Soil Erosion: The Problem Persists Despite the Billions Spent on It

The dust storms that have swept part of the Great Plains in recent months have been for many people a surprising reminder of the 1930's, when such storms were so devastating as to drive thousands of people from their farmsteads. And, in truth, conditions of the kind that produced the "Dust Bowl" in the southern Great Plains 40 years ago have in some areas reasserted themselves ominously.

Yet, while drought, high winds, and blowing dust have brought severe hardship and even ruin to many farmers this year, the chief significance of the dust storms does not lie in their immediate effects, however distressing. Rather, the dust storms are especially significant as spectacular if redundant evidence that effective soil conservation of the kind necessary to sustain the agricultural productivity of the Great Plains and other farming regions over the long term simply has not been achieved.

Indeed, although nearly $15 billion has been spent on soil conservation since the mid-1930's, the erosion of croplands by wind and water (in most of the United States, erosion is caused chiefly by water) remains one of the biggest, most pervasive environmental problems the nation faces. The problem's surprising persistence apparently can be attributed at least in part to the fact that, in the calculations of many farmers, the hope of maximizing short-term crop yields and profits has taken precedence over the longer term advantages of conserving the soil. For, even where the loss of topsoil has begun to reduce the land's natural fertility and productivity, the effect is often masked by the positive response to heavy applications of fertilizer and pesticides, which keep crop yields relatively high.

This complacency on the part of a large part of the farming community helps explain why, in all the public and political furor over environmental problems during the last decade, soil erosion has received so little attention. Yet water pollution can never be eliminated as a serious national problem until the flow of farm sediments into rivers and streams is drastically reduced.

In fairness to the farmer, his tendency to put short-term profits ahead of conservation is not simply a matter of greed, for he has been feeling the effects of inflation and sharply rising costs for tractor fuel, pesticides, labor, and equipment. Many farmers struggle under a growing indebtedness, and their need for increased returns is often very real. Nevertheless, a failure to reduce erosion to acceptable levels—or to where soil losses are not much greater than accretions—could lead sooner or later to a major decline in crop yields.*

Familiar Remedies

Soil specialists generally agree that erosion can be reduced to tolerable levels by long-familiar engineering and biological methods and practices. These include contour plowing; terracing; strip-cropping (with strips of wheat or other grain crops that give little soil protection alternating with strips of grass or legumes); rotating crops to improve soil structure; leaving harvest residues or litter on the soil surface; converting marginal erosion-prone land from crop production to pasture; planting shelterbelts or windbreaks; and—of increasing importance—practicing "minimum tillage," or disturbing the soil as little as possible in planting operations and thereby leaving strips of sod between crop rows.

(According to estimates of the U.S. Department of Agriculture (USDA), if minimum tillage practices were extended to 80 percent of all U.S. croplands—as compared to the 10 percent covered at the end of 1974—this in itself would reduce soil erosion by 50 percent or more. The continuing spread of minimum tillage, which offers the further advantage of reducing labor costs and loss of soil moisture, is said to be one of the few encouraging new developments with respect to soil conservation.)

The seriousness of the soil erosion problem was pointed out 2 years ago in a little-noticed report prepared for the Senate Committee on Agriculture and Forestry by the Council for Agricultural Science and Technology (CAST), which is made up of representatives of about a dozen professional groups having to do with soil science, animal husbandry, seed improvement, agricultural engineering, meteorology, and the like. The CAST report said, among other things, that "five problem conditions are evident which could trigger a dust bowl" in the Great Plains and perhaps a part of the Corn Belt if a sustained drought were to occur.

One was that Great Plains farmers were reported to be changing from wheat-fallow or wheat-sorghum-fallow rotations to continuous planting of wheat in order to take advantage of high wheat prices, even though this was eliminating strip-cropping for wind erosion control. Also, by plowing with moldboard plows to bury the seed of downy bromegrass (a pest that reduces yields when wheat is grown continuously from year to year without rotation), many farmers were leaving the surface bare of harvest residues that help hold the soil in place.

The other conditions cited were the extensive leveling of fields (in some cases creating barren patches of erosion-prone sand) to permit the installation of the new wheeled irrigation systems that turn in a wide arc from a center pivot; the conversion of rangeland to grain production in response to high prices for grain and low prices for cattle, an unfavorable development from the standpoint of soil conservation because of the greater susceptibility of cropland to wind erosion; and the increasing practice in the Corn Belt of plowing cropland in the fall and turning under the stubble or harvest litter that would otherwise have helped protect the soil from winter and spring winds.

Addressing the soil erosion problem nationally, the CAST report said more than a third of all cropland was suffering soil losses too great to be sustained without a gradual, but ultimately disastrous, decline in productivity. It is generally accepted among soil scientists that even "deep soils" cannot sustain a loss of more than 5 tons an acre per year without hurting productivity. Such scientists therefore see real cause for alarm in the fact that erosion losses nationally have been variously estimated at about 9 or 12 tons an acre per year, and that, in extreme cases, losses of 60 tons or more are recorded. Under normal farming conditions—discounting erosion losses—new topsoil forms at a rate of about 1.5 tons an acre per year.

As noted in the CAST report, the Soil

*See the article "Land degradation: Effects on food and energy resources" by D. Pimentel *et al.* (*Science*, 8 October 1976). According to the authors, 4 billion tons of sediments are carried by surface runoff into waterways of the 48 contiguous states each year, and three-fourths of it comes from farmland. They estimate that another billion tons of soil is lost through wind erosion, with by far the greater part of this loss occurring in the West.

Willow windbreaks protect organic soil on a farm in the Lapeer Soil Conservation District in Lapeer County, Michigan. The major crop grown on this farm is bluegrass sod. [Soil Conservation Service, Department of Agriculture]

Conservation Service's most recent *Conservation Needs Inventory* (published in 1967), reported that farmers in 7 of the 12 Corn Belt states were doing a better job of protecting highly erodible cropland in 1958 than they were a decade later, and that, furthermore, only 36 percent of the some 472 million acres of cropland existing in 1967 had been adequately "treated" against soil erosion through such practices as strip-cropping and terracing.

Program Failures

In February, the General Accounting Office (GAO) issued a report† that helps explain why past soil conservation efforts have not been more effective. Representatives from GAO visited a total of 283 farms, chosen at random, in the Corn Belt, the Great Plains, and the Pacific Northwest and found that 84 percent of them were losing more than 5 tons of soil an acre per year on those croplands for which measurements were made. Even more disturbing was the fact that there was no evidence that the soil losses were consistently smaller for the farmers who had been participating in USDA conservation programs than for those who had not. Losses for both groups were found to be "well above the maximum tolerable level."

The GAO said that USDA, which has been spending several hundred million dollars annually on various soil conservation programs, had not been actively seeking out those farmers most in need of help; that in the case of the farmers the department had helped, it had not done enough to encourage them to carry out their conservation plans effectively and over the long term; and that less than half of the money in the big cost-sharing program administered by the Agricultural Stabilization and Conservation Service (ASCS)—$190 million has been appropriated for this program for fiscal year 1977—had been used for measures primarily oriented toward conserving the nation's topsoil and that most of it had gone for improving crop yields. The GAO said that because of this, Iowa—the first state to establish a cost-sharing program for soil conservation—had withdrawn from the ASCS program after only 1 year. The GAO indicated that Congress as well as USDA was responsible for this situation because recent appropriations measures had allowed farmers and the local soil conservation districts wide discretion as to which practices to follow.

A particular criticism which the GAO made of the Soil Conservation Service (SCS) was that its some 2750 district conservationists spend a substantial part of their time preparing elaborate conservation plans for individual farms which are seldom followed and soon become out of date. Less than half of the 119 farmer "cooperators" whom the GAO visited were using the plans the service had prepared for them.

Thomas Barlow, a member of the Washington staff of the Natural Resources Defense Council (NRDC), a private activist group, says that the fundamental weakness in the soil conservation programs is that they are not effectively linked to USDA programs to which farmers look for economic security, namely those that provide price supports, farm loans, crop insurance, and disaster relief. In his recent testimony before the Senate Committee on Agriculture, Barlow recommended that Congress enact legislation to withhold financial assistance until the farmer shows that he has put into effect, and is properly maintaining, an appropriate program of conservation for his land.

Actually, there has been a linkage between farm price supports and conservation practices going as far back as 1935, the year that the SCS was created as a part of Franklin D. Roosevelt's New Deal. But during most of this 40-year period, the farm commodity markets have been plagued with surpluses, and it has been relatively easy to persuade farmers to withdraw substantial acreages from crop production and convert them to pasture, shelterbelts, or other uses consistent with soil conservation.

In more recent years, however, as farm surpluses have been eliminated with the growth of overseas markets, farmers have felt a strong incentive—both because of the rising commodity prices and (in many cases) their growing indebtedness—to put as much of their land into production as possible. The Barlow proposal, which is sure to arouse controversy if it begins to gain currency, is designed to make the farmer a soil conservationist for all seasons, for the periods of high commodity demands as well as for the periods of crop surpluses.

James W. Giltmier, a senior staff member of the Senate Agriculture Committee, does not believe the Barlow proposal is acceptable. In his judgment, neither the farmers nor Congress will sit still for the idea that the government should have that much say-so about how farmers manage their land.

But if this is true, what can be done? Giltmier says that the Senate has already taken a major step in response to the soil erosion problem by passing the Land and Water Resources Conservation Act of 1977. This measure, now pending action in the House Committee on Agriculture, would require USDA to prepare an appraisal of land and water conservation problems—and an action program and

†Entitled *To Protect Tomorrow's Food Supply, Soil Conservation Needs Priority Attention*, this document (CED-77-30) can be obtained from the General Accounting Office Distribution Section, Room 4522, 441 G Street, NW, Washington, D.C. 20548 for $1 (the report is free for students, teachers, libraries, and nonprofit groups).

statement of policy to go with it—by the end of 1979. But, because the pending bill contemplates a 2-year deferral of major initiatives and calls for a continuation of the strictly voluntary approach to soil conservation, it will not satisfy Barlow and others who believe that the soil erosion problem cries out for early and much stronger action.

M. Rupert Cutler, USDA's new assistant secretary for conservation, research, and education, told *Science* that the most promising new approach to the soil conservation problem will be through section 208 of the Clean Water Act of 1972. Under this section, each state is required to submit to the Environmental Protection Agency (EPA), by 1 November 1978, an enforceable plan for abating pollution from all identifiable sources, including such "nonpoint" sources as farmland.

According to the section 208 strategy currently under development by EPA and USDA, the some 3000 soil conservation districts—there is one in virtually every farming county—will be used as the local "delivery system" for making sure that the plan objectives are met with respect to controlling erosion from croplands and farm woodlots. Although these districts are state-chartered local government entities, they typically look to the local and regional employees of USDA agencies such as the SCS, the ASCS, and the Farmers Home Administration to do necessary fieldwork, such as giving farmers technical assistance on erosion problems.

Change the Buzzwords

What this means, then, is that it will fall to USDA personnel to persuade farmers to do whatever must be done if needless erosion is to be stopped. An obvious advantage of proceeding in this way is that, because of the comfortable, friendly relationship that exists between USDA field personnel and farmers, the latter presumably would not feel that they are being visited by some heavy-handed federal enforcers. Also, in light of the backlash against EPA and "pollution control" which is manifest in some quarters, including the farming community, there may well be an advantage in putting the rhetorical emphasis on protecting the agricultural resource base. "If you are going to get the job done, you've got to change a few buzzwords, and 'pollution' is one of them," observes one USDA soil conservation specialist.

But a question that EPA and USDA have not yet seriously dealt with is what to do about those farmers—and there could be many—who prove unwilling to adopt essential soil conservation practices. Section 208 leaves it to the states to provide the sanctions needed to bring recalcitrants into line. Yet, while some 18 states have enacted sedimentation control laws, Joseph Krevac, EPA's branch chief for "nonpoint" water pollution sources, says that in all but two of these states—Pennsylvania and Iowa—erosion associated with farming activities has been exempted.

High winds, dry weather, and a lack of plant cover on the soil combine to create a dust storm near Lamesa, Texas, on the southern Great Plains. Although this photograph was taken several years ago, scenes such as this one have been duplicated many times this past winter in the Great Plains region. [Soil Conservation Service, Department of Agriculture]

Congress may find that, just as Barlow has suggested, the most readily available sanction for enforcing compliance with 208 plan objectives is to make the adoption of adequate soil conservation practices a condition for participation in USDA financial assistance programs. And, since Congress has required floodplain zoning and the floodproofing of buildings as a condition for federal flood insurance, one can certainly argue that it would make equally good sense to insist on soil conservation practices as a condition for future farm loans, crop insurance, disaster relief, and maybe price supports.

The very idea of such a thing may be upsetting to farm groups, and Barlow—who is something of a red flag to the farm groups because of his activist role on issues such as stream channelization and wetlands drainage—readily concedes that his proposal will go nowhere unless it is taken up by Carter Administration officials. "I'm a gadfly," he says. "The leadership is going to have to come from the Administration."

Secretary of Agriculture Bob Bergland acknowledges that the soil erosion problem is severe, and his office has a policy review of it now underway. "We are losing 15 tons of topsoil out of the mouth of the Mississippi River every second," he observed at his Senate confirmation hearing. "We know we cannot do that forever. And yet we have only begun to scratch the surface in our conservation activities."

If the Administration does take up the Barlow proposal, there will be some other circumstances that may work in its favor. One is that farmers and the senators and representatives who speak for them in the Congress may conclude that, to obtain passage this year of the kind of farm bill the agricultural community favors, they had better not get at cross-purposes with the Administration and the environmentalists on a major issue of land stewardship. Another is that, with the scenes of billowing clouds of dust blowing in the wind on the Great Plains still fresh in everyone's memory, the public will know that the past stewardship leaves plenty to be desired.

—LUTHER J. CARTER