively narrow range of 0.5 to 3 maf. In contrast, regional irrigation water consumption ranges from 0.2 to 22 maf, reflecting wide variation in irrigated area and climate. Thus, variability in regional water use is due largely to differences in irrigation water use.

Irrigation accounts for 85 maf, or 81 percent, of the Nation's total freshwater consumption (figure 2). Regionally, irrigation water consumption ranges from 0.2 maf in Appalachia to 21.9 maf in the Southern Pacific. Irrigation's share of total water use is highest in the Northern Mountain region (97 percent) followed by the Northern and Southern Pacific (each at 93 percent) and the Northern Plains (91 percent).

[1] An acre-foot equals an acre of land covered to a depth of 1 foot, or 325,851 gallons. Consumptive use is water lost from the immediate water environment through evaporation, plant transpiration, incorporation into products or crops, or consumption by humans or livestock. It does not measure withdrawals from a water source or nonconsumptive uses, such as hydropower and instream habitat.

Figure 2
Water Consumption in Irrigation and Others Uses, 1990



Value and corresponding circle size represent maximum consumptive use in million acre-feet.

Source: U. S. Geological Survey

Figure 2 clearly shows the dominance of irrigation as the primary consumptive water use in the West, accounting for 90 percent of the area total. Irrigation accounts for half of all water use in the East, with the greatest use in the Southeast and Delta regions. The potential for water supply conflicts involving agriculture is no longer a "western" problem as irrigation increases in humid areas.

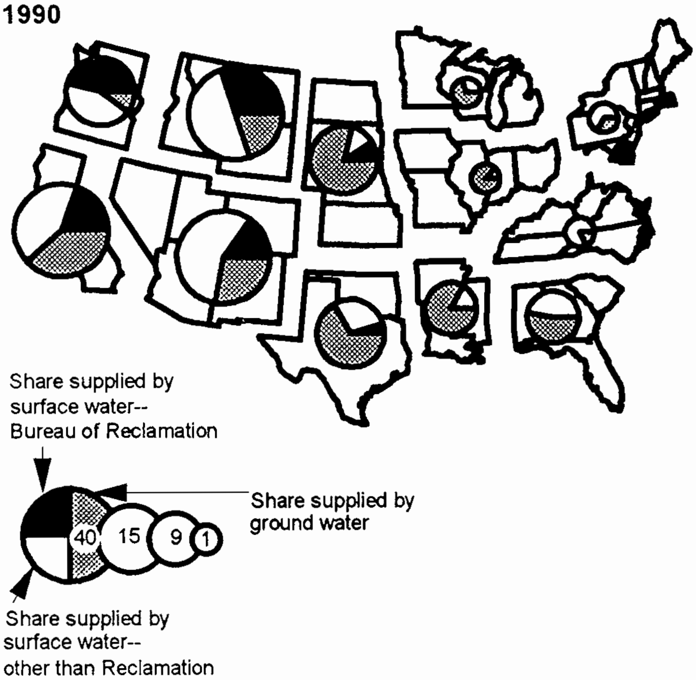
Total water withdrawn for irrigation purposes in 1990 was estimated at 152 maf by the U.S. Geological Survey (USGS). This exceeds the amount of water actually consumed in irrigation by the quantity returned to the water environment (67 maf, or 44 percent of withdrawals). Irrigation return flows may involve runoff to surface water sources or deep percolation to ground water sources. Return flows may be available for other uses depending on hydrologic conditions, which are often complex and site-specific. Availability and useability of return flows are influenced by the location of return flows relative to the initial point of withdrawal, time lags ranging from hours to decades, and changes in water quality from water-soluble chemicals and compounds.

Surface water is the primary source of U.S. irrigation withdrawals (63 percent) and dominates in the far West, Northeast, and Appalachia. Ground water is the primary source in the Plains States, Midwest, and Southeast, supplying the remaining 37 percent of irrigation withdrawals (figure 3).

The federally financed Bureau of Reclamation provides about one-third of irrigation's total surface water supply, all in the West (figure 3). Reclamation's regional share of surface irrigation withdrawals is greatest in the Northern Pacific region, providing 51 percent of the total surface water supply. Reclamation's share of total surface irrigation supplies is also significant in the Northern Plains, Northern Mountain, Southern Pacific, and Southern Mountain regions at 45, 37, 32, and 21 percent, respectively.

Figure 3

Irrigation Water Withdrawals by Major Water Source, 1990



Values and corresponding circle size represent maximum irrigation water withdrawals in million acre-feet.

Source: U. S. Geological Survey and U. S. Bureau of Reclamation

Because irrigated agriculture is the dominant water user, significantly increased water demands for urban and industrial needs, environmental uses, and reserved rights of Federal and Native American lands will require irrigation water conservation and reallocation. Responsibility for facilitating policy change to promote water conservation, and institutional modifications that allow water reallocation, will vary depending on geographic location and water source. For example, Federal reform of Reclamation water pricing and allocation policy would have the greatest impact on Western irrigators relying on Reclamation water (see box below). Policy actions involving ground water and non-Reclamation surface water will require action at the individual State level. Assistance for improved on-farm water conservation practices that may reduce water withdrawals for irrigation is provided through both State and Federal programs.

Reference

Solley, W.B, R.R. Pierce, and H.A. Perlman. *Estimated Use of Water in the United States in 1990.* U.S. Geological Survey Circular 1081, pp.69, 1993.

Federal Policies Alter Water Delivery Priorities in California

In 1992, the Central Valley Project Improvement Act (CVPIA) was enacted as part of U.S. Public Law 102-575. CVPIA represents a dramatic departure from previous Federal law, by specifically providing water for fish and wildlife purposes, increasing water prices, shortening contract terms, and permitting transfers of federally supplied water to areas outside the project service area. The provisions of CVPIA are advocated by some as necessary to meet expanding nonagricultural water demands in the West.

The Central Valley Project (CVP) is one of 191 federally financed Bureau of Reclamation projects supplying water for irrigation and other purposes in the West. The CVP provides all or part of the water for 2.2 million irrigated acres in California's Central Valley. The CVPIA requires that a minimum of 800,000 acre-feet of CVP water be allocated for fish and wildlife purposes, above current wildlife refuge deliveries.

The early April water delivery forecast for the northern CVP was of 5.3 million acre-feet (maf) to traditional users (farms, cities, and several wildlife refuges), after meeting the requirements of CVPIA. This year, CVP water deliveries will be reduced, not because of water allocated for fish and wildlife under the CVPIA, but because of drought-limited reservoir storage and operational restrictions imposed by the Endangered Species Act. The drought-ending wet winter in California significantly reduced the need to restrict agricultural supplies to provide the reserved fish and wildlife water relative to last year, when only 3.6 maf were delivered through the northern CVP system.

One goal of the CVPIA is to restore wildlife and fish habitat in the Central Valley, with minimal disruptions in water supplies for irrigated agriculture and other sectors. As this is the first irrigation season since passage, the effects of CVPIA remain uncertain for both traditional water users and river habitat. Whether the CVPIA can serve as a blueprint for reform of other Reclamation projects depends, in part, on improvements in habitat quality and the magnitude and consequences of agricultural water delivery reductions.

Spring Soil Moisture Conditions Generally Favorable

The long-term drought in the West has receded except in areas of the Northwest. Spring topsoil moisture conditions were favorable in much of the East.

By early May, soil moisture conditions had improved across much of the western United States (figure 4). Above-normal winter snow and spring rainfall significantly reduced both the total area and intensity of the western drought relative to a year ago. Drought conditions have been alleviated in the central Mountain States and much of California and Nevada, following 6 consecutive dry years. Unusually dry conditions continue, however, in areas of the Pacific Northwest, Northern Mountain, and Northern Plains regions.

Drought conditions reported here are based on the Palmer Drought Severity Index (PDSI), which measures long-term abnormal dryness or wetness. The PDSI reflects the general status of water supplies over the recent past (months/years) in terms of runoff, aquifer recharge through deep percolation, and evapotranspiration. The PDSI responds slowly to current precipitation and may not fully represent crop root-zone moisture or field conditions.

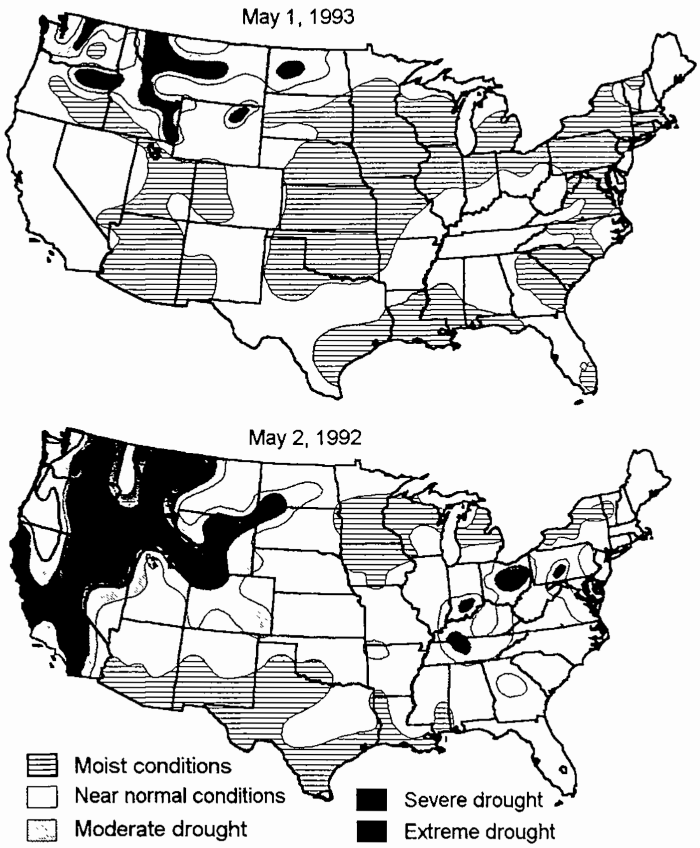
In the West, unusually wet conditions are occurring again this spring in Arizona, New Mexico, and along the Texas coast, with expansion of moist conditions through much of the Central Plains (figure 4). While early growing-season topsoil moisture conditions were adequate across major small grain and cotton regions, heavy rainfall delayed field preparation and planting in many areas, particularly in the Plains.

In the East, early-season soil moisture conditions were generally favorable. Localized drought conditions in the Corn Belt, Mid-Atlantic and Southeast regions at the start of the 1992 cropping season have disappeared. Moist conditions now exist in areas of the Midwest, Delta and east coast States. Excessive rains have hampered planting of corn and other crops in much of the East, especially in the Corn Belt. Continued wet conditions could reduce yields due to disease, waterlogging, limited field access, and a shorter growing season.

Farm Response to Moisture Conditions

Early-season soil moisture is an important factor affecting farm production decisions. In rainfed production regions, crop selection, acreage planted, tillage operations, seeding rates, and other management decisions are based on early-season soil moisture levels. Low subsoil moisture increases the risk of poor germination, yield loss and crop failure in rainfed production regions, as dependency on amount and timeliness of seasonal rains increases. Irrigated production regions are generally less affected by rainfall shortages, because adequate irrigation water supplies to meet soil moisture deficits help to ensure normal crop production in dry years. However, prolonged drought may affect irrigated production through reduced water storage and interruptions in irrigation water service.

Figure 4
Drought-Affected Areas Based on Palmer Drought Index, 1993 and 1992



Source: NOAA/USDA Joint Agricultural Weather Facility.

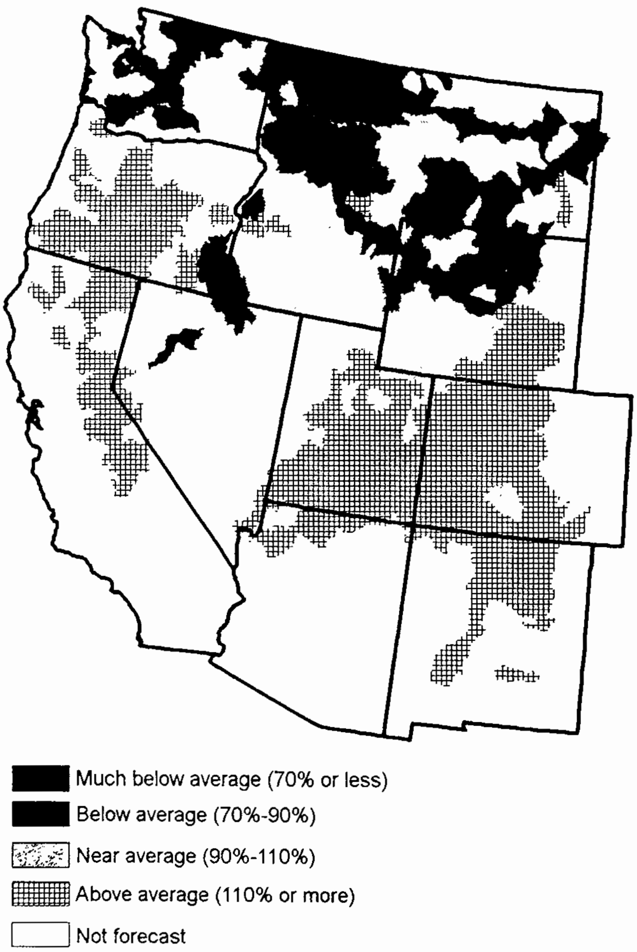
Surface Water Supplies for Irrigation Improve in the West

Heavy winter precipitation improved streamflow prospects and replenished many reservoirs supplying irrigation water, although reservoir storage remains below normal in most Western States.

Agricultural production in the arid West would be greatly curtailed without access to surface water for irrigation, which is made possible through extensive water storage and conveyance facilities. Of approximately 37 million irrigated acres in the 17 Western States, roughly 50 percent are partially or fully supplied by surface water. Surface water supplies include both direct stream diversions and releases of stored water from reservoirs to augment natural streamflow. The western reservoir system is carefully regulated to capture and store water (primarily snowpack runoff) during spring high flow periods and wet years. Stored water is distributed during peak seasonal demand periods and is used to supplement flows in dry years for irrigation, urban, industrial, and instream uses.

Figure 5

Western Streamflow Forecast for Summer 1993, As of May 1



Source: NOAA/USDA Water Supply Outlook.

Streamflow Forecast Improved

This summer's streamflow forecast has improved for most regions of the West (figure 5), following several years of well-below-normal flows in many basins. The National Weather Service and the Soil Conservation Service estimate streamflow based on spring flows, observed snowpack, and normal summer rainfall. Above-normal summer streamflow forecasts are projected for drainage basins arising in the Southern Rockies, Sierra Nevadas, and the Pacific Coast ranges. Irrigators relying on direct stream diversions in these river basins should have adequate water supplies. Streamflow forecasts remain below normal, although somewhat improved, in the Upper Missouri and Columbia River Basins.

Reservoir Levels Remain Low

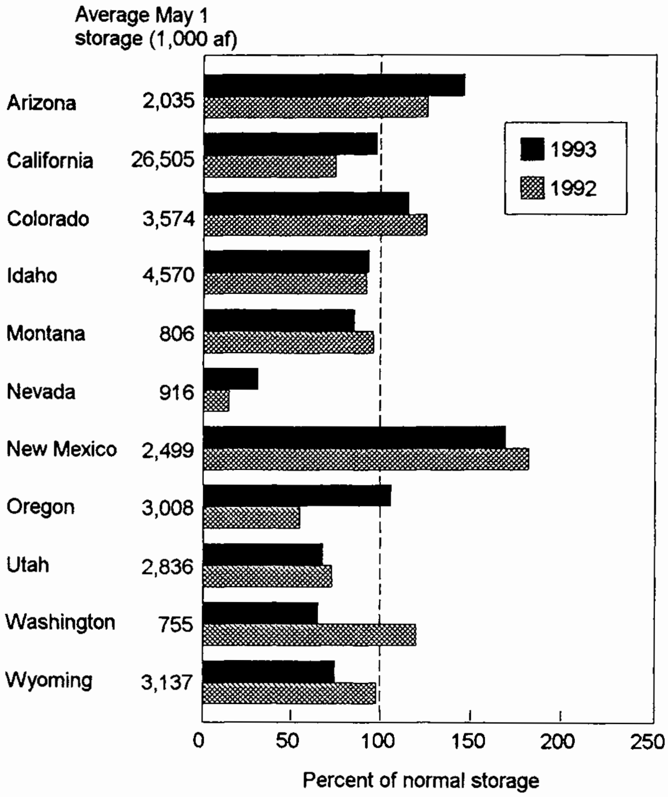
Reservoir levels in early May reflect the varied multiyear precipitation patterns and somewhat improved streamflow conditions. Above-average water storage in impoundments supplying irrigation in New Mexico, Arizona, and Colorado is attributable to several years of above-normal runoff in the Southern Rockies (figure 6). Acute shortages of stored water are reported in Nevada, where successive drought years have left reserves at only 30 percent of normal, although higher than last year's levels. Storage reserves in California and Oregon, which were seriously depleted by drought, have increased significantly. Oregon levels are slightly above normal and California levels are 96 percent of normal.

Storage declined from last year's levels in Montana, Utah, Washington, and Wyoming, and now range from 65 to 85 percent of normal. Since snowmelt provides most of the runoff, it is unlikely that storage levels in deficit States will improve significantly this year. Due to successive years of drought, irrigators relying on stored water supplies in 1993 may not receive their normal entitlement, despite projected streamflow of normal or above in many areas.

Impacts of Low Surface Water Supplies

Irrigators affected by short-term reductions in water deliveries may respond in various ways, including: substitution of more expensive ground water; reductions in acreage planted to intensive water-using crops; reductions in total acres irrigated; partial irrigation applications; and increases in water-use efficiency with improved system management. Impacts will vary by producer, depending primarily on the availability and cost of ground water and surface water supplies from emergency sources.

Figure 6
Surface Water Storage Conditions, Western States, May 1



Source: USDA/SCS Central Forecast System and California Department of Water Resources.

Nonagricultural industries are also affected by limited surface water supplies. Reduced hydroelectric power generation in affected basins may result in higher electricity costs as hydropower is replaced by more costly thermoelectric sources. At the same time, power demands may increase with substitution of pumped ground water for surface water. Reduced surface water supplies can have a direct impact on water-based recreation, with implications for many State and local economies. Low water supplies could also restrict barge navigation, which is used as a low-cost means to transport fertilizers, grains, and other bulk items needed or produced by agriculture. Reduced runoff in the upper Missouri basin limited the downstream barge season in recent years.

Reduced surface water supplies have significant consequences for fish, waterfowl, and other wildlife. Perhaps nowhere in the West is the debate over environmental impacts of traditional river allocations more pitched than in the Pacific Northwest. Wild salmon populations in the Columbia-Snake River Basin have declined dramatically because of structural and velocity flow restrictions due to hydropower, upstream habitat loss, overharvesting, disease, predation, and other factors. Recent listing of several salmon subspecies under the Endangered Species Act has prompted Federal, State, and public interest groups to press more vigorously for a reallocation of river flows. Continued drought in the Northwest intensifies pressures on salmon recovery, and may lead to further restrictions on water supplies for irrigation and other uses.

Water Supply Summary

Projected agricultural water supply conditions are favorable for much of the Nation, and likely the best in 5 years. Heavy winter precipitation replenished soil reserves and stored surface water supplies in California and the Central Rockies, helping to relieve persistent drought conditions in those areas. However, below-normal summer streamflow and reservoir storage are expected for areas of the Pacific Northwest, Northern Rockies, and Northern Plains, reducing water supplies for irrigation and other uses. For these areas, several years of "normal" precipitation are required to replenish water storage to near-normal levels.

While drought has been alleviated in most areas, consecutive drought years have left an enduring impact in the policy arena. The prospect of reduced water supplies has focused attention on traditional management priorities of irrigation, power generation, and navigation, in light of emerging demands for municipal, recreation, and environmental uses.

For Western irrigated agriculture, restrictions on surface water supplies will likely force changes in traditional irrigation practices, with greater emphasis on water conservation and increased reliance on ground water reserves. In fact, some California irrigators will adjust practices this year because of reduced surface water deliveries to meet environmental needs (see box on page 10). Pressures for structural adjustment of the Western water allocation system are likely to continue, if not intensify, in the foreseeable future.

Irrigated Acreage, Water Use Steady

Total irrigated area on U.S. farms is not expected to change, as continuing adoption of irrigation in the East is offset by limited water supplies in the West and higher set-aside requirements.

Irrigated land in farms is forecast to be 52.8 million acres this year, unchanged from the revised estimate for 1992. Soil moisture conditions have improved dramatically in the Southwest, but tight water allocations may contribute to another year of declining irrigated area as the Southwest continues to adjust. Based on the 1993 March *Prospective Plantings* report, about 15 States will set new records for area irrigated. Only three States in the West made the list. Western water supplies for irrigation continue to be limited by drought across the Northwest and low reservoir levels in most Western States.

Increases in irrigation come from reduced set-aside requirements for wheat, barley, and cotton; from improved wheat and oat prices; and from continuing adoption of irrigation in the Northern Plains and Eastern States. This has been offset by increased set-aside requirements for corn and rice, weaker prices for several crops, and further adjustment to limited water supplies resulting from the western drought. If improved soil moisture conditions persist across most of the East, forecasts of irrigated area are likely to be adjusted down as the season progresses.

The improved soil moisture conditions will also affect water application rates, especially in Eastern States, where irrigation is supplemental. There is no indication from regional and crop mix adjustments in irrigated areas of a change in total water use, but improved soil moisture and continuing gains in irrigation efficiency suggest that the average application rate is likely to be no more than the 1.8 acre-feet forecast for 1993.

Long-Run Trend Has Been Up

At 52.8 million acres (table 5), the revised estimate for 1992 is up 6.4 million acres from 1987, a year in which irrigation was reduced by near-record cropland diversions. The year 1987 is also the most recent for which statistics are available from the Census of Agriculture. Reports from the 1992 Census become available over the coming year and are expected to show irrigation exceeding the previous Census-year record in 1978 by about 2.5 million acres. Since 1969, irrigated land in farms has increased by one-third.

Regional Irrigation Trends Differ

Not all regions shared equally in the expansion of irrigated area. Since 1978, irrigation increased in the Northern Plains and all eastern regions, but decreased in the Southern Plains and western regions. While most States set new records in the past 2 or 3 years, States of the arid Southwest, from Texas to California, experienced either lingering effects of the drought or a continuing pattern of decline begun a decade earlier. Irrigated areas in Southwest States have ebbed at least 10 percent and by as much as one-third from previous highs. Florida irrigation followed the same pattern and declined more than 15 percent. Colorado, Utah, and States across the North-

Table 5--Irrigated land in farms, 1969-93, by region

Region	1969 1/	1974 1/	1978 1/	1982 1/	1987 1/	1989 2/	1990 2/	1991 2/	1992 3/	1993 4/
					Million acres					
Northeast, Appalachian, & Southeast	1.8	2.0	2.9	2.7	3.0	3.2	3.4	3.3	3.4	3.4
Lake States & Corn Belt	0.5	0.6	1.4	1.7	2.0	2.3	2.2	2.5	2.8	2.7
Northern Plains	4.6	6.2	8.8	9.3	8.7	9.7	9.8	10.1	10.7	10.6
Delta States	1.9	1.8	2.7	3.1	3.7	4.2	4.6	4.8	5.4	5.4
Southern Plains	7.4	7.1	7.5	6.1	4.7	5.3	5.5	5.7	5.4	5.3
Mountain	12.8	12.7	14.8	14.1	13.3	14.5	14.6	14.3	14.3	14.5
Pacific	10.0	10.6	12.0	11.9	10.8	11.5	11.4	10.8	10.7	10.8
United States 5/	39.1	41.2	50.4	49.0	46.4	50.9	51.6	51.7	52.8	52.8
					Million hectares					
Northeast, Appalachian, & Southeast	0.7	0.8	1.2	1.1	1.2	1.3	1.4	1.4	1.4	1.4
Lake States & Corn Belt	0.2	0.2	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.1
Northern Plains	1.9	2.5	3.6	3.7	3.5	3.9	4.0	4.1	4.3	4.3
Delta States	0.8	0.7	1.1	1.3	1.5	1.7	1.9	1.9	2.2	2.2
Southern Plains	3.0	2.9	3.1	2.5	1.9	2.2	2.2	2.3	2.2	2.2
Mountain	5.2	5.1	6.0	5.7	5.4	5.9	5.9	5.8	5.8	5.9
Pacific	4.0	4.3	4.9	4.8	4.4	4.7	4.6	4.4	4.3	4.4
United States 5/	15.8	16.7	20.4	19.8	18.8	20.6	20.9	20.9	21.4	21.3

1/ Census of Agriculture. 2/ Revised estimates constructed from several unpublished USDA sources and the Census of Agriculture. 3/ Preliminary estimates. 4/ Forecast. 5/ Includes Alaska and Hawaii.

west (where the drought persists) were down moderately from more recent peaks.

In contrast, the Northern Plains was up a fifth from levels reported in the 1987 census. Further east, the growth in irrigation has been more dramatic. Corn Belt irrigation was up about 50 percent from the last Census, as was irrigation in the Delta States. The Lake States were up about 25 percent. The Southeast was up 10 percent in spite of the no-growth situation in Florida, the region's dominant irrigation State. The revised estimates for irrigated land in farms in 1992 were up from 1987 by one-third in the Appalachian States and about 6 percent in the Northeast.

Water Use Up

In about 2 years, data from the 1993 Farm and Ranch Irrigation Survey become available and are expected to indicate continuing gains in efficiency of water use, especially in the drought-affected West. Based on application rates reported in the 1988 Farm and Ranch Irrigation Survey and changes in irrigated crop areas since then, the Nation's farmers will use 15 percent less water per acre irrigated than 24 years earlier.

In 1969, 2.09 acre-feet (a.f.) of water were used for every acre of farmland irrigated (table 6). With rapid expansion of supplemental irrigation outside the desert Southwest, where application rates are highest, and with declines in application rates in most Western States, the National average application rate has fallen to 1.8 a.f.

Rates in the Southwest range from 1.5 a.f. in Texas to 4.5 a.f. in Arizona. In the Southwest, the trend in crop mix to rice, alfalfa, and other crops requiring more water per acre has offset efficiency gains. Averaging across crops, rates have increased for California, Nevada, and Arizona in the far Southwest and for Texas. In all other States west of the Mississippi average rates have declined since 1969.

Application rates across the Northwest, ranging from 1.07 in South Dakota to 2.0 a.f. in Idaho, have declined significantly. The expansion in Northwest irrigation coincided with the availability of sprinkler technologies that tend to be more efficient than the gravity feed systems previously adopted in the Southwest. In contrast, application rates in all but a few Eastern States ranged from .3 to .7 a.f. in 1969 and have since increased substantially.

Farmers' efforts to become efficient water users should not be judged by application rates alone. Crop yields on irrigated land have generally increased 10-50 percent since 1969. Higher yielding crops usually require more water. Efficiency gains in terms of water volume applied per unit of produce are impressive.

When applied by crop to irrigated areas, the application rates suggest that about 95 million a.f. of water were used to irrigate farmland in 1990. This figure differs from that reported by USGS for 1990 (figure 3). However, adjustments for differences in definition remove most of the discrepancy. Adjustments of the USGS estimate for conveyance losses, irrigation on park areas and golf courses, and other differences in estimated area irrigated bring the USGS estimate within 10 percent of ERS estimates. The remaining difference can not be explained directly but could include adjustments to regional weather conditions between 1988 and 1990 (not accounted for in the ERS estimates) and the fact that error exists in both estimates.

Table 6--Average depth and volume of irrigation water applied on farms, 1969-93, by region

Region	1969 1/	1974 1/	1979 2/	1984 2/	1988 2/	1989 3/	1990 3/	1991 3/	1992 3/	1993 4/
	Depth (feet)									
Northeast, Appalachian, & Southeast	0.68	0.95	1.26	1.37	1.26	1.25	1.24	1.22	1.22	1.22
Lake States & Corn Belt	0.56	0.66	0.80	0.77	0.86	0.85	0.84	0.85	0.86	0.86
Northern Plains	1.37	1.45	1.29	1.14	1.19	1.19	1.19	1.19	1.19	1.19
Delta States	1.30	1.49	2.15	1.47	1.48	1.43	1.43	1.42	1.47	1.46
Southern Plains	1.41	1.50	1.43	1.39	1.43	1.44	1.40	1.40	1.43	1.43
Mountain	2.48	2.36	1.99	2.04	2.06	2.04	2.04	2.05	2.05	2.03
Pacific	2.74	2.89	2.67	2.80	2.86	2.81	2.80	2.82	2.82	2.82
United States 5/	2.07	2.09	1.89	1.86	1.88	1.85	1.83	1.81	1.80	1.80
	Volume (million acre-feet)									
Northeast, Appalachian, & Southeast	1.2	1.9	3.7	4.1	4.0	4.0	4.2	4.1	4.2	4.2
Lake States & Corn Belt	0.3	0.4	1.2	1.5	1.8	1.9	1.8	2.1	2.4	2.3
Northern Plains	6.3	9.0	11.7	10.7	10.5	11.5	11.7	12.1	12.7	12.6
Delta States	2.4	2.7	5.2	4.9	6.3	6.1	6.6	6.8	8.0	7.8
Southern Plains	10.5	10.7	10.5	8.4	7.3	7.7	7.7	8.0	7.7	7.6
Mountain	31.8	30.0	29.2	29.0	28.2	29.6	29.9	29.3	29.2	29.4
Pacific	27.4	30.7	32.5	32.4	32.2	32.4	32.0	30.4	30.2	30.4
United States 5/	81.1	86.4	94.9	91.9	91.3	94.1	94.8	93.7	95.2	95.2

1/ Census of Agriculture. 2/ Estimates constructed from the Farm and Ranch Irrigation Survey estimates of application rates and ERS estimates of irrigated acreage. 3/ Estimates constructed by interpolating State/crop application rates between FRIS years and accounting for area changes in crop irrigation. Application rates since 1988 are assumed to be unchanged. 4/ Forecast. 5/ Includes Alaska and Hawaii.

Conservation Promoted by Various USDA Programs

New programs under the Water Quality Initiative and recent farm acts, as well as longstanding USDA assistance and research programs, are working to conserve soil, water, and other natural resources and improve their quality.

Water Quality Initiative Activities

- **Educational, technical, and financial assistance** is directed to selected demonstration, hydrologic unit area, and water quality projects and national estuaries to accelerate the adoption of water quality protection practices by farmers.

- **Special research and development efforts** are developing and identifying technology and production systems that reduce the environmental effects of agricultural chemical use. Efforts include Management System Evaluation Areas and special research grants.

- **Database development and evaluation activities** include collection of survey data from farmers on pesticide and nutrient use on major crops in conjunction with current farming practices, and analysis of the economic and environmental impacts of implementing water quality practices and programs in the various projects and evaluation areas.

Provisions of 1985 and 1990 Farm Acts

- **Conservation Reserve Program (CRP)** allows farmers to voluntarily retire from crop production highly erodible or environmentally sensitive cropland for a 10-to 15-year period. In exchange, participants receive annual rental payments up to $50,000 and 50 percent cost share assistance for establishing vegetative cover on the land.

- **Conservation compliance provision** requires farmers with highly erodible cropland to have an approved conservation plan on that land and to fully implement the plan by January 1, 1995, to maintain eligibility for USDA program benefits.

- **Sodbuster provision** requires that, in order to be eligible for USDA program benefits, farmers who convert highly erodible land to commodity production must have an approved conservation system on that land.

- **Swampbuster provision** states that farmers who convert wetlands for, or to make possible, the production of an agricultural commodity are ineligible for USDA program benefits, unless there is a determination that conversion would have only a minimal effect on wetland hydrology and biology.

- **Wetlands Reserve Program (WRP)** provides easement payments and cost sharing to farmers who return farmed or converted wetland back into a wetland environment on a permanent or long-term basis. Payments cannot exceed the fair market value of the land less the value of permitted uses, such as hunting, fishing, managed timber harvest, or periodic haying and grazing. Up to 1 million acres may be enrolled in the program by 1995.

- **Water Quality Incentives Projects (WQIPs)** provide annual incentive payments up to $3,500 per year for 3-5 years to farmers who implement a USDA-approved water quality resource management plan.

- **Environmental Easement Program,** when funds are appropriated for its implementation, will provide annual payments for up to 10 years and up to 100 percent cost sharing to farmers who agree to deed restrictions that provide long-term protection to environmentally sensitive land. Payments cannot exceed $50,000 annually and can total no more than $250,000 per farm.

- **Integrated Farm Management Program** assists producers in adopting farm resource-management plans to conserve resources and comply with environmental requirements. Participants devote at least 20 percent of their enrolled crop-acreage bases to resource-conserving crops such as legumes or legume-grass-small grain mixtures, without losing crop acreage bases and reducing farm program yields. Unlimited haying or grazing may occur on up to 50 percent of the resource-conserving crops on Acreage Conservation Reserve lands. Other haying and grazing provisions further increase producers' options. The program's goal is to have 3-5 million acres enrolled by 1995.

- **Farmland Protection provision** stipulates that the Farmers Home Administration (FmHA) provide guarantees and interest rate subsidies for institutional loans to States for purposes of protecting and preserving farmland for agricultural use. No implementation has occurred to date.

- **Pesticide Recordkeeping provision** requires private applicators of restricted-use pesticides to maintain records accessible to State and Federal agencies regarding products applied, amount, and date and location of application. The requirement became effective May 10, 1993.

- **Forest Stewardship Program** provides grants to State forestry agencies for expanding tree planting and improvement and for providing technical assistance to owners of nonindustrial private forest lands in developing and implementing forest stewardship plans to enhance multi-resource use.

- **Stewardship Incentive Program (SIP)** provides cost-sharing up to 75 percent for practices in approved forest stewardship plans for enhancing multiple uses of nonindustrial private forest lands. Payments may not exceed $10,000 annually per landowner and practices must be maintained for at least 10 years.

Long-standing Assistance Programs

- **Agricultural Conservation Program (ACP),** initiated in 1936, provides financial assistance (up to $3,500 annually or $35,000 under long-term 10-year agreements) to farmers who carry out approved conservation and environmental protection practices on agricultural land and farmsteads. Administered by the Agricultural Stabilization and Conservation Service (ASCS).

- **Conservation Technical Assistance (CTA),** initiated in 1936, provides technical assistance to farmers for planning and implementing soil and water conservation and water quality practices. Administered by the Soil Conservation Service (SCS) and local Conservation Districts.

- **Extension Service (ES)** provides information and recommendations on soil conservation and water quality practices to landowners and farm operators in cooperation with the State Extension Services and State and local offices of USDA agencies and Conservation Districts.

- **Small Watershed Program,** initiated in 1954, assists local organizations in flood prevention, watershed protection, and water management. Part of this effort involves establishment of measures to reduce erosion, sedimentation, and runoff.

- **Great Plains Conservation Program (GPCP),** initiated in 1957, provides technical and financial assistance in 10 Great Plains States for conservation treatment on entire operating units. Financial cost-share assistance is limited to $35,000 per farmer contract. GPCP is now funding a water quality special project in each of the 10 states.

- **Resource Conservation and Development Program (RC&D),** initiated in 1962, assists multi-county areas in enhancing conservation, water quality, wildlife habitat, recreation, and rural development.

- **Water Bank Program,** initiated in 1970, provides annual rental payments to farmers for preserving wetlands in important migratory waterfowl nesting, breeding, or feeding areas.

- **Colorado River Salinity Control Program,** initiated in 1974 and amended in 1984, established a voluntary on-farm cooperative salinity control program within the USDA, and provides cost-sharing and technical assistance to farmers to improve the management of irrigated lands to reduce the amount of salt entering the Colorado River.

- **Forestry Incentives Program,** initiated in 1978, provides cost-sharing up to 65 percent for tree planting and timber stand improvement for private forest lands of no more than 1,000 acres.Maximum payment per owner is $10,000 annually.

- **Emergency Conservation Program,** initiated in 1978, provides financial assistance to farmers in rehabilitating cropland damaged by natural disasters.

- **Rural Clean Water Program (RCWP),** initiated in 1980 and scheduled to end in 1995, is an experimental program that has been implemented in 21 selected areas. It provides cost-sharing and technical assistance to farmers who voluntarily implement approved best management practices to improve water quality. Cost-share payments are limited to $50,000 per farm.

- **Farmers Home Administration (FmHA)** provides loans to farmers for soil and water conservation, pollution abatement, and building or improving water systems. May acquire 50-year conservation easements as a means of helping farmers reduce outstanding loan amounts. Also places conservation easements on foreclosed land being sold, or transfers such lands to government agencies for conservation purposes.

Data and Research Activities

- **Agricultural Research Service (ARS)** conducts research on new and alternative crops and agricultural technology to reduce agriculture's adverse impacts on soil and water resources.

- **Cooperative State Research Service (CSRS)** coordinates conservation and water quality research conducted by State Agricultural Experiment Stations and land grant universities. This agency allocates and administers funds appropriated for special and competitive grants for water quality research.

- **Economic Research Service (ERS)** estimates economic impacts of existing and alternative policies, programs, and technology for preserving and improving soil and water quality. With National Agricultural Statistics Service, collects data on farm chemical use, agricultural practices, and costs and returns.

- **Forest Service (FS)** conducts research on environmental and economic impacts of alternative forest management policies, programs, and practices.

- **Soil Conservation Service (SCS)** conducts soil surveys, snow surveys, river basin studies, National Resource Inventories, and supports plant materials centers.

Government Conservation Expenditures Highest Ever

Spending on conservation activities by USDA and State and local governments has increased steadily over the past decade. In recent years, rental payments for land retired for conservation purposes have become the largest category of USDA conservation expense.

USDA and related State and local government expenditures for conservation exceeded $3.6 billion in 1992 and could reach $3.9 billion in 1993 (figure 7). This total has been increasing in recent years, but could take its first drop in 1994 with budget tightening occurring at all levels. USDA expenditures account for the bulk of government conservation spending. In 1992 USDA spent 86 percent of the total ($3.16 billion), compared with 8 percent for States ($291 million) and 6 percent for local governments ($203 million).

Total USDA conservation expenditures for 1993 are expected to be around $3.4 billion, up $244 million from 1992. A slight drop is budgeted for 1994 (table 7). Related State and local government spending on conservation increased steadily through 1991, dropped about $20 million in 1992, but rose again for 1993 to more than $533 million, the highest ever. However, appropriations at the local level actually declined by almost 20 percent.

Rental and easement payments are estimated to account for over half of USDA conservation expenditures in 1993 (figure 8 and table 7). The bulk of these are rental payments to participants in the Conservation Reserve Program (CRP) for land retired from production. Rental payments will also be made for land enrolled in the Water Bank Program and easement payments for land accepted into the new Wetlands Reserve Program.

Technical assistance and extension expenditures of $814 million in 1993 would be the highest ever and could account for nearly one-fourth of the USDA total for conservation purposes. However, the proportion is much lower than prior to 1988 when CRP rental payments became the largest single component of USDA conservation expenditures.

Cost-sharing for practice installation in 1993 accounts for just over 10 percent of USDA spending, with lesser proportions going to conservation data and research and to project conservation programs. The only category of conservation spending in 1993 that is below its 1992 level is that for project conservation programs (table 7).

For 1994, higher expenditures are budgeted for rental and easement payments and for technical assistance and extension. All other categories in the proposed 1994 budget show a decline that is particularly steep for cost-sharing for practice installation.

Figure 7
Conservation Expenditures by USDA and Related State and Local Programs, 1985-1993

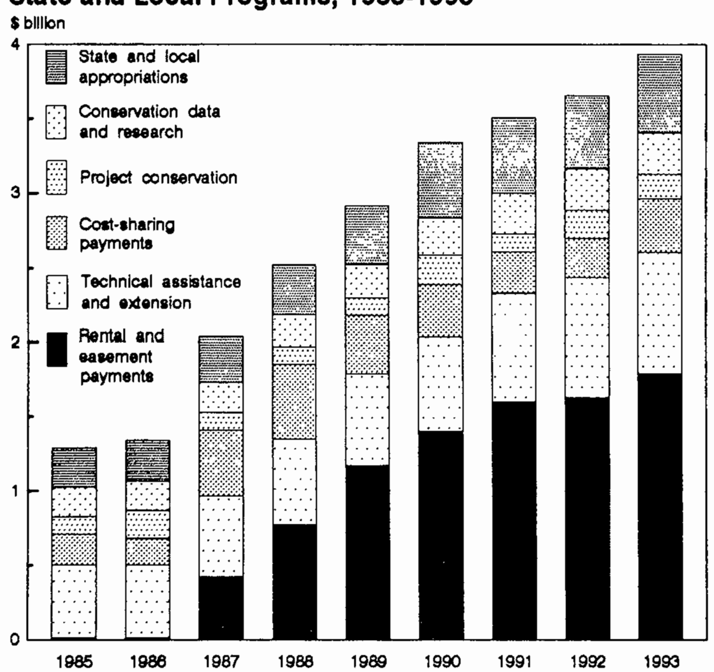
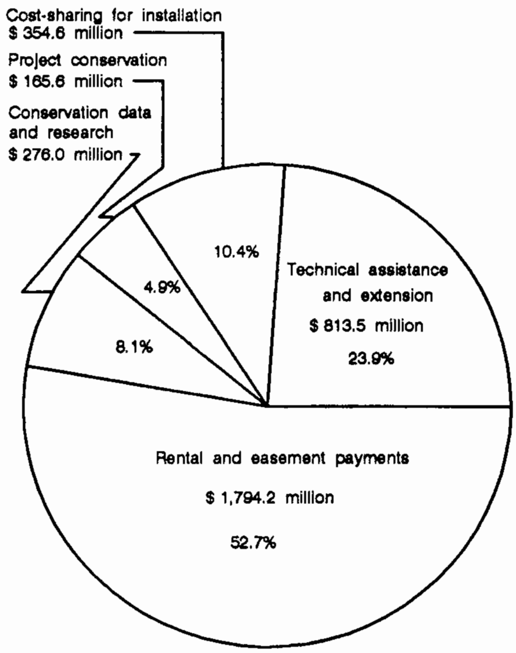


Figure 8
USDA Conservation Expenditures, 1993



Total expenditures $3403.9 million

Table 7--USDA conservation and water quality expenditures from appropriations, fiscal 1983-94 1/

Activities and programs 2/	All conservation expenditures											
	1983 actual	1984 actual	1985 actual	1986 actual	1987 actual	1988 actual	1989 actual	1990 actual	1991 actual	1992 actual	1993 estimated	1994 7/ budgeted
	$ million 1/											
A. Technical assistance and extension	490.0	478.9	488.0	488.4	545.4	579.9	621.3	629.5	726.3	804.8	813.5	905.6
Conservation technical assistance (SCS) 3/	276.9	293.7	302.0	286.7	332.0	366.4	386.7	396.7	426.5	477.9	490.2	539.8
Extension information and education (ES)	15.9	16	16.4	16.3	15.7	18.1	19.8	23.5	29.4	31.1	31.1	32.7
Cooperative forestry management (FS)	17.1	10.7	10.8	9.5	10.0	10.8	10.3	25.3	54.3	71.5	59.7	77.4
Conservation administration (ASCS)	32.8	35.3	33.1	37.3	47.6	61.4	62.4	60.2	73.8	72.6	73.4	75.8
ASCS transfer programs (receiving agency) 4/												
Agricultural Conservation Program (SCS)	11.0	11.2	11.2	10.5	9.3	11.2	10.1	11.3	10.6	10.8	11.7	9.0
Conservation Reserve Program (SCS)	0.0	0.0	0.0	10.8	21.9	5.6	27.9	1.2	11.1	8.5	6.4	11.2
Forestry Incentives Program (FS)	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Water Bank Program (SCS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	1.5	1.5
Wetland Reserve Program (SCS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	3.1	27.9
Other ASCS Programs (SCS) 5/	-0.8	1.0	0.6	3.5	3.9	2.0	1.7	6.8	6.8	7.6	9.5	6.3
SCS programs 4/												
Great Plains Conservation Program (SCS)	9.1	9.1	9.1	8.9	9.1	8.7	8.2	8.0	8.3	9.1	8.9	8.6
Resource conservation & development (SCS)	16.3	16.3	17.8	17.4	17.8	18.2	18.4	23.1	24.2	26.0	26.8	26.3
Watershed and flood prevention (SCS)	110.5	84.4	85.8	86.3	76.8	76.3	74.6	72.1	79.5	83.8	89.9	88.0
B. Cost-sharing for practice installation	216.5	214.3	209.9	180.7	448.1	504.8	389.9	353.2	278.8	266.0	354.6	220.9
Agricultural Conservation Program (ASCS)	176.5	174.5	179.2	129.7	172.6	186.6	174.0	187.8	171.6	179.1	223.0	141.4
Cover establishment--CRP (ASCS) 4/	0.0	0.0	0.0	12.4	245.6	284.8	182.3	118.1	40.9	39.3	33.8	15.6
Cover establishment--WRP (ASCS) 4/	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
Forestry Incentives Program (ASCS)	11.3	11.1	11.5	9.8	10.7	10.6	11.1	10.2	12.4	11.5	12.8	10.4
Stewardship Incentive Program (FS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.9	0.8	17.8	25.9
Great Plains Conservation Program (SCS)	12.2	12.3	12.5	11.5	11.4	11.8	12.2	12.9	16.4	16.2	16.4	16.3
Other programs (ASCS) 5/	16.4	16.5	6.7	17.2	7.8	11.0	10.3	24.2	17.7	19.1	48.3	11.3
C. Project conservation programs	220.3	129.1	115.4	187.3	116.2	115.2	113.2	196.8	121.1	187.5	165.6	158.0
Watershed and flood prevention (SCS)	205.9	119.5	106.9	179.6	109.0	108.2	106.4	192.6	115.4	181.0	159.9	152.2
Resource conservation & development (SCS)	14.4	9.7	8.5	7.7	7.2	7.0	6.7	4.2	5.7	6.5	5.7	5.8
D. Subtotal for implementation (A + B + C)	926.9	822.3	813.4	856.3	1109.6	1199.9	1124.3	1179.5	1126.1	1258.3	1333.7	1284.5
E. Conservation data and research	191.5	198.4	200.0	197.8	202.2	216.0	225.3	247.3	266.7	272.4	276.0	271.8
Soil and water conservation research (ARS)	63.5	63.7	63.7	62.4	59.3	60.5	65.9	73.6	73.6	73.9	74.3	75.3
Cooperative State research (CSRS)	27.9	29.6	32.8	31.3	31	33.1	34.5	40.6	50.6	53.8	53.8	48.3
Forest environment research (FS)	19.7	20.4	20.3	23.9	28.2	29.3	31.1	35.3	40.7	39.0	41.8	44.8
Plant materials centers (SCS)	3.8	4.0	4.1	3.9	4.6	4.9	5.0	7.2	7.9	8.1	8.1	7.9
Resource economics research (ERS)	5.0	7.7	5.4	4.0	4.0	3.1	3.0	4.6	5.5	5.8	6.3	5.0
Data collection and analysis (SCS) 6/	71.6	73.0	73.7	72.3	75.2	85.1	85.7	85.8	88.2	91.5	91.5	90.2
Water Quality Initiative (NAL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3
F. Rental and easement payments 4/	8.8	8.8	8.8	8.4	418.4	768.5	1171.1	1406.0	1603.2	1629.6	1794.2	1828.1
Rental payments--CRP (ASCS/CCC)	0.0	0.0	0.0	0.0	410.0	760.1	1162.1	1393.7	1590.1	1612.5	1739.5	1811.0
Rental payments--Water Bank (ASCS)	8.8	8.8	8.8	8.4	8.4	8.4	9.0	12.2	13.1	17.1	17.1	17.1
Easement payments--WRP (ASCS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.5	0.0
G. Total distributed expenditures (D + E + F)	1127.2	1029.5	1022.2	1062.5	1730.2	2184.3	2520.7	2832.8	2996.1	3160.3	3403.9	3384.4

1/ Current dollar estimates from Office of Budget and Program Analysis (OBPA) USDA. Includes water quality expenditures. 2/ Responsible USDA agencies in parentheses; ARS--Agricultural Research Service; ASCS--Agricultural Stabilization and Conservation Service; CCC--Commodity Credit Corporation; CSRS--Cooperative State Research Service; ERS--Economic Research Service; ES--Extension Service; FmHA--Farmers Home Administration; FS--Forest Service; NAL--National Agricultural Library; and SCS--Soil Conservation Service. 3/ Includes the inventory and monitoring, resource appraisal, and program development activities carried out by SCS. 4/ Included because the main purpose of these programs is conservation of soil and water resources. 5/ Includes Colorado River Salinity Control Program, Emergency Conservation Program, and Rural Clean Water Program. 6/ Includes river basin surveys and investigations, soil surveys, and snow survey water forecasting. 7/ Amounts shown (budgeted) for ASCS and SCS in 1994 are comparable to prior years. The 1994 budget includes a proposal to merge ASCS, SCS, and FmHA to form the Farm Services Agency.

Water Quality Initiative in Its Fourth Year

Started in fiscal 1990, USDA's Water Quality Initiative has promoted farmers' adoption of improved practices and developed new information and databases.

Different Assistance Strategies Being Tried

The Water Quality Initiative (WQI) was undertaken in 1990 to provide producers the knowledge and technical means to voluntarily address on-farm environmental concerns and related State water quality requirements. By 1992, the WQI had extended assistance to farmers in over 200 selected project areas in nearly all States (figures 9 and 10). Different strategies for promoting farmers' adoption are depicted in these efforts. The 16 demonstration projects (Demos) are 5-year projects that rely heavily on educational and technical assistance to achieve adoption of improved practices by farmers and to apply new and innovative technology to solve agricultural nonpoint source problems (table 8). The 74 hydrologic unit area (HUA) projects, also of 5 years' duration, put relatively more resources into financial (cost sharing) assistance and less into education.

The Water Quality Special Projects (WQSPs), which are mostly 1- year projects, have devoted 95 percent of funds to financial assistance and 5 percent to technical assistance. There were 35 WQSPs in 1992. In contrast, the 6 regional and 21 estuary projects have so far received only accelerated technical assistance under the WQI and have had to rely on other programs for educational and financial assistance. The Great Lakes, Chesapeake, and Gulf of Mexico regional projects and all estuary projects are administered by EPA (see latter discussion on non-USDA programs).

Tight appropriations for the WQI have prevented planned expansion in the number of Demos and HUAs. Appropriated funds in 1993 for both activities are down from 1992 levels. The WQSPs are usually funded only once, so farmers in these areas must contract for practices during that 1 year, even though implementation may take place over several years. Only two WQSPs are being funded for 1993 and these, unlike the usual, are receiving second year funding to further reduce agricultural pollution entering Lake Champlain in coordination with the new regional project established for that area.

Adoption of Practices Increasing

During 1992, the Demos and the HUAs achieved significantly increased implementation of improved practices (table 8). Statistics for the WQSPs have not been reported separately from the longstanding Agricultural Conservation Program (ACP) from which the funds are taken. So far only limited data are available for the regional projects and estuaries. The practices being implemented appear to be achieving reductions in sediment, nutrients, and pesticides entering surface and ground waters (see later section on program benefits).

A special study of producer adoption of key improved practices is being done in the initial eight Demonstration projects to assess the extent to which the concentration on educational and technical assistance and demonstration farms influences general adoption. The baseline survey completed in 1992 found adoption of the key practices across the projects to range from near none to up to two-thirds of producers. For example, in the six projects where split application of fertilizer is a key practice, adoption ranges from 10 to 50 percent of producers. One or more follow-up surveys will be conducted to determine how these rates increase over time and what portion of adoption can be attributed to the Demo projects.

Figure 9
Location of Water Quality Initiative Projects in 1992

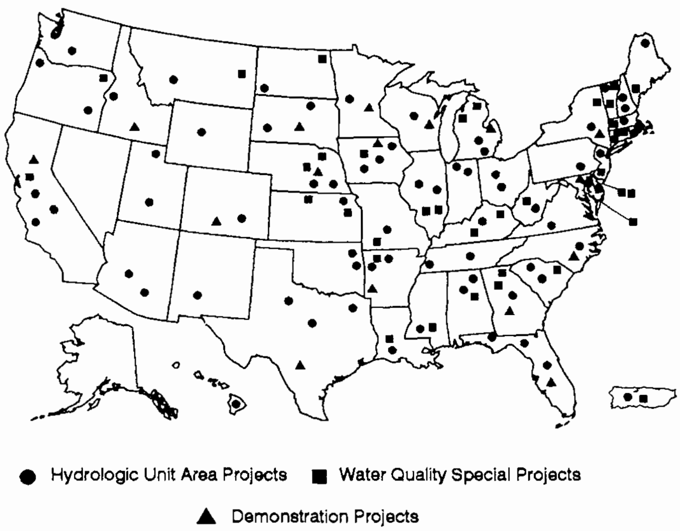
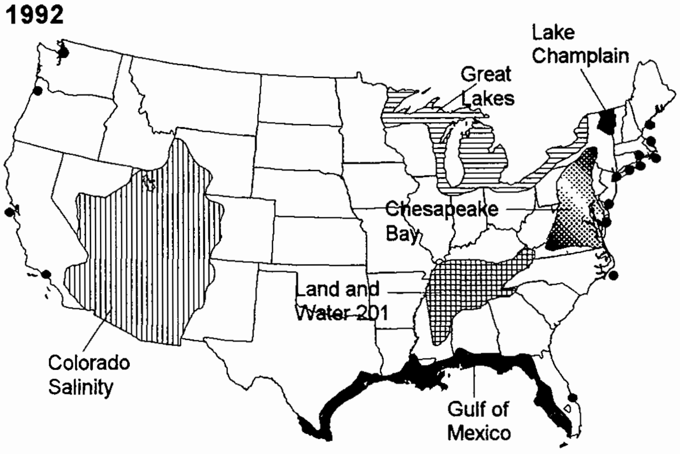


Figure 10
Water Quality Initiative Regional Technical Assistance, 1992



Technical assistance provided by the Soil Conservation Service

Selected Demo and HUA Projects Being Evaluated

An Extension Service (ES)-led assessment of the organization and implementation of the first eight demo projects has been completed and results were used by program and project managers to improve the overall program. The Soil Conservation Service (SCS) is conducting physical impact evaluations in eight demos and eight HUAs to provide information for improving program effectiveness and progress reporting. The Economic Research Service (ERS) is evaluating economic aspects of five projects. Initial results from the physical and economic evaluations will be available in 1993.

Research and Development Expands Knowledge of Practices

Research and development activities by the Agricultural Research Service (ARS) and Cooperative State Research Service (CSRS) under the WQI occur in cooperation with State Agricultural Experiment Stations. Through 1992, ARS had funded 62 projects in 26 locations and CSRS had awarded 142 competitive grants for research on improved practices and agricultural systems that reduce potential water contamination. Also the research covers improved methods and procedures for assessing impacts of practices and programs.

One major research endeavor is the Management System Evaluation Areas (MSEAs) occurring in five selected areas of Iowa, Minnesota, Missouri, Nebraska, and Ohio. The thrust of the MSEAs is to evaluate alternative corn/soybean production systems under different soil, weather, and hydrologic settings and provide demonstrations of those systems that are environmentally and economically sound.

Chemical Use and Area Surveys Build Databases

The Water Quality Initiative is funding surveys aimed at providing farm level data to determine the magnitude of water quality problems or permit assessment of alternatives for farmers and other affected parties. Agricultural chemical use surveys covering major crops and growing areas were initiated by ERS and the National Agricultural Statistics Service (NASS) in 1990 and have continued annually. Data gathered include types, application, timing, and amounts of fertilizer, pesticides, and other chemicals. Also, data are obtained on irrigation, cropping and production practices, and, for a subset of sample points, economic information on the farm unit.

Studies in eight critical water quality areas are also helping establish the link between production practices and resource characteristics. ERS and NASS have gathered chemical use and farm practice information to be correlated with soils, land use, water quantity and quality, and other hydrologic data supplied by SCS and U.S. Geological Survey (USGS)..

Table 8--Status of Water Quality Initiative activities, fiscal 1990-93

Activity	1990	1991	1992	Enacted 1993
Educational, technical, and financial assistance activities:				
1. Demonstration projects:				
Number of active projects	8	16	16	16
Demonstration farms	NA	135	135	NA
Major practices implemented (number) 1/	NA	2,984	5,447	NA
Total USDA funding (millions) 2/	$3.0	$8.5	$8.5	$7.7
% education/technical/financial	31/38/31	25/54/21	25/54/21	29/60/11
2. Hydrologic Unit Area projects:				
Number of active projects	37	74	74	74
Major practices implemented (number) 1/	NA	8,606	19,900	NA
Total USDA funding (millions)	$13.9	$31.5	28.1	19.0
% education/technical/financial	13/34/53	12/50/38	14/43/43	20/64/16
3. Water Quality Special Projects:				
Number of annual projects	1/ 40	35	35	2
Major practices implemented	- - - - - - - - - -Included in ACP- - - - - - - - -			
Total USDA funding (millions)	$11.9	$9.1	$9.1	$1.1
% education/technical/financial	0/5/95	0/5/95	0/5/95	0/5/95
4. Regional activities:				
Regional continuing projects (number)	5	5	6	6
Estuaries of National Significance	17	17	21	21
Major practices implemented (number) 1/	NA	NA	NA	NA
Total USDA funding (millions)	$6.7	$7.9	$8.3	$8.4
% education/technical/financial	01/100/0	0/100/0	0/100/0	0/100/0
5. Improved program support and transfer:				
ES (million)	$1.8	$3.9	$4.5	$4.5
SCS (million)	$4.9	$7.5	$7.6	$7.6
ERS evaluation (million)	$0.1	$0.5	$0.5	$0.5
Research and development activities:				
Management System Evaluation Areas (number)	5	5	5	5
ARS expenditures (million)	$7.9	$12.9	$15.3	$15.3
CSRS research grants (million)	$6.7	$ 9.0	$9.0	$9.0
ERS collaboration (million)	$0.2	$ 0.5	$0.5	$0.5
Database development and evaluation activities:				
ERS for Ag. chemical database (million)	$1.5	$1.9	$2.3	$2.3
ES for chemical database support (million)	$0.3	$0.3	$0.3	$0.5
Nat. Agr. Library for information center (million)	$0.3	$0.3	$0.3	$0.3

1/ Sum of producers applying major categories of practices. Does not represent total producers because of double counting. 2/ Excludes funds to ERS, which are included under improved program support.
NA means not available.

CRP At 90 Percent of Goal, But Faces Uncertainty Beyond 1995

The Conservation Reserve Program (CRP) has been a popular program with numerous environmental advantages. But even though 12 signups have been completed, questions have arisen about the program's costs and conservation gains.

CRP is beginning its eighth year, and 36.5 million acres of highly erodible cropland and other environmentally sensitive cropland have been converted to less intensive uses (table 9 and figure 11). Signals about its future, however, are unclear. Congress provided no money for new CRP enrollment in fiscal 1993. But the President's Budget includes funding in fiscal 1994 and has indicated intentions to fund a further enrollment of 1.5 million acres in fiscal 1995.

Twelfth Signup Added 1.1 Million Acres

During the last CRP signup, the twelfth, held June 15-26, 1992, USDA's Agricultural Stabilization and Conservation Service (ASCS) tentatively accepted 1.1 million crop acres for retirement in 1993 out of 2.6 million acres bid (figure 12). One big change that began with the tenth signup (March 1991) was the revision of the bid acceptance process. The revised procedure ranks bids based on the ratio of an environmental benefits index to the government cost of the contract. The bids accepted are the highest ranking ones, contributing to greater cost effectiveness of the program.

The twelfth signup, like the previous two signups, continued the upward trends in per acre rents and the percentage of enrollment planted to trees. Also similar to the previous two signups, the distribution of new enrollment has shifted more to the Midwest and Eastern States, away from the Great Plains and Mountain States (table 10). The bid ranking procedure also continued to give greater priority to areas having watersheds draining into the Chesapeake Bay, Long Island Sound, and the Great Lakes Region.

Questions About the CRP's Future

CRP contracts begin expiring in late 1995, but if funding is provided, USDA and the farmer may extend the contracts 5 to 10 years. Three primary questions are being asked about CRP's future: 1) What will happen to CRP acres when current contracts expire, 2) What are the environmental and commodity market implications, and 3) How could the Federal Government respond?

Groups representing a diversity of interests are presenting various positions. The Soil and Water Conservation Society is preparing a resolution supporting the CRP and emphasizing public returns from the CRP, in terms of reduced erosion and other environmental benefits. In contrast, a recent GAO report[1] stresses the cost of the program and notes that the projected total Federal outlay for CRP could reach $19 billion by the year 2003. The GAO states that programs such as the Agricultural Conservation Program, the Small Watershed Program and the Great Plains Conservation Program are cheaper than the CRP and cover more acres, but doesn't compare the environmental benefits.

[1] GAO, "Conservation Reserve Program: Cost Effectiveness is Uncertain", No. GAO/RCED-93-132. 14 pp. March 1993.

Figure 11

CRP Enrollment, Signups 1-12, 1986-93

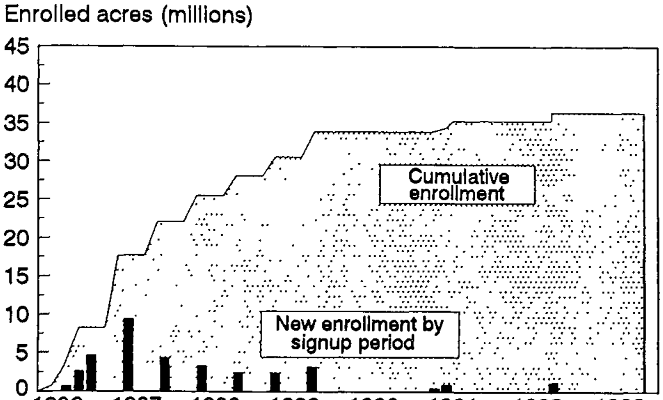


Figure 12

CRP Enrollment Through Signup 12

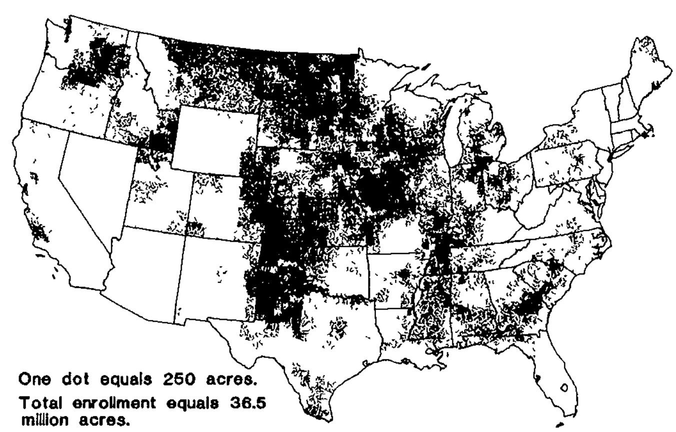


Table 9--Enrollment in the Conservation Reserve Program, signups 1-12 and cumulative fiscal 1986-93

Item	Number of contracts	Number of acres	Average rental rate	Average erosion reduction
	1,000	Million	$/acre/year	Tons/acre/year
Signup period:				
#1 March 1986 1/	9.4	0.75	42.06	26
#2 May 1986	21.5	2.77	44.05	27
#3 August 1986 2/	34.0	4.70	46.96	25
#4 February 1987 3/	88.0	9.48	51.19	19
#5 July 1987	43.7	4.44	48.03	17
#6 February 1988 4/	42.7	3.38	47.90	18
#7 July 1988	30.4	2.60	49.71	17
#8 February 1989 5/	28.8	2.46	51.04	14
#9 July-August, 1989	34.8	3.33	50.99	14
#10 March 1991 6/	8.6	0.48	53.66	17
#11 July 1991	14.7	1.00	59.37	15
#12 June 1992 (tentative) 7/	19.5	1.10	63.09	16
Total	376.2	36.50	49.70	19
Cumulative enrollment by fiscal year:				
1986	21.0	2.04	43.11	28
1987	145.9	15.71	49.15	23
1988	233.5	24.47	48.52	21
1989	295.4	29.82	48.78	20
1990	333.4	33.92	48.93	19
1991	342.0	34.40	49.00	19
1992	356.7	35.40	49.29	19
1993 (tentative)	376.2	36.50	49.70	19
	1,000	Million hectares	$/hectare/year	Metric tons/ hectare/year
Signup period:				
#1 March 1986 1/	9.4	0.30	103.85	58
#2 May 1986	21.5	1.12	108.77	60
#3 August 1986 2/	34.0	1.90	115.95	56
#4 February 1987 3/	88.0	3.84	126.40	43
#5 July 1987	43.7	1.80	118.59	38
#6 February 1988 4/	42.7	1.37	118.27	40
#7 July 1988	30.4	1.05	122.74	38
#8 February 1989 5/	28.8	1.00	126.02	31
#9 July-August, 1989	34.8	1.35	125.90	31
#10 March 1991, 6/	8.6	0.19	132.49	37
#11 July 1991	14.7	0.40	146.59	33
#12 June 1992 (tentative) 7/	19.5	0.44	155.78	36
Total	376.2	14.76	122.72	42
Cumulative enrollment by fiscal year:				
1986	21.0	0.83	106.44	63
1987	145.9	6.36	121.36	52
1988	233.5	9.91	119.80	47
1989	295.4	12.08	120.44	45
1990	333.4	13.74	120.81	43
1991	342.0	13.93	120.98	43
1992	356.7	14.34	121.70	42
1993 (tentative)	376.2	14.76	122.72	42

1/ Eligible acres included cropland in land capability classes II through V eroding at least three times greater than the tolerance rate (see definitions), or any cropland in land capability classes VI through VIII. 2/ Eligible acres expanded to include cropland in land capability classes II through V eroding at least two times the tolerance rate and having gully erosion. 3/ Eligible acres expanded to include cropland eroding above the tolerance rate with an erodibility index of 8 or greater. 4/ Eligible acres expanded to include cropland in land capability classes II to through V eroding at least two times the tolerance if planted in trees. Eligibility also extended to cropland areas 66 to 99 feet wide adjacent to permanent water bodies for placement into filter strips. 5/ Eligible acres expanded to include cropped wetlands and cropland areas subject to scour erosion. 6/ Eligible acres expanded to include cropland devoted to easement practices, cropland in priority wetlands, cropland within established wellhead protection areas. Farmed wetlands, even if otherwise eligible, were ineligible for enrollment. 7/ Actual number of contracts, acres enrolled, rental rates and erosion reduction based on conditional acceptance. Useful life easement requirements were eliminated.

Table 10--CRP enrollment, rental payments, and erosion reductions, signups 1-9 and 10-12, by region

Signups 1-9 under 1985 farm act

Region	Number of contracts	Total cropland enrolled	Trees planted	Reduced commodity base	Average annual rent payment	Average annual erosion reduction
	1,000	Million acres	1,000 acres	Million acres	$/acre	tons/acre
Northeast	5.5	0.20	9.0	0.07	59.62	13
Appalachian	26.0	1.06	139.6	0.53	53.83	26
Southeast	31.4	1.57	1207.4	0.73	42.60	15
Delta States	16.3	1.09	625.3	0.43	43.93	19
Corn Belt	80.1	4.73	62.9	2.65	73.04	18
Lake States	47.2	2.63	97.2	1.63	58.54	16
N. Plains	73.4	9.43	8.4	6.48	45.94	15
S. Plains	26.6	5.08	19.4	4.09	40.19	32
Mountain	20.3	6.44	4.4	4.02	39.73	19
Pacific	6.5	1.70	5.7	1.14	49.29	13
United States	333.4	33.92	2179.3	21.76	48.93	19
	1,000	Million hectares	1,000 hectares	Million hectares	$/hectare	metric tons/ hectare
Northeast	5.5	0.08	3.6	0.03	147.32	29
Appalachian	26.0	0.43	56.5	0.21	133.01	58
Southeast	31.4	0.64	489.0	0.30	105.26	34
Delta States	16.3	0.44	253.2	0.17	108.55	43
Corn Belt	80.1	1.92	25.5	1.07	180.48	40
Lake States	47.2	1.07	39.4	0.66	144.65	36
N. Plains	73.4	3.82	3.4	2.62	113.52	34
S. Plains	26.6	2.06	7.9	1.66	99.31	72
Mountain	20.3	2.61	1.8	1.63	98.17	43
Pacific	6.5	0.69	2.3	0.46	121.80	29
United States	333.4	13.74	882.6	8.81	120.91	43

Signups 10-12 under 1990 farm act

Region	Number of contracts	Total cropland enrolled	Trees planted	Reduced commodity base	Average annual rent payment	Average annual erosion reduction
	1,000	Million acres	1,000 acres	Million acres	$/acre	tons/acre
Northeast	0.6	0.02	1.2	0.00	53.39	6
Appalachian	2.8	0.11	13.1	0.05	55.49	19
Southeast	2.8	0.13	92.8	0.07	43.83	12
Delta States	2.5	0.16	119.1	0.08	46.63	11
Corn Belt	18.7	0.91	40.9	0.50	80.99	15
Lake States	9.3	0.40	40.6	0.22	59.58	10
N. Plains	3.1	0.24	1.5	0.16	48.27	16
S. Plains	1.9	0.28	3.5	0.22	40.23	28
Mountain	1.1	0.27	0.4	0.17	38.10	16
Pacific	0.7	0.98	0.9	0.07	54.99	12
United States	43.4	2.60	314.0	1.53	59.85	15
	1,000	Million hectares	1,000 hectares	Million hectares	$/hectare	metric tons/ hectare
Northeast	0.6	0.01	0.5	0.00	131.94	13
Appalachian	2.8	0.04	5.3	0.02	137.12	41
Southeast	2.8	0.05	37.5	0.03	108.31	27
Delta States	2.5	0.07	48.2	0.03	115.72	24
Corn Belt	18.7	0.37	16.6	0.20	200.14	33
Lake States	9.3	0.16	16.4	0.09	147.21	23
N. Plains	3.1	0.09	0.6	0.06	119.27	37
S. Plains	1.9	0.11	1.4	0.09	99.40	61
Mountain	1.1	0.11	0.2	0.07	94.14	35
Pacific	0.7	0.04	0.4	0.03	135.88	27
United States	43.4	1.05	127.1	0.62	147.90	34

Wetlands Reserve Program Implemented

The Wetlands Reserve Program is one of USDA's newest conservation efforts. It began as a pilot program with an initial funding of $46 million and has broad-based public support and interest.

The Wetlands Reserve Program (WRP) was created by the 1990 Food, Agriculture, Conservation, and Trade Act (FACTA) in response to the public's interest in reducing the loss of wetlands and furthering environmental values. The WRP is popular with farmers because it provides an option to deal with marshy and swampy fields that are hard to farm. Environmentalists see the program as an opportunity to restore wetlands that have rapidly disappeared in the last 50 years.

The fiscal 1992 appropriations bill provided $46 million for a pilot WRP and established a maximum enrollment of 50,000 acres. These acres were selected from individual State pools to ensure geographic and wetland diversity. The first signup in July 1992 included tracts from 265 farms (some farms had several tracts accepted), totaling 49,888 acres (table 11).

Farmers in the designated States who were interested in the program first enrolled their cropland, considered "farmed wetlands" or prior converted wetlands, at their county ASCS office. The SCS and other agencies helped individual farmers develop a restoration plan. The farmer then could make a non-obligatory bid on what he/she would accept. If the bid was accepted, ASCS would enter into a contract with the farmer for a wetland easement.

ASCS was required to consider all costs of obtaining easements and shared 75 percent of the landowner's costs of the rehabilitation of the wetland for a permanent easement. ASCS could pay for permanent easements through 10 equal annual payments or 1 lump sum.

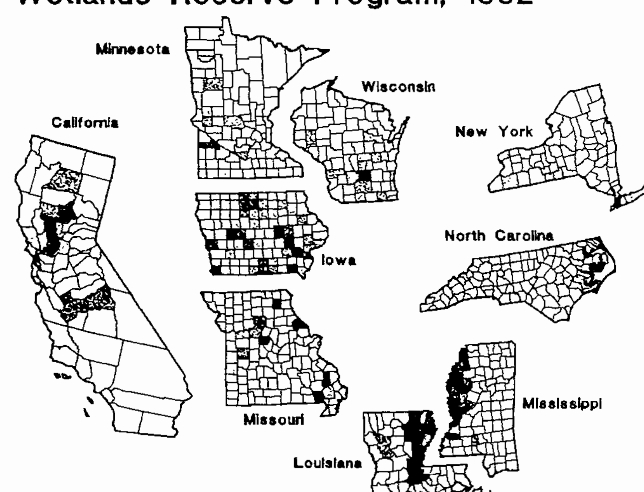
Although owners of 500,000 acres expressed an intention to bid into the WRP, only about 250,000 acres were offered. Of the 250,000 acres offered, about 20 percent were selected due to the maximum enrollment limit. Louisiana and Mississippi offered the most acres. Mississippi had the most farms and acres accepted into the program (figure 13).

Federal easement payments to States were greatest in California, where easement values were highest, and in Mississippi, where acreage accepted was large. The highest per acre easement costs were in California and New York; the lowest were in Louisiana and Mississippi. Farmers with accepted acreage are expected to receive about $37 million in easement payments, or $140,000 per farm, with additional costs for restoration cost-share, technical assistance and settlement fees representing a part of the $46 million Federal outlay.

The WRP's popularity and broad-based support continue and the proposed USDA budget includes funding to enroll 450,000 acres in 1994 and another 500,000 acres in 1995.

Figure 13

Wetlands Reserve Program, 1992



One dot equals 1 acre.
Dot locations within counties do not represent actual locations of acres.

Table 11--Pilot Wetlands Reserve Program in 1992: Acres, farms and easement payments, by state 1/

States	Acres with intentions to bid	Acres offered	Acres accepted	Farms accepted	Avg. acreage/ farm	Easement payments Total	Per farm	Per acre
	Number					$1,000		
California	78,519	34,296	6,026	21	287	9,802	467	1,626
Iowa	45,068	27,889	5,096	83	61	4,881	59	958
Louisiana	119,323	69,913	14,075	43	327	6,907	161	491
Minnesota	33,296	13,119	706	10	71	640	64	907
Mississippi	115,726	64,957	14,885	47	317	8,355	178	561
Missouri	28,669	14,575	2,669	21	127	2,301	110	862
New York	3,005	496	72	5	14	183	37	2,525
North Carolina	25,587	15,299	4,713	6	785	2,934	489	623
Wisconsin	12,885	8,516	1,647	29	56	1,036	36	629
Total	462,078	249,059	49,888	265	188	37,038	140	742

1/ Source: Daniel Colacicco, "The 1992 Wetlands Reserve Program-Report to Congress," ASCS, USDA. 22 pp. Feb. 1993.

Compliance Provisions Encourage Increased Conservation on Sensitive Lands

Conservation compliance has increased soil conservation on highly erodible cropland, but many lands still do not have a conservation plan fully applied. Sodbuster and swampbuster provisions have encouraged preservation of sensitive grasslands and wetlands.

The conservation compliance provision of the 1985 farm act pertains to cropland fields of which at least one-third or 50 acres are highly erodible soils. SCS has so far identified about 148 million acres nationwide in fields that qualify as highly erodible land (HEL) subject to the provision (table 12). This number has increased over time as additional determinations are made. Failure by a producer to have an SCS-approved conservation plan on HEL, and to fully apply the plan by January 1, 1995, will result in loss of eligibility for USDA program benefits. Most of this land has an approved conservation plan; on only 7 million acres have producers not requested or yet accepted a conservation plan.

Conservation Compliance Certified on 86 Million Acres; Pending on 55 Million

An approved conservation plan has been certified as fully applied on 86 million acres, about 58 percent of the total determined HEL or 61 percent of HEL with approved plans. That leaves some 55 million acres with plans that are either not yet fully applied or not yet certified by SCS as fully applied. SCS reports that conservation plans are being applied on schedule on most of this acreage, but specifics are not available.

Compliance Achievement on Remaining Acres May Be More Challenging

HEL bid into the CRP and HEL already eroding at low levels because of existing conservation have contributed greatly to the compliance achievement to date, from one-third to two-thirds of the 86 million acres (table 12). While some of the 55 million acres of HEL with full compliance still pending could go into the CRP, to the extent additional signups occur, most will have to come into full compliance by other means. Also the pending HEL could have relatively less existing conservation in place than did the lands that have already been certified as in full compliance.

What are the prospects for the remaining 55 million acres of HEL with approved plans? SCS forecasts that about 70 percent of the planned HEL will have plans fully applied and certified by the end of 1993, and that 85 percent or more will come into full compliance by the deadline (figure 14). The American Farmland Trust[1] found that 86 percent of 885 surveyed producers (all subject to compliance) indicated they would comply with the conservation plans by 1995. Only 14 percent said they would not or were uncertain.

[1] Esseks, J.D. and Kraft, S.E., "Opinions of Conservation Compliance Held by Producers Subject to It". Report for the American Farmland Trust. Feb. 24, 1993.

Table 12--Statistics on highly erodible lands (HEL) subject to conservation compliance requirements, April 1993

Item	Million acres		Percent	
HEL determinations 1/	148			
HEL with an approved conservation plan	141		100	
HEL certified in full compliance (approved conservation plan fully applied)		86		61
HEL with an approved conservation plan not fully applied or not yet certified		55		39
HEL in the CRP 2/	28			
Highly erodible soils eroding at the T level or less in 1987 3/	35			

1/ Determinations made by SCS field staff include cropland in fields that have at least one-third or 50 acres (which ever is less) of highly erodible soils. This number has increased over time as more producers apply for benefits and more determinations are made. 2/ Estimated at 76 percent of the 36.5 million acres in the CRP. The 76 percent number is based on an SCS survey of 5 percent of CRP contracts. 3/ Based on 35 million acres of highly erodible soils found in the 1987 National Resources Inventory to be eroding at T or below (which would technically qualify these soils as being in compliance).

Source: Soil Conservation Service data and ERS estimates.

Sodbuster and Swampbuster Enforcement Actions Have Deprived Some Producers of USDA Benefits

Land subject to the sodbuster provision is currently estimated at 224 million acres, about 25 percent of all land in farms. Farmers who wish to cultivate highly erodible land not cropped during 1981-85, must obtain and fully apply an approved conservation plan or lose eligibility for USDA program benefits. Producers asking for benefits when they are not in compliance are deemed in violation and are denied benefits. ASCS statistics combining conservation compliance and sodbuster violations from 1986-92 (separate statistics not available) indicate that 1,185 producers were found in violation on a total of 129,241 acres (table 13). Total benefits denied amounted to over $6.4 million. This does not include an additional 578 producers under tobacco and peanut eligibility who were in violation and denied unspecified price support and disaster benefits.

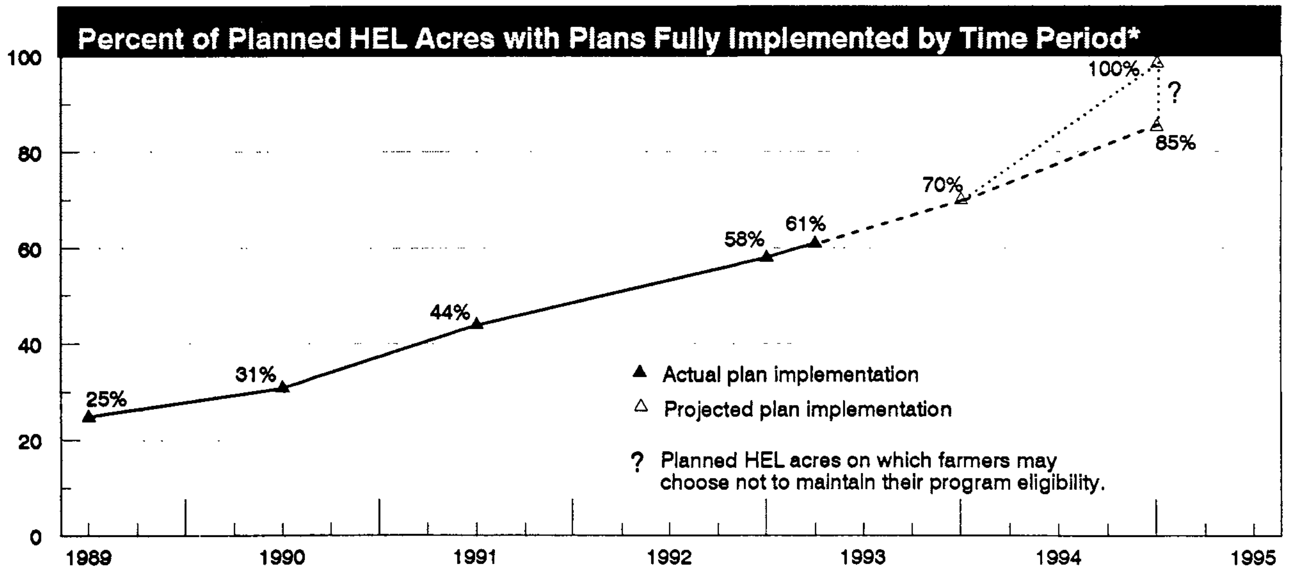
Like sodbuster, the swampbuster provisions entail partial or total loss of farm program benefits to farmers who convert a wetland for the purpose of producing an agricultural commodity. From 1987 to 1992, 376 producers were found in violation on a total of 5,560 acres (table 14). Total benefits denied amounted to nearly $5.3 million. This does not include an additional 95 producers who were in violation and denied unknown benefits under tobacco and peanut marketing eligibility.

Recently, USDA's Office of Inspector General (OIG)[2] expressed concerns that some farmers who received USDA benefits were in violation of the swampbuster rules. OIG suggested improvements in the application and treatment of exemptions, coordination of work schedules and communications between the respective agencies with the responsibilities for the wetland programs, and sampling of data. SCS and ASCS require that all converted wetlands must be restored before USDA program benefits can be received and have told OIG that most of the cases under scrutiny involved technical questions and were not violations of the spirit of enforcement.

[2]Office of Inspector General, Audit Great Plains Region, "Wetland Conservation Provisions", Audit Report No. 50600-2-KC, December 1992. 43 pp.

Figure 14

Conservation Compliance Plan Implementation Progress



* Highly erodible land (HEL) acres with plans that are in full compliance (all conservation plan practices applied).

Source: Soil Conservation Service.

Table 13--Conservation compliance and sodbuster violations, 1986-92 1/

Year	Producers found in violation	Land in violation		Value of benefits denied
	Number	Acres	Hectares	Dollars
1986	2	10	4	10,834
1987	27	1,240	502	224,327
1988	95	2,680	1,085	529,756
1989	39	2,271	919	251,622
1990	215	56,538	22,881	1,536,215
1991	413	39,776	16,097	2,130,969
1992 2/	394	26,726	10,816	1,734,939
Total	1,185	129,241	52,304	6,418,662

1/ Source: ASCS. 2/ Preliminary.

Table 14--Swampbuster violations, 1987-92 1/

Year	Producers found in violation	Land in violation		Value of benefits denied
	Number	Acres	Hectares	Dollars
1987	7	46	19	96,225
1988	59	565	227	744,666
1989	60	454	184	1,006,208
1990	75	480	194	1,261,875
1991	114	1,275	516	1,364,391
1992 2/	61	2,740	1,109	793,284
Total	376	5,560	2,249	5,266,649

1/ Source: ASCS. 2/ Preliminary.

Other Farm Act Provisions Affect Agricultural Resources

The 1990 farm act also created the Agricultural Water Quality Protection Program, Integrated Farm Management Option, and Pesticide Recordkeeping.

Water Quality Protection Program Initiated as Water Quality Incentive Projects (WQIPs)

The Agricultural Water Quality Protection Program, commonly known as the Water Quality Incentives Projects, (WQIP's) provides farmers with technical assistance and financial incentives to voluntarily modify their agricultural practices in order to reduce nonpoint source pollution. The enrollment goal set forth in the 1990 farm act was 10 million acres during 1991-95.

The WQIP's were funded in fiscal 1992 at $6.75 million and practices were initially implemented under the Agricultural Conservation Program (ACP) in existing USDA Water Quality Initiative project areas. In February 1992, farmers in the first offering submitted 2,133 requests covering 371,000 acres. A national coverage of 106 new projects in 42 States has been approved for fiscal 93 and funding is $15 million. States are preparing new proposals and projects for fiscal 1994.

The development of a water quality resource management plan is required for participating farms. Incentive payments on enrolled land are averaging $20-21 per acre for the 3-year life of the agreement.

Integrated Farm Management Program Option

The Integrated Farm Management (IFM) Program Option assists producers in adopting integrated, multi-year, site-specific resource plans by reducing farm program barriers. It allows farmers flexibility in maintaining their acreage bases with unlimited haying and grazing on up to 50 percent of the enrolled land placed in the acreage conservation reserve. Farm program payments will not be reduced when resource-conserving crops are planted as part of a rotation on payment acreage. (See Box on USDA Conservation and Water Quality Programs).

The cumulative enrollment under IFM through 1992 is 96,040 acres in 32 States. There is an annual limit of 5 million new acres under this program. The IFM contracts with landowners are for a minimum of 3 years, but at the producer's option may be extended 2 years. Also, the IFM resource-conserving crop acreage must average at least 20 percent of participating program crop acreage base.

National Pesticide Recordkeeping Underway

Pesticide recordkeeping, previously required by some States, became a national program on May 10, 1993. Private applicators who are currently not keeping records under State regulations, will be required to do so. The recordkeeping requirement will be limited to restricted use pesticides and will include the product name, the amount and date applied, the location of the area treated, and the name and certification number of the applicator. USDA's National Agricultural Statistics Service (NASS) will annually survey the applicators for purposes of compiling aggregated statistics for entry into a national pesticide data base. Particular locations and producers will not be revealed in released information.

Longstanding Conservation Programs Provide Varied Assistance to Farmers and Rural Areas

Various longstanding USDA programs provide financial, technical, or extension education assistance to farmers and institutions in rural areas to further adoption of conservation practices or the protection of critical rural lands and resources.

More Than One-Fourth of U.S. Farmers Assisted

More than a half-million or over one-fourth of U.S. farmers were assisted by USDA during 1992 in some way to further their use of conservation practices (table 15). Most of these producers implemented practices with conservation technical assistance provided by SCS. A large (but not reported) number received Extension Service (ES) staff assistance on conservation or participated in ES conservation education programs. Over 140,000 farmers received some form of financial assistance, usually as cost-sharing, but sometimes as emergency aid to restore conservation after disasters, rental payments on land restored to wetlands, or as a reduction in loan principal for granting a conservation easement.

Table 15--Status of long-standing USDA conservation programs, fiscal 1988-93 1/

Program	Fiscal year 1988	1989	1990	1991	1992	2/ 1993
Agricultural Conservation Program: (ASCS)						
Total assistance: (million $) 3/	$197.8	$184.1	$199.1	$182.1	$189.9	$234.7
Number of participants: (thousand)	139.9	124.4	123.8	123.9	120.2	NA
Avg. assistance per participant: ($) 3/	$1,414	$1,480	$1,608	$1,470	$1,580	NA
Conservation Technical Assistance: (SCS)						
Cooperators assisted (million)	1.2	1.3	1.8	1.2	1.2	NA
Cooperators applying practices (million)	0.9	1.0	0.4	0.9	0.5	NA
Resource management system acres (million)	19.5	25.2	27.4	18.4	18.0	NA
Acres serviced by CTA during year (million)	61.8	62.6	60.7	59.6	59.6	NA
Extension Service Staff Allocations: (ES)						
Water Quality Initiative FTE 4/	NA 5/	NA	NA	NA	698	696
(% of total) 6/					(4.3%)	(4.4%)
Sustainable Agr. Initiative FTE	NA	NA	NA	NA	634	633
(% of total)					(4.0%)	(4.0%)
Natural Resources/Environmental Mgmt. FTE	NA	NA	NA	NA	17.21	NA
(% of total)					(10.8%)	NA
Great Plains Conservation Program: (SCS)						
Total funding (million $) 3/	$20.5	$20.4	$20.9	$24.6	$25.3	$25.3
Total active contracts (whole farm units)	5,079	5,129	5,443	5,779	6,336	NA
New contracts during year	930	953	971	1,047	1,185	NA
Applications awaiting funding	1,589	1,725	1,909	2,580	2,680	NA
Acres under active contracts (million)	15.1	15.2	16.6	15.1	19.4	NA
Counties covered in 10 states	518	518	518	518	556	NA
Avg. cost/new contract ($000)	22	21	22	23	21	NA
Water Bank Program: (ASCS)						
Total payments to participants (million $) 7/	$8.5	$7.9	$8.0	$9.0	$9.9	NA
Total agreements in force	4,944	4,756	5,044	5,515	6,031	NA
Total acres in agreements (000)	552	509	543	607	671	NA
Average annual payment/agreement	$1,716	$1,653	$1,589	$1,632	$1,637	NA
Forestry Incentives Program: (ASCS)						
Total assistance (million $) 3/	$11.8	$12.3	$11.4	$13.6	$12.7	$14.0
Number of participants	5,168	5,048	4.760	5,417	5,179	NA
Acres treated (000)	189	198	187	215	208	NA
Average assistance per acre	$62	$62	$61	$63	$61	NA
Average assistance per participant/year	$2,283	$2,436	$2,394	$2,511	$2,452	NA
Emergency Conservation Program: (ASCS)						
Total assistance provided (million $) 3/	$4.4	$7.2	$12.5	$12.6	$9.5	NA
Number of farms	2,365	4,861	8,958	6,877	4,907	NA
Acres served (million)	0.4	2.5	1.1	1.0	1.0	NA
Colorado River Salinity Control Program: (ASCS)						
Funding total (million $)	$4.9	$5.5	$10.3	$14.8	$14.8	$13.8
Cost-share assistance (million $)	$3.1	$3.4	$6.0	$8.9	$8.8	NA
Participants	77	127	172	214	349	NA
States with participants	3	3	3	3	3	NA
FmHA Programs:						
Soil and water loans: (million $)	$4.7	$5.9	$6.1	$5.5	$2.7	$2.7
(number)	348	360	247	206	138	NA
Conservation easements, number to date	0	3	13	14	15	NA
Acres in easements, total to date	0	321	2,756	2,774	2,791	NA
Properties transferred for conservation purpose:						
number	2	13	17	151	71	NA
acres	485	4,047	8,954	50,447	21,692	NA
Small Watershed Program: (SCS)						
Projects authorized for planning	31	18	18	11	35	18
Projects authorized for installation	26	19	19	23	11	11
Obligations for planning (million $)	$8.6	$8.4	$8.6	$8.9	$9.2	$9.5
Obligations for installation (million $)	$134.5	$137.0	$130.1	$140.8	$144.2	$165.2
Resource Conservation and Development Program: (SCS)						
Active areas (number)	189	189	194	209	236	NA
Federal funding (million $)	$25.1	$25.1	$27.3	$29.9	$32.5	$32.5
State and local funding (million $)	$66.0	NA	$108.1	$160.5	$131.1	NA

1/ See pages 16-17 for a description of each program. The agency administering the program is in parenthesis. The Rural Clear Water Program is not included because it has received no funding since 1981, and is only servicing existing contracts and completing monitoring and evaluation. 2/ Dollar numbers in 1993 are based on appropriations or anticipated expenditures. 3/ Includes both technical and financial assistance. 4/ Full-time equivalents. 5/ Not available. 6/ Total FTE in 1992 devoted to all extension activities at Federal and State levels were 15,972 in 1992 and 15,789 in 1993. 7/ Actual expenditures rather than obligations.

Source: Annual program reports of the various agencies and Office of Budget and Program Analysis, USDA.

ACP, the Largest Cost-Sharing Program

The Agricultural Conservation Program (ACP), administered by ASCS, is by far the largest cost-sharing program. Over 120,000 farmers received ACP financial assistance for conservation during 1992, down from previous years and from nearly 140,000 farmers in 1988. The average assistance per participant was about $1,600, of which 94 percent was cost-sharing and the balance was technical. Funding and participation in fiscal 1993 may be up significantly.

The Great Plains Conservation Program, administered by SCS, is limited to selected counties in 10 States and is much smaller than the ACP, but addresses the conservation needs of whole farm units. The average assistance cost exceeds $20,000 per contract for longterm agreements, of which about two-thirds is cost-sharing.

The Resource Conservation and Development Program stresses community development and attracts State and local contributions that exceed Federal funds by several times. In 1992, State and local funds of $131 million were four times the Federal expenditures of $32 million.

The Colorado River Salinity Control Program includes only Colorado, Utah, and Wyoming, although authorized for more. Both cost-share assistance to farmers and total program funding increased every year since the program's initiation in 1987, up to 1992 when program funding held constant.

Funding and activity in the Forestry Incentives Program, Emergency Conservation Program, and Small Watershed Program remained fairly steady over 1988-92. Funding for the Water Bank Program has recently been increased to assist farmers in preserving wetlands.

Increased Emphasis on Water Quality

Most of the longstanding conservation programs are placing increased emphasis on water quality. For example, over $36 million, one-fifth of ACP funding in 1992, went for cost-sharing practices to improve surface water quality, up from $13 million and 7 percent of funds in 1988 (table 16). The Extension Service in 1992 allocated 4 percent of its staff specifically to water quality initiatives. The Great Plains Conservation Program is funding a special water quality project in each of the program's 10 States, with emphasis on nutrient and pesticide management.

Table 16--Agricultural Conservation Program (ACP) expenditures by primary purpose, fiscal 1988-92

Primary purpose	Cost-share expenditures				Percent of total			
	1988 1/	1990	1991	1992	1988	1990	1991	1992
	$Million				Percent			
Erosion control	$133.8	$112.2	$111.5	$106.3	71.2	64.7	61.7	58.9
Water conservation	27.7	24.7	23.6	22.8	14.7	14.3	13.0	12.6
Surface water quality (SWQ):								
Sediment	1.7	3.5	4.9	5.9	0.9	2.0	2.7	3.3
Animal waste	6.8	13.8	18.4	20.5	3.6	7.9	10.2	11.3
Fertilizer	1.4	2.8	4.8	5.8	0.7	1.6	2.7	3.2
Toxics	0.4	0.3	0.6	1.1	0.2	0.2	0.3	0.6
Salinity	2.4	1.2	0.8	0.9	1.3	0.7	0.4	0.5
Other SWQ	0.7	0.8	1.0	2.5	0.4	0.5	0.6	1.4
Subtotal SWQ	13.4	22.4	30.5	36.7	7.1	12.9	16.9	20.3
Groundwater quality	0.3	0.3	0.4	0.4	0.2	0.2	0.2	0.2
Energy	0.9	1.1	1.2	1.2	0.5	0.6	0.7	0.7
Wildlife	1.3	1.3	1.5	1.4	0.7	0.7	0.8	0.8
Wood production	9.1	9.9	10.9	10.2	4.8	5.7	6.0	5.7
All other	1.5	1.5	1.2	1.5	0.8	0.9	0.7	0.8
Total 2/	188.0	173.4	180.8	180.5	100.0	100.0	100.0	100.0

1/ Recent peak year for total cost-share expenditures under ACP. 2/ These data differ slightly from the more recent information in table 7, but are the only available source of expenditures by primary purpose.

Source: Based on data from Agricultural Stabilization and Conservation Service, USDA

Farmers Expand Use of Crop Residue Management

Farmers are recognizing the benefits of crop residue management, a widely used conservation practice. USDA has an action plan to help producers with highly erodible lands meet conservation compliance requirements through adoption of crop residue management.

Crop residue management (CRM) includes conservation tillage and other conservation practices that provide sufficient residue cover to protect the soil surface from the erosive effects of wind and water (see box).

Conservation tillage was used on almost 89 million acres in 1992. Impressive gains in the use of high residue conservation tillage systems will likely continue as farmers use crop residue management to implement their conservation compliance plans, to reduce production costs, and to improve environmental quality. For example, the area planted with no-tillage systems doubled between 1989 and 1992 (table 17).

Management of crop residue has been the practice most often specified in conservation compliance plans. Nearly 75 percent of the highly erodible acres with plans include crop

Crop Residue Management/Tillage Systems

Crop Residue Management (CRM) is a conservation practice that usually involves a reduction in the number of passes over the field with tillage implements and/or in the intensity of tillage operations, including the elimination of plowing (inversion of the surface layer of soil). The practice is designed to leave sufficient residue on the soil surface to reduce wind and/or water erosion.

CRM is a year-round system that includes all field operations that affect the amount of residue, its orientation to the soil surface and prevailing wind and rainfall patterns, and the evenness of residue distribution throughout the period requiring protection. This may include the use of cover crops where sufficient quantities of other residue are not available to reduce the vulnerability of the soil to erosion during critical periods.

Conservation Tillage--Any tillage and planting system that maintains at least 30 percent of the soil surface covered by residue after planting to reduce soil erosion by water; or where soil erosion by wind is the primary concern, maintains at least 1,000 pounds (per acre) of flat, small grain residue equivalent on the surface during the critical wind erosion period. Two key factors influencing crop residue are (1) the previous crop, which establishes the initial residue amount and determines its fragility, and (2) the type of tillage operations prior to and including planting.

Types of Conservation Tillage

1. **No-till**--The soil is left undisturbed from harvest to planting except for nutrient injection. Planting or drilling is accomplished in a narrow seedbed or slot created by coulters, row cleaners, disk openers, in-row chisels, or roto-tillers. Weed control is accomplished primarily with herbicides. Cultivation may be used for emergency weed control.

2. **Ridge-till**--The soil is left undisturbed from harvest to planting except for nutrient injection. Planting is completed in a seedbed prepared on ridges with sweeps, disk openers, coulters, or row cleaners. Residue is left on the surface between ridges. Weed control is accomplished with herbicides and/or cultivation. Ridges are rebuilt during cultivation.

3. **Mulch-till**--The soil is disturbed prior to planting. Tillage tools such as chisels, field cultivators, disks, sweeps, or blades are used. Weed control is accomplished with herbicides and/or cultivation.

Other Tillage Types--Tillage and planting systems that leave less than 30 percent of the soil surface covered by residue but may meet erosion control goals with or without other supporting conservation practices (i.e., strip-cropping, contouring, terracing, etc.).

4. **15-to 30-Percent Residue**--Tillage types that leave 15-30 percent residue cover after planting or 500 to 1,000 pounds (per acre) of small grain equivalent during the critical wind erosion period.

5. **Less than 15-Percent Residue**--Tillage types that leave less than 15-percent residue cover after planting or less than 500 pounds (per acre) of small grain equivalent during the critical wind erosion period.

Table 17--National use of crop residue management practices, 1989-1992 and forecast 1993

	1989	1990	1991	1992	1993 1/
	Million acres				
Total area planted (NASS) 2/	331.6	326.9	326.0	327.6	NA
Total area planted (CTIC) 3/	279.6	280.9	281.2	282.9	282.7
Area planted with:					
No-till	14.1	16.9	20.6	28.1	37.0
Ridge-till	2.7	3.0	3.2	3.4	3.7
Mulch-till	54.9	53.3	55.3	57.3	61.0
Total conservation tillage 3/	71.7	73.2	79.1	88.7	101.7
Other tillage types:					
15-30% residue	70.6	71.0	72.3	73.4	77.0
< 15% residue	137.3	136.7	129.8	120.8	104.0
Total other tillage types 3/	207.9	207.7	202.1	194.2	181.0
	Percent				
Percentage of area with:					
No-till	5.1	6.0	7.3	9.9	13.1
Ridge-till	1.0	1.1	1.1	1.2	1.3
Mulch-till	19.6	19.0	19.7	20.2	21.6
Total conservation tillage	25.6	26.1	28.1	31.4	36.0
Other tillage types:					
15-30% residue	25.3	25.3	25.7	25.9	27.2
< 15% residue	49.1	48.7	46.1	42.7	36.8
Total other tillage types	74.4	73.9	71.9	68.6	64.0
	Million hectares				
Total area planted (NASS) 2/	134.2	132.3	131.9	132.6	NA
Total area planted (CTIC) 3/	113.2	113.7	113.8	114.5	114.4
Area planted with:					
No-till	5.7	6.8	8.3	11.4	15.0
Ridge-till	1.1	1.2	1.3	1.4	1.5
Mulch-till	22.2	21.6	22.4	23.2	24.7
Total conservation tillage	29.0	29.6	32.0	35.9	41.2
Other tillage types:					
15-30% residue	28.6	28.7	29.3	29.7	31.2
< 15% residue	55.6	55.3	52.5	48.9	42.1
Total other tillage types	84.1	84.1	81.8	78.6	73.3

NA = Not available.
1/ The 1993 forecast is based on expert opinion and 1993 Prospective Plantings report (NASS) March 31, 1993.
2/ Estimates of area planted to principal crops from the National Agricultural Statistics Service (NASS), USDA.
3/ Estimates of conservation tillage use from the National Surveys of Conservation Tillage Practices from the Conservation Technology Information Center (CTIC), National Association of Conservation Districts. The total area planted by tillage type (CTIC) is less than total area planted (NASS) because the NASS estimates include crops not counted in CTIC surveys. For example, NASS includes all hay harvested in total area planted.

residue management as a key measure to be implemented by 1995. The results from recent national surveys show increased use of crop residue management tillage systems (table 17). Despite achieving the treatment of over 50 percent of the highly erodible lands by December 31, 1992, a special effort is needed to help farmers meet their conservation planning goals to reduce soil erosion and improve water quality.

USDA Action Plan Assists Conservation Compliance Implementation

The U.S. Department of Agriculture has developed a Crop Residue Management Action Plan to assist producers with highly erodible land in implementing conservation systems with appropriate conservation technologies to meet the requirements of their approved conservation plans by 1995. Fostering the timely adoption of improved methods of managing crop residues is critical for producers to comply with the conservation provisions of the 1985 and 1990 farm acts.

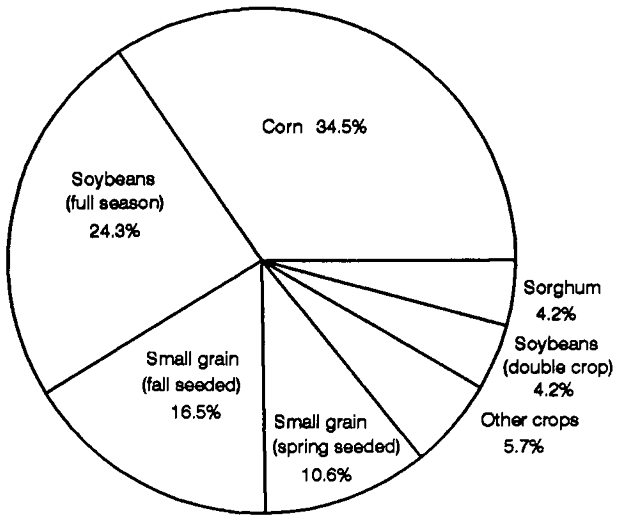
This initiative has three major components: information delivery, technology training, and technical assistance. The initiative is intended to deliver timely information; provide increased technical assistance to help land users install conservation systems; help producers better understand the conservation provisions of farm legislation; and help them maintain their eligibility for USDA program benefits.

One vehicle to help accomplish this initiative is a cooperative effort between the USDA agencies and the Conservation Technology Information Center to establish and maintain Crop Residue Management alliances at the national, State, and local levels. State alliances have been established in 19 States. These alliances include USDA agencies, industry, farm media, grower associations, commodity groups, conservation societies, environmental organizations, and others interested in promoting the conservation of soil and water resources.

Conservation Tilled Area Grows

In 1992, conservation tillage was used mainly on corn, soybeans, or small grains (figure 15). About two-fifths of the total acreage planted to corn and soybeans was conservation tilled. Where double-cropping occurred, about 63 percent of the double-cropped soybeans, 51 percent of the double-cropped corn, and 46 percent of the double-cropped sorghum were produced using conservation tillage systems. Farmers apply CRM mostly on their own, only 560,000 acres of conservation tillage were cost-shared in 1992.

Figure 15
Conservation Tillage Acres by Crop, 1992 1/



1/ Share of total acres planted with conservation tillage.
Source: Conservation Technology Information Center data.

The Corn Belt and Northern Plains contained the largest areas of planted cropland in 1992 and included nearly 63 percent of total conservation tilled acres (figure 16). These regions plus the Lake States, Mountain, and Southern Plains have substantial acreage with 15-to 30-percent residue cover. With improved crop residue management, a significant portion of this acreage has the potential to qualify for conservation tillage status in the future.

No-till Use Spreads Rapidly

The area planted with no-till has doubled since 1989 to over 28 million acres in 1992. No-till's share of conservation tilled area is greater in the six eastern regions than elsewhere (figure 17). Among the major crops, the area planted with no-till has expanded in each of the last 4 years. The rate of increase has been greater for the row crops (corn, soybeans, and cotton) than for small grains and sorghum (figure 18).

The upward trend in the use of high residue conservation tillage systems has resulted in no-till and ridge-till accounting for over 35 percent (more than 31 million acres in 1992) of the national acreage with conservation tillage. This demonstrates a shift away from clean tillage (less than 15-percent residue) and a move toward tillage systems leaving more crop residue on the soil surface (table 17).

High residue conservation tillage systems, such as no-till, can leave as much as 70 percent of the soil surface covered with crop residues. Higher crop residue levels offer more protection against erosion than lower residue levels. Crop residue management (CRM) systems are usually more cost effective than other erosion control measures in protecting highly erodible land.

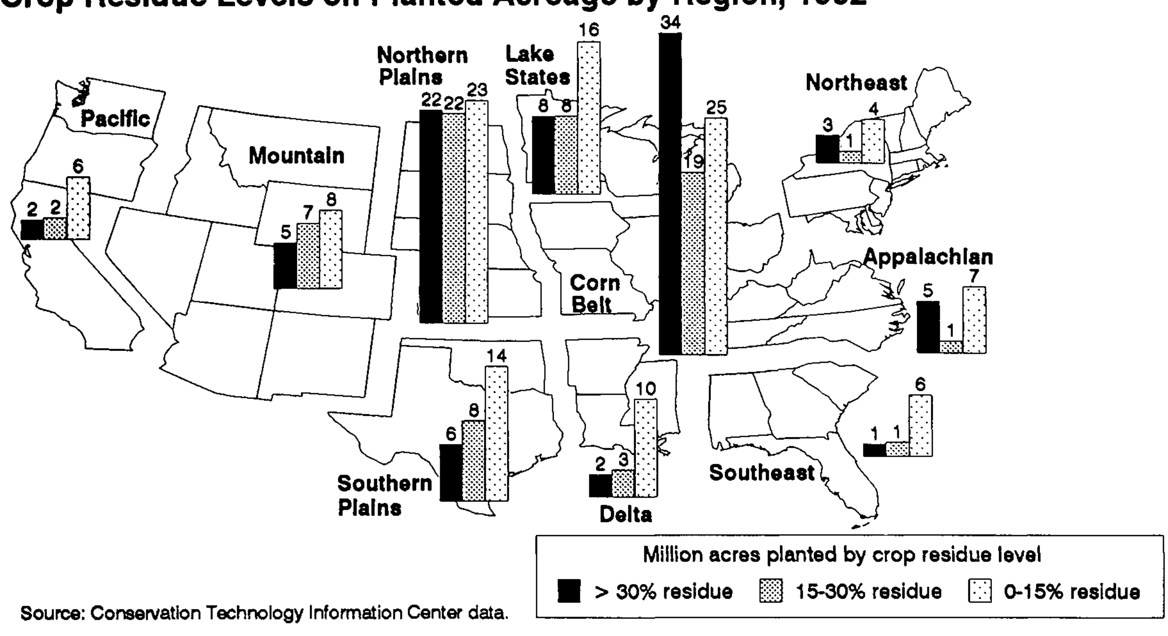
Conservation Tilled Acres May Exceed 100 Million in 1993

Further expansion in the use of no-till and steady growth in the use of ridge-till and mulch-till are expected in 1993 (table 17). This forecast is based on normal weather during planting season in the major corn, soybean, and spring seeded small grain producing areas, and continued use of tillage systems that result in sufficiently high levels of crop residue to meet the requirements of conservation compliance plans. Some fields in parts of the Corn Belt and Lake States were severely rutted during harvesting operations last season. This condition could contribute to more intensive tillage than expected during seedbed preparation.

Crop Residue Management Systems Usually Have Lower Costs

While new or retrofitted machinery may be required to adopt CRM systems, fewer trips over the field and reduced labor

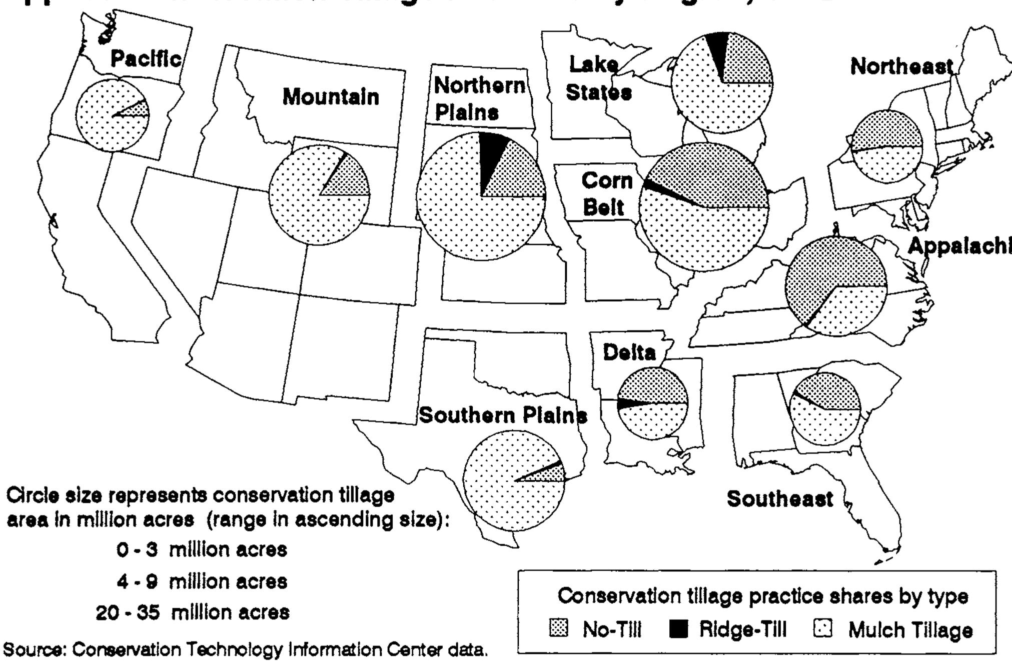
Figure 16
Crop Residue Levels on Planted Acreage by Region, 1992



Source: Conservation Technology Information Center data.

Figure 17

Applied Conservation Tillage Practices by Region, 1992



Source: Conservation Technology Information Center data.

requirements can result in immediate cost savings. If energy prices increase, CRM practices become more profitable because less fuel is consumed with fewer trips over the field. Machinery costs usually decline in the long run because a smaller machinery complement is needed. However, CRM systems might require more attention to proper timing and placement of fertilizers and pesticides and in carrying out tillage operations.

Chemical costs may also vary because the combination of active ingredients and/or the method of application are often different between CRM systems. However, the crop rotation (including cover crops), moisture availability and its timing, nonchemical nutrient sources and pest control practices, and other factors influencing nutrient availability and pest populations appear to have greater impact on chemical use in annual crop production than the type of tillage system.

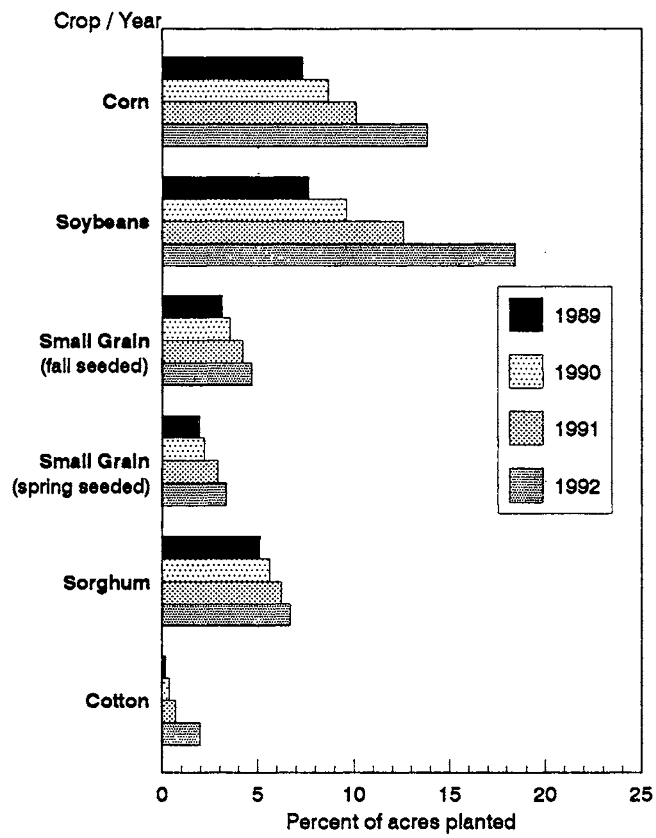
CRM systems include the proper application of registered herbicides as an essential component. CRM systems are also among the most cost-effective systems to meet the requirements of conservation compliance plans.

Other field practices, such as contour farming, strip-cropping, cover crops, field terraces, filter strips, and grassed waterways, also reduce soil erosion, water runoff, and associated chemical loss. Crop rotations can lower pesticide runoff risk by increasing crop residue levels and water infiltration while improving soil structure. The use of crop rotations often reduces the area needing treatment with pesticides,and decreases reliance on annual applications of the same pesticide, which add to increased pest resistance and reduced effectiveness.

The water quality effects of crop residue management are discussed in a special supplement at the end of the Conservation section, see page 38.

Figure 18

Percent of Acres Planted with No-Till, by Crop, 1989-92



Source: Conservation Technology Information Center data.

Farmers Also Adopting Other Improved Management Practices

Besides CRM, USDA programs promote farmers' use of improved nutrient, pesticide, integrated crop, animal waste, and other management practices, as well as more traditional conservation.

The WQI and ACP are helping farmers implement integrated crop management, nutrient management, and pesticide management (table 18). While the total acreage assisted was only around 1 million acres in 1992, the number is substantially above 1991 and the prospects are for continued expansion. Although just starting up in 1992, the Water Quality Incentive Projects and the Integrated Farm Management Option should further this expansion.

In 1992 ACP and WQI also helped farmers install nearly 4,400 animal waste systems, up from 3,800 in 1991 and under 2,000 in 1988. Over $20 million of ACP funds went into cost-sharing animal waste systems in 1992, triple that of 1988 (table 16).

The CRP between 1987 and 1990 idled extensive acreage of cropland and placed it under grass cover. Smaller acreage went into trees and wildlife habitat. In recent years, the ACP has contributed annually to grass cover establishment on over a half million acres, grass cover improvement on 1 million acres or more, and grazing land protection on over 3 million acres.

Table 18--Major practices implemented under USDA conservation programs, fiscal 1988-92

Practice and program 1/	1988	1989	1990	1991	1992	1988	1989	1990	1991	1992
	Million acres treated					Million hectares treated				
Grass cover establishment:										
ACP	0.65	0.61	0.58	0.61	0.59	0.26	0.25	0.23	0.24	0.24
CRP	7.36	4.27	3.02	0.33	0.79	2.98	1.73	1.22	0.13	0.31
Grass cover improvement:										
ACP	1.37	1.17	0.96	1.00	1.00	0.55	0.47	0.39	0.40	0.40
CRP	0.47	0.29	0.17	0.04	0.09	0.19	0.12	0.07	0.01	0.04
Tree planting:										
ACP	0.16	0.13	0.12	0.13	0.12	0.06	0.05	0.05	0.05	0.05
CRP	0.50	0.41	0.19	0.09	0.10	0.20	0.17	0.08	0.04	0.04
FIP	0.16	0.16	0.15	0.18	0.16	0.06	0.06	0.06	0.07	0.06
Wildlife habitat establishment:										
ACP	0.02	0.02	0.02	0.02	0.03	0.01	0.01	0.01	0.01	0.01
CRP	0.39	0.31	0.65	0.01	0.01	0.16	0.13	0.27	--	--
Cropland protective cover: ACP	0.75	0.64	0.58	0.61	0.65	0.30	0.26	0.23	0.25	0.26
Conservation tillage:										
ACP	0.45	0.33	0.43	0.41	0.56	0.18	0.13	0.06	0.17	0.22
WQI regional activities	NA	NA	NA	4.2	4.8	NA	NA	NA	1.70	1.94
Strip cropping systems: ACP	0.14	0.12	0.15	0.12	0.10	0.06	0.05	0.06	0.05	0.04
Integrated crop mgt.: ACP	--	--	0.03	0.20	0.28	--	--	0.01	0.01	0.01
Nitrogen management:										
WQI Demo projects	0	0	NA	0.01	0.22	0	0	NA	--	0.09
WQI HUA projects	0	0	NA	0.20	0.44	0	0	NA	0.08	0.18
WQI regional activities	NA	NA	NA	0.13	0.19	NA	NA	NA	0.05	0.08
Phosphorus management:										
WQI Demo projects	0	0	NA	0.01	0.13	0	0	NA	--	0.05
WQI HUA projects	0	0	NA	0.07	0.43	0	0	NA	0.03	0.17
Pesticide management										
WQI Demo projects	0	0	NA	0.04	0.08	0	0	NA	0.02	0.03
WQI HUA projects	0	0	NA	0.13	0.58	0	0	NA	0.05	0.24
WQI Chesapeake Bay	NA	NA	NA	0.22	0.25	NA	NA	NA	0.09	0.10
	Million acres served					Million hectares served				
Grazing land protection: ACP	3.60	3.77	4.72	3.33	3.66	1.46	1.53	1.91	1.39	1.48
Irrigation water cons: ACP	0.82	0.77	0.69	0.77	0.69	0.33	0.31	0.28	0.31	0.28
Terraces and diversions: ACP	1.08	0.93	0.62	0.70	0.75	0.43	0.38	0.25	0.28	0.30
Water impoundments: ACP	0.27	0.27	0.22	0.19	0.14	0.11	0.11	0.09	0.08	0.06
Sediment control struc.: ACP	0.25	0.22	0.21	0.22	0.20	0.10	0.09	0.08	0.09	0.08
Sod waterways: ACP	0.22	0.17	0.18	0.26	0.20	0.09	0.07	0.07	0.11	0.08
	number									
Animal waste mgmt. systems:										
ACP	1,947	1,753	2,348	2,912	3,844					
WQI Demo projects	0	0	NA	123	162					
WQI HUA projects	0	0	NA	200	325					
WQI regional activities	NA	NA	NA	581	74					
Wellhead protection:										
WQI Demo projects	0	0	NA	62	463					
WQI HUA projects	0	0	NA	2,304	1,553					

1/ ACP = Agricultural Conservation Program. CRP = Conservation Reserve Program. FIP = Forestry Incentives Program.
HUA = Hydrologic Unit Area. WQI = Water Quality Initiative.
No data available for programs or projects not listed

Source: Annual reports of the various programs.

Program Benefits: Erosion and Pollutants Down

USDA conservation programs have significantly reduced erosion from 1987 levels, and will achieve more before 1995. The programs also reduce chemicals entering the Nation's surface and ground waters.

The CRP took 36 million acres out of crop production and placed them under protective cover, and reduced cropland erosion by 670 million tons per year (table 19). This is a drop of over one-fifth in annual cropland erosion from the 1987 level of 3 billion tons.

Conservation compliance, with its stimulus for farmers to apply additional conservation to highly erodible lands, could further reduce erosion by over one-tenth by 1995, compared with 1987. The program's estimated net impact on erosion in 1992 was over 100 million tons (excluding acreage going into the CRP or already eroding at the T level or below (table 19). In the Great Plains, additional lands coming into compliance and better moisture for cover crops contributed to significantly less wind erosion during November 1992 to February 1993 compared to a year earlier.

USDA programs are also reducing or improving fertilizer and pesticide use. Lands in the CRP receive lower applications of fertilizer and pesticides than if they had remained active cropland. In the WQI producers implementing improved nutrient management used 50 million pounds less nitrogen and 65 million pounds less phosphorus in 1992 (table 19). Pesticide applications fell more than 500,000 pounds. For all three inputs, the reductions were several times greater than those achieved in 1991 by the WQI. These reductions, although still insignificant compared to total use in the United States, can benefit water quality in environmentally sensitive areas.

The Colorado River Salinity Control Program reduced the salt load entering the river in 1992 by an estimated 153,000 tons. The downstream benefits (reduction in damages caused by salinity) have been estimated to be at least $50 per ton of salt reduction, which would make for a total benefit in 1992 of over $7.6 million.

Table 19--Impacts of USDA conservation programs on erosion and chemicals, fiscal 1988-92

Impact and program 1/	1988	1989	1990	1991	1992
			Million tons		
Erosion reduced/soil saved by:					
Conservation Reserve Program 2/	514	596	644	654	672
Conservation Compliance 3/	0	0	0	NA	103+
Agricultural Conservation Program 4/	40	34	33	34	30
Conservation Technical Assistance and GPCP 4/5/	463	353	309	282	298
Annual Acreage Reduction Program 4/6/	107	62	56	60	36
WQI regional activities				2	
			Million lbs.		
Nitrogen application reduced by:					
WQI Demo projects 4/				0.9	8.9
WQI HUA projects 4/				1.7	38.5
WQI regional activities 4/				8.1	5.9
Phosphorus application reduced by:					
WQI Demo projects 4/				0.2	17.3
WQI HUA projects 4/				1.5	57.4
WQI regional activities 4/				4.4	5.8
			1,000 tons		
Salt load reduced by:					
Colorado River Salinity Control Program 2/	62	75	92	132	153
			1,000 lbs. active ingredient		
Pesticide load reduced by:					
WQI Demo projects 4/				48	66
WQI HUA projects 4/				191	462

1/ No data or estimates available for programs not listed or where blanks exist. 2/ All lands treated by program, including those first treated in past years which are still reducing erosion. 3/ Minimum estimate for 1992 based on 18 million acres of additional lands with a conservation plan fully implemented, excluding land in the CRP or which was eroding at or below T in 1987 (See table 11 for more information in lands subject to compliance). The average erosion reduced was assumed to be 5.7 tons/acre/year. This is the average reduction in erosion that would occur if erosion on HEL lands in the 1987 NRI were reduced to the T rate or by one-half (whichever was the lesser reduction). 4/ Reduction on lands newly treated during year only. No estimates exist of continuing reductions on lands treated in prior years. 5/ Includes partial double counting with CRP, Compliance, and ACP programs. 6/ Assumes average reduction of 2 tons/acre/year. While this is a commodity program, idling the land and less cultivation preserve soil.

Source: Annual program reports of the various agencies.

Many Non-USDA Programs Affect Agriculture

Nearly a dozen non-USDA Federal programs for water quality affect agriculture, in addition to State-operated programs in the majority of States.

- **The Nonpoint Source Program**, established by Section 319 of the Clean Water Act, requires States and U.S. territories to file assessment reports with the Environmental Protection Agency (EPA), identifying navigable waters that cannot attain water quality standards without reducing nonpoint source pollution. This program requires management plans to be developed that specify actions to reduce nonpoint source pollution. All States now have EPA-approved programs. The Act authorizes up to $400 million annually in grants to States for implementing these plans, with $50 million awarded in fiscal 1992.

- **The National Estuary Program**, established by Section 320 of the Clean Water Act, is administered by the EPA. It provides for the identification of nationally significant estuaries that are threatened by pollution, preparation of conservation and management plans, and for Federal grants to State, interstate, and regional water pollution control agencies for preparing and implementing the plans.

- **The National Pollutant Discharge Elimination System (NPDES) Permit Program**, established by Section 402 of the Clean Water Act, is also administered by EPA. It controls point-source discharges from treatment plants and industrial facilities (including large animal and poultry confinement operations). For 1993, EPA has authorized 38 States and one territory to operate the NPDES permit program.

- **The Safe Drinking Water Act (SDWA)** provisions require the EPA to set standards for drinking-water quality and requirements for water treatment by public water systems. Also SDWA requires States to establish a wellhead protection program to protect public water system wells from contamination by chemicals, including pesticides, nutrients, and other agricultural chemicals. The EPA may make grants to States for developing and implementing safe drinking water and wellhead protection programs.

- **Pesticide programs**, established by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and administered by the EPA, provide the legal basis under which pesticides are regulated. FIFRA's re-registration process (which requires the EPA to approve the active ingredients used in agricultural insecticides and herbicides) could enhance ground water protection by controlling the use of highly leachable chemicals.

- **The Coastal Zone Act** authorizes National Oceanic and Atmospheric Administration and EPA assistance to coastal States to develop Coastal Zone Management Programs and Coastal Nonpoint Pollution Control Programs. In total, 29 States have approved management programs and are developing nonpoint programs for approval. The latter shall specify and implement management measures to restore and protect coastal waters, in conformity with EPA guidance. Once approved, the programs will be implemented through changes in each State's nonpoint source pollution (Section 319) program and its coastal zone management program.

- With the **Groundwater Quality Protection Program**, EPA is implementing a ground water strategy for the 1990's that emphasizes pollution prevention. In 1992, EPA provided $12 million to States to implement comprehensive State Ground Water Protection Programs.

- **The National Irrigation Water Quality Program**, administered by the U.S. Department of the Interior, identifies areas adversely affected by toxic elements in irrigation return flows, and undertakes re-mediation in conjunction with other Federal, State, and local agencies and groups.

- **The National Water Quality Assessment Program**, administered by the U.S. Geological Survey, is monitoring and describing the status and trends in the quality of the Nation's surface water and ground water, including occurrences of pesticides, nutrients, and sediment. In 1992, field investigations were underway in 20 areas across the Nation.

- **The Clean Lakes Program**, re-authorized by Section 314 of the Clean Water Act, authorizes EPA grants to States for lake classification surveys, diagnostic/feasibility studies, and for projects to implement lake restoration and protection practices. To remain eligible for grants, a State must submit a biannual report to the EPA on the status of lakes and establish a clean lakes demonstration program.

- **Regional initiatives** include the Chesapeake Bay Program, the Great Lakes Program, and the Gulf of Mexico Program. Each is a cooperative effort among various States that contribute funds, and is managed by a regional authority. Federal agencies provide assistance. Under USDA's Water Quality Initiative, the Soil Conservation Service has accelerated technical assistance to the three programs.

- **State-administered programs** for agricultural pollution control in 30 States include the following incentives: regulations and penalties (27 States), cost sharing (25), tax credits (7) low interest loans (5), input taxes (4), land use controls (3) and purchase of easements (2).

Water Quality Effects of Crop Residue Management

Crop residue management combined with other appropriate management strategies and the proper selection and use of chemicals can play a crucial role in protecting water quality.

Agricultural activities affect water quality. For example, tillage operations loosen soil particles, which can then be dislodged by wind and water erosion. Sediment is a major problem for surface water quality. During rainfall and runoff, rainfall mixes with the soil and water in a thin mixing zone at the soil surface, and either infiltrates or runs off (2, 5, 7).[1] Runoff begins when the rainfall rate exceeds the infiltration rate (20). If chemicals are located on the surface, there will be significantly greater losses in surface runoff, compared to areas either not treated or where chemicals were incorporated with tillage.

Tillage practices that leave substantial amounts of crop residue evenly distributed over the soil surface are a primary defense against the generation of sediment and sediment-related chemical (fertilizers and pesticides) losses. The filtering action of the increased organic matter associated with higher levels of crop residue results in cleaner runoff (20). More crop residue also increases the opportunity for captured chemicals to break down into harmless components through the action of microorganisms contained in organic matter in the residue or in the top layer of soil and exposure to air and sunlight (9, 18, 23). Thus, under normal conditions, the presence of increased crop residue usually reduces the volume of contaminants associated with runoff to surface waters by constraining sediment losses and enhancing infiltration (11).

Proper management of crop residue is an effective technique to reduce soil erosion and water runoff, improve soil tilth and organic matter, and increase moisture retention. The greater infiltration resulting from crop residue management improves soil moisture but raises concerns about the potential leaching of dissolved chemicals into shallow ground water (2, 24). The timing, route, and volume of infiltrating water are very important relative to chemical losses in surface runoff or subsurface drainage (2). The movement of chemicals from the point of application to ground or surface waters depends on a complex interaction between a variety of site specific factors ranging from the climate and the hydrologic, geologic, and topographic characteristics of the land surface to the inherent characteristics of the soils and the applied chemical materials (20, 23).

Chemical Properties

The behavior of chemicals in the environment is determined by their interrelationship with soil, plants, and water. The fate of applied chemicals depends on the respective propertiesof the active ingredients, such as their adsorption, persistence, and solubility characteristics (9, 11, 25).

Although many soil and chemical factors (including soil moisture, clay content, pH, and temperature) affect adsorption, the percentage of organic matter is a major predictor in defining adsorption strength (12, 15, 18). The greater the adsorption property, the more likely the chemical will stay where it is applied to perform its intended function or is degraded. Chemicals with low adsorption characteristics indicate potential loss through runoff or subsurface drainage (leachate). However, losses in subsurface drainage may be small if the time required for transport through the soil profile exceeds chemical persistence (12).

Persistence refers to how long a chemical takes to dissipate in the environment. A primary mode of dissipation is decomposition and is indicated by half-life, which is the length of time required for half of the chemical to degrade or decompose by chemical, biological, or photochemical (sunlight) processes. A highly persistent chemical remains intact by virtue of its properties and provides prolonged effectiveness but also prolonged opportunity for environmental contamination. Chemicals that can be decomposed by sunlight and/or have a tendency to evaporate readily require incorporation to get them into the soil to delay decomposition (15). Once a persistent chemical moves deeper into the soil by infiltration, there is less opportunity for degradation because microbiological activity usually decreases with depth (24).

Solubility is desirable for chemicals that need to readily mix with water and remain in solution for easy and more uniform application. Most water soluble chemicals leach more readily from the root zone and have the potential to end up in the ground water. Solubility and adsorption are usually inversely related; i.e. as solubility increases adsorption decreases. However, some water soluble chemicals have high adsorption properties so they do not leach as readily as their solubility would indicate, e.g. paraquat and glyphosate (12, 24).

For surface-applied chemicals that are not strongly adsorbed, initial infiltration before runoff begins can be an important factor in decreasing concentrations and losses in surface runoff (1). Surface runoff losses for chemicals that degrade or dissipate with time after application are determined by elapsed time and infiltration rates for the first few storms after application. Infiltration that decreases surface runoff may increase leaching losses depending on the route the percolating water takes through the soil profile (2).

[1] Numbers in parentheses refer to references cited at the end of the supplement.

Potential for water contamination is heightened when a persistent chemical is used consistently for a number of years, e.g. atrazine. However, atrazine's persistence enables it to perform well in controlling weeds during the growing season, but also raises environmental concerns about its prolonged use. The combination of persistence and repeated use over long periods make atrazine a potential source of contamination through infiltration. From an environmental perspective, low persistence is generally better. (For more on atazine and water quality, see the special article at the end of this report)

Pesticide materials that are highly mobile and long lived in the environment are less desirable than those that adhere tightly to the targeted material and are short lived. Pre-emergence herbicides are generally tilled into the soil where they must be sufficiently mobile and persistent to reach and destroy weed seedlings. These properties facilitate the migration of pre-emergence chemicals in the environment through surface water runoff or percolation to ground water. Post-emergence and burndown herbicides are generally less mobile and less persistent, and, therefore, less likely to migrate from their target (25). For example, glyphosate and paraquat, although highly soluble, also have strong adsorption and relatively short half-life properties, which therefore reduce their potential for contaminating ground water through infiltration.

The difference in chemical properties between pre-emergence and post-emergence or burndown herbicides is an important factor when considering the impact on the environment of herbicide use associated with a particular tillage system. Tillage systems that employ herbicides with lower mobility and shorter half-life are preferable from a water quality standpoint to tillage systems that require herbicides with greater mobility and longer half-life.

Ground Water

The potential for ground water contamination is facilitated by the characteristics of the aquifer that determine how easily water can percolate through the soils and geologic formations. Water movement can be rather rapid through soils developed in glacial outwash materials and over fractured limestone (karst) formations.

Analysis of the effects of no-till systems on ground water quality has been conditioned by the knowledge that (a) surface water runoff is reduced and infiltration is increased; (b) macropores (earthworm burrows, large root tunnels, and/or large expansion/contraction cracks) are far more prevalent and the lack of disruptive tillage allows them to persist; (c) post-emergence herbicides are an essential component of no-till systems; and (d) no-till allows for continuous row crop production on slopes that required rotational cropping when clean tillage and cultivation were used for weed control (10, 12).

Surface macropores are left intact roughly to the degree that the soil surface is left undisturbed by tillage. The persistence of macropores creates the potential for preferential flow paths to deliver water and surface-applied chemicals rapidly through the top layers of the soil profile (10). This permits water and water-borne materials to bypass the root zone where most biological and chemical transformations and adsorption take place, especially during intense early summer storms.

During early summer the soil is provided little protection from the growing crop (canopy) against frequent and often intense storms. This is also a period of rapid weed development requiring the application of control measures such as cultivation and/or herbicides (a worst-case scenario). Consequently, the potential for contaminants to be included in runoff water is greatly enhanced. However, recent research indicates that under normal climatic and hydrologic conditions, crop residue management systems (including conservation tillage and no-till in particular) are no more likely to degrade ground water than other tillage systems (12). The increased volume of infiltration dilutes the concentration level of contaminants in the percolate to ground water.

Research in the field (3, 10, 14, 16, 17, 21) and with rain simulators (6, 10, 13, 22) shows that only if the first storm delivers a large volume of rain in a short time (a high intensity storm), very closely after a chemical application, and soil moisture prior to the storm was high, is there much chance for measurable transport of the chemical in water runoff or in macropores. After all other storms, the concentration of chemicals in the preferential flow paths is very low, often lower than that of the water in the fine pore matrix of the soil (23). The water in the fine pore matrix would contain any dissolved chemicals that were incorporated into the soil or infiltrated in ways other than through macropores.

If, however, during the first few hours after a chemical is applied there is a small storm or low intensity rainfall, the water flow through the macropores is very limited and, therefore, little or no chemical transport occurs. A light rainfall appears to bond chemicals more tightly to the residue or soil particles and/or moves them into the soil matrix so that if a big storm follows, even though water flow increases within the macropores, chemical transport decreases. The combination of time and intervening rainfall reduces the likelihood of significant macropore transport of surface-applied chemicals in subsequent storms (1, 2, 10).

Macropores are not direct conduits from the soil surface to the groundwater aquifer but instead rarely extend to depths greater than 1 meter in most soils where no-till systems are used with continuous corn (10). Since macropores are essentially dead-end tubes within the root zone, water and chemicals infiltrating through them must subsequently move into the subsoil matrix.

High populations of microorganisms are commonly present in the surface residue and adjacent topsoil, as well as in the walls of the macropores themselves (9). Therefore, any percolate would be exposed to their activity. The contention that flow of chemicals through macropores under no-till systems is a substantial threat to groundwater quality cannot be supported by the evidence (10).

Surface Water

Several field studies (3, 14, 16) conducted on small watersheds under natural rainfall on highly erodible land (14 percent slope) have shown that no-till reduces soil erosion by more than 90 percent compared with moldboard plow tillage. Water runoff under field conditions was more variable depending on the frequency and intensity of rainfall events but averaged about 30 percent of the levels from moldboard-plowed fields (3, 14, 16, 21). Because chemical loss from treated fields can occur through being dissolved in runoff water and by adherence to soil particles, reduction in treated field chemical loss to surface water would be expected to parallel soil erosion and water runoff results.

The field studies included the application of five major herbicides (alachlor, atrazine, cyanazine, metolachlor, and simazine) used on corn, soybean, and sorghum crops. The no-till systems showed more year-to-year variation in herbicide runoff expressed as a percentage of moldboard plow system runoff. However, results of the field studies confirmed the expected relationship: no-till systems substantially reduced runoff losses for all active ingredients studied. Average herbicide runoff losses from treated fields with no-till systems for all products and all years were 30 percent of the runoff levels from moldboard-plowed fields (12).

Conservation tillage systems, such as no-till, ridge-till, and chisel plowing, that retain protective amounts of residue on the soil surface throughout the year were found to reduce chemical runoff, soil erosion, and water runoff from treated fields below the levels associated with moldboard-plowed fields. No-till was the most effective on highly erodible lands (HEL) while ridge-till and chisel-plow practices gave good results on less erodible and rolling fields. In fact, studies on reduced soil compaction and improved internal field drainage by subsurface drainage tile indicate that field practices that increase water infiltration can reduce herbicide runoff (4, 8).

The movement of surface-applied agricultural chemicals is determined by the properties of the specific chemical and the properties of the soil and associated materials such as surface residue. Strategies to control erosion or prevent sediment from a treated field from being carried with surface runoff are appropriate to reduce chemical loss for strongly adsorbed chemicals. Higher crop residue levels reduce the amount of agricultural chemicals that reach surface waters attached to sediment or dissolved in the runoff (2, 24).

Moderately adsorbed chemicals are also lost with surface runoff, but most are dissolved in runoff water rather than attached to sediment. Methods to reduce runoff and/or incorporate applied chemicals into the soil would be recommended to control losses.

Weakly adsorbed and non-adsorbed chemicals are lost with subsurface drainage water (leachate) either naturally with subsurface flow or with subsurface tile drainage effluent. Determining the optimum rate of application and adjusting timing and placement of the chemicals, or use of non-leachable forms or additives can improve efficiency of use and reduce leaching losses (24).

Protecting water quality is a matter of understanding the relationships between chemicals and their carriers--sediment, surface runoff, and subsurface drainage (leachate) water--and making informed decisions to balance the inevitable tradeoffs that occur.

Tillage operations change the soil environment into which fertilizers and pesticides are introduced. Crop residue management combined with other appropriate management strategies and the proper selection and use of chemicals can play a crucial role in protecting water quality.

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Atrazine and Water Quality: Issues, Regulations and Economics

by
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Abstract: Atrazine is an important herbicide in the production of corn. Recent detections of atrazine in surface water have raised concerns about the quality of some drinking water supplies in corn producing areas. Corrective actions required by the Safe Drinking Water Act could be costly to water users. A general ban or use restriction on atrazine would negate the need for additional water treatment, but would be costly to producers and consumers. Local atrazine management efforts in areas most at risk would be a more efficient means of protecting water supplies.

Keywords: Atrazine, water quality, water treatment, management practices, economic costs.

Atrazine is an important herbicide in the production of corn and sorghum. Recent findings indicate that elevated amounts of atrazine are running off fields and entering surface water, primarily in the Midwest (8)[2]. Water monitoring studies find atrazine 10 to 20 times more frequently than the next most detected pesticide (2).

Recent changes in the Safe Drinking Water Act make public water utilities legally responsible for providing drinking water with atrazine concentrations below a standard of 3 parts per billion (ppb). Based on monitoring studies, some publicly owned drinking water systems in the Midwest face the possibility of having to alter their treatment systems to meet the atrazine standard. Such changes would impose higher costs on water system users. An alternative to treating water is to reduce the amount of atrazine entering water resources.

Atrazine History and Use

Atrazine has been a major agricultural herbicide for more than 30 years. It is one of the most used pesticides in the country. Atrazine is used primarily on corn, and is the primary pesticide used on corn (tables A-1, A-2). Over 60 percent of all corn acreage is treated with atrazine (14,15). Atrazine is also used on sorghum, sugarcane, and a variety of specialty crops. Until recently atrazine was also registered for industrial use, primarily to maintain right-of-ways. Use has declined in recent years, but annual sales still range between 75 and 80 million pounds of active ingredient (a.i.) (5).

Atrazine is popular for a number of reasons. It is relatively inexpensive, effective, and flexible. Atrazine can be applied to corn pre-plant, pre-emergence, or post-emergence. Most atrazine on corn is currently applied pre-emergent or pre-plant. Atrazine is often applied in mixes that contain other herbicides.

Atrazine application rates on corn depend upon climate and soil texture, with reduced rates required on sand, loamy sands, and sandy loam soils. In 1991 atrazine was applied to corn at an average rate of 1.15 pounds per acre in the major corn producing States (14). In 1992 the rate averaged 1.12 pounds per acre (15). Atrazine is applied to sorghum in a similar manner. In 1991 the application rate on sorghum averaged 0.97 pounds per acre (14). Application rates on corn and sorghum have generally decreased since atrazine was first brought onto the market.

EPA has officially classified atrazine as a possible human carcinogen. Based on current data, atrazine can be characterized as practically nontoxic to birds (16). There is sufficient data to characterize atrazine as moderately toxic to coldwater fish and moderately to slightly toxic to warmwater fish. Atrazine can be highly toxic to freshwater invertebrates, such as insects. Atrazine has a half-life of 146 days in loam soil. However, in heavy, wet soils and in poorly aerated surface and ground water, the half-life increases to 660 days.

Recent concerns over atrazine in surface water resulted in EPA's acceptance of a voluntary label change for the use of atrazine in 1992. Current label restrictions require that atrazine not be mixed or loaded or used within 50 feet of all wells. In addition, the product may not be applied aerially or by ground within 66 feet of perennial or intermittent streams, lakes, ponds, or rivers, or within 200 feet of surface water used as drinking water supplies. The maximum application rate for corn and sorghum is 2.5 pounds per acre per calendar year. The product cannot be applied through any type of irrigation system, and industrial uses such as for clearing rights of way are prohibited.

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[2] Numbers in parentheses refer to references cited at end of article.

Detections in the Environment

Numerous monitoring studies for atrazine have been conducted over the past decade on river systems and on individual water supply facilities and reservoirs. These studies have been conducted by Federal agencies, State agencies, and chemical manufacturers. States reporting at least one water supply with mean annual atrazine concentrations greater than the maximum contaminant level (MCL) of 3 ppb (putting it out of compliance with the Safe Drinking Water Act) include Kansas, Missouri, Ohio, Illinois, and Iowa (3, 6, 9, 10, 12, 17).

Some general statements can be made based on the results of the monitoring studies. Atrazine is sometimes found in ground water, but rarely above the MCL. Factors associated with more frequent detections in ground water include karst terrain (limestone formations that permit easy movement of water), shallow, permeable soils, unconfined aquifers, and irrigation (17).

Atrazine is almost always found in surface water in areas where it is used. Greatest concentrations are found in the spring, after application. In most of the surface water studies, mean annual concentrations are below the MCL. Lowest levels of exposure occur in community water supplies drawing from the Great Lakes, large rivers, and rivers draining large watersheds dominated by forests or grazing land. Even though seasonal spikes may approach or even exceed the MCL, these spikes tend to be short-lived and mean annual concentrations are generally below the MCL.

Drinking water drawn from smaller rivers or reservoirs having agricultural watersheds appears to be most at risk from atrazine. On rivers, seasonal spikes can be very high, and concentrations greater than the MCL can persist for up to 6 weeks after the application period (8). Reservoirs tend to act as pollutant sinks, so if they are contaminated during spring rains, atrazine concentrations tend to remain high for a long time. Under such conditions the likelihood increases of municipal water supplies being out of compliance with the Safe Drinking Water Act.

Treatment

If a water utility's water is found to be out of compliance with the Safe Drinking Water Act because of atrazine (or any other pollutant), an alternative source of water must be found or treatment technology installed. The treatment technology designated by EPA to control herbicides in drinking water is granulated activated carbon (GAC).

For a small utility, the cost of a GAC system is quite large. For example, in EPA Region VII (MO, KS, IA, NE) 13 public water supplies are expected to have trouble meeting the new atrazine MCL (10). Initial costs of establishing adequate GAC treatment systems for these 13 suppliers are $8.3 million. Annual treatment costs were estimated to be approximately $180,000 (10). The 13 water systems supply about 36,000 people. Per capita costs are therefore $229 for capital costs and $5 for annual operation and maintenance costs.

Public water systems using surface water supply 21 million people in the atrazine-use area (1). If *all* publicly owned systems in the Midwest had to incur the same per capita costs as the 13 systems above, total annual treatment costs would be about $400 million, including $277 million in capitalized costs of GAC systems annualized over 30 years at 4 percent and $105 million in annual operation and maintenance costs.

The $400 million is an overestimate for two reasons. The per capita costs were calculated with data from relatively small systems. The per capita costs for the larger systems would be smaller. Also, most water systems currently appear to be in compliance with the atrazine drinking water standards. However, the estimate provides a useful upper bound of water treatment costs for comparing to the costs of preventing or limiting atrazine from entering water supplies in the first place.

Besides costs to the water treatment industry, atrazine in surface water may have adverse effects on wildlife and the environment. However, whether the concentrations of atrazine currently found in surface water are affecting ecosystems is currently unknown.

Table A-1--Atrazine use trends, 1964-92

	Quantity		Acres			
Year	Corn	Total	Corn			All crops
	1,000 lbs ai		1,000 acres	Percent acreage	Rate (lbs/acre)	1,000 acres
1964 1/	10,225	10,837	7,592	12	1.35	7,912
1966 1/	21,066	23,495	13,740	21	1.53	14,978
1971 1/	52,000	57,216	35,993	49	1.44	39,842
1976 1/	83,790	90,340	56,863	67	1.47	61,750
1980 2/	62,600	NA	42,200	56	1.48	NA
1982 1/	69,700	84,600	47,900	60	1.46	NA
1985 2/	NA	NA	35,200	59	NA	NA
1986 2/	NA	NA	38,205	68	NA	NA
1987 2/	NA	NA	35,694	70	NA	NA
1988 2/	NA	87,230 4/	31,807	60	NA	NA
1989 2/	NA	NA	33,023	57	NA	NA
1990 3/	58,125	NA	47,692	64	1.22	NA
1991 3/	52,060	NA	45,262	66	1.15	NA
1992 3/	54,939	NA	49,249	69	1.12	NA

ai = active ingredient
NA = not available
1/ National Pesticide Use Survey. 2/ Cropping Practices Survey of Major Producing States. 3/ Chemical Use Survey. 4/ Ciba-Geigy, 1989.

Atrazine Management

Atrazine can enter water resources through point source or nonpoint source discharges. Point source discharges are due to carelessness in storage, mixing, disposal, and application. Point source discharges can be important. In one study in Ontario, 22 percent of pesticide detections in 11 watersheds were linked to carelessness when applying atrazine adjacent to streams (7). Point source best management practices center on simple care in handling the material.

Nonpoint discharges occur when the chemical leaches through the soil profile or is carried with surface runoff before it is degraded. Such occurrence is not necessarily a matter of carelessness, although careless handling and application could exacerbate a problem. A number of management practices are available for reducing atrazine loadings where the chemical is applied. Many farmers already use these practices, which reduce the amount of atrazine applied to fields, or reduce the atrazine-carrying runoff to surface waters.

One option is to switch to one or more other herbicides. However, the current substitutes for atrazine are more costly or less effective. Atrazine applications can be reduced by better timing, using scouting, and applying the pesticide in bands rather spraying the entire field. Incorporating atrazine directly into the soil, rather than applying to the surface, reduces the opportunity for surface runoff.

A number of crop management systems also reduce runoff, including conservation tillage, contouring, strip cropping, and filter strips. Using rotations can reduce the acreage needing treatment and can break pest cycles, thereby reducing the need for future applications.

Costs of Control

Alternative management systems can impose costs on producers, through increased production costs or decreased crop yields. Reducing application rates of atrazine and allowing only post-emergent applications in the Corn Belt, Lake States, and Northern Plains is estimated to reduce producer income $320 million annually, due to increased production costs and decreased yields (11). Consumers would not be significantly affected because prices would rise only slightly.

A ban on atrazine would have a greater impact on production. Total economic costs to producers and consumers have been estimated to be about $800 million annually for a ban in the Corn Belt, Lake States, and Northern Plains (11), and about $1.2 billion annually for a ban in 27 production areas that include all or part of Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Wisconsin, and Colorado (4). Costs would be less over time as the production system adjusted.

Under a ban, annual government program costs are estimated to be reduced by as much as $570 million because of higher corn and sorghum prices, assuming no changes in the farm programs (4). Farmers would respond to the ban by using more of the atrazine substitutes (simazine, cyanazine, dicamba, bentazon, alachlor, metolachlor) and increasing the use of a corn-soybean rotation.

A-2--Atrazine use on corn, by major producer State, 1991-92

State	1991 Area	1991 Total	1992 Area	1992 Total
	Percent	Mil lbs	Percent	Mil lbs
Georgia	NA	NA	67	759
Illinois	81	10,615	83	11,320
Indiana	89	6,332	79	6,505
Iowa	62	7,354	68	8,160
Kansas	74	1,596	78	1,555
Kentucky	88	2,013	91	1,875
Michigan	74	2,549	69	2,504
Minnesota	32	1,684	39	2,201
Missouri	85	2,911	85	2,787
Nebraska	70	6,290	73	6,389
North Carolina	76	1,012	78	1,244
Ohio	81	4,108	80	3,810
Pennsylvania	78	1,329	76	1,297
South Carolina	72	274	86	431
South Dakota	18	490	27	827
Texas	72	963	75	1,190
Wisconsin	52	2,048	59	2,088

NA = not available
Source: USDA 1991, 1992.

Conclusions

Atrazine is a widely used herbicide in corn and sorghum production. Of all pesticides it is the most widely detected in surface and ground water resources. Concentrations in some surface waters exceed drinking water standards established for community water treatment systems.

The costs of treating all surface water consumed by those living in the Midwest would be about $400 million annually. Because only a portion of public water systems appears to require treatment, actual costs are probably substantially less than $400 million per year. Banning atrazine would eliminate the need to incur these costs, but the annual costs to producers and consumers could range between $800 million and $1.2 billion.

Economically, it appears that a total ban would cost more than the cost of removing atrazine from drinking water. While a shift to rotations has other environmental benefits, the increased use of other herbicides could lead to other water quality problems. This consequence is a concern for any policy that targets a single chemical.

A general reduction in application rates and banning all preplant and pre-emergent applications would generate producer costs of around $320 million. Whether the benefits of this option outweigh the producer costs will depend upon how many water systems will require treatment. However, based on current water quality data, the water treatment benefits will probably be less than the costs.

The results imply that targeted atrazine control methods, which might include local bans in certain areas, are more efficient than an overall ban, or even a general restriction in use. Targeted control would allow continued use, thus lessening the production impacts of the analyses presented above, while addressing what appears to be very localized problems.

The issue becomes one of identifying those watersheds requiring atrazine runoff control, and the most appropriate alternative management strategies.

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