Economics of Soil Conservation

or

Does Soil Conservation Pay?

John J. Waelti
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What is "Conservation?"

To this audience, whose members have been in the conservation movement for years, and who both practice and advocate soil and water conservation measures, it may seem to be a meaningless exercise to define what we mean by "conservation." Yet, the term is often used loosely, and in such a way as to convey wrong impressions. While we can apply the term to any natural resource, I will use it in the context of soil.

People occasionally suggest that conservation is "non-use." "Preservation" is a more accurate term with which to describe non-use. To carry the point further, conservation does not mean reducing the rate of soil loss to zero. It means, however, the deferred use of a resource to a later time as compared to a use pattern in which the resource is used earlier during a planning period. Hence, we can refer to "soil conserving practices" such as rotations which include several years of legumes. The use of terraces and contouring are further examples of conservation practices. The soil is being used, and some is being lost. However, less is being lost than would be the case with a rotation with a heavier emphasis on row crops, or with not using practices such as terracing and contouring.


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Again, the rate of soil loss is not reduced to zero. However, the rate of loss is reduced, thereby contributing to a higher rate of productivity in the future.

The Incentives of Producers

"Investment" basically is the deferring of present consumption in order to achieve more consumption at a later date. Since conservation involves such a tradeoff, the basic elements of this decision are similar to any decision regarding investment.

Investment decisions regarding soil conservation are made by individual farmer-producers in accordance with their perceived self interest. To put it in simpler terms, "farmers will do what they see to be profitable." The actions of producers may be modified by society through rules, regulations, taxes and subsidies to be consistent with social goals. Ethical and social values (conservation practices which are considered to be socially responsible and which draw praise from the community) may also affect individual actions. The producer is nonetheless faced with the hard profit-loss decisions faced by any entrepreneur of a competitive enterprise.

The basics of the investment decision, then, are the costs incurred for the present relative to returns realized in the future. The catch is, however, costs and returns to whom? The reason why the decisions of a private entrepreneur become a matter for public policy is that short run decisions for the producer may not be consistent with the long run decisions for society. Let us take a closer look at the decision process and the nature of the costs and returns to see why this may be so.

In an investment decision, the present value of the costs are compared with the present value of the anticipated returns. Normally, the costs occur
early in the planning period—the returns later. The existence of an interest rate means that the present value of future benefits are reduced. A quick glance at the accompanying table shows that benefits received far out in the planning period tend to be relatively insignificant in terms of present value. Furthermore, as the interest rate rises, the present value of future amounts becomes even less. At 20%, the present value of $1,000 fifty years from now is only eleven cents.

The cost of an investment in conservation practices may be in terms of capital expenditures, reduced income because of emphasis on grass and legumes rather than row crops, or because of leaving more of the field in grassed waterways. The costs of these investments and the foregone income could either be enjoyed as consumption, or invested in alternative projects. Thus, the rate of return on the investment must be at least equal to the rate of return in alternative investments. If this is not the case, the producer simply does not have the market incentive to undertake conservation projects. Again, present interest rates make income received more than ten to twelve years from now relatively insignificant.

Institutions having responsibility for maintaining soil productivity, such as the U.S. Soil Conservation Service, have been lamenting that the nation has "gone backward" recently in terms of soil conservation programs. There are several factors which have contributed to this. First, the high farm prices since the early 1970s have brought additional land into production, some of which is marginal, and which has high potential for wind and water erosion. Furthermore, high prices for row crops such as corn and soybeans increases the cost (in terms of foregone income) of maintaining a high grass-legume rotation and in terms of leaving grassed waterways.
### Table 1: Present Value of $1,000 at Various Rates of Interest.

<table>
<thead>
<tr>
<th>Year</th>
<th>5%</th>
<th>8%</th>
<th>12%</th>
<th>16%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$952.38</td>
<td>$925.93</td>
<td>$892.86</td>
<td>$869.57</td>
<td>$833.33</td>
</tr>
<tr>
<td>2</td>
<td>907.03</td>
<td>857.34</td>
<td>797.19</td>
<td>756.14</td>
<td>694.44</td>
</tr>
<tr>
<td>3</td>
<td>863.84</td>
<td>793.83</td>
<td>711.78</td>
<td>657.52</td>
<td>578.70</td>
</tr>
<tr>
<td>4</td>
<td>822.70</td>
<td>735.03</td>
<td>635.52</td>
<td>571.75</td>
<td>482.25</td>
</tr>
<tr>
<td>5</td>
<td>783.53</td>
<td>680.58</td>
<td>567.43</td>
<td>497.18</td>
<td>401.88</td>
</tr>
<tr>
<td>6</td>
<td>746.22</td>
<td>630.17</td>
<td>506.63</td>
<td>432.33</td>
<td>334.90</td>
</tr>
<tr>
<td>7</td>
<td>710.68</td>
<td>583.49</td>
<td>452.35</td>
<td>375.94</td>
<td>279.08</td>
</tr>
<tr>
<td>8</td>
<td>676.84</td>
<td>540.27</td>
<td>403.88</td>
<td>326.90</td>
<td>232.57</td>
</tr>
<tr>
<td>9</td>
<td>644.61</td>
<td>500.25</td>
<td>360.61</td>
<td>284.26</td>
<td>193.81</td>
</tr>
<tr>
<td>10</td>
<td>613.91</td>
<td>463.19</td>
<td>321.97</td>
<td>247.19</td>
<td>161.51</td>
</tr>
<tr>
<td>25</td>
<td>295.30</td>
<td>146.02</td>
<td>58.82</td>
<td>30.38</td>
<td>10.48</td>
</tr>
<tr>
<td>50</td>
<td>87.20</td>
<td>21.32</td>
<td>3.46</td>
<td>.92</td>
<td>.11</td>
</tr>
</tbody>
</table>
A second factor is high interest rates. As we again note from Table 1, higher interest rates penalize future benefits which would be realized from conservation practices.

Still another factor is the introduction of ever larger machinery which is less compatible with terraces and contouring. The incentive is for producers to tear out windbreaks and fencerows and to plow up waterways in order to have fields which are larger and more convenient for big machinery.

While it is difficult to say how much each of these factors contributes, casual observation is consistent with warnings of conservation agencies. I see fields near my home area in Southern Wisconsin which I remember as being contoured, now being plowed straight through by large machinery. Parts of fields formerly left in grassed waterways are now planted to corn. While the market incentives are to farm intensively, the eroded soil and sediments washed off those fields are clearly not in the longer run interests of society. While this example is only a personal observation, let us look at some empirical evidence to see what market incentives are. Following that, we will look more in detail at the nature of, and reasons for, the dilemma of the divergence between goals of the individual and of society.

Empirical Evidence

As we look at empirical evidence regarding market incentives two points need to be made. First, not all farmers use only market incentives as their total basis for decision making. Most producers consider to some degree a stewardship responsibility for land. Furthermore, a farm version of "peer pressure" exists. Positive rewards in terms of recognition, and negative sanctions in terms of neighborhood disapproval exist. Yet, in view of the current situation, these obviously are not sufficient. Factors which weaken...
the effect of positive non-monetary rewards and negative sanctions are a degree of absentee landownership, and farm neighborhoods which are less close than in the days of neighborhood cooperation in threshing, shredding and silo-filling. Today's farmer is likely to be similar to the urban resident that never visits, or perhaps does not even know, the resident across the street.

The second point in looking at empirical evidence is that at this stage we are not attempting to specify what producers should do. We are simply looking at where the market incentives lie. To the extent that market incentives produce actions that diverge from the goals of society, we will need to look at alternatives for public policy. The highpoints of several empirical studies follow:

An Illinois study concludes that sediment damage from erosion is as high as 16% of net income per acre. Each area should separately determine which combination of crop rotation, tillage system, and conservation practice is best from society's point of view.1/

A second Illinois study concluded that farmers had no incentive to change crop and tillage methods unless sediment damage was included in income.2/ A study of another Illinois watershed concluded that if total cost of soil erosion were computed, it would be in society's interest for

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farmers to change rotations and tillage practices.  

Another Illinois study concluded that on the watershed studied, conservation tillage methods could reduce sedimentation by 50%, and leave net farm income at current levels. However, reductions in sediment by more than 50% would be at the expense of farm income.  

A 1979 study concludes that unless a more effective public policy is instituted, much of the A horizon soil will be lost within a 100 year period.  

A Southern Iowa study concludes that the costs of reducing erosion to "tolerable levels" is three times higher than the benefits.  

A recent Pennsylvania study concludes that in the short run, a strict soil loss policy could reduce the income of dairy farmers.  

An Idaho study concludes that soil conserving practices reduces the income of wheat farmers.

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One could go on. But the point is made that the pure market incentives of producers often differ from the goals of society.\footnote{For a more complete list of references on economic incentives and soil conservation see: Kerestes, D. and K. W. Easter, A Review and An Annotated Bibliography of Studies of Soil Conservation Programs, Practices and Strategies. Dept. of Agricultural and Applied Economics, University of Minnesota Staff Paper P81-1. January 1981.}

The Dilemma

The goal of society is to have an adequate food supply at reasonable cost today, and to ensure that future generations will be provided resources with which to produce an adequate food supply for themselves. A further goal of society is to maintain non-point pollution at a level which is not injurious to water quality and which is consistent with a dependable food supply. The goal of producers is to manage their farms to achieve a satisfactory level of living today and to bequeath a viable operation to their children.

The goals of the individual and society may differ because of two factors: 1) the previously mentioned time factor and 2) the matter of external costs. Let us examine each of these in turn.

For both producers and society, investment involves the tradeoff between a lower level of consumption today for an anticipated higher level in the future. A major problem, however, is that the time dimension of individuals and society differs. Within a generation, or even two generations, income losses due to erosion may not be noticeable, particularly to the extent that technology overcomes or "masks" the effect of erosion.

From society's perspective, however, the individual planning horizon is too short. Individuals perceive no market incentive, especially at high interest rates, to make investments for which the payoffs are uncertain and far into the future. Most individuals are not confronted with the problem
of irreversible damage of the soil resource within their planning period. Thus the market fails to provide adequately for the future.

The second source of market failure is the matter of external costs. A part of the cost of soil erosion is sedimentation of lakes and streams. This cost is incident on society in general. Costs of sedimentation to the individual responsible for erosion are insignificant or zero. Since the existing market provides no means for the costs of sedimentation to be realized by the individuals responsible, the actions of the individuals are again not in accord with the goals of society.

**Policy Options**

The central question is, "What combination of soil loss and food production does present day society wish to achieve?" Soil loss could be reduced to near zero. But this would be at tremendous cost in terms of foregone food production. These costs are greater than society wishes to incur. The objective, then, is a tolerable rate of soil erosion consistent with adequate food production. Further, because of the market incentives, society prefers a lower rate of soil erosion than is currently induced by market forces. Let us briefly examine several policy options.

One possibility would be that of regulations for tillage practices. This would limit farmers in their choice of production methods. For example, farmers might have to increase small grains and grass-legumes in their rotations. The effect of this policy would increase cost of food production and decrease output. This in turn would drive up food prices and reduce the U.S. competitive position in international markets.

Another alternative would be to tax soil loss. The effect of this might be to increase food prices through the effect of reduced production.
Under either the regulation or soil loss tax approach which would tend to decrease production and increase food prices, low income consumers would bear a large part of the burden of soil conservation.

There are other policy options which may be more palatable to farmers and perhaps to consumers as well. Farmers could be subsidized indirectly or directly for reducing soil erosion. They could receive payments for adopting certain cropping practices or rotations. A policy in operation for some time is cost-sharing and technical assistance by the Soil Conservation Service for adopting practices such as contouring, strip cropping, and terracing.

Taxes and regulations strike a negative chord, especially during these times when so many people seem to be questioning what they perceive to be "government intrusion into private affairs." There is a cost of administering programs of regulations and soil loss taxes. Regarding subsidies, the taxpayer tends to question the legitimacy of subsidizing a farmer for "what he should be doing anyway." The proposition that there is a divergence between private incentives and public objectives often becomes lost in policy discussions.

A policy tool that is increasingly discussed is to tie eligibility for government price and income support programs to compliance with soil conservation practices. A producer might be required to use recommended conservation practices, for example, to qualify for a price support program. Producers who cultivated land recommended left in permanent pasture could be denied participation.

These possible methods each have their limitations. There are two other points that merit discussion, however. The first of these is
technology. The "big machinery" technology has undoubtedly been a factor which has given a disincentive to follow soil conserving practices. However, one must feel that we have hardly begun to adequately explore the technology involving, for example, minimum tillage methods, tillage practices which would leave more residue on the ground or which in other ways would make high value crops consistent with soil conservation. This would seem to be a high priority area for research by government and Land Grant institutions.

A second point is the matter of a "conservation ethic." It has been said that civilization depends on the willingness of people to follow unwritten rules. No government can regulate everything. Regulations are costly and unpopular at best. However cold reality dictates that they are often necessary. My safety in crossing the street is dependent on the assurance that you will stop your vehicle in recognition of the red light. But again, since not everything can be regulated, the limited capacity of government must be directed toward those "rules of the game" deemed most urgent.

If a "conservation ethic" can be fostered, government rules and regulations for soil conservation may not be as necessary. However, as we have seen, the market incentives do not favor it. Further, the loss in rural neighborhood solidarity has reduced the peer pressure for adopting conservation practices. Groups and associations such as the Soil Conservation Society can do much toward fostering such an ethic, and can provide extremely valuable educational programs, and group support for conservation efforts. This is an example of a set of activities conducted by an association of individuals with the government being a cooperator instead of a negative rule-maker or enforcer. Again, however, we must be pragmatic and recognize
that as long as individual incentives are not consistent with social goals, we are facing the necessity of public policy options which may affect the actions of the individual producer.

Summary

The market creates incentives for the producer which lead to a rate of soil erosion greater than that consistent with public policy objectives. Therefore, methods are needed to reduce soil erosion to levels consistent with public policy objectives. Technology oriented toward cropping and tillage practices more consistent with soil conservation is a step in that direction. The fostering of a "conservation ethic" may reduce the necessity for rules and regulations on cropping and tillage practices. Yet, as long as the market incentives lead to actions not consistent with social objectives, policy options including taxes, regulations, subsidies, and technical assistance will be increasingly discussed as alternatives to help reduce the rate of erosion.