being diverted from agriculture to other uses. Fewer than one-half as many U.S. farms exist today (2.3 million in 1980) as in 1950 (5.6 million).[11] The USDA estimates that 875,000 acres of cropland per year will be diverted from cropland to other uses over the next 50 years.[12] And thousands of farmers have tried to reduce their dependence on farm income, either by leaving their farms entirely or by farming part-time. It is not surprising, then, that many farmers find it unprofitable to make investments in maintaining soil quality. One USDA study found the costs of implementing soil conservation techniques in Iowa to be three times as great as the benefits to farmers.[13]

It follows that real progress in maintaining soil productivity will be difficult until such time as the returns to agriculture are at least equal to the returns in nonagricultural industries. Over the long term, agricultural economists forecast that reductions in the number of farms, increases in the average size of these farms, and expansion of the agricultural export market should steadily increase the returns to farming. Over the short run, however, the picture is much more gloomy. Three successive years of bumper crops and a worldwide recession have steadily driven down farm prices and incomes. Also, this increasingly capital-intensive industry has been hurt by high interest rates. In 1982 the real income of farm families (measured by average personal disposable income per farm, adjusted for inflation) reached its lowest level since 1968.[14]

A Case of Government Failure?

The analysis presented here supports conclusions of two different kinds. First, with regard to the specifics of the soil conservation problem in the United States, the data make the argument for spending resources on soil conservation programs more difficult to establish. If the programs are intended to redress intergenerational inequities, it must be argued that merely maintaining current agricultural capacity is not enough—that future generations are entitled to greater agricultural resources than currently exist. If the programs are aimed at combating pollution, the magnitude of the benefits conferred by the programs and the inadequacy of other available alternatives need to be more clearly established. Most importantly, if the programs are to be more than just income transfers to farmers, it must be demonstrated that Congress and the USDA possess (or can find) sufficient knowledge, power, and determination to make the programs work.

Second, with respect to the operation of government programs in general, the case of soil conservation illustrates a recurring theme in the literature of economics and politics that *both* markets and governments sometimes fail to allocate resources equitably and efficiently. In particular, the analysis presented here implies that these two decision-making mechanisms often fail for much the same reasons. To maintain intergenerational equity, for example, a soil conservation program might be necessary because a system of private markets might not provide sufficiently for the needs of future generations. But the actions of Congress with respect to the ACP bear out the fears of many natural resource economists that public decision-making mechanisms might not be any more cognizant of the needs and rights of future generations than are private markets. The 1975 decision of which conservation projects to fund, although seemingly based on technical issues in farm management, represents a victory of current farming interests over the interests of farmers and consumers in the future.

Similarly, in dealing with soil-erosion-related water pollution, the same factors that cause private markets to fail also hinder government programs directed at the problem. If the extent of soil pollution of rivers and lakes caused by individual farms could be monitored cheaply, a system of taxes could be devised to deal with this problem, while leaving soil management policy in private hands. In fact, if the number of affected individuals were small and property rights were clearly established and enforced, the market itself might be able to solve this problem efficiently through a system of payments between farmers and those hurt by soil-erosion-caused pollution. Since it is difficult and expensive to monitor water-pollution rates in this way, however, the government might have to encourage specific farming practices to deal with this situation. The trouble is that government in this instance has no guidelines by which to target its resources on the problem or gauge success in achieving its goals. Under these circumstances, legislators and agencies tend to measure program performance in terms of numbers of participating farms, types of conservation practices performed, and total dollars spent, rather than in terms of soil saved from erosion or waterways cleaned of pollution. If public authorities are at all inefficient in executing these programs, this situation tends to exacerbate that inefficiency by frustrating program evaluation and control. It is not at all surprising, therefore, that analysts have found soil conservation resources poorly focused in terms of soil erosion needs.

11. USDA, *Agricultural Statistics, 1980*, p. 417.

12. USDA, *Soil and Water Resources Conservation Act Appraisal, Part II. Soil, Water, and Related Resources in the U.S.: Analysis of Resource Trends*, 1980, p. 49. A 1.2:So 3/7/980.

13. This report was separately published in the *Journal of Soil and Water Conservation;* see Paul Rosenberry, Russell Knutson, and Lacy Harmon, "Predicting the Effects of Soil Depletion from Erosion," *Journal of Soil and Water Conservation*, vol. 35, no. 3 (May-June 1980), pp. 131-4.

14. USDA, Economic Research Service, *Agricultural Outlook*, November 1982, p. 14.

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Soil Conservation: Market Failure and Program Performance

by Paul Gary Wyckoff

Since the days of the Dust Bowl, policy analysts and policymakers have worried that uninformed and/or indifferent farmers might wear out the very resource most crucial to their livelihood—the soil. In the 1970s and 1980s, this concern has intensified as part of a growing awareness of natural resource scarcity and environmental quality issues. This *Economic Commentary* examines the economic rationale behind soil conservation programs, assesses the magnitude of the soil erosion problem, and evaluates the effectiveness of current U.S. soil conservation policies. In addition, this article analyzes the reasons why these programs have failed to meet all of their objectives, and it illustrates some common problems in making and carrying out public policy.

Economic Basis for Soil Conservation

Soil conservation programs have two principal economic objectives. First, from the standpoint of efficiency, it can be argued that soil erosion should be prevented because it contributes to the pollution of rivers and streams. The eroding soil hinders the navigation of these waters, and it also can change their ecological character (e.g., by filling up ponds and changing them to marshes), thus destroying the habitat of indigenous wildlife. In addition, the soil can act as a carrier of pesticides, fertilizers, and other agricultural chemicals that can damage the aquatic environment.

The magnitude of this environmental problem has not been clearly established. However, soil conservation programs can be especially important here because soil-erosion-related pollution is of a "non-point" nature—it cannot be easily traced to particular farms or farmers. Thus, the usual environmental regulations or fees cannot be used to combat soil-erosion-related water pollution.

Second, it has been argued that even if agricultural markets operate efficiently, resources might not be distributed equitably across generations by a system of private markets. Once farmland is badly eroded, it is technically possible to restore its productivity through the heavy use of crop residues and fertilizers; yet, the costs are such that it is quite often economically inefficient to do so. Practically speaking, then, land that is destroyed by current generations will be permanently lost to society (or lost for the 100 years to 250 years that it takes for land to rejuvenate naturally). Since succeeding generations are not direct participants in the markets for agricultural land and other factors of production, their well-being depends entirely on the benevolence of the current generation in preserving resources for future use. Many conser-

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vationists argue that a system of unfettered private-resource markets would discount the future too heavily—not enough attention would be given to the needs of future generations. Depending on the importance of intergenerational equity to society and our expectations about the needs of future generations, it might make sense for the government to redistribute resources from current to future generations. This would be similar to the redistribution of income from rich to poor members of the current generation. Ideally, a government responding to this argument would try to lower the rate of discount (or interest) on all productive resources, man-made as well as natural. If this is not possible because of other considerations (for example, macroeconomic policy needs), a second-best solution might be to preserve at least those nonrenewable resources that are crucial to some minimum standard of well-being for future generations. Undoubtedly, productive agricultural land can be considered a crucial resource of this kind.

Intergenerational considerations are further complicated by the rapidly expanding world population and the severe erosion problems being experienced in many underdeveloped nations. Not only do these factors put additional pressure on the resources available in the future, but they also give these intergenerational issues an international dimension as well. Increasingly, policymakers will be asked to decide whether members of future generations who are not Americans, but instead citizens of some underdeveloped nation, ought to be considered in questions of intergenerational equity.

Extent of the Problem

In ***absolute*** terms, our stock of soil "capital" is slowly wearing out. The U.S. Department of Agriculture (USDA) estimates that cropland with a deep topsoil layer can withstand the loss of 5 tons of topsoil per acre per year without loss of productivity. Cropland covered with a thin layer of topsoil can withstand the loss of 1 ton of topsoil per acre per year. (These are the approximate rates at which nature rebuilds the soil.) Based on these standards, the USDA estimates that about one-third of the cropland in the United States is eroding too fast to rebuild all of its productivity. If the cropland used for specialized crops (such as perennial flowers, orchards, and vineyards) is not considered, the national average erosion rate for cropland is 5.1 tons per acre per year.[1]

This soil erosion problem is distributed quite unevenly across the United States. Three areas—the Midwest, the Great Plains, and the Pacific Northwest—are particularly hard hit by soil erosion. The General Accounting Office (GAO) studied a random sample of 283 farms in these regions in 1977 and found that 80 percent of the farms had erosion rates of over 5 tons per acre per year.[2] The Corn Belt states, while encompassing some of the most fertile cropland in the nation, also have some of the highest soil erosion rates. In 1977, for example, Illinois cropland lost an average of 6.7 tons of soil per acre; Iowa cropland lost 9.9 tons of soil per acre; and Missouri cropland lost 10.9 tons per acre.[3]

Despite these seemingly alarming statistics, soil erosion does not present American agriculture with a crisis situation. Although the *rate* of erosion is high in many areas, implying a decline in farmland productivity, the *stock* of U.S. farmland is enormous. When these erosion trends are converted to an acre-equivalent basis and compared with our vast stock of farm capital, a picture emerges of only very gradual decline in soil quality. The executive vice president of the National Association of Conservation Districts, R. Neil Sampson, has estimated that farmland typically can withstand the loss of 650 tons of topsoil per acre before becoming uneconomic to farm. By these estimates, soil erosion reduces the stock of available farmland by only 0.75 percent per year. Even when the diversion of cropland to other uses is included in considerations of cropland loss, Sampson estimates that the stock of available farmland is declining by only 1.5 percent per year.[4] Similarly, Secretary of Agriculture John Block has estimated that erosion will destroy the equivalent of 25 million acres to 62 million acres of cropland over the next 50 years. This translates into an annual reduction of just 0.1 percent to 0.3 percent of the cropland from erosion alone, and a total loss of farmland (from both causes) of 0.85 percent to 1.05 percent per year.[5]

When these very slow rates of soil loss are compared with the slow but steady increases in land productivity from other sources over the past 50 years, it becomes clear that the ***productive capacity*** of U.S. agricultural land is not declining over time: future generations will receive an endowment of agricultural capital that can feed approximately as many people as it does at present. Output per acre increased an average of 1.82 percent per year from 1970 to 1978 and 1.73 percent over the 48-year period from 1930 to 1978.[6] Since additional fertilizer use has caused much of the current productivity increase, future rates of productivity increase will probably be lower than 1.82 percent because of higher energy costs and tighter environmental restrictions. Even at its lowest post-Depression point in the 1940s, however, output per acre grew at an average of 1.29 percent per year. This increase would approximately offset the current loss of soil from erosion and diversion to other uses. Thus, it seems doubtful that the current generation is passing on agricultural resources that are less productive than it received.

Program Performance

Most observers agree that the current soil conservation programs are not working; indeed, there is little evidence to show that these programs have any impact on the rate of soil erosion. The consensus among soil experts is that the resources devoted to soil conservation are not very well focused on the problem. One USDA study concludes that "effectively targeting erosion control funds according to the potential for erosion could more than triple the amount of soil saved through the program."[7]

Current soil conservation policy has two principal components. The Conservation Operations Program (COP), with a fiscal 1982 budget of $311 million, provides technical assistance and advice to farmers about how to reduce soil erosion, mostly in the form of detailed soil conservation plans for individual farms. The Agricultural Conservation Program (ACP), with a fiscal 1982 budget of $190 million, provides cost-sharing funds to farmers who undertake approved soil conservation projects.

An often-heard criticism of COP is that resources are not always concentrated on those farms experiencing the worst soil erosion problems, since assistance is provided only to farmers who request help. Also, because little effort is devoted to follow-up visits to farmers who have been given conservation plans, these plans quickly become outdated and are discarded by the farmer. As a result, the 1977 GAO study cited earlier found that there was no significant difference in soil erosion rates for farmers assisted by COP and farmers without such assistance—a negative finding independently confirmed by two other studies.[8]

The major criticism of the Agricultural Conservation Program is that its cost-sharing funds are not well targeted to projects that reduce soil erosion. A great variety of projects (about 60) are funded, most of which improve the general productivity of farms but have little to do with conserving soil. For example, 10 percent of ACP funds are distributed for the installation of drainage systems (either open-ditch or underground) to remove excess water from flat or slightly depressed farmland. Yet, precisely because of its lack of gradient, this sort of farmland is unlikely to experience much soil erosion.

Because of these targeting problems, less than one-half of ACP funds go to farms with erosion rates of more than 5 tons per acre per year—the farms that really need help.[9] The diversion of funds is so great that the state of Iowa, which started its own program of cost-sharing for conservation projects on a cooperative basis with ACP, decided in 1975 to separate its program completely from ACP. GAO reported that "state officials said that this action had been taken because the ACP authorized too many production-oriented practices that would not achieve enduring conservation benefits."[10]

Why does the USDA continue to fund projects that save negligible amounts of soil? The legislative history of ACP indicates that the general improvement of farm income is an important, although unstated, goal of the program. In 1970, farmers had proposed, and the USDA had approved, 60 different projects related to soil conservation to be funded under ACP. Saying that it wanted to limit funding to projects providing lasting conservation benefits, the USDA had pared this list to a handful of projects by 1975. In that year, however, Congress specifically directed (in the appropriations bill for the program) that *all* of the projects allowed in 1970 should be funded—a clear repudiation of the USDA's efforts to target ACP funds more carefully.

In addition to targeting problems, current U.S. policy conflicts with some powerful economic forces. Because of the nature of consumers' need for food, the demand for farm products rises much more slowly than the demand for nonfarm products as an economy grows. As a result of this imbalance, productive resources of all kinds are

1. See USDA, *Soil and Water Resources Conservation Act Appraisal, Part I. Soil, Water, and Related Resources in the U.S.: Status, Condition, and Trends,* 1980, pp. 97-196. Supt. Doc. No. A 1.2:So 3/7/980.

2. U.S. Congress, General Accounting Office, *To Protect Tomorrow's Food Supply, Soil Conservation Needs Priority Attention,* 1977, p. 5. GA 1.13: CED-77-30.

3. USDA, Soil Conservation Service, *America's Soil and Water: Condition and Trends,* December 1980, p. 9. A 57.2:Am 3.

4. See R. Neil Sampson, "The Ethical Dimension of Farmland Protection," in Max Schnepf, Ed., *Farmland, Food, and the Future* (Ankeny, Iowa: Soil Conservation Society of America, 1979), pp. 91-4.

5. See Secretary Block's remarks in a hearing before the U.S. Senate Committee on Agriculture, Nutrition, and Forestry, *Administration's Recommendations for a Comprehensive Soil and Water Conservation Program: Hearings before the Committee on Agriculture, Nutrition, and Forestry, October 28, 1981,* p. 20. Y 4.Ag 8/3:So 3/5. The figures for rates of change are from the author's calculations, using figures from Secretary Block's remarks and from Sampson, "The Ethical Dimension."

6. See J.B. Penn, "Economic Developments in U.S. Agriculture during the 1970s," in D. Gale Johnson, Ed., *Food and Agriculture Policy for the 1980s* (Washington, D.C.: American Enterprise Institute, 1981), pp. 15-7.

7. USDA, *Soil and Water Resources Conservation Act Appraisal, Part I,* p. 51.

8. See *To Protect Tomorrow's Food Supply,* p. 16; Christine A. Ervin and David E. Ervin, "Factors Affecting the Use of Soil Conservation Practices: Hypothesis, Evidence, and Policy Implications," *Land Economics,* vol. 58, no. 3 (August 1982), pp. 277-93; and Herbert Hoover and Mark Wiitala, *Operator and Landlord Participation in Soil Erosion Control in the Maple Creek Watershed in Northeast Nebraska,* USDA, 1980.

9. *To Protect Tomorrow's Food,* p. 16.

10. *To Protect Tomorrow's Food,* p. 16.