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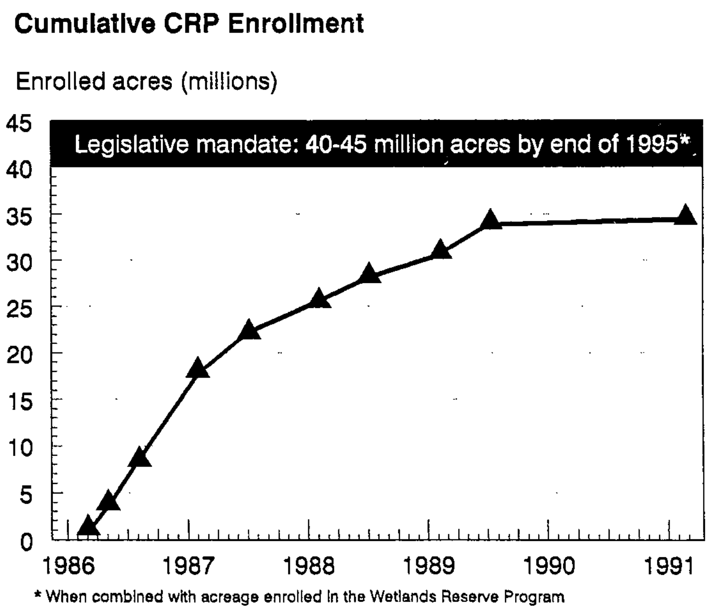
Situation and Outlook Report



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Summary

Farmers are responding to policy changes in the 1990 Farm Act, including a new planting flexibility provision and new enrollment criteria for the Conservation Reserve Program (CRP). These changes, drought in the West, and other environmental and economic factors caused farmers to adjust their planting, irrigation, conservation, and water quality protection decisions.

The 338 million acres expected to be used for crops are down 3 million from last year and well below the 1981 peak of 387 million. Cropland declined in all regions except the Corn Belt and Lake States. Largest declines occurred in the Mountain, Pacific, and Southern Plains regions reflecting the 11.2 million acre decline in U.S. wheat. Wheat farmers participating in the 1991 Federal program had to set aside 15 percent of their acreage compared to only 5 percent in 1990. On the other hand, feed grain, cotton, and rice producers had lower set-aside requirements.

The 63 million acres idled under Federal programs this year includes 29 million in the annual programs and 34 million in the CRP. With the higher set-aside requirement, wheat acreage idled in the annual program was 15.2 million, more than double the amount idled in 1990. Idled corn, sorghum, barley, cotton, and rice, however, were down 6.8 million acres to partially offset the increase in wheat. Farmers idled 565,000 more acres in the CRP this year and have enrolled an additional 1.12 million for 1992.

A new planting flexibility provision was offered this year to participants in the annual programs. The provision allowed farmers to plant an alternative crop and still keep their base acreage and eligibility for future income support payments. Fifteen percent of their base acres, called "normal flex acres," and an additional 10 percent, called "optional flex acres," could be planted to a program crop or an approved flex crop.

This year farmers did not take full advantage of the new planting flexibility provision and continued to plant the program crop. Of the potential 33 million acres that could have been flexed, farmers took advantage of the provision on only 7.5 million. After accounting for shifts from one program crop to another, the net flex acreage was 5.7 million acres. Corn base planted to corn declined 2.6 million acres, due mostly to farmers producing soybeans on corn base. Wheat was down 1.7 million acres, mostly from a shift to soybeans and other nonprogram crops on the wheat base.

Areas in California and Nevada are in the fifth consecutive year of drought and portions of North Dakota, the Pacific Northwest, and central Rocky Mountains are in the fourth. Streamflows of less than 70 percent average were forecast for much of the Colorado, Snake, and California basins. Early summer reservoir levels for irrigation were below normal in most western States. The most acute shortages are in Nevada, with reservoir levels at only 15 percent normal, California at 64 percent normal, and Oregon and Utah with less than 70 percent normal. Arizona, Colorado, New Mexico, and Washington have above normal water storage this year.

The drought in California and surrounding States has limited water supplies for irrigation as well as hydroelectric power generation, recreation, and wildlife habitat. California irrigation is estimated down over 700,000 acres since 1988 due to the continuing drought. Besides reducing irrigated acres in response to short water supplies, producers have also relied on partial irrigations, improved management, substitution of more expensive ground water, and crops that require less water. The result for many producers will be lower production and higher operating costs.

The new enrollment criteria for CRP includes a bid acceptance process designed to select land that provides the highest conservation and environmental benefit relative to program cost. Bids that exceed local rental rates for the soil-specific class of land are rejected. Land in filter strips, other easement practices, and wellhead protection areas are given priority acceptance. Remaining bids are then ranked and accepted using a formula that takes into account environmental benefits and contract cost.

Following an 18-month pause in enrollment, the tenth and eleventh signups were held in 1991. In the tenth signup, farmers bid nearly 2.5 million acres to be enrolled in the program in 1991, of which 565,000 were tentatively accepted. As a result of the new bid procedure, a larger proportion was accepted in the Corn Belt, Delta, and Lake States. Earlier signups had larger enrollments from the Plains and Mountain regions. The average rental rates are up, but the benefits are expected to be higher. Erosion reductions are higher and include more land with water erosion. While both water and wind erosion can reduce productivity, controlling water-caused erosion generally produces greater benefits to water quality, recreation, and wildlife habitats.

The 1990 farm bill established a new Wetland Reserve Program (WRP), an Agricultural Water Quality Protection Program (AWQPP), and increased penalties for violations of Conservation Compliance, Sodbuster, and Swampbuster provisions. The WRP is expected to return 1 million acres of farmed or converted wetland back into a wetland environment through permanent easements with farmers. The AWQPP goal is to enroll 10 million acres around wellheads,

Karst areas with sinkholes, and land identified under the Federal Water Pollution Control Act as threatening endangered species habitats, and other sensitive areas. These short-term agreements will allow commodity production but will require implementing a water quality protection plan; reporting nutrient, pesticide, and animal waste applications; and providing results from soil, tissue, and well tests.

Cropland

Acreage Down Slightly from 1990

The 338 million cropland acres expected to be used for crops in 1991 are down just 3 million (0.9 percent) from 1990 (table 1). After peaking at 387 million acres in 1981, when none were idled under Federal programs, cropland used for crops has trended downward through 1988. This decline was mainly due to increased farmer participation in Federal programs aimed at limiting crop production or soil erosion. Land idled by Federal programs declined 22 percent (16.9 million acres) from 1988 to 1989, but increased 4 percent (2.5 million acres) from 1989 to 1991. Cropland used for crops increased 14 million acres from 1988 to 1989 and declined about 3 million acres from 1989 to 1991.

Federal programs idled more than 63 million acres in 1991, an increase of more than 1 million from 1990 but considerably less than the 1983 and 1988 peaks of 78 million acres (table 1, figure 1). This year's increase was the result of 1.1 million more acres idled in annual crop programs plus 0.6 million acres newly enrolled in the Conservation Reserve Program (CRP). The increases in land idled by Federal programs since 1989 reflect a combination of slightly higher rates of program participation, lower set-aside requirements for some program crops, and continued increases in land bid into the 10-year CRP.

Farmers intend to harvest 306 million acres of the 19 principal crops, which together with minor crops would raise total harvested acres in 1991 to more than 319 million acres. Nearly 12 million acres are estimated to be double cropped.

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

Cropland	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991 2/
					Million acres					
Cropland used for crops	383	333	373	372	357	331	327	341	341	338
Cropland harvested 3/	347	294	337	334	316	293	287	306	310	307
Cropland failure	5	5	6	7	9	6	10	8	6	7
Cultivated summer fallow	31	34	30	31	32	32	30	27	25	24
Cropland idled by all Federal programs	11	78	27	31	48	76	78	61	62	63
Annual programs	11	78	27	31	46	60	53	31	28	29
Long-term programs	0	0	0	0	2	16	25	30	34	34
Total, specified uses 4/	394	411	400	403	405	407	405	402	403	401
					Million hectares					
Cropland used for crops	155	135	151	151	144	134	132	138	138	137
Cropland harvested 3/	140	119	136	135	128	119	116	124	125	124
Cropland failure	2	2	2	3	4	2	4	3	2	3
Cultivated summer fallow	13	14	12	13	13	13	12	11	10	10
Cropland idled by all Federal programs	4	32	11	13	19	31	32	25	25	25
Annual programs	4	32	11	13	19	24	21	13	11	11
Long-term programs	0	0	0	0	1	6	10	12	14	14
Total, specified uses 4/	159	166	162	163	164	165	164	163	163	162

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 one 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.

Figure 1
Major Uses of U.S. Cropland

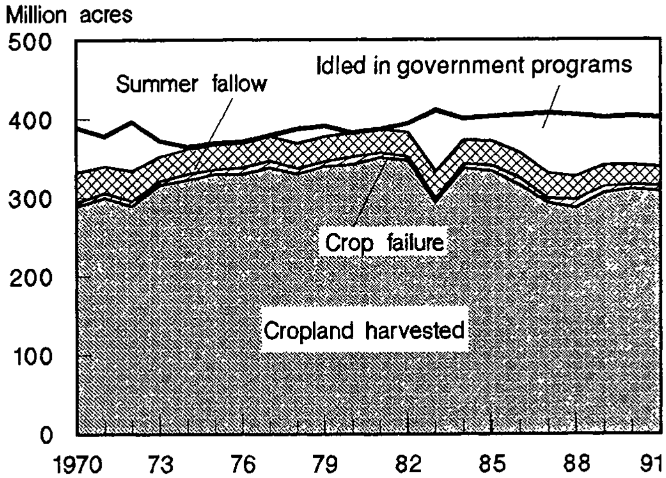
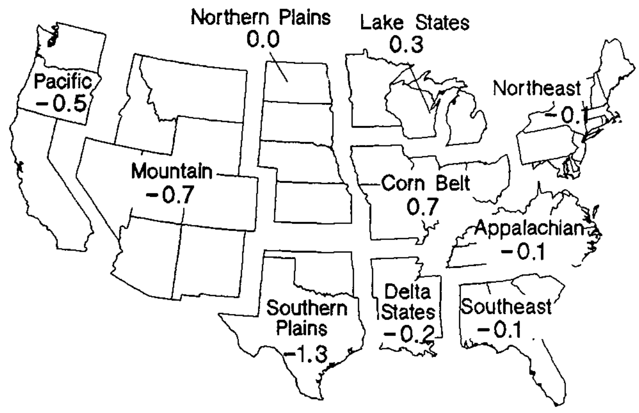


Figure 2
Change in Cropland Used for Crops by Farm Production Region, 1990-91



In million acres.

After allowing for double cropping, harvested cropland is expected to total nearly 307 million acres, about 3 million acres below last year but 44 million acres below the 1981 high of the last 40 years.

An estimated 24 million acres were summer fallowed in 1991, down about 1 million acres from 1990 (table 1). No doubt, some additional land normally summer fallowed has been contracted into the CRP. Lower set-aside requirements for most program crops also contributed to the decline in land summer fallowed since 1987.

Cropland used for crops in 1991 likely will decrease slightly, reflecting decreases in principal (including program) crops planted and increases in idled acres (table 5). Crop failure is estimated to be 7 million acres, about 2.2 percent of the planted acreage. Crop failure has declined from 1989 and 1988, when severe drought devastated several regions, and is about the same as in 1985. It is also about equal to the average for the last decade. This estimate is based on acres indicated to be harvested and does not reflect disaster conditions, based on reduced yields, that have been indicated in more than 200 counties. The failure estimate also reflects sharp regional changes from last year. These included lower estimated crop failure in the Corn Belt, Southeast, and Mountain regions and a higher failure in the Southern Plains and Pacific regions.

Lake States and Corn Belt Farmers Increase Cropland in 1991

Cropland used for crops in 1991 is higher than last year in just 2 of the 10 farm production regions (fig 2). Cropland used for crops increased most in the Corn Belt followed by the Lake States—0.7 million acres and 0.3 million acres. These regions also had the largest increases in cropland harvested—0.7 million acres in the Corn Belt and 0.3 million acres in the Lake States. The Southeast had a slight increase in cropland harvested, but was actually using less total cropland in 1991 due to an estimated decrease in crop failure (table 2).

The increases in cropland acres in the Corn Belt and Lake States regions are due mainly to increases in corn and soybeans acreage (table 7). In addition, fewer acres were idled in Federal programs in these regions in 1991 than in 1990 (see table 3). Fewer acres were also idled in Federal programs in the Northeast, Appalachian, Southeast, and Delta regions, but cropland decreased, albeit slightly, as well.

Of perhaps greater significance were the cropland changes in the Mountain, Pacific, and Plains regions. Cropland declined most in these regions, except the Northern Plains (table 2). The Mountain, Pacific, and Plains regions experienced increases in land idled in Federal programs, while all other regions had decreases (table 3). Among the major crops, wheat declined 7.3 million acres in these 4 Western regions while oats and rice had small declines (table 7).

Idled Acreage Increases Above 1989 and 1990

About 63.3 million acres were idled under Federal programs this year (table 3). This excludes an additional 0.5 million acres of feed grain and wheat base which were idled from program crop production under 0/92 provisions, but were planted to minor oilseeds as allowed by the 1990 farm bill. Less than half—28.8 million acres—of the 1991 idled acreage is in annual Federal acreage reduction programs (including the 0/92 and 50/92 programs not planted to minor oilseeds); the remainder is enrolled in the CRP.

In contrast to the annual changes since 1987, 1.1 million acres more cropland were idled by annual crop programs in 1991 than in 1990 (table 4). Net changes in individual crops due to the annual programs reveal some important differences between 1990-91 changes and those of other recent years. The only increases in idled base acres were oats, 0.3 million acres (150 percent) and wheat, 7.7 million acres (103 percent). Increases in the idled base acreage of these two crops more than offset decreases in the idled base among the other program crops, which continued to decline as most had done from 1989 and 1990.

In addition to the total increase in land idled by annual programs, an additional 0.3 million base acres were bid into the CRP. Net base acreage idled by annual programs and the CRP in 1991 increased by 1.4 million acres from a year earlier, more than offsetting the 0.4 million acre decline from 1989 to 1990. The differences between the total idled acreage in tables 3 and 4 represents nonbase acres idled by the CRP in 1986 through 1991.

All acreage enrolled in the CRP must remain idle for the full 10-year life of the CRP contract. Base acreage in the CRP is preserved and could return as effective base acreage eligible

Table 2--Cropland used for crops in 1991, and 1990-91 change, by region

Region	Cropland used for crops 1/				Share of all cropland used for crops
	Cropland harvested	Crop failure	Summer fallow	Total	
1991:	Million acres				Percent
Northeast	11.2	0.1	-	11.3	3.3
Lake States	34.2	0.4	-	34.6	10.3
Corn Belt	80.0	0.7	-	80.7	23.8
Northern Plains	74.6	1.3	12.8	88.7	26.2
Appalachian	16.4	0.2	-	16.6	4.9
Southeast	9.9	0.2	-	10.1	3.0
Delta States	15.0	0.4	-	15.4	4.5
Southern Plains	26.7	2.2	0.8	29.7	8.8
Mountain	24.6	0.6	8.2	33.4	9.9
Pacific	14.8	0.9	2.3	18.0	5.3
United States 2/	307.4	7.0	24.1	338.5	100.0
	Million hectares				Percent
Northeast	4.5	3/	-	4.6	3.3
Lake States	13.8	0.2	-	14.0	10.3
Corn Belt	32.4	0.3	-	32.7	23.8
Northern Plains	30.2	0.5	5.2	35.9	26.2
Appalachian	6.6	0.1	-	6.7	4.9
Southeast	4.0	0.1	-	4.1	3.0
Delta States	6.1	0.2	-	6.2	4.5
Southern Plains	10.8	0.9	0.3	12.0	8.8
Mountain	10.0	0.2	3.3	13.5	9.9
Pacific	6.0	0.4	0.9	7.3	5.3
United States 2/	124.4	2.8	9.8	137.0	100.0
1990-91 change:	Percent				
Northeast	-0.9	4/	4/	-0.9	
Lake States	0.9	0.0	4/	0.9	
Corn Belt	0.9	-12.5	4/	0.9	
Northern Plains	-0.5	4/	4.1	4/	
Appalachian	-0.6	4/	4/	-0.6	
Southeast	1.0	-33.3	4/	-1.0	
Delta States	-2.0	4/	4/	-1.3	
Southern Plains	-5.0	29.4	-33.3	-4.2	
Mountain	-0.8	-25.0	-3.5	-2.1	
Pacific	-5.7	350.0	-11.5	-2.7	
United States 2/	-0.7	11.1	-1.6	-0.6	

- = None or fewer than 50,000 acres (20,234 hectares).

1/ Preliminary. Based on farmers' intentions to harvest. 2/ Includes the 48 conterminous States. Fewer than 200,000 acres (80,940 hectares) were used for crops in Alaska and Hawaii. Breakdown may not sum to totals due to rounding. 3/ More than 20,235 hectares (50,000 acres) but less than 50,000 hectares. 4/ No change or less than 0.05 percent.

for program participation at the end of the CRP contract (table 5). However, it could also remain idle without loss of base after expiration of the CRP contract under provisions of the 1990 Farm Act.

Commodity Acreage Reduction Requirements

Feed Grains. Participants in the 1991 feed grain programs were required to idle at least 7.5 percent of their base acreage of corn, sorghum, and barley in the acreage conservation reserve (ACR), down from a 10 percent requirement in 1990 and 1989. Also, there has been no paid land diversion (PLD) since 1988. The 1991 oats program required no idling of base acres. In recent years, 5 percent of oats base acres had to be idled.

Feed grain acreage idled in the 1991 program totals about 12 million, compared with about 17 million acres in 1990 and 1989 (table 4). Nearly 2 million acres (2 percent) more feed grains were enrolled in Federal crop programs in 1991 than in 1990. However, the 5-million-acre decrease in idled acres is due largely to the lower ACR requirements for corn, sorghum, and barley in 1991 from 1989 and 1990. In addition to the annual program participation, more than 10 million acres of feed grain base have been enrolled in the CRP—about 9 percent of the 1991 national feed-grain base of 115 million acres. The idled oats base represents participation in the 0/92 program as no ACR idling was required for oats in 1991. Provisions of the 1992 feed grain program are expected to be announced by September 30.

Harvest estimates of feed grains are up 2.3 million acres from 1990. This is the net of increases of 1.7 million corn acres, 0.6 million sorghum acres, and 0.9 million barley acres, and a decrease of 0.9 million oat acres.

Wheat. Participating wheat growers had to idle 15 percent of base acreage in 1991 compared with 5 percent in 1990 and 10 percent in 1989. However, 36.3 million acres of the 67.6 million 1991 enrolled wheat base is under the winter wheat option. This option resulted from the late passage of the 1990 farm bill and permitted an exception to the 85 percent maximum payment acreage discussed below under "Flex Acres Provisions Allow Considerable Shift From Corn to Soybeans." Under this option, producers could receive deficiency payments on their entire permitted acreage. The deficiency payment was determined using a 12-month national average price, rather than a 5-month average price. If the 5-month price is more than 10 cents below the 12-month price,

Table 3--Cropland idled under Federal acreage reduction programs, by region

Region	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991 1/
					Million acres					
Northeast	0.1	1.0	0.1	0.2	0.5	0.9	0.9	0.7	0.7	0.6
Lake States	0.7	8.0	1.6	2.0	4.2	7.0	6.7	4.7	4.7	4.6
Corn Belt	1.2	17.9	2.9	3.8	8.5	15.3	13.9	8.8	9.0	8.2
Northern Plains	3.7	20.9	9.4	10.1	14.3	19.7	20.8	15.8	16.8	18.3
Appalachian	0.1	2.6	0.3	0.5	1.3	2.7	3.0	2.3	2.3	2.0
Southeast	0.2	2.3	0.5	0.7	1.3	3.0	3.2	3.0	3.0	2.9
Delta States	0.6	3.5	1.3	1.9	2.4	3.5	3.1	3.0	2.6	2.4
Southern Plains	2.3	12.8	5.7	5.9	8.3	11.7	12.0	10.0	9.8	10.6
Mountain	1.7	6.1	3.9	3.9	5.4	8.7	10.2	9.1	9.6	10.3
Pacific	0.6	2.9	1.3	1.6	2.2	3.5	3.8	3.2	3.1	3.4
United States 2/ 3/	11.1	77.9	27.0	30.7	48.1	76.2	77.7	60.8	61.6	63.3
					Million hectares					
Northeast	4/	0.4	4/	0.1	0.2	0.4	0.4	0.3	0.3	0.2
Lake States	0.3	3.2	0.6	0.8	1.7	2.8	2.7	1.9	1.9	1.9
Corn Belt	0.5	7.2	1.2	1.5	3.4	6.2	5.6	3.6	3.6	3.3
Northern Plains	1.5	8.5	3.8	4.1	5.8	8.0	8.4	6.4	6.8	7.4
Appalachian	0.1	1.1	0.1	0.2	0.5	1.1	1.2	0.9	0.9	0.8
Southeast	0.1	0.9	0.2	0.3	0.5	1.2	1.3	1.2	1.2	1.2
Delta States	0.2	1.4	0.5	0.8	1.0	1.4	1.3	1.2	1.1	1.0
Southern Plains	0.9	5.2	2.3	2.4	3.4	4.7	4.9	4.0	4.0	4.3
Mountain	0.7	2.5	1.6	1.6	2.2	3.5	4.1	3.7	3.9	4.2
Pacific	0.2	1.2	0.5	0.6	0.9	1.4	1.5	1.3	1.3	1.4
United States 2/	4.5	31.5	10.9	12.4	19.5	30.8	31.4	24.6	24.9	25.6

1/ Preliminary. 2/ Includes the 48 conterminous States. Because of rounding, regional data may not sum to U.S. totals. 3/ Includes cropland idled by 0/92 and 50/92 programs from 1986 through 1991, except for about 0.5 million acres (0.2 million hectares) enrolled in 0/92 in 1991 and planted to minor oilseeds. Also includes 2.0 million acres (0.8 million hectares) enrolled in the Conservation Reserve Program in 1986, 15.7 million acres (7.0 million hectares) enrolled in 1987, 24.5 million acres (9.9 million hectares) enrolled in 1988, 29.8 million acres (12.1 million hectares) enrolled in 1989, 33.9 million acres (13.7 million hectares) enrolled in 1990, and 34.5 million acres (14.0 million hectares) enrolled in 1991. 4/ Less than 50,000 hectares.

deficiency payments will be determined using the 5-month price plus 10 cents.

About 15.2 million acres of wheat base was idled in the annual program, up 7.7 million acres from last year. Although nearly 1 million acres more were enrolled in 1991 than complied in 1990, the increase in idled acres is largely due to the increase in ACR requirements as 0/92 participation was over 5 million acres in both years. In addition, 10.4 million acres of wheat base were enrolled in the CRP for 1991, an increase of 0.1 million acres from last year. Wheat harvest is estimated at 58.1 million acres in 1991, down 11.3 million from last year (table 7). The wheat acreage reduction program (ARP) announced for 1992 is 5 percent.

Cotton and Rice. Participation in the upland cotton program in 1991 required the idling of 5 percent of base acres in contrast to the required idling of 12.5 percent of base in 1990 and 25 percent in 1989. The extra-long staple (ELS) cotton program required idling 5 percent of base in 1991, 1990, and

Table 4.--Base acreage idled under Federal acreage reduction programs, United States

Program and crop	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991 1/
					Million acres					
Annual programs:										
Corn	2.1	32.2	3.9	5.4	14.2	23.2	20.5	10.8	10.7	7.3
Sorghum	0.7	5.7	0.6	0.9	2.9	4.1	3.9	3.3	3.3	2.3
Barley	0.4	1.1	0.5	0.7	2.0	3.0	2.8	2.3	2.9	2.0
Oats	0.1	0.3	0.1	0.1	0.5	0.8	0.3	0.3	0.2	0.5
Wheat	5.8	30.0	18.6	18.8	21.0	23.9	22.5	9.6	7.5	15.2
Cotton	1.6	6.8	2.5	3.6	4.0	3.9	2.2	3.5	2.0	0.9
Rice	0.4	1.8	0.8	1.2	1.5	1.6	1.1	1.2	1.0	0.6
Total, annual programs 2/	11.1	77.9	27.0	30.7	46.1	60.5	53.3	30.9	27.7	28.8
Conservation Reserve Program: 3/										
Corn					0.2	2.3	2.8	3.4	3.8	3.9
Sorghum					0.2	1.2	1.9	2.2	2.4	2.4
Barley					0.1	1.1	1.9	2.4	2.7	2.8
Oats					0.1	0.5	0.9	1.1	1.3	1.3
Wheat					0.6	4.2	7.1	8.8	10.3	10.4
Cotton					0.1	0.7	1.0	1.2	1.3	1.3
Rice					4/	4/	4/	4/	4/	4/
Total, Conservation Reserve Program 2/					1.2	10.0	15.5	19.0	21.8	22.1
Total base acres idled 2/	11.1	77.9	27.0	30.7	47.4	70.5	68.8	49.9	49.5	50.9
					Million hectares					
Annual programs:										
Corn	0.8	13.0	1.6	2.2	5.7	9.4	8.3	4.4	4.3	3.0
Sorghum	0.3	2.3	0.2	0.4	1.2	1.7	1.6	1.3	1.3	0.9
Barley	0.2	0.4	0.2	0.3	0.8	1.2	1.1	0.9	1.2	0.8
Oats	5/	0.1	5/	5/	0.2	0.3	0.1	0.1	0.1	0.2
Wheat	2.3	12.1	7.5	7.6	8.5	9.7	9.1	3.9	3.0	6.2
Cotton	0.6	2.8	1.0	1.5	1.6	1.6	0.9	1.4	0.8	0.4
Rice	0.2	0.7	0.3	0.5	0.6	0.6	0.4	0.5	0.4	0.2
Total, annual programs 2/	4.5	31.5	10.9	12.4	18.7	24.5	21.6	12.5	11.2	11.7
Conservation Reserve Program: 3/										
Corn					0.1	0.9	1.1	1.4	1.5	1.6
Sorghum					0.1	0.5	0.8	0.9	1.0	1.0
Barley					5/	0.4	0.8	1.0	1.1	1.1
Oats					5/	0.2	0.4	0.4	0.5	0.5
Wheat					0.2	1.7	2.9	3.6	4.2	4.2
Cotton					5/	0.3	0.4	0.5	0.5	0.5
Rice					4/	4/	4/	4/	4/	4/
Total, Conservation Reserve Program 2/					0.5	4.0	6.3	7.7	8.8	8.9
Total base acres idled 2/	4.5	31.5	10.9	12.4	19.2	28.5	27.8	20.2	20.0	20.6

1/ Preliminary. 2/ Because of rounding, crop acreages may not sum to the totals. Base acreages idled under 0/92 and 50/92 programs from 1986 through 1991 are included in annual program data. However, about 0.5 million base acres of feed grains and wheat enrolled in 0/92 in 1991 and planted to oilseeds 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 (20,235 hectares). 5/ Less than 50,000 hectares.

1989. Only 0.9 million acres of cotton base were idled in the annual program in 1991. The 1.1 million fewer acres idled in the cotton programs were expected, based on changes in ARP requirements. The enrolled base in the 1991 program was only slightly less than the complying base in 1990. However, the area expected to be harvested in 1991 is 1.7 million acres (15 percent) greater than was harvested in 1990 (table 7). Nearly 0.2 million acres of this increase can be attributed to crop flex provisions in 1991 (table 6).

Participation in the rice program required idling 5 percent of base acres compared with 20 percent in 1990 and 25 percent in 1989. Actual participation resulted in 0.6 million acres of rice base idled, down nearly 40 percent from 1990. As with some of the other program crops, a smaller base acreage was enrolled in 1991, in spite of a reduced ARP requirement.

In addition to the annual program participation, just 1.3 million cotton base acres and 13,218 rice base acres were enrolled in the CRP for 1991. Announcement of the provisions of the upland cotton program for 1992 are expected by November 1.

Idled Acreage Up Only In Western Regions

Between 1990 and 1991, total acreage idled increased in the Western regions and decreased in the East (table 3). The increases ranged from 7 percent in the Mountain region to 9 percent in the Plains regions and to 10 percent in the Pacific region. The largest proportional decreases occurred in the Northeast, Appalachian, Delta, and Corn Belt where 12, 10, 9, and 9 percent less acreage, respectively, was idled in 1991 than a year earlier. The largest absolute decline occurred in the Corn Belt where 0.8 million fewer acres were idled in Federal crop programs.

Participation in the annual crop programs changed very little from 1990 to 1991. Enrolled base acres increased less than 2 percent from the complying base acreage in 1990 (table 5). The enrolled base acreage of barley, oats, wheat, and rice increased. ELS cotton base enrolled was the same as last year, but participation in the other program crops declined.

Table 5--Principal and program crops planted, total base acreage, and other Federal program acreage statistics and relationships

Item	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991 1/
	Million acres									
Principal crops planted	358.6	309.4	344.9	342.1	326.9	304.9	308.1	316.7	319.1	314.8
Program crops planted	222.3	189.3	215.3	216.8	204.0	185.4	182.8	196.1	196.3	192.0
Total base acreage of program crops	229.9	229.8	234.4	240.3	235.0	236.4	239.2	239.0	238.4	235.6
Base acres in CRP 2/					1.2	10.0	15.5	19.0	21.8	22.1
Effective base acreage 3/	229.9	229.8	234.4	240.3	233.8	226.4	223.7	220.0	216.6	213.5
Complying base acreage	96.9	168.1	128.6	162.8	192.9	197.2	187.8	168.0	166.6	169.4 4/
Annual program set-aside	11.1	77.9	27.0	30.7	46.1	60.5	53.3	30.9	27.7	28.8
Complying base minus set-aside	85.8	90.2	101.6	132.1	146.8	136.7	134.5	137.1	138.9	140.6 4/
Complying base planted	73.7	79.8	88.0	116.1	135.5	131.6	125.0	123.1	132.1	NA
	Million hectares									
Principal crops planted	145.1	125.2	139.6	138.5	132.3	123.4	124.7	128.2	129.1	127.4
Program crops planted	90.0	76.6	87.1	87.7	82.6	75.0	74.0	79.4	79.4	77.7
Total base acreage of program crops	93.0	93.0	94.9	97.2	95.1	95.7	96.8	96.7	96.5	95.3
Base acres in CRP 2/					0.5	4.0	6.3	7.7	8.8	8.9
Effective base acreage 3/	93.0	93.0	94.9	97.2	94.6	91.6	90.5	89.0	87.7	86.4
Complying base acreage	39.2	68.0	52.0	65.9	78.1	79.8	76.0	68.0	67.4	68.6 4/
Annual program set-aside	4.5	31.5	10.9	12.4	18.7	24.5	21.6	12.5	11.2	11.7
Complying base minus set-aside	34.7	36.5	41.1	53.5	59.4	55.3	54.4	55.5	56.2	56.9 4/
Complying base planted	29.8	32.3	35.6	47.0	54.8	53.3	50.6	49.8	53.5	NA
	Percent									
Effective base acreage as percentage of principal crops planted	64.1	74.3	68.0	70.2	71.5	74.3	72.6	69.5	67.9	67.8
Complying base acreage as percentage of effective base acreage	42.1	73.2	54.9	67.7	82.5	87.1	84.0	76.4	76.9	79.3 4/
Complying base acreage as percentage of program crops planted	43.6	88.8	59.7	75.1	94.6	106.4	102.7	85.7	84.9	88.2 4/
Complying base planted as percentage of program crops planted	33.2	42.2	40.9	53.6	66.4	71.0	68.4	62.8	67.3	NA

NA = Not available.

1/ Preliminary. 2/ Program began in 1986. 3/ Total base acreage of program crops less base acres in CRP.
4/ Based on enrolled base acres for 1991.

Base Acreage Down From 1985 Peak

Total base acreage of major program crops—wheat, feed grains, cotton, and rice—reached a peak for the last decade at 240.3 million acres in 1985 (table 5). However, since 1986 the CRP has cut the effective base acreage in each subsequent crop year, until this year it reached a decade low.

Complying base acreage is the portion of effective base acreage operated by producers who chose to participate in annual commodity programs. Participation in annual crop programs varies for several reasons, including the attractiveness of program provisions and outlook for crop prices. The proportion of the effective base complying (enrolled) in 1991 is 79.3 percent, up 2.4 percentage points from 1990, but still 7.8 percentage points below the peak participation in 1987 (table 5).

The maximum acreage that program participants may plant is the complying base acreage minus the acreage required to be idled (acreage conservation reserve). Because not all program participants plant up to their maximum acreage, the complying base actually planted is less. Many producers use the 0/92 and 50/92 programs to idle additional acreage.

Total acreage of program crops planted includes the acreage planted by nonparticipants as well as the complying base planted by program participants. The proportion of program-crop acreage enrolled in Federal programs rose from 33 percent in 1982 to 71 percent in 1987 and declined from 1987 through 1989. In 1990, more than two-thirds of the acreage of all program crops was produced by participants in annual Federal programs and that proportion will likely increase in 1991.

Flex Acre Provisions Allow Considerable Shift From Corn to Soybeans

The 1990 farm bill initiated a "maximum payment acreage," which limits deficiency payments to program participants to 85 percent of the base acreage established for their program crop. The 15 percent of base acres on which deficiency payments will not be made are called "normal flex acres" and are unrelated to the individual program ARP requirements. These normal flex acres can be planted to the original program crop, another program crop, or an approved flex crop.

Planting flexibility provides some incentive for movement toward alternative agriculture and increased crop rotation. It was originally proposed to allow a range of crop choices to producers without loss of income support payments or base acreage eligible for support. As a result of the Budget Reconciliation Act of 1990, which amended the 1990 farm bill, deficiency payments on 15 percent of base acres were eliminated. These were called "normal flex acres" and were permitted to be planted to other crops. Base acreage, however, would be retained in the program crop if the land use was flexed to other crops.

In addition to normal flex acres, an additional 10 percent of program crop base acres could be used as "optional flex acres." If a crop other than the original program crop is produced, the optional flex acres are also not eligible for deficiency payments. However, for both normal and optional flex acres, 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. Crops specifically excluded from production on flexed acres are fruits and vegetables, including potatoes, dry edible beans, lentils, and peas. Any other crops may be excluded by the Secretary of Agriculture. So far, peanuts, tobacco, wild rice, nuts, trees, and tree crops have been excluded.

Based on program crop enrollment in 1991, excluding wheat base enrolled under the winter wheat option discussed earlier, normal flex acres would comprise nearly 20 million acres (see last line of each section in table 6). An additional 13 million more could be optionally flexed. Program enrollment for 1991 shows about 7.5 million acres of "gross" flexed acreage of the potential 33 million acres. This would infer that a high proportion of normal flex acres were still planted to the original program crop and that the optional flex acres provision was not heavily used. After accounting for land shifted from one program crop to another, the net flex acres amount to a little more than 5.7 million (table 6).

The numbers in table 6 indicate the direction and magnitude of change in the program crop at the head of each column. That is, 438,000 acres were flexed out of corn and into another program crop. In turn, corn gained 500,000 acres flexed from other program crops. In total, including land flexed into nonprogram crops, corn lost nearly 2.6 million acres, of which 90 percent was flexed to soybeans.

Although there were shifts into and out of each of the program crops, only corn and cotton gained larger areas from other program crops than they lost to other program crops through the flex provisions. On a relative basis, cotton gained considerably more than corn and was the only program crop to have a net increase from the crop flex provisions. Cotton increased by 183,000 acres, net of land flexed from cotton to other crops. In contrast, even though corn gained more acres from other program crops than was flexed from corn to other program crops, it experienced a large loss, primarily to soybeans. Soybeans gained more than 4.2 million acres (75 percent) of the more than 5.7 million net flex acres from all program crops in 1991.

Table 6--Use of crop base flex area by program crop, 1991 1/

1991 Use of flex area	Program crop base acreage flexed							
	Corn	Sorghum	Barley	Oats	Wheat	Cotton	Rice	Total
	Thousand acres							
Flexed to other program crops	-438	-286	-169	-197	-682	-60	-63	-1,895
Flexed from other program crops	500	203	102	49	444	486	21	1,804
Flexed to nonprogram crops:								
Soybeans	-2,376	-308	-210	-81	-826	-171	-246	-4,220
Minor oilseeds	-65	-18	-67	-18	-210	-16	-9	-404
Other nonprogram crops	-259	-82	-136	-38	-389	-55	-60	-1,019
Subtotal - Nonprogram crops	-2,700	-409	-413	-137	-1,425	-242	-316	-5,642
Net change due to crop base flex provisions	-2,638	-492	-480	-286	-1,664	183	-358	-5,733
Normal flex acres 2/	-9,542	-1,561	-1,309	-419	-4,690 3/	-1844	-595	-19,960
	Thousand hectares							
Flexed to other program crops	-177	-116	-68	-80	-276	-24	-26	-767
Flexed from other program crops	202	82	41	20	180	197	8	730
Flexed to nonprogram crops:								
Soybeans	-962	-125	-85	-33	-334	-69	-100	-1,708
Minor oilseeds	-26	-7	-27	-7	-85	-6	-4	-163
Other nonprogram crops	-105	-33	-55	-15	-157	-22	-24	-412
Subtotal - Nonprogram crops	-1,092	-166	-167	-55	-577	-98	-128	-2,283
Net change due to crop base flex provisions	-1,067	-199	-194	-116	-673	74	-145	-2,320
Normal flex area	-3,862	-632	-530	-170	-1,898 3/	-746	-241	-8,078

1/ A negative number indicates the area flexed (or available for flexing) out of the crop heading the column to another crop. A positive number indicates the area flexed into the crop heading the column from another program crop. 2/ Normal flex acres were computed as 15 percent of enrolled base acres of the program crops. Optional flex acres could be up to an additional two-thirds of the normal flex acres (10 percent of enrolled base acres). 3/ Excludes wheat base acreage enrolled under the Winter Wheat Option.

In comparing the gross acres flexed out of program crops to the potential normal flex acres, a smaller proportion of cotton acres were flexed (16 percent) followed by corn (33 percent). Oats experienced the greatest flex of acres to other crops—80 percent. The relatively low shifts in crops through the acreage flex provisions infers that producers' preferred crop rotations have not been constrained by past base acreage provisions. In many cases, producers likely had no good alternative. However, another reason for the relatively low rate of flexing might have been the late passage of the 1990 barm bill and no experience with the base acreage flex provisions. Participation in 1992 will provide greater insight into this aspect of the farm programs.

Wheat and Oat Acreage Down But Most Other Major Crops Up In 1991

Harvested acreage of corn, sorghum, barley, soybeans, and cotton is expected to rise in 1991, while wheat and oats is estimated to fall. The acreage of rice harvested is unchanged from 1990 (table 7). Total harvested cropland is expected to be down 2.3 million acres from a year earlier.

The decrease in harvested acreage is due partly to the increase in land idled in Federal programs. Land idled by programs has increased from 1990 in the Northern Plains, Southern Plains, Mountain, and Pacific regions (table 3). Land idled in Federal programs declined or was unchanged in the other 6 regions. The increase in lands on which crops failed was just about offset by the decrease in summer fallowed land.

Shifts in acreage among crops are more significant than the small decline in harvested cropland. Wheat acreage harvested in 1991 is estimated at 58.1 million acres, down 11.3 million from a year ago and down 1.2 million acres from the 1985-89 average. More than two-thirds of the expected decrease results from 7.8 million more acres of wheat base idled. All regions except the Northeast show reductions in harvested acres from 1990. The decreases were particularly large in the Northern Plains (2.8 million acres), and Southern Plains (2.7 million), regions where large increases occurred last year.

Harvested oats acreage is estimated to fall 0.9 million acres (15 percent) from 1990. The harvested acres of the other major crops are expected to be unchanged (rice) or to increase in 1991 (table 7).

Harvested corn acreage in 1991 is forecast at 68.7 million, up 1.7 million from a year earlier. Largest gains are predicted for the Northern Plains (1.2 million acres), and Corn Belt (0.4 million). This increase in the Northern Plains follows a similar increase last year and harvested acreage is estimated to be nearly 19 percent above the 1985-89 average.

Sorghum acres harvested for grain in 1991 are estimated at 9.7 million, up 0.6 million (7 percent) from a year earlier.

Table 7--Harvested area of major crops, by region

Crop	Period	Northeast	Lake States	Corn Belt	Northern Plains	Appalachian	Southeast	Delta States	Southern Plains	Mountain	Pacific	United States 1/
							Million acres					
Corn: 2/	1985-89 Ave.	2.5	10.3	33.0	11.3	3.6	1.4	0.4	1.4	1.0	0.4	65.3
	1990	2.3	11.2	33.7	12.2	3.2	1.2	0.4	1.5	1.0	0.3	67.0
	1991	2.3	11.3	34.1	13.4	3.1	1.1	0.5	1.7	1.0	0.2	68.7
Sorghum: 2/	1985-89 Ave.	-	-	1.1	5.7	0.2	0.2	1.0	3.6	0.5	3/	12.3
	1990	-	-	0.7	4.5	0.1	0.1	0.5	2.9	0.3	-	9.1
	1991	-	-	0.7	4.7	0.1	0.1	0.5	3.2	0.4	-	9.7
Barley:	1985-89 Ave.	0.2	1.0	-	3.8	0.1	3/	-	0.1	3.3	1.4	9.9
	1990	0.2	0.9	-	3.0	0.1	3/	-	3/	2.6	0.7	7.5
	1991	0.2	1.0	-	3.3	0.1	3/	-	3/	2.9	0.9	8.4
Oats:	1985-89 Ave.	0.5	1.9	1.2	2.3	0.1	0.1	3/	0.3	0.3	0.2	6.9
	1990	0.4	1.7	1.1	2.0	3/	0.1	3/	0.3	0.2	0.1	5.9
	1991	0.4	1.3	0.8	1.7	0.1	0.2	3/	0.2	0.2	0.1	5.0
Wheat:	1985-89 Ave.	0.6	3.3	4.1	24.5	1.5	1.3	1.5	9.3	9.4	3.8	59.3
	1990	0.6	3.8	6.3	28.8	1.8	1.2	2.3	10.5	10.0	4.1	69.4
	1991	0.6	2.8	4.8	26.0	1.5	0.9	1.4	7.8	8.8	3.5	58.1
Soybeans:	1985-89 Ave.	1.0	6.2	30.0	6.3	4.5	2.8	7.5	0.5	-	-	58.8
	1990	1.1	6.2	28.8	6.7	4.3	2.0	7.0	0.4	-	-	56.5
	1991	1.2	7.3	30.5	7.2	4.0	1.7	6.3	0.4	-	-	58.6
Cotton:	1985-89 Ave.	-	-	0.2	3/	0.5	0.7	2.2	4.7	0.5	1.2	10.0
	1990	-	-	0.2	3/	0.7	0.9	2.8	5.4	0.6	1.1	11.7
	1991	-	-	0.3	3/	1.1	1.1	2.9	6.5	0.5	1.0	13.4
Rice:	1985-89 Ave.	-	-	0.1	-	-	-	1.8	0.3	-	0.4	2.6
	1990	-	-	0.1	-	-	-	2.0	0.3	-	0.4	2.8
	1991	-	-	0.1	-	-	-	2.1	0.3	-	0.3	2.8
							Million hectares					
Corn: 2/	1985-89 Ave.	1.0	4.2	13.4	4.6	1.5	0.6	0.2	0.6	0.4	0.2	26.4
	1990	0.9	4.5	13.6	4.9	1.3	0.5	0.2	0.6	0.4	0.1	27.1
	1991	0.9	4.6	13.8	5.4	1.3	0.4	0.2	0.7	0.4	0.1	27.8
Sorghum: 2/	1985-89 Ave.	-	-	0.4	2.3	0.1	0.1	0.4	1.5	0.2	3/	5.0
	1990	-	-	0.3	1.8	4/	4/	0.2	1.2	0.1	-	3.7
	1991	-	-	0.3	1.9	4/	4/	0.2	1.3	0.2	-	3.9
Barley:	1985-89 Ave.	0.1	0.4	-	1.5	4/	3/	-	4/	1.3	0.6	4.0
	1990	0.1	0.4	-	1.2	4/	3/	-	3/	1.1	0.3	3.0
	1991	0.1	0.4	-	1.3	4/	3/	-	3/	1.2	0.4	3.4
Oats:	1985-89 Ave.	0.2	0.8	0.5	0.9	4/	4/	3/	0.1	0.1	0.1	2.8
	1990	0.2	0.7	0.4	0.8	3/	4/	3/	0.1	0.1	4/	2.4
	1991	0.2	0.5	0.3	0.7	4/	0.1	3/	0.1	0.1	4/	2.0
Wheat:	1985-89 Ave.	0.2	1.3	1.7	9.9	0.6	0.5	0.6	3.8	3.8	1.5	24.0
	1990	0.2	1.5	2.5	11.7	0.7	0.5	0.9	4.2	4.0	1.7	28.1
	1991	0.2	1.1	1.9	10.5	0.6	0.4	0.6	3.2	3.6	1.4	23.5
Soybeans:	1985-89 Ave.	0.4	2.5	12.1	2.5	1.8	1.1	3.0	0.2	-	-	23.8
	1990	0.4	2.5	11.7	2.7	1.7	0.8	2.8	0.2	-	-	22.9
	1991	0.5	3.0	12.3	2.9	1.6	0.7	2.5	0.2	-	-	23.7
Cotton:	1985-89 Ave.	-	-	0.1	3/	0.2	0.3	0.9	1.9	0.2	0.5	4.0
	1990	-	-	0.1	3/	0.3	0.4	1.1	2.2	0.2	0.4	4.7
	1991	-	-	0.1	3/	0.4	0.4	1.2	2.6	0.2	0.4	5.4
Rice:	1985-89 Ave.	-	-	4/	-	-	-	0.7	0.1	-	0.2	1.1
	1990	-	-	4/	-	-	-	0.8	0.1	-	0.2	1.1
	1991	-	-	4/	-	-	-	0.8	0.1	-	0.1	1.1

- = None reported.
1/ Includes the 48 conterminous States. Because of rounding, regional acres (hectares) may not sum to U.S. totals.
2/ Corn and sorghum for grain. 3/ Less than 50,000 acres (20,235 hectares). 4/ More than 20,235 hectares (50,000 acres) but less than 50,000 hectares.

The acreage increased or was unchanged in all regions that normally produce sorghum. Increases in the Northern Plains, Southern Plains, and Mountain regions probably resulted from the replanting of land suffering heavy winter-kill of wheat to sorghum. Also, in spite of the increase from last year, the 1991 estimate of harvested sorghum area is still 21 percent below the 1985-89 average.

The acreage of barley harvested is estimated to increase 0.9 million acres (12 percent) from 1990. Increases occurred in the Lake States, Northern Plains, Mountain, and Pacific regions. Even so, the 1991 harvested acreage of barley is 15 percent below the 1985-89 average.

Soybeans are expected to be harvested on 58.6 million acres in 1991, about 2.1 million more than in 1990 even though 4.2 million acres were flexed into soybeans from other program crops. Soybean acreage increased in the Northeast, Lake States, Corn Belt, and Northern Plains regions. Soybeans declined in the Appalachian, Southeast, and Delta regions and were unchanged in the Southern Plains.

Harvested acreage of cotton is expected to be 13.4 million in 1991, up 1.7 million from 1990. Land idled in the annual cotton program decreased by 1.0 million acres for the 1991 crop year. The increase in cotton acreage is largest in the Southern Plains (0.9 million acres) followed by the Appalachian, Delta States, Southeast, and Corn Belt regions. Small decreases in cotton acreage occurred in the Mountain and Pacific regions.

Water Supply and Irrigation

Above normal precipitation provided good soil moisture conditions for major rainfed crop production regions this spring. However, deficient precipitation through much of the winter intensified drought conditions in irrigated regions of the West, while favorable spring conditions gave way to summer drought in portions of the East and Midwest.

Early-season Topsoil Moisture Conditions Adequate

Based on early-season precipitation (January-May), topsoil moisture conditions at planting appeared adequate across most of the nation (figure 3). Above or near-normal precipitation was reported in the far Southwest, Central and Northern Plains, Mississippi Valley, and throughout the eastern States. In California, heavy rainfall in March lessened the severity of the prolonged drought, although late-spring rains were disappointing. While record heat scorched much of the eastern U.S. in May, widespread crop losses were averted due to adequate soil moisture. For the Northern Plains, Southwest, and Southern coastal regions, favorable topsoil moisture conditions this spring contrasted with serious deficit conditions in early 1990 (figure 4).

Heavy rainfall in portions of the Mississippi Valley, Southeast, and Midwest regions resulted in flooding and wet field conditions during the spring planting season. Where soil moisture is excessive, field workdays can be limited for spring planting and harvesting of winter crops. Yield loss can occur in these areas due to waterlogging, increased pest problems, and reduced growing seasons. Shorter-season crops, although generally less profitable, become more attractive as planting is delayed.

Low early-season rainfall contributed to topsoil moisture deficiencies in certain areas of the country (figure 3). Topsoil moisture deficiencies were particularly acute at planting time in the southern High Plains region of Texas, Oklahoma, Kansas, and New Mexico. In addition, topsoil moisture deficiencies intensified existing drought conditions in the central Mountain region and Pacific Northwest.

Long-term Drought Continues in West

As of early May, drought conditions continued to grip much of the western United States. The most seriously affected regions included Nevada, California, eastern Oregon and Washington, and areas of Colorado, Wyoming, Idaho, and Utah. Moderate drought conditions prevailed in North Dakota and the Southern High Plains of Texas, Oklahoma, Kansas, Colorado and New Mexico (figure 5).

Subsoil drought conditions are represented in this report based on the Palmer Drought Severity Index (PDSI), which measures long-term abnormal dryness or wetness and generally does not indicate existing field conditions. Late spring decisions reflect subsoil drought conditions in the West which have persisted since the begining of the 1990 crop year (figure 6). In fact, areas of California and Nevada are in their fifth consecutive drought year, while portions of North Dakota, the Pacific Northwest, and Central Mountain regions are in their fourth drought year. While moisture conditions were generally favorable in the Northern High Plains, abnormally low summer rainfall has resulted in expanded drought areas from Texas through North Dakota.

In the East, early season rains helped to alleviate dry conditions in portions of the Midwest and Florida. However, generally favorable spring moisture conditions gave way to localized summer drought conditions throughout the eastern Cornbelt, mid-Atlantic, and Northeast regions.

Water Supply Forecast and Farm Response

The early-season water-supply outlook has an important effect on production decisions. In rainfed production regions, crop selection, acreage planted, tillage operations, seeding rates, and other management decisions are based on preseason soil moisture levels. Under irrigated production, anticipated water supplies at the beginning of the year can influence number of acres irrigated, and timing and number of water applications.

Drought conditions can severely impact both agriculture and the environment, particularly in multiyear drought areas. Low subsoil moisture increases the dependency on amount and timeliness of seasonal rains, thereby increasing the risk of poor germination, yield loss, and crop failure. Range conditions deteriorate, which can force livestock producers to reduce herds. Forest growth suffers, and seedlings and mature trees can die from moisture deficiency. Range, brush, and forest fires are more common and harder to control. Wildlife suffers from decreased food stocks, loss of cover, and increased competition for available water.

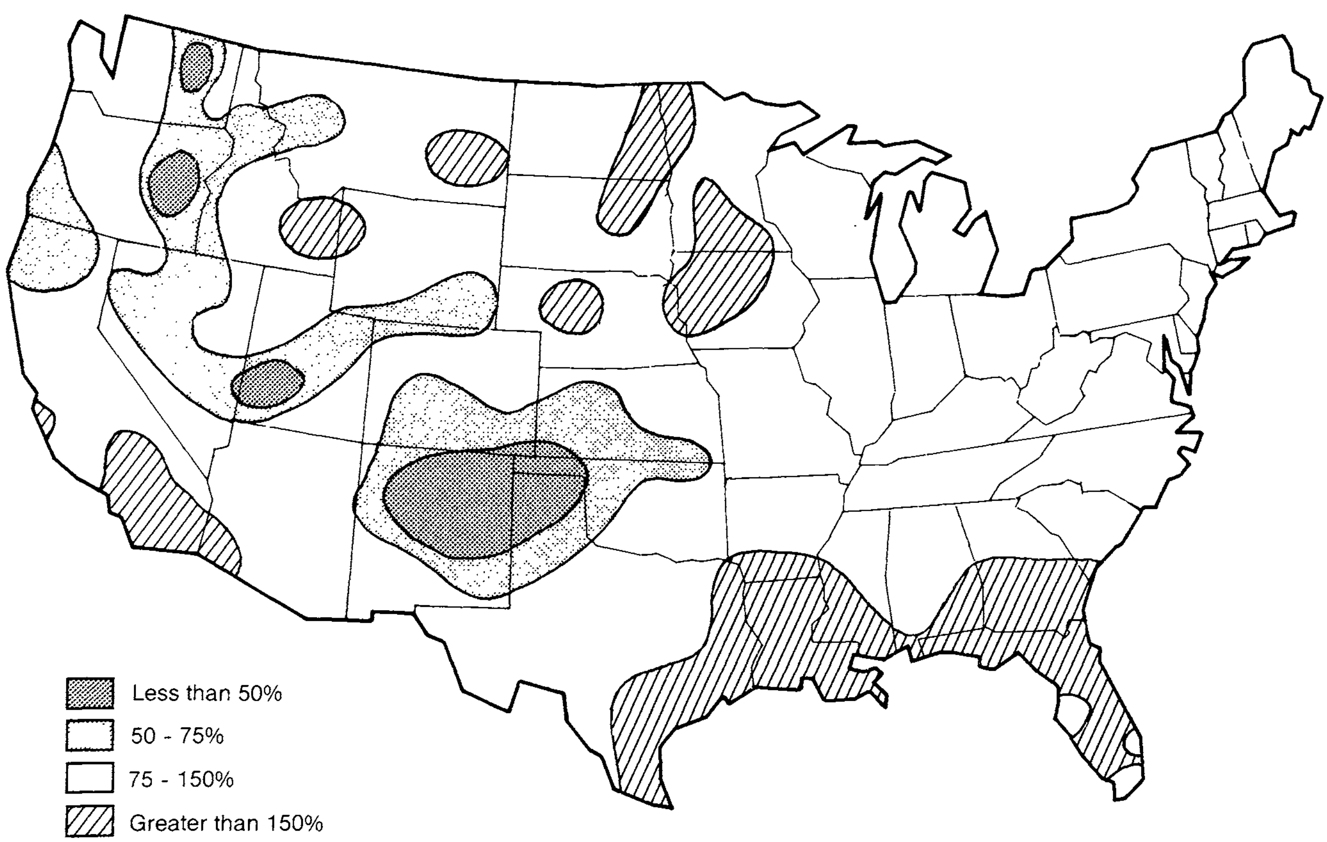
Irrigated production is less affected by drought conditions when water supplies are adequate. Irrigation water applied to meet soil moisture deficits ensures normal crop production and economic activity in most dry years. However, prolonged drought can impact irrigated production through reduced streamflow and water storage levels, and water levels too low to meet peak demands.

Surface Water Supplies Short for Irrigation

Agricultural use of surface water for irrigation occurs predominantly in the arid West, where extensive water storage and conveyance facilities exist (figure 7). Of approximately 37 million irrigated acres in the 17 western States, roughly 18.5 million acres, or 50 percent, are partially or fully supplied by surface water.

Figure 3

Percent of Normal Precipitation, January 1 - May 4, 1991



Source: NOAA/USDA Joint Agricultural Weather Facility.

Surface water supplies include both direct stream diversions and releases of storage water 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 dry years for irrigation, municipal, and instream uses.

This summer's streamflow forecast was for below normal conditions over most surface water-irrigated regions of the West. The National Weather Service and the Soil Conservation Service forecast streamflow of less than 70 percent of average for much of the Colorado, Snake, and California basins, based on observed snowpack, precipitation, and streamflow (figure 8). Summer streamflow forecasts of near or above normal were limited to reaches of the upper Missouri River, Columbia, and Rio Grande basins.

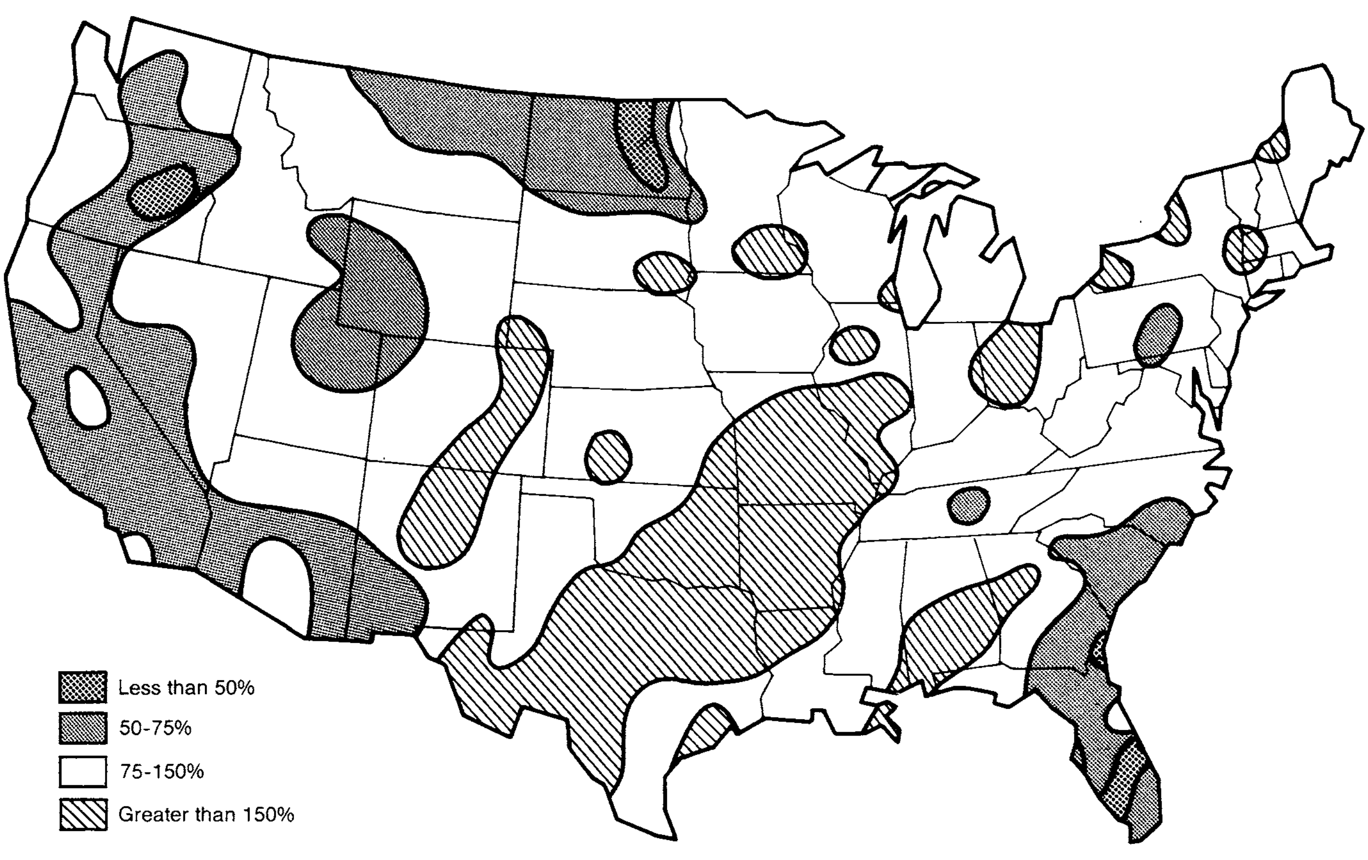
Reservoir levels in many western States were critically low entering the 1991 irrigation season. The most acute shortages occurred in Nevada, where successive years of declining stocks have left reservoirs with only 15 percent of normal levels (figure 9). California reservoir levels were at 64 percent of normal, down from 72 percent in early 1990. Other States with below-normal reserves and reporting lower levels than last year include Oregon, Utah, Montana, Idaho, and Wyoming. Based on streamflow forecasts, it is unlikely that low reservoir levels in the Colorado Basin, Snake River Basin, Great Basin, and California Basin will increase significantly this season. Arizona has reported a substantial increase from last year in stored water, while storage in Colorado, New Mexico, and Washington remained substantially above normal.

Impacts of Low Surface Water Supplies

Low levels of projected streamflow and reservoir storage will limit surface water supplies for irrigation in several Western areas, including most of California (See box A). Irrigators will adjust to short-term water reductions in various ways, including partial irrigations, increased water-use efficiency with improved system management, substitution of more expensive (and potentially lower quality) ground

Figure 4

Percent of Normal Precipitation, January 1-May 26, 1990



Source: NOAA/USDA Joint Agricultural Weather Facility.

water, reductions in acreage in water-intensive crops, and reductions in total acres irrigated. Impacts will be greatest on low-valued forage crops, less significant on field cash crops, and generally inconsequential on high-value, specialty crops. Actual impacts will vary by producer, depending primarily on the availability and cost of ground water and surface water supplies from emergency sources.

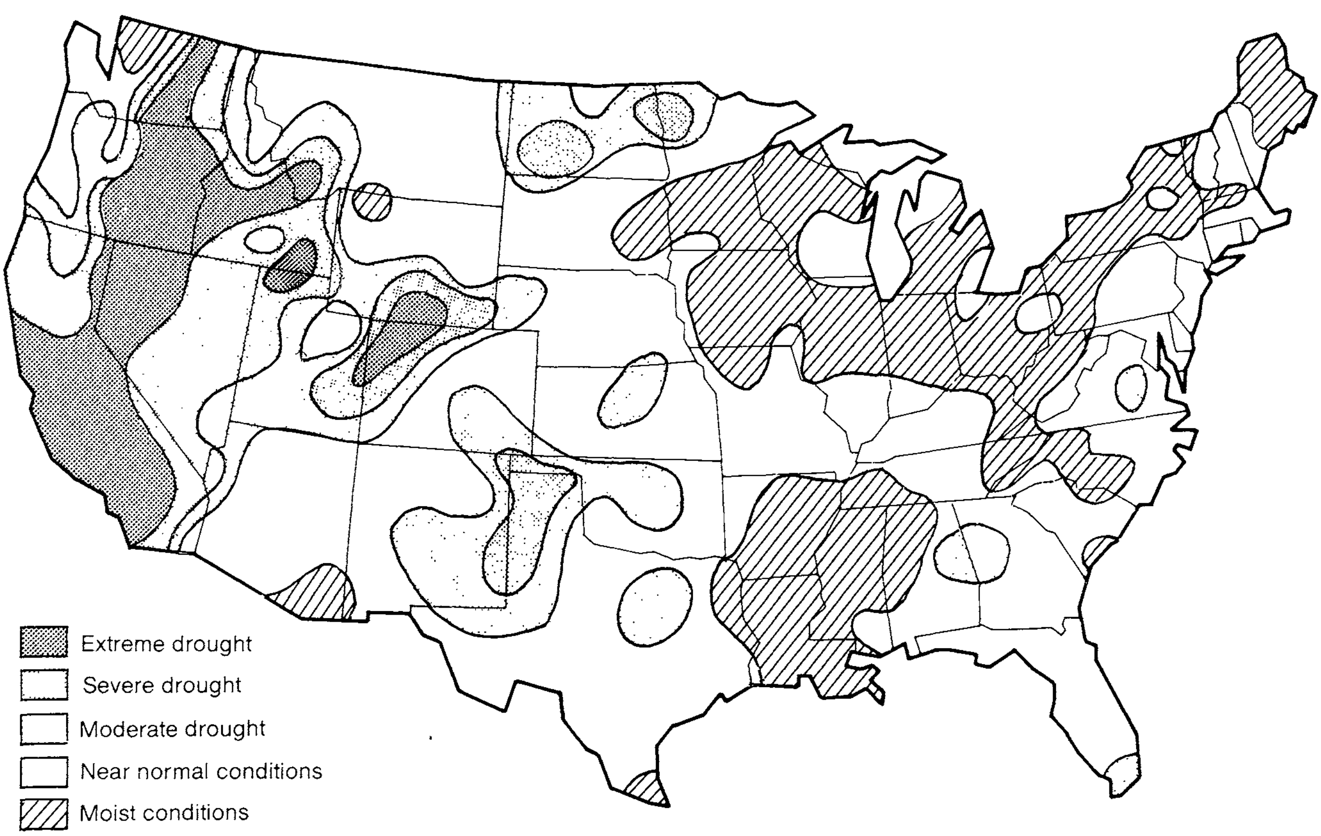
Hydroelectric power generation will be reduced due to below-normal streamflow and reservoir levels in the Snake, California, and Missouri river systems. At the same time, power demands for irrigation pumping are likely to increase as irrigators substitute pumped ground water for surface water. Costs of electric-powered pumping systems will rise in cases where hydroelectric power is replaced by higher-priced thermoelectric sources.

Barge traffic on the Missouri will be affected by below-normal reservoir levels. The 5 largest reservoirs in Montana, which are managed primarily for downstream river transport, were 25 percent below normal on May 1. Reservoir levels in the Dakotas were also about 25 percent below normal. (Large mainstem reservoirs managed for navigation are not included in figure 9). Barges are used as a low-cost means to transport fertilizers, grains, and other bulk items needed or produced by agriculture. Barge traffic on the Missouri moved 688,000 tons of grain and soybeans in 1988. A disruption in barge traffic would increase the cost of agricultural transport and heighten pressure on rail lines and other transportation alternatives, but should not disrupt the national grain distribution system.

Recreation is an important source of revenue for many western communities, and continued reductions in surface water supplies are likely to have serious consequences for State and local economies. Recreation interests most directly affected by declining water levels include sport fishing, lake and downstream white-water boating, and waterfront service accommodations. Pressures to redefine Federal management priorities of the Missouri river system to give greater consideration to upstream recreation interests underscore the increasing economic and political importance of the recreation sector.

Figure 5

Palmer Drought Severity Index, May 4, 1991



Source: NOAA/USDA Joint Agricultural Weather Facility.

Reduced reservoir water can also have significant consequences for wildlife habitat. In some locations, environmental interests are pressing for minimum flow requirements sufficient to maintain stream-related habitats under dry conditions. In the Pacific Northwest, debate has centered on management of hydroelectric power generation to preserve traditional salmon runs. In the San Francisco bay estuary, minimum stream outflows that assure water quality standards for aquatic life have been established. In Nevada's Stillwater National Wildlife Refuge, a private conservation organization purchased water rights to ensure minimum flows during low-flow years in an innovative example of market transfers to meet environmental objectives. Another indicator of the emerging importance of environmental considerations in water supply management is reflected in the Environmental Protection Agency's veto of the Two Forks Dam proposal in Colorado. Federal opposition to the dam focused in large part on wildlife protection, including upstream trout fisheries and downstream habitat for migratory waterfowl.

Ground Water Importance to Agriculture

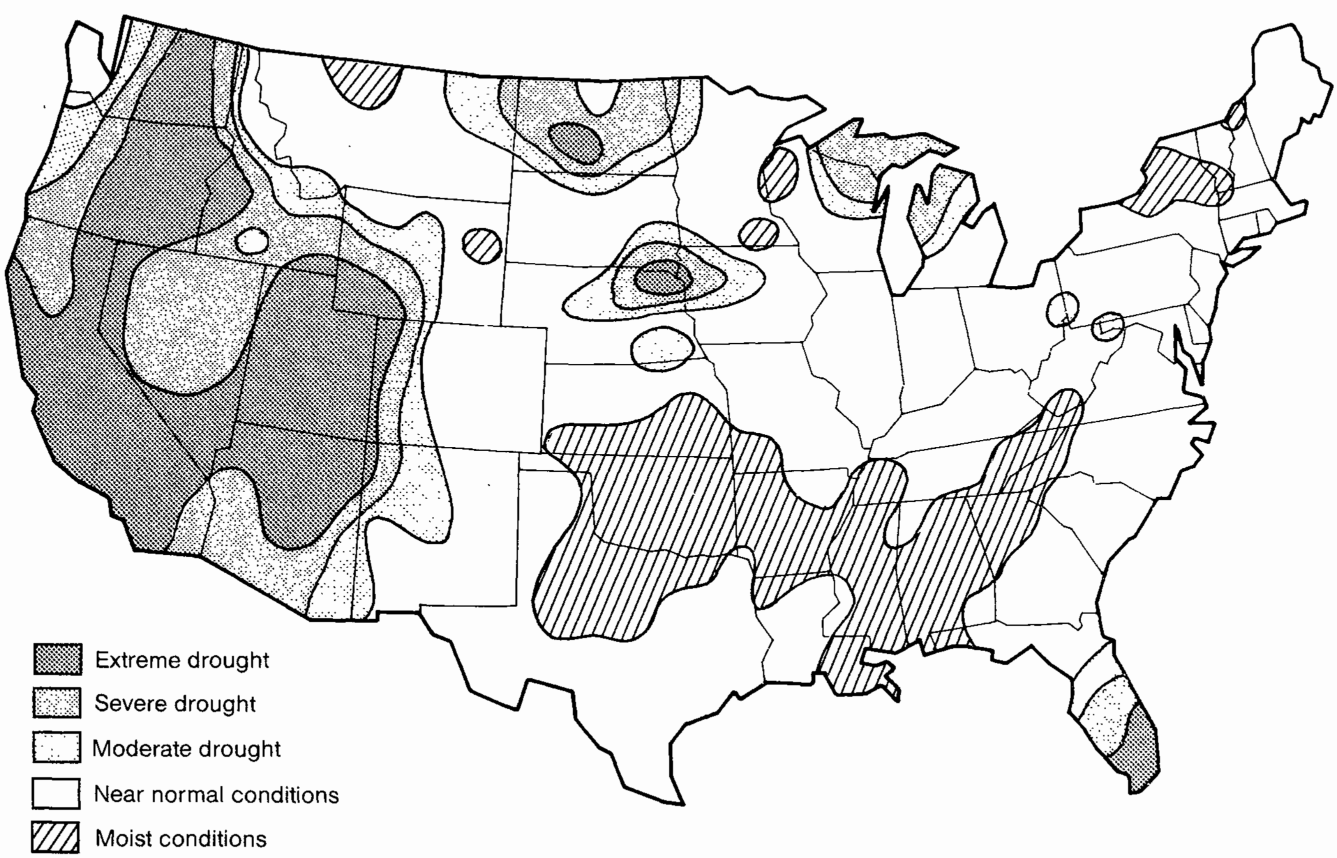
Ground water is a major source of water for irrigation and is the source for most rural domestic and livestock uses in the United States. As opportunities for further large-scale surface water development are limited, satisfying increased water demands in the future will depend on continued use of ground water resources as well as reallocation of existing surface water supplies.

Ground water supplied roughly 48 percent of total irrigation water used nationwide in 1988. The Southern Pacific region (California) accounts for the highest ground water use, with roughly 10 million acre-feet pumped. The Northern Plains, Southern Mountain, and Delta States regions pumped about 9.0, 5.2, and 4.9 million acre-feet, respectively. [1/]

1/ U.S. Department of Commerce, Bureau of the Census. *1987 Census of Agriculture, Farm and Ranch Irrigation Survey*, Vol. 3, AC87-RS-1, U.S. Government Printing Office, Washington, D.C. 1990.

Figure 6

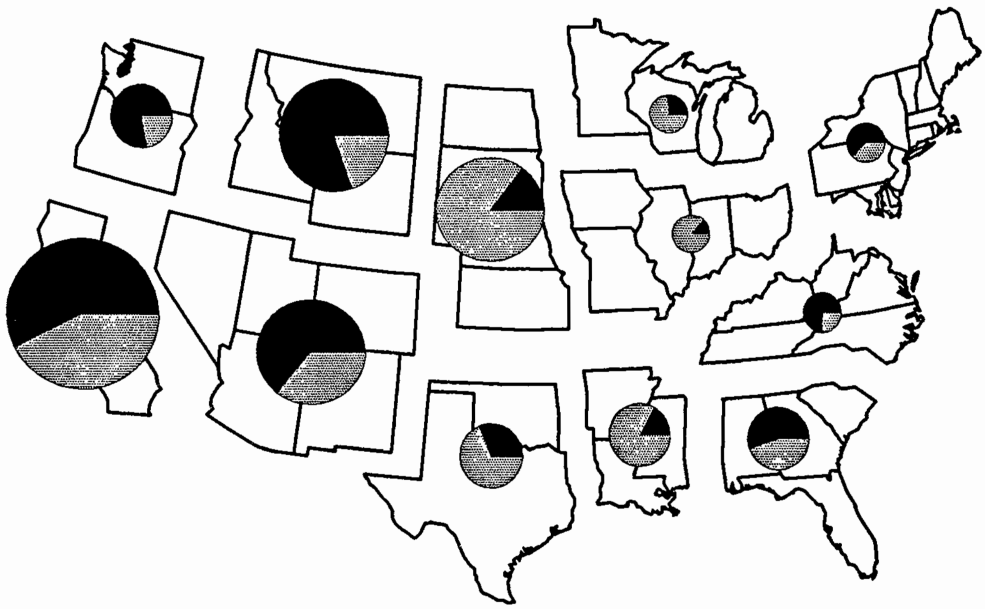
Palmer Drought Severity Index, April 28, 1990



Source: NOAA/USDA Joint Agricultural Weather Facility.

Figure 7

Irrigation Water Withdrawals by Source for Major Crop Production Regions, 1988[1/]



1/ Circle size represents total irrigation withdrawals in million acre feet (ascending order): 0.0 - 2.5 maf, 2.5 - 7.5 maf, 7.5 - 15.0 maf, 15.0 - 25.0 maf

Irrigation water shares by source

Surface water

Ground water

Source: 1988 Farm and Ranch Irrigation Survey.

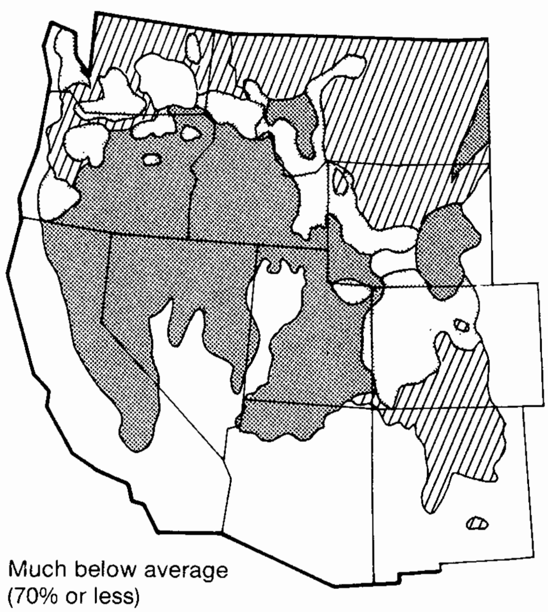
In the arid West, ground water as a percent of total irrigation water use was greatest in the Northern Plains, 85 percent; followed by the Southern Plains, 69 percent; and Southern Pacific, 43 percent (figure 7). In the more humid eastern regions, where irrigation is used mainly to supplement natural rainfall, ground water is the primary water source. Ground water as a percent of total water use was highest in the Corn Belt, 87 percent; followed by the Delta States, 83 percent; Lake States, 74 percent; and Southeast, 45 percent.

Ground water pumping is energy intensive. It can also be costly, directly affecting production costs of irrigated crops and resulting net income. With about 346,000 active irrigation wells, of which roughly 263,000 are in the West, ground water pumping costs are not insignificant. The cost depends on depth of the water, pumping pressure, cost of fuel, and pumping system efficiency. As part of a special survey following the *1987 Census of Agriculture*, information was collected on water depth, operating pressures, and fuel sources. Many states and power suppliers have testing programs for pumping system efficiencies, but general statistics are not available.

Depth to water averaged 97 feet in the Western States, with greatest average depths in the Southern Plains and Northern and Southern Mountain regions (table 8). While average depths to water are less than 100 feet, many locations pump

Figure 8

Spring and Summer Streamflow Forecast, May 1, 1991



Much below average (70% or less)

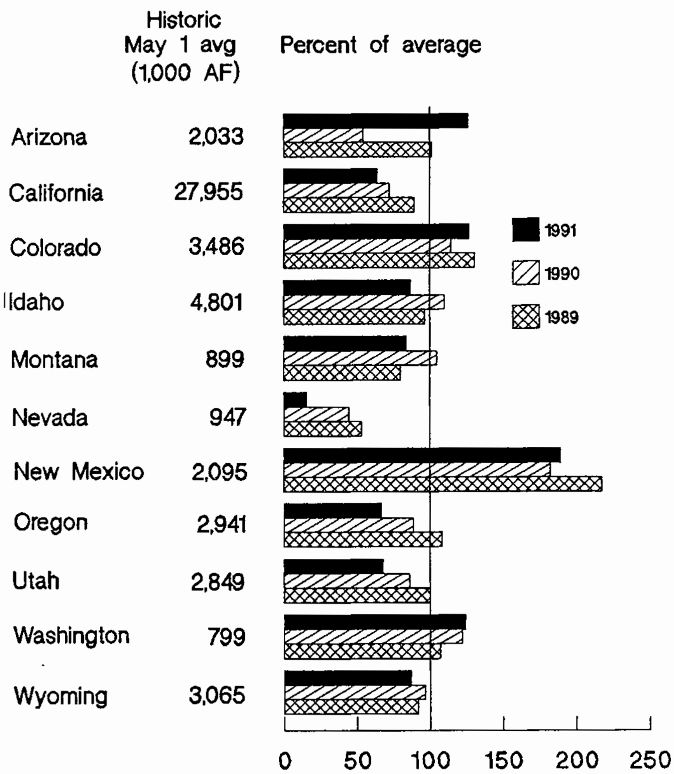
Below average (70 - 90%)

Near or above average (90 - 130%)

Not forecast

Source: NOAA/USDA Water Supply Outlook.

Figure 9
Surface Water Storage Conditions for Western States, May 1



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

from 500 feet or more. In the East, depth to water averaged 39 feet with the greatest average depth in the Delta States. As a general rule, the deeper the water, the greater the pumping cost, and the more sensitive the cost to fluctuations in energy prices.

Average well pressure ranged from about 65 pounds per square inch (psi) in the Lake States to 19 psi in the Delta States, with an average of 36 psi in Eastern regions and 34 psi in Western regions. Well pressure is an additional indicator of water cost. The higher the operating pressure, the more it costs to supply irrigation water, all other factors constant. Low average pressure in a region generally indicates a high share of non-pressure (gravity) irrigation technologies rather than pressurized drip and sprinkler systems.

Power sources for ground water pumping include electricity, natural gas, LP gas, and petroleum based fuels. In the Western States, nearly 70 percent of irrigation well pumps are driven by electricity, while 18 percent are powered by natural gas. In the Eastern States, petroleum pumps account for 46 percent of total, with 43 percent of pumps electrically-driven (table 8). The power sources for wells indicates that eastern irrigators are more likely to face variation in water costs due to changes in the price of petroleum. Western irrigators, with electricity supplies from low-cost hydropower

Table 8--Characteristics of irrigation wells for major crop producing regions, 1988

	Total wells 1/	Depth 1/	Operating 1/ pressure	Discharge 1/	Power source of wells 2/			
					Electric	Nat Gas	LP Gas	Petroleum
	number	(feet)	(psi)	(gpm)	percent			
Northeast	2,573	21	60	587	36.4	0.0	10.4	53.2
Appalachian	1,715	26	34	678	53.5	0.0	7.4	39.1
Southeast	25,563	36	47	695	38.5	0.0	2.7	58.8
Lake States	7,375	32	65	672	67.9	0.0	2.2	30.0
Corn Belt	11,619	23	38	987	40.7	1.0	27.1	31.2
Delta States	34,255	49	19	1,170	41.6	4.8	9.4	44.1
Total Eastern States	83,100	39	36	929	43.0	2.1	9.1	45.7
Northern Plains	82,569	79	38	757	42.1	25.7	12.8	19.4
Southern Plains	54,683	150	26	479	52.4	41.9	3.7	2.0
Northern Mountain	9,161	125	58	955	95.8	0.8	0.2	3.3
Southern Mountain	28,284	104	33	926	79.0	11.8	2.7	6.5
Northern Pacific	14,880	57	51	407	98.8	0.0	0.0	1.2
Southern Pacific	73,195	80	30	757	96.8	0.6	0.3	2.3
Total Western States	262,772	97	34	702	69.4	17.7	5.0	7.9
	number	(meters)	(atm) 3/	(m^3ph) 4/	percent			
Northeast	2,573	6.4	4.1	133.3	36.4	0.0	10.4	53.2
Appalachian	1,715	7.9	2.3	154.0	53.5	0.0	7.4	39.1
Southeast	25,563	11.0	3.2	157.9	38.5	0.0	2.7	58.8
Lake States	7,375	9.8	4.4	152.6	67.9	0.0	2.2	30.0
Corn Belt	11,619	7.0	2.6	224.2	40.7	1.0	27.1	31.2
Delta States	34,255	14.9	1.3	265.7	41.6	4.8	9.4	44.1
Total Eastern States	83,100	11.9	2.4	211.0	43.0	2.1	9.1	45.7
Northern Plains	82,569	24.1	2.6	171.9	42.1	25.7	12.8	19.4
Southern Plains	54,683	45.7	1.8	108.8	52.4	41.9	3.7	2.0
Northern Mountain	9,161	38.1	3.9	216.9	95.8	0.8	0.2	3.3
Southern Mountain	28,284	31.7	2.2	210.3	79.0	11.8	2.7	6.5
Northern Pacific	14,880	17.4	3.5	92.4	98.8	0.0	0.0	1.2
Southern Pacific	73,195	24.4	2.0	171.9	96.8	0.6	0.3	2.3
Total Western States	262,772	29.6	2.3	159.4	69.4	17.7	5.0	7.9

1/Values are based on all wells used on the farm, pumped and artesian. 2/Values are based on reported power sources of all pumps on farms with pumped wells. 3/atm = atmospheres. 4/m^3ph = cubic meters per hour .

and long-term coal contracts, incur less variability in annual energy costs.

Well discharge rates provide an indication of the ability of the agricultural sector to withdraw ground water. Average regional well discharge rates ranged from 407 gallons per minute (gpm) in the Northern Pacific region to 1170 gpm in the Delta States region. These discharge rates allow each well to pump from 1.8 to 5.2 acre-feet per 24-hour day. In regions with many active wells, the withdrawal capability of ground water is significant.

Ground water overdraft occurs where withdrawals for irrigation and other uses exceed natural recharge of the aquifer, resulting in a decline in water tables. Declining water tables contribute to rising pumping costs for agriculture and other uses. Reductions in well yield can increase pumping time for a given quantity of water, resulting in increased labor and equipment costs. Other potential effects include land subsidence, saltwater intrusion, reduced surface water flows in surface water systems linked to ground water, and early economic exhaustion of common property ground water reserves.

Ground water overdraft generally occurs where concentrations of irrigated acreage depend heavily on ground water, as in the Southern Plains, Mountain States, and Southern Pacific regions. Many States have established programs to reduce ground water declines through technical assistance for improved water management, incentives to adopt water-conserving technologies, and, in some cases, limits on water withdrawals.

Effects of the current drought on western ground water reserves are likely to be limited, as irrigation supplies generally come from large aquifers that cannot be exhausted over several dry years. However, extended drought conditions contribute to accelerated rates of overdraft. Low precipitation can reduce the rate of natural recharge in relatively shallow, rapidly recharged aquifers. At the same time, pumping rates are increased due to greater water demands across sectors and loss of surface water supplies.

Water Supply Outlook

Adequate rainfall in much of the country provided good early season conditions for agriculture in 1991. Last year's soil moisture deficits in the Midwest, Southeast, and southwest Mountain regions were largely replenished at the time spring cropping decisions were made. In areas of the Midwest, Mississippi Valley and Southeast, heavy spring rains resulted in some flooding and delayed planting.

Portions of California, the Great Basin, the Pacific Northwest, the central Mountain region, and North Dakota are in a continuing drought. Below-normal summer streamflow is expected for most of the West, affecting water supplies for irrigators who divert streamflow. Moreover, water storage in reservoirs supplying irrigation was less than 90 percent of normal in 7 of 11 States, with critically low levels in Nevada and California.

As areas of the West enter their fourth and fifth drought year, restrictions on water use will become more commonplace in agriculture and other sectors. Declining reservoir storage levels will increase competition among municipal, recreation and environmental interests, and the more traditional reservoir management priorities of irrigation, power generation, and navigation. Restrictions on irrigation water supplies will force changes in traditional irrigation practices, adjusted cropping patterns, and increased reliance on ground water reserves.

The continued short-term pressures on the water storage and delivery system are rapidly becoming a longer-run problem. In many areas of the West, several years of "normal" precipitation are required to replenish water storage to near-normal levels. Pressure for water conservation and structural adjustment of the western water allocation system are likely to continue for the foreseeable future.

Irrigated Acreage Reaches Previous Record

Farmland irrigated in 1991 is estimated to be about 52 million acres, up 1.1 million acres from last year and only 100,000 acres short of the 1981 record. Increases result from a change in the mix of annual program crop set asides, irrigation on flex acreage, and continuing development of irrigation in eastern States. Irrigation increased in all regions except the Pacific Coast. The Northern Plains and all crop production regions east of the Mississippi are estimated to be at record high acreages of irrigated land, with growth especially strong in the Lake States, Corn Belt, Appalachian, and Delta States regions. Increases were partially offset by continuing declines in the drought-affected Southwest.

California Irrigating Lowest Acreage in Decades

The Southwest drought has reduced irrigated area. Normally, with substantially lower idle acreage requirements for program crops, cropland used for crops will increase, as will irrigated acreage. This relationship, however, did not hold in California. While California's set-aside area is down 200,000 acres from 1988, preliminary estimates indicate that California farmers may be irrigating a half million fewer acres. This suggests that the 1988-91 cumulative drought impact on irrigated crops could be a decrease of over 700,000 acres. California likely is not the only Southwest State affected. Estimates of irrigated area for Nevada, Arizona, and Utah are also below 1988 levels.

Table 9--Irrigated land in farms, 1969-89, by region

Region	1969 1/	1978 1/	1982 1/	1985 2/	1986 2/	1987 1/	1988 2/	1989 2/	1990 3/	1991 3/
					Million acres					
Northeast, Appalachian, & Southeast	1.8	2.9	2.7	3.1	3.0	3.0	3.1	3.2	3.3	3.4
Lake States & Corn Belt	0.5	1.4	1.7	2.1	2.0	2.0	2.2	2.3	2.2	2.4
Northern Plains	4.6	8.8	9.3	9.8	9.5	8.7	9.1	9.7	10.1	10.6
Delta States	1.9	2.7	3.1	3.6	3.4	3.7	4.2	4.2	4.5	4.8
Southern Plains	7.4	7.5	6.1	5.6	5.1	4.7	5.2	5.3	5.3	5.4
Mountain	12.8	14.8	14.1	13.5	13.7	13.3	13.6	13.9	14.2	14.2
Pacific	10.0	12.0	11.9	11.5	10.9	10.8	11.0	11.1	11.2	11.1
United States 4/	39.1	50.4	49.0	49.4	47.7	46.4	48.7	49.8	50.9	52.0
					Million hectares					
Northeast, Appalachian, & Southeast	0.7	1.2	1.1	1.3	1.2	1.2	1.3	1.3	1.3	1.4
Lake States & Corn Belt	0.2	0.6	0.7	0.9	0.8	0.8	0.9	0.9	0.9	1.0
Northern Plains	1.9	3.6	3.8	4.0	3.8	3.5	3.7	3.9	4.1	4.3
Delta States	0.8	1.1	1.3	1.5	1.4	1.5	1.7	1.7	1.8	1.9
Southern Plains	3.0	3.0	2.5	2.3	2.1	1.9	2.1	2.1	2.1	2.2
Mountain	5.2	6.0	5.7	5.5	5.5	5.4	5.5	5.6	5.8	5.8
Pacific	4.0	4.9	4.8	4.7	4.4	4.4	4.5	4.5	4.5	4.5
United States 4/	15.8	20.4	19.8	20.0	19.3	18.8	19.7	20.2	20.6	21.1

1/ From data published in the Census of Agriculture. 2/ Revised estimates constructed from several unpublished USDA sources and the Census of Agriculture. 3/ Preliminary estimates. 4/ Includes Alaska and Hawaii.

Table 10--Double cropping and irrigation

Item	1969 1/	1974 1/	1978	1982	1987
			1,000 acres		
Double Cropped					
vegetables	NA 185	189	200	188	203
other	NA 2996	5715	7552	12140	8845
Total	3181	5904	7752	12328	9048
Double Cropped and Irrigated					
vegetables	NA 144	154	167	164	182
other	NA 269	461	720	827	746
Total	413	614	887	991	928
			Percent		
Irrigated proportion of double cropped acres					
vegetables	NA	81.1	83.6	87.3	89.7
other	NA 9.0	8.1	9.5	6.8	8.4
Total	13.0	10.4	11.4	8.0	10.3

1/Class I-V farms (All farms with sales greater than $2500)

Source: Census of Agriculture.

With the exception of occasional regional droughts, the primary determinants of year-to-year changes in area irrigated continue to be the longrun trend of technology adoption and the effects of annual commodity programs. Overall, the acreage idled under annual programs increased 1.1 million acres. This change in idled acreage would normally cause some decrease in irrigation. This year, a shift in the mix of idled crops and new planting flexibility features make the simple relationship between irrigation and total annual idled acres inappropriate. The idle acreage requirement for wheat tripled, while the requirements for rice, cotton, and corn, which are more dependent on irrigation, were relaxed. Because the proportion of wheat irrigated is small relative to other commodities, the net effect is an increase of about 1 million irrigated acres in 1991.

The adoption trend of irrigation development (recently, a phenomenon of the Mississippi and Great Lakes watersheds) has been about one-third of a million acres per year. The difference between the total 1.3 million acre expected increase and the 1.1 million acre observed increase may be attributable to the Southwest drought and other factors.

Irrigation and Double Cropping

Double cropping intensifies the use of inputs, including irrigation. Table 10 reports an estimate of double cropped and irrigated acreage. Double cropping totaled over 9 million acres in 1987, up from 3.2 million acres in 1969. Intensification of farming has occurred, increasing irrigation from 12.5 percent of all crops harvested in 1969 to 14.7 percent in 1987 and increasing double cropping from 1.2 percent to 3.1 percent.' Most double cropped acreage involves sorghum or soybeans following winter wheat or some other small grain. Although involving a smaller acreage, many vegetables are double cropped and frequently are irrigated. Whereas 81 percent of vegetable double cropping was irrigated in 1974, only 8.1 percent of the other double cropping was irrigated. By 1987, these proportions had increased to almost 90 percent and 8.4 percent, respectively.

Irrigation Outlook

The near term outlook for U.S. irrigated land in farms will continue to be driven primarily by annual cropland set-aside requirements and the status of far western water supplies. Wheat idling requirements announced for the 1992 crop year have dropped to 5 percent from this year's 15 percent. With no change in other program crops and the continuing background trend, irrigation could be up a half million acres in 1992. Further tightening of water supplies in the Southwest, however, could offset some of this increase, but is unlikely to prevent a new record irrigation of farm land.

Box A

California Drought Continues into Fifth Year

California growers knew early that a fifth year of drought would mean shortages in irrigation water supplies. The drought this year has been more severe than during any of the previous four years, with a projected Sacramento River Basin runoff level among the lowest on record — only 1976 and 1977 have been lower during the past 50 years.

Limits on irrigation water use also have been more severe this year. The California State Water Project, which normally delivers about 5 percent of the total water used by agriculture, ceased all deliveries to irrigators. The U.S. Bureau of Reclamation's Central Valley Project (CVP), which provides about 30 percent of agriculture's supply, delivered only 25 percent of normal to most contractors with two major exceptions. Water-right holders whose claims predate Federal water development (about 40 percent of CVP's normal deliveries) received 75 percent of normal supplies, as specified in their contracts. The Friant Unit of the CVP delivered just over 50 percent of normal supplies to some water districts from Fresno to Bakersfield.

The overall water supply outlook would have been much worse except for the much-above-normal March rains that fell in the central and southern part of the State. The rains prevented 1991 from becoming a disastrously dry year by providing soil moisture, improving range and forest conditions, and significantly improving local runoff and reservoir conditions.

This drought is serious and agricultural production, net income, and farm related business will all suffer. Agricultural net returns are expected to decline from reduced production and increased water costs. Some local areas will be especially hard hit, although income effects are not likely to be significant outside those areas. Near-normal production of fruits and vegetables and higher commodity prices for some crops will help mitigate the impact of lost production.

Producers receiving reduced surface water supplies responded by increasing ground water use, idling some land, minimizing waste, and shifting water to higher valued crops. Despite these efforts, reduced production is expected for cotton, rice, corn, and, to a lesser extent, most other irrigated crops.

In addition, the water shortage is expected to have serious consequences for non-agricultural sectors of the economy and environment. Limited runoff and reduced reservoir levels mean less water for hydroelectric power generation, smaller lakes for recreational activities, and greater difficulty in providing instream flows for fish, wildlife habitat, and river-related recreation. The increased cost of generating electricity will affect those pumping ground water for irrigation, as well as the general economy. Reduced recreational opportunities will also have broad economic and quality-of-life impacts.

In response to this year's water shortage, California officials established a market mechanism for water transfers as a means to shift water to meet high priority needs. The market mechanism, termed the "water bank," established a State agency as the water broker. The State purchased about 800,000 acre-feet of water from willing agricultural sellers at $125 per acre-foot, pooled the water, and is now distributing it to purchasers at $175 per acre-foot. The water bank is designed to meet some of the most critical urban, environmental, and agricultural water needs, and increase carryover storage into 1992.

Continued water shortages are likely. CVP reservoir carryover going into 1992 is forecast at 25 percent less than this year, and this year's carryover was only half of the target level. While not guaranteeing water shortages next year, declining reservoir levels reduce flexibility of the water delivery system for all water users. Storage levels for May 1, 1991, were 64 percent of normal. At least 2 or 3 years of average precipitation would be required to bring California's reservoirs back to normal levels.

The drought has intensified pressures to modify Bureau of Reclamation policies on delivery priorities, pricing, and transferability of water resources. Several bills have been or are now being considered by the U.S. Congress to provide for one or more provisions on temporary drought adjustments, long-term drought planning, water transfer provisions, water pricing, and flows for instream uses. While most of the bills' provisions are short run, some long-term institutional changes are discussed.

Thanks to March rains; State-sponsored water market transfers; ground water resources; and a sophisticated water storage, transfer, and delivery system, the impact of the California drought will be relatively small at the State and national level. Irrigators and households continue to find ways to reduce waste and increase efficiency. Adjustments in water use forced by the drought will, hopefully, continue to dampen water demand for years to come.

The 1990 Food, Agriculture, Conservation, and Trade Act (FACTA), revised several existing conservation programs and created new programs to improve water quality and to protect sensitive environments. See boxes B and C for highlights on changes and new provisions offered. USDA and other Federal agencies are moving forward with new research efforts and special projects aimed primarily at protecting the Nation's drinking water while older programs re-direct their focus toward farming practices that improve surface water quality and sustain conservation productivity.

CRP Enrollment Resumes

USDA Redesigns Acceptance

Taking direction from the 1990 farm bill provisions, USDA developed revised program rules for operation of the CRP during 1991 through 1995. These rules include new CRP eligibility criteria and a new bid acceptance process.

CRP eligibility now includes:

- Highly erodible cropland;
- Cropland devoted to filter strips and other easement practices;
- Cropland in State water quality areas (Hydrologic Unit Areas under the President's Water Quality Initiative);
- Cropland in established conservation priority areas (Chesapeake Bay, Long Island Sound, and Great Lakes Region);
- Cropland within established wellhead protection areas; and
- Cropland subject to scour erosion.

Farmed wetlands, formerly eligible for CRP enrollment, are no longer eligible even if they would be eligible under other criteria. This reflects the preference of Congress to place farmed wetlands in the new Wetlands Reserve Program. Prior converted wetlands, however, may still qualify for CRP enrollment in some instances.

Because remaining enrollment opportunities in the CRP may be limited to 5 or 6 million acres, it is likely that more acreage will be offered by farmers than can be accepted. Consequently USDA developed a new bid acceptance process designed to select acres that provide the highest conservation and environmental benefits relative to the government costs of enrollment. The process also promotes rental rate competition between farmers and complies with legislative requirements by insuring that CRP rental payments do not exceed prevailing local rents for comparable land.

Farmers may now submit up to 4 different CRP bid types. "Standard" bids for 10-year contracts comprise the majority of bids. They contain conservation practices for which useful life easements are not required. Conversely, "Easement" bids contain practices, such as filter strips, requiring useful life easements of 15-30 years. "Wellhead Standard" bids are similar to Standard bids except that the land being offered is within an approved wellhead protection area. Finally, "Wellhead Easement" bids are for land within an approved wellhead protection area and require the farmer to grant a useful life easement.

At the conclusion of a signup, all bids are reviewed by local county ASC committees to determine if the land is eligible for CRP enrollment and if the farmer is eligible for participation. If one or both of these conditions is not met, the bid is flagged for later rejection.

All bids are then transmitted to the National Office of the Agricultural Stabilization and Conservation Service (ASCS). There, the rental payment requested by a farmer is screened against a bid-specific and soil-specific estimate of the rent that could be earned on local comparable cropland. Bids that exceed this amount are rejected. The bid screen amount is not related to the Maximum Acceptable Rental Rate (MARR) that was uniformly applied within bid pools in signups 1-9.

Eligible Easement and Wellhead bids that survive the bid screen are automatically approved for CRP enrollment. These bids typically involve a limited number of acres and a small Government cost, but provide significant conservation and environmental benefits.

Eligible Standard bids that survive the bid screen must compete for the remaining acreage that can be enrolled under the signup's predetermined limit. At the heart of this competition is a formula that ranks bids based on the ratio of an environmental benefits index to the Government cost of the contract. The environmental benefits index measures the potential contribution to conservation and environmental program goals that the bid would provide. The seven coequal conservation and environmental goals targeted in the tenth and eleventh CRP signups included:

- surface water quality improvement,
- potential ground water quality improvement,
- preservation of soil productivity,

- assistance to farmers most impacted by conservation compliance,
- tree planting,
- enrollment in Hydrologic Unit Areas identified by the President's Water Quality Initiative,
- enrollment in established conservation priority areas.

As the CRP continues, these goals may be revised to achieve other priorities.

For purposes of CRP enrollment, there is little that a farmer can do to increase the environmental benefits for a given parcel of cropland that is bid. Consequently, if farmers who offer "Standard" bids wish to maximize their probability of CRP acceptance, they must submit competitive rental payment requests.

Box B:

1990 Food, Agriculture, Conservation, and Trade Act Conservation Title

The 1990 farm bill entitled Food, Agriculture, Conservation and Trade Act (FACTA) creates several new programs and amends the conservation provisions in earlier farm bills to strengthen the federal role for protecting the nation's soil and water resources. The following changes and new provisions are contained in the 1990 FACTA.

Amendments to Compliance, Sodbuster, and Swampbuster

Potential penalties for violating the conservation compliance, sodbuster, and swampbuster provisions have been increased. Violations can result in denial of farm program benefits. The benefits that can be denied have been expanded to include payments from the Agricultural Conservation Program (ACP), Emergency Conservation Program, disaster assistance payments for weather-damaged trees, CRP, Agricultural Water Quality Protection Program (AWQPP), Environmental Easement Program, and assistance under the small watersheds program.

At the same time though, Congress gave USDA greater flexibility in administering these provisions. When "good faith" violations occur, graduated penalties may be assessed relative to the extent of environmental damage. Moreover, when violations are technical or minor in nature and have a minimal effect, farmers cannot be denied benefits.

ECARP Goal Is 40-45 Million Acres By 1995

The Environmental Conservation Acreage Reserve Program (ECARP) is composed of a revised Conservation Reserve Program (CRP) and a new Wetlands Reserve Program (WRP). FACTA mandates that 40-45 million acres, including the 33.9 million acres enrolled in the CRP during 1986-1990, are to be enrolled in the ECARP by the end of 1995.

CRP is extended. Besides extending the deadline for CRP enrollment through 1995, FACTA also designates proposed eligible lands, provides incentives for new hardwood tree planting and conversion of existing CRP acres to trees, and establishes conservation priority areas in the Chesapeake Bay Region, the Great Lakes Region, and the Long Island Sound Region. In addition, FACTA calls for one million acres per year to be reserved for CRP enrollment in calendar years 1994 and 1995. These acres are intended to provide a buffer that can be used to enroll highly erodible lands that cannot be treated with a conservation plan under the conservation compliance provision.

FACTA also calls for USDA to extend the protection of crop acreage bases, quotas, and allotments on CRP lands after contracts expire if the owner or operator will continue to keep the land in the appropriate conserving uses. USDA is given authority to extend CRP contracts for 10 years following their expiration. Land owners may also have the option to place CRP land in the Environmental Easement Program.

Wetlands Reserve is created. The Wetland Reserve Program will return farmed or converted wetland back into a wetland environment. FACTA calls for USDA, to the extent practicable, to enroll 1 million acres in a wetland reserve during 1991-95 by soliciting bids from landowners. While farmed or converted wetlands is the primary target of the program, eligibility also extends to non-cropped wetlands (such as Water Bank lands), riparian corridors, and critical wildlife habitat.

Unlike the 10-year contracts for the CRP, participants in the WRP must agree to long-term easements on enrolled land. Easements can be permanent, for 30 years, or the maximum duration allowed under applicable State laws. Participants must implement a wetland easement conservation plan that restores and protects the wetland's functional

Redesigned CRP Alters Enrollment Pattern

Following an 18-month pause in enrollment, a tenth signup under the Conservation Reserve Program (CRP) was held March 4-15. Nearly 2.5 million acres of highly erodible or environmentally sensitive cropland were bid. Although results are not final pending endorsement of contracts by farmers, 565,000 of these acres were tentatively accepted from that signup into the 10-year cropland retirement program (table 11). The addition of this land would bring total CRP enrollment to nearly 34.5 million acres (figure 10). In July an eleventh signup was held in which 2.4 million acres were bid and 1.12 million were tentatively accepted. However, since land enrolled in the 11th signup will not be retired from production until the 1992 crop year, the following material will focus on the 10th signup.

Enrollment Shifts Eastward. Owing to the significantly redesigned bid acceptance process and new eligibility criteria, enrollment in the tenth signup was quite different from that obtained in signups 1-9. As figure 11 indicates, 62 percent

values. They must also agree to the permanent retirement of any existing cropland base and allotment history on enrolled land. In return participating farmers will receive payments and cost sharing. Total compensation cannot exceed the fair market value of the land less the value of the land unencumbered by the easement. Economic uses of the restored wetlands, such as hunting, fishing, managed timber harvest, or periodic haying and grazing, are allowed to help reduce the cost of acquiring easements.

Agricultural Water Quality Protection Program

The goal of the newly established AWQPP is to enroll 10 million acres during calendar years 1991-95. USDA is to enter into agreements with owners and operators for developing plans to protect water quality. Unlike most CRP contracts and WRP easements, these agreements do not preclude commodity production on enrolled acreage.

When implemented, eligible lands will include wellhead protection areas (land within 1,000 feet of a public well), areas of shallow Karst topography where sinkholes convey runoff water directly into ground water, critical cropland areas identified under Section 319 of the Federal Water Pollution Control Act, areas where agricultural nonpoint source pollution is adversely affecting threatened or endangered specie habitat, and other environmentally sensitive areas identified by USDA, EPA, the Department of the Interior, or State agencies.

Agreements will be 3 to 5 years in duration. Participants will be required to implement a USDA-approved water quality protection plan; report nutrient, pesticide, and animal waste materials usage rates; supply production evidence, well test results, soil tests, and tissue tests for each year of the agreement.

In return, participants will receive an annual incentive payment not to exceed $3,500 per person per year. Cost sharing is also available if a farmer elects to preserve wetlands or enhance wildlife habitat. During the agreement period, producers also receive program payment yield and base acreage protection.

Environmental Easement Program

The purpose of the Environmental Easement Program will be to provide long-term protection of environmentally sensitive lands or to reduce water quality impairment. No acreage mandate or goal has been set. Under the program long-term or permanent easements will be offered to landowners during 1991-95.

Eligible land will include:

- Land in the CRP that poses an environmental threat and is likely to return to production upon contract expiration.
- Land in the Water Bank.
- Cropland containing riparian corridors, areas of critical wildlife habitat, or environmentally sensitive areas that, if cropped, would prevent a producer from complying with State or Federal environmental goals.

CRP land planted in trees is specifically made ineligible for the EEP.

Participants must agree to recorded deed restrictions, to implement a natural resource conservation management plan on enrolled land, and to permanently retire any existing cropland base and allotment history. In return, participants can receive up to 100 percent cost sharing for establishing conservation measures and practices, and annual easement payments for 10 years or less. Easement payments can total no more than the lesser or $250,000 of the difference in the value of the land with and without an easement. The total amount of easement payments made to a person for any year can not exceed $50,000.

of the acreage enrolled in Signups 1-9 was located in the Northern Plains, Southern Plains, and Mountain States. However, only 30 percent of tenth signup acres was accepted from these regions, while much greater percentages came from the Corn Belt, Delta, and Lake States. Enrollment percentages also increased in the Appalachian, Southeast, and Northeast regions.

Enrollment In Priority Areas Significant. More than 72,000 acres, or 13 percent of the tentatively-approved tenth signup land, came from conservation priority area watersheds such as the Chesapeake Bay, Long Island Sound, and the Great Lakes Region. These conservation priority areas were established by the 1990 farm bill. USDA will attempt to achieve a significant level of enrollment in these water-

Box C:

Provisions To Protect and Restore Wetlands

Historic Perspective

Between 1780 and 1989, 53 percent of the 221 million acres of continental U.S. wetlands were drained and converted to other land uses. Agricultural uses accounted for an estimated 87 percent of the 13.8 million acres of the wetlands converted between the mid-1950's and the mid-1970's. This translates into annual losses of 458,000 acres. Estimates for the mid-1970's to mid-1980's put the annual rate of loss at 290,000 acres, with agricultural uses accounting for 54 percent of the total. Between 1982 and 1987, losses have apparently slowed even further to 100,000-200,000 acres per year.

For the first 200 years of U.S. history, the Federal Government approved of and assisted with wetland drainage to further public health and economic development goals. For the first 70 years of this century, USDA had a policy of direct financial and technical assistance to the farm community for wetland drainage. Most direct incentives ended in the 1970's for a variety of reasons, culminating in Executive Order 11990 issued in 1977. This ordered federal agencies to "...minimize the destruction, loss or degradation of wetlands..." and to "...avoid direct and indirect support of new construction in wetlands whenever there is a practicable alternative...." The "swampbuster" provision in the 1985 Food Security Act and changes in the 1986 Tax Reform Act strengthened the wetland protection policy. The swampbuster provision made farmers ineligible for price support payments, farm storage facility loans, crop insurance, disaster payments, and insured or guaranteed loans if an annual crop was planted on converted wetlands. The Tax Reform Act eliminated deductions for land clearing and conservation expenses, and preferential treatment of capital gains, including capital gains realized from draining wetlands.

FACTA amended swampbuster to provide opportunities for wetland restoration and for partial loss of benefits. Previously, loss of program benefits only occurred in the year converted wetland was planted to an agricultural commodity. Benefits were restored when a crop requiring no annual tillage was planted in the following year. Now, converting a wetland to make production possible will invoke loss of benefits, which cannot be restored until the converted wetland is restored.

The minimal effect clause, which exempts conversions that are determined to have minimal effect on the hydrological and biological properties of the wetland, has been expanded to allow wetland restoration to mitigate wetland losses. "Mitigation" means that a farmer can drain a wetland without losing farm program benefits if another prior converted wetland on the farm or in the local area is restored.

The new graduated penalty provision allows an operator to violate swampbuster once in 10 years if the wetland is restored and if the conversion occurred in good faith. The penalty ranges from $750 to $10,000, depending on the severity of wetland destruction. The operator remains ineligible for farm program benefits until the converted wetland is either restored or mitigated. Previously, the operator lost all farm program benefits, no matter how small the area of wetland converted.

Wetland Reserve Program Established

FACTA also established a new agricultural wetland reserve program that will restore up to one million acres of cropland to wetlands. (See box B.)

Because of funding limitations the program will not be implemented until 1992. The WRP will be run somewhat likes CRP, with signup periods during which landowners can bid land into the program. However, legal requirements for compensating and recording permanent easements mean that more negotiation with the landowner willbe needed before WRP bids are accepted. Lack of information on wetlands and restoration potential suggests that USDA will have regional enrollment pools for WRP, rather than the single national pool now being used for sheds in order to maximize water quality and wildlife habitat benefits.

In addition, more than 10,000 acres were added in high priority watersheds specifically targeted by USDA to improve water quality in coordination with the President's Water Quality Initiative.

Average Rental Costs and Erosion Reductions Up Slightly. Annual rental payments received by farmers in the tenth signup averaged $53.96 per acre; only somewhat greater than the $50.99 per acre received in the ninth signup held July-August 1989 (table 11). This increase is primarily due to the regional shift in enrollment; less low cost Western land and more higher cost Eastern cropland. Government

CRP enrollment. As a consequence of the new WRP, cropped wetlands formerly eligible for CRP enrollment are no longer eligible. Since WRP focuses on restoring prior converted wetlands, owners of cropped wetlands will have fewer options for their land.

Standards for Wetland Definition

One of the first federal attempts to protect wetlands, Section 404 of the 1972 Federal Water Pollution Control Act amendments, authorizes the Corps of Engineers and the Environmental Protection Agency (EPA) to regulate wetland conversion through a permit process. Prior to 1989, the Corps did not consider areas previously converted for crop production as wetlands subject to Section 404 permit requirements. "Normal agricultural and silvicultural practices...," such as maintenance of drainage ditches and levees were considered exempt from Section 404 permit requirements.

However, faced with concerns over differing wetland definitions, the four agencies of the Federal Government with primary wetland responsibilities (Corps, EPA, Fish and Wildlife Service (FWS), and USDA) adopted in 1989 a standard wetland delineation manual that uses the more encompassing USDA definition. While Section 404 regulations still exempt most routine agricultural practices, wetlands on a considerably larger amount of farmland now come under the Corps purview.

At first, the crops did not differentiate between prior converted wetlands and cropped wetlands used in swampbuster. Complaints from farmers forced the Corps to no longer require permits for 10-22 million acres of farmed wetlands converted to agricultural production prior to 1985. This change completes the movement toward more consistent Federal wetland policy begun in 1989.

Criticism from landowners led to a multi-agency effort to revise the 1989 manual. At issue is the amount and duration of flooding needed to define land as wetland. The 1989 manual defined wetland as land that was saturated within 18 inches of the surface for seven days a year. A compromise definition would require land to be flooded at least 15 consecutive days during the growing season or saturated at the surface for at least 21 days. This would remove from Section 404 jurisdiction an estimated one-third of currently subject wetlands. Wetlands covered by the swampbuster provision will probably also be affected. In return for reducing the scope of wetlands protected, the full 1 million acre WRP will be funded. Because of funding limitations, USDA originally planned a 600,000 acre WRP.

One of the factors that probably influenced revision of the 1989 delineation manual was a number of bills from Congressional critics of Federal wetlands policy. These bills, which could amend Section 404 as part of the Clean Water Act reauthorization, would restrict the official wetland definition, treat different classes of wetlands differently, and require Federal compensation for development restrictions on some classes of wetlands.

"No Net Loss" Goal

In his 1990 budget to Congress, President Bush called for "no net loss" of wetlands as a policy goal. He established a task force under the White House Domestic Policy Council to determine how the goal could be achieved. This comes at a time when Section 404, swampbuster, and tax reform provisions likely have reduced wetland conversion substantially. Recent estimates of wetland losses range from 100,000 to 300,000 acres per year, considerably lower than the 450,000 acres per year estimated for the 1950's to 1970's.

Revision of the 1989 delineation manual to restrict the scope of jurisdictional wetlands should make the no net loss goal easier to achieve. By eliminating drier land from the wetland definition, much of the area landowners would like to drain no longer counts as lost wetland. USDA's Wetland Reserve Program is one of the few tangible steps taken toward no net loss. Given the furor over Federal wetland regulation, voluntary approaches with compensation seem politically desirable. Few wetlands can be protected with such programs, however, given continued tight Federal budgets.

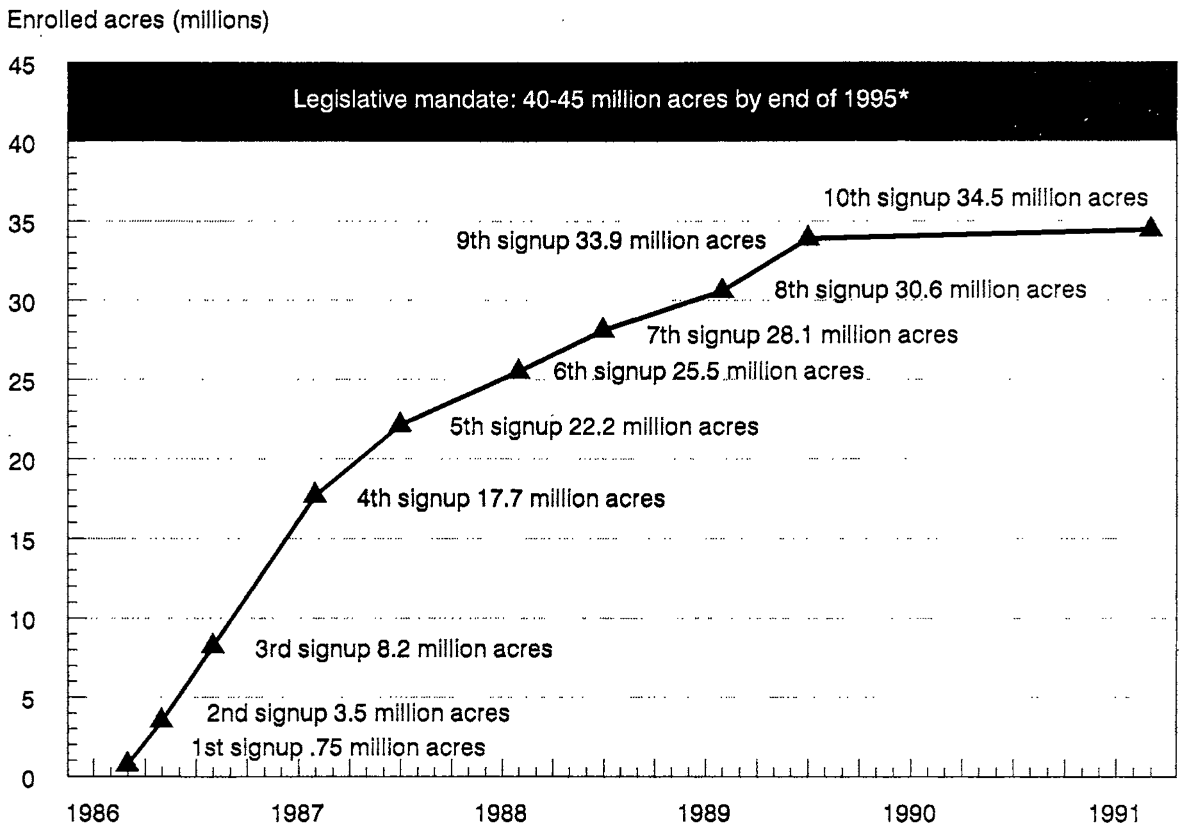
Table 11--Enrollment in the Conservation Reserve Program

Item	Number of contracts	Total cropland enrolled	Average rental rate	Average erosion reduction
	1,000	Million acres	$/acre per year	Tons per acre per 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	10.7	0.56	53.96	16
Total	344.1	34.48	49.01	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 /6	344.1	34.48	49.01	19
	1,000	Million hectares	$/hectare per year	Metric Tons per hectare per 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	10.7	0.23	133.23	36
Total	344.1	13.96	121.04	43
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 /6	344.1	13.96	121.04	43

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 through V eroding at least two times the tolerance rate if planted in trees. Eligibility also extended to cropland areas 66 to 99 feet wide adjacent to permanent water bodies for placement in filter strips. 5/ Eligible acres expanded to include cropped wetlands and cropland areas subject to scour erosion. 6/ Actual number of contracts, acres enrolled, rental rates, and erosion reduction based on conditional acceptance. Eligible acres expanded to include cropland devoted to easement practices, cropland in state water quality areas, cropland in conservation priority areas, cropland within established wellhead protection areas. Farmed wetlands, even if otherwise eligible, were made ineligible for enrollment.

Figure 10

Cumulative CRP Enrollment



* When combined with acreage enrolled in the Wetlands Reserve Program

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

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	5.7	0.21	9.5	0.07	59.40	13
Appalachian	26.8	1.09	144.4	.54	53.79	26
Southeast	32.3	1.61	1236.1	.75	42.61	15
Delta States	17.2	1.15	665.2	.46	43.96	19
Corn Belt	84.1	4.89	74.0	2.73	73.06	18
Lake States	49.6	2.72	110.4	1.67	58.44	16
Northern Plains	74.2	9.48	8.8	6.51	45.94	15
Southern Plains	26.9	5.13	21.4	4.13	40.19	32
Mountain	20.6	6.51	4.7	4.07	39.71	19
Pacific	6.6	1.72	6.1	1.15	49.32	13
United States	344.1	34.48	2280.6	22.07	49.01	19
	1,000	Million hectares	1,000 hectares	Million hectares	$/hectare	metric tons per hectare
Northeast	5.7	0.08	3.9	0.03	146.79	29
Appalachian	26.8	0.44	58.5	0.22	132.93	58
Southeast	32.3	0.65	500.6	0.30	105.29	33
Delta States	17.2	0.46	269.4	0.18	108.62	42
Corn Belt	84.1	1.98	29.9	1.11	180.54	40
Lake States	49.6	1.10	44.7	0.68	144.41	36
Northern Plains	74.2	3.84	3.5	2.64	113.53	34
Southern Plains	26.9	2.08	8.7	1.67	99.31	72
Mountain	20.6	2.64	1.9	1.65	98.12	43
Pacific	6.6	0.70	2.5	0.47	121.87	29
United States	344.1	13.96	923.6	8.94	121.04	43

cost-shares for vegetative cover establishment will average $43.54 per acre.

Annual soil erosion reductions on land enrolled in the tenth signup averaged 16.5 tons/acre/year (table 11). This is a net improvement over the 14 ton/acre/year average reduction achieved in the ninth signup. Perhaps more importantly, however, the composition of the erosion reduction changed. In signups 1-9, most of the soil erosion reduction was from wind erosion experienced primarily in the West. By contrast, in the tenth signup 70 percent of the erosion reduction will be sheet and rill (water-caused) erosion experienced primarily in the East. While both forms of erosion can reduce agricultural productivity, reduction of sheet and rill erosion generally produces greater offsite water quality, recreational, and wildlife benefits.

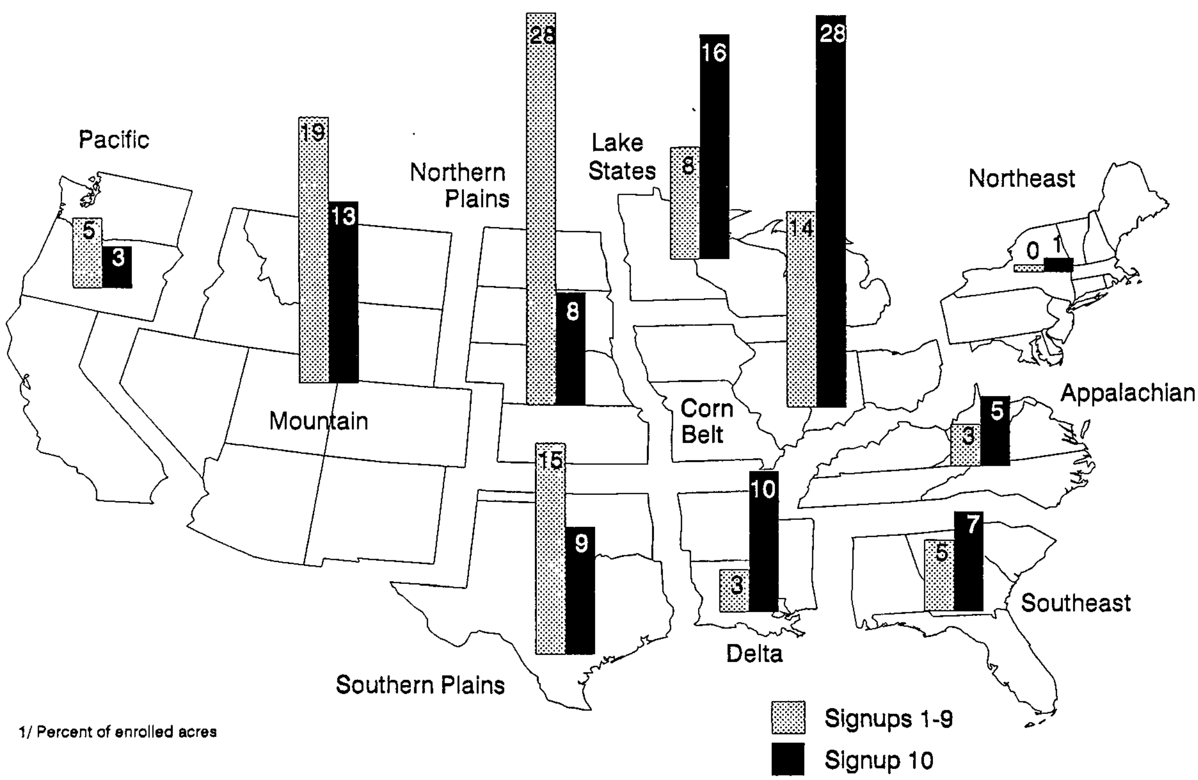
Tree Planting Blossoms. As in past signups, most of the tentatively-approved acres are scheduled to be placed in grass cover (77 percent) for the 10th signup (table 13). However, in the tenth signup, the percentage of land to be planted in trees increased significantly. In signups 1-9, trees accounted for 6 percent of the enrollment. In the tenth signup, fully 18 percent of the acres will receive tree cover. In addition, 3,400 acres were enrolled as filter strips and 20,700 acres will be placed in a variety of special conservation practices that benefit wildlife.

Unlike previous signups, acres enrolled as filter strips, wildlife habitat improvement, salt-tolerant grasses, field windbreaks, grassed waterways, contour grass strips, shelterbelts, and living snow fences are subject to useful-life easements of 15-30 years. The easements require the farmer to maintain these practices for their useful life although CRP rental payments are made for only the first 10 years. In total, more than 27,800 acres tentatively-approved in signup 10 are subject to useful life easements.

Percentage of Corn Base Retirement Increases. As a requirement for CRP participation, a farm's crop acreage base must be reduced in proportion to the acreage enrolled in the CRP. In signups 1-9 a total of 21.8 million acres of commodity program base were reduced. Wheat base accounted for 47 percent while corn base comprised 17 percent.

Figure 11

Tenth CRP Signup Shifts from Western to Eastern Regions 1/



1/ Percent of enrolled acres

In the tenth signup, an additional 325,000 acres of commodity program base were reduced. Of this, 35 percent represented wheat base while 31 percent is corn base. These acres are ineligible for commodity program payments during the 10-year CRP contract. However, because commodity program set-aside rates are now calculated on a stocks-to-use basis, new CRP enrollment may result in a lowering of set-aside rates and thus little or no commodity program cost savings.

Progress on Conservation Compliance Plans Continues

Consèrvation compliance plans have been fully implemented on approximately 54 million acres (40 percent) of the 135 million acres with plans under conservation compliance. The Soil Conservation Service will carry out random status reviews on 5 percent of conservation plans annually to determine if producers are actively applying their plans. Those producers not meeting their plan schedules could lose eligibility for farm program benefits.

Other USDA Conservation Programs

Older USDA conservation programs continued their assistance efforts to reduce soil erosion, conserve water, improve water quality, protect watersheds, and improve habitat (see box D). While funding for technical assistance and education to implement the conservation provisions of the 1985 FSA and the Water Quality Initiative are expected to be up in fiscal 1991, funding for older programs is down. Less funds were available in fiscal 1991 for the Agricultural Conservation (ACP) and Small Watersheds Programs that offer cost-sharing to farmers to offset their cost of installing conservation practices. This change in funds reflects the increased federal efforts to protect water resources from potential contamination from agriculture.

Agricultural Conservation Program Shifts to Water Quality

Since 1988, cost-shares paid by the USDA's Agricultural Conservation Program (ACP) for soil erosion and water conservation purposes have declined while payments for improving water quality increased (table 14). ACP funds are being used to implement practices in areas under the Water Quality Initiative. Some 125 water quality projects under the Initiative received support from the ACP in 1991. Financial assistance for all ACP practices in 1990 was $173 million, down from $188 million in 1988 when high expenditures were incurred for erosion control.

Water quality practices continue to receive an increasing proportion of ACP cost-sharing, with expenditures increasing from $7.2 million in 1984 to $22.4 million in 1990. Over two-thirds of the 1990 allocation for water quality was provided for animal waste management. The remaining one-

Table 13--CRP acreage treated by various conservation practices

	Signups 1-9		Signup 10	
Practice	Coverage	Share of cropland enrolled	Coverage	Share of cropland enrolled
	1,000 acres	Percent	1,000 acres	Percent
Grass cover	29,707	87.6	434	77.0
Tree planting	2,179	6.4	101	18.0
Wildlife habitat	1,974	5.8	21	3.7
Field windbreaks	7	0.0	1	0.2
Diversions	83	0.2	0	0.0
Erosion, sediment, & water control structures	40	0.1	0	0.0
Grass and sod waterways	15	0.0	1	0.2
Filter strips	49	0.1	3	0.6
Alley cropping	NA 1/		0	0.0
Salt grasses	NA		2	0.3
Total 2/	33,922 0	100.0	564	100.0
	1,000 hectares	Percent	1,000 hectares	Percent
Grass cover	12,031	87.6	176	77.0
Tree planting	882	6.4	41	18.0
Wildlife habitat	799	5.8	8	3.7
Field windbreaks	3	0.0	0	0.2
Diversions	34	0.2	0	0.0
Erosion, sediment, & water control structures	16	0.1	0	0.0
Grass and sod waterways	6	0.0	0	0.2
Filter strips	20	0.1	1	0.6
Alley cropping	NA	0.0	0	0.0
Salt grasses	NA	0.0	1	0.3
Total	13,738	100.0	228	100.0

1/ Not available as a practice in signups 1-9. 2/ Acres where more than one practice was applied are counted only once in the total.

Box D:

USDA Conservation and Water Quality Programs

President's Water Quality Initiative includes:

- Expanded **Education and Technical Assistance** in selected demonstration projects, hydrologic unit areas, and special water quality projects;
- Special **Research and Development** in new technology and production systems; and
- New **Database Development and Evaluation** of the economic and environmental impacts of water quality practices and programs.

Continuing Assistance Programs

These programs, administered by the Soil Conservation Service (SCS) and the Agricultural Stabilization and Conservation Service (ASCS), provide financial and technical assistance to farmers, ranchers, local organizations, and multi-county areas to implement practices to achieve soil and water conservation, water quality improvement, timber stand improvement, recreation, and rural development.

- **Agricultural Conservation Program (ACP)**, initiated in 1936, provides financial assistance to carry out conservation and environmental protection practices on agricultural land.
- **Conservation Technical Assistance (CTA)**, initiated in 1936, provides technical assistance to farmers by the Soil Conservation Service (SCS) through Conservation Districts.
- **Great Plains Conservation Program (GPCP)**, initiated in 1957, provides technical and financial assistance in Great Plains States for conservation treatment on entire operating units.
- **Small Watershed Program (PL-566)**, initiated in 1954, assists local organizations in flood prevention, watershed protection, and water management.
- **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.
- **Colorado River Basin Salinity Control Program (CRBSC)**, initiated in 1974 and amended in 1984, established a voluntary onfarm cooperative salinity control program within the USDA, and provides for cost-sharing of onfarm improvements.
- **Rural Clean Water Program**, initiated in 1980 and ends in 1995, is an experimental program that has been implemented in 21 selected areas. It provides cost-sharing and technical assistance to farmers voluntarily implementing best management practices to improve water quality.
- **Emergency Conservation Program**, initiated in 1978, provides financial assistance to farmers in rehabilitating cropland damaged by natural disasters.
- **Farmers Home Administration (FmHA)** provides loans to farmers and associations of farmers for soil and water conservation, pollution abatement, and building or improving water systems that serve several farms.
- **Forestry Incentives Program** provides cost-sharing up to 65 percent for tree planting and timber stand improvement for private forest lands of 1,000 acres or less.
- **Water Bank Program**, initiated in 1970, provides annual payments for preserving wetlands in important migratory waterfowl nesting, breeding, or feeding areas.

Research and Extension Programs

- **Agricultural Research Service (ARS)** conducts research on new and alternative crops and agricultural technology to reduce agriculture's adverse impacts on soil and water.
- **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.
- **Extension Service (ES)** provides information and recommendations on soil and water quality practices to land owners and operators in cooperation with State and local offices of USDA agencies and Conservation Districts.

third was allocated about equally for sediment control and nutrient management.

In 1990, nearly 10 million acres were treated or served by the ACP, up from 9.6 million acres in 1989 (table 15). Of the 10 million acres, 3 million were directly treated by cost-shared practices, and nearly 7 million benefited from protective practices such as terraces, diversions, sod waterways, and sediment and water control structures. Approximately 51 percent of the treated acres involved the establishment of a permanent grass or legume cover.

Table 14--Agricultural Conservation Program by primary purpose, 1984-90

Purpose	Unit	Year						
		1984	1985	1986	1987	1988	1989	1990
Erosion Control (English units)								
Cost-shares paid 1/	Mil $	111.4	126.4	93.5	92.4	133.8	114.3	112.3
Reduced erosion over	Ton/ac	6.0	5.7	5.8	6.4	5.9	5.5	5.5
life of practice	Mil tons	38.1	40.6	29.5	28.3	39.9	34.3	33.3
Cost-share per ton of reduced erosion 1/	$/ton	0.60	0.60	0.60	0.60	0.59	0.61	0.60
Erosion Control (Metric units)								
Reduced erosion over	MT/HA	13.4	12.8	13	14.3	13.2	12.3	12.3
life of practice	Mil MT	38.7	41.3	30	28.8	40.54	34.9	33.8
Cost-share per ton of reduced erosion 1/	$/MT	0.61	0.61	0.61	0.61	0.6	0.62	0.61
Water Conservation (English units)								
Cost-shares paid	Mil $	19.8	20.9	15.1	15.1	27.7	25.8	24.7
Water conserved over	Ac-ft	0.7	1.0	0.9	1.0	1.2	1.0	1.1
life of practice	1000 Ac-ft	579.2	823.5	446.1	422.1	742.0	644.1	653.0
Cost-share per ac-ft of water conserved 1/	$/Ac-ft	3.43	2.57	3.41	3.69	3.88	4.15	3.89
Water Conservation (Metric units)								
Water conserved over	M/HA	0.09	0.12	0.11	0.12	0.15	0.12	0.14
life of practice	1000 M/HA	71.5	101.6	55	52.1	91.6	79.5	80.60
Cost-share per ac-ft of water conserved 1/	$/M/HA	27.8	20.83	27.63	29.9	31.44	33.63	31.52
Water Quality								
Cost-shares paid	Mil $	7.2	10.2	9.3	9.5	13.4	15.9	22.4
		Percent of total cost-shares						
Sediment		5.6	13.5	14.4	13.8	12.7	13.3	15.4
Animal waste management		55.4	49.1	47.1	42.8	51.1	50.2	61.5
Fertilizer		0.3	8.6	8.5	12.9	10.4	12.5	12.4
Toxics		0.0	1.7	0.8	1.7	2.8	2.5	1.4
Salinity		38.1	26.0	27.8	25.3	17.8	16.6	5.5
Other		0.7	1.1	1.5	3.5	5.1	5.0	3.8
Wood Production and Other								
Cost-shares paid	Mil $	10.9	10.4	8.9	10.0	13.1	12.8	14.1
		Percent of total cost-shares						
Wood production		31.7	50.2	65.0	57.5	69.1	72.2	70.4
Wildlife		5.7	7.4	8.2	6.0	10.2	7.8	9.4
Energy		11.0	13.3	8.2	5.2	6.6	4.8	7.6
Groundwater pollution abatement		0.3	0.2	0.4	3.0	2.4	1.4	2.0
Groundwater recharge		0.1	0.0	0.0	0.2	0.1	0.1	0.1
Other		51.3	28.9	18.2	28.1	11.7	13.7	10.5
Total Cost-shares Paid	Mil $	149.2	167.9	126.7	127.0	188.0	168.8	173.4

1/ Amortized

Source: Agricultural Stabilization and Conservation Service

Table 15--Area treated or served by cost-shared practices, 1981, 1986-1990

Practice and program	1981	1986	1987	1988	1989	1990	1981	1986	1987	1988	1989	1990
	----Million acres treated----						----Million hectares treated----					
Permanent vegetative cover:												
Agricultural Conservation Program (ACP)	2.78	1.55	1.54	2.02	1.78	1.54	1.13	0.63	0.62	0.82	0.72	0.62
Conservation Reserve Program (CRP) 1/		1.70	12.42	7.84	4.57	3.19		0.69	5.03	3.17	1.85	1.29
Tree planting:												
ACP	0.13	0.13	0.15	0.20	0.17	0.17	0.05	0.05	0.06	0.08	0.07	0.0
CRP		0.21	0.76	0.52	0.42	0.19		0.08	0.31	0.21	0.17	0.0
Cropland protective cover:												
ACP	1.50	0.64	0.60	0.75	0.64	0.58	0.61	0.26	0.24	0.30	0.26	0.2
Conservation tillage:												
ACP	0.72	0.63	0.42	0.45	0.33	0.43	0.29	0.25	0.17	0.18	0.13	0.0
Strip cropping systems:												
ACP	0.12	0.09	0.08	0.14	0.12	0.15	0.05	0.04	0.03	0.06	0.05	0.0
Other Practices	0.06	0.07	0.14	0.10	0.11	0.13	0.02	0.03	0.06	0.04	0.04	0.0
Total area treated 2/:												
ACP	5.31	3.11	2.93	3.66	3.15	3.00	2.15	1.26	1.19	1.48	1.27	1.2
CRP		2.04	13.67	8.76	5.35	4.38		0.83	5.54	3.55	2.17	1.7
Total area treated	5.31	5.15	16.60	12.42	8.50	7.38	2.15	2.09	6.72	5.03	3.44	2.9
Area Served	----Million acres served----						----Million hectares served----					
Grazing land protection (ACP)	3.44	2.03	1.74	3.60	3.77	4.72	1.40	0.82	0.70	1.46	1.53	1.9
Irrigation water cons. (ACP)	0.90	0.49	0.49	0.82	0.77	0.69	0.36	0.20	0.20	0.33	0.31	0.2
Terraces and diversions (ACP)	0.58	0.41	0.64	1.07	0.93	0.62	0.23	0.17	0.26	0.43	0.38	0.2
Water impoundments (ACP)	0.79	0.21	0.20	0.27	0.27	0.22	0.32	0.05	0.08	0.11	0.11	0.0
Sediment & water control structures (ACP)	0.42	0.22	0.17	0.25	0.22	0.21	0.17	0.09	0.07	0.10	0.09	0.0
Sod waterways (ACP)	0.73	0.18	0.13	0.22	0.17	0.18	0.30	0.07	0.05	0.09	0.07	0.0
Other practices (ACP)	0.43	0.25	0.18	0.25	0.27	0.31	0.17	0.10	0.07	0.10	0.11	0.1
Total area served	7.29	3.79	3.55	6.48	6.40	6.95	2.95	1.53	1.44	2.62	2.59	2.8
Total area cost-shared	12.60	8.94	20.15	18.90	14.90	14.33	5.10	3.62	8.16	7.65	6.03	5.8

1/ The CRP began in 1986. There were no new signups in 1990. 2/ Includes some practices not listed.

Source: Agricultural Stabilization and Conservation Service.

More Land Benefiting From Conservation Practices

According to the 1987 Natural Resources Inventory recently released, nearly 12 million more acres of U.S. cropland had one or more conservation practices in use in 1987 than in 1982 (table 16). About 241 million acres (about 57 percent of total cropland) now have or benefit from some form of conservation treatment.

The most common conservation practice in 1987, in terms of number of acres treated, was reduced tillage. While not all 110 million acres reported in reduced tillage met the technical definition of conservation tillage (30 percent or more of the soil surface covered with previous crop residue after planting), any residue left on the soil surface offers some protection from erosion. Other important practices installed in the past included contour farming, irrigation water management, surface drains, and grassed waterways.

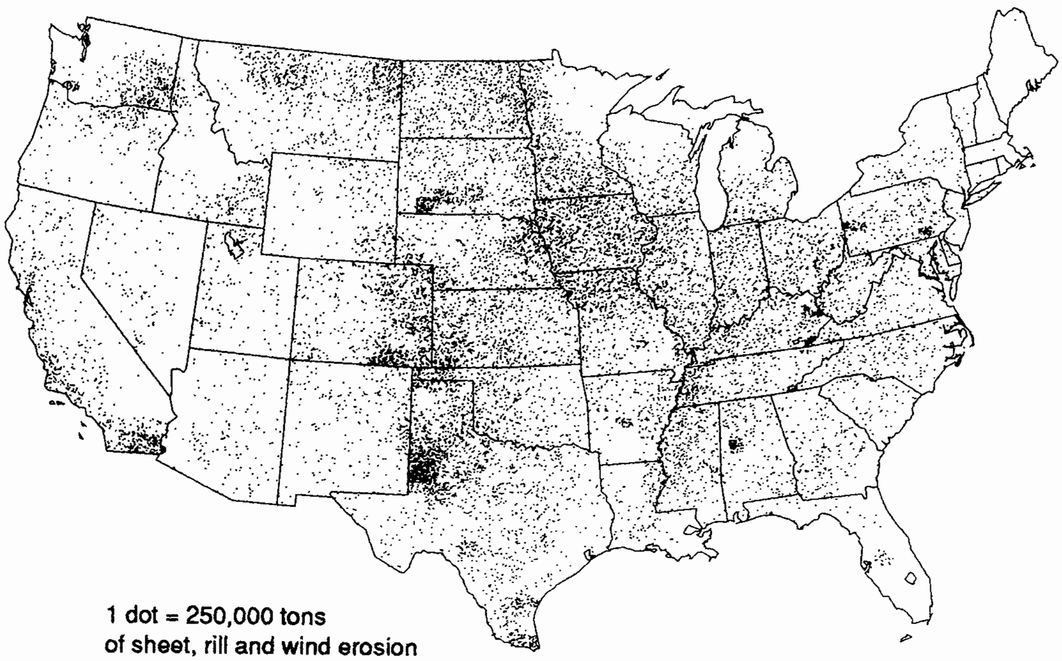
The 1987 Inventory also showed erosion levels on U.S. agricultural land generally down from 1982 levels (figure 12). While total U.S. cropland was up slightly between the 1982 and 1987 inventories, erosion was down 5 percent due to reduced water-caused erosion rates on cultivated cropland. Rates on rangeland, forestland, and pastureland were also down slightly.

In 1987, highly erodible cropland accounted for about 30 percent of total cropland, but made up nearly 60 percent of total cropland erosion, and over 40 percent of total erosion on non-federal lands (table 17). Erosion on these highly erodible lands was down from 1982 levels.

Progress was also made between 1982 and 1987 in preserving soil productivity. The number of cropland acres eroding above the tolerance (T) value (that erosion rate above which productivity declines) decreased by nearly 5.4 million acres or about 3 percent (table 17). Some land where erosion was reduced to T or below, appears to have come out of that land with the highest productivity loss in 1982 (that eroding above 3 times the T value). Again changes in cropping patterns and increased acreage with conservation practices are the likely cause of improvement.

Another National Resources Inventory is scheduled for 1992 and will help evaluate the performance of conservation poli-

Figure 12
Average Annual Erosion, 1987



1 dot = 250,000 tons
of sheet, rill and wind erosion

Source: Soil Conservation Service, *Natural Resources Inventory, 1987*

Table 16--Applied conservation practices on U.S. cropland, 1982 and 1987

Practice	1982 1/	1987 1/	Change	1982 1/	1987 1/	Change
	Million acres			Million hectares		
No practice	192.1	181.8	-10.3	77.7	73.6	-4.2
Reduced tillage 2/	97.3	110.3	13.0	39.4	44.6	5.3
Contour farming	34.1	32.5	-1.6	13.8	13.2	-0.6
Field windbreaks	6.0	6.2	0.2	2.4	2.5	0.1
Grassed waterways or outlets	19.3	21.8	2.5	7.8	8.8	1.0
Irrigation water conveyance pipeline	18.9	20.7	1.8	7.6	8.4	0.7
Irrigation water management	28.5	31.8	3.3	11.5	12.9	1.3
Pasture and hayland management	22.3	24.8	2.5	9.0	10.0	1.0
Stripcropping and contouring	3.5	3.8	0.3	1.4	1.5	0.1
Terraces	28.4	30.2	1.8	11.5	12.2	0.7
Subsurface drains	26.5	29.6	3.1	10.7	12.0	1.3
Surface drainage						
Field ditches	21.8	23.9	2.1	8.8	9.7	0.8
Mains or laterals	12.2	13.1	0.9	4.9	5.3	0.4
Total land with practices 3/	229.3	241.0	11.7	92.8	97.5	4.7
Total cropland	421.4	422.8	1.4	170.5	171.1	0.5

1/ Some additional acres may have received the practice. The Inventory only obtained acreage for three practices per site and some sites have more than three applied conservation practices. 2/ Some of this acreage does not have residue levels after planting that fully qualify as conservation tillage. 3/ Individual practices sum to more than total because some land received more than one practice. The total also includes land with practices other than those listed.

Source: National Resources Inventory, 1982 and 1987 cies. Its results will reflect CRP effects, Conservation Compliance, ACP changes, and other recent public and private efforts to reduce erosion.

Farmers Use Conservation Tillage Systems on 73 Million Acres

Conservation tillage systems were applied on over 73 million acres during 1990 (table 18). Conservation tillage was used mainly on corn, soybeans, or small grain (figure 13). More than 30 percent of the total acreage planted to corn, soybeans, and sorghum was conservation tilled. Conservation tillage was most frequently used with double-cropping with about 58 percent of the double-cropped soybeans, 52 percent of the double-cropped corn, and 42 percent of the double-cropped sorghum acreage produced with conservation tillage systems.

Conservation tillage refers to any system leaving 30 percent or more of the soil surface covered with previous crop residue after planting. Two key factors influencing crop residue are the previous crop, which establishes the initial amount and fragility of residue, and the type of tillage operations prior to and including planting.

No-till and ridge-till accounted for over 27 percent (almost 20 million acres) of the total acreage in conservation tillage nationwide. The use of these two conservation tillage systems is more important in the 6 eastern regions (figure 14). High residue conservation tillage systems such as no-till and ridge-till can leave as much as 70 percent of the soil surface covered with crop residues and offer more protection than other tillage systems.

The recent upward trend in the use of high residue conservation tillage systems will likely continue as farmers use conservation tillage to meet Conservation Compliance requirements, to reduce their production costs, and to capture other benefits associated with the use of these tillage systems.

Table 17--Change in rural land use and soil erosion between 1982 and 1987

Land use	Area 1982	Area 1987	Area Change	Total Erosion 1/ 1982	Total Erosion 1/ 1987	Total Erosion 1/ Change	Erosion Rates 1982	Erosion Rates 1987	Erosion Rates Change
	--- Million Acres ---			--- Million Tons ---			--- Tons per Acre ---		
Rural Non-federal land									
Cropland	421.4	422.8	1.4	3106	2962	-144	7.37	7.01	-0.36
Pasture land	132.3	130.0	-2.3	167	167	0.0	1.26	1.28	0.02
Rangeland	407.7	401.7	-6.0	534	492	-42	1.32	1.28	-0.10
Forest land	393.6	394.4	0.8	344	311	-33	0.87	0.79	-0.08
Other	59.6	59.9	0.3	395	316	-79	6.62	5.27	-1.40
Total	1414.6	1408.8	-5.8	4546	4248	-298	3.21	3.02	-0.19
Cropland by erodibility class									
Highly erodible 2/	122.9	123.0	0.1	1801	1704	-97	14.05	13.85	-0.80
Less erodible	298.5	299.8	1.3	1305	1258	-47	4.37	4.20	-0.17
Cropland by cause of erosion									
Water-caused erosion	414.9	416.0	1.1	1797	1586	-211	4.33	3.81	-0.52
Wind-caused erosion	190.7	199.5	8.8	1309	1376	67	6.86	6.90	0.04
None	2.5	2.5	-0-	--	--	--	--	--	--
Cropland erosion relative to Tolerance (T)									
Eroding at T or below	232.5	239.3	6.8	466	474	8	2.00	1.98	-0.02
Eroding above T to 3T	128.2	126.4	-1.8	994	981	-13	7.75	7.76	0.01
Eroding above 3T	60.7	57.1	-3.6	1646	1507	-139	27.17	26.39	-0.78
	- Million hectares -			- Million Metric Tons -			Metric Tons per hectare		
Rural Non-federal land									
Cropland	170.5	171.1	0.6	2818	2687	-131	16.48	15.70	-0.78
Pasture land	53.5	52.6	-0.9	151	151	--	2.87	2.87	0.00
Rangeland	165.0	162.6	-2.4	484	446	-38	2.93	2.73	-0.20
Forest land	159.3	159.6	0.3	312	282	-30	1.95	1.77	-0.18
Other	24.1	24.2	0.1	356	287	-71	14.92	11.95	-2.97
Total	572.4	570.1	-2.3	4123	3853	-270	7.20	6.75	0.45
Cropland by erodibility class									
Highly erodible 2/	49.7	49.8	0.1	1634	1546	-88	32.82	31.02	-1.80
Less erodible	120.8	121.3	0.5	1184	1141	-43	9.82	9.41	-.41
Cropland by cause of erosion									
Water-caused erosion	167.9	168.4	0.5	1630	1439	-191	9.76	8.53	-1.23
Wind-caused erosion	77.1	80.7	3.6	1188	1248	60	15.30	15.41	0.11
None	1.0	1.0	-0-	--	--	--	--	--	--
Cropland erosion relative to Tolerance (T)									
Eroding at T or below	94.0	96.8	2.8	423	430	7	4.50	4.44	-0.06
Eroding above T to 3T	51.9	51.2	-0.7	902	890	-12	17.41	17.38	0.03
Eroding above 3T	24.6	23.1	-1.5	1493	1367	-126	59.72	59.43	-0.29

1/ Includes wind erosion on cropland. 2/ Erodibility index is 8.0 or higher.

Source: 1982 and 1987 National Resources Inventory

Table 18--National use of conservation tillage, 1983-1990

Use	1983	1984	1985	1986	1987	1988	1989	1990
				Millions acres				
Total area planted 1/	309	345	342	327	305	308	317	319
Area planted with conservation tillage 2/	70	87	95	97	86	88	72 3/	73 3/
				Millions hectares				
Total area planted 1/	125	140	139	132	124	125	128	129
Area planted with conservation tillage 2/	28	35	38	39	35	36	29 3/	30 3/
Percentage of area with				(percent)				
No-till	3.3	4.1	4.4	4.4	4.1	4.2	4.4	5.3
Ridge till	0.3	0.4	0.6	0.6	0.7	0.8	0.9	1.0
Other conservation tillage 3/	19.0	20.7	22.8	24.6	23.4	23.6	17.4	16.7
Total conservation tillage	22.6	25.2	27.8	29.6	28.2	28.6	22.7	22.9

1/ Estimates of acres planted to principal crops from the National Agricultural Statistics Service, USDA. 2/ Estimates of conservation tillage use from the National Surveys of Conservation Tillage Practices from the Conservation Technology Information Center, NACD. 3/ The definition of "other conservation tillage" was refined in 1989 from that used in previous years.

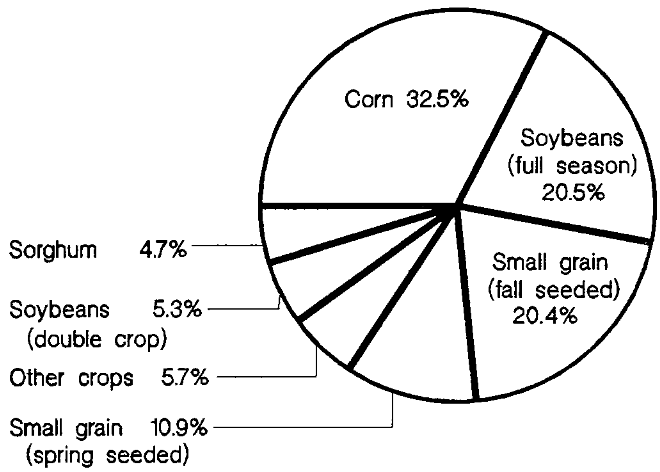
The Corn Belt and the Northern Plains had the largest acreage of conservation tillage (figure 15). These regions plus the Lake States accounted for over two-thirds of total conservation tilled acres in 1990.

In addition to reducing soil erosion and water runoff, the adoption of conservation tillage also increases infiltration. While reduced erosion and runoff decrease the potential of agricultural chemicals reaching surface waters, the increased infiltration raises concerns about the potential of dissolved chemicals leaching into shallow ground water. Some recent research results, however, indicate that under normal climatic conditions conservation tillage is no more likely to degrade ground water than other tillage systems.

While new or retro-fitted machinery may be required to adopt conservation tillage, fewer trips over the field and reduced labor requirements can result in cost savings. If energy prices increase, conservation tillage becomes 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 with the adoption of conservation tillage. However, conservation tillage systems might require better management in the proper timing and placement of fertilizers and pesticides and in carrying out tillage operations.

Figure 13

Conservation Tillage Acres by Crop, 1990[1]



1/ Share of total acres planted with conservation tillage.
Source: CTIC data.

Water Quality Problems in Agriculture: New Findings

EPA Releases Survey Results on Pesticides and Nitrates in Drinking Water

The Environmental Protection Agency has released the results from a nationwide survey of drinking water wells. Conducted over a 5 year period, this survey evaluated the presence of pesticides and nitrates in both community and private drinking water wells in the United States. The survey showed that while at least half of the nation's drinking water wells contained detectable amounts of nitrate, only about 1.2 percent of community water systems and 2.4 percent of rural private wells contained nitrates at levels higher than EPA's standard. About 10 percent of the community wells and 4 percent of the private wells surveyed contained detectable levels of one or more pesticides, with less than 1 percent of the surveyed wells containing pesticides at concentrations higher than those considered to pose an immediate risk to human health.

USDA Survey of Cotton Chemical Use Highlights Potential Water Quality Problems

The 1989 Cotton Water Quality survey gathered data on cotton agricultural chemical use, production practices, and resource conditions in 14 cotton-producing States. Data gathered on the use of fertilizers, herbicides, insecticides, and other agricultural chemicals were analyzed to assess the potential water quality problems that are thought to be associated with cotton production. Surveyed acreage was classified according to the relative likelihood that chemicals applied to cotton cropland would leach into ground water or run off into surface waters, based on the properties of the chemicals applied and the physical characteristics of the soil at each sample point.

Results of this analysis indicate that vulnerability of cotton acreage to leaching pesticides does not appear to be widespread. Only 3 percent of all surveyed cropland was given the highest relative potential for pesticides to leach into ground water. Possible problems with nitrogen leaching into ground water may be more widespread; 42 percent of the cotton acreage, primarily in the Delta and West, was classified as having the highest relative potential for nitrate leaching.

USDA is also surveying producers to estimate the use of fertilizers and pesticides on other major field crops, vegetables, and fruit. These surveys will provide a comprehensive data base for researchers and policy makers to address potential water quality effects, along with other environmental or economic impacts from agriculture.

The President's Water Quality Initiative Aims To Prevent Water Pollution from Agricultural Chemicals

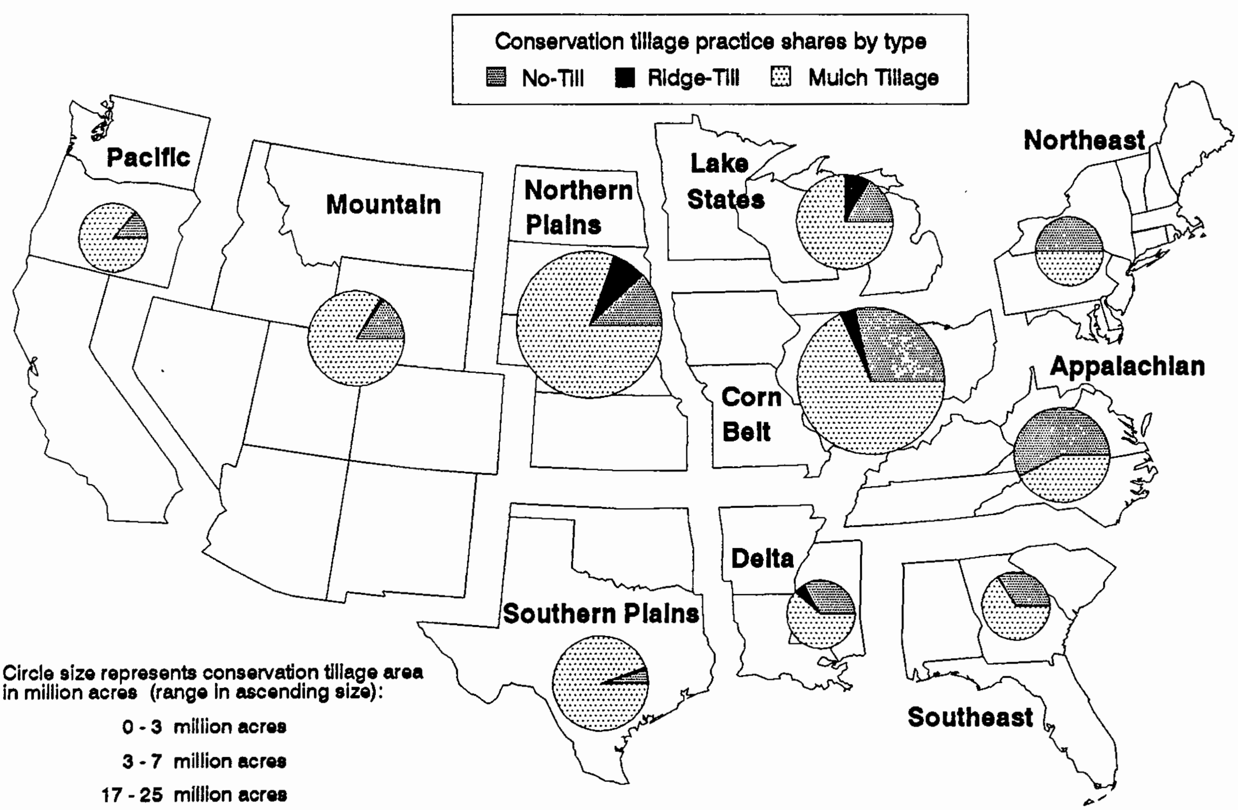
Management System Evaluation Areas Program Develops New Farming Systems

One part of the President's Water Quality Initiative consists of a research program to develop new farming systems which protect ground water quality. Five research sites, or Management Systems Evaluation Areas, have been established to help develop new farming systems and technologies to prevent ground water contamination from nitrogen and pesticides. A variety of alternative farming practices (changes in rotation, nutrient management, reduced pesticide application rates) are being studied. The evaluation areas are located in Ohio, Nebraska, Minnesota, Missouri, and Iowa.

USDA Research Develops New Farming Systems To Protect Water Quality

On-going USDA research programs have been augmented under the Initiative to increase research and development of practices and technologies to prevent pollution of surface and ground water. The Agricultural Research Service and the Cooperative State Research Service are undertaking a

Figure 14
Applied Conservation Tillage Practices, 1990



Source: Conservation Technology Information Center data wide-ranging program to increase understanding of and develop new ways to reduce farming effects on water quality. Research topics include sources and prevention of water contamination; remediation and cleanup of contaminated soils and water; soil and water management and farming systems development; and socioeconomic implications (including costs to farmers, degrees of acceptance and adoption, and costs to consumers of new management systems).

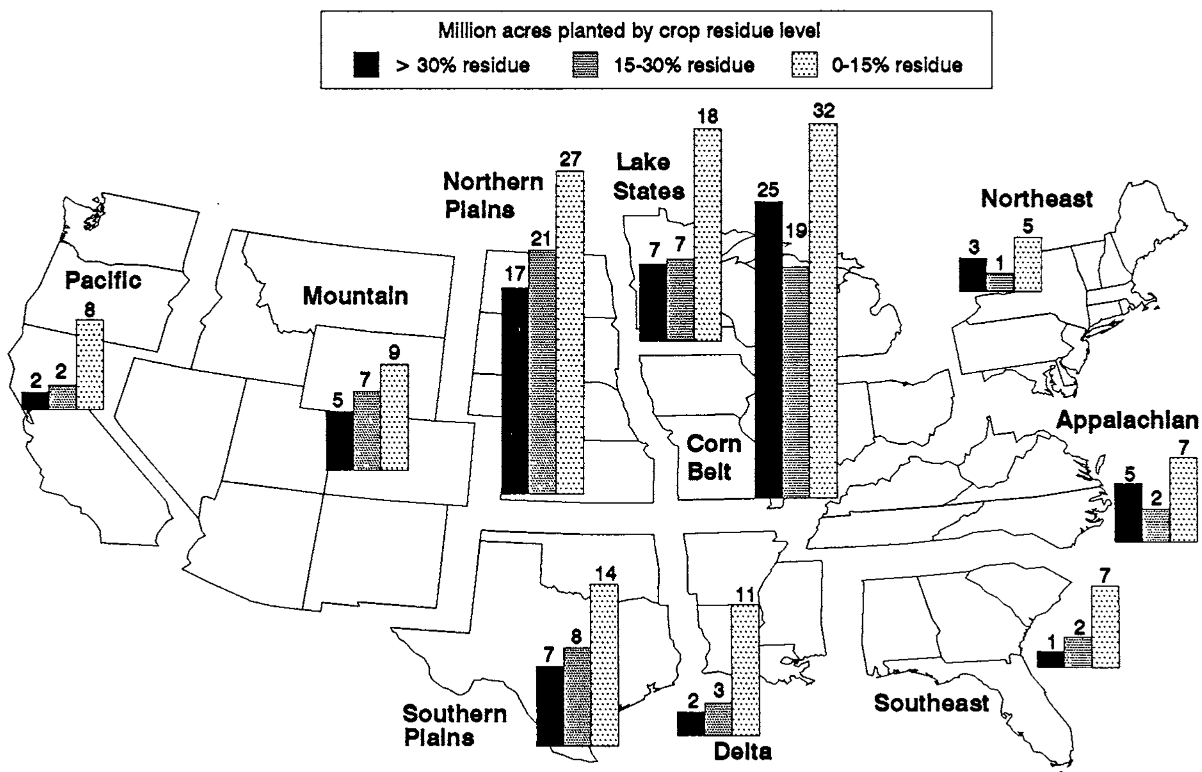
Five-Year Projects Promote Practice Adoption

USDA has designated 16 demonstration projects and 74 hydrologic unit area projects to promote adoption of improved water quality production practices (figure 16). These projects emphasize using demonstrations of improved practices on actual farms as a means of promoting general adoption of farming practices that reduce agriculture contaminants. The hydrologic unit area projects, in turn, are an attempt to accelerate water quality practices by farmers in critical areas through more intensive technical and financial assistance. Practices promoted by these two efforts depend on the types of agriculture and water quality problems, and fall into the following categories.

- **Cropping practices:** rotations that reduce fertilizer or pesticide use or erosion and runoff.
- **Nutrient management practices:** soil, plant tissue, water, and manure nutrient testing; nutrient budgeting and setting realistic yield goals; improved timing and incorporation of fertilizer application; nitrification inhibitors; fertigation; back siphoning protection on irrigation systems; etc.
- **Pesticide management practices:** pest scouting, application rates/timing/method, chemigation, equipment calibration, improved product selection, cultivation systems, alternative cropping, etc.
- **Irrigation management practices:** soil moisture testing, scheduling applications, micro irrigation systems, surge valves, land leveling, drainage water reuse, etc.
- **Tillage management practices:** mulch till, ridge till, no till, and other tillage and planting methods that leave additional amounts of previous crop residue on the soil surface after planting.
- **Other conservation practices:** contouring, strip cropping, filter strips, terraces, etc.
- **Farmstead and wellhead protection practices:** improved chemical handling, storage, and disposal; septic tank improvement; improved well design; etc.

Figure 15

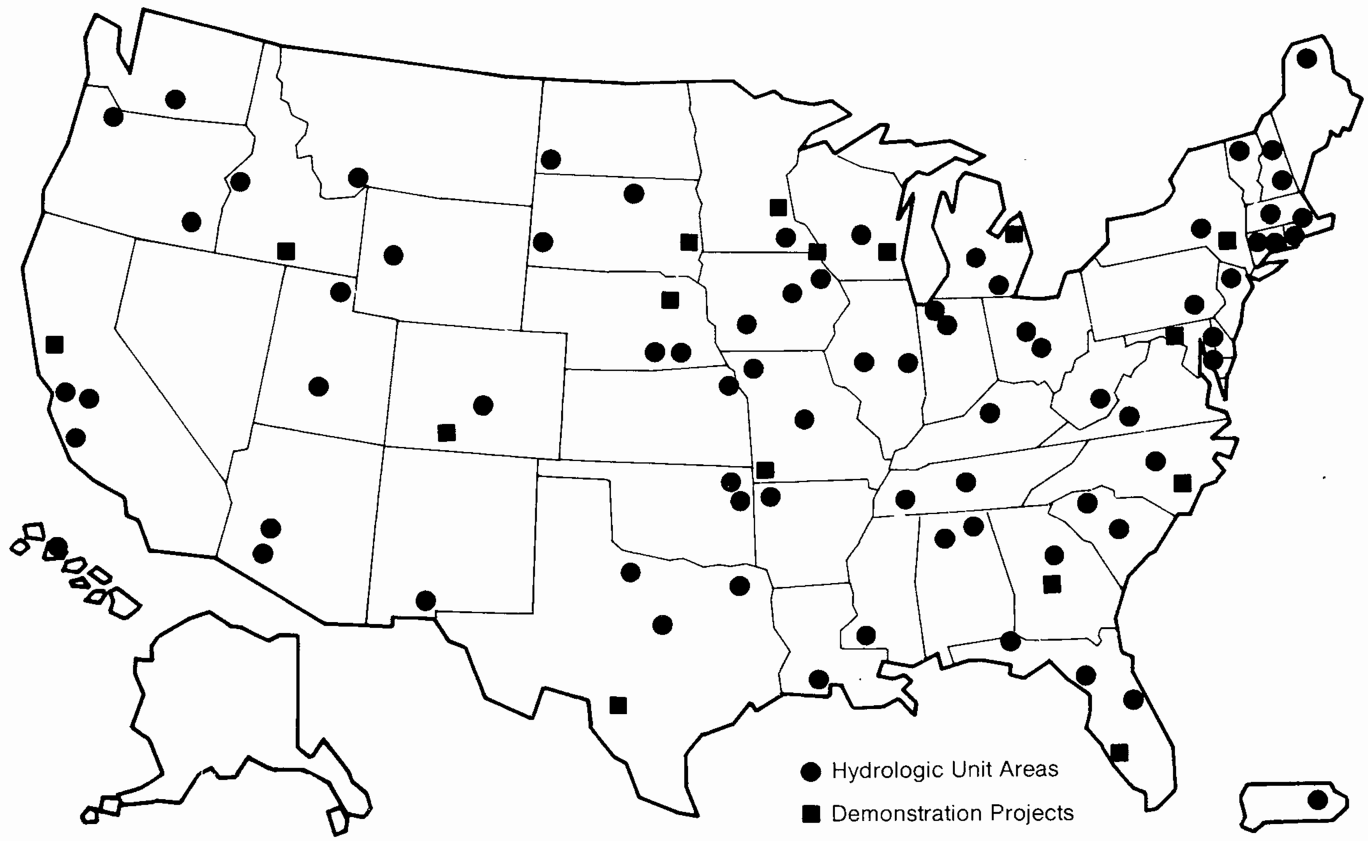
Crop Residue Levels on Planted Acreage, 1990



Source: Conservation Technology Information Center data

Figure 16

Demonstration Projects and Nonpoint Source Hydrologic Unit Areas



- **Waste management practices**: improved manure storage, handling, and application; milk house waste disposal; dead animal disposal; etc.

Federal funding in fiscal 1991 for the Demonstration Projects and Hydrologic Unit Areas totaled $42.3 million, up from $16.9 million in 1990. The duration of each of these projects is about 5 years. About one-third of the 1991 funding is for cost-sharing assistance to farmers and the remainder for education and technical assistance to establish the projects. No new projects have been designated for the coming year, but an additional 8 demonstration projects and 37 hydrologic unit areas are projected for 1993. In addition to these, the Initiative now incorporates 1-year projects also funded by ACP. There were 39 such projects in 1991.

USDA's Area Studies to Provide Detailed Evaluation of Water Quality

USDA's Area Studies program, which is part of the Water Quality Initiative, will research the linkages between farm production, natural resource conditions, and water quality. Selected geographic areas will be surveyed to determine farm production practices and economic conditions, along with detailed hydrologic and geophysical information in each area. The areas selected for study will be located where the U.S. Geological Survey is working to measure the quality of surface and ground water resources under its National Water Quality Assessment program. Data gathered under this program will be used to understand how water resources are affected by farm production and chemical use, and how pollution prevention programs and other farm programs affect both farm production and environmental quality. The first four sites selected for detailed evaluation are the Central Nebraska Basin; the White River, Indiana; the Lower Susquehanna Basin, Pennsylvania; and the Mid-Columbia Basin, Washington.

Other Federal Water Quality Programs

Pesticides and Ground Water Strategy

The goal of the EPA's "Pesticides and Ground-Water Strategy" is to prevent adverse effects to human health and the environment and to protect the environmental integrity of the Nation's ground water resources. Because ground water cleanup is costly and difficult to achieve, the EPA's goal is to emphasize the prevention of pollution wherever possible.

Priority for protection will be on ground water resources currently used or reasonably expected to be used for drinking water supplies, or ground water that is hydrologically connected to surface water. A general reference point strategy will be used, where maximum contaminant levels are established and emergency actions may be triggered (for example, canceling a particular pesticide) when ambient concentrations reach or exceed this level.

The design and implementation of pollution control programs will be left to State and local officials. The Federal Government will provide technical expertise, information, and guidance and play a general oversight role in relation to local actions in enacting and monitoring nonpoint-source pollution controls.

Amendments to the Coastal Zone Management Act

Recent amendments to the Coastal Zone Management Act include provisions aimed at controlling nonpoint sources of water pollution. Under Section 6172 of the 1990 Amendments, those States that have a Federal Coastal Zone Management Plan will be required to develop and submit to EPA and the National Oceanic and Atmospheric Administration for approval a "Coastal Nonpoint Source Pollution Control Program." These programs will be to develop and implement management measures to protect and restore coastal waters.

States will be required to identify land uses in coastal areas which can contribute to degradation of water quality, identify the extent of critical areas adjacent to coastal waters that contain those land uses, and implement management measures to achieve and maintain applicable water quality standards and protect designated uses. EPA has released guidance documents with recommended management measures, that are based on application of best available nonpoint pollution control practices or technologies which are economically achievable. These recommended measures represent a departure from previous pollution control laws, in that they are based on technology rather than on water quality measures.

Box E:

Non-USDA Water Quality Programs Affecting Agriculture

- **1987 Water Quality Act Section 319 Programs:**

Section 319 of the Act requires States and Territories to file assessment reports with the EPA identifying navigable waters where water quality standards cannot be attained without reducing nonpoint source pollution. States are also required to file management plans with EPA identifying steps that will be taken to reduce nonpoint source pollution. All states have now filed assessment reports and management plans; final approval of the management plans is underway. The Act authorizes up to $400 million for implementing these plans; $37 million was awarded this year.

- **1987 Water Quality Act National Estuary Program:**

Section 320 of the 1987 Water Quality Act provides for identification of nationally significant estuaries threatened by pollution, preparation of conservation and management plans, and for Federal grants to State, interstate and region water pollution control agencies for purposes of preparing the plans.

- **Pesticide Programs:**

The Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA) provides the legal basis under which pesticides are regulated. The reregistration process of FIFRA (which requires 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.

- **Safe Drinking Water Act:**

The Safe Drinking Water Act (SDWA) requires the EPA to publish drinking water standards (MCL's) for any contaminants which can have adverse health effects in public water systems (serving over 25 persons or with 15 connections). Standards established by EPA under the SDWA are being used as guidelines for assessing contamination of ground water supplies in private wells as well. The EPA also sets non-regulatory health advisories on contaminants for which MCL's have not been established. The SDWA also established a wellhead protection program to protect sole-source aquifers from contamination by pesticides and agricultural chemicals.

- **Coastal Zone Management Act:**

The goal of the Coastal Zone Act Reauthorization Amendments of 1990 is "to restore and protect coastal waters." States with a federally approved coastal zone management program are also required to develop a Coastal Nonpoint Source Pollution Control Program and submit it to the Environmental Protection Agency and National Oceanic and Atmospheric Administration.

Trends in Resource Protection Policies in Agriculture

by
William M. Crosswhite and Carmen L. Sandretto [1/]

Abstract: Conservation is a key policy instrument in resource protection and environmental quality programs to control erosion and runoff from agricultural lands. It has contributed to maintaining soil productivity, reducing commodity surpluses through cropland acreage diversion, and controlling nonpoint source pollution. Resource protection in the 1990's will continue to rely on conservation as a major component of technical solutions to environmental quality problems and State management plans for controlling nonpoint source pollution.

Keywords: Conservation, resource protection policy, acreage reduction programs, commodity surpluses, soil erosion, nonpoint source pollution, and water quality.

The role of conservation and water quality policies is being changed to better address the wider public interest in natural resources and environmental quality. This continues a 60-year trend of increasingly comprehensive soil and water conservation policies (figure A-1). In this article we cite key trends in resource protection and discuss the context for future policy formulation.

Since the 1930's, conservation and environmental policies have given successively less attention to improving productivity and maintaining farm income and more attention to off-farm impacts on the environment. Federal involvement in conservation began in the 1930's by establishing long-term policies to enhance cropland productivity by controlling wind and water erosion. The mechanisms employed to encourage resource protection included cost sharing and technical assistance to adopt conservation practices. In the 1950's and 1960's, conservation-oriented programs for regional concerns, flood protection, and rural development were added. During periods of surplus production, conservation and cropland diversion programs were used to idle program crop acreage and to help support farm income.

Public policy during the past two decades has increasingly stressed farming methods that mitigate the off-farm effects of pollutants generated within agriculture. The evolution from individual conservation practices to Best Management Practices (BMPs) and recently to integrated management systems has reflected experience with and research on conservation techniques adaptable to modern farming operations. The Farm Acts of 1985 and 1990 targeted highly erodible and/or environmentally sensitive cropland and wetland preservation in the land retirement provision of the Conservation Title. The conservation compliance provisions require farmers to meet minimum levels of conservation and resource protection on program crop acres in order to continue to receive benefits from participation in commodity programs. While participation remains voluntary, farmers tend to view the mandatory aspects of these provisions as regulatory. New program options are being developed and demonstrated to encourage producers to adopt the new resource protection measures. These methods are more likely to be adopted if farmers find them economically advantageous.

Establishing a National Conservation Policy

During the 1920's, U.S. agriculture was characterized by surplus production, depressed farm income, and widespread severe soil erosion. Congress authorized a study in 1930 to examine the causes of erosion and recommend methods to control it. National soil conservation programs were developed to control and reduce adverse effects on soil productivity. The soil conservation program as we know it today began in 1935 when the Soil Conservation Act established the Soil Conservation Service (SCS) in the U.S. Department of Agriculture and replaced the Soil Erosion Service, established in the U.S. Department of Interior in 1933.

A comprehensive Federal and State administrative structure evolved to provide research, education, and financial and technical assistance to support conservation and farm programs initiated in the 1930's. To target problems in selected geographic areas, the Great Plains Conservation Program, Small Watershed Program, and Resource Conservation and Development Program were added. Eight agencies in the Department of Agriculture now carry out the various conservation and farm programs (Box D).

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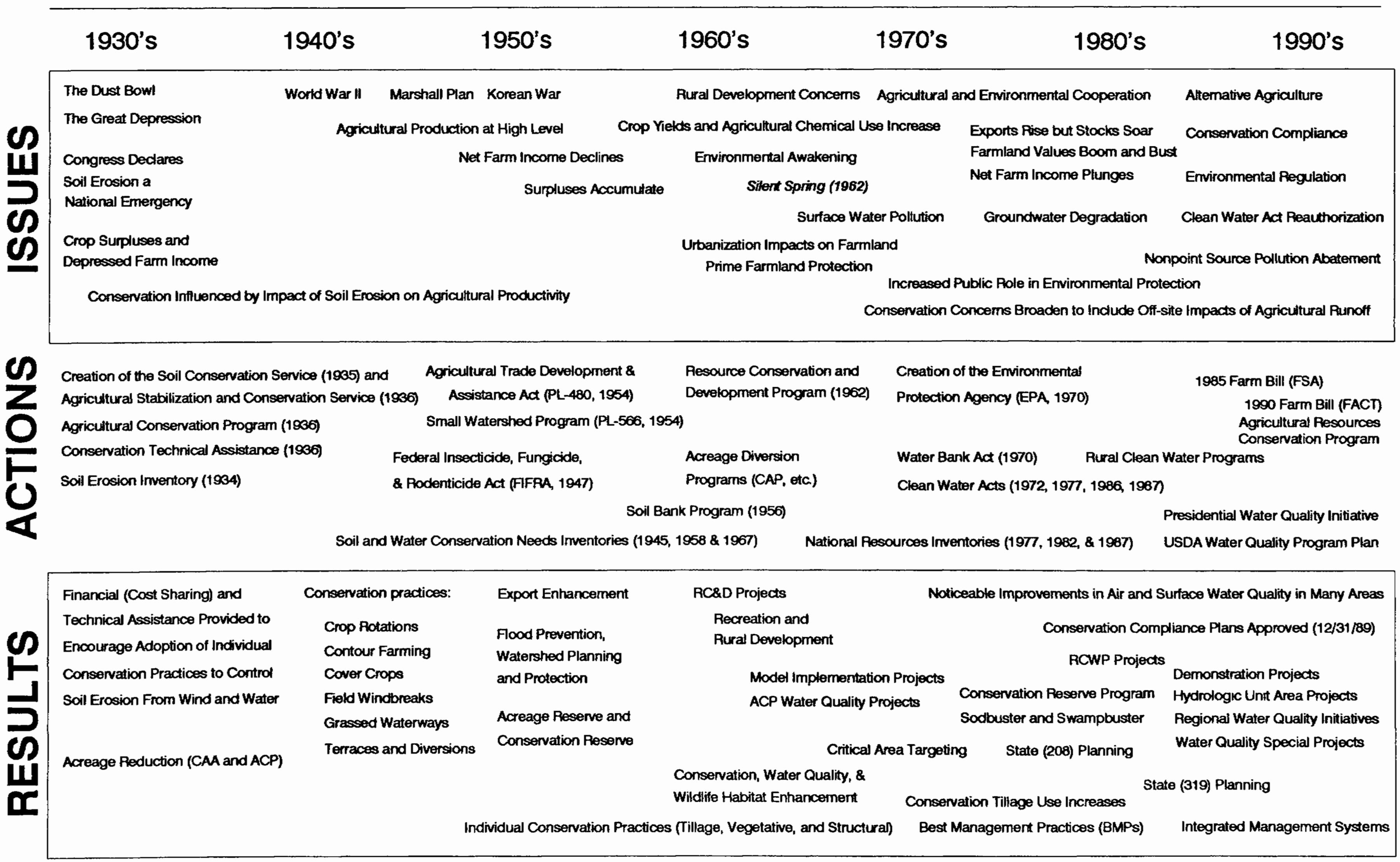
Figure A-1

The Evolution of Conservation, Resource Protection, and Water Quality Efforts



Conservation's Role in Controlling Surplus Production

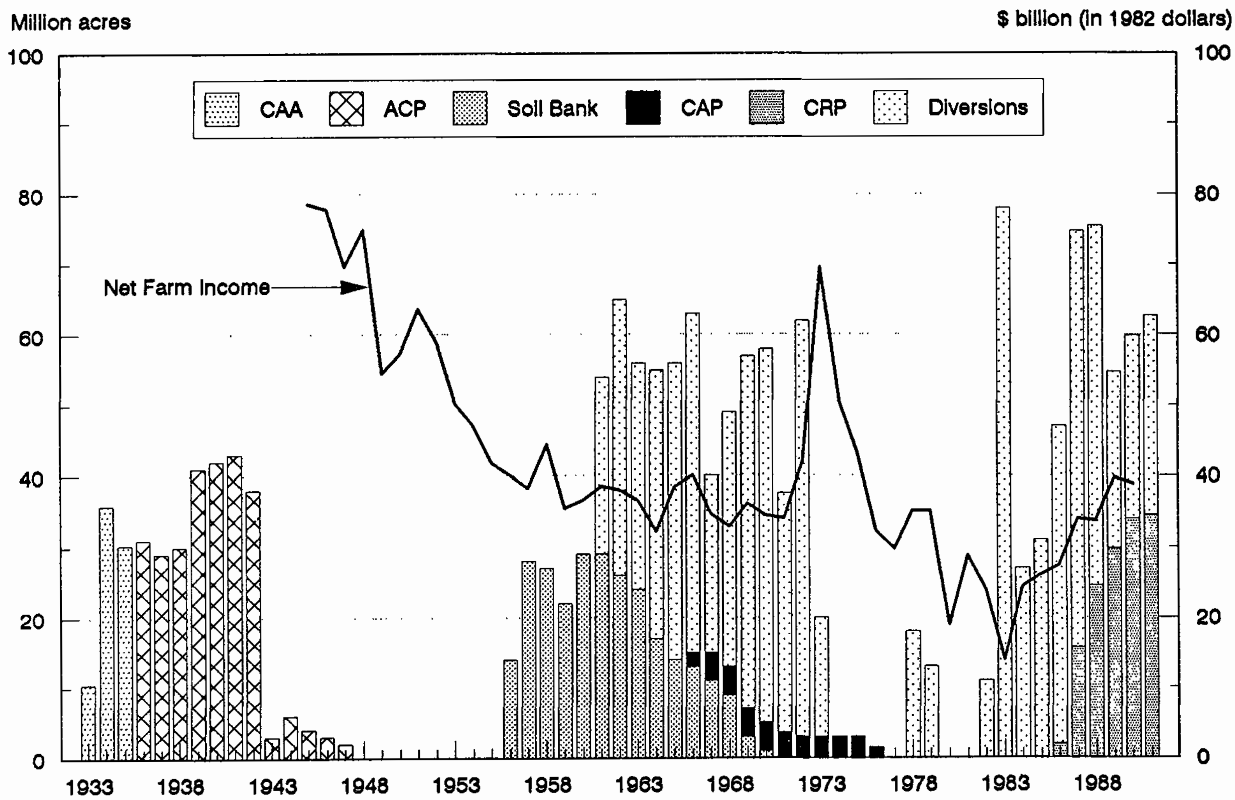
Conservation policies have been integrally linked with farm policies to control surplus production. Conservation and acreage reduction programs have been implemented during three major periods: 1933-41, 1956-73, and 1983-present to control over-production and excess commodity stocks (figure A-2). Production controls were first established in the Agricultural Adjustment Act of 1933, which was invalidated by the Supreme Court in 1936. Production controls were restored in the Soil Conservation and Domestic Allotment Act of 1936, which also established the Agricultural Conservation Program (ACP). The ACP placed an average of 36 million acres of cropland in permanent cover between 1936 and 1942 to reduce production of surplus crops, and provided farmers cost sharing and technical assistance to carry out soil conservation measures that reduced both wind and water erosion from cropland.

Following World War II, excessive supplies of program crops reduced net farm income. Conservation and acreage reduction programs were employed to boost farmers' incomes. The Agricultural Act of 1956 established the two-part Soil Bank. The first part, the Acreage Reserve Program, paid farmers to reduce acreage of land planted to surplus commodities. This was a notable shift from total reliance on commodity loans and nontargeted land diversion. The second part, the Conservation Reserve Program, provided for 3- to 10-year contracts for retirement of any land designated by the farmer without regard to specific resource conditions. Long-term land retirement was to provide conservation and resource protection for soils, water, forests, and wildlife and in some cases included whole farms. The Acreage Reserve Program ended in 1958 and enrollment in the Conservation Reserve ceased in 1961, but program crop acreage placed in the long-term conservation reserve remained idle into the 1970's.

Although the number of harvested acres of crops declined because of lower support levels, lower market prices, and acreage reductions through the Soil Bank; commodity stocks, and thus public program costs, continued to grow throughout the 1950's (figure A-3). To help combat these problems, the Agricultural Act of 1961 established acreage diversion programs for corn and sorghum. The diverted acreage had to be land that was normally planted to corn or sorghum. The buildup of Commodity Credit Corporation (CCC) corn stocks, for example, was halted when 19 million acres (22 percent of the corn base) were diverted from production in

Figure A-2

Cropland Acreage Reductions by Type of Program 1933-1991 and Net Farm Income 1945-1990



1961. Acreage diversions continued through the 1960's and into the 1970's to offset excess production arising from support prices that were set above market clearing levels. These cropland acreage reductions, in combination with farm income support efforts, stabilized farm income from 1958 until the early 1970's.

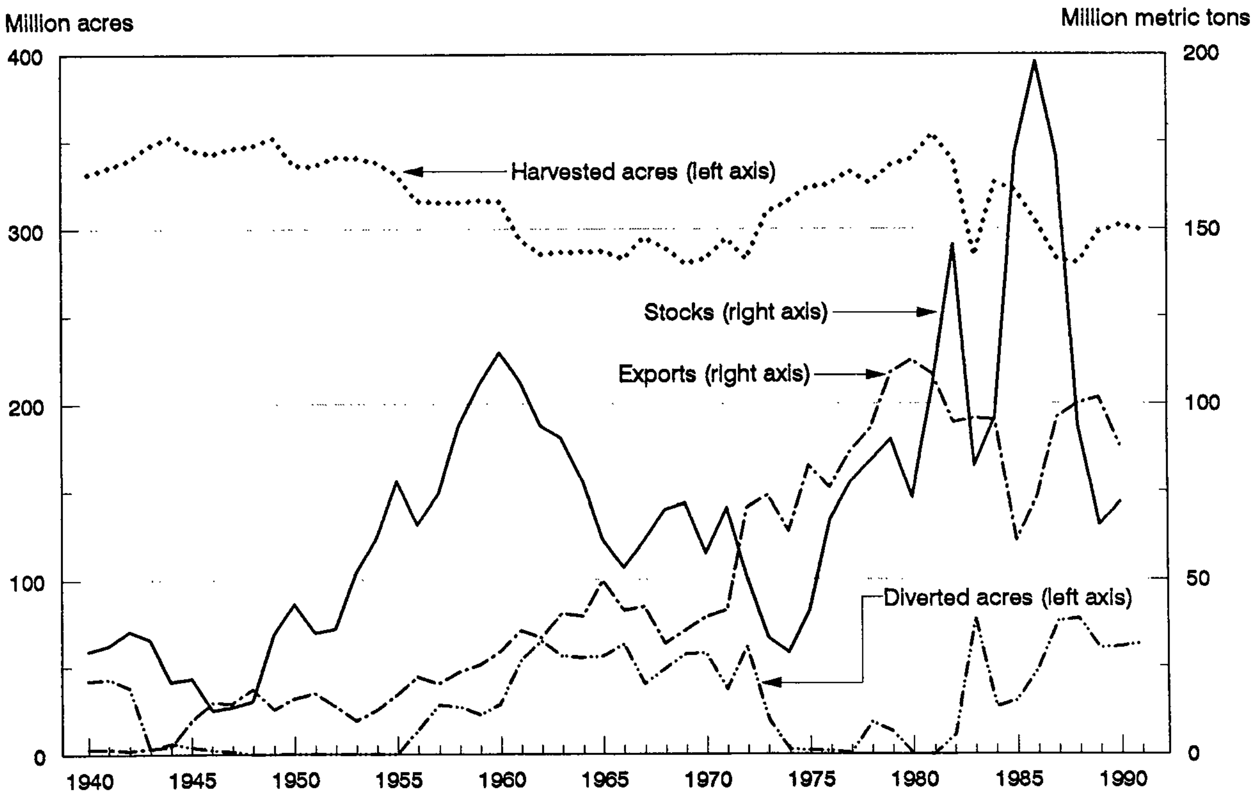
The 1960's ended with carryover stocks well below levels at the start of the decade. Surplus production and commodity stocks began rising in 1975 as crop acreage was increased in response to higher prices driven by rising exports that began in the early 1970's. Even though exports continued to expand rapidly, surpluses grew substantially from 1975 into the 1980's with increases in cropland harvested. Acreage diversions were introduced again in 1982 to deal with a precipitous decline in net farm income.

A combination of large acreage reductions by the Payment-in-Kind Program and a serious nationwide drought in 1983 temporarily reduced production and surpluses. However, following a rapid buildup of stocks, the 1985 Farm Bill established the Conservation Reserve Program (CRP) to deal with both continuing commodity surpluses and resource protection issues. But unlike the Conservation Reserve of the Soil Bank which permitted enrollment of any land the farmer designated, the new Conservation Reserve Program was targeted to highly erodible and/or environmentally sensitive cropland. This marked a further step in the evolution of acreage reduction programs beyond the diversion of commodity base acres or land normally planted to surplus commodity crops. In 1986, annual acreage diversions were supplemented by acreage reductions provided by the Conservation Reserve Program (CRP).

Rising crop yields, as measured by crop production-per-acre increases, have been an underlying cause of the persistent problem of surplus stocks since 1950 (figure A-4). The impact of production technology on crop yields was observed early in the 1950's but was attributed to improved weather and labor resources. From the 1950's to the early 1970's, improved crop varieties and increased use of fertilizers and pesticides helped boost yields. For example, corn yields trended upward from an average annual increase of 0.53 bushels per acre in the early 1950's to 2.81 bushels per acre during the period 1954-72, but the rate of increase dropped to 1.64 bushels per acre in the period 1975-90. Ironically enough, successful conservation measures also seem to have a generalized long-term effect on maintaining or raising crop yields.

Figure A-3

U.S. Feed Grain and Wheat Stocks and Exports, Cropland Acres Diverted and Harvested, 1940-1990



Agriculture Contributes to Nonpoint Source Pollution

Over the last two decades there has been an increased public awareness of and concern for how agricultural chemicals and animal wastes contribute to water pollution. Nonpoint source pollution from agriculture could possibly arise from high levels of fertilizer and pesticide residue, irrigation activities that discharge sediment, salts, and nutrients in return flows, and confinement feeding operations that concentrate livestock wastes. Erosion from cropland is a significant source and carrier of nonpoint source pollutants. Infiltration and percolation of agricultural chemicals through the soil are potential contributors to surface and groundwater degradation. Agriculture generates most of the pesticides, plant nutrients, biological oxygen demand, and total suspended solids from nonpoint sources of pollution (table A1).

Nonpoint source pollutants, in combination with the toxic substances from point sources such as discharges from industrial facilities and sewage treatment plants, contributed to visible degradation of the nation's air and water resources in the 1950's and 1960's. With increasing frequency, pollution was seen to have adverse effects on various avian, aquatic, and terrestrial species. Environmental damage from industry and agriculture were highlighted in 1962 by Rachel Carson in her book, *Silent Spring*.

In the 1970's, water and wind erosion accelerated when perennial vegetative cover was disturbed or destroyed to ex-

Table A1--Estimated nonpoint and point source pollution loadings of major pollutants

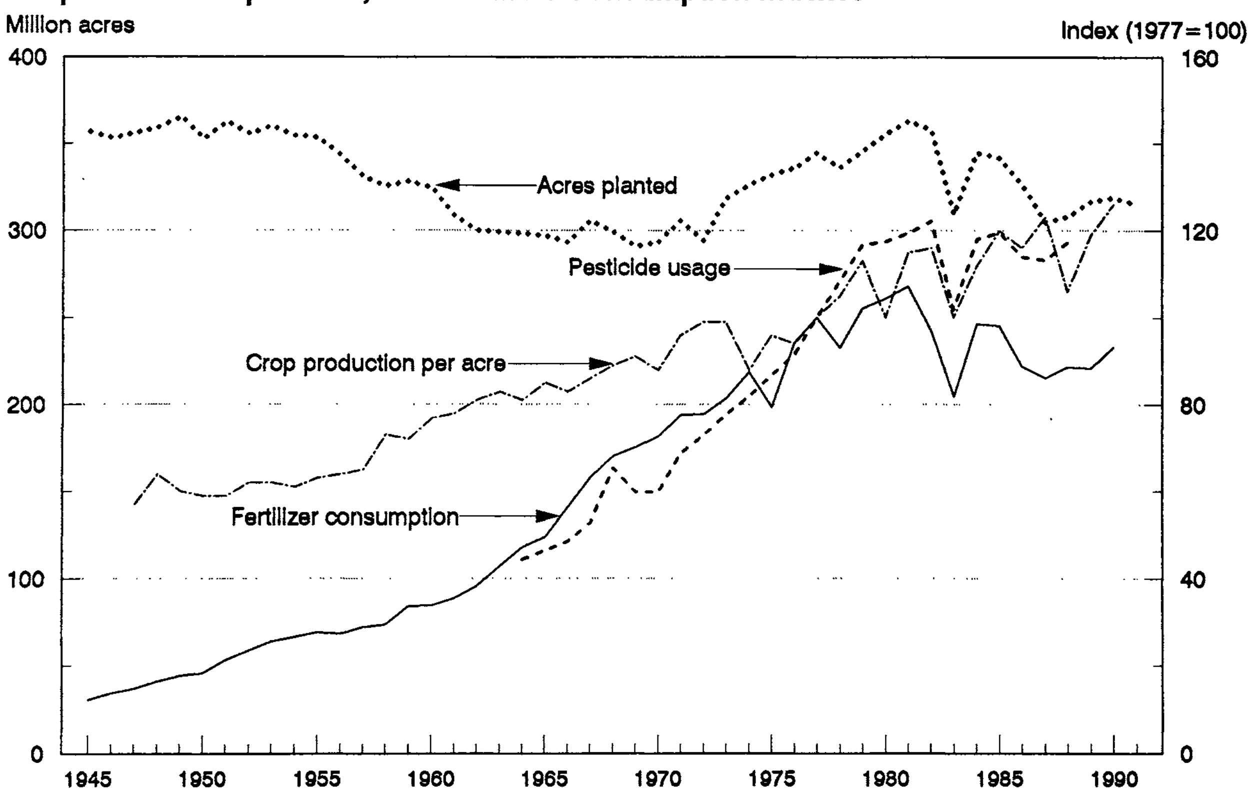
	Pesticides	Total Phosphorus	BOD 1/	Total Suspended Solids
	tons/yr	1,000 tons/yr	million -- tons/year --	
Nonpoint sources				
Agricultural	2,064	1,431	27.3	1,787
Other nonpoint	115	182	3.1	928
Subtotal	2,179	1,613	30.4	2,715
Point sources	n/a	330	3.1	4
Total, all sources	2,179	1,943	33.5	2,719
	--- Percent share of all sources ---			
Nonpoint sources				
Agricultural	95	74	81	66
Other nonpoint	5	9	9	34
Subtotal	100	83	90	100
Point sources	n/a	17	9	-
Total, all sources	100	100	100	100

Source: (3)

1/ Biological oxygen demand

Figure A-4

Cropland Acres Planted and Agricultural Pesticide Usage, Crop Production per Acre, and Fertilizer Consumption Indexes



pand crop production, especially in the Corn Belt. Unless accompanied by explicit conservation measures, modern crop and livestock production methods tend to increase air and water pollution and soil productivity losses. Fertilizer and pesticide use rose sharply throughout most of the 1960's and 1970's. Application rates per acre increased at the same time as crop acres increased in the 1970's. Since the late 1970's, fertilizer use has fluctuated in response to price changes and number of crop acres. Pesticide use continued to climb until the early 1980's, but has since stabilized (figure A-4).

New Directions in Conservation and Water Quality Legislation

Federal laws and administrative procedures affecting agriculture have embraced soil and water conservation and agricultural nonpoint source pollution control measures. The Federal Water Pollution Control Act Amendments of 1972, also known as PL 92-500, was among the first of the major water quality legislative acts for agriculture. The Secretary of Agriculture was authorized to enter into contracts with rural landowners and operators to install and maintain Best Management Practices (BMPs) to control agricultural nonpoint sources of pollution. Developing and implementing Best Management Practices has integrated soil erosion control measures with nonpoint source pollution abatement. Water quality legislation affecting agriculture has retained the major features of earlier conservation programs, such as voluntary participation by farmers and financial and technical assistance. In addition, it has emphasized education, research, improved interagency cooperation, and State responsibility to develop and implement new agricultural production technology for pollution abatement.

The Food Security Act of 1985 established the Conservation Reserve Program (CRP) with the joint objectives of conservation and income support, plus provisions regulating conversion of grassland and wetlands to cropland (Sodbuster and Swampbuster) and addressing conservation problems on highly erodible land (Conservation Compliance). These new quasi-regulatory features modify, to some extent, the traditional voluntary approach that had characterized earlier conservation programs and increase government involvement in farm operations. The CRP resulted from collaboration between agricultural and environmental groups based on the favorable impact of the 1956 Soil Bank on wildlife habitat and desirable species populations, including pheasants. Beginning in 1988, efforts were made to encourage the enrollment of filter strips and wetlands to enhance water quality.

The Food, Agriculture, Conservation, and Trade Act of 1990 (FACTA) reshaped conservation programs. It included revised program rules for operating CRP during 1991-95, a new Wetland Reserve Program (WRP), pesticide-use recordkeeping requirements, and revised conservation compliance and incentive features. The planting flexibility provision was intended to allow farmers a range of crop choices on a portion of program crop base acreage. Farmers can switch to crop rotations with sustainable characteristics without threatening their income support payments or base acreage eligible for support.

Farm policy shifts are creating linkages between acreage reduction and conservation programs that enhance environmental quality, while supporting farm income. These changes are exemplified in the 7 conservation and environmental goals targeted in the Tenth Conservation Reserve Program (CRP) signup.

The President's Initiative on Enhancing Water Quality began in 1989. It brought together several different programs from Federal and State agencies. The USDA's 5-year Water Quality Plan emphasizes education and technical assistance, research, and database development. Eleven agencies cooperate in the Department's water quality initiative. They work with State and local governments, other Federal agencies, and the private sector. Program activities will develop and demonstrate new ways to reduce the effects of agricultural sources of pollution. The evaluation goal of the initiative is to provide information to assist in the development and implementation of effective water quality programs in agriculture.

Conservation Through Agronomic and Technical Treatment of Cropland

Early research on ways to protect cropland recognized that soil erosion causes are numerous and their interaction complex (1). It led to the use of terracing, grassed waterways, and contour planting. Other measures included crop rotations, stubble mulch in drier areas, protective cover or nurse crops, and conversion to permanent pasture of land not suited to crops. The idea that erosion can be controlled by changing the ways we cultivate and use land has been assimilated to help control agricultural nonpoint source pollution.

Since the development of BMPs in the 1970's, considerable progress has been made through an approach that embodies social and technical criteria that include agronomic and environmental effectiveness, economic achievability, social acceptability, and technical feasibility. This BMP approach incorporates conservation and management features into production systems to reduce erosion and chemical use and provides a conceptual basis for "alternative agriculture," also known as "sustainable," "regenerative," "organic," or "low-input" agriculture. Planting flexibility and related provisions of the 1990 farm bill encourage farmers to consider these alternatives.

State Responsibility for Nonpoint Source Pollution Control

Water quality planning by States was retained in the Water Quality Act of 1987 (PL 100-4). Section 319 of the Act directs States to identify navigable waters where pollution control is required to attain water quality standards and to develop and implement management plans for nonpoint source pollution control in those watersheds. Management plans will include a list of BMPs for controlling pollution and a plan implementation timetable.

The Outlook for Resource Protection in the 1990's

The Food, Agriculture, Conservation, and Trade Act of 1990, the Department's Water Quality Initiative (WQI), and the Water Quality Act of 1987 set the direction for conservation and water quality policies and programs in agriculture through 1995. They provide a joint Federal-State framework for finding and implementing technical solutions to agricultural point and nonpoint sources of pollution. States will identify critical areas of nonpoint source pollution and plan and guide the implementation of specific programs. The Department of Agriculture and the agricultural research and education community, including the Land Grant Colleges and Universities, will develop and structure technical research and education programs and financial and technical assistance.

Regulatory responsibility for achieving water quality objectives has been assigned to other agencies, primarily the Environmental Protection Agency (EPA). All 50 states now have a water quality plan of action; and various agencies at the Federal, State, and local levels have structured nonpoint source pollution management programs that contribute to the national program.

The technical approach to solving nonpoint source pollution in agriculture raises concerns about the likely cost to producers, effects on our competitive position in the world market, and the adequacy of future food supplies. Efforts over the next 5 years will concentrate on research to develop new technology and on demonstration programs using education, financial, and technical assistance to devise approaches for improving the rate of farmer adoption of conservation practices. Information from an array of 5-year projects (1991-1995) carried out on farms and in agricultural watersheds will demonstrate new ways to minimize nonpoint source pollution. The economic and pollution abatement impact of farming practices and systems will then be assessed. The production systems that evolve will consist of complementary blends of new technological measures and traditional practices and systems.

There is renewed interest in research on how farmers evaluate and decide to adopt new practices and production methods. Important factors include commodity prices, energy and other input costs, farm program benefits, transition costs and investment requirements, new information and management requirements, and availability of educational programs and financial and technical assistance. Farmers will invest voluntarily in new technology that is demonstrated to be cost effective in meeting production and environmental goals under actual farming conditions.

The need to measure progress and performance of resource protection was recognized very early. Expanded water quality monitoring could establish more clearly the linkages between production practices and erosion and runoff on pollutant loadings. Parallel expanded economic evaluations, combining economic and technical results, are needed to determine the farm-level economic effects of changing practices and production systems.

Can the nation sustain growth in food production and preserve the quality of our environment? The answer depends to a large extent on the success of new technology for pollution abatement within production agriculture that now features capital-intensive monoculture, continuous cropping, and reliance on manufactured inputs such as fertilizer and pesticides. A growing awareness of the social and environmental problems associated with production technology can lead to developing a policy in which government actions and funding will play a more decisive role in the nature and direction of technological change.

Conventional thinking tends to treat resource conservation and water quality protection as constraints on production and profits. While agricultural and environmental groups tend to disagree on the likely risks and benefits of alternative agriculture, farmers have demonstrated that they will adopt new practices and production systems where there are greater profits or when government provides financial and technical assistance. The primary challenge is to reconcile potential short-term gains from exploitation of natural resources with the long-term benefits from their prudent and sustainable use. Water quality initiatives, government assistance programs, and growing awareness by farmers of the need for environmental improvement are important factors influencing the development and adoption of new production systems.

Targeting, planting flexibility, conservation compliance, land retirement, Sodbuster, and Swampbuster promote more consistency between commodity, conservation, and environmental policies. They also reflect more control over farm programs to achieve net reductions in agrichemical use and erosion. If the voluntary-technical approach does not achieve desired levels of pollution abatement and enhanced water and environmental quality, the trend toward more regulation will likely continue.

Progress over the next five years is likely to come from increased government support for research, education, and assistance to farmers; consumer acceptance of higher prices for food that is perceived to be safer; and farmers' continued willingness to adopt production systems more compatible with water quality and food safety concerns. Public support for conservation and water quality programs in agriculture is likely to continue, if acceptable public benefits are achieved and their nature and extent are made known to both the public and farmers.

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Summary of State Water Quality Laws Affecting Agriculture

by
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Abstract: Much of the responsibility for protecting surface and ground water quality from nonpoint sources of pollution, including agriculture, has been given to the States. A variety of approaches are currently being used, including input controls, land use controls, and economic incentives. The protection approaches taken by States could cause regional shifts in agricultural production. State regulations also increase the demand for information and financial assistance from USDA.

Keywords: Nonpoint source pollution, sediment, agricultural chemicals, surface water, ground water, best management practices.

Sediment, chemicals, and other materials originating on fields, forests, streets, and other nonpoint sources are the cause of many of the remaining water quality problems in the United States. Water pollution laws have greatly reduced discharges from factories, sewage treatment plants, and other "point" sources of water pollution. There has been much less success in reducing pollution from nonpoint sources, reflecting the level of attention given to this problem. Nonpoint source pollution is defined as effluent entering a water body over a broad area, unlike point source pollution which enters waterways via a discrete entry point.

Current Federal surface and ground water quality laws give States the leading role to develop management strategies for controlling nonpoint pollution. Since agriculture is a major source of nonpoint source pollutants, the actions taken by States have an important bearing on agriculture. Differences in regulatory frameworks between States could cause regional shifts in crop production that would not otherwise occur. In addition, regulations could increase the demand for USDA education, technical assistance, and cost-share programs for practices to improve or protect water quality. The President's Water Quality Initiative and other USDA research efforts could position USDA as a major supplier of assistance to State nonpoint source water quality efforts.

Description of Federal Water Quality Legislation

Surface Water

Regulation of surface water quality is authorized in the 1972 amendments to the Federal Water Pollution Control Act (PL 92-500). These amendments clarify the Act's objective to restore and maintain the chemical, physical, and biological integrity of the Nation's waters, and declare a national water quality goal of "fishable/swimmable" (*8*). While the emphasis is on control of pollution from point sources, one provision (Section 208) requires States to develop and implement plans to control "areawide" pollution problems not covered by the Act's point source discharge permitting system. The law directed States to identify nonpoint source problems, to specify procedures and methods to control nonpoint sources (Best Management Practices or BMPs), and to implement controls (*8*).

BMPs include land use controls and land management practices that help attain water quality standards. EPA allowed States to enact programs based on voluntary compliance. The 1977 Clean Water Act (PL 95-217) further outlined the role of nonpoint source reduction in meeting national water quality goals, and gave USDA a role in providing technical and financial assistance for BMPs.

The 1972 and 1977 Acts resulted in significant reductions in point source discharges. However, reductions in nonpoint source discharges were disappointing, largely because little information was available on the extent of or control strategies for nonpoint source pollution. Furthermore, EPA could not readily judge whether State plans were adequate for achieving water quality goals. Finally, EPA was not given effective enforcement tools to ensure that nonpoint source management plans were actually implemented (*8*).

Congress took a more direct approach with the Water Quality Act of 1987 (PL 100-4). This law places special emphasis on nonpoint source pollution by amending the Clean Water Act's "Declaration of Goals and Policy" to specifically call for the control of nonpoint sources of pollution. Section 319 of the Act requires each State to 1) identify navigable waters that cannot reasonably attain or maintain water quality standards or goals without controlling nonpoint sources, 2) identify nonpoint sources which add significant amounts of pollution to those waters, and 3) develop a nonpoint source management program on a watershed-by-watershed basis to control and reduce specific nonpoint sources of pollution. The Act also authorized Federal loan and grant

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funds to help States develop and implement nonpoint source control programs.

The approach taken to control nonpoint source pollution in the Clean Water Act differs fundamentally from the approach to control point source pollution. For point sources, a strong Federal authority is emphasized. The Federal Water Pollution Control Act established a nationally coordinated permit program for all point sources, including municipal treatment plants, factories, mines, and larger feedlots. The permits require compliance with EPA discharge limitations for specific classes of dischargers, and are based on the effectiveness of the best available wastewater treatment technologies.

Responsibility for nonpoint source pollution control, in contrast, has been left primarily with the States. The Federal government's role has been restricted to reviewing plans, providing scientific expertise, planning assistance, and funding (*5*). There are 2 major reasons for the limited Federal role. First, most nonpoint problems are a direct result of past and present land use decisions, so solutions frequently lie in finding different ways to manage land (*5, 3*). The Constitution limits Federal involvement in local land use decisions, leaving such decisions to State and local governments. In addition, management of nonpoint source pollution is based on a water quality standards approach. Management practices are to be developed at the local level to ensure the quality necessary for local water uses. The large number of variables makes solutions site-specific, justifying a local role in solving problems.

Ground Water

The regulatory provisions of the Clean Water Act do not apply to ground water, and at present there is no unified Federal policy for protection. The Safe Drinking Water Act (SDWA), Comprehensive Environmental Response, Compensation, and Liability Act, Resource Conservation and Recovery Act, Toxic Substances Control Act, and Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) all address distinct aspects of ground water protection, but none is intended as an umbrella policy for total resource protection.

The laws that have the greatest impact on agriculture are SDWA and FIFRA. The SDWA gives EPA the authority to set standards for drinking water. The part of the law that has the greatest bearing on agriculture is the provision calling for a wellhead protection program. This program, like the nonpoint source control program under CWA, calls for the creation of State programs, rather than addressing the problem at the Federal level. Upon approval of a State program, Federal funding is authorized to cover a majority of State costs for developing and implementing the program.

FIFRA provides direct controls over the sale and use of pesticides. Under FIFRA, all pesticides must be approved by EPA through a mandatory registration process. Registration of products determined to pose an unacceptable risk to human health or the environment can be denied, thereby preventing their distribution and use. FIFRA also calls for pesticides to be classified on the basis of use. Pesticides classified for restricted use can be sold only to certified applicators and can involve additional use restrictions.

States cannot allow labeling and packaging requirements that are less restrictive than the Federal requirements. However, subject to EPA approval, a State can register additional uses of federally registered pesticides to meet special local needs. The States also have substantial power to adopt controls more stringent than Federal controls.

State Approaches for Nonpoint Source Management

State water quality laws take a variety of forms, but regulations that affect farm management decisions can be divided into 3 general categories. Input control regulations can require BMPs, ban certain management practices, or restrict chemical use. Land use controls can ban crop production from sensitive areas and require vegetative filters. Economic incentives consist of taxes on production inputs, such as fertilizer.

Identifying State regulations was not an easy task. State statutes can be specifically designed to protect a water resource, or the resource can be protected under a broad environmental protection statute. In addition, there may exist "secondary" statutes that contain provisions for protecting a water resource from a particular problem. Because few States have a comprehensive water quality protection law, we possibly missed some statutes and provisions. Another complicating factor is that a State might have a clearly stated authority for controlling pollutant discharge, yet have no regulations or guidelines in place for such control.

Input Controls

Input controls are defined as any regulations that affect the way pesticides, nutrients, or soil can be managed or used. A different set of regulations has evolved for each input.

Pesticides

Registration of pesticides is controlled at the Federal level through FIFRA. However, States can build upon FIFRA by applying more stringent requirements, and even banning a pesticide that is registered by EPA. California and Arizona have two of the most stringent programs. Both States require strict regulation of those pesticides with the potential to enter an aquifer (*7*). In California, if a pesticide is determined to be potential threat to aquifers, it is placed on a ground water protection list. When a listed substance is found in ground water, the substance is subject to regulation and can have its State use registration canceled.

Pesticide registration fees paid by manufacturers have been increased in some States. In Iowa the fee is based on gross sales, and can range between $250 and $3,000 for each product and formulation. The initial reaction from manufacturers after the law was passed was to reduce the number of products registered (*1*). However, the increased fees did not reduce the number of pesticides actually available to farmers. With low registration fees (less than $100) manufacturers commonly register all their products, even those for which there is no local use. The increased fee in Iowa caused manufacturers to register only those pesticides which are applicable to problems likely to arise in Iowa. Registration fees are also relatively high in California, Minnesota, North Carolina, and Wisconsin (*2*).

States can place application restrictions on pesticides that go beyond the use restrictions required by EPA. For example, Aldicarb can only be applied on Wisconsin potatoes 4 to 6 weeks after planting, no more than once every 2 years on the same fields, and at a rate of no more than 2 lbs. active ingredient per acre (down from 3 lbs.) (*4*). Florida, New York, Maryland, New Jersey, Rhode Island, and Virginia similarly restrict use to every other year and at lower application rates.

Chemigation, the application of agricultural chemicals through irrigation systems, is controlled in 6 States. A potential danger with chemigation is that chemicals can enter the aquifer directly unless the system has a device to prevent backflow. Technology that prevents backflow is required in Colorado, Kansas, Minnesota, Nebraska, North Dakota, and South Carolina. Such technology increases the fixed cost of irrigation systems and maintenance costs.

Fertilizers

Fertilizers are not regulated at the Federal level. All fertilizer or nutrient controls originate at the State level. Seventeen States require some form of nutrient BMPs. Three strategies for controlling fertilizer use to protect water quality are restricting general use, creating special protection areas, and targeting landowner complaints.

Arizona and Florida have general restrictions on nutrient runoff. Arizona and Florida use permitting systems to get farmers to adopt nutrient (primarily nitrogen) BMPs. Arizona grants to farmers a general permit for nitrogen fertilizer application requiring the use of recommended nitrogen BMPs. If a farmer is found not using BMPs, then the general permit is revoked and an individual permit is required. The individual permit is more difficult to obtain, and involves much greater scrutiny. Severe monetary penalties can result if a farmer is found to be in violation of the individual permit.

Florida uses a permitting system to protect water resources from runoff from "new" agricultural land (after 1982). Florida has regulatory authority for all drainage and stormwater systems (including agricultural) at the point of discharge to State waters, thereby providing a means to assure compliance with State water quality standards. Under the Stormwater Rule, all "new" stormwater discharges are to use appropriate BMPs to treat the runoff prior to discharge into State waters. The rule establishes design and performance standards for various BMPs such that 80-95 percent of total annual pollutant load is removed. This permit must be obtained for new agricultural lands unless the land is covered by a conservation plan (developed by SCS or private engineer) approved by the local Soil and Water Conservation District. An established agricultural operation that changes its drainage system must also develop a plan or obtain a permit. In areas around particularly valuable and threatened waters, local Water Management Districts can require that older operations develop plans or obtain Storm Water permits.

Florida, Nebraska, Minnesota, Idaho, and Connecticut can require nutrient management in specific geographic areas designated by the State. In Nebraska, Natural Resource Districts (NRD) can establish Special Protection Areas (SPA) for the protection of ground water. Plans are developed by the NRDs for farmers within the SPAs to control, stabilize, reduce, or prevent the increase or spread of ground water contamination (*2*). As an example, the Central Platte NRD calls for a ban on all fall and winter nitrogen applications when the average nitrate concentration in monitoring wells is 20.1 mg/l or greater. Farmers who fail to comply could be fined or jailed.

Nitrogen BMPs are required in Connecticut in areas overlaying stratified drift aquifers to protect drinking water supplies. Florida, Idaho, and Minnesota can require fertilizer BMPs in the watersheds of waters deemed valuable because of their unspoiled nature. Michigan requires BMPs for phosphorus reduction in the Saginaw Bay and Lake Erie watersheds as part of a strategy for protecting the Great Lakes. Cost sharing and technical assistance are offered to assist farmers in adopting the necessary BMPs.

Seven States require nutrient BMPs if a water quality standard is violated, or if a complaint is filed by a citizen or agency (Idaho, Maryland, Oklahoma, Pennsylvania, Vermont, Wisconsin, Wyoming). For most of these laws, violators are given every opportunity to correct the situation before a fine or penalty is levied. In Wisconsin, for example, all possible avenues of abatement are explored with a landowner before a fine is levied. In Pennsylvania, however, a fish kill resulting from the discharge of manure, sediment, or other agricultural pollutant will result in an immediate fine from the Department of Fisheries, based on the number of fish killed.

In one case, the owner of a hog operation was fined $10,000 for a fish kill caused by runoff of manure from his farm.

The chemigation laws that cover pesticide applications through irrigation systems in Colorado, Kansas, Minnesota, Nebraska, North Dakota, and South Carolina also cover nutrient applications.

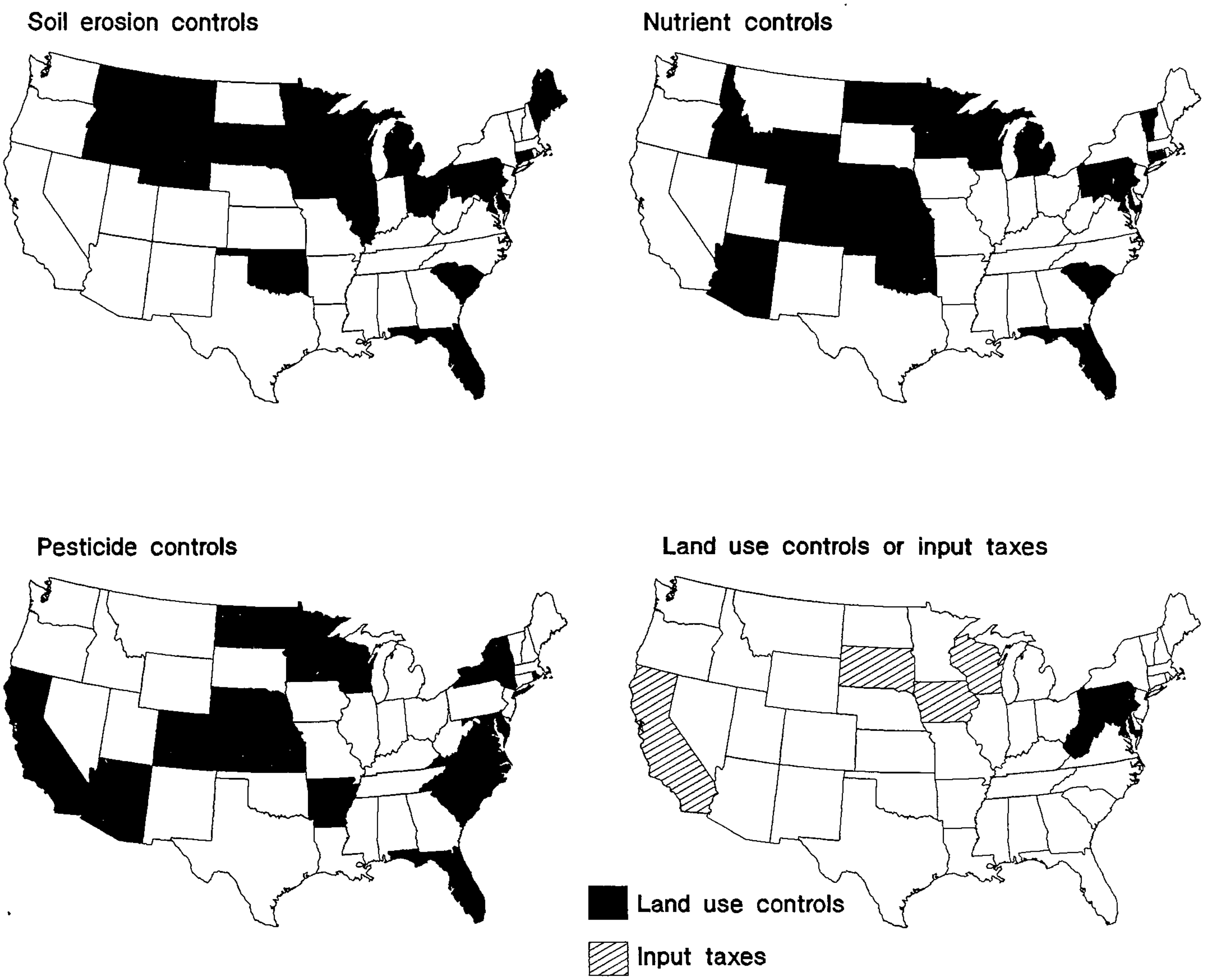
Soil

Nineteen states require some degree of soil erosion control to address water quality problems. Strategies include statewide plans, special area plans, and complaint-based controls.

Eight states require erosion control plans on cropland (Connecticut, Delaware, Maine, Michigan, Minnesota, Montana, Ohio, South Carolina). Ohio requires that farmers apply and maintain conservation practices that keep predicted soil loss from sheet and rill erosion and wind erosion less than permissible soil loss values ("T"). Maine requires that a license be obtained for discharging sediment or erosion pollutants unless an approved conservation plan exists and is being followed. However, this requirement is voided if Federal or State cost share funds are unavailable for developing and implementing a plan. Requirements for soil conservation BMPs in Delaware and Minnesota are also contingent on the availability of cost-share funds. Three States require BMPs in the watersheds of scenic, high quality waters (Idaho, Minnesota, and Oklahoma). Florida applies the same laws to sediment that are applied to nutrients.

Ten states require use of BMPs on the basis of complaints filed by a citizen or government agency (Idaho, Illinois,

Figure B-1
State Erosion With Water Quality Laws Affecting Agricutlure



Iowa, Maryland, Ohio, Oklahoma, Pennsylvania, South Dakota, Wisconsin, Wyoming). As with nutrient BMPs, most States work with the operator to address the problem, including cost-sharing BMPs, and use penalties only as a last resort.

Land Use Controls

Land use controls including zoning, land acquisition, and easements are targeted to areas deemed critical for protecting water resources. Because of Federal laws such as the Safe Drinking Water Act, most States have moved to restrict land use in the area of drinking water wellheads or over sole source aquifers (*2*). In fact, local zoning is seen as the best hope for ground water protection in most States (*6*). However, agriculture is often excluded from any land use controls for ground water protection, due mainly to resistance in rural areas (*2*).

Pennsylvania and Maryland are using land use controls to protect surface water. In Pennsylvania, agricultural fields must be set back from streams, leaving a vegetative filter. Maryland has very specific land use policies within 1,000 feet of the Chesapeake Bay shoreline and adjacent to all tributaries flowing into the Bay. Cropping practices are restricted within this zone.

Economic Incentives

Two types of economic incentives for encouraging farm operators to adopt new management practices are subsidies (cost-sharing) and taxes. Cost-share programs have been a mainstay of USDA and the States for many years. These programs are voluntary, and can be effective in the short run in getting farmers to adopt management practices that reduce their incomes. However, the cost of such programs could limit their use as long term solutions.

Taxes are a negative incentive that could induce farmers to change management practices. A tax that sufficiently raises the cost of an input would cause an operator to reduce the use of that input (all else remaining the same). Four States were found to have taxes on nitrogen fertilizers. California places a tax on fertilizer retailers. Such a tax indirectly raises the price for farmers. In Iowa, South Dakota, and Wisconsin, the farmer pays the tax. However, in all cases, the tax is intended as a source of revenue, and not as a means for reducing fertilizer use, and therefore runoff. The revenue is generally used for research, education, and cost-share programs. The tax rates are low enough that no discernable use impacts have been observed.

Summary

Twenty-seven States were found to have laws that could affect some farm management decisions. However, no State has a comprehensive legal framework for protecting both surface and ground waters from all agricultural nonpoint source pollutants. Even where some segment of agriculture is addressed through a water quality law, the degree to which the law is implemented or enforced varies between States.

Efforts on the part of States to develop nonpoint source management programs for agriculture are in the early stages. As better monitoring data and chemical fate and transport models are developed, more comprehensive and enforceable control programs can be developed where purely voluntary programs are inadequate.

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