United States General Accounting Office

GAO

Briefing Report to the Chairman, Subcommittee on Agricultural Research and General Legislation, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate

June 1989

CROP PRODUCTION

Outlook for Post-Drought Recovery During 1989

GAO/RCED-89-161BR

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-235636

June 6, 1989

The Honorable Kent Conrad
Chairman, Subcommittee on Agricultural
Research and General Legislation
Committee on Agriculture, Nutrition,
and Forestry
United States Senate

Dear Mr. Chairman:

As requested in your August 29, 1988, letter and in subsequent discussions with your office, we obtained information on the (1) likelihood of normal wheat, corn, and soybean crops in 1989 following the severe drought of 1988 and (2) potential effects of a 15-percent decrease in wheat and corn production in 1989. The 1988 drought was among the worst in this century and left several regions of the nation with below-normal soil moisture going into the fall and winter.[1]

In summary, it is difficult to predict potential wheat, corn, and soybean production, because the timing and level of future precipitation are unknown. If inadequate soil moisture and precipitation cause below-normal crop production, it is likely that crop supplies (including available stocks) would tighten, prices would rise, and use (consumption) would decrease.

In October 1988, U.S. Department of Agriculture (USDA) officials anticipated that an average level of precipitation would occur in 1989 and that, as a result, normal crops nationwide would be produced. However, USDA estimated in May 1989 that U.S. wheat production for 1989 would total 2.05 billion bushels, which is some 500 million bushels lower than expected in December 1988. The lower estimate is mainly caused by below-normal precipitation in Kansas, Oklahoma, and Texas--leading producers of winter wheat. Also, state climatologists are not optimistic about the harvest for wheat and other crops grown in the Northern

[1]The 1989 winter wheat crop was planted in the fall of 1988 and will be harvested by mid-July 1989. The growing season for corn and soybeans starts in the spring, and these crops are harvested in the fall.

Plains region.[2] For corn and soybeans grown in the Corn Belt[3] and Lake States[4] regions, state climatologists believe that it is too early to determine whether a normal crop will be produced.

A simulation by USDA's Economic Research Service (ERS) estimated the potential effects of a 15-percent decrease in 1989 wheat and corn production from levels expected in December 1988. The simulation suggests that wheat and corn prices would rise 18 and 36 percent, respectively, from the levels expected in December 1988. Total (domestic and export) wheat use would decline by 11 percent and corn use by 10 percent from expected levels. Wheat stocks as a percentage of total use would decrease from the expected level of 22 percent to 20 percent. Between 1972 and 1988, the median level was 43 percent. Corn stocks as a percentage of total use would decrease from an expected level of 22 percent to 18 percent. Between 1972 and 1988, the median level was 23 percent.

Section 1 of this briefing report provides background information on droughts and federal and state weather-forecasting activities. Sections 2 and 3 provide a detailed presentation of our analysis in response to your questions.

SCOPE AND METHODOLOGY

Our work was performed between September 1988 and May 1989. To examine the likelihood of normal crop production following the 1988 drought and the effects of a 15-percent decline in crop production, we interviewed officials at USDA's ERS, Agricultural Stabilization and Conservation Service, National Agricultural Statistics Service, and the National Oceanic and Atmospheric Administration (NOAA)/USDA Joint Agricultural Weather Facility. We also interviewed crop and weather analysts at USDA's World Agricultural Outlook Board and its Interagency Commodity Estimates Committee. To obtain weather forecasts for 1989, we

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[2]Kansas, Nebraska, North Dakota, and South Dakota.

[3]Illinois, Indiana, Iowa, Missouri, and Ohio.

[4]Michigan, Minnesota, and Wisconsin.

interviewed officials at NOAA's National Weather Service (NWS). We obtained crop production and outlook studies done by the Federal Reserve Bank of Kansas City and the President's Interagency Drought Policy Committee. To obtain indications on states' outlooks for 1989 wheat, corn, and soybean production, we interviewed 12 state climatologists--5 from the Corn Belt, 4 from the Northern Plains, and 3 from the Lake States regions.

We requested USDA's ERS to simulate a 15-percent decrease in 1989 wheat and corn production from levels expected in December 1988. We asked ERS to perform the simulation because ERS regularly provides crop supply, demand, and price analyses for USDA and the agricultural industry. We did not independently test or evaluate the simulation methodology or results.

We discussed the results of our work with USDA and NWS officials, who reviewed parts of the draft report for technical accuracy. However, at the request of your office, we did not obtain formal agency comments on this report.

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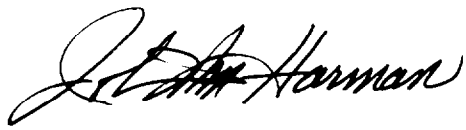
As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date of this letter. At that time, we will send copies to the Director, Office of Management and Budget; Secretary of Commerce; Secretary of Agriculture; Administrator, Agricultural Stabilization and Conservation Service; and other interested parties. Major contributors to this briefing report are listed in appendix I.

Sincerely yours,



John W. Harman
Director, Food and
Agriculture Issues

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ABBREVIATIONS

ASCS	Agricultural Stabilization and Conservation Service
ERS	Economic Research Service
GAO	General Accounting Office
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
P.L.	Public Law
RCED	Resources, Community, and Economic Development Division
USDA	U.S. Department of Agriculture

SECTION 1

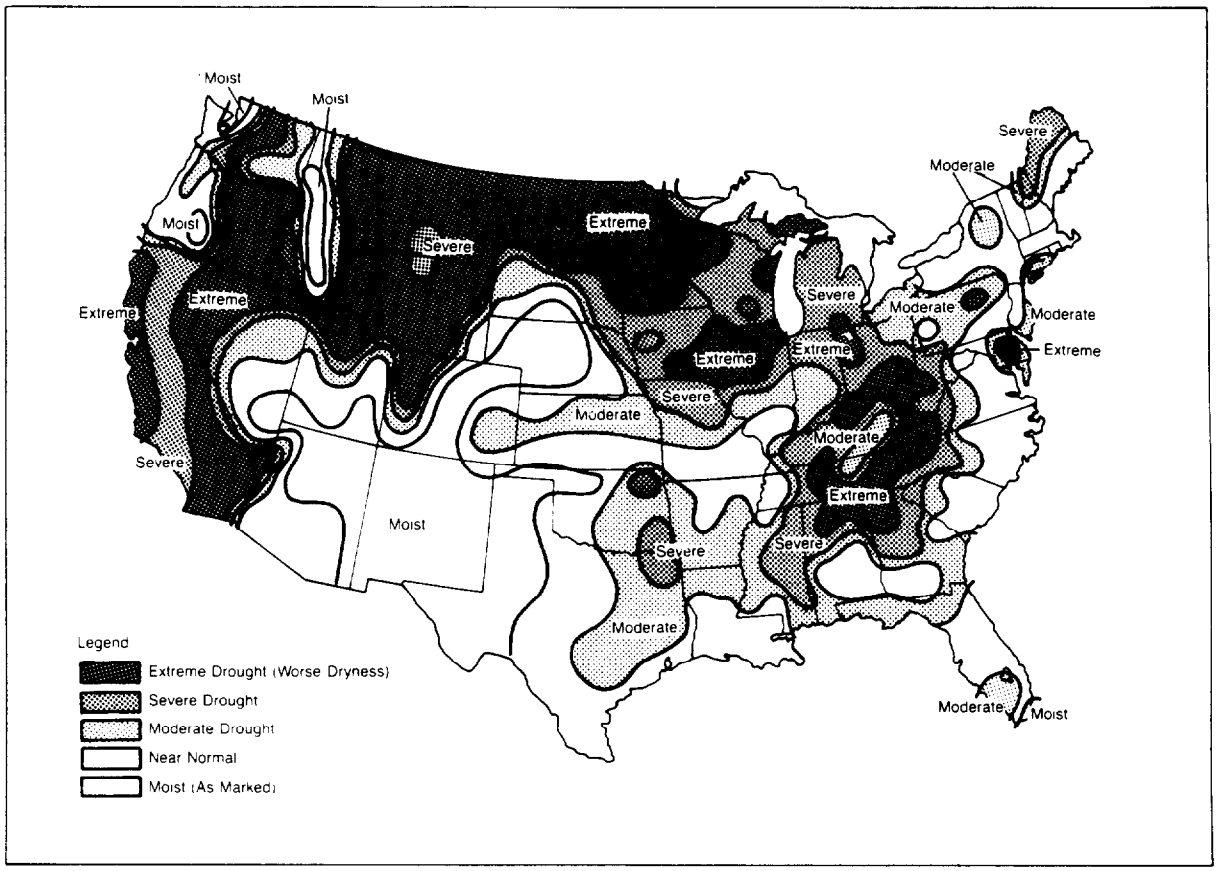
INTRODUCTION

This section describes and compares the 1988 drought with other droughts in this century and discusses federal and state weather-forecasting activities.

DROUGHTS IN THE 20TH CENTURY

The 1988 drought ranks among the nation's worst droughts in this century. Hot, dry weather during the spring and summer of 1988 spread rapidly across a large area of the nation. By the end of June 1988, about 35 percent of the contiguous United States was abnormally dry. By late July 1988, extreme or severe drought conditions peaked as 43 percent of the nation succumbed to arid conditions. The U.S. Department of Commerce's National Oceanic and Atmospheric Administration (NOAA)/U.S. Department of Agriculture (USDA) Joint Agricultural Weather Facility data show that the Northern Plains and Corn Belt regions were among the hardest hit areas. This is shown in figure 1.1.

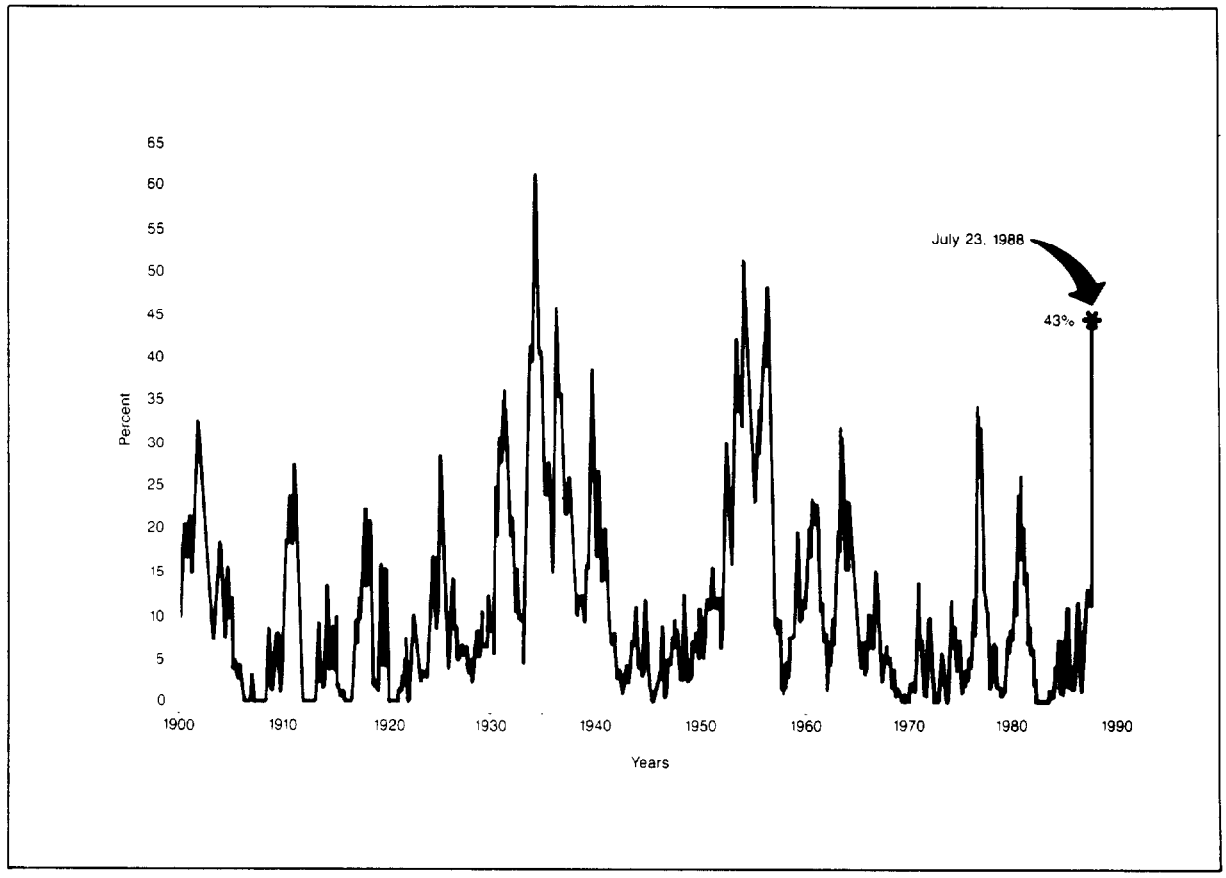
Figure 1.1: Drought Severity Index--July 23, 1988



Source: NOAA/USDA Joint Agricultural Weather Facility.

As shown in figure 1.2, droughts occur in a percentage of the country nearly every year and have been more severe in the 1930s, 1950s, and again in 1988.

Figure 1.2: Percentage of Contiguous United States Having Extreme or Severe Drought From 1900 Through July 23, 1988



Source: NOAA's National Weather Service.

1980 Droughts

The 1988 drought was not the first in the 1980s. As shown in table 1.1, previous droughts occurred in 1980 and in 1983. Although corn, soybean, and wheat yields (bushels per acre) were affected by the droughts, corn has shown a greater percentage of reduction in yields because of drought than the other two crops. Corn yields in 1988 were down over 29 percent from 1987 levels,

soybean yields about 21 percent, and wheat yields about 10 percent.

Table 1.1: Comparison of Corn, Soybeans, and Wheat Yields, 1980-88

Year	Corn	Soybeans	Wheat
	---(bushels per acre)---		
1980[a]	91.0	26.5	33.5
1981	108.9	30.1	34.5
1982	113.2	31.5	35.5
1983[a]	81.1	26.2	39.4
1984	106.7	28.1	38.8
1985	118.0	34.1	37.5
1986	119.3	33.3	34.4
1987	119.4	33.7	37.7
1988[a]	84.6	26.8	34.1

[a]Drought year.

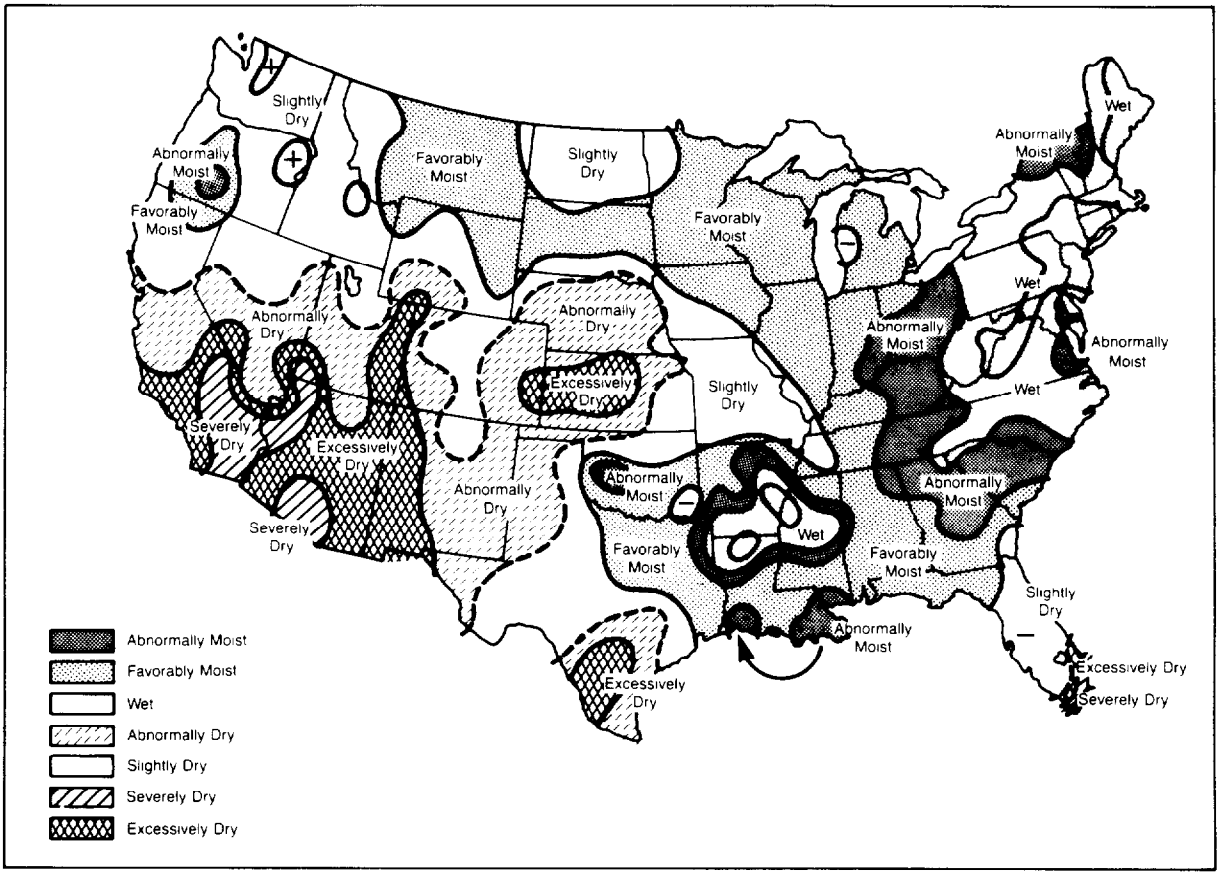
Source: USDA.

1989 Crop Moisture Levels

The NOAA/USDA Joint Agricultural Weather Facility reported on crop moisture levels throughout the nation as of May 13, 1989. (See fig. 1.3.) It identified several winter wheat states (Kansas, Nebraska, and Texas) as having slightly to excessively dry crop moisture levels[1] caused by the 1988 drought and continuing lack of precipitation in 1989. Several major corn and soybean states in the Corn Belt and Lake States regions were having favorably to abnormally moist crop moisture conditions.

[1]Crop moisture levels are based on short-term crop needs versus available water in a 5-foot soil profile.

Figure 1.3: Crop Moisture Index--May 13, 1989



Source: NOAA/USDA Joint Agricultural Weather Facility.

WEATHER-FORECASTING ACTIVITIES AND ORGANIZATIONS

NOAA's National Weather Service (NWS) is responsible for collecting and reporting the nation's climate and weather data. NWS' Climate Analysis Center produces 6-to-10 day, 30-day, and 90-day forecasts.

USDA has broad responsibilities relating to the development and use of climate and weather information in executing its program responsibilities. Its Economic Research Service (ERS) and National Agricultural Statistics Service are the principal

agencies that forecast and provide information on agricultural commodities supply, demand, and price.

The NOAA/USDA Joint Agricultural Weather Facility produces a weekly weather and crop bulletin. This bulletin contains, among other things, national weather and agricultural summaries, measures of drought severity, and individual state summaries on weather and crop outlook.

State climatologists provide information on state weather and soil moisture conditions to local governments and corporations. According to the President of the Association of State Climatologists, most state climatologists are full-time professors at state colleges and universities. Some state climatologists produce a monthly publication of their state's weather and soil conditions.

SECTION 2

POTENTIAL FOR NORMAL CROP PRODUCTION IN 1989

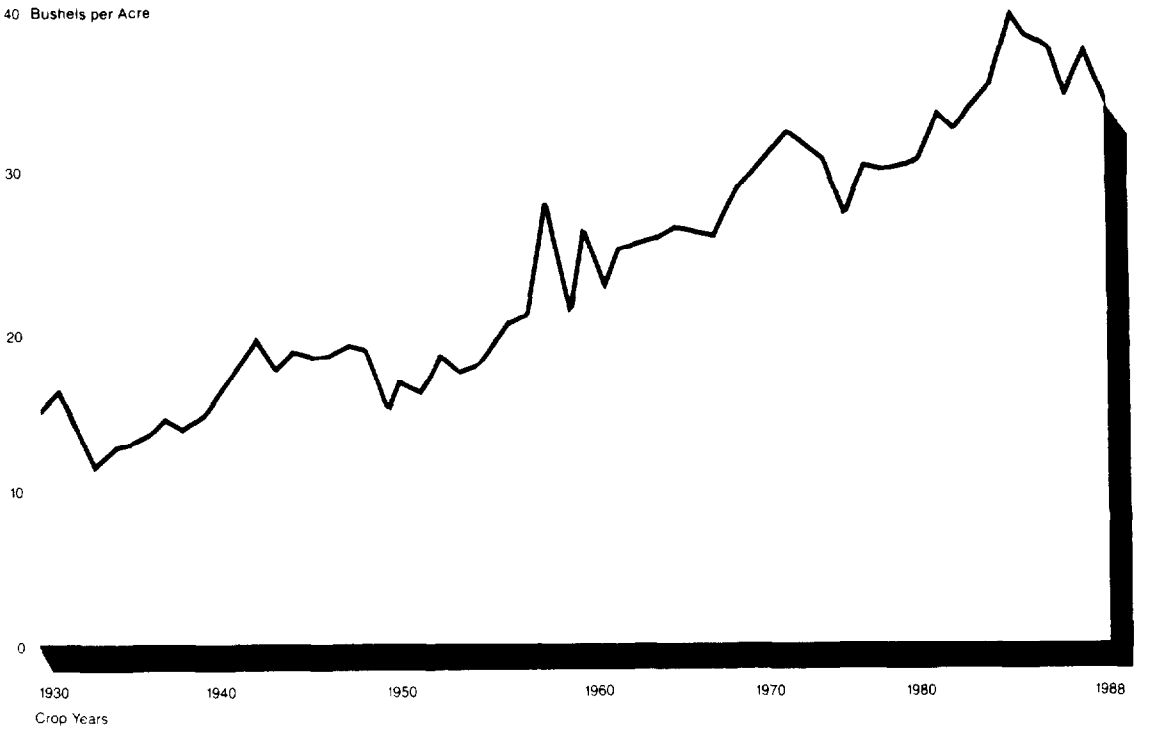
This section provides the outlooks for wheat, corn, and soybean production for 1989. As of May 1989, the prospects for normal production of winter wheat were well below normal in many states. No one knows for sure what the prospect for corn and soybeans planted in the spring will be. Historical trends indicate that overall corn and soybean production will probably rebound in 1989, but parts of the relevant growing regions remain under dry conditions.

OVERVIEW

Predicting potential crop production is difficult because the timing and level of future precipitation are unknown. According to officials of ERS and USDA's Agricultural Stabilization and Conservation Service (ASCS), an average level of precipitation in the growing season will be sufficient to produce an average crop for wheat, corn, and soybeans nationwide in 1989. Precipitation in the growing season is the most important factor affecting crop yields, they said. In addition, they told us that the level of soil moisture before the growing season begins is not a good indicator of subsequent crop yields, although the crop is more vulnerable with below-normal soil moisture. They said that the northwest had low soil moisture in 1987 and going into 1988. However, the states in the northwest had a good 1988 crop because precipitation came at the right time.

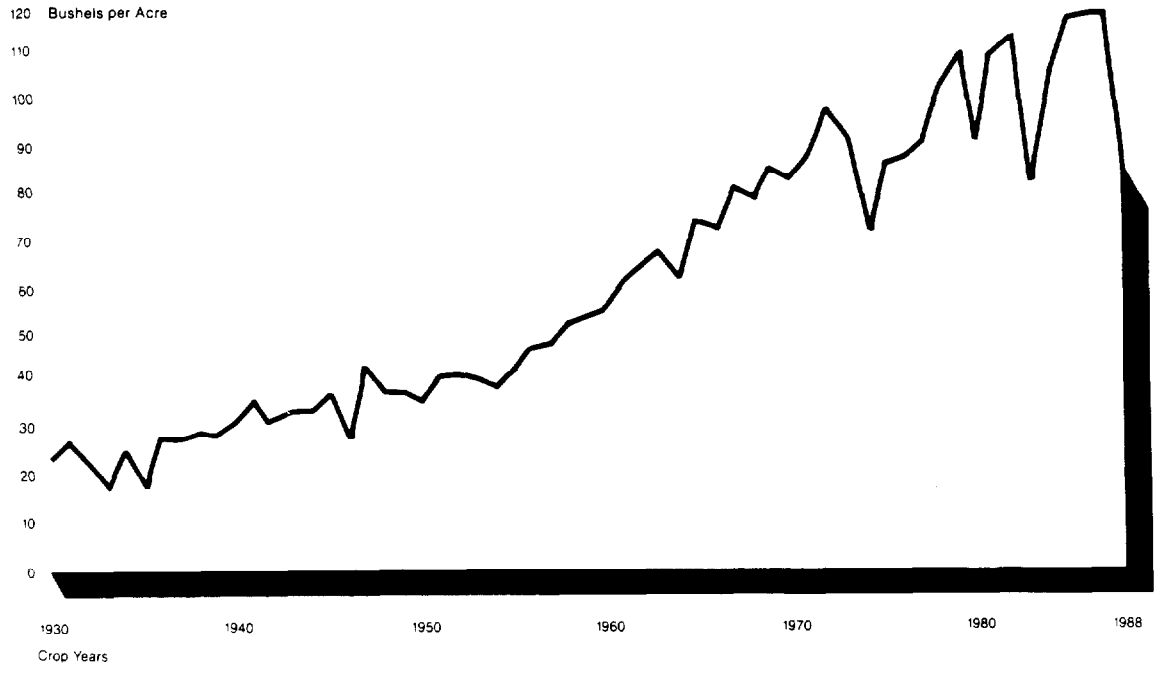
According to ERS officials, no one knows for sure whether the 1989 crops will rebound because of the difficulty in predicting weather. However, historical data of major crops indicate that a rebound is the most likely outcome on a nationwide basis. (See figs. 2.1, 2.2, and 2.3, respectively.)

Figure 2.1: Wheat Yields--1930 Through 1988



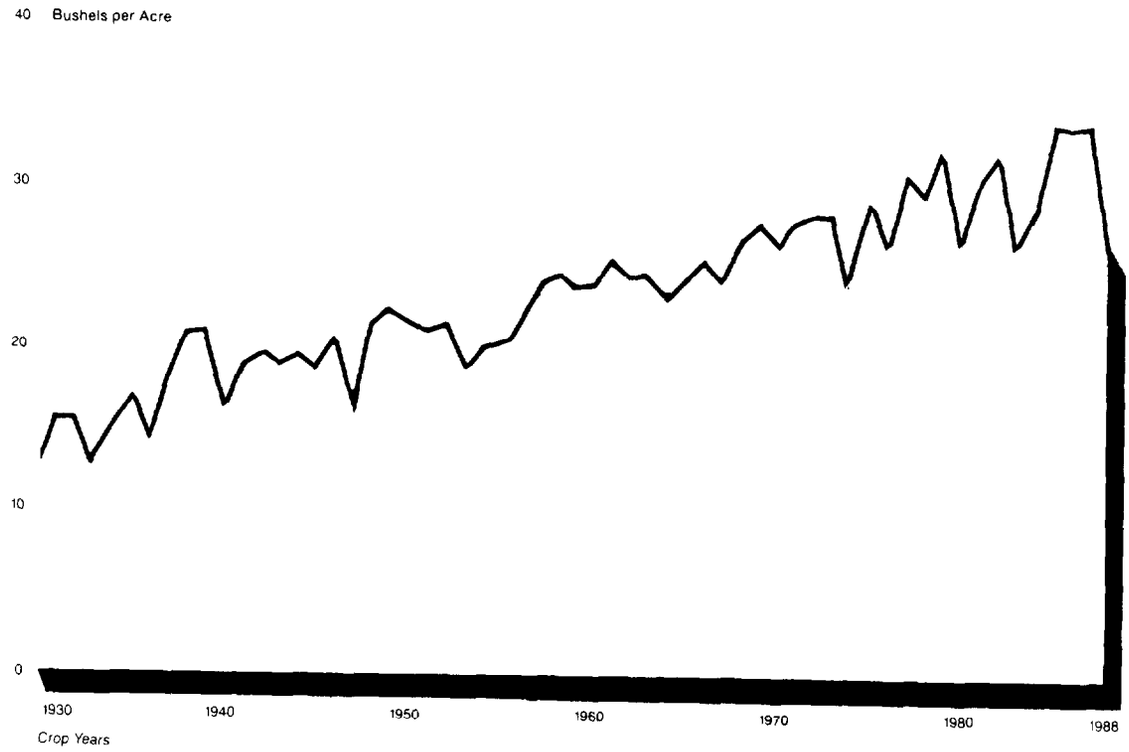
Source: USDA.

Figure 2.2: Corn Yields--1930 Through 1988



Source: USDA.

Figure 2.3: Soybean Yields--1930 Through 1988



Source: USDA.

According to a December 1988 study by the Federal Reserve Bank of Kansas City, which tracks agricultural conditions in the midwest, crop yields are likely to rebound in 1989 under normal weather conditions. The study states that a return to normal weather patterns is the most likely scenario for the 1989 growing season. However, the study stated that much of the nation remains affected by the 1988 drought because of below-normal precipitation in the fall. The depleted soil moisture in the driest areas of the nation, such as the Corn Belt and the Northern Great Plains, has not been recharged by fall rains. Therefore, in the absence of adequate soil moisture, the 1989 crops will be especially dependent on spring rains and timely precipitation throughout the growing season.

The President's Interagency Drought Policy Committee, which was created to examine problems caused by the 1988 drought, reported on December 30, 1988, that historical data suggest that crop production should rebound in 1989 and grain stocks should start to reaccumulate. The Committee reviewed the period 1950 through 1987 to see how production changed in years following a year when production declined 15 percent or more. They found that, on average, corn production rebounded by 42 percent and stocks grew 42 percent; soybean production rebounded by 17 percent and stocks grew 30 percent; and wheat production rebounded by 20 percent and stocks grew 31 percent.

We asked 12 state climatologists for their forecasts on whether an average level of precipitation would produce an average crop in 1989. Six state climatologists from the Lake States and Corn Belt regions said that their states would have an average crop with an average level of precipitation during the growing season in 1989. Four state climatologists from the Northern Plains region said that an average level of precipitation would not produce an average crop in their region in 1989. The remaining two state climatologists from the Corn Belt region made no forecast.

WHEAT OUTLOOK

As of May 1989, USDA's outlook is for lower-than-expected wheat production. USDA estimates that U.S. wheat production would total 2.05 billion bushels--some 500 million bushels lower than expected in December 1988. Lower wheat production is expected, in part, because of dry conditions in the major winter-wheat-producing states of Kansas, Oklahoma, and Texas. As of May 16, 1989, the NOAA/USDA Joint Agricultural Weather Facility forecasted that winter wheat production would total 1.43 billion bushels--an 8-percent decrease from 1988 levels. Yield prospects are for an average of 34.9 bushels per acre, down 4.3 bushels from last season. This would be the lowest average winter wheat yield since 1978.

The four state climatologists in the Northern Plains region said that their states would have below-normal crop yields with an average level of precipitation in 1989 because of low levels of soil moisture. For example, the North Dakota state climatologists said that an average level of precipitation will not produce an average crop in his state in 1989. North Dakota normally receives its largest amount of precipitation during the fall season and not in the spring. However, precipitation was below normal in the fall of 1988. He also said that there is an 80-percent probability that reduced crop yields will occur in his state and crop yields, if lower, could be anywhere between 5 and 50 percent of normal yields.

CORN AND SOYBEAN OUTLOOK

In May 1989, the NOAA/USDA Joint Agricultural Weather Facility reported that crop moisture levels are favorably to abnormally moist in the Lake States region and much of the Corn Belt region. In the Corn Belt region, Missouri and southwestern Iowa have slightly dry crop moisture levels. Replenishment of soil moisture will be difficult in these states because the National Weather Service is forecasting below-median precipitation there for the period May through July 1989.

In March 1989, state climatologists in the Corn Belt and Lake States regions said that it was too early to determine whether their states will have an average corn and soybean crop in 1989. However, six of the eight climatologists in these regions said that, if they receive an average level of precipitation in the growing season, they will have average crops. The other two state climatologists did not make a forecast.

NATIONAL WEATHER FORECASTS FOR MAY THROUGH JULY 1989

Excess precipitation is unlikely for the Northern Plains region and much of the Corn Belt and Lake States regions for the period May through July 1989, according to NWS. This period is critical for the completion of the winter-wheat-growing season and for most of the corn- and soybean-growing season. NWS' 90-day outlook for May through July 1989, figure 2.4, shows a large area of the nation with equal or less-than-equal chances of exceeding median precipitation.[1] Above-median precipitation is forecasted only for the areas in and near Idaho and Utah and the eastern parts

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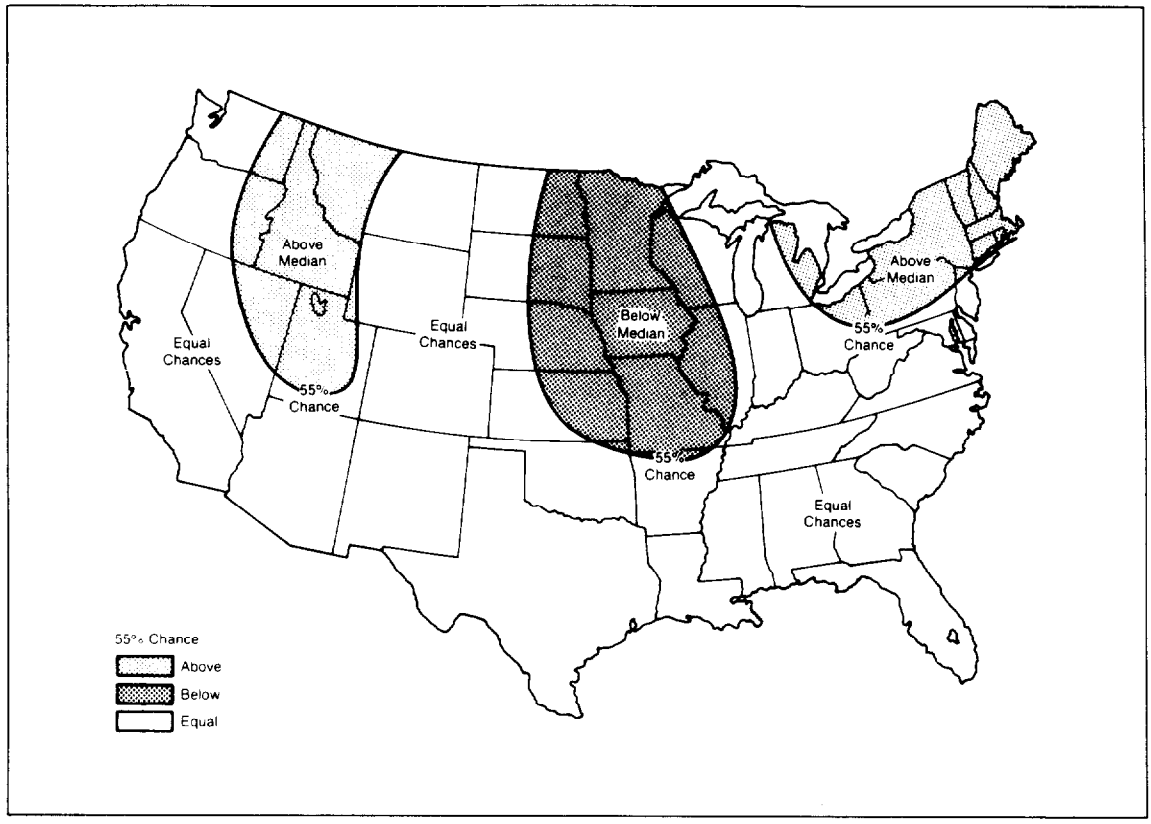
[1]"Equal chances" means that there is too little information for NWS to predict whether precipitation will be above or below the median level. "Below-median" means that there is less than a 45-percent chance of at least median precipitation. "Above-median" represents a greater than 55-percent chance of at least median precipitation. NWS' median is estimated from 30 years (1951-80) of data on total inches of precipitation in the same 90-day period.

of Ohio and Michigan through the northeastern states. Below-median precipitation is forecasted for the eastern parts of the Dakotas, Nebraska, and Kansas, the western parts of Illinois and Wisconsin, and the entire states of Minnesota, Iowa, and Missouri. Equal chances of accumulating above- or below-median precipitation are forecasted for the remainder of the nation.

Figure 2.4: U.S. Precipitation Forecast--May Through July 1989



Source: NWS.

SECTION 3

ESTIMATED EFFECTS OF A 15-PERCENT DECREASE IN CROP PRODUCTION

To examine the potential impact of below-normal wheat and corn production, we requested that ERS simulate a 15-percent decrease in 1989 production from expected, or baseline, levels that were estimated in December 1988. This section presents the results of that simulation. This section also discusses the changes that May 1989 estimates of production and stock levels may have on the relevance of the simulation.

RESULTS OF SIMULATION

If reduced soil moisture and minimal precipitation cause a 15-percent decrease in 1989 wheat and corn production, higher prices, lower use, and lower stock levels would be expected. ERS' simulation indicates that wheat and corn production would be reduced by 375 million bushels and 1.2 billion bushels, respectively, from levels estimated in December 1988. Because of higher prices for both crops, total wheat and corn use would be reduced by 11 and 10 percent, respectively, from expected levels. Export use (relative to baseline levels) would decline proportionately more than domestic use. In the domestic market, food and seed use would decline proportionately less than feed use. Prices of wheat and corn would be more than 15 percent higher in the simulation. Wheat prices would increase 18 percent, and corn prices would be 36 percent higher.

Under the simulated 15-percent decrease in production, ending wheat stocks (the amount in public and private storage at the end of the marketing year) would be reduced by 91 million bushels, which is about 17 percent lower than the baseline level. Wheat ending stocks of 458 million bushels would be the lowest since the 1974-75 crop year, when 435 million bushels remained in storage. Wheat stocks of 458 million bushels represent 42 percent of domestic wheat use and 20 percent of total use. Between 1972 and 1988, the median level of wheat stocks as a percentage of total use was about 43 percent.

The simulation shows that ending corn stocks would be reduced by 440 million bushels, or about 26 percent lower than the baseline level. Corn ending stocks of 1.274 billion bushels represent 18 percent of total use. Between 1972 and 1988, the median level of corn ending stocks as a percentage of total use was about 23 percent.

Table 3.1 shows USDA's expected 1989 levels for supply, use, and price and ERS' estimated results under the simulated 15-percent reduction in wheat and corn production. In developing the

baseline level, USDA expected normal weather conditions to prevail.

Table 3.1: Effects of a 15-Percent Decrease From Expected Levels of Wheat and Corn Production in 1989

	Wheat		Corn	
	Expected level	15-percent reduction	Expected level	15-percent reduction
	(millions of bushels)		(millions of bushels)	
Domestic supply:				
Beginning stocks	528	528	1,446	1,446
Production	2,550	2,175	8,000	6,800
Imports	15	20	3	3
Total supply	3,093	2,723	9,449	8,249
Domestic use:				
Feed & residual	270	260	4,600	4,200
Food & seed	849	830	1,260	1,175
Domestic total	1,119	1,090	5,860	5,375
Exports	1,425	1,175	1,875	1,600
Total use	2,544	2,265	7,735	6,975
Ending stocks	549	458	1,714	1,274
Ending stocks/use	0.22	0.20	0.22	0.18
	(per bushel)		(per bushel)	
Season average price	$3.60	$4.25	$1.95	$2.65
	(in millions)		(in millions)	
Harvested acres	67.1	64	67.8	67.3
	(bushels per acre)		(bushels per acre)	
Yield	38	34	118	101

Note: The data are estimated levels for the 1989/90 marketing year, which ends on May 31, 1990, for wheat and August 31, 1990, for corn.

The simulation shows that, while production of both crops would decrease by 15 percent, prices, use, and ending stocks do not change proportionately. The results indicate that wheat and corn use would not change much despite considerably higher prices because their use tends to be price inelastic--in other words, use would decrease less than 15 percent within the year despite prices that are more than 15 percent higher. Because wheat and corn use decrease less than production, stocks would be drawn down to absorb the demand. In the simulation, as wheat and corn use fall by less than 15 percent, ending stocks decrease by more than 15 percent.

The simulation also shows proportionately different results for wheat and corn. Corn prices increase by a greater percentage than wheat prices, and corn ending stocks decrease proportionately more than wheat ending stocks.

The results of the simulation indicate that, wheat stocks would decline proportionately less, in part, because more than half of U.S. wheat is exported. The simulation assumes that export use is generally more responsive to price increases than domestic use because alternative sources of grain tend to be easily accessible to foreign wheat purchasers. When U.S. grain prices increase relative to competitors' prices, it is assumed that foreign buyers would cut back their purchases of U.S. grain, substituting grain from other countries.[1]

Under ERS' simulation of a 15-percent decrease in production from expected levels, ending wheat stocks are estimated to be 458 million bushels. Included in these stocks is a sizable amount of wheat stocks that are not free to enter the market. These stocks are contained in the Food Security Wheat Reserve, which the Congress established to assist developing countries suffering from emergency food shortages. USDA is authorized to reserve up to 4 million metric tons (147 million bushels) of wheat.[2]

ERS' simulation includes 147 million bushels that are held in the Food Security Wheat Reserve. However, a USDA official said that as of April 1, 1989, USDA was storing less than the 147 million bushels in the reserve. He said that USDA had provided 16 million bushels of wheat from the reserve to eligible countries. Also, an additional 34 million have been authorized for donations during this marketing year. Further, he said that USDA has no plan

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[1]In this analysis, except for the 15-percent decrease in domestic wheat and corn production, all market conditions remain the same, including foreign buyers' continued access to alternative commodity supplies at competitive prices.

[2]The Food Security Wheat Reserve Act of 1980, P.L. 96-494, established this wheat reserve.

to replenish any of this wheat during the 1989/1990 crop year for two main reasons. First, high market prices are encouraging producers to sell their crops rather than forfeit them to USDA under the price-support loan program. As a result, USDA owns a limited quantity of wheat stocks that could be assigned to the Wheat reserve. Second, USDA is not likely to purchase wheat stocks on the open market and risk disrupting wheat prices. Therefore, the reserve is likely to be 50 million bushels less than the authorized maximum.

An ERS official told us that if stocks in the Food Security Wheat Reserve are assumed to be 50 million bushels less than the 147-million-bushel maximum, more of the 458 million bushels of ending stocks would be available for the market. This could lead to a small decrease in wheat prices.

The corn ending stocks in ERS' simulation are estimated to be 1.274 billion bushels. Included in these stocks is a relatively small amount that is not comprised of free stocks. They are held by USDA in the Disaster Reserve program. To alleviate distress caused by a natural disaster, the Congress authorized USDA to reserve 75 million bushels of grains.[3] According to a Kansas City Commodity Office official, USDA is storing 75 million bushels of government-owned feed grains (mainly corn and milo) for the Disaster Reserve program. He also said that as of April 1, 1989, this reserve had not been used.

The Farmer-Owned Reserve, which the Congress established to support grain prices, will probably not constrain wheat and corn stocks from entering the market.[4] The reserve allows stocks to be held off of the market until market prices reach a designated "release" level. According to a USDA official, USDA expects minimal quantities of wheat and corn to remain in the Farmer-Owned Reserve at the end of the 1989/90 marketing year.

Revised Wheat and Corn Estimates

Monthly updates in USDA's estimates of wheat and corn supply, use, and prices may have relevance for ERS' simulation of a 15-percent decrease in wheat and corn production. As previously noted, in May 1989, USDA estimated that U.S. wheat production would total 2.05 billion bushels--some 500 million bushels lower than expected in December 1988. Lower wheat production is expected, in part, because of drought conditions in such major winter-wheat-producing states as Kansas, Oklahoma, and Texas. In May 1989, USDA

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[3]The Agricultural Act of 1970, P.L. 91-524, as amended, established the Disaster Reserve program.

[4]The Food and Agriculture Act of 1977, P.L. 95-113, created the Farmer-Owned Reserve.

estimated beginning corn stocks to be 1.83 billion bushels--some 384 million bushels higher than expected in December 1988. Beginning stocks are larger, in part, because 1988 production proved to be higher and use proved to be lower than levels estimated in December 1988.

USDA's revised wheat estimate of 2.05 billion bushels of production is close to the 15-percent simulated level of 2.175 billion bushels. The revised production level has also helped to move USDA's revised estimates of use, ending stocks, and prices closer to the 15-percent simulated level. The increase in beginning corn stocks in USDA's estimates would likely contribute to lower prices, higher domestic and export use, and higher ending stocks.

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