

testifying to Congress in the early summer, called the drought and heat wave conclusive evidence that the predicted greenhouse effect was occurring, some scientists of a variety of backgrounds were saying privately that this year was only a precursor of things to come. The pattern of the drought as well as the several very hot years experienced in the 1980s seemed to them consistent with the predictions of the climate models that purport to take account of the effects of buildup of greenhouse gases.

There has not, surprisingly, been a corresponding skepticism expressed by others. For example, some point out that long-range, large-scale climate models, lacking the greenhouse mechanism, can produce runs of years like the 1980s, with extremely high temperatures, but without those runs implying any trend. Others say that long-term cooling is at least as likely as warming, based on very long-term climate swings for the earth, and that recent events are only blips on that trend.

It does seem clear that deciding which

position is correct will take years, probably decades. But in the meantime, the advocates of the greenhouse explanation make the argument that the rational, risk-averse policy is to work toward reducing greenhouse gas emissions now, because if we wait for decisive statistical evidence it will be too late.

Thus, in a sense, the drought of 1988 has been swallowed up in a larger policy debate--about world economic development, population growth, and energy policies--because it has been linked to the temperature-increase predictions that are driving this larger debate. In combination with the apparent power of the cost-sharing coalition on Capital Hill, this has produced a very different set of reactions to what the student of past droughts and water policy developments would have expected. Perhaps the most hopeful note in all this for national water policy is that the stress on conservation and water-rights markets in the West is so far surviving the stress of low rainfall and high temperature.

IMPACT OF THE 1988 DROUGHT ON AGRICULTURE

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During the peak growing months of the summer of 1988, the heart of the Nation's Farm Belt was gripped in the most pervasive drought everrecorded. As a result of the drought, livestock producers were forced to reduce herds as forage, water supplies diminished and crop producers suffered heavy losses.

Production and Prices

Pastures and ranges in the United States averaged near-record poor condition throughout the summer. Hay production is estimated to be down 12 percent from 1987 despite a 9 percent increase in harvested acreage including hay cut from acreage idled under

farm programs. Short forage supplies have increased cow sales and some of these are going to slaughter, while some are going to producers who have forage available. Weekly cow slaughter is now down from early summer and for the year to date cow slaughter is off about 6 percent from 1987. Utility cow prices are \$48-\$49 per cwt, near prices in early May and up from around \$40 per cwt in late June, at the onset of the drought.

This year's prospective grain and soybean harvests have been reduced by the drought but production prospects have stabilized since mid-August. Total supplies--including stocks at the start

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of the 1988 season plus production--are expected to be adequate although commodity prices will be higher.

The U.S. winter wheat crop, which will account for around 86 percent of total U.S. wheat production, is about the same as last year. The spring wheat crop, including durum, is estimated to be down 56 percent from 1987. Total wheat supplies for 1988/ 89 are expected to be 3.1 billion bushels, off 22 percent from 1987 but equal to 121 percent of total use. Farm-level wheat prices are expected to average 40-55 percent higher this marketing year compared with \$2.57 per bushel during the 1987/88 marketing year.

This fall's corn harvest is estimated to be down 37 percent from last year's harvest. Even with this major crop loss, large projected carry in stocks mean total corn supplies in 1988/89 will exceed use by a lower but near-average margin. Corn prices at the farm are expected to average 20-40 percent higher for the 1988/89 marketing year. Production of other feed grains is also projected to decline this year. Relatively large carry in stocks of grain sorghum and barley will help offset production shortfalls.

Soybean production this fall is projected to be 23 percent below last year. Soybean supplies in the United States during the 1988/89 marketing year will be the lowest in 12 years and ending stocks will be at minimum levels of less than one month's use. As a result, soybean prices next year are expected to be 20-60 percent higher than this year.

The sugarbeet crop is expected to be down 10 percent while supplies of sweet corn, green beans, green peas, carrots, and beets will also be smaller. Production of some fruit crops in Michigan and other states will be lower but the effects on total production of major fruits will be small.

The effects of the North American drought on world crop supplies will be buffered by relatively large foreign production. Foreign grain

production is expected to be up 2 percent from a year ago.

Coarse grain production outside the United States is expected to be the third highest on record and foreign wheat production is expected to be the second highest ever. Foreign oilseed production is expected to be a record level, up 6 percent from 1987. Overall, global grain production is projected to be off 4 percent from last year. World grain stocks at the end of 1988/89 are expected to be about 17 percent of global use, near the relatively low levels of the early 1970's.

Farm Income

Cash receipts from the sale of farm products in 1988 are expected to be larger than last year. Farmers will partly offset reduced production by selling stored crops and higher crop prices will more than offset lower marketings, causing crop cash receipts to rise. On balance, net cash income in 1988 is expected to be about the same as the \$57.1 billion in 1987. The drought will change the distribution of income as crop farmers outside the drought areas will reap larger incomes, farmers hit by the drought will have both smaller crops and deficiency payments, and livestock, dairy and poultry producers will face smaller profits because of higher feed and forage prices. Income will be augmented by \$6-7 billion in direct payments for crop losses, feed assistance, Federal crop insurance payments, and emergency disaster loans provided as part of the new drought aid legislation and under current law.

Agricultural Trade

Reduced 1988/89 crop supplies and higher prices are projected to reduce the volume of U.S. farm exports and to increase unit export values. The United States has assured its customers that it will not impose any restrictions on exports of farm products because of lower supplies. The drought does not lessen the need for long-term global farm policy reform and the United States continues to push for the elimination of trade-distorting subsidies in the Uruguay Round.

Food Prices

The drought is still expected to add up to one percentage point to food prices in 1988. Annual average food prices in 1988 are projected to be 3-5 percent higher than in 1987, although monthly food prices later this year could be more than 5 percent above year-ago levels.

Record red meat and poultry production in 1988, bolstered by some distress marketings because of the drought, are tempering food prices while prices of some fruits and vegetables are higher due to drought losses. This year's drought may add up to two percentage points to food prices in 1989 which are expected to increase moderately.

LESSONS LEARNED FROM THE 1986 DROUGHT

Bill Johnson and Mike Deas*

Introduction

Drought is a natural hazard; occurrence is infrequent and the full impact may not be realized for many months. The relatively gradual onset of a drought, as compared to *floods*, provides an opportunity for establishing plans and policies which can minimize detrimental effects, particularly to water supplies.

Unfortunately, the infrequent nature of drought causes many plans and policies to be ad-hoc in nature, predominantly based on the vague memories of the last major drought-induced water shortage. Successes and failures can be realized from these policies; however, they are often lost because of a failure to perform a post-drought analysis to evaluate their effectiveness.

This failure to conduct ex poste analyses was the impetus for the U.S. Army Corps of Engineers Institute for Water Resources to evaluate Corp drought policies as they were applied during the 1985-86 drought in the southeastern United States. This study was conducted by the Corps' Hydrologic Engineering Center. Its purpose was to determine whether there is a need to modify current Corps' drought policy based upon lessons during the 1985-86 drought. The following summarizes these lessons and identifies nine subject areas essential in a successful drought contingency plan.

Method of Investigation

Research on the 1986 drought in the southeastern United States utilized information from a variety of sources. Information was drawn from field trips, existing drought plans, interviews, correspondence and published literature.

An initial visit was made to the South Atlantic Division (SAD) office, Atlanta, to speak firsthand with engineers directly involved in the drought. In addition, division and district correspondence and documentation on the Corps' role during the water shortage were reviewed. As part of the initial information gathering trip, a drought contingency planning workshop for Corp's districts was attended in Cincinnati, Ohio. These visits provided the initial information for this study.

A meeting with the Federal Emergency Management Agency (FEMA), Atlanta Regional Office, was also arranged to determine their role as emergency assistance during the drought. Additionally the Atlanta Regional Commission (ARC), which regulates the water supply for the city of Atlanta and surrounding communities, and the state of Georgia's Environmental Protection Division (Water Resources Unit) were visited to understand state involvement in the drought.

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