

Soil Depletion and
Land Rent

7 - NRJ article

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Washington, D. C. 20250

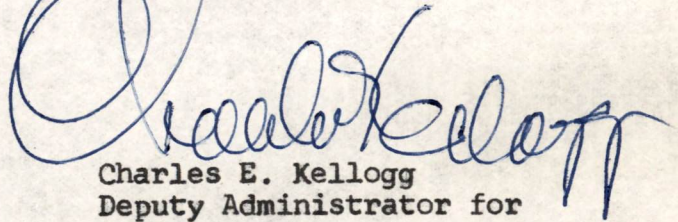
May 7, 1965

Dr. M. Mason Gaffney
Department of Economics
University of Wisconsin
Milwaukee, Wisconsin

Dear Dr. Gaffney:

If you receive reprints of your article, Soil depletion and
land use, in the January issue of the "Natural Resources Journal,"
I should like to have one.

Sincerely yours,

A large, stylized handwritten signature in blue ink, which appears to read "Charles E. Kellogg".

Charles E. Kellogg
Deputy Administrator for
Soil Survey

but sometimes it is not. The question always is whether the gains outweigh the costs.

If this obvious but important point is neglected, the way is open to advocate policies that make no economic sense at all. An extreme example is provided by those who have been able to conclude—without examining costs—that government policy should be directed to the *full* regulation of nearly all the nation's streams over the long run. (Full regulation means the complete or nearly complete evening out of flow on a stream. The usual means for doing this is to build storage capacity behind dams.) Other cases of error resulting from neglect of costs may be more subtle. For example, no satisfactory argument can be constructed for an indiscriminate policy of maximum sustained yield from "forest lands." Nor can a satisfactory argument be made for a policy to conserve coal by requiring coal operators to mine 100 per cent or any other percentage of the coal in a deposit. Such questions cannot be discussed usefully without reference to costs.

Conflicts within the conservation area will not be eliminated even if the term conservation is used in a proper way; that is, without pretense that a particular conservation policy is desirable, *ipso facto*, without reference to costs. But clear usage is a tool which at least will not hinder—and probably will aid—the resolution of conflicts over the use of resources. It is likely that a clear usage, always with the realization that conservative action is desirable only if benefits exceed costs, will be of increasing importance, for the intensity of conflicts over the use of certain resources probably will increase as time goes on.

In the future as in the past, however, many conservation problems will continue to be settled for us by the working of the private market system. This is especially true of the minerals industries. By and large, we accept the price system as the arbiter between the present and the future, and there is little prospect that this practice will be abandoned. We do not, for example, impose a tax on the production of copper in order to save copper for use by future generations. The problem of the level of recovery is left to the mining company, the smelter, and the refiner. The reason why the price system can be trusted to yield a suitable solution to many of the conservation problems involving minerals is that costs and benefits involved in mining and related activities effectively enter into the calculations of private firms to a greater extent than is true for the exploitation of other natural resources.

The petroleum industry in the United States constitutes a notable exception, of course. The fact that single ownership was not coextensive with oil pools required some sort of action to prevent the need-

less multiplication of oil wells and to prevent economically wasteful loss of oil underground. Our attempts to cope with these problems seem to be running into increasing difficulty, however, not because the problem of rational exploitation of an oil pool has suddenly become more difficult from a technical point of view, but because the particular method of control in vogue is yielding some undesired results.

The elements of our control system are, first, control (actually only partial) of total production of the industry. The objectives are mixed, of course, being both conservation and control of price. If control of price were not involved there would be no restriction of production of individual wells below "efficient capacity" or perhaps MER (maximum efficient rate). The second element of the system is spacing regulation. A third element is limitation of imports. An additional point, so important it must be called a fourth element of the system, is that there is essentially no restriction on the development of new producing capacity other than the test of profitability. The combined effect of these factors is the development of capacity to produce far in excess of current production, as could easily have been predicted.

The difficult conservation problems—and this includes U.S. petroleum production—arise in those cases where relevant costs and benefits are not united in the calculations of a single economic unit. In some cases, the benefits from a certain action cannot be appropriated by the business that would have to pay for the action. Elimination of stream pollution is a case in point. Or the benefits from a certain action may be worth the cost to a firm, but perhaps this action imposes costs on others for which the firm does not have to pay. Logging and grazing may increase the rapidity of runoff, for example, an effect that may be of no concern to the logger or grazer but which may be of prime importance to downstream users of the water. Sometimes a governmental decision-making unit may neglect certain costs or benefits because it is engaged in stimulating one type of resource use. This may even be viewed—in practice if not legally—as its official mission. Sometimes certain costs or benefits are not brought to bear on a decision because they cannot be quantified in money terms or can be described only in vague nonquantitative terms.

It is likely that in the natural resource area this type of problem will become more pressing as time goes on, both because demands for each of the possible uses of some resources are growing relative to supply, and because new rival demands are rising rapidly whereas before they may have been inconsequential.

Consider, for example, just a few of the various parties with at least

partially conflicting interests in the way land and streams are used. There is irrigation vs. power, irrigation vs. domestic and industrial water use, uses requiring dams vs. the scenery, fishing, etc., associated with flowing streams, in particular the whole complex of benefits associated with flowing streams vs. domestic and industrial water use. There is the sand and gravel pit or the clay pit with its ugliness and sometimes dangerous pools of water vs. the residential area with its small children, logging vs. scenery, highways bringing a greater density of people to remote areas vs. solitude, logging and grazing vs. the people downstream who want a slower runoff, and so on.

There are two factors that will tend to intensify these conflicts as time goes on. One is the increase in population, with its obvious effects on the demands for the many different uses of water and on the supply of open space. The other factor is what appears to be an increasing per capita demand for many particular forms of outdoor recreation and for outdoor recreation in general. A number of these forms of recreation do require extensive space and a low density of people. The changing structure of demands for services of resources arising from these two factors suffices to insure no easing of problems in the conservation area.

Exploitation of minerals may be less affected than will be the use of other natural resources, but even here the increased density of population will have its effect—by zoning or otherwise—especially on the ubiquitous minerals. And even in areas where population density remains low, mineral operations will experience more frequent collisions with the various forms of outdoor recreation activity. This will not be a new problem, but it will arise more frequently.

How are the conflicts to be resolved? A first step has already been suggested; namely, to stop pretending that a policy is desirable just because it entails the conservation of something.

Some conflicts can be solved easily since they involve situations in which all the potential users of a resource can *effectively* voice their demands in monetary form. In such cases the presumption in our society (but perhaps rebuttable in some instances!) is that the highest bidders should win, whether the resource is in public or private ownership. It is highly desirable that an effort be made to develop new forms of organization and procedure to permit more extensive use of the market to resolve questions of resource use.

But in many cases there are serious difficulties standing in the way of a thoroughgoing market solution of the problem of rival demands. While interference with and modification of the market's solution will

not necessarily yield a better result, the possibility is open. Regulation of the way a resource is used may be desirable where the private user does not take account of significant costs or benefits that his action imposes or gives to others. Some decisions have long-lasting consequences requiring an estimate of demands and costs far into the future, with some cases involving social penalties for underestimate (or overestimate) that may not effectively enter into the private decision. Some benefits and costs do not yield easily, if at all, to valuation in terms of money even for current flows of benefits and costs, let alone those of the future. Here we must analyze and calculate as best we can, trying to search out *all* benefits and costs, some of which may have to be measured and described in nonmonetary terms. It should be recognized that there *are* benefits flowing from natural resources for which individuals cannot express their preferences in money terms simply because there is no feasible way for this to be done. In particular, it will not do to argue that society "needs" lumber or minerals but that scenery, etc., can always be dispensed with. This is an unreal choice, for the problem always involves a specific location. If consumers could express their preferences in economic terms, they might well indicate they want a particular slope to be forested rather than bare.

A consequence of the fact that some flows of benefits and costs do not receive effective expression in monetary terms is that some of the decisions about the use of natural resources inevitably involve substantial redistributions of real income. The losers from the destruction of the beauties of nature are rarely compensated. The point is not that they should be compensated or that "nature" must always be preserved. The point is that, at a minimum, those whose responsibility it is to make decisions on the use of certain resources should be aware that attention to total costs and benefits may not be enough, for the effects on the real incomes of particular individuals may be substantial.

Unfortunately there is no magic formula that will resolve these problems. The "multiple use" solution, for example, is certainly applicable in many cases, but in some cases it turns out to be just a slogan serving to camouflage the complete sacrifice of one use to others. For example, a reservoir may yield multiple uses including certain forms of recreation, but it is also true that construction of a reservoir entails the complete sacrifice of all uses that depend on the presence of a flowing stream. Once again the lesson is that no slogan, not even one so appealing as multiple use, can resolve all the conflicts present in resource use. Some uses are simply inconsistent with some other uses.

In any particular decision involving incompatible uses, one or the

other must be sacrificed, of course. But for a group of decisions involving different projects, uses need not be inconsistent for all projects in an area taken together. It is only by paying close attention to the evolving pattern of use decisions that it is possible to give recognition and at least partial satisfaction to incompatible demands. An indiscriminate application of a multiple-use slogan runs the danger that certain uses which are inconsistent with "multiple use" will get neglected in decision after decision, thus securing no recognition in the final picture that emerges.

In many cases the instrument for resolution of conflict will have to be the political process. The participants include not only those ordinarily thought of as politicians, but the varied types of participants in any significant political problem such as interested voters, government employees, lobbyists, journalists, and so on. Obviously *some* sort of resolution comes out of the process, but the question is how to make the results better. Certainly information and understanding of effects are necessary. Apart from this we need ingenuity and imagination in the formulation of new or variant solutions—new compromises, if you like. And in this area, as in many others, the majority ought to take very seriously its obligation not to trample unheedingly over the minority. In the case of nature preservation issues, especially, certain segments of the population may receive an important part of their real income—measured in satisfaction—from publicly or privately owned resources in which they have no legal interest.

If this advice is taken to heart by the participants in these conservation problems, a change in posture will be required in some cases. While it may seem tactically wise—and may even be pleasant—to oppose all dam construction or to damn the wilderness enthusiasts as a minute nonworking portion of the population with perverted tastes, any progress toward a more suitable resolution of conflicts as they arise is going to be made by those who are less inflexible. An abandonment of fixed positions would be helpful.

The main burden of this discussion perhaps will not be attractive to those who believe that greater conservation of some one thing is always desirable, whether that be songbirds, irrigation water, trees, or grass for sheep, for we have downgraded the term. As often used, it is taken to imply sufficiency for action. The view suggested here, on the other hand, is that a conservative act may or may not be desirable, depending on all the associated benefits and costs and perhaps on the redistribution of real incomes involved. But this downgrading of the term, if it should be called that, does not carry with it any implication that

conservation issues are unimportant. Rather, insistence that acts of conservation should not be undertaken simply because something is conserved reflects a view that conservation problems are so important that it is unwise to deal with them on the basis of slogans.

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Museum Gaffney

What Is Conservation?

By

ORRIS C. HERFINDAHL

More a petulant outburst than a constructive contribution.



Reprint Number 30
AUGUST 1961

RESOURCES FOR THE FUTURE, INC.

1775 MASSACHUSETTS AVENUE, N.W.
WASHINGTON 6, D. C.

*Single copies free on request
Additional copies 25 cents each*

Reprinted from *Three Studies in Minerals Economics*, published by Resources for the Future, Inc., 1961.

RESOURCES FOR THE FUTURE, INC., a nonprofit corporation, was established in October, 1952, with the co-operation of The Ford Foundation. Its purpose is to advance the development, conservation, and use of natural resources through programs of research and education. Most of its studies are in the field of the social sciences.

I

WHAT IS CONSERVATION?

A discussion between two conservationists who are interested in conserving different things often degenerates into polite name calling or worse. Smith will tell Jones that he doesn't know what *true* conservation is. And Jones will reply acidly that what Smith proposes—far from being conservation—is profligate waste. Finally the discussion ends from boredom or exhaustion, with each conservationist walking away shaking his head and saying to himself that he doesn't see how anyone could hold such inane views. The outsider viewing this fruitless exchange is puzzled. If both parties are for conservation, which everybody seems to think is a good thing, what are they quarreling about?

One of the difficulties is that the word conservation is used with varying meanings, often without telling the other party to the discussion what one's own definition is. But the confusion is not simply a matter of failing to let the other fellow in on one's private definition, for many users of this term seem to have no clear definition of their own and seem to prefer the ambiguity that results.

The imprecision surrounding use of the word, conservation, has been associated with widespread attempts to appropriate its persuasive sound for special interests. If a certain proposal is labeled a conservation proposal, or to go even further, if the proposal is said to represent *true* conservation—implying that there is a subtle but compelling case for its adoption—there is probably a tendency for more favorable reaction than if a less emotive term is used. After all, if a person is asked whether it is better to conserve or not conserve, he no doubt will vote for conservation. Of course it would be unthinking of him to vote at

all since he didn't ask the questioner what meaning was to be given to conservation, but the point is that the mere mention of the word tends to stimulate favorable response rather than a search for meaning.

The confusion surrounding use of the term conservation and the attempt to appropriate favorable reaction to it for special interest proposals and programs is readily apparent to even the most cursory examination. It is an interesting exercise to go over speeches or writings on conservation matters and to ask what definition of conservation the person might have had in mind. Quite often it turns out that he believes his policy should be adopted *because* it will conserve (that is, save for future use or preserve for use) a *particular* resource product, for example, water for irrigation. But confusion arises when the city dweller insists that the water should go to the city for drinking, cooling, etc., because *that* is really conservation.

Sometimes general definitions are given. A widely favored one is the following: "Conservation is the use of natural resources for the greatest good of the greatest number for the longest time." This is the definition that Gifford Pinchot, the founder of what historians are wont to call the Conservation Movement, was fond of using. Pinchot credits the definition to W J McGee (who insisted on no periods after the initials), a freewheeling intellect of very wide interests and great ability who worked with John Wesley Powell and later with Pinchot.¹

When this definition is read off rapidly—conservation is the use of natural resources for the greatest good of the greatest number for the longest time—the three superlatives have a delightful ring. If this is conservation, how could anyone be opposed to it? No one could be, of course, unless he stops to ask himself how three variables can be maximized at the same time. Imagine a father trying to distribute a bag of candy to his children so as to maximize the amount of candy received by each child who gets candy *and* the number of children receiving candy *and* the length of time the candy will be visible.

Still another general formulation has enjoyed great popularity with politicians for over half a century, and with others whose audiences are of opposing minds. Again let us take Pinchot's formulation, which may have been fathered by him: "Conservation implies both the development and the protection of resources, the one as much as the other. . . ."² On the surface, this should command general assent, for

¹ Pinchot, Gifford, *Breaking New Ground* (New York: Harcourt, Brace and Co., 1947), p. 326.

² *Proceedings of the Joint Conservation Conference*, Sen. Doc., 60th Cong., 2nd Session, Vol. 10, p. 123.

who among us is opposed to development? Who is opposed to the protection of resources? The trouble comes when the blanks are filled in. Suppose that development means covering a canyon with a lake for purposes of power and irrigation while preservation means leaving the canyon alone so that its beauty can be seen. An excellent example is provided by the Echo Park controversy. It was indeed impossible both to develop the dam site and at the same time preserve one of the products of this natural resource, namely, the beauty of Echo Park and the nearby canyons. Unfortunately, a verbal incantation that reconciles the irreconcilable does not in fact resolve the very real conflict between development and preservation. There is no inconsistency between development and preservation, however, if one's objective is the "conservation" of only one of the uses of the resource.

In the case of mineral resources, the stock of which is used up in the act of consumption—perhaps with some recirculation—the injunction to develop and preserve simultaneously is even more mystifying than it was in the preceding case. Development in the case of minerals means production, but preservation presumably means postponement of consumption. How can both be done simultaneously except by accumulating an ever larger inventory of metal above the ground?

Pinchot's casual approach to the problem of definition is even further illustrated on the same page where we are admonished both to develop and to preserve. For example, "The essence of conservation is the application of common sense to the common problems for the common good." Or, "Conservation is simple, obvious, and right." Comment would be superfluous.

Slackness and confusion in definition, so clearly exemplified in the writings of Pinchot and his contemporaries, have continued down to the present. It is only the exceptional writer on conservation whose use of the word is not self-contradictory or a mere camouflage, whether deliberate or not, for the promotion of some special interest such as special wilderness areas, irrigation, power, and so on. The definitions of Pinchot's time, perhaps better called slogans, have been repeated ever since. "The greatest good for the greatest number for the longest time" will be with us for a long time to come. And almost any speech on natural resources coming out of the Department of the Interior contains the contradictory admonitions to develop and to preserve within the same sentence.

What is the origin of this confusion in definition? Why has it continued for so long? In my view this indifference to clarity of definition rests in considerable part on the existence of deep underlying conflicts

among various interest groups in the area of conservation policy, by which I mean the policy problems involved in determining how natural resources are used. Proponents of special conservation interests, in their zeal to alter governmental policy, have made clarity and consistency of definition a secondary consideration. Indeed, clear definition might lose all the advantage to be gained from using so fine sounding a word as "conservation" or the related "develop and preserve." Clarity about real intentions might unnecessarily antagonize those who otherwise would not press home to the real meaning behind generalities.

Certainly one of the dominant conflicts in the field of conservation was and is the conflict between development and what I shall call nature preservation. By development is meant the use of natural resources in such a way as to involve the construction of auxiliary capital goods such as dams, roads, processing plants, hotels, etc. "Nature preservation" is a term which embraces the whole spectrum of groups interested in preserving various aspects of nature as she is (Or is it with some "development"?) for the direct enjoyment of individuals. Such diverse things are involved as birds (to be preserved for eye, ear, and palate), solitude, scenery, trees, flowing water, naturally still water (that is, natural lakes), etc. This is sometimes said to constitute the birds and bees school of conservation, a phrase that can be uttered with a tone of either affection or derision, depending on whether one is in or out of the group.

The antagonism between development and nature preservation has always been present in the field of conservation. Even the founder of the movement in the United States, Gifford Pinchot, was not disposed to ride both these horses at the same time. It is quite clear on reading his writings that he was a developmentalist first and a preservationist only secondarily, if at all.

For example, in 1903 Pinchot made the following statement in an address to the Society of American Foresters:

The object of our forest policy is not to preserve the forests because they are beautiful . . . or because they are refuges for the wild creatures of the wilderness . . . but . . . the making of prosperous homes . . . Every other consideration comes as secondary.³

It is not surprising that the nature preservationist groups became increasingly dissatisfied with Pinchot's views on what conservationists should be doing, and that they came to feel he was using the Conservation Movement to promote policies to which they were strongly op-

³ Quoted in Hays, Samuel P., *Conservation and the Gospel of Efficiency* (Cambridge: Harvard, 1959), p. 41.

posed. This divergence in points of view was an important factor in bringing about the disintegration of the Conservation Movement.⁴

The conflict between development and nature preservation has erupted from time to time in pitched battles. For example, New York's constitutional provision requiring the Adirondack State Park lands to be kept "forever wild"—that is, with no lumbering—was the subject of intense controversy in the constitutional revisions of 1895 and 1915, and there are always attempts to nibble away at it. Most recently the nature preservationists tilted with developmentalists who wanted a thruway constructed to pass through the eastern part of the Park. This controversy is especially interesting for our purposes because it also provided an example of the conflict between development and preservation *within* the ranks of the preservationists. That is to say, the preservationists were divided, with one group, whose *bona fides* is not open to question, supporting the thruway partly on the ground that it would not prevent the preservation of anything worth preserving. The Constitutional amendment required to allow construction of the thruway (called the Northway) was passed, and construction is in progress.

The Hetch-Hetchy controversy, involving construction of a dam across a beautiful valley to supply water for San Francisco, is still remembered by many. The establishment and the regulations governing the uses of wildlife refuges, national parks, and national forests have been and continue to be the source of controversy between the two groups. Recently an intense struggle has been going on over a bill that would establish wilderness areas on certain parts of Federal land holdings.

These few brief references give only a hint of the depth and pervasiveness of the perennial conflict between development and nature preservation. It should be emphasized again, however, that this is not the only controversy within the groups who call themselves conservationists. Various types of development often turn out to be incompatible with each other: irrigation versus urban water supply, for example. And within the nature preservation group there are latent conflicts that come into the open every now and then. The split over construction of the Northway has been mentioned, but there are many more. For example, the National Park Service—certainly a nature preservationist organization—frequently comes under fire because it concedes too much to development in the form of roads, accommodations, and so on. Struggles within the preservationist group fre-

⁴ *Ibid.*, passim.

quently involve a difference of view in the amount and type of development in the form of facilities that should accompany "preservation."

It is these conflicts, then, which are an important source of uncritical or intentional usage according to which the statement that a certain action or policy is conservative in nature (in the everyday meaning of conserve) is meant to imply the desirability of that action or policy. "Build the dam, because that will *conserve* water and prevent its waste in spring floods." Or, "It is only by not building the dam that the natural beauties of the valley can be *conserved*." Each side has tried to wrap itself in the favorable reaction surrounding the word conservation.

Broadly speaking, there are two ways by which usage can be brought to heel so that it will aid rather than hinder understanding. One way is to say that the goal of conservation policy is to adjust outputs through time in such a way as to maximize the return from all resources at the disposal of society. In the process of doing this, some resources will be used up, perhaps "completely," and there may be a gradual transformation of "natural" resources into man-made capital "goods" of many different types. To put it differently, this view of conservation policy equates it with "wise use of resources."

This is a view that enjoys considerable currency. If carefully adhered to, it avoids what we have called the main difficulty in usage, for on this view you cannot say that a certain policy represents "true conservation" until a *complete* economic analysis of its effects has been attempted, and no reasonable person can ask for more than that. But to equate conservation with "wise use" is to attain a defensible usage only by assimilating the problem of conservation completely into the general economic problem of maximizing output and by departing radically from the everyday meaning of the word "conserve."

Def. It is preferable, in my opinion, to preserve common usage and to agree that a conservative act is one which saves something for future use instead of present use or which saves something for use instead of nonuse. This usage leaves open the possibility that the conservation of one resource may entail the sacrifice of another resource which others may want to conserve. Thus there is *no* justification for concluding that a certain policy should be adopted simply because it conserves some resource, for it may involve so much cost either in the form of current productive services required (e.g., to build a dam) and/or in the destruction of *other* resources that it is not justified. A proper usage, if the everyday meaning of "conserve" is retained, should *not* involve the implicit view that conservation is always desirable. Sometimes it is,

Candahl, Murray. & Schalter

'Ec. Rating of Sails for Tax Act.'

f7E 8-54; 483-99

Accessibility also a big factor
in fm. l.v.

Quality of road.

Might cite Scofield
studies etc.

Candahl, Scholter, & Murray.

'E. Rating of Suits for Tax Ass.'

JFE 8-57: 483-9

Wald says suit classifr. has
bn. perfected so can be used to
permit reliable predictions
as to productivity.

11.


For samples of recent manuals on classification of agricultural land for tax purposes the reader is referred to: A Procedure for the Equitable Assessment of Nebraska Farm Land, Quentin W. Lindsey, Agricultural Experiment Station, University of Nebraska, Lincoln, Nebraska (Bulletin 400, December 1950) and Procedure for Land Reclassification in Montana, Montana State College Agricultural Experiment Station, Bozeman, Montana (Bulletin 459, February 1949). The German system of land classification, which is also followed to a considerable extent in Finland, is similar to that described in this section. See N. Westermarck, "Economic Problems in the Classification of Land," Proceedings of the Eight International Conference of Agricultural Economists (Oxford University Press, 1953), pp. 253-264, and subsequent discussion, pp. 265-269. *on capacity.*

See Land Classification for Agricultural Development, Development Paper No. 18, Food and Agriculture Organization of the United Nations (November 1952).

Add to soil depth article.

Bldgs are "flowing funds," a 3rd kind of resource concept. Time-deprn.

Land never + heat. Is fund, & flow, but never a flowing fund.

p 7 - Comments by B. Held
Economic value

The matrix - this
is erodible. Can you
compartmentalize the fertility
aspects from it? Essentially
perhaps, but practically, no.

Site remains but macro-
relief, sub-soil & drainage
are subject to destruction
even if left unharmed by man -

"Economic value of matrix"

Location^{alone} is valuable in agricultural
production where secondary production
takes place. Little need to be concerned
with this.

2d category -

"Causewayable flaw -" what specifically
is it?

3^d Category - ^{Plant} ~~Soil~~ nutrients &
- Revaluing fund - in the soil, fertility?
"Inventory" - or working capital.

4th "expendable surplus"

Liquidation -

Not economical to replace, or
prevent loss of - ^{also applies to original level of}
~~fertility, as well as soil depth.~~

Interesting job here of ascertaining
proportions of total land values each
of these categories.

p11- One of the problems in erosion
is the matter of ^{that sort of} gullying which
removes land from use absolutely &
makes use of other areas more costly &
difficult. - Gullying often is
destruction of some element of the
matrix.

"Omelette problem" in
soil resources -

what is the resource?

what is it that pays ^{econ.} present?

I'm inclined to think that
only the location or site
factor is significant.
Fertility is an input.

Bottom of 8 -

Top soil expendable when land
cheap - conservable at higher
prices - Depends again on how
you divide current land values
between the 4 categories previously
mentioned.

Top of 9 - more soil "replaceable"
when fertilizer is cheaper -

Fertilizer subst. for ^{added} area on
the extensive margin -

If fertilizer used, must weigh
cost of holding it as against cost of
replacing it.

p 10. -

Article, submitted to JFE.

^{Economic}
"Soil ~~Fertility~~ Depletion in the Definition of Land Rent."

1. Renewed modern interest in ~~gross~~ land rent. Items: hi level fm l.v. effort to understand, to impute "net fm inc." among factors; Keiper et al.; scholarly articles by Hauray, Sanborn, Misham; soil banks, predict how much land be banked at diff. rates; inc. tax, how much r.o. is depreciable; Feasibility of land tax. No longer very to protest that there is such a thing as land, has value, walks home w. good share fm inc. Indeed, $\$1406 \times .06 = 8.46$, $\frac{2}{3}$ fm inc. on Soil Bank method
- 1 $\frac{1}{2}$. Land rent of more enduring value than topical fashions. Several reasons for wanting to single out ground rent at all times. v. Intro. to Chi. paper.
2. Imputation always stumbling block. Not so hard in cities, bldg & site distinct. Fm. land fertile field for anti-imputation school, whose arguments re mixing, stirring & blending of inputs attain highest plausibility re soil
- 2 $\frac{1}{2}$. While imputation is not w/o problems, neither is it hopelessly difficult. Reading much of anti-imputation lit., one cannot escape ^{impression} that basic problem lies in lack of desire ^{based either on good anti-intellectualism or special pleading.}
3. Present article is attempt to suggest workable scheme for surmounting many difficulties thrown up.

4. Mood of present paper is reconciliation of the objective & the construction. Is assumed desirable goal worthy of pursuing to analyze g.v., ^{separate from other shares,} if can honestly be done. Contribute, ^{on individ. level,} to improved allocn; replacement pol; rental arrangements, ^{on social level, to improved} tax policy & adm. of public lands; & public ^{conservation;} works programs whose payoff is in enhanced returns to land.

Thus the paper is frankly oriented toward ^{construction} goal of devising workable means to distinguish land inc. from inc. imputable to human agencies, on the presumption that such a distinction is useful for pr. & public decisions.

Soil Depletion and Land Rent

This paper ~~purports~~ ^{attempts} to define land rent net of soil depletion. (over)

The last few years have witnessed a revival of economists' interest in land values and land rent. ~~Not long ago~~ ^{as recently as 195-} ~~it was possible to write~~ ^{in 195=} of the "Declining Importance of Land in Ag." as though the age of hydroponics were imminent at least. Since then the value of fm. r.e. has risen from — to \$1386, and the % of that which is "land" — or at least is not "buildings" — has risen from — % to $\frac{67+26+9}{138} = \frac{102}{138} = .74$. Since then the annual Δ to fm. r.e. values has equalled about — % of net fm. inc. Since then the vested int. of fm. landholders in values sustained only by public price supports has become widely recognized as a major, perhaps the major barrier to rational revision of ~~the~~ obsolete fm. programs. Since then it has been learned that a public outlay of \$700m yrlly for land rental was enough ~~to~~ to retire only 28 m.a., or $\frac{28}{100} = .28$ % of ^(the worst of it) our cropland, from ~~of~~ ^{annual} ~~prodn.~~ ^{value} ~~the remainder is enough to absorb the~~ ^{living support of net fm. inc.} Since then it has been widely recognized that hi l.v. are the prime barrier to entry of young men into farming.

~~Today.~~

I ~~take it as~~ ~~Perhaps it is this res~~ Along w. the revival of land prices has come a ~~state~~ ^{shown} of ~~scholarly~~ ^{required} attn. to land & rent. (Fute, cite)

It is not very today, $\therefore$, as it might have been ten yrs ago, to apologize for (over)

If Land & rent are topical, they are also of enduring import to econ. It is ^{net} land rent, & not contract rent, ~~&~~ that determines the allocation of land ^{at the margin} among firms, and ~~the~~ [by the same process that it determines the willingness of farmers to consign lands to the Soil Bank.] It is land rent that determines the optimal allocation of land between present & future uses, that is to say that ^{helps} determines

It is an ^{outgrowth} of a larger study of land rent and does not pretend ~~purpose~~ to be ~~any~~ more than a ^{subspecialized} fragment, ~~narrowly~~ focussed on its ~~the~~ limited subject. Many of its implicit postulates may be challenged by some economists, but there is ^{only a minimal introductory gesture at} ~~no~~ ^{attempt to} defend them, as they wd. constitute a separate topic. It does ~~not incidentally~~ have bits dicta on conservation, tax policy, mineral depletion, and other topics, which it is hoped may have some illuminative qualities.

giving one's attention to land & its rent. There is no longer any qu. that there are such ~~a~~ things, that their value is significantly large, & they play an important role in human affairs.

the optimal timing of replacement of ^{another topic of his current interest -} bldgs, orchards, terraces, ~~fences~~,
partures, livestock, timber, & other capital items. It is ground rent
which produces, ... It is g.r. which provides ... It is, finally, g.r.
which, if it can be clearly distinguished from other distr. shares, constitutes
probably the only ideal tax base, ^{& certainly a very practicable one} in a world increasingly in need of
ideal & practicable tax bases.

a major barrier to the use of ^{the} ground rent concept has always
been that of imputation, ~~and~~ especially where exhaustible elements
are involved. ^{The anti-imputationists point out that you can't unscramble an (over)}
The distinction of urban sites from buildings is
fairly clear-cut. Farm soils, ^{however,} provide ~~the~~ ^a most fertile field for
the ~~anti-imputation school,~~ ^{omelette} ~~whose arguments about the~~
~~scrambling, blending, & mixing inputs so that analysis of components~~
~~becomes impossible, appear to reach their highest plausibility~~
~~with respect to farm soils.~~ Farm soils are not only amended by
& mixed w. man-made ^{nutrients,} ~~some part of them appear to~~ but ~~they~~ ^{they} lack the differential
~~perpetual life-expectancy,~~ ^{the potentiality of better use,} that so ~~clearly~~ ^{sharply} distinguishes ^{frying pans from} ~~buildings.~~ Here the frying pan seems to merge with the omelette.

~~Writer's position, concede you find unscramble an omelette, but you
can tell it from the frying pan.
Faced w. such difficulties, the omelette school bids us
retreat into the safety of negative denial or revels in the confusion which it can
project into the situation. It rather seems to the writer, that,
given the will, economists can evolve constructive solutions~~

omelette. ^{I must} ~~The Minister~~ concedes that, but insists that ^{we} you can
tell ^{the omelette} ~~it~~ from the frying pan, always assuming ^{we} ~~you~~ really want to.

~~Fixed~~

The omelette school revels in the difficulties facing economists who seek to impute returns to specific inputs in this combined w. soil.

The difficulties ^{are undeniable, & will always} afford delightful debaters' points for ~~those who enjoy~~ scoring the captious. Their ^{substantive} formidableity, however, is largely a function of the observer's assessment of the desirability of resolving them.

I suggest that the constructive value of such resolution is high enough so it shd. certainly be undertaken.

It is true of any situation, indeed, that ^{& their separate workings} the more sharply we can analyze ^{its} the elements ~~of any situation~~, the more power we have to control it, for both priv. & public ends. Some specific priv. advantages from imputing returns to land are the ff. It ~~permits~~ is essential for opt. combos. of inputs; for ec. allocn of lands among firms; ^(including soil bank) for opt. ^{timing of the} allocn of land between successive uses; ^{and} for rent determination. On the public level, it is

~~useful~~ useful for tax policy, conservation policy, admin. of public lands, & evaluation of p.w. ^{part of} whose payoff comes in the form of enhanced l.v. These seem adequate ends to motivate economists to

seek for means to ~~scrub~~ ^{scour} out their intellectual frying pans, even that to which the ^{old} omelette clings most tenaciously

End intro.

$\frac{1}{2}$ way MS, Rent & fertility.

Mostly consumed in final MS

A. Ground rent ~~as an income~~ and soil fertility.

Ground rent is an income, corresponding to a perpetual flow of services from a resource that use does not deplete. It is analogous to the legal concept of usufruct, the right to the income of an estate without impairment of its substance. Ground rent ~~does not~~ is net of depletion of virgin fertility, for depletion constitutes sale of the substance of the resource, and the corresponding payment is not income but a transfer compensable to sale of ^{title to part of} the land ~~itself~~ itself. Of course ground rent is also net of depreciation of improvements, among which we must count artificial fertility.

~~It is probably~~
Some writers have ^{unfortunately clouded the point by} ~~been careless not deducted~~ failed to deduct depletion ~~from~~ in defining rent. Thus Bence ...

But this may probably be ascribed more to carelessness than forethought, for it is not essential to any Bence thesis. Federal inc. Tax law

also fails to ^{let} ~~allow~~ firms to deduct soil depletion from taxable inc. ^{but} ~~again~~ this can be ascribed to adm. problems & ^{being} ~~policy~~ of ^{appearing to subsidize soil mining} ~~encouraging~~ soil depletion, for ^{more serious is} ~~altho~~ business ~~business~~ ^{rewards mineral} ~~law~~ ^{clearly recognizes} ~~that~~ ^{other} kinds depletion most handsomely. A striking

lapse by the keepers of our "nat. inc." accounts, ^{who} ~~in their~~ failure to deduct for soil depletion (or mineral depletion?), thus effecting a material overstatement of the true nat. inc. Enthusiasts Analysts of economies of scale in farming are also guilty of overlooking soil depletion, altho it shd. be

obvious that ~~small~~ larger equipment is less adept at following irregular contours, and fitting between terraces, etc. A simple & straightforward application of the truism that income is net of depletion would result I believe in I believe ~~materially~~ ^{considerably different} ~~alter some of our~~ ^{profession's} current enthusiasm ~~fashion in admiration~~ for economies of scale in farming. The present point, however, is only that we Whether that intuition be right or wrong, however, the fact is that such investigations are not made. We tend to compartmentalize our thinking: soil erosion is ~~the province of~~ ^{by} SCS, ^{& the Malthusians;} economies of scale are for the Farm Bureau. & the infra. of wheeled equipment. The result is that a good deal of production economics in effect implicitly arrogates ~~the~~ receipts from ~~sale of~~ soil depletion to the net income column.

A more intricate question ~~arises~~ is the proper treatment of the income imputable to exhaustible soil fertility during the time when ~~it~~ ^{that} is not yet exhausted. Is this comparable to ground rent, an income imputable to natural & public forces exogenous to the individual landholder? Or is it properly regarded as the reward ^{of an owner's} ~~past~~ abstinence from destroying the soil, and ~~as an incentive~~ ^{as a socially functional} incentive to conserve ~~it~~ ^{soil} in the future? To analyze this knotty topic it is useful to distinguish ~~several distinct~~ at least four ^{significantly diff. ~~separate~~ ^{ec.}} ~~economically~~ ^{different} aspects of virgin fertility, which ~~possess~~ ^{differs} significant economic differences.

P — Prevailing soils terminology, like that in so many fields, has been developed by natural scientists on a conceptual framework not oriented to the problems of economics, and it is legitimate as well as necessary for economists to develop their own terms to point up distinctions vital in their analysis.

I assume my readers are conversant w. the basic fund-flow distinction and I will not liken the four categories I propose are these: 1, The permanent matrix; 2, The conservable that here.

← The 1st 2 categories, I suppose, are extreme opposites, and their distinction entirely obvious. One is the permanent matrix of the ground; and the other is the expendable surplus of depletable virgin fertility which it does not pay the farmer to conserve. The first of these is a pure flow resource, not depleted by use. The 2nd includes, or replaces, (with gain) expendable surplus/geological fund resources, like stored-up nutrients, ~~and~~ but also, in ^{judges} ^{in some} flow resources, like soil texture, and the body of the topsoil itself, which, ^{may} yield true incomes ^{as long as} before being expended, ^{extremely} ^{not destroyed} those polar opposites.

The other 2 categories are in between. The 3d comprises the conservable "conservable flow" elements which are physically destructable yet not economical to destroy --- ~~and~~ more positively, which are ec. to conserve. The fourth comprises the "revolving fund" of soil nutrients. These last are fund resources which leave the soil ^{& site} embodied in the crops, but ^{& time to use,} which are replaceable. economical to replace. ^{or renew.}

The proper attitude of economists toward ~~income~~ payments for the use of the soil has been hotly controverted largely I believe because of failure to w/o benefit of such distinctions.

Just what proportion of the value of a soil belongs in which category will vary with the individual soil. ~~as well as with price & cost parameters or they change over time.~~ Alluvial bottom land, renewed by periodic floods, and aeolian accretions, is largely permanent ^{despite any abuse.} Thin, eroding soils on steep hillsides in regions of torrential rains, ^{may} have almost no permanent or conservable ^{use} value. The proportion also will change with (own)

The question has been clouded by a propensity of some ~~debaters~~ ^{debaters}

2/19/50 The proportion also changes over time as expendable surpluses are liquidated and ~~that component~~ ^{the remaining surplus} becomes progressively smaller. Around growing cities, on the other hand, soils destined ^{soon} to underlie concrete again become expendable.

price and cost parameters. When land is cheap ^(and/or appreciating, as we will see) a great deal of topsoil seems "expendable", but when land is dear ^{later} that becomes "conservable" as ~~land~~ ^{prices rise} when land is dear. - ~~a fact that~~ ^{has become so that farm land} calls for very different conservation practices ^{at today's high prices} than were appropriate ~~ten or twenty~~ in 1940 or 1950.

When fertilizer is dear the soil elements it is ex. to replace are fewer than when fert. is cheap, so that w- in the last 20 yrs of relatively cheaper's fertilizer ~~the~~ a good deal of topsoil that was ^{simply} expendable has become replaceable; likewise some that was conservable has become replaceable. Cheaper fertilizer tends to ~~decrease~~ the value of soil matrices, at least those that present an elastic demand for it, while reducing rel. value of matrices that need little or no fertilizer.

to choose one or another kind of virgin soil to represent the whole order. Some ardent soils fundamentalists, ^{& Malthusians, e.g., refer to} regard ~~virgin~~ fertility as ^{entirely} a gift of Nature without replacement or substitute; while some private-property

fundamentalists select the Dutch polders as their prototype & represent all soil as ^{essentially} ~~as~~ human products, ^{created} ~~virtually~~ from nothing by industrious and of course de- serving men, and consisting largely of ^{an inventory of nutrients} ~~turning over~~ periodically like a grocer's stock. Ricardo is ^{usually regarded as} ~~accused of~~ having ^{considered} ~~regarded~~ all soil as indestructible, ^{[altho it may be that} ~~but I rather think~~ he is ^{posthumous} ~~more the victim of~~ critics

^{have unduly weighted} ~~who seized upon~~ one unhappy turn of phrase.] A more genuine instance is that of the modern production economist who analyzes economies of scale w/o heed to the accelerated soil erosion that attends use of larger equipment on rolling land. Such analysts ^{in effect are} ~~are~~ by their neglect ^{implicitly} ~~treating~~ ^{presuming} ~~more eloquently than any Ricardian,~~ that topsoil is in- destructible. (Ftute: This neglect also reflects in part the relatively low land prices of 15 years ago when much of this research was conceived. at today's prices it is ^{can continue to} ~~less~~ ^{should} ~~unlikely~~ that analysts ^{treat} ~~land~~ as virtually a free good and the economies of extensive farming ^{with land-using progress} ~~will seem~~ less & less persuasive.)

No such extreme position is proposed here. Rather, each soil ~~must be~~ has its own mix of the four economic components. (But in genl.

^{Move} { I believe it is true that the larger part of the net income imputable to ^{farm} ~~land~~ is properly described as rent, that is as income from a resource whose production potential is determined by natural & social forces exogenous to the ^{atomistic} ~~individual~~ owner.]
Let us examine first the matrix, the ^{most} ~~lasting~~ ^{permanent} ~~aspect~~ ^{of soil.} ~~aspect of soil.~~
The matrix is, "indestructible" in the sense that for practical purposes it is indestructible by man (own) ^{What all does it comprehend?}
^{extinction} ~~First is site, or~~ ^{plus location} ~~location & extension.~~ ^{relating to water & sources of complement.} Next ~~are~~ ^{is} the climate prevailing over that site, ^{important} ~~Then~~ ^{obviously for its own sake and also as a major soil-building determinant} are the macro-relief; the country rock and the mantle of till or loess where these are quite deep; - a bottom land's source of alluvium, and every land's inflows from wind & surface water.

That does not mean it is changeless. Nature is ~~never~~ not static. Rather, the matrix is unchangeable by normal agric. activities of ~~man~~ the user. Note, ^{also} the phrase is "of the user," not "of man." The value of the matrix, which is its economic content, is changeable by ~~exogenous~~ human action exogenous to the atomistic site. Its permanence, changelessness, etc.

~~the underground drainage subsoil and its drainage properties~~ (" " - Kr.)

Another important element of the matrix is the subsoil, ^{esp. its drainage.} "Crop production is as dependent on the subsoil as on the surface layer." - (Kr. p. 29) We shd. also include

many nutrient elements which, altho withdrawn by use, are present in inexhaustible supply ^{given the proper combo. of climate, relief, & subsoil — all cover} relation to demand. All these factors not only determine much of a soil's productivity & versatility, but its responsiveness to input and the duration of response to fertilizers & improvements. (which human amendments cannot therefore claim full credit for all their ^{infra-marginal} increments to production.)

The matrix is the most important ex. component in most soils in America. Were that not so we wd. find little use for soil maps. Soils are the product of ^{massing,} prolonged & transcendent natural forces not easily overcome, for better or worse, by man's efforts. "Soils then do not wear out," wrote Chas. E. Kellogg, "in the sense that an automobile wears out. They may become poorer, as a result of ~~poor input~~ improper input. ... But usually they can be brought back to a good state whenever men know what to do and want to do it." (p. 211)

It shd. be remembered that throughout much of history the major restorative treatment given to tired land has been simply to let it rest, fallow, so its natural ^{regeneration} ~~restorative~~ powers might catch up with man's withdrawals. On the other hand, Kellogg advises us that our "worn-out" eastern soils never were of much value, and those built up by man decline, when neglected, to their original state (p. 263)

clearly parts of the matrix — soil formation is a continuing process, ^{with} a moving profile cutting continually down into the parent material (Kellogg? —)
Even ^{virgin} topsoil is ~~for~~ sometimes for practical purposes part of the matrix, where it is ~~very~~ deeper than ~~at~~ crops need. Then the topsoil below root level is trapped in unproductive cold storage. The loss of top inches lets roots penetrate deeper into the ^{surplus} ~~unproductive~~ lower topsoil and no very large depletion change is in order until ~~we begin scraping~~ ^{rootlets begin to tap the} bottom ^{layer.} Where alluvial soils are 30' deep, as in parts of the SIV e.g., topsoil is for practical purposes a flow resource, indepleted by use.

Next let us examine these ~~three~~ ^{elements} of soil which it is possible, if not always
 ex. to destroy or deplete. As mentioned, I ^{suggest it is useful to} ~~dividing these into 3 categ.~~ ^{dividing these into 3 categ. as concepts}
~~significantly diff~~ ^{tools of anal.} One is, like the matrix, a flow res; 2 are fund res.

The flow res. is the "conservable flow" element, that which, ~~is ex. to~~ while
 destructable, is not ex. to destroy bcs. its ^{emplaced} value in place exceeds its liq. value.

One fund res. is the "revolving fund" element, that which is ~~not~~ not ex. to
 conserve, ^{in place} as is, but is ex. to replace or renew. The other fund res. is the
 "expendable surplus". that which is not ex. either to conserve or replace.

The "conservable flow" element of soil ^{virgin} ~~is~~ ^{indignantly be} ~~exemplified by~~ ^{over} ~~soil~~
 "texture", that is a soil's workability, and capacities to receive, store, &
 release water & nutrients. ~~Another examples wd. be in thin mantles of~~
 loess or glacial till which were superior to the country rock beneath, hence
 worth conserving. I believe that humus wd. also surely fall in this
 class, even tho it bears some resemblance of the "revolving fund" but

let us postpone ~~close~~ that problem until we discuss the "revolving fund"
 which might also claim it.

Conservation of virgin ^{soil} ~~endowments~~ differs from matrix of old bldgs in a number of ways. ^{rather human products} To p. 6 1/2
 Next
 1 Income imputable to cons. ^{flow} above consen. costs, is a form of
 ground rent. ^{The virgin soil is of course a natural gift, like the matrix. Looking to the future}
 The res., altho destructable, is not ex. to destroy and so
 has the same permanent ^{ex.} life expectancy as the matrix. Its liq. value
 is by def. always below its ~~im-~~ placed value. Its rent is reduced by the
 cost of conserving it, but there remains an excess over consen. cost which is
 properly part of rent.

is well exemplified by a rather thin ^{surface} layer of exogenous soil - loess, or glacial till - underlain by an inferior country rock matrix. A ^{good} large share of virgin soil texture ^{also} ^{he} ^{conservable flow elements} would, ordinarily ~~fall in this class~~ - the friability, and capacities to receive, store, & release moisture & nutrients - for these may be maintained ^{at virgin levels} with due care, even though depletion is possible. ^{Virgin} Humus, which ~~so~~ much affects texture, ^{may be} ^a part of ^{the} conservable flow resource - its ^{distinction} ~~difference~~ from revolving fund ^{element is} ~~is~~ detailed presently.

An important by-product of the "conservable flow" concept is to afford a ^{distinctive} ~~simple~~ & objective meaning for the ~~concrete~~ - word "conservation".

"Conservation" is ^{cost} ^{is that} ^{incurred} expenditure devoted to ~~a~~ ^{other sacrifice} ~~adjustment~~ to reduce the loss of ~~the~~

^{elements of} ~~virgin~~ ^{flow resources} ~~feels~~ ^{virgin} ~~endowments~~ ^{endowments} that may be, but need not be, ^{And "comm." is result of saving of consumable flow, & fund, etc.} depleted by me.

The def. may even be given normative content, w/o loss of objectivity, by limiting it to virgin endowments whose ^{im}placed value exceeds their liquidation value, and which are

^{in that sense properly described as "irreplaceable"} ^{whose loss is properly described as "irreversible"} ^{retarding the} ^{geological funds} ~~the~~ depletion of virgin ~~endow-~~

^{means} ~~that~~ ^{can} ~~only~~ ^{be} ~~used~~ ^{by} ~~depletion~~, ^{and} ^{made normative by defining opt. deple. rate.} Conservation differs from

In either case the concept of "conserv." is given a unique force by its application only to limited virgin endowments, ^{not to man-made res., nor to replaceable virgin res.} ~~not to man-made res., nor to replaceable virgin res.~~ limited virgin endowments, not to man-made

res. ^{hence of particular} It is ^{of} ~~peculiar~~ interest to the land ext. & the ^{welfare &} ~~distribution~~ ^{therein}

interested in the meaning of "rent."

Frute

Note. Humus in soil is more accurately described as decomposing, rather than decomposed. In this respect it resembles man-made improvements. The reasons for regarding humus as part of the conservable flow element are developed shortly.

To that, some might object that the conservable flow elements are really a human contribution: man has abstained from ~~destroying~~ ^{destroying} them in the past and requires an incentive payment to ensure future abstinence.

The objection must fall, however, because the lign. value the landholder has forborne from realizing ^{has been} ~~is less than~~ ^{has been} never exceeded the emplaced value he has chosen instead. His contribution has been & will be simply to allocate the land to its most lucrative use, ^{over time,} ~~to~~ to abstain from ~~widely irresponsible self-infliction of damage~~ ^{injury.} ~~which is~~ ^{impairment.}

The point is clearer ^{to expand} when the holder's choice is between alt. ~~uses~~ ^{at one} ^{or over one pt.} of time. An urban landholder who devotes a site to ^{the highest} commercial use thereby sacrifices ~~resid. use, & other commercial uses nearly as~~ ^{remunerative,} but ~~the max. commercial rent is no less ground rent.~~ ^{the max. commercial rent is no less ground rent.} ~~to have of any other alternative values is to be deductible in defining ground rent.~~

For the essence of ground rent is not the excess of return above o.c. — that is a ~~totally~~ ^{usage} different ^{meaning} of the term "rent," (I believe an indefinable one) which let us henceforth differentiate & identify ~~with the quality~~ ^{as}

as "transfer-rent". The essence of ground rent is the excess of gross product of return above the human contributions, ^{and it is ~~to~~ ^{only} simply obfuscation to describe the sacrifice of any alternatives uses as human "contribution" to production.} ~~Therefore by this defn.~~

The conserving landholder's sacrifice of lign. values is simply the sacrifice of an unex. lower alt. use -- in this case an unex.

True-distrib. of ~~the~~ revenues. The max. possible rent is no less completely ground rent on account of the possibility of alternative land uses.

One indeed which must often be negative, where land is misallocated.
* Elsewhere ~~in~~ I have expanded on this question at greater length. "Land & Rent in Welfare Econ," Chap. 5, ^{askerian, for, Cherson, M., & Harris, M. (eds)} Land Use Res. Symp., ~~at~~ Becht: Julius H. Springer Press, 1962.

An operational test of whether a payment ^{for a nonhuman resource} is ground rent is whether the landholder ^{in the long run} wd. fail to supply the resource, if the full, ^{or wd. withdraw it once supplied,} latent rent were charged to him as a ^{periodic} lump sum, ^{test} uncontingent on his allocative decision. Natural origin of the ~~essence~~ ^{charge} here. The prospect of such a ~~test~~ ^{charge} ~~landholder~~ ^{might deter a landholder from creating the tax base} ~~wd. not have supplied virgin fertility~~ ^{supplied virgin fertility} ~~initially, but~~ ^{uncontingent rent charges} Nature has already ~~done that~~ ^{done that}. ~~He wd. not be moved to~~ liquidate conservable flow elements, since he wd. thereby simply lower his income, the tax ~~not falling~~ ^{being} uncontingent on conservation and not declining in result of depletion. ~~With the~~ ^{change} ~~tax~~ ^{being} levied, the landholder not only can still conserve ~~valuable~~ soil elements whose emplaced values exceed their liq. values, he must to put the site to its highest use, and is constrained to to meet the tax bill.

That conclusion presumes that abandonment is not a possibility, meaning in practice that the landholder ~~has~~ ^{has} some appreciable equity in improvements ^{and the} ~~or other~~ soil elements matrix. ^{who equity} ~~conservable soils~~ ^{conservable soils} ~~degradation of~~ ^{hold tenure} ~~take or keep title to conservable flow~~ situations that permit men to ~~take or keep title to conservable flow~~ ^{with a high proportion of conservable flow elements} ~~in which they have little equity~~ create a dangerous potential separation of costs & revenues: the occupant may gut the soil & abandon it ~~even~~ ^{to} creditors, landlords, or ~~the~~ ^{taxing agencies, - let us borrow a term from the law of entail & lump them as "remainder men" -} ~~the~~ ^{the} ~~fact~~ ^{fact}, even though ~~the~~ ^{the} ~~high values he secured~~ ^{the high values he secured} realized ~~fall below the emplaced values he~~ ^{fall below the emplaced values he} destroys. In such situations it behooves ~~neither private nor public~~ ^{neither private nor public} creditors or landholders to ~~treat~~ ^{treat} conservable flow elements ~~like~~ ^{as} indestructible ~~and~~ ^{and} their income as a form of ground rent, ^{who due precaution vs. abandonment.} ~~Precautions against~~ abandonment would encompass such measures as making tenure of contingent

on substantial improvements; making land liabilities personal obligations; requiring bonds; ~~and~~ empowering ^{priv. & public} creditors & landholders to evict immediately for delinquencies; and the like. Probably the achievement of ec. stability wd. make ~~the~~ ^{the} greatest contribution of all, for it is the boom-bust cycle ^{above all} that periodically ~~puts~~ ^{moving} farms lands in the hands of those w/o equity. Likewise all measures that encourage land mgs to improve ^{& reside on} land

But no policy recommended now

~~Such~~ ^{encouraging abandonment} situations can be minimized by intelligent social policy. They have arisen historically ~~where~~ ^{in the recession from} largely as the ~~backwash~~ ^{backwash} of land booms which left when overextended debtors were left w/o equity; on lands which were ~~bad~~ ^{where improvement as well as} exploitively from the start, w/o heavy improvements; & in jurisdictions which tolerated prolonged tax delinquencies & protracted foreclosure proceedings.

This is not the place to discuss policy, other than to submit that effective policies are feasible to prevent ~~anyone's~~ ^{the absence of such policies indeed is} reap the benefits of soil lign. w/o ~~not~~ ^{the presence of} bearing the costs! Assuming such policies in effect, ^{the income of} the income of conservable flow elements of soil is a ground rent.

Another argument sometimes voiced against regard's conservable flow incomes ~~Another possible objection to the idea that the inc. of conservable~~ ^{as ground rents is that they are} flows is part of rent in the idea that ~~fruits of the landholder's good judgment.~~

If the landholder gets no credit in this case for forbearance, it is still conceivable that he shd get credit for ^{correct allocation decision.} judgment. Where the disclosure of the outcomes of allocation decisions is immediate it is hard to allow much to a landholder for his judgment, which requires

Argument input

little more than the ability to distinguish higher from lower ^{neighbors} ~~offers~~.

But where time distribn of uses & long term invests qusky, are involved, ~~qns of judgment & risks enter to muddy the wtr~~ It is

a greater input input is prerequisite to allocation decisions. That

human contribution is sometimes seized upon & identified as the cause of rent.

~~Rent~~ ^{however} ~~scarcity~~ is never a value that land yields w/o human contribution, but the yield in excess of human contribution. The valuation of

human inqrl. inputs involg judgment is trickier than valuing simpler labor inputs, but that such ^{imputation} ~~valuation~~ occurs, and leaves ^{unimpaired} ~~substantiated~~ the product unexhausted, ~~grossly~~ ^{gross} is manifest in the prices paid for ~~some~~ land. We

return to this question when discussing ~~rent as a~~ residual vs. direct imputation of rent.

Next let us discuss the "revolving fund" element of virgin soil fertility. It is that element which ~~it~~ is not ec. to conserve, but is ec. to replace or renew ^{w. inputs imported} ~~from~~ ^{from} ~~offsite~~. Examples of revolving funds are the scarce mineral nutrients, N, Ph, K, & Ca., which are necessarily removed from the site ^{embodied in} ~~in~~ crops & livestock, ^{and} ~~but~~ which may be replaced by commercial fertilizer. Another e.g. is underground wtr in ~~much of~~ ^{some} ~~and areas~~, the S.F. Valley of Calif., which is drawn on by pumping down but is also rechargeable by human hand (the ^{source of} ~~source~~ ^{used for} ~~used for~~ recharge, & the rechargeable aquifer & settling beds, are flow res.) Ground wtr on the W.T.'s high plains, on the other hand, is not a revolving fund ~~but~~ ^{but an expendable surplus, because} ~~there is no ec. source of recharge.~~

- a. Ex. to repl. Anal. to mfr.-mch. invier. Embodied in crops. High value & unplanned value and also > replacement cost.
- b. E, g.

c. Revolving funds ~~do not include~~ are largely a feature of comm. ag., in which crops are ^{exported for} ~~far removed~~ from sites of growth so nutrients are not ^{entirely} replaced by the closed ~~biological~~ cycles characterizing natural condition, and must be imported. Revolving funds are to be distinguished from soil elements like humus, which ~~behave~~ under natural condition may be said to rotate, ^{but very slowly} in a ~~sort of~~ closed cycle, ^{a natural process} which is ^{properly} conservable & is part of the "conservable flow" element, as the term ^{is} ~~is~~ used here.

d. The distinction is important bcs inc. imputable to revolving fund is not part of gross rent, while inc. of conservable flow is. Let us elaborate.

e. Elaborate. Humus not liquidated - conservn & depletion are part of one integral indivisible process, a process which occurs in Nature, too.

f. ^{humus is conservable flow, even tho other revolving funds are human, inc. are profit or int.} So revolving fund is ^{site inc. a rent} ~~human~~ ^{vs. human} ~~contra~~. Also possible objection from other side, revolving fund shld be land, inc. a rent on initial endowment.

True, must acct for initial endowment somehow, but one altern.

Revolving fund doesn't meet other tests of rent, than natural origin.

So acct. otherwise.

Not quite mining, but close.

e. (cont.) Humus is not ex. to replace. Like revolving fund, may be likened to ~~accr.~~ wh. in a res., inflow & outflow. Unlike rev. fund, humus may ~~be~~ not be drawn down & refilled, so analogy fails & had better be dropped as potentially misleading. It's prohibitively expensive most areas to rebuild humus. But if conserve virgin humus it helps maintain itself by contributing to richness of crops grown on it.

e (cont.)

Humus not quickly embodied in product. More analogous to catalyst, helps process w/o being consumed in it.

Humus not homog. Young & old layers. Old layers probly release selves easier to plants. New layers help in storage fns.

Some readers will wonder if consm. as defined, differs in any sign. way from nature of ~~the~~ structure bldgs.
To some short-run possibly, but as long-term one quite diff.
I believe there are some profound diff.

Diff. springs from natural origin of soils. "Conserve" uniquely approp. to lin. nat. res not produced, & not ^{easy} reproducible.
Natural, intrinsically able to sustain self indef., even requires simpler moves, negative forebearance from destruction, or compensation for man's interposition.

Mutual, slows deprec. consm. maintain in stop it altogether for some elements. Larger input
∴ justified to conserve ^{as vi. maintenance & life for 20 yrs.} ~~conservation~~. creates perpetuity. Distinction seen w/in consm itself: terraces

last 20 yrs, but soils they conserve are there to be conserved again.

Soil is natural product, so human inputs are ^{always} distinct; bldg structures are man-made, so waste is continuation of bldg process, scarcely distinguishable from it.

Bldgs deprec. w. time; soil only w. use, or abuse

∴ absence. " doesn't in quest (who in particular situation)

Bldgs, mutnd, are more like revolving fund, parts replaced.

" are demolished to salvage site

One is tempted to say point contrast by say's structures decompose while soil is product of decomposition, but only part true. Soil also contains ~~organic waste~~ ^{decomposer's} mtrl. But the decomposer's mtrl. in soil is either the parent ~~waste~~ mtrl., ~~the~~ is indef long supply: and organic wastes from the surface. Former is inf. supply,

Latter, form of humus, supplied initially by nature, & kept at natural level by virtue of heavy surface vegn which abundant humus makes possible, may be regarded as a natural perpetual motion machine bequeathed by nature, which man has but to keep in running order. Thus, if soil is in part a process of decompn, rather than ~~the~~ purely the product of it, it is a self-sustaining

humus
(revolving fund)

Some might think humus is revolving fund

- Res supplied from man's surface vegn & wastes
- Res. particles circulate on site, vertically.

But

- Surface vegn depends on virgin humus. Perpet. motion
- Vert. circ. is natural. Horiz. is revolving fund.

Even man-made soils are out of ~~the~~ w. the elements. Continual effort very to maintain deviation from natural ~~the~~ prescribed by climate, natural cycle of input & withdrawal.

V7, B, p. 1

6. 2d, examine "conservable flow."

surplus, not ex. either to overmeasure or replace.
Distinction not physical but ex. & chance w. ex.

parameters. e.g. fertilizer relatively
cheap now, cheaper replacement, as
an effect of prevailing price may mean a
flow of future services ^{in ag.}
Disco. neg. value

A proper meaning for "conservation" - action to maintain natural

Conservable flows, e.g.: soil texture, & corpus itself, esp. of a thin mantle e.g.

Income to convertible lease is a part of ground rent.

(moving profile relevant here). Catalytic agents, re-value but only on site.

Best Objection falls, her landholder's contribution is just to put land to use yielding highest rent over time. He deserves no special credit for ~~his~~ ^{his} ~~own~~ ^{own} ~~from~~ ^{from} ~~wild & irresponsible~~ ^{self-education} holder's

is between alternative uses ~~etc~~ w/o any complicating gn. of alt. time-distribution.

e.g. - an urban site, landholder devotes to commercial use, & thereby sacrifices
 & lower commercial uses, ^{entire} commercial income is no less, ^{ground} rent. He not only can earn the ^{commercial} rent, ^{he must} utilize site to capacity, and if
 farm use, but ^{entire} commercial income is no less, ^{ground} rent. Here, gen. is one of full rent
 in charged to
 as a land

time dist. Owner sacrifices ^{alternative} ~~all possible~~ time distributions of feature, i.e. for the ^{by a landlord on} ~~present~~ ^{as a lump sum} ~~discounted~~ ^{he is forced to} net value, ~~that w. max.~~ ^{landholder is}

~~That w. max. product is due to
^{over} This minimal managerial contribution of the landholder is
 not the cause of rent. It is one of the labor inputs necessary to extract
 the max. net rent from a site, and as such deserves the imputation of
 some of the product. But the reason land titles sell for good prices
 is because the combined land & input inputs yield a gross return, or rent,
 above the value of the input~~

Also change as depletion proceeds, e.g. 24+4 inch of topsoil from top, is considerable for many yrs, gradually works to top, becomes expendable. Better save for later.
No try here to say which is which, but only to define the concepts.

RESIDUAL

The idea that considerable flow income is not ground rent, but a return for human contribution, might evolve as follows. First, rent is pictured as a ^{hence uncontingent on input. inputs.} residual forthcoming automatically, a sort of golden egg ^{w/o human contribution} the land lays for us each year ^{present} without our fallow we may commit our fallow of commission or omission. Once we accept that ^{concept passing} view of rent we have practically defined it out of existence, for in fact land ^{always} requires the ^{complementation} of some input to mgt. input, reasonably priced, to even achieve the imputation of the max. possible rent. ^{From that it is but a step to conclude it should all inputs to mgt. is no rent.} Rent does not come w/o offer human ^{contribution} effort, but in excess of ^{that} effort ^{reasonably priced.} contribution. Rent does not come w/o sacrifice of other land uses, but w/o sacrifice of human resources other than those required from the production in excess of rent.

Rent is a resid. - whatever remains after other, more importunate inputs are paid. Some land users input small rents. Those who input larger ones, $\therefore$, are creating the Δ values.

Rent as resid. also makes it risk-bearer, likens it to stores, hence gives landlord credit for optimal timing by making time-distr. of use like decision re capital.

not contingent on actual use,

new
for
separate
section

~~Better put this all
re matrix, for it applies there, too, and is simpler there.~~

Another source of confusion here is the idea that rent is a return above o.c.,
apply's to all res. indiscriminately ^(entirely?) so all yield some rent & none is all rent.
~~let us call this "transfer rent", since it refers to transfer between alt. uses.~~

Essence of ground rent is lack of human contribution (at least by indiv. human who collects the rent). ~~By this concept~~ ~~From this concept~~ there virtually is no ground rent, since the

2d best use may be defined as close to the first best as one wishes and the
max. possible ground inc. reps mostly the sacrifice of the 2d highest. ^{o.c. may even be higher, often is.} Obviously
that concept of "rent" is not the one relevant here. (~~I am elsewhere~~ Indeed?
gn. if the concept is definable at all or relevant anywhere (cite Land & rent in
welfare as.) Rent comes not w/o effort, but in excess of effort; not w/o

~~sacrifice of alternatives, but w/o sacrifice of human labor or savings.~~

~~The xfr.-rent concept~~
This view is esp. mislead'g bcs rent, ^{actually earned by land,} instead of being an excess above o.c., is often
usually below o.c. due to mkt imperfections. Thus xfr.-rent is often negative.]

The xfr.-rent concept wd. have us regard the income imputable to the
conservable ~~flow~~ aspects of soil as rent only insofar as said income exceeded
~~the next best~~ ^{some closer} alternative -- in this case ~~more rapid depletion~~ the 2d best
true distribution of liquidation. Thus again the lion's share of rent wd. be
a "human contribution", the sacrifice of the 2d best use. Indeed this concept
wd. destroy not only rent from conservable surplus, but from matrix too.

[Wd. even give many neg. rents, wherever o.c. > current rent, which often true.]

Again, essence of ground rent is quite diff., only likened to "xfr.-rent" by transparent
analogies. Essence is lack of ~~human~~ excess of yield over value of ~~human input~~ con-
tribution by the rent-collector indiv. atomistic landholder who collects the rent.

Landholder deserves credit for not being incredibly irresponsible & wild ...
Final source of confusion - time lag between invest. & return

still

? some nervousness about calling

Uncontingency test, natural origin not enough, must also be ^{under} ~~possible~~ to withdraw, by liquidation. Conserv. flow is ^{inc.} ~~flow~~ ^{flow is cons.} ~~flow~~ ^{to lig. by def.}

policy implic. seems to be that indiv. need not collect it, society can appropriate it. need incentive to conserve for future. as w. all qns. of social approp. of rent,

depends on how appropriated. Rent not [a golden egg laid yrly by land] indestructible but product of careful husbandry by society & indiv. Society's contribution is to harness rents by lump-sum ^{adv.} ~~tax~~ on latent potentialities of sites. Fear of destroy'g goose? Contrary, is surest way to force owner to allocate land most eefly, includ'g selection of time-dist. of use.

Another cause of special nervousness

Conservable fund case differs in irreversibility. We must ^{remember} here, never a chance to repair damage.

→ There is need to avoid any separation of costs & revenue by clumsy instrs.

i.e. of situation occasionally found where much of soil value is conservable flow, & ^{impt. land. A heavily mortgaged buyer.} are no improvements, holders will quit soil & leave. Usually result of land hoarding,

backwash of overexpansion, tax rates above long term prospects.

Society, the remainderman, shd. require some sort of bond posted by landholder to preclude such. Usually improvements are the bond.

How differ from "conserving" old bldg? ^{That is more like revolving fund, actually replace parts. Job gets continuously harder, while that which Nature left us is intrinsically capable of sustaining itself, that is how Nature came to leave it. Bldg. ulty. reach ^{over}}

Biggest problem, defining conservable-flow inc. as rent, is element of judgment.

If outcomes were instantaneous, no problem of mgtl. judgment. Allocate to

to rent use, immediately. Deferred results, judgment enters, rightly claims part

of product. ~~But~~ This part of product is not ground rent; but neither does it

impute to landholder as such. ^{& investor of capital} Impute to ~~impute~~ ^{impute} such. — they may or may not be same person. Deferral of liquidation is not a characteristic of

land but of capital. Etc. ... makes cons. flow look like cap., but cap. must also be initially stored by man, (& replaceable?) Check file on horiz. imputation.

Allude, but defer to later, rent as resid.

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Rent not a resid. & shock-absorber. Shock absorbing is fn. of funds, not flow res.

Bldgs. deprec. w. time, soil only w. use. Soil improves w. time, better.
pt. of no net remaining value. & Bldgs also obsolete bcs are continually being reproduced, &
approp. use of site keeps changing. Bldgs have lig. value = value in place, soil doesn't, that's
why it is conservable. Bldgs preempt site from other improvements, ~~and~~ must be
demolished to release site; Soil can be used again & again.

Now define revolving fund. Man removes ^{fertility in} crops, ~~thereby~~ replaces by
import's fertilizers. No longer a flow res., but a fund that turns over. It ^{not} ~~is~~ ^{acc.} to replace, but
to conserve, but to draw down & replace. which ^{does not remove humus from} ^{is more properly} category of a cons. ^{blow}

import's fertilizers. No longer a flow res., but a fund that must be replaced. ^{which does not remove humus from the soil} to conserve, but to draw down & replace. Natural soil nat. static, even if had reached eq., ^{is organic matter in process of decomposition. Nat. const. bcs natural inflow from plants on site = nat. loss from final fall decomposition.} Kellogg 251. The nature of humus content by return of ^{site-produced} organic matter, ^{altho it bears some resemblance to vermic's fund,} falls under def. of conserv's a flow res as used here (alt-ly, might be a 5th categ.). for fb. reasons.

Humus also differs in being largely catalytic, not embodied iron product.

a. Are not depleting ^{static} natural fund & then renewing or replacing it. Are ~~continuing~~ ^{continuing} maintg. the level in a nat. ^{lake} reservoir, originally filled by Nature, by a process origly controlled by Nature. Analogy, herd of wild cattle, harvest increase, maintain numbers. (Gna.)

b. The orig. humus supplied by Nature is to large extent source of its own replacement. ^{Self-perpetuating.} Not dealing here w. what is removed from site, but a recirculation. Soil texture is ready to hold & ~~wait~~ ^{wait} decompose humus, some rich easy to mntn. humus.

Humus differs in being permanent, not (easily) withdrawable. Its inc. then has essential quality of rent, i.e. not evict's or elicits supply. also, in an impt. sense, doesn't serve to prevent removal of supply - never turn over, never is replaced.

Begin w. rich humus: crops are rich, easy to maintain. ^{or merchant's} Revolving fund is that part of soil which is analogous to a mfr's inventory of raw mtrls. It comprises elements of fertility that are bodily removed from soil in crops or livestock and are replaced ^{by man} from off site by ~~fertilizers~~ ^{importing} feed, ~~etc.~~ fertilizer etc. Essential diff: replaced by natural soil processes as quickly as withdrawn, so are flow res. Essential diff. is, is cheaper to replace than commerce. Applies largely to minerals, not humus. Minerals can be drawn down, then replaced. Humus must be maintained at a level.

Essential diff. is source of replacement. Humus replaced from itself, onsite, or from mntng nat'l. source of inflow. Minerals must be imported.

Essential similarity is you begin w. initial boost from Nature, maintain it. Diff. is one you say is depleted & replaced; the other is maintained or con-

Essential similarity is you begin w. initial boost from Nature, maintain it. Diff. is, one you say is depleted & replaced; the other is maintained or conserved. Conserving a natural process is like conserving a natural thing, essence is cheaper to conserve than replace.

after a generation they are all new, but still conservable flow. The initial advantage received from nature has not been lost, nor ~~express~~ significantly ^{transformed} altered in kind.

Another analogy, underground water in aquifer originally filled by nature. Man pumps & recharges, maintains balance. Initial charge is never lost. "Flow" is obviously relevant here, use the word to make plausible

One ^{income} is ~~more~~ like ground rent; other more like ~~not~~ interest or profit on man-made capital.

No insistence on this pt. Cd. treat it either way. Wd. ultly have same policy implns. probly. If ~~humus is capital~~ Revolv'g fund was given origly by Nature; ~~the~~ nature of fund is to interest of landholder so long as instrs not perverse, i.e. so long as no tax is contingent on nature of level of fund. So return on both is a form of rent.

~~the~~ Society initially gives landholder not just matrix, but a full resr. which it is ~~to~~ his interest to keep full. Income from it is legit by part of rent. Keeping it full involves no sacrifice by landholder, same a sacrifice of folly, of self-ruination. That principle applies both to humus & revolving fund, & of course to conserveable flow. Therefore makes it of no account whether we call humus one or the other.

Has drawback of looking backwards. That is inevitable, since we are concerned here w. virgin soil. After 1,000 yrs what diff. wd it make? This - the humus wd. still be unrec. to deplete & then replace, whereas revolv'g fund cd. be & is simulated by man all the time. So the distinction is inapt. As techn. changes, some soil aspects may shift categories

(humus etc., liquidation value less than value in place)
Differs thus essentially from revolv'g fund, liq. value always exceeds value in place. (Value in place in low lies is replaceable)

The test of whether an income is rent is what wd. happen if society or landlord charged full unit by capacity-tax, (& abandonment precluded) wd. abandonment ensue? This is a test bcs non-abandonment means something is left for pr. holder from continued use & nature of improvements. - . . . ?

With revolv'g fund, liq. value = replacement value, so as soon as tax cut into its income it wd. be liquidated & not replaced. But humus etc., liq. value < replacement cost and value in place, so can

cut into income w/o its being liquidated, & land abandoned. How far in?
 All the way? If rent-collector were reasonably alert to abandonment,
 yes. Only req. that landholder's equity > liq. value of soil.

Another diff. - w. revolving fund, outgo & replacement are separate
 ops, level fluctuates, can deplete now, renew later. W. conservable flow,
 outgo & replacement are simul., & part of same ops on site. Cannot
 draw down now, restore later.

Essential of rent, is not req. for landholder to receive to keep resource in
 being. No threat of withdrawal.

Inc. of conservable flow is rent. Bcs you can take it, & is still to
 landholder's interest to conserve soil -- that is, he can still make competitive
 return on his other inputs by doing so. It is true he cd. also take a sneak
 & abandon. Difference is, if cut into inc. of revolving fund, he must
 abandon, he has no incentive to replace nutrients as withdrawn, only to
 liquidate everything as fast quite fast -- at an opt. liquidation rate.

The income of revolving fund cd. be regarded either as ~~\$~~ rent on
 the initial fund supplied by Nature; or as profit on the man-made
 replacement funds. The latter is probly more desirable, to keep the
 meaning of rent as an inc. that can be capacity-taxed away w/o negative
 effects. ~~But~~ If we choose this latter course, we must not forget to
 account for the original depletion, now rep'g a sale of fertility from
 the then-owner to his customers, comparable to depletion of mines.
~~But~~ That is largely of historical interest in settled areas, but wd. be

Early.

~~Original~~ Thoughts on
expendable surplus, before writing
draft for ~~the~~ "Ground Rent & the
Allocation of Land".

Return for ideas about mines etc.

of current interest in ~~some of the~~ newly develop^{ing} ~~countries~~ ^{areas of which there are many:}, e.g. on the virgin lands of the Cagayan Valley of Luzon, or the new coffee clearings of Brazil, or the newly opened white highlands of Kenya, ~~and~~, in our own country, the fertile west side of the SJV newly opened by FRP.

~~What~~ The net inc. ~~of~~ imputable to revolving fund is profit or interest on a man-made resource, and not part of rent. It is quite compensable to stored feed.

Bes. of rapid turnover, net inc. is small cfd. to gross. It is $\therefore$ rather inelastic to int. rates, likewise to adval. taxes. ^{It is that some resemble ground rent.} So if it is ~~cut into~~ ^{levied on} accidentally, results not likely to be great. Only durable goods need worry about that.

Finally, virgin ^{expendable} surplus. Lign. value $>$ in-place value. How differ from nutrients in inexhaustible supply which are part of matrix? ^{supply is finite} Supply exhaustible w- in foreseeable future. Like mines. But unlike mines not very valuable, as if you ~~have~~ ^{use} it, you ~~pay~~ ^{conserve} it. Is surplus of virgin fertility over what is ec. either to conserve or replace.

Is ec. to deplete. ^{oversimplified} E.g. if topsoil is 48" deep, & crops use only top 24", the lower 24" is trapped in ~~unproductively~~ ^{improductively} cold storage & can only be fructified by using up the upper inches. It is probably often true, also, that ~~over~~ ^{over} Found e.g. in U.S. in some prairie soils, formed under grass, which when

virgin have higher fertility than it is ec. to maintain. Surely not true

of Podzols, formed under trees, which I in human when farmed. (cite Kellogg) Eastern soils, however, may also in pioneer conditions have contained what appeared to be a surplus, under

[Some ground with wd. come in this class. In W.T.s, e.g., ground with is ^{unyield} expendable surplus - not that there is ~~an~~ ^{unyield} large unit, but ~~that there is~~ ^{what there is} can only be used by depleting it. ~~deplete it~~. Ground with in Calif, other hand, is largely a revolving fund res., but is ec. to ~~recharge~~ ^{recharge} it.]

Might be thought that ^{a maximum of} virgin fertility ~~and~~ ^{even to} usually appear in expendable surplus categ. ^{wd. appear there} when soil 1st ~~first~~ farmed, bec. then is input due to remoteness of wkts etc. Other hand, while its total value is then low, so is its liquidation value, whereas its ~~prospective~~ ^{prospective} future long term value is magnified by antions of higher future demand.

the soil-bldg processes, the downward movement of the soil profile into parent
matrl., is rejuvenated ^{& generated} by thinning very heavy layers of virgin topsoil.

Distinction depends on time-horizon. One yr, only a little is expendable. As used here, inf. horizon,
what will ultly be expended. Is a forecast, is doubt. But no practical problem, bcs. inc. of unexpended
expendable is rent, same as conservable.

The virtually migratory agric. of our westward expansion. The distinction of
expendable surplus from conservable & replaceable soil aspects depends in part on
prices & costs

Is after ^{fruits} alleged pioneer farms are universally unconscious of future values of soil and think only of today, getting virgin soils ^{merely} & irretrievably. Allegation ^{one cheap, but the quality does not square w. the known fact that} In pioneer conditions land spec is ripe, whereby not only are fund elements of soil reserved for future depletion, but flow elements

also withheld from use, altho they are not ^{even} fundable, and simply waste, (a waste ^{probly} as great as that from premature depletion by some other farms.)

There are plenty of buyers in pioneer fringe land who have an eye to the future, esply in boom pds

It has been perhaps more ^{the violence of boom & bust in frontier areas,} a cyclical phenomenon, also ^{or} highly dependent on the individual & his position in a world of primitive and often chaotic credit mkt., that has led many virgin soils to be drawn on rather heavily

The result is a mixed pattern wherein some soils in U.S. still contain a considerable expendable ^{virgin} surplus, while others have long since lost theirs and consist of man-made fertility.

Is a ~~ten~~ long-run tendency, & properly so, for ^{lands} areas of poor location & rich soils, ^{such as the So. Plains} to export fertility to lands of good location & low fert., like So.

Virg. surplus consists both of fund res & potential flow res. Fund, ^{depletion unavoidable} surplus ends when becomes ec. to replace, replace fund. Flow, ^(testine, corpus) surplus ends when becomes ec. to conserve

It is the last categ., hard qn. of what is income, hence rent. Very important qn., bears on all qns of mineral es., too.

Nutrients, liq. value at time of realize not inc. But appren. up to then has an inc. ^{to indiv & society.} Is it rent, or profit on historical human contribution of obtaining?

Abstaining is entirely neg. concept. Human has simply ^{allot} a geological fund to highest use, in his own interest, same story as before. If full rent were charged, he wd. do it — [in this case probably a ^{special kind of} severance tax, not contingent on owner's choice of liq. date.] appren is a special kind of rent.

Flow aspects, likewise, appren is inc., ^{depletion is not,} same reasoning. But now, another aspect. While unexhausted, soil texture yields incomes! ^(do do fund nutrients by contrib to soil health, but negligible) They are rents, indistinguishable from the inc. of conservable flows. ^{They are quickly imperceptible, however, for the very fact that the soil is surplus — e.g. the ^{uppermost} top inch. of ~~36"~~ 36" of topsoil — indicates that there is more of the same underneath, which is being held in cold storage by the existence of the top layers. (Where ^{top} soil is 30' deep, as in parts of S.F., loss of topsoil is not signif. depletion at all, return is income, a rent.)}

Invalid { Expendible surplus, by def. liq. value $\times$ long term value in place, or "in-place" value. If in-place value = 0, we wd. call whole thing rent. Depletion is only the in-place value. Liq. value less in-place value = rent. Liq. may require many yrs.

Just as value of expendible fund can be no greater than cost of replac'g it, so value of expendible flow can be no greater than cost of conserv'g it. It can be much less, but may not have to begin conserv'g for 30 yrs.

Soil has no in-place value unless exhaustible. If inesh. is part of matrix.

The mine analogy is never very good, but even w. found elements, they are used in conjunction w. ^{endemic} local flow elements; & they are replaceable, after run thru expendable surplus. w. expendable flows, even less good.

The excess of liq. value over in-place value is a rent, an income. It's max'd by opt. timing. Differs from matrix rents, not perpetual. It's temporary rent.

Expendable surplus is drawn on ea. yr. until liq. value of last particle = in-place value. ^{Error, I believe.}
$$[In\text{-}place\ value\ in\ turn = liq\ next\ yr \div (1+i)]$$
 Income is apprecn. of unexhausted part -- not just the part to be used next yr., but all future yrs.

There are dim. rents in this exhaustion, as in everything, per unit time. Regard year as unit. -- no day-to-day valuation. Depletion generates a rent -- regard it as an input in dim. rents. ^{Catalytic value, fructify site a bit.} Only the mgnt. daily outflow-rate = depletion charge. But this rent won't be much, bcs. if mgnt. value fell below ave. by more than i , better to save for next yr. Otherwise it is all depletion -- impairment of substance.

Now return to flow aspects. Their liq. value is = cons costs abridged while they yield income. If you conserved, wd. be a net inc., $G - [C_m + C_c]$

Liq. value is C_c , abridged? No, not even that much, isn't yet worth conserving? But costs abridged are what you wd. spend to save last inch, to save use of site itself. Very hi. Actual isn't you do have to spend in fees, is it. Inc. of top inch lost in given yr. is negligible. a) Plants use much more than the part lost; b) The part lost is not available full yr; c) Questionable if any of the topsoil can have product imputed to it when present in redundant quantity, so $mvp = 0$. Like ample wt, its presence is then a quality of the site. Its loss simply brings up more to use.

Flow, expendable. Do they yield any income before being expended? Or does lign. value consist of depletion?

They may be used for years before actually sheet-eroding off surface. During those years they are conservable flow elements, and yield incomes, "topsoil rent". If mgt in-place value is zero those incomes impute to matrix, and only gradually impute to conservable flow elements as topsoil acquires scarcity ^{in-place} value and begins to become conservable.

They also yield incomes by appreciating (just as stored grain does). Is a subvariety of rent - test, is not destroyed by a full ~~uncontingent~~ ^{un-} contingent change (natural origin makes it rent) ^{signif.} liquidated.

They yield no income in the yr. of when expended or depleted. In-place value is value of depletion charge, & in-place value is next yr's lign. value $\div (1+i)$. Lign. value is less than cons. cost, until soil becomes conservable. If there is n years' supply, lign. value is future cons cost $\div (1+i)^n$

~~If haven't covered it by this time, uncontingent full rent charge, to be fully uncontingent, is not avoidable by abandonment. Wherever abandonment is a possibility, sell ~~land~~ topsoil to holder, give him an equity. Or require bond; or make charge a personal liability. Never leave liquidatable soil w. holder w/o equity; never let uncontingent charge become contingent on non-abandonment.~~

Expendable surplus generates 2 other kinds of ground rent, too.

One is the annual increment to the replaced value of the unexpended surplus as it nears its liquidation date. The simplest way to handle that is let it cumulate until liquidation date, at which time it offsets depletion? (Or does it? Rather, that helps explain why gross yield is mostly income?)

Refer!!

"Crop production is dependent on the
subsoil as well as the surface layer."

- H. H. Kunkopf, p. 29, in

No. Gist (ed), (Columbia: Curators of Univ. of

No. 3, 1950.)

Ag.

917.78

M 682

Going on reserve, 9-61.

Return. This & many other articles are good.

Kellogg, Chas. E. The Soils that Support Us NY: The Macmillan Co., '41
(Chief of the Div. of Soil Survey, Bureau of Plant Industry, Soils & Ag. Engg. (USDA). For decades,
Soil, when man first farms it, is not a static fund. Humus, e.g., is
continually being added by decomposing plants, & being lost, in a mature
virgin soil. (Kellogg, 267)

"Soils then do not 'Wear out' in the sense that an automobile wears out.
They may become poorer . . . as a result of improper mgmt. . . .
But usually they can be brought back to a good state whenever men know
what to do & want to do it." p. 271

pp. 41-43 Humus or organic matter in soil is in flux in nature. So
natchly is a revolving fund resource. And some surplus, on prairie soils. p. 259.
Or some initial deficit. After a few years of culture the initial
endowment is replaced. But to build it up where there was none, growing ex. crops,
is seldom ex. Bes. lacking virgin humus, hard to grow crops or grasses that replace humus. p. 45
Humus, then, is def. by revolving fund, in cycle of nature. As are
associated soil life organisms.

p. 45 Nature plants make soil more productive for themselves, not others
(this wd. be true of climax vegn. anyway). Most crops resemble grasses,
hence do better on grassland.

p. 46 Ultimate soil determinants: climate; slope; parent rock.

Soil is in eq. w. parent rock, slope & climate. "New fresh minerals enter
the soil from beneath just as fast as the rain washes out from
the surface & leaches it out thru the drainage."

p. 47 Under crops, soil reaches a new eq. Concept of continual
mining of topsoil is wrong. Soil is being formed continually, & propagandists
have overstated net losses I think.

Kellogg, 2

Versatility of soil. Is esply. hi for "Gray-Brown Podzols" of n.e. U.S.
p. 155 So each farm is more diversified. Grain, grasses, vegetables, -- &
all important crops except citrus, & etc.

Less productive than Chernozems, but very responsive to mgmt.
Independent family fm concepts grew here. Cf. Chernozem, more need for
coopn.¹⁵⁷ (also lower i.g., more absentee ownership.)

Gray-Brown Podzols are like soils of n.w. Europe.

✓ p. 263 Many "worn-out" soils of the East never were productive. And if
built up they decline, if neglected.

Competition of productive Western soils is what caused their
abandonment.

Some English soils have bn. built up, exploited, & repeat cycle
several times.

p. 267 The "surplus" mantle or expendable surplus idea doesn't apply to
all soils. On clearing Gray-Brown Podzol & turning to c-o-a-a,
new = m wd. have more humus than Nature. But Prairie soil wd.
have less.

p. 268 Soils reaching new = m. Prairie soil won't continue to
lose at initial rate.

p. 7 "... in a small area, ..., where there are only very small differences
in climate or in the native plants, differences in soils will follow differences
in rocks."

What is an SCS

"land use capability table"?

Maybe useful in distinguishing
land from improvements.

Land capability tables
classify land by its productive potential,
Classes I-VI, e.g. Consider slope
as well as soil type. These should
be very useful. SCS ideology
calls for every acre to be put
to its highest use.

Income of fertility.

Given some ^{income} fertility, is ~~to~~ draw on it some, but not entirely.

If draw on it entirely, lose not only the fertility, but use of site, largely.

This suggests irreplacability.

Rationally one would use irreplaceable aspects much more sparingly than replaceable nutrients, since the loss is in perpetuity. A nutrient element can be used only once anyway; & can usually be replaced. Soil structure, tilth, friability, etc., will yield over many years, perhaps forever. Storage capacity vs. stored matter.

In extreme cases soil is virtually destroyed, but let's begin w. middle cases. Soil may run down, like improvements. (but it doesn't have to, since there can be continuous intake.) Terraces, when they must be replaced, you have bare land. Nutrients, when you begin adding, you are down to bare land.

✓ The fact that fertility can be lowered further irrationally does not distinguish it from subsoil, as that too may be injured irrationally. The basic matrix of soil which is maintained yields an income; & that income is ground rent.

You cd. also value soil ^{on} ~~on~~ ^{range & thereof} cost of keeping, analogous to cost of production. Cost of keeping is benefit from depleting. This is cost. Income in perpetuity is the benefit. If latter exceeds former, it is ground rent! Incommensurable.

Re consumable flow.

Contradiction: I say soil is
conserved, & so lasts perpetually.
But if a house is maintained
same way, I say it is really a
new house, etc.

Problem was overdrawn. ~~No problem~~. Still some problem.

Troublesome analogy of maintg. old bldg. & conserving soil.
I say conservable soil is perpetuity, bec. is cheaper to conserve than replace.

But I say of bldgs. maintn. is really replacing, initial bldg. doesn't last long.

What is diff?

a. You replace actual physical parts of bldg. "Best axe I ever had --- ~~four new handles & 3 new heads.~~ ~~lasts~~ Never wears out. all it needs is a new handle & now & then, & occasionally a new head."

b. Bldgs reproduced, over 1m a year. But not making any more Marshall Silt Loam.

c. As bldg. ages, income falls & conserv. cost rises. On ~~a~~ conservable soil, conservation costs are level.

d. You can build things to last nearly forever, like filling land, even w/o. maintn. Probly can bld. more kinds of things to last forever w. maintn. They are like conservable soil.

As to whether maintn. is to be regarded as replacement, that is a physical qn. Eclly. the pt is soil is const. in yields & lasts. Bldgs. deprec. Whether we regard maintn. as ending life of orig. bldg. or loaning inc. from it, shdn't make any diff. to effects of i.r., etc.

If bldg does last long, it yields little future income.

e. Physically, you maintain soil by keeping it from washing away. Most bldg. maintn. involves partial replacement, or restoration. Even cleaning floors, & painting, are renewals - granted they are undertaken to protect wood.

When one "conserves" old
bldg, is bes. it wears out
unevenly. Is a time-indivisibility

If cd. build old bldgs
worth more than rent in
perpet., everyone wd. do so, until
cdrit.

NEWS SERVICE

in Newspapers

Agriculture and Extension Division

November 29, 1961

Strip-Mined Land Is Difficult To Reclaim

Strip mining for coal is converting farmland to wasteland in several sections in Missouri. More than 30,000 acres have been strip-mined and the area is steadily increasing.

Strip mining is done in 12 counties. It is most extensive in the western counties of Barton, Bates, and Henry. Extensive areas also occur in Macon and Randolph counties.

Various methods of reclaiming strip-mined land for some type of agricultural use have been tried. Results have varied, according to H. H. Krusekopf, professor emeritus of soils at the University of Missouri.

Forestation has not been effective in Missouri. Most of the trees die because of drought or unfavorable soil conditions.

Reclamation by seeding lespedeza, sweet clover, and various grasses has been extensive and successful in many locations. The success, Krusekopf says, depends on the character of the strip material, and degree of leaching and weathering.

Strip material consisting largely of sandstone or acid shale may require 10 or more years of weathering before even the most tolerant plants appear.

Strip material containing limestone or that is derived from calcareous shale requires little weathering and quickly covers with vegetation. Sweet clover and other legumes are the first plants to appear.

The strip-mined land in northern Missouri has been glaciated. The glacial till is a sandy clay, moderately acid or alkaline. It weathers quickly to form a soil. It is for this reason that the spoil banks in northern Missouri are more quickly reclaimed than strip land in western counties.

Grading or leveling of strip-mined land has received little consideration because of the cost. Grading apparently is not necessary when the land is planted to trees, but for forage crops it is desirable. This is shown by the better vegetation cover on those sites that have a gentle slope due to grading or erosion.

On a leveled, experimental field in Bates County, various grasses and legumes were seeded, with application of fertilizer and lime. Of all the grasses and legumes, fescue grass was the only one to survive, and now forms a thick mat over the en-

Vets Outline Poultry Vaccination Program

A vaccination program for poultry has been outlined in a new folder prepared by the University of Missouri School of Veterinary Medicine.

The veterinarians say the important thing is to have a planned vaccination program. By knowing the exact date for giving the vaccines, the poultryman can be sure to have the correct type of vaccine on hand.

When a vaccination program is started, buy all vaccine from one manufacturer, the veterinarians advise.

Four diseases are discussed in the folder: Newcastle disease, infectious bronchitis, fowl pox, and infectious laryngotracheitis.

Copies of Folder 98, "Vaccination Program for Poultry," can be obtained at county extension offices or by writing to the Mailing Room, Waters Hall, Columbia.

tire field. Fertilizer had no effect.

The vegetation on the graded area is in sharp contrast to the almost barren surface on ungraded surrounding strip land.

Of more significance is the faster weathering of the strip material to acquire soil-like properties. On the steep slopes of the ungraded areas, much of the rain is lost as run-off, erosion is severe, and the formation of soil is very slow.

Complete grading or leveling may not be feasible, but strike-off grading of the tops of the ridges should be a practical requirement, Krusekopf says. Until greater effort at reclamation are made, the majority of the strip-mined land will continue to be idle wastes, he concludes.

It's a waste of money to provide bright lights in the laying house, say University of Missouri extension poultry specialists. A 40 or 60-watt bulb covering 200 sq. feet of floor space is still enough to increase fall egg production.

Crop production is 56 percent higher per acre than it was 40 years ago. Output per breeding animal is 81 percent greater.

There are now 2,300,000 4-H boys and girls in 94,000 clubs throughout the 50 states and Puerto Rico.

Commons, J.B. - A progressive tax on bare land values
Pol. Sci. Quarterly

4 factors in land: bare land, improvements, original fertility, improved fertility. (Natural 'capacity to respond to fertilizing' is bare land - can it be distinguished.?) It is a 'foundation for fertilizing' says Commons. Really only space characteristic of land is really indestructible ~~the~~ Earth can be moved. It may be wise to consider all local differences in fertility as improvements to begin with, taxing on ^{position} area basis.

1602, the 'Case of Monopolies', interesting econ. doctrines re. monop. revealed.

captious?

Grimstad Bill, Wise '21, proposed that 'if fertility were kept at par,' then it was $\frac{1}{2}$ land value. So a completely run down farm is worth $\frac{1}{2}$ one kept at par. Obviously arbitrary & unsatisfactory. Their surveys show completely run down farm has lost 100% available plant food, $\frac{1}{3}$ total plant food.

'Concept of bare land vs. maintained land is familiar to farmers'. If so, would simplify administration.

If starting with virgin land, we would say fertility was part of bare land - tho even then, because it is destructible & requires labor to maintain, it maybe should be differently judged. No - land could be taxed assuming fertility, & this would require maintenance. - if delinquency forbidden.

But instead we arrive on a scene of some land maintained, some improved, some exhausted. If at this point we declare ~~original~~ present fertility the base, we are confiscating past labor - not only by exchange, but directly. If we take original, exhausted land will never be used. So we are forced to take exhausted land as the base, counting ~~the~~ fertility as an improvement. This still permits exhaustion, but discourages it, & saves making people land bankrupts as the counting fertility as land system would do. Probably ok, but not perfect. Is perfection possible?

Commons, cont.

The problem remaining is to distinguish the 'land base' from maintained farm. Today many run down farms exist, furnishing proper comparison. Effect of lvt should be to build them up. Then what will basis be? By that time we should have observed the regeneration of so many farms we will have worked out a general cost of production of fertility picture.

Assessing should become the highly specialized & rewarded profession that law is today - when laws are simplified & lawyers looking for work, they become assessors.

Of course no point exists at which you stop exhausting fertility & start exhausting 'capacity to retain fertility', except as latter refers to underlying rocks.

Another view: in order to expend labor on fertility, farmer must know he is to get the ~~reason~~ market to return. Indeed, if he were not going to it would be socially unwise to have him build fertility - it is not an end in itself. Now say demand for farm products declines. Some land value declines, & tax. As future market for fertility's products declines, less incentive to build fertility. Ok.

The rub is: it is now possible to mine a farm as a perfectly legitimate way of living on investment? No - a terrifically wasteful way of living on corpus, as you must pay tax to do it. Better to sell to ~~an~~ active farmer, invest in bank, & draw from that corpus for living. Of course you would have income from bare land enough to pay tax, so it is not ^{wasteful} payment. However, if we are going to regard fertility as private prop, we must allow for its being consumed as owner sees fit. In general the principle is that what is private prop. will be produced amply. If fertility is regarded as such, as a labor product, its loss is only the owner's, not a social loss. If farmer starts to wash away irreplaceable part of soil, if such there be, then he will find himself taxed for what he does not have, as tax will not be reduced on that account.

Comments, cont.

Wisc. cities, imp. = 60%, land 40% value.
country, structural imp. = 20%, land & fertility = 80% value.
If $\frac{1}{2}$ is fertility figure, as ~~the~~ Grimstad Bill suggested, 40% is also rural land ratio.

Wisc., 1919: rural land: \$1.3 b
urban "lots" .4 b

Ralston-Nolan Bill introduced in Congress, "based on single tax theory that fertility is a gift of nature", does not exempt fertility. Also has surtax on large holdings - so does Grimstad. Grimstad is "farmers' single tax". Was to be a surtax on existing prop. tax. \$10,000 exemption.

~~Public Utilities~~ Grimstad exempts standing timber, for same as ~~land~~ ^{fertility} reasons. - to encourage new ~~timber~~ ^{tree} production. Again, it would be ideal to distinguish virgin from produced timber. Virgin should be taxed on sustained yield principles. Or we might have a severance tax on virgin, treating it like minerals, & annual tax on timber producing capacity. It is easier for to distinguish virgin from produced timber than original from produced fertility. So tax virgin timber as part of land - no - virgin timber is a mineral, land growing capacity is land. Distinguish the 2. - mineral rather than fertility principles apply to timber, fertility principles to land. But what shall mineral principles be?

It is customary to separately evaluate stumpage.

We must distinguish virgin timber from subsequent growth, too.

Grimstad taxes minerals. Reason for treating them differently from virgin timber is that conservation problem is more pressing with timber, monopoly with minerals. This is because timber is
a) More common b) Reproducible Not acceptable reasons.

Comments, cont.

'Clearing' differentiated from maintenance because it need be done only once, it leaves no constructive products. So what.

Effects of LVT on M: lower P, increase T. Loans on land security would be a problem - but most such loans are also on improvements, whose rising value would compensate.

Δ value of funds is income to indiv. To society, it is mostly a redistribution, rather than net inc. C.O.L. rises as price of funds rise.

The income is a form of rent. Like other rents, it is not entirely passive. Not w/o effort, but in excess of effort.

Landholder must decide what use to choose. If we followed one line of thought far enough, he could choose uses w. zero net returns, so entire rent is owing to his sagacity in not doing so. Indeed he might blunder into uses w. neg. returns, and deserve even more than rent for not doing so.

But this reasoning, i.e., confuses profit & rent. ~~Choice~~ Possibility of choosing wrong use implies lag between invest. & liquidation. To abstract, assume immediate disclosure of outcomes. Then there is no decision problem, but just putting to highest use, sacrificing lesser uses, including amenity or pleasure ... self-gratification.

When land must be committed for long periods, decision problem becomes important. Men who can guess right can ~~go~~ are in limited supply, so their returns on equity cap. will not be reduced by compn. to a genl. level, even. ^{But by the time crowd catches on to what it shd. be, it's too late.} Assessor can take full ex. rent from land, year after year, having benefit of hindsight, and good guesser can still take 20% / yr on his old invest. Those who demand the 1st rent too, & claim they cannot make do w/o it, are confessing they are poor mngs of invest., poor forecasters, decision makers, etc. Assessor has benefit of hindsight, but he dare not use it to look back & claim all the profits on old invest., rather, to set land rent at o.c. in future use, using best guess of mkt. today.

Landholder as such simply lets land go to high bidder. Risk-taking is fun. of investor as such.

Is rational for society, the remainderman, to require holders of land that has hi 70 conservable flow topsoil, to ~~require~~ commit considerable fixed improvements to land to guarantee vs. their sequestering the conservable flow.

W. conservable flow, income is land rent, even tho holder cd. make off w. it, bcs is to his interest, to max. rent, to conserve it.

✓ Same reasoning to expendable surplus income. There is an optimal rate of depletion. Income of unexpended expendable surplus is the best thing for owner to do, hence ~~not~~ due to his sacrifices.

Concept of passive rent makes this hard to see -- scratch it.. If landowner puts land to highest use he collects full potential rent. It is no less rent bcs. he might have failed to put land to best use. So with depletion: landholder cd. deplete at wrong time, but the max. he can get by depleting at right time is all imputable to land.

To say he gets this w/o effort or sacrifice is not to say he did not sacrifice less desirable alternative uses of the land, including those yielding him direct satisfactions. But he gets more satisfactions by best use.

To make this pt. must clearly distinguish 2 rent concepts: income to land; & xfr rent.

3. The return ~~for~~ ^{attributable to} ~~degrading~~ ^{impairing} soil texture is ^{not income but} a transfer payment, ~~just~~ quite ~~the~~ like the return for withdrawing nutrients. But the ~~return~~ ^{return} attributable to ~~unimpaired~~ ^{impaired} virgin soil texture, while it remains unimpaired, is an income.

Looking to the past, or ex post, this income is part of ground rent.

A large ~~greater~~ part of impairable virgin fertility is not economical to impair. We need not credit the individual landholder with any contribution to production simply for refraining from destroying natural res. which ~~he has no interest in~~ ^{there is no net gain in} destroying, so a large share of this income is includible in ground rent.

Is ~~it~~ this income part of ground rent? In one sense yes, because it is the income of a natural resource never created by man.

In another sense no, however, because ~~the~~ ^{the} income-yield's res. has been preserved from impairment by past abstinence ^{from exploitation;} ~~and~~ looking to the future, ~~it can be preserved from unec. impairment only by~~ ^{assigning the holder of the income} ~~the~~ ^{future} the holder needs assurance of his right to receive the full future income, to motivate him adequately not to sacrifice future incomes for present ~~not~~ ^{exploiting} returns.

Were I the officers of the AEA I ~~had~~ ^{should} proclaim the coinage of a new ~~name~~ ^{word} to identify this distinct ~~type~~ ^{variety} of income. Being much less influential, however, I will content myself with ~~suggesting~~ ^{turning} a noun into an adjective and labelling this income as "topsoil rent". As everyone knows that topsoil can ~~be~~ wash away, this ~~seems to~~ label has good mnemonic qualities.

Let this up so knock down.

Virgin fertility

10

1. Rent is an income, excludes xfr payments for withdrawal of virgin fertility.
 Almost too obvious, ~~but~~ to mention, but surprisingly often flouted.
 Bence. (Wantrup?). Nat. inc. analysts. Income tax law, no depletion allowed.

2. Soil is complex resource, however, & poses some ^{trickier} ~~other~~ problems in def. of ground rent. Let us begin by distinguishing ^{mineral} ~~soil~~ nutrients, which are withdrawn by use, & soil texture. Nutrients are a fund resource, ^{partly} ~~analogous~~ to mineral deposits: they yield no income (other than possible price appreciation.)

2 economic aspects of virgin fertility, the fund & the flow.
 ~~Generally~~ The fund aspect of ^{fertility} ~~soil~~ is ^{partly} ~~analogous~~ to a mineral deposit.
 it ~~yields no income~~ contributes nothing to output until it is itself ~~totally~~ withdrawn, embodied in the product or wasted in the ^{economically} ~~production~~ process. [It differs from minerals in that it may often be replaced by soil amendments or accelerated soil ^{breakdown} ~~evolution~~. It differs also in that it may contribute to the biological health of soil, & so yield some income in the years before it is withdrawn.]

The flow aspects of ^{fertility} ~~soil~~ is exemplified by soil texture, which comprehends the soil's workability and storage capacity for water & nutrients. Soil texture yields true income, ~~without~~ ^{without} net of depletion, and yet it is not a pure flow resource since it may be impaired by ~~the~~ ^{of virgin soil} ~~economic~~ use.

Precisely ^{which} ~~what~~ physical ~~soil~~ properties ^{of virgin soil} ~~are~~ ^{fund} ~~resources~~ ^{which} are flow res. is a question ^{where details} ~~pure~~ may leave for the present to future joint research by soil technicians & econs. But for the present we ~~must~~ know enough to see the need for defining a new ^{sub} ~~category~~ ^{of resources: flow} ~~category~~ ^{the} ~~flow~~ ^{res.} ~~which~~ ^{may be} ~~depleted~~ ^{impaired} ~~by~~ ~~economic~~ use.

- ✓ Surplus mantle is not entirely sterile, bcs when you get down to min. needed topsoil, ~~is~~ (depth & quality) is very costly to farm w/o any loss. So is ec. to begin conserving earlier, w/ less stringent measures.
- This is expressed by allowing the surplus mantle has a value, that of obviating conserv. outlays.

There must be clear lines among all categories. Surplus mantle is that which will be neither conserved nor replaced.

100% conservation of conservable topsoil is impossible? Some aspects of it are 100% conserved. Those that aren't are part of surplus mantle; or are replaced, e.g. by sheet erosion from higher lands, & are flow res.

- ✓ Expendable Surplus mantle is "mined"; revolving fund is drawn on. Taking surplus mantle is mining bcs it is irreversible — economically, i.e.
- ✓ Exhausting underground w/o is "mining" in W.T.s. bcs not renewable, but is revolving fund drawdown in Tulare Cty. etc.

Ex post, yield of expendable mantle may be largely income. But income is current, in yrs when value rose, & not at time of liquidation. Say a man paid current mkt. price to Land Office initially, then conserved mantle from depletion. Each yr's Δ value is true income for a real ec. sacrifice & contribution.

- ✓ Refute idea inc. of conservable impairable topsoil is return for human abstinence.

- ✓ Refute idea rent comes in w/o action — distinguish latent rent from kinetic rent, is place to do it.

Revolving fund resource differs a good deal from a dead mineral fund resource. Its intramarginal productivity exceeds its cost; & even its marginal productivity exceeds its sheer removal value. It has a catalytic value in a broad sense -- it fructifies other elements already there, & is inexhaustible. Thus it yields an income above replacement cost -- the marginal quantity does. It must, to pay interest on its cost.

Thus it differs from inert natural fund res. -- minerals. But revolving fund res. cease to be natural res. after 1st depletion. Problem of rent on them only arises before replacement begins.

But then, no problem: entire income above depletion is rent, & no matter if imputes to permanent or temporary qualities of virgin soil.

Surplus mantle differs from revolving fund in being not ex. to replace; differs from conservable topsoil in being not ex. to conserve. Surplus mantle consists of ~~both~~ both replaceable & conservable qualities which are not ex. either to replace or conserve.

✓ Conservable topsoil is a definite value at any given time, based on current opinions of the future. These may change. This makes for a future shift in ground rent. ^{downwards, if l.v. are higher.} But this problem not unique to this particular distinction. Wage rates change, e.g., & change rents. All parameters are changeable.

✓ Surely, nutrients may be replaced & so are revolving fund res. But some virgin nutrients will be costlier to replace than to "conserve." Not that they can be conserved permanently, but withdrawal can be slowed & replacement postponed. Occasionally withdrawal can be slowed to = rate of natural renewal.

✓ Some nutrients are replaced by natural ~~soil breakdown~~ or organic soil processes, as quickly as withdrawn, & so are flow res. Like conservable topsoil rather than matrix, tho. ^{bes organic processes may be stopped.}

Virgin fertility,

7

~~There are many who~~ ^{those who}

It is rare that anyone ^{explicitly} alleges topsoil to be "indestructible" — even

Ricardo probably never meant it in any such dogmatic sense as ~~in~~ some critics seize upon — But it is ^{very common} ~~equally~~ ^{almost universal among farm production econs (over)} rare for any modern analyst of

scale economies to give heed to ~~the~~ accelerated soil erosion

that attends use of larger equipment on rolling land, and such

analysts are by their neglect ~~in effect~~ implicitly regarding topsoil

as ~~indestructible~~ ^{more eloquently} than any Ricardian.

to ~~form judgment~~ judge the efficiency of various input combos w/o any regard to their effects on soil erosion.

But it is very common to find farm econs ^{omitting any allowance for soil losses} neglecting ~~who by their neglect~~ ~~to neglect~~ ~~betray~~ ^{more eloquently than any Hyper-Ricardian} their implicit assumption of the indestructibility ^{stop} of soil. ^{or inexhaustibility}

It is almost universal among farm econs, ~~eg.~~, to judge

the relative eff. of diff. input combos & scales of farm w/o any regard to their effects on soil erosion. The modern ~~enthusiast for~~ ~~scale econs, eg.~~ It is rare for ^{the latter-day} modern

enthusiast of scale econs, eg., to give any heed to the accelerated soil loss that attends use of 8-row cultivation on rolling land.

This sort of neglect betrays, more eloquently than any ^{explicit} Hyper-Ricardian ~~assertions~~ ^{asseverations}, an implicit assumption of the indestructibility or inexhaustibility of the original powers of the soil. The solicitude of some

economists for the conservation of virgin soil seems limited to the occasion when ^{a needle is wanted to hedge} someone seeks to define economic rent!

Virgin fertility.

6

surplus mantle is almost a pure fund resource.. It does yield small incomes, 2 ways:

- a, Excess of current net yield over present value of optimal future net yield. This is rent; rest is sale of natural asset. (Incidentally, confusion obtains over rent bcs. of idea you can't avoid receiving it. That is not essence, but that it imputes to watch res. Might bring this into paper.)
- b, Value of Δ physical yields. Negligible. Or reduced consn. outlays? Again, not income. ~~The~~ ^{the} ~~excess~~ ^{income} cons of surplus mantle you ^{can} ~~lose~~ ^{have} ~~lose~~ ^{one} finite, so charge depletion. So (b) is same as (a).

Just how much soil is which varies w. the soil. Alluvium, e.g. all renewed, 100% flow. But some soils very steep, shallow, erasive, use one yr. & destroy, 100% fund. One soil has enduring qualities & another plays out in a few yrs.

~~Much of the ex. writ~~
~~Has been a tendency for those discussing topics to~~
Topic has been clouded by propensity of ^{some} discussants to move too ~~fast~~ ^{quickly} to ~~an~~ ^{an} extreme position, choosing one ~~class~~ ^{some} of attribute of some virgin soils ~~to~~ to represent the whole order. It is easy, e.g., to find no trick at all, e.g., to locate ~~an~~ ardent soils fundamentalists who regards all virgin soil fertility as irreplaceable & all depletion ~~immort.~~ ^{an irretrievable loss.} Then there are the prop. property fundamentalists who regard all fertility as a ~~rotating~~ revolving fund completely analogous to a grocer's stocks. There are hyper-Malthusians pessimists who regard ~~the~~ fertility as largely depletable & irreplaceable ^{nutrients.}

Some aspects of fertility, it is cheaper to renew artificially than maintain natural virgin. ~~that~~ Such aspects of virgin soil have $\therefore$ no value, are not a resource. (They have a mining value.) They are rotatable.

✓ But other aspects, cheaper to maintain virgin endowment. Such virgin endowments are limited natural resources yield^{net} & perm^{net} income streams: rent.

✓ "Rotating" is wrong concept here, bec. you are not replac^g. By def. you cannot replace or rebuild this res. as cheaply as you can maintain the natural endowment from impairment.

[Some nutrients are "rotating": ~~But~~ They are like goods on a shelf. But they are small part of total. May be limed, but so are many things.]

The steps you take to maintain virgin endowments are not analogous to replac^g the topsoil depth or texture. Here is a proper & unique meaning for "conservation." This income is "conservable, ^{virgin} topsoil rent".

✓ The def. of "conservation" has been used cert^{ly} for long time
✓ Each annual consen. cost can be looked at as conserv^g this per-
manently & yield^g a permanent income, net of future consen. costs.

Or you can match permanent annual costs vs. permanent annual incomes, amounts to same thing.

Treat as unit unless costs & revenues are separated, re (2).

Elements of a ^{virgin} land

Flow	{	1. Indestructible, ^{exogenous} e.g. surrounding veg ^{etation} ; climate	Inexhaustible base & matrix: ^{parent rock whose decomposition gives soil its substance.} Parent rock ^{Location} Glacial till 100' deep.
Fund	{	2. Economically conservable: ^{economically replaceable & rotatable} renewable ^{revolving fund} largely fruitless base, at small cost ^{rent, but this varies w. soil}	
		3. Expendible	The ground, impaired but not expendable ^{impaired but not expendable}
		4. Surplus mantle	permanent topsoil (so long as avoid any separation of costs & revenues) Vulnerable but conservable. Slope; texture ... includ ^g ability to respond to amendments.

Surplus mantle yields income while being impaired, bec since it has ~~little~~ Product of natural veget^{ation}, altered by man, so not reproducible by man --- often very slowly formed anyway. Or deposited by glaciers, not being currently formed.

Abandonment ^{ff. exploitation} were more result of accumulated delinquent taxes I suspect, than hi taxes per se. Hi taxes & fees foreclose wd. preclude much exptn. And also wd. let us define most inc. as grnd. rent!

✓ "Surplus Topsoil" - that which it is ech. to impair, (bes it will yield little future income, & it costs money to conserve it.)

X "Conservable Rotating Topsoil" - wd. deteriorate if used w/o ^{consn. outlay} ~~maint.~~ & replacement, but is ech. to maintain. For most ^{ec. analysis & policy purposes} ~~practical~~ purposes may be merged w. ground, ^{treated as unit.} Exception is when abandonment is a possibility, by present occupant w/o equity in land or improvements.

"^{Expandable} ~~Surplus~~ Topsoil" yields little future inc, hence negligible current income.

✓ "Conservable Rotating Topsoil" differs from human products in that it cannot be rebuilt as cheaply as it can be continually maintained.

✓ You earn income from ~~the~~ ^{conservable} "Rotating Topsoil". But only the mgnd. top centimeter yields an income as small as annual ~~main~~ ^{main} costs. Remainder yields more - a net income. That is rent ~~not other~~ (explicit outlays hv. been deducted.)

W/o Topsoil, $TP = 0$, but that doesn't make TP impute to topsoil.

When, then, do we say Topsoil has all "rotated"?

How differ from bldgs? Inventories?

✓ ^{Conservation of} ~~Main~~ differs from replacement 2 ways: a. The physical soil is not exchanged, but prevented from eroding away; b. Consn. invmt. is to prevent future losses; replacement to restore past ones; c. Consn. outlay is to mntn a flow resource; replacement to mntn. level of a revolving fund resource. (see p. 7 for more on revolving funds)

Virgin fertility.

3

Emphasize large share of virgin fertility is not exhausted in ordinary use. Subsoil drainage; ~~topography~~; most nutrients; basic mineral composition;

- ✓ Also emphasize, ability of a soil matrix to accept & hold
- ✓ improvements varies w. soils, & is itself a virgin & enduring soil characteristic. Nitrogen, phosphorus & K, poured on Sahara, wd. yield 0.2 g.

~~Another problem defining ground rent is, when deplete virg. fertility, what is value of loss? Is present value of most favorable future use. At what i.r.? Is highest present value any potential site-user cd. put on it, but not it alone, whole complex of use. If assume that is present occupant. then his i.r. counts; if someone else, then his.~~

~~Involves forecast & judgment, is $\therefore$ not 100% definable. But neither is anything else.~~

Assume is ec., given perfect mkt., to impair texture so as to lower ~~out~~ permanent output level to .80 of sustainable virgin level. Then the .80 level is ground rent.

- ✓ If holder reaches pt. of no equity, then his taxes reduce his exploitation. Bes. he reaches limit of expltn. when current net exploitive yield fails to cover taxes.

How distinguish topsoil rent from ground rent? Might be partly instl. Physically, over a time, all soil cd. be reduced to zero net current ~~of~~ yield, ~~so if~~ if every yr. user has no int. in next yr. Or topsoil rent cd. be that imputable to what holder wd. destroy before abandoning his taxes.

This distinction has the ~~fairly~~ difficulty of requiring some exercise of judgment & even forecasting in ~~the~~ separating that which is permanent from that which is ~~ex.~~ to ~~be~~ impair.

Further, ~~what~~ the time between the permanent & the impainable will change w. time & technology. The difficulty is inherent in the subject, however, & there is no gain in blinking it. As a practical matter it is useful in 99% of all cases to distinguish the permanent from the impainable. It wd. be foolish to let the other 1% frighten us into abandoning a qualy useful & definable distinction.

2d kind of income, from price Δ s to withdrawable nutrients.

✓ altho withdrawable, nutrients & texture remain fixed in location & aggre. quantity, retain some of qualities of ground.

Many nutrients are so abundant in soil that, even tho withdrawn physically, supply is inexhaustible, & may be treated as flow resource. Some are renewed periodically by nature. e.g. alluvial soils, are like flow res.

Withdrawing minerals yields some income if present value of best alternative timing of withdrawal is less than imputed return from present withdrawal.

↳ likewise impairing texture.

✓ Export, is an income from hold'g from past time of lower value.

✓ as practical matter, signif. of impainable ^{conservable} virgin fertility is never create instns. whereby holder's equity may fall to zero & motivate him to exploit & abandon.

Income of ^{reducibly, expendable} ~~depletable~~ virgin fertility, (cont.) (from back of "Remaining work" page.

^{Expendable} ~~Depletable~~ virgin soil fertility & condition yields signif. income 2 ways. Physically, by Δ output (w/o being ~~depleted~~); expended or exhausted or removed); fully, by Δ in real value over time. Nutrients you can remove only once. Texture, if retained, wd. yield long stream of future values.

Intro { Nutrients are a fixed resource (w. some of characteristics of a flow resource since they can be renewed from within the soil over a long period.) Texture is a flow resource (w. some of character of a fixed since it can be destroyed by neglect & misuse.)
~~Nutrients yield ^{physical} not net income. Texture does.~~

No. ^{Only the conservable yields inc., & it is rent} Looking to the past, this ^{income} is rent; to future, no, but up to a sacrifice of higher current inc. from destruction. Policy implications should look largely to future, & to past only as affects future. Will probably look to past even more, in practice, ~~too~~ out of desire to do justice, & ~~no one~~ ~~can~~ one can hardly object to that. One can only ~~if society~~ insist that we settle the scores of the past in ways that do not prejudice the future.

Crude The question here is essentially one of terminology. Income from soil texture ~~which~~ in excess of what it is ec. to maintain permanently is not ground rent, but a unique category of income that deserves a separate name. We will not coin one here, but call it the earnings of retained ^{surplus} virgin soil texture. It is not included in the term "ground rents" which is limited to the income imputable to that ~~from~~ much of Nature which is economically permanent, that is which it is either impossible or uneconomical for ~~the~~ private ~~owner~~ title-holder to deteriorate, impair.

the discussion of expendable surpluses, which we now take up.

Lign. value exceeds emplaced value
Or will, w-in foreseeable future.

Might seem furthest removed from matrix, but in one way very close.

Prob. fund = perpet. flow. E.s. not inf. fund, but abundant one, low emplaced value bes. surplus. Emplaced value low enough, $\rightarrow 0$, e.s. $\rightarrow$ matrix, fund $\rightarrow$ flow.

Thus an expendable surplus is a ~~very~~ large but finite fund which grows small enough so that ~~the~~ ^{its} emplaced value of a crosses ~~the~~ our threshold of ^{perception} ~~attention~~. The threshold is inevitably an arbitrary line — let us suggest the line when emplaced value surpasses 3% of liquidation value. That arbitrariness would be a source of embarrassment if the values involved were material, or if the line affected the amount of rent. but neither is the case. For the excess of liquidation value over emplaced value is clearly part of ground rent. ~~The only depletion ^{cost} value we can net out is the emplaced~~
The valuation of the surplus expended this year is not its liquidation value next year, or any early year, for those are not sacrificed by this year's withdrawal. If, for example, we have a 50-year supply of calcium, the withdrawal in year 1 does not sacrifice a withdrawal in year 2, but in year 50. The emplaced value is the liquidation value expected for year 50 discounted back over 50 years to the present. That is all we can net off as "depletion." The rest is income; ground rent.

The controversy ^{& complexity} latent in that conclusion, ^{esp. in relation to mines & oil wells,} causes me to shrink from pursuing it here. ~~as ever insisting on it.~~ If it be valid, it would seem to follow that the depletion allowances ~~given~~ permitted by Federal income tax law to oilmen etc. are grossly excessive, not only due to the detailed loopholes which we ~~all~~ read so much about, but in basic conception.

The upshot of this appendix is that depletion of virgin fertility, or the possibility of it, do not detract much from ground rent. Matrix income is all rent. Conservable flora resource income is all rent, after deduction of ~~the~~ conservation costs. Revolving funds supplied by man yield ^{gross} ~~net~~ incomes that are not rent, ~~and~~ but largely amortization, with a small net income that is not rent either but ~~a~~ interest on a capital investment. Expendable surpluses yield liquidation values from which only a small depletion charge, based on remote future liquidation, is properly deductible, so that their liquidation yields largely a species of rent income.

A QUARTERLY BIBLIOGRAPHY OF UNIVERSITY PRESS PUBLICATIONS

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Agriculture and Animal Science

BEAR, Firman E. *Earth: The Stuff of Life*. 238 p.

5½ x 8½ in. \$3.95

OKLAHOMA, JAN. 25

The problems of soil conservation in the light of present-day practices, describing soils in relation to the growth of plants, animals and man; with a plea for sensible conservation of our renewable natural resources. Author is editor-in-chief of *Soil Science*.

BENJAMIN, Maxine M. *Outline of Veterinary Clinical Pathology*. 186 p.

8½ x 11 in. Paper, \$3.95 IOWA STATE, NOV. 10

This concise manual dealing with all domestic animals gives the reasons for running tests, methods employed in tests and interpretation of test results. It features direct smears to demonstrate bacteria, fungi, inclusion bodies and neoplasms; pregnancy tests; anemia findings and urine findings.

IOWA STATE University Center for Agricultural and Economic Adjustment. *Labor Mobility and Population in Agriculture*. 231 p.

5¼ x 8½ in. \$4.95

IOWA STATE, JAN. 5

A summary and interpretation of current knowledge, which suggests areas of needed

Mercury, but, though they were welcome, they were not my game. My game was the nonliterary student, and my device for luring him into my bookshop was simplicity itself. I encouraged him to sit down.

For down the middle of the room there were two or three undistinguished tables, which I managed to fringe with some ordinary classroom chairs. I put the books on the shelves and a sign on the wall (or was it written in chalk on the black-board?) "Please feel free to read any of these books as long as you want to. If you want to buy one of them, it is for sale."

As I needed a name as remote from *Ye Olde Village Booke Store* as I could get, after consultation with my colleagues I determined on *The Bull's Head Bookshop*. It seemed appropriate to a tobacco-raising state. I got my friend George Horner to devise a sign we hung on an iron projecting from the doorway into the hall, and for this he painted, God knows why, a blue-eyed bovine. It was a lucky accident. Persons who had no notion of either reading or buying a book except under compulsion came to look at this zoological curiosity, and remained to read. By and by some of them even bought books. As we had no way of wrapping a book in fancy packages, customers went away content with the naked volume. And we had, if my memory is right, no charge accounts—that is, no official charge accounts, though if we caught an undergraduate longing to possess a particular book, yet lacking the immediate cash, I think we made arrangements.

For the most part our customers respected the books they read, but under handling books do get soiled. To take care of this situation (and also, once matters developed, to make room on the shelves for new books) we had periodically an auction. I think I ran the auction, though my memory may betray me, but the quarterly auction became something of an event, and people came from such far-away places as Durham and Hillsboro to participate.

Since I could not spend my entire day behind the desk in the *Bull's Head Bookshop*, I was spelled by willing assistants—students and members of the faculty, none of whom, I think, had ever sold books before. The process of buying and selling was simplicity itself—the customer paid his money and took the book, and the money was put in a metal box in the drawer of the desk. So far as I know, nothing was stolen from the cash box, though I think some of the books "disappeared." But as North Carolina ran on the honor system, there was no problem.

When I left North Carolina for the University of Michigan in 1930 the *Bull's Head* was a relatively flourishing concern. There were no empty shelves, and the weekly receipts were healthy. I was assured that it would not be allowed to die. Now it is housed in the library building and is not only one of the leading bookstores in the state, it is one of the leading bookstores of the nation because of the patient care and thought the staff of the University of North Carolina has given to it.

Sunday



ST. LOUIS POST-DISPATCH

PICTURES

JUNE
24, 1962



Missouri's Despoiled Landscape

Continued

The QUEST For COAL



Machine-made ridges (in photo on cover) scar countryside near Kingdom City, Mo., as result of man's quest for age-old deposits of coal. Area is part of 3000 acres mined by Marriott-Reed Coal Co. in last 26 years. Brackish water is discolored by high acid content of subsoil in Callaway County. Recent study showed 65 per cent of county's land is toxic or marginal. In photo above, giant shovel removes overburden of clay and shale to uncover

vein of coal at Peabody Coal Co.'s mine near Bevier, Mo. Both companies have formal programs to abate water pollution and restore land. Missouri is relative pigmy in coal industry, producing only 2,890,000 tons valued at \$12,450,000 in 1960. Illinois ranks fourth in coal production. In 1960 Illinois operators mined 45,977,000 tons valued at almost \$184,000,000; half of the Illinois output came from underground mines.

Strip Miners Leave A Scarred Countryside But Increasingly They Cover Their Tracks With Farms, Forests

By RICHARD G. GRAY of the PICTURES Staff

The mammoth shovel gouged into the steep bank of earth, taking a 110-ton-bite of topsoil, clay and shale. Then, with its boom pointing high into the air, the machine swung its load to the opposite side of the trench amid a shower of falling earth. Again and again the machine repeated the operation, slowly and methodically eating its way across the landscape and leaving a trail of brown, barren mounds known as "spoil banks." The shovel was being used by miners to strip away many feet of overburden to get at a shallow seam of coal below.

Thirty years ago miners in the Missouri-Illinois area stripped rich coal fields and left the scarred countryside for mother nature to heal as best she could. Today men assist the elements. Since the beginning of this year, Illinois law has required operators to grade a 10-foot-wide swath across the tops of the mounds and to seed the upturned soil with grasses and clovers. For years, however, many companies have been going beyond these minimum requirements in Illinois as well as Missouri, where there has been no movement for a spoil management bill thus far.

Since World War II in the Little Egypt country of Southern Illinois, for instance, there has been new land in place of the old — perhaps not promised land, but land of fulfillment. On the once-barren spoil banks, peach and apple trees bloom and bear fruit, cattle fatten and evergreens flourish in the making of future commercial forests. Farther north, in Fulton County, rows of corn and wheat have replaced the machine-made ridges. And near the town of Canton, the Truax-Traer Coal Co. is converting spoil banks into a plush housing development with \$40,000 to \$50,000 homes and a golf course.

As of the first of this year, 52 per cent of the 105,428 acres of stripped land in Illinois had been reclaimed. In Missouri, where nearly all of the reclaimed land has been put into pasture, 58 per cent of the 18,314 acres of spoil had been restored by last January. Some of this land has been sold or leased to farmers and recreation clubs, but in a number of instances the coal companies farm the soil themselves. Several of the operators have gone into the Christmas tree business.

Despite these efforts there is still opposition to strip mining. Only last month Senator Frank J. Lausche (Dem.), Ohio, introduced a bill in Congress calling for the Interior Department to study remedial action the federal government might take to relieve the spoil bank problem. Referring particularly to land mined before reclamation became widespread, Lausche declared: "In many areas the land has been robbed of its resources and abandoned to the wrath of the elements." But his indictment included recently stripped lands, too, when he said: "There are large areas where, as a result of stripping operations, public highways have suffered severe damage by reason of slippage; streams, lakes and wells have been polluted; wildlife cover has been destroyed, and the entire areas themselves have been abandoned as unproductive and virtual wastelands."

Other critics charge that acid conditions resulting from stripping leave great bald spots on the landscape and kill aquatic life. Proponents answer that only 3 or 4 per cent of the land is left toxic and that measures are being taken to avoid water pollution.

Operators contend that most of the land was marginal to begin with, and that stripping has actually improved much of the soil by turning up potassium, phosphorus and other trace elements in a sort of super depth-plowing operation. Company officials involved in farming say that they raise better crops and are able to gain more pounds of beef for each acre of pasture than farmers on surrounding land that has not been mined.

Coal officials maintain they are improving recreational facilities by creating lakes on what once was dry land, and hills and valleys on the prairies. They point out, too, that their operations bring considerable economic activity into rural areas.



Massive shovel digs into wall bordering field in Macon County, Mo. First trench (called box cut) is made at coal seam in hilly country or at property line in level terrain. Overburden is piled on surface next to area to be mined. Coal vein is cleaned by scrapers and revolving brushes. Then small dynamite charges blast coal loose, and smaller shovels load fuel onto trucks. Earth from second and subsequent cuts is piled into trenches left by removal of the coal. Last cut is often left open so that springs and drainage can form lakes.

Photos by ARTHUR WITMAN of the PICTURES Staff

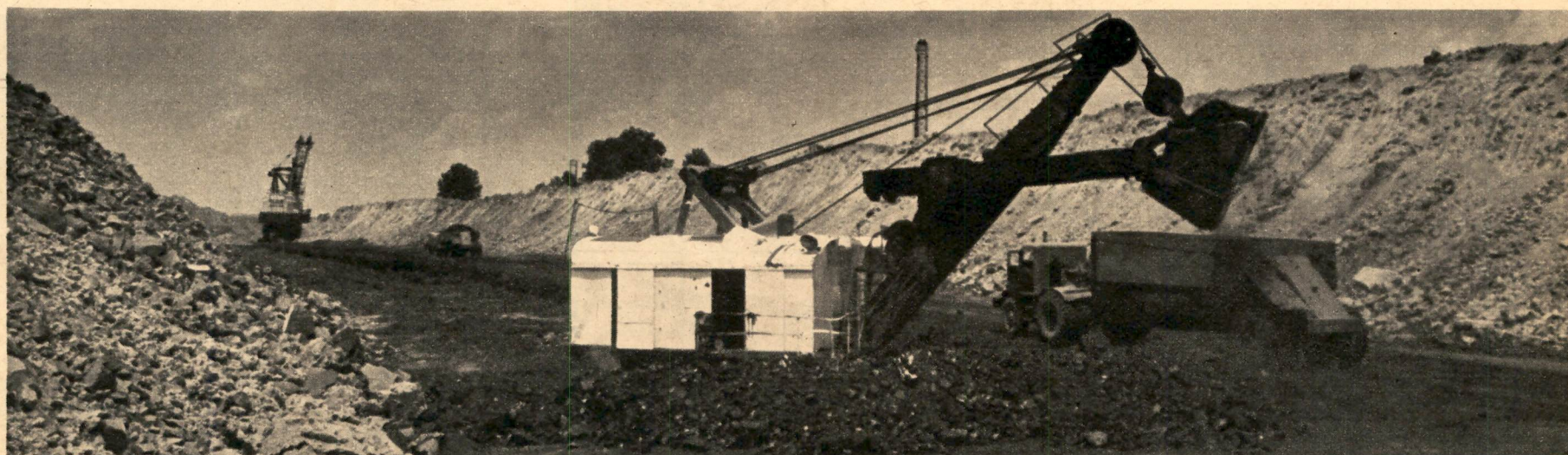
Continued



QUEST for COAL

Continued

One of world's largest earth moving shovels takes overflowing bite out of wall at Fidelity Mine. It is stripping away 45 feet of overburden to expose six-foot coal seam. Electric powered shovel holds 75 cubic yards, cost \$4,000,000 and took six months to assemble at mine site. New 115-cubic-yard machine is under construction for Peabody Coal Co. of St. Louis. It will be used at Sinclair mine near Greenville, Ky.



Half-buried in coal seam, small shovel loads truck at Fidelity Mine. Coal lay on surface of earth in exposed ledges or outcroppings when first discovered in the United States in 1673 by Louis Joliet and Father Jacques Marquette near Utica, Ill. As surface

supplies were exhausted men took to picks and hand shovels to follow seams underground. Later animal-drawn scrapers were used. With advent of the steam shovel in 1877 strip mining was well on its way to becoming the large-scale industry it is today.



Bulldozer shapes spoil banks into rolling hills at United Electric Coal Co.'s Fidelity Mine near DuQuoin, Ill. The land is usually allowed to settle for a few years before grading and seeding process begins.



Seeking out sweet clover and grasses, cattle range over part of 1200 acres of restored pasture now in use at Fidelity Mine. The company plans to develop 1200 more acres of pasture in the next two years for its 500 head of stock.



Apple orchard stretches toward woods on reclaimed land near DuQuoin. Lake in foreground was made by leaving last cut and letting trench fill with spring and

rain water. Most lakes on Fidelity property are stocked with bass, crappie and bluegill, and are open to public for fishing provided permission is obtained.



One of 12 full-time farm hands at Fidelity Mine puts late spring spray on peach trees. United Electric's Fidelity farm produced 20,000 bushels of apples and 4000 bushels of peaches last year on 135 acres of orchard. Farm Manager Paul Seastrom expects orchard to pay its own way in year or two.

End

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* Protein in ample amounts helps hold off hunger, and SEGO with its larger serving contains 10% more hunger-controlling protein.

Adequate Soil Fertility Guards Against Erosion

Adequate soil fertility helps prevent erosion, Earl Kroth, University soils researcher, reports.

Kroth says results of trials at the Midwest Claypan Experiment Station near McCredie give concrete evidence of fertility's effect on erosion. This research was conducted cooperatively by the Missouri Agricultural Experiment Station and the Agricultural Research Service, U. S. Department of Agriculture.

Plots in continuous corn during 1954-60 receiving only starter fertilizer lost an average of 1.7 tons of soil per acre per year. Plots receiving full soil treatment lost only 1.4 tons of soil per acre. Average corn yields for 1955-60 were 51 and 101 bushels respectively.

The effect was less noticeable

with corn grown in rotation with wheat and meadow. Soil losses under both starter and full treatments were .8 ton per acre but respective corn yields were 77 and 104 bushels per acre.

Effect of fertilizer was even more evident after a 4-inch rain-storm last summer, Kroth says.

Continuous plots with starter fertilizer only, had 1.7 inches of runoff and lost 3.4 tons of soil per acre. Full treatment plots had 1.1 inches of runoff and lost 1.5 tons of soil per acre.

Kroth summarizes by saying that adequate fertility helps prevent erosion by promoting a heavier, faster developing crop cover. However, adequate fertility will not take place of mechanical erosion control measures such as terraces.

1-24-62

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3-62

WHAT'S MANURE WORTH?

Doan

The problem of manure disposal from intensive, confined hog production units has been a difficult one to solve. The method that shows the most promise is the lagoon which has worked successfully in many areas. When this method of disposal is used, the manure is not available for use as fertilizer. The table below is based on an analysis at the University of Illinois.

ESTIMATED COSTS AND RETURNS OF HANDLING HOG MANURE

Hogs produced annually	Cost of storing and spreading manure		Cost of a manure lagoon		Value of manure spread*	Net gain by saving manure
	Investment	Annual	Investment	Annual		
250	\$1,519	\$ 319	\$203	\$ 51	\$ 202	-\$ 66
500	1,972	458	267	67	405	14
1,000	2,814	746	390	98	810	162
2,500	4,756	1,552	747	187	2,025	660

*Based on maximum amount salvaged under typical farm conditions.

When you store and spread manure you make about \$1.20 per hour. If you have surplus labor available, then salvaging manure can be a paying proposition. Otherwise, a lagoon which allows you to use your time for more productive purposes is probably more efficient. One development which may change this situation is the use of slatted floors. Perhaps it will be practical to haul out this manure that accumulates under these floors.

2-14-62

RI FARM

For Missouri

University of Missouri College of A

Landslides Are Common In Missouri Hill Land

Landslides are not limited to mountain areas but are common in the hill land sections of Missouri, according to H. H. Krusekopf, professor emeritus of soils at the University of Missouri.

He defines a landslide as a mass of earth or soil moving down a slope. The mass may vary from 25 to several hundred feet in width, one to 10 feet in thickness, and may range in volume from 100 to several thousand cubic yards of soil material.

The movement may be fast, or may extend over several days and weeks. Slides are not always recognized or seen, especially when they occur on grassy slopes or under forest litter.

In Missouri, landslides occur most frequently on the steep, loess-covered hills along the Missouri and Mississippi rivers. Krusekopf says the loess is underlain by materials such as glacial clay, shale, or limestone. When the loess becomes waterlogged, its contact with the sublayer is weakened, and the entire mass may slide down the slope.

The newly exposed soil is known as a scar. Recent slide scars are quite noticeable, but tend to become obscure in a few years because of weathering and plant growth.

Soil creep is another type of soil movement, according to the soils specialist. It generally occurs very slowly on long, gentle slopes. It involves a long time—measured in hundreds of years.

The soil mass may accumulate at the base of a slope or even push into the alluvial valley, to form benchlike surfaces. In soil classification, such benches are called colluvial fans in contrast to waterlaid alluvial fans.

Another form of mass soil movement is known as slumping, Krusekopf says. It affects smaller areas and smaller volumes than landslides or soil creep, but is far more frequent and widespread. It probably occurs most frequently on the rolling prairie land in northwestern Missouri, where the loess cover is comparatively thin and is underlain by glacial clay. Clay points and the cat-walk terraces on the river bluffs are attributed, in part, to soil slumping.

Slumping occurs in the Ozark region, especially where residual

material from two geological formations are found on the same slope. Slumped areas sometimes are indicated by better forest growth, probably because of the shattered subsoil.

On the granite hills in the central Ozark region, slumping has removed the soils from the upper slopes and exposed the bedrock to form glades.

Slumping is a process that may occur again and again for many years. It results in shallow soil on the upper slope and an accumulation, often of great thickness, on the lower slope. Such soil movement often is wrongly attributed to erosion.

Most land slides and mass soil movements occur in the spring when the soil is waterlogged, and during periods of freezing and thawing. It is a factor to consider in the placement of roads and pipelines, and deserves more observation, Krusekopf believes. Effective control measures have not yet been devised.

Changes in farming in Missouri and in the United States during the past 25 years have been remarkably similar in direction and more or less similar in degree, reports Gordon Nance, University of Missouri agricultural economist.

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Federal Judge to Rule Depletion Allowances Can Apply to Water

* * *

West Texas Farmer Who Uses Water to Irrigate Fields Is to Get \$300 Tax Refund

Special to THE WALL STREET JOURNAL

AMARILLO—A U.S. district judge indicated here he will rule that Federal "depletion allowance" laws can apply to a farmer using water under his land to irrigate his fields.

Such depletion laws, aimed at compensating mineral producers for a diminishing of capital, up to now have been used mainly by oil, gas and mining concerns.

In a letter to attorneys for a West Texas farmer and for the Government, Federal Judge Joseph B. Dooley said he will soon rule in favor of the farmer in his suit for an income tax refund. The letter said the judge intends to call a meeting of attorneys to clear out technical problems before he hands down his decision.

The farmer, Marvin Shurbet, sought a \$300 refund on his 1959 Federal income taxes on the ground that water under his land has a great influence on its market value. He claimed this water supply is being depleted as he pumps it out for irrigation purposes and hence he is entitled to deduct such loss of capital from his income in figuring income taxes.

The suit was filed by Mr. Shurbet on behalf of the High Plains Underground Water Conservation District No. 1, a state organization, regarded as a test case. Officials of the water district estimated the judge's ruling would save West Texas farmers about \$1 million a year in Federal tax payments.

In opposing the suit, the Government agreed the water table in the area is dropping. However, it contended that the water supply is being replenished through rainfall, and therefore water isn't a mineral in the sense of gas and oil for income tax purposes. Mr. Shurbet answered, through testimony by experts, that some of the water in the Ogallala formation underlying his farm was deposited thousands of years ago, and that it would therefore take thousands of years for it to be replenished.

Judge Dooley ordered the Government to refund the \$300 to Mr. Shurbet.

Wilshire, Camerina Petroleum Acquire \$3,197,000 of Leases

NEW YORK—Wilshire Oil Co. of Texas and Camerina Petroleum Corp. jointly purchased for \$3,197,000 about 90,000 net acres of oil, gas and mineral leases in the Arkoma Basin.

This is part of the 100,000 acres the companies said on Oct. 17 they would acquire for \$3.5 million, subject to receiving satisfactory documents of title.

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Value of Terracing.

1. Need for community action, but w/ flows over boundaries.

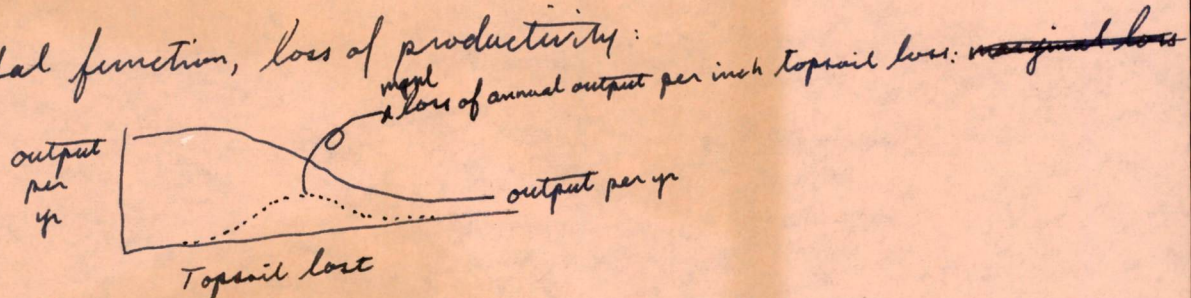
How apply to many lands? Washed Districts

2. How determine what rotation is best permissible w. & w/o terraces?

Still arbitrary SCS.

3. Note several dimensions you get into. Typical of good research project.

4. Sinusoidal function, loss of productivity:



5. Individuals w. low i.r. won't really conserve more. Buy more land, and fringe land is so far from center, xptn cost eats into returns for cons practices.

It is not consen just to put something to a lower use



RESOURCES

Some findings and conjectures from recent research
into resource development and use



*He who considers things in their growth and origin will obtain the
clearest view of them.—ARISTOTLE, POLITICS*

NUMBER 12

RESOURCES FOR THE FUTURE, INC.

FEBRUARY, 1963

THE FARMERS' DILEMMA

IN THE THIRTY YEARS since the problem of soil erosion first gained widespread public attention in the United States, efforts to control it have become one of the federal government's largest natural resource programs. Over the three decades nearly eight billion dollars of public funds have been allocated to reduction or prevention of large-scale soil losses on privately owned land. Additional money has been spent on federally owned lands. Over-all results of the conservation programs, though well worth while, have fallen short of the hopes that many people held at the beginning.

✓ This is due largely to limited response to the programs by landowners and farm operators. The physical problems of erosion control are seldom too difficult. The techniques for managing crops, soil, and water so that the natural forces of geologic erosion do not accelerate and get beyond control are well developed. Often there is a choice among methods. ✓ The real difficulties usually seem to lie in social and economic circumstances.

A SERIES OF STUDIES undertaken in Iowa in recent years on problems of erosion control has produced information of general interest, for the social and economic environment is more uniform throughout the nation than soils, climate, topography, and patterns of land use. The severe erosion hazard which faces farm operators on the rolling hills of western Iowa calls for strong measures of erosion control if soil losses are to be held to a minimum on cropland. But soil losses on many farms there remain relatively high although for the area as a whole they have been reduced somewhat in the past thirty years.

On a typical hilly farm in the area, a farmer must



often accept a lower income if he makes a major effort to reduce soil losses. Furthermore, land values have risen to such a level in recent years that intensive cropping by new owners seems to be necessary if the land is to be paid for from farming operations. There are strong indications that the farms in the area are over-valued in relation to their income-producing capability under a system of farming which keeps soil losses low. Both farm income and land values rose rapidly in Iowa during the 1940's. When farm incomes were at their peak in 1948 average farm land values in the livestock-farming area of western Iowa were 220 per cent of the 1941 value.

Farm income started to slide in 1952 in Iowa, as in the nation, but Iowa farm land values continued to increase. Total net farm income of Iowa farm operators declined by 40 per cent between 1952 and 1960. Meanwhile the average value of farm land in the state increased by 13 per cent and in western Iowa by 6 per cent. Changes in the income-producing capacity of the land can hardly be said to have produced such increases in value. *So was it abandonment of conservation*

Valuations greatly in excess of the long-term agricultural productivity of land lead to excessively high fixed commitments which compete for funds needed for erosion control outlays. They also lead to exploita-

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tion of the investment in the farm in an effort to meet the annual payments of principle^{al}, interest, and taxes.

A further difficulty arises because changes in land prices from 1949 to 1957 apparently had no relation to either the change in erosion between those years or the level of erosion in 1957.

To overcome these deterrents to erosion control is not a simple matter. An appraiser of land for purchase and tax purposes would have to distinguish between income which results from the true productive powers of the land itself and that which comes out of capital. He would also have to take into account future decreased yields and increased costs arising from soil erosion. In both instances he needs assistance that only economic research can provide. Such information is not now readily available.



THERE IS A LIMIT to the amount of soil erosion control that the individual alone can afford to do on his land. If additional efforts cannot be justified by the benefits he receives, the responsibility for their cost must be borne by the public body—a county, state or federal government—which is most representative of the principal beneficiaries. Some of the financial assistance provided by the Agricultural Conservation Program Service can be placed in this category. Payments which share the cost of draining cropland, for example, would be nothing more than subsidies to the landowner to increase productive capacity if the addition of this tillable land to his farm did not result in less intensive use of eroding land. Other payments, if carefully handled, can be used to cause farmers to adopt erosion-control practices.

The use of public funds, however, does not necessarily fill the gap between what the farmer can do and what society desires. If the public goal calls for a greater degree of erosion control than the farmer can afford, an estimate might be made of what it would cost him to prevent further soil

loss. With this guidance, the public's share could be determined. One solution for financing some of the land-treatment measures considered to be in the public interest lies within the purview of the Watershed Protection and Flood Prevention Act. The legislation requires that at least half of the land in the watershed above retention reservoirs and other flood-prevention structures must be protected by appropriate conservation measures before federal assistance is provided. Some of these land-treatment measures conceivably can be financed with the assistance of cost-sharing arrangements of the Agricultural Conservation Program Service.

The watershed approach provides a framework within which to secure the co-operation of neighboring landowners in applying a more integrated system of erosion-control measures among farms. And because some state legislatures now give authority to counties to take part in watershed projects, this integration often can be reinforced. Even so, this may not be sufficient, considering the watershed act's requirement that the local sponsoring group must secure the co-operation of the owners of half of the critically situated land in the watershed.

One additional means of persuasion at the disposal of local government is the property tax. As an example, the taxes levied on cropland might be reduced if specified erosion-control practices were installed on lands subject to heavy soil losses. If this were done, however, some counties with heavily eroded land would eventually be forced to raise all tax rates and in some instances require state aid to make up lost tax revenues. On the other hand, the tax incentive to protect the productive capacity of the benefited property could result in its continuation on the tax rolls as producing property instead of gradually becoming worthless with a lien of unpaid taxes against it.

Adapted from Soil Erosion and Some Means for Its Control (Special Report No. 29, Iowa Agricultural and Home Economics Experiment Station), August 1962, by R. Burnell Held, of RFF; Melvin G. Blase, Economic Research Service, USDA; and John F. Timmons, Department of Economics and Sociology, Iowa State University.



MAN IS THE MEASURE

OUR DEBT to future generations will be discharged to the extent that we maintain a high rate of quantitative and qualitative progress—to the extent that we alter, in a direction favorable to human welfare generally, the conditions that determine the choices open to men when they are free to choose. Already . . . the heritage of knowledge, equipment, and economic institutions that the industrial nations are able to transmit to future generations is sufficient to overcome the potentially adverse effects of continual and unavoidable shift to natural resources with properties which, on the basis of past technologies and products, would have been economically inferior. The industrial nations have learned, in short, how to maintain technological progress, to avoid quantitative diminishing returns. An open question is whether they have also learned how to maintain social progress, to continue improving the quality of life, to avoid qualitative diminishing returns. Even more open is the question whether these nations, in co-operation with those that have not yet become industrialized, will be able to assure both quantitative and qualitative progress for mankind. . . .

The capacity of scientific progress to create new problems for society, it appears, has outrun the capacity of social progress to solve them. Because of the lag of social innovation, it is possible to be concerned with whether man has learned how to avoid something comparable to diminishing returns in the quality of life. . . . The dynamic, accelerative character of technological change seems to suggest that expansion in the number of social value standards are not

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SOIL EROSION AND SOME MEANS FOR ITS CONTROL

by R. Burnell Held, Melvin G. Blase and John F. Timmons



Department of Economics and Sociology

United States Department of Agriculture
Cooperating

Special Report No. 29

Agricultural and Home Economics Experiment Station
Iowa State University of Science and Technology
Ames, Iowa — August 1962

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SUMMARY

The control of soil erosion on the many farms where it is still a problem would not be difficult if it required only an understanding of the critical physical relationships between climate, topography, plant cover, water and soil as well as an ability to prescribe the proper engineering and agronomic measures for each situation. Soil losses, when greatly in excess of those produced by natural geological processes, result from the use of particular farming practices and cropping systems. While an understanding of the physical conditions which produce this erosion is essential, so is an understanding of the reasons that farmers choose the methods of farming which expose their soil to the hazard of heavy erosion losses.

Although alternatives are limited, landowners and farm operators have some leeway in selecting between those farming methods which tend to increase the loss of soil and those which tend to reduce it. Their choices are restricted by the physical environment, economic considerations and the customs and legal arrangements associated with the use and ownership of property. Little can be done to ease the restrictions of the first two factors. Customs and legal arrangements can be changed, but at a slow rate.

The decisions of farmers also reflect their personal goals, values and beliefs, and the amounts and kind of information available to them. The opinions of friends and neighbors and the resources available are also factors that farmers consider. An understanding of the environment in which decisions are made is necessary if farmers are to be encouraged to make the choices that are more conducive to erosion control and if the obstacles which prevent farmers from making such choices are to be overcome.

Obstacles to Erosion Control

When farm people reject the physical measures needed to control erosion, they do it for a number of different reasons. Some farmers are not sufficiently aware of the rate of soil loss or its significance to be concerned. Others, with greater awareness, fail to act because of a feeling that they can continue to get along without doing anything. Still others have been misinformed about the effects of certain practices or object to those which conflict with their established pattern of farming.

Other farmers grant that the soil losses must be reduced to some extent, but, for various reasons, they feel unable to make a greater effort themselves. Some believe that the benefits they would receive from additional control measures would not be sufficient to offset other difficulties they foresee. Others cite the cost of particular measures, or of closely related investments which would be required. These farmers mention, for example, the reduction of income which would follow any curtailment of corn acreage and indicate that their present incomes are inadequate for the demands placed upon them.

Behind many of these difficulties are such things as the lack of control of, or access to, sufficient productive land or other resources to permit the kind of reorganization of the farm business so necessary with the application of certain erosion-control measures. In other instances, resources may be adequate but may not be organized in the most efficient manner. Often, particularly on rented farms but also on owner-operated farms, the operator's limited span of interest in the farm as a source of income contributes to these difficulties. Landowners often do not believe that the market value of their farms is being reduced by the level of erosion taking place.

Customary rental arrangements fail to make adequate provision for major investments that would be required by a change in farm organization to accommodate the necessary erosion-control measures. Many tenants using crop-share leases find it difficult to change certain of their farming practices and rotations unless changes are made in their leases.

How Much Erosion Control Is Needed?

While there is general agreement that erosion losses must be reduced, there is less agreement on the degree of control that is desirable. Neither is there a clear understanding as to where the responsibility rests for the cost of achieving this control. This situation is in itself an obstacle to greater accomplishment.

Of immediate importance is the determination of a level of control over soil losses which farm people can be expected to attain without great financial sacrifice. This will not necessarily be the same from farm to farm. The difficulty and cost of bringing erosion losses down to a specified level nearly always increases as land slopes increase in steepness or length and as the percentage of the cropland on a farm with a serious erosion hazard increases.

Farmers often cannot achieve that level of erosion control on their farms which seems necessary in the public interest unless they are given financial assistance. Some of this assistance is available through the cost-sharing funds administered by federal agencies. These funds, however, are not always as effective as they might be in bridging the gap between the level of control achieved by private efforts under the most favorable conditions and the level of control desired. In some instances, payments may be inadequate to achieve the level of control desired, while in other instances they may be too generous.

Prescriptions for overcoming the known obstacles must be viewed primarily as guides for action. Their effectiveness will vary with the vigor and skill with which they are used and the circumstances of their use. It is doubtful that the obstacles can be overcome by relying solely on one or two techniques, or by neglecting to relate what is done through one agency or group to that done by others.

Creating an Awareness of the Problem

If more farm people, and landlords in particular, are to be reached, a greater educational effort, supplemented with new approaches, will undoubtedly be necessary. A greater awareness might be created if soil losses were estimated, farm by farm, community by community, throughout a soil conservation district, and if this were followed by comparisons and economic interpretation. Business and professional people, especially those who have frequent opportunities to discuss matters of farm business with farmers and landowners and who provide farm owners and operators with legal and other services can be valuable allies in this effort. If such business and professional people are given an awareness of the erosion situation in the farming community and an understanding of the factors which make erosion control difficult, they can help farmers overcome some of the obstacles to greater control of erosion.

Education has an important role to play where information or understanding is the critical need. When a farmer objects that the earning capacity of his farm would be reduced if he were to adopt the recommended erosion-control measures, his objection may be based in part upon a lack of information. He may only need to be shown that his fears are groundless. On the other hand, there are situations in which this objection is valid. The difficulty arises if erosion-control measures are specified for a farm without consideration of their probable economic impact on the particular farm business.

Conservation Farm Plans

Changes in the concept of soil conservation farm plans are desirable so that the plans may take into account the socio-economic factors that are so important in determining how land is used. The appraisal of the physical situation on the farm must be matched by an appraisal of various aspects of the farm business. Then it becomes possible to determine how much of the financial responsibility for erosion control a particular farmer can be expected to assume and the point at which outside assistance is necessary. Achievements in the field of electronic data processing and improvements in farm budgeting techniques make it possible to give serious consideration to the more detailed planning required by this proposal.

An expertly planned reorganization of farm enterprises will not automatically remove all obstacle situations. It may, however, shift attention from minor or inconsequential obstacles to more troublesome and more significant underlying matters—such as those of obtaining additional resources and the problems associated with tenancy and credit.

Revision of lease forms and provisions to encourage the types of investment and other changes needed might have greater chance for success if a strong community effort were made to achieve them. The psychological support that the community leaders could give would be important. Educational efforts on these matters have had little

success to date. Given support, they could accomplish much.

Problems of Financing Conservation Measures

Credit appears to be a problem, not so much because of its unavailability, but because of the reluctance of farmers to use it for erosion control and closely related measures. The farm plan could suggest a scheduling of the necessary investments, both those directly related to erosion control and those required to make the plan economically feasible. It should also provide income estimates that are as accurate as possible. Well-devised plans also would be of assistance in negotiating with lenders.

Sometimes the major beneficiary of a given erosion-control measure does not own or control the land on which the measure must be installed and is under no obligation to pay any share of the costs necessary to accomplish it. A few farmers have taken advantage of the provision for pooling the federal cost-sharing payments to secure a practice on the property of another which is beneficial to them all. Little use has been made of this provision, however. Cooperative arrangements of this sort require both the stimulation and assistance which the soil conservation districts might easily provide without necessarily assuming financial responsibility.

Public Responsibility

In some instances, the public interest in achieving a degree of control over erosion exceeds that which the individual farmer can afford, or which can be achieved through the cooperative efforts of several property owners. If efforts have already been made to remove existing obstacles to private performance, the responsibility for additional effort is clearly that of the larger public. This public might be the county; in other instances it might be either the state or the federal government.

The difficulties here are not so much the unwillingness of governmental units to do anything but the lack of sufficient discretion and guidance. Public funds may be used either before they are really required or to a degree that is actually unnecessary in some instances. In other situations individual farmers may be asked to do far more than should be expected of them, and, as a result, do nothing. In the interest of making the most of the financial support that is available, the criteria used in disbursing these grants merit a thorough review.

The Institutional Environment

Land prices, taxes on land, interest rates, federal farm programs, and relative prices and costs determine the attractiveness of one type of farm enterprise as against others. In many instances in western Iowa, these factors tend to favor enterprises in which the erosion hazard is the greatest. One farmer, even a small group of farmers, can do little to change this economic and institutional environment. The general public should be aware of the repercussions that policies, set for accomplishing other objectives, may have with respect to ero-

sion control. If there is an opportunity to choose between different policies to accomplish a particular purpose, consideration, where possible, should be given to whatever implications they may have for the manner in which land is used.

Police Powers

Should an individual who, for reasons of his own, declines to cooperate in an erosion-control effort which benefits him and people in a large geographic area as well, be permitted to thwart it even if others are willing to bear their just share, or more, of the costs? There is little in the body of common law to back up the moral obligation such an individual may have with respect to damages to others which he brings about because of his unwillingness to change from a system of farming that contributes to the excessive runoff of water and the washing of soil. The state has at its disposal the police powers and, in turn, these may be delegated to subjurisdictions. The police powers have been

used in Iowa in an effort to eradicate noxious weeds and to safeguard the milk supply, to mention only two instances of their application to agricultural situations. They have not been made available, however, for use in combatting the problem of soil erosion. Can the desired goals in erosion control be accomplished and the investments which are being made for this purpose be protected as they should be without the use of these powers? These questions warrant more attention than they now receive.

Erosion control is something which is not accomplished on a once-and-for-all basis. Owners and operators of farms change, technology changes, and the economic and political environments change. Nor can an effective erosion-control program be built around the use of a single technique or by competing groups, each going its own way with its own approach to the problem. It can be less of a problem, however, if a greater effort is made to understand its causes and to devise means for solving the related social and economic problems.

Soil Erosion and Some Means for Its Control¹

by R. Burnell Held, Melvin G. Blase and John F. Timmons²

Soil erosion of serious proportions continues on many acres of cropland throughout the United States. Farmers in western Iowa must contend with one of the more serious soil erosion problems in the nation. Some farmers there, and many others in the United States, have been successful in reducing the loss of soil from their fields to a low level. In contrast, some have achieved only moderate control, and others, very little control.

The reasons for the varying levels of accomplishment are many. Some farmers simply are not aware of the physical magnitude or economic significance of the soil loss taking place on their farms. Others recognize that erosion is occurring but find it difficult to apply control measures because this would require them to make new investments, to change farm enterprises or cropping systems, to assume new risks or to take a temporary loss of income. Farmers are often either unable or unwilling to make these changes, given their present circumstances. The question then arises, what might be done to alter these circumstances if these are significant impediments to further erosion-control efforts?

This report summarizes the findings of investigations conducted in western Iowa in an effort to obtain an understanding of the factors which underlie the relatively slow rate of adoption of erosion-control measures there. The results of these studies and the conclusions which have been drawn from them in this report could be of general usefulness elsewhere.

Characteristics of the Study Area

The section of western Iowa studied is a long, narrow area of nearly 1,700,000 acres, 82 percent of which is cultivated. It lies approximately parallel with the Missouri River from just above the point at which the river touches the state at Sioux City on the north and continues beyond the state boundary on the south. The area is separated from

the river and the adjacent heavy, poorly drained bottomlands by a range of bluffs. The soils of the bluffs, known as Hamburg silt, and those of the study area, the Ida and Monona soils, are loess soils of great depth. This soil material, a coarse silt, overlays glacial drift material.

The bluffs are too steep to be tilled, but the slopes leeward of the bluffs, although also steep, are largely in crops. The loess on these slopes is less coarse and more shallow than that of the bluffs, although it is more than 30 feet deep in most places.

Ida soil is found on slopes of between 8 and 25 percent. The soil is low in nitrogen and phosphorus, but crops respond well when these elements are provided. Monona soil is quite similar to Ida soil. It has a higher clay content and is usually found on slopes that are less steep than those on which the Ida soil is found. Both the water-holding capacity and the availability of phosphorus are greater for Monona soil than for Ida soil.

The coarse texture of these soils and the topography of the land makes them highly susceptible to erosion. Climate is an additional factor contributing to the erosion problem. At least one short rainstorm of great intensity usually occurs during the summer months when the surface of the soil is most vulnerable to washing. One such storm in the area produced 4-1/2 inches of rain in 75 minutes. Actual measurements of the silt deposited by the runoff from the storm in flood-control reservoirs indicated that soil losses had averaged between 20 and 40 tons per acre over the entire watershed.³

The patterns of land use and the tillage methods prevailing in western Iowa add to the existing natural erosion hazard. Most farmers devote a high proportion of their land to row crops, primarily corn, which they feed to cattle and hogs. In the last 10 years, row crops have occupied as much as 40 percent of the farm land. On many farms corn is planted on even the steepest slopes and cultivated up and down the slope. As recently as 1957, farm operators on 38 percent of the farms in a sample of 138 farms in the area were making no attempt to farm with the contour of the land. Farmers on 60 percent of these farms in 1952 were making some use of commercial fertilizers, but, by 1957,

¹ The observations and suggestions contained in this publication are based in part upon studies in which all three authors and Professor John C. Frey, now of Pennsylvania State University, participated at various times under the cooperative arrangements between the Iowa Agricultural and Home Economics Experiment Station and the U. S. Department of Agriculture. The cooperation of Resources for the Future, Inc. is gratefully acknowledged for enabling the senior author to devote a substantial period of time to prepare this report.

² Research Associate, Resources for the Future, Inc.; Agricultural Economist, Economic Research Service, presently on military leave; and Professor of Economics, Iowa State University; respectively.

³ H. P. Johnson and R. K. Frevert. Selected intense storms in the Little Sioux River watershed. *Agr. Eng.* 40:26-29. 1959.

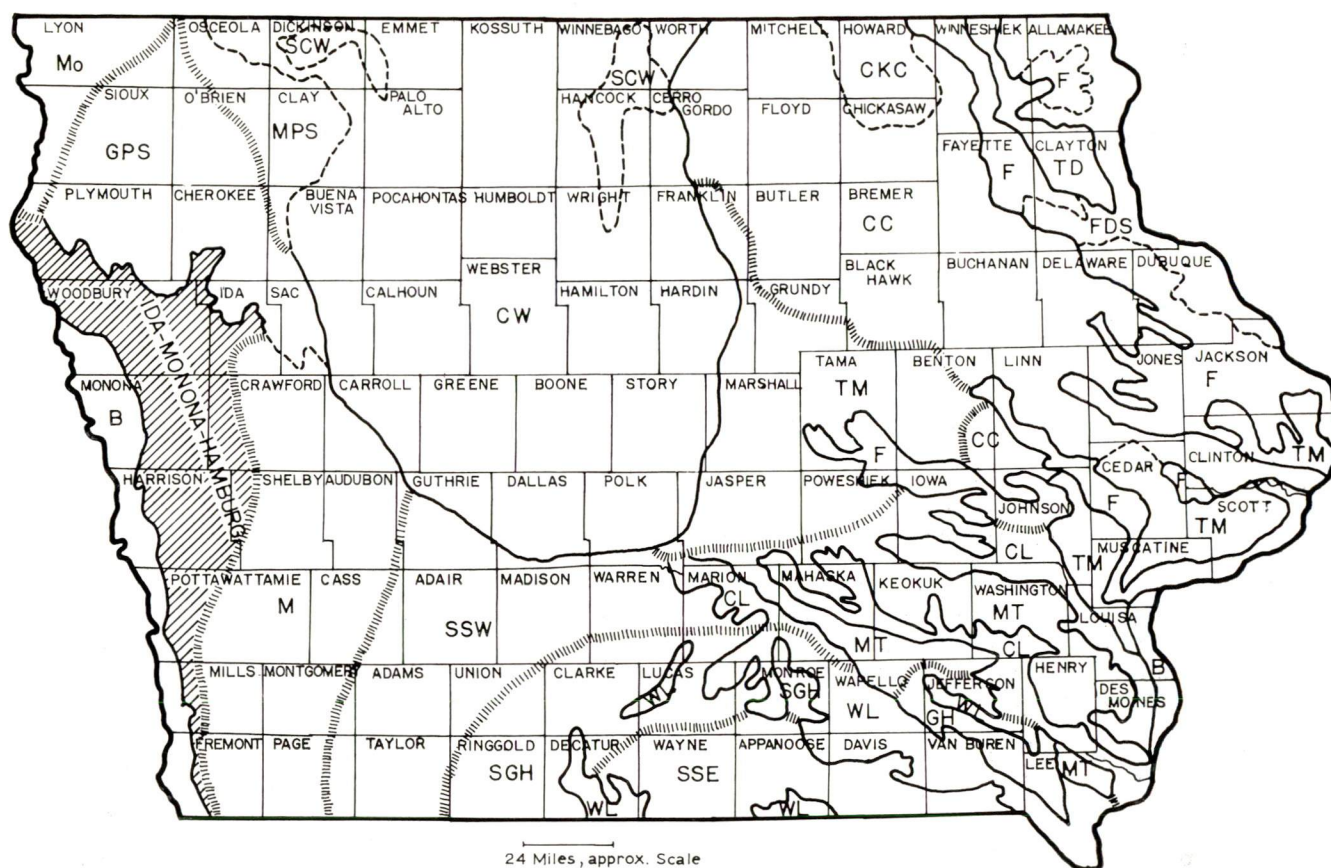


Fig. 1. Location of the Ida-Monona-Hamburg Soil Association Area in western Iowa.

fertilizers were being used on only 42 percent of them. Drouths in the immediately preceding years and the less favorable financial position of the farmers were largely responsible for this change in fertilizer use.

Research Procedures

Measurements of the soil loss on individual farms are difficult and expensive to obtain. An estimated rate of loss can be calculated by applying certain factors obtained from experimental work to the particular topographic and soil conditions and the soil management and cropping pattern on any farm. Such estimates indicate that soil losses from sheet erosion in the Ida-Monona area are great. Observation alone indicates the severity of gullying. Farms in the area have an average of two major gullies per farm.

For purposes of research, a sample of farms was drawn at random from all the farms in the study area. Maps were prepared for these sample farms which provided detailed information on soils and topography. Information as to the crop rotations and soil management practices followed and other related data were obtained by interview in 1949, 1952 and 1957. Soil loss rates were calculated from this information for each of these years.

The Soil Conservation Service provided two farm plans developed especially for the study for each of the sample farms. These plans were similar in con-

cept to those ordinarily developed for farmers co-operating with the program of the soil conservation district. In this instance the procedure followed differed from actual practice. The farm operators had not requested the plans and had no knowledge of them until after they were developed. Two plans were then presented to each farm operator. Both had been designed to achieve the same result—a soil loss no greater than 5 tons—and were to be viewed as alternatives. One plan accomplished the goal by a maximum use of terraces. This plan also permitted the maximum acreage of corn consistent with the erosion-control goal. The other plan eliminated terraces but achieved the same degree of erosion control through the maximum use of forage crops at the expense of the corn acreage.

The farm operators and owners were interviewed to determine their reaction to each plan and to the individual practices. If they rejected a particular practice, their reason for doing so was determined. Sufficient additional information was obtained to test the validity of the factors they indicated had prevented, or would prevent, them from carrying out the practices.⁴

⁴ Detailed quantitative discussions of research procedures and the various findings are discussed in the following publications: John C. Frey, Some obstacles to soil erosion control in western Iowa, Iowa Agr. and Home Econ. Exp. Sta. Res. Bul. 391, 1952; R. Burnell Held and John F. Timmons, Soil erosion control in process in western Iowa, Iowa Agr. and Home Econ. Exp. Sta. Res. Bul. 460, 1958; Melvin G. Blase and John F. Timmons, Soil erosion control in western Iowa: progress and problems, Iowa Agr. and Home Econ. Sta. Res. Bul. 498, 1961.

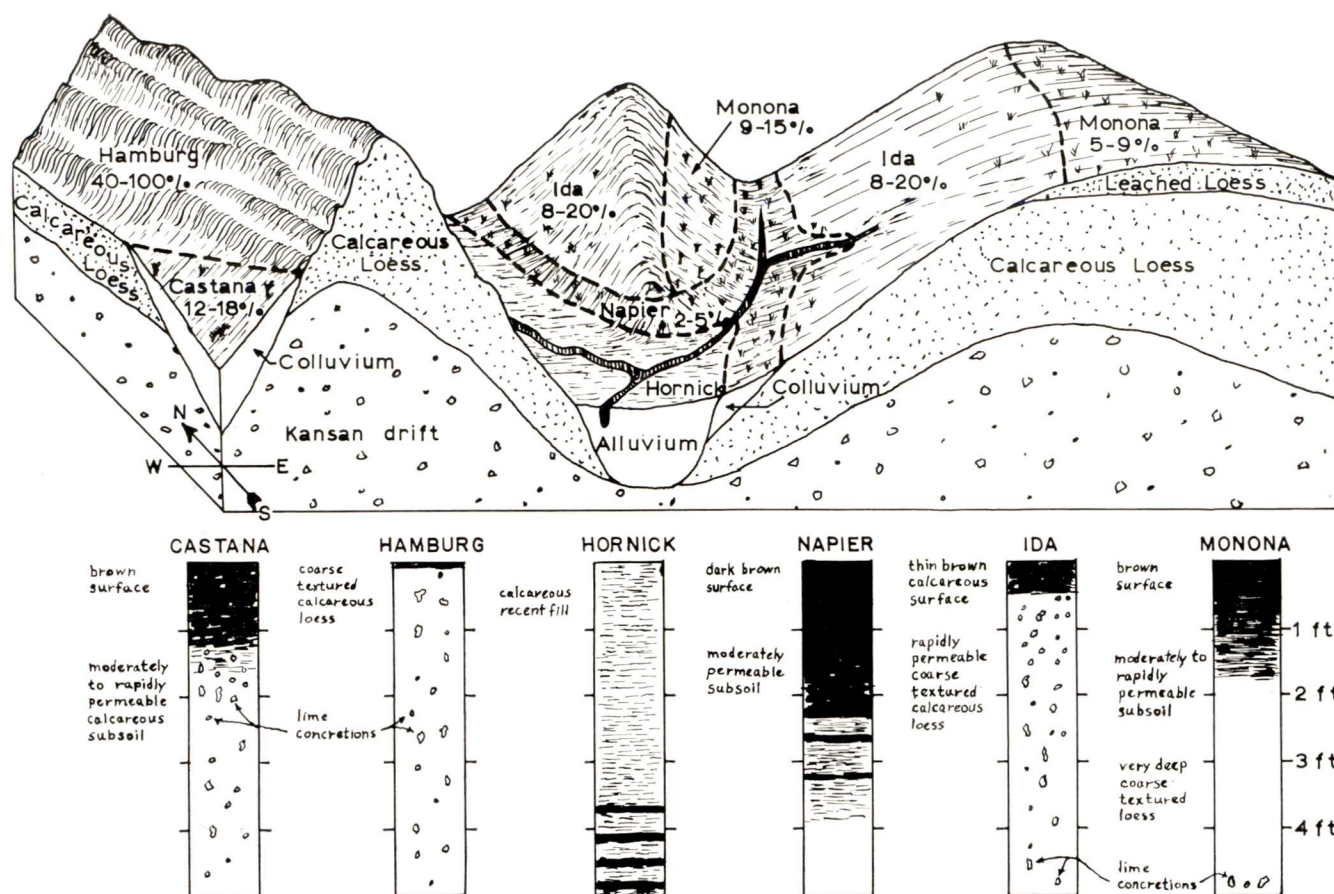


Fig. 2. The geographical relationship of the Ida-Monona-Hamburg and related soils and their characteristics.

Extent of Soil Losses

Average erosion losses for the entire sample, when examined at three different points in time, showed a drop from an annual rate of approximately 21 tons per acre in 1949 to 20 tons in 1952 and to 14 tons in 1957. Only one of five farms had a lower rate of soil loss in 1952 than in 1949, but soil losses in 1957 were lower than 1952 losses on two of every five farms. On some farms, however, the progress made between 1949 and 1952 had been lost by 1957. More than a fourth of the farms on which erosion had been reduced during the period between 1949 and 1952 showed greater soil losses in 1957 than they had had in 1952. In addition, soil losses increased by more than 5 tons per acre for 10 percent of the farms on which there had been no important change in the rate of soil loss between 1949 and 1952. Farm operators on only 15 percent of the farms surveyed had achieved soil loss rates of 5 tons or less when they were visited in 1957.

The absolute control or prevention of all soil erosion is an undertaking that would be both difficult and of questionable value. But how much effort should be made? The Soil Conservation Service technician, in his recommendations to a farmer concerning soil erosion control, is guided by the objective of bringing soil-deteriorating processes more nearly into balance with soil-generating processes. Using this concept, only that rate of soil loss may

be permitted which does not remove the topsoil faster than it can be replaced by natural processes. Such a determination is difficult to make and must often be arbitrarily set. For the Ida-Monona soil association, this permissible rate has been set at 5 tons per acre per year. (Five tons per acre may be easier to visualize as a layer of soil covering an acre of land to the depth of 0.04 inch.) An average annual loss of soil any greater than this would be considered serious enough to warrant action to prevent it. In terms of the 5-ton standard, soil losses which averaged 20 tons per acre, or even 14 tons per acre, fall far short of being satisfactory.

This higher soil loss in many instances damages the individual farm operator, his immediate neighbors, the community and the county. Less directly, it hurts both the state and the nation. Fields, crops, roads and bridges are damaged, and drainage ditches across the bottomland are filled with silt and require periodic cleaning.

MAJOR FACTORS HINDERING SOIL EROSION CONTROL

Reducing the losses from soil erosion is not a difficult technical achievement if one is concerned with only the physical aspects of the problem. The 5-ton goal can be achieved on most western Iowa farms in several different ways. Tillage operations performed following the contours of a field reduce, by approximately half, the loss of soil which occurs

if tillage operations do not follow field contours. If row crops are planted on ridges or in lister basins made to follow these contours, soil losses will drop to between 20 and 30 percent of the losses which occur under the conventional system. The use of terraces reduces losses to a level of 10 to 20 percent of the loss if none of these practices were followed.

The cropping pattern followed on farms also has considerable influence in determining the rate of soil loss. The greater the proportion of forage in the rotation, the lower is the soil loss. Increases in the proportion of the rotation devoted to corn require an increase in the use of mechanical measures, such as terraces, if soil losses are to be kept at a given level or are to be reduced.

The job of obtaining acceptance and use of the practices and rotations necessary to bring erosion losses down to the maximum loss that can be permitted, 5 tons per acre, appears deceptively simple for several reasons. Some farmers have much to gain from use of certain measures. The recommended mechanical practices reduce the loss of soil and the plant nutrients it contains. They also increase the level of soil moisture, an important factor in crop production in western Iowa where moisture often becomes the limiting factor in late summer. Crop yields reflect this difference when compared with areas to the east.

Assistance of various kinds is also available to farmers. Federal cost-sharing arrangements are available to help finance the construction of terraces. Incentive payments are made to encourage farmers to farm with the contour of the land. Technicians of the Soil Conservation Service are available to provide planning and technical assistance, and research results obtained on an experimental farm in the area with the same kind of soils are available through the Cooperative Extension Service. Farmers who cooperated with the federal government's 1957 acreage reserve program to reduce the output of commodities in surplus, received some compensation for reducing their corn acreage. Yet, with all these factors at work, the goal remains unattained. Why haven't the various efforts been more successful? What changes are necessary if the desired goal is to be attained?

The difficulties encountered in reducing over-all soil losses on farms in western Iowa to a 5-ton level arise from a combination of factors. An understanding of the attitudes and values of the operator himself is of primary importance if a greater response is to be obtained from efforts to increase the extent of erosion-control measures on farms. Farm operators, and nonoperating farm owners as well, differ in their goals and values, particularly in the priorities they assign to various goals and in the means they select to obtain them. Information concerning the differences and why they exist is essential to an understanding of the obstacles to greater use of erosion-control practices. However, people are more reluctant to express themselves on such things than on questions more closely related to farming operations.

Attitudes of Farmers

The operator on each farm in the sample studied was asked on each of the three visits the kind and extent of the practices he felt were needed on his farm to reduce erosion losses. If the practices mentioned by these farmers had been applied, the average soil loss rate in 1949 would have been 16 tons rather than 21 tons; and for 1957, 12 tons rather than the 14 tons per acre estimated on the basis of practices actually in use. Thus, there is evidence of an awareness by many farmers of the need for certain additional measures to reduce erosion losses even though this goal does not coincide with the 5-ton goal.

There are, however, farmers in the area who show little or no concern about the erosion situation on their farms. Some are actually unaware that soil erosion is taking place. Others are aware of the losses but tend to discount their importance. Soil losses of 20 tons per acre, when this is seen only as 0.16 of an inch, do not seem great in any one year, especially when one considers that the material from which the topsoil was originally formed is still 100 to 400 inches deep in most of the area. The original topsoil has long been gone from the steeper slopes. The light-colored subsoil, however, still is easily tilled. With the application of barnyard and green manures and commercial fertilizers, crops respond as well, or nearly as well, as in the uneroded areas.

A frequent response to the question of why a farm operator objected to a recommended erosion-control practice was simply that he could not see the need for it. This response was given to one or more practices on 47 out of 138 farms visited in 1957. The average rate of erosion on these farms, over 16 tons per acre, was greater than the rate for the entire sample.

The loss of usable crop and pasture acreage from the farms is more obvious with gullying than with sheet erosion. Gullying is a serious matter in other respects, too. Gullies impose many inconveniences in farm operations. They make awkward field boundaries necessary and prevent ready access to fields. An enlarging gully is also a serious threat to adjoining property owners. Nevertheless, many of the gullies have existed in some stage of development for a long enough period that the present farm operator has either nearly forgotten the time when they were less developed or actually has no knowledge of that time.

The attitude of many farmers toward gullies is almost fatalistic. Once the gullies have reached through the loess to the underlying glacial till (and gullies 30 to 40 feet deep are not uncommon), nothing can be done to obliterate them short of expensive earth-moving measures. Many farmers seem to feel that there is also little they can do to prevent further enlargement of the gullies. In some instances the additional damage that can be done would be negligible in comparison to that already done. Other gullies apparently have reached their maximum length, but large sections of the soil forming the vertical walls can still slough off and tumble into the gully. Similarly, lateral gullies can,

and do, develop from the main stem. And so these U-shaped, canyon-like gullies have become an accepted, although undesirable, feature of the landscape—something that must be lived with.

Community Influences

The prevailing attitudes in a farm community toward soil erosion and its control are undoubtedly an influence on individual farm operators. Sociologists are careful to distinguish between the leadership provided by formally organized groups, which would include in this case farm organizations, civic groups, churches, governmental agencies, etc., and the influence of relatives, neighbors and other respected persons outside these more formal groups. The influence of persons in the latter group may be as great or greater than that of those in the first group. If the attitudes, opinions and values of the leaders in the informal groups are unfavorable, the work of the leaders of the formally organized groups is made that much more difficult. For anyone to have the best understanding of the situation on a particular farm, he should determine as best he can the farm operator's position relative to the community and its leaders and the prevailing attitudes in the community.

The importance of community influences has been apparent in these studies. The desire of farmers in some communities to obtain federal assistance under the terms of Public Law 566, for the development of the small watershed in which their farms are located, generated a positive influence for erosion control. The importance of the thinking or reaction of neighbors was revealed in the responses obtained to a question asked of the farm operators to learn to whom they looked for information about erosion-control matters. Most of the farmers mentioned a neighbor. A much smaller number indicated someone in a government agency. The Soil Conservation Service was the agency most frequently mentioned in this respect. When farmers were asked who would be their choice of a person to organize a conservation "field" or "work" day, they most often mentioned a neighboring farmer. Some suggested a co-leadership arrangement between a leading farmer and a representative of a government agency.

Persons other than farmers—particularly bankers, lawyers and leading businessmen—also influence the attitudes of landowners toward erosion control. Whether this influence is more likely to reinforce previous attitudes rather than change them is not known. It depends upon the individuals involved.

Some landlords look to a particular farmer, whose farming ability they respect, and use him and his farming methods as a standard by which to compare the performance of the tenants on their own farms.

Representatives of public agencies who work with farm people have long recognized the importance of gaining acceptance of their programs by the outstanding and most progressive farmers in a community. However, the persons of influence in a farming community are not always found only

among these people. Some outstanding farmers have surprisingly little influence. The studies in western Iowa disclosed various instances in which a person who was opposed to certain erosion-control measures, but who had considerable influence in his neighborhood, was offsetting the example provided by a farmer who had been successful in reducing the erosion losses on his farm.

Lack of Concern by Owners and Operators

Much of the effort to achieve a greater degree of erosion control by farmers is based on the assumption that, though farm owners and farm operators may not be aware of the extent of the soil losses taking place on their farms, once they become aware of the situation, they will make an effort to reduce the loss. Educational efforts premised on this thinking have been successful with some farmers. The assumption is questionable when dealing with others. A reassessment of the underlying psychology of existing education programs is needed as well as an appraisal of the entire effort. Either the information presented is not sufficiently convincing to these farm people, or they are not even being reached. Farm landlords are a particular problem, especially those with little or no direct experience in farming themselves. They and others of advanced age often have no contact with either those persons responsible for the educational efforts or their programs.

It is a mistake, however, to believe that, once farm people have been made aware of the erosion situation on their farms, they will always do something about it. More than a third of the farm operators interviewed considered the erosion-control plans recommended for their farms to be unnecessary. Although there appeared to be economic justification for this reaction in some instances, the failure of many of these people to make even those efforts to reduce erosion losses for which there was little or no cost indicated that something more than economic obstacles was involved. Sometimes it was a matter of misinformation that held them back. At other times it was the effect of custom or inertia.

Some of the reactions to the recommended practices indicated the prevalence of misinformation concerning them as well as a lack of understanding. Some farmers asserted that commercial fertilizer would cement the soil, kill earthworms or otherwise do more harm than good. Others merely indicated that they did not want the practices. Some said that contouring would increase rather than decrease erosion. Some rejected anything which in any way involved the federal government. Objections to contouring and terracing on the grounds of the inconveniences and difficulties involved could be accepted as valid, but such comments were often followed with a statement from the person interviewed that there was no real need for these practices on his farm in the first place.

When it was first introduced, farming with the contour came into direct conflict with what had been a long-established method of farming in the Corn Belt. Several generations of farmers had

taken pride in their straight-plowed furrows and checked corn fields. Older farmers and landlords often asserted that it was impossible to raise good corn unless it was planted in this manner because of the necessity of cultivating it at least once in a direction perpendicular to the planting direction to control weeds. They either ignored or were unaware of the effectiveness and general availability of herbicides which make weed control less of a problem for other farmers. Similarly, the desirability of holding cultivation to a minimum so as to avoid needless destruction of corn roots was something that did not concern them.

Traditional or customary methods of farming still have a dominant influence over some farmers. They may be willing to accept the fact that certain changes in their farming operations are desirable, but considerable inertia must be overcome before they will make the changes. As might be expected, reactions of this general type were most frequently obtained on farms where the rate of soil loss was considerably greater than for the sample as a whole. Because these farmers seldom saw a need for any change in their farming operations, their erosion-control goal, if one may be said to have existed, coincided with the relatively high loss then occurring on the farm.

Frequently farm operators objected to the extent to which a particular practice was recommended. Unlike those who were totally opposed to certain erosion-control measures, these persons recognized the need to do something. The recommended farm plans, in their view, were too demanding in the level of erosion control attempted. The operators were willing to adopt the recommended practices in part but not to the degree necessary to reduce soil losses to a level of 5 tons.

Operators sometimes preferred an intermediate plan somewhere between the extremes of (1) the maximum of mechanical practices and maximum corn acreage and (2) the plan in which corn acreage and mechanical practices were reduced but hay and pasture crops were increased. Some change in the type or amount of the practices planned for these farms would have been acceptable to these farm operators.

Income Considerations

Situations in which farmers were reluctant to adopt the erosion-control measures that they recognized as having some merit were often found to have roots in one or more of three basic economic obstacles. Some farm operators and owners placed an unusually high premium on immediate income relative to that expected over a longer period of time. Often these same people, and others too, did not have farm businesses that were large enough to provide them the level of living they desired and at the same time permit them to maintain their soil resources. For other farm operators, a third type of problem existed. They were unable to reduce their erosion losses with the present organization of their farm businesses but would find it possible to reduce erosion if the farm businesses were reorganized.

Often a choice must be made in the use of land between the production of immediate income and its use for producing a larger stream of income in the future. A farmer's preference in this matter makes a great deal of difference in the control of erosion. Nearly every farm owner and operator who was interviewed gave some expression of his own time preferences, either directly or indirectly. Tenants with 1-year leases and no expectation of renewing them and landowners with similarly short expectations of continued ownership often were encountered. They were ready to sacrifice future productivity for immediate income. At the other extreme were the relatively infrequent instances of older farmers to whom income was no longer a prime objective. Their goal was to pass on to an heir a farm with the capacity of high production for the future.

Another basic economic obstacle was the small quantity of land and capital possessed by some farm operators. Many operators placed a high value on preserving the future productivity of soil. But with only a small farm business and limited financial resources with which to expand it, they found it necessary to make intensive use of the land to obtain a satisfactory level of income. Furthermore, they were not in a financial position to make investments in measures such as terraces because of the cost.

Farm situations on which soil losses are high sometimes call for only more effective use of resources already available. There were farm operators in the sample whose level of income was such that they felt they could not afford to accept a smaller corn acreage on their sloping fields. Unlike the farmers just mentioned, however, they had, or could obtain, sufficient assets which, if more effectively organized and used, would increase their output even with the adoption of those changes necessary to reduce their erosion losses. Frequently, lack of knowledge was responsible for part of this problem. In other cases their uncertainty about the future prevented the use of their land, buildings, machinery, livestock and financial resources that would have given them a larger average annual income in the long run.

Most farmers naturally expect their farming efforts each year to yield them both an immediate and, what they consider, a satisfactory income. Unless they have other sources of income, their operations must be planned to accomplish this. Most farmers are not inclined to use precise economic calculations or to weigh in detail the alternatives open to them when they make managerial decisions. Furthermore, the information they need to do this is not always available. This is particularly true with respect to the costs and returns to specific erosion-control practices. Recognizing this, much effort has been made during the last 25 years or more by the farm magazines, the agricultural colleges and various governmental agencies to demonstrate and to convince farmers that "soil conservation pays." These efforts have not always produced the results desired. The physical situation on the demonstration farm may be representative

of that for many farms in a large area, but conditions of tenure, managerial ability, capital position, and other factors which contribute to the financial success of the operator and the demonstration farm may be quite different on other farms.

In periods such as the present, when farm incomes are under pressure, farmers as a group are less ready to make investments of any kind in which there is much uncertainty present, even though there may be some promise of financial reward. Thus, while the farmers interviewed may not have fully appreciated the longer-term economic implications of erosion losses of 20 tons per acre as against 10 tons per acre, or 5 tons per acre, they were concerned with the cost and immediate income implications of the various control measures recommended in the two farm plans presented to them. In 1957, slightly more than half of the farmers objected to one or more recommended practices because they feared that to adopt it would jeopardize their income, and they were not in position to take a loss of income then even though it might be recovered at a later date.

Farmers who examined both of the plans prepared for their farms quickly discovered that there was often little choice between the two with respect to the effect of the plans on immediate net income. The plan which emphasized mechanical measures depended to a large extent upon the installation of terraces to reduce the level of soil losses. While both technical and financial assistance would have been available to farmers if they had wished to build a system of terraces, many farmers said that they would be unable to finance the work with the funds they had available. Although credit was available to most operators to cover the costs of erosion-control practices, they were reluctant to use it in this way.

Some farmers said they could not consider any investments of their own funds because of demands on their present incomes for living expenses, operating expenses and debt repayment. If funds remained after meeting these claims, they said they would consider using them to install erosion-control practices. Even then, erosion-control practices were rated relatively low compared with other investment possibilities in the farm business.

Farmers had various reasons for giving erosion-control measures this low priority. They were pessimistic as to the effect that such investments would have upon their immediate incomes. They also had noted that land prices in the area failed to reflect all the consequences of previous erosion. Changes observed in the estimated value of a group of the sample farms in the area over a 10-year period appeared to have no relation to either the amount of erosion taking place on the farm or the changes in the rate of loss which had occurred during the period.

Farmers also objected to the alternative erosion-control plan which eliminated the use of terraces but substituted a crop rotation high in forage crops and low in corn acreage. Such a cropping system, they said, would greatly reduce their immediate income. Unless they increased the number of rough-

age-consuming livestock, many of these farmers would have had no way to convert the increased quantities of forage into a marketable product. Many of them also objected to expansion of such a livestock enterprise on their farms. Some were unable to finance the purchase of the necessary livestock. Others felt that the purchase price for this type of livestock was too high or that the element of risk was too great. Still others disliked this type of farming, and in some instances, the farm operator had no, or only limited, experience with such enterprises.

Rental Arrangements

Farm tenants also foresaw difficulties in addition to those already mentioned if they were to attempt to apply some of the recommended practices. In several instances the difficulties had arisen already. Many of the owners of tenant-operated farms showed no more concern about the erosion situation on their farms than did their tenants. They also had the same misinformation about the different practices designed to reduce soil losses. Under these conditions few tenants would find it easy to carry out the measures required on their farm to bring soil losses down to the public standard. In fact, some tenants had even been forbidden to farm with the contour because of the fear that weeds could not be properly controlled.

There also were tenants who did not cooperate with landlords who desired to bring about a more effective control of erosion through a change in farming practices.

Tenants and landlords face a particularly difficult problem with respect to the construction of a system of terraces, a project which has property-right implications similar to the construction of buildings, fences or drainage systems. Logically, the initial investment should be the responsibility of the landlord. If he does not make the investment, few tenants are likely to do so. Their usual short-term interest in the farm will not generally justify it, particularly if there is no provision in the lease to compensate the tenant in some manner if he leaves, or must give up the farm. No leases with such provisions were found on the farms studied.

Changes in rotations and the accompanying changes required in the livestock enterprise would be particularly difficult on tenant-operated farms without a change in the lease on those farms where a crop-share lease, the most common type of lease, is used. Here again, custom and inertia make such changes difficult.

Even if the difficulties could be ironed out, landlords and tenants often expressed the doubt that a level of income satisfactory to both of them could be produced on the farm if the recommended practices were adopted. In many of the instances in which an elderly landlord was involved, the farm was his or her only source of income and provided a comparatively small income at that. The prospect for the investment of the additional capital, which these farms would require if an erosion-control plan were to be successful, was not good.

Field Layout

Both contouring and terracing often require the relocation of fences and changes in the size and shape of fields if the practices are to be most effective and if difficulties such as numerous short, point rows are to be kept to a minimum. Even so, changes in slopes make it impossible to maintain a constant width throughout any cropping strip. This and the extra trouble and expense caused by the necessity of relocating fences prevent many farm operators from using the practices. In some instances the location of roads and gullies would complicate matters and make it difficult to change existing field layouts to achieve fields of a size and shape that would permit ease and efficiency in the use of machinery.

REMEDIAL APPROACHES TO SOIL EROSION CONTROL

A variety of obstacles stand in the way of further progress in the reduction of soil erosion in western Iowa. (The major obstacles which have just been enumerated have been tested and found to be valid.) Further analysis of these obstacles, in turn, often reveals additional difficulties. What people think and why they accept certain beliefs is important even if their attitudes or beliefs are of questionable rationality or do not agree with what is thought to be the true state of affairs. But, before anyone can expect to deal effectively with these resistances to the further control of soil erosion, he should be aware of these things so that he can react to them with full knowledge of the difficulties and not on the basis of faulty assumptions.

The positive side of the situation in western Iowa has been neglected up to this point, but there also were farms in the area on which the operators had been successful in reducing erosion losses to more acceptable levels. The favorable experiences of these operators have suggested some of the remedial measures which follow. Others are suggested because they seem to offer the logical solution to the particular problem. Not all are new, but some have not been widely used.

Identifying Public and Private Interests

More serious than the mechanical and physical difficulties associated with farming with the contour of the land or with the installation of terraces, which are definite obstacles to be overcome, are the obstacles which have economic roots. These arise from the fact that the farm operator (and often, on rented farms, the landlord as well) is (1) largely unaware of or unconcerned about the rate of soil loss taking place, (2) unaware or uninformed of the cost of alternative techniques for reducing losses or (3) aware of the problem but under pressure to maintain his income at all costs.

These are some of the sources of difficulty in achieving greater control of soil erosion. These situations lie largely within the scope of human relations and economics. What can be done to overcome them?

Numerous suggestions can be made as to means which might be used. Not all of them will be successful but they can be tested only by actually try-

ing them. Some remedies depend largely upon arrangements which must be worked out by the farm operator himself. Others require joint efforts of tenant and landlord or the cooperative efforts of neighbors. Still others require the use of governmental powers—those of spending, taxing and policing.

The federal, state and local governments already are using, with varying degrees of intensity and success, some of their powers in an effort to overcome these difficulties. These efforts can be made more effective with a clearer knowledge of what the significant obstacles are. Further, public agencies have not begun to exhaust all the possibilities of integrating their efforts between agencies or with the efforts of farmers, nor are they empowered to take some of the action that may at times be required. The legislative and judicial bodies, as well as the administrative agencies, have roles to play to facilitate private efforts.

Some preliminary guidance can be gained by selecting the means which can be tried if agreement can be reached upon (1) the goals sought and (2) the division of responsibility for initiating and financing the efforts made. It is upon these points that some of the present difficulty rests. It must be recognized that these are matters which call primarily for political decisions based on the logic of economics. Economics provide a procedure for analyzing the situations requiring a decision. Some decisions, however, must be made which take into account factors and values other than the maximization of profit.

Sufficient recognition of a public interest in the control of erosion on privately owned land exists to justify public expenditures. Such expenditures have been made for educational efforts, technical assistance to farmers without cost and the sharing of costs on certain measures designed to reduce erosion. The extent to which such investments can be justified as in the public interest has never been established in a forthright manner. Federal agencies requesting funds to finance such efforts have often found their requests trimmed before they reached the Congress, and the Congress itself has frequently appropriated less than the requested amounts. Funds provided by state legislative bodies have been exceedingly limited.

In practice there have been, and continue to be, annual budgetary limits to the amount of soil erosion control that the federal and state governments will support. This ultimately sets a level on physical accomplishments. The size of appropriations usually is determined more as the result of intuitive judgments as to what is desirable, by political considerations and by the competition for public funds for other purposes. This happens in part because sufficient study has not been undertaken to determine the implications of various levels of soil erosion on the nation's requirements for agricultural production in the future, taking into account the dynamics of the technology of agriculture and the possibilities for meeting future requirements with alternative means.

No statement of objectives of erosion-control

in quantitative or even relative terms can be found in federal legislation. Public Law 46 of April 27, 1935, the Soil Conservation Service enabling act, declares that it is the policy of Congress "to provide permanently for the control and prevention of soil erosion." It does not indicate, however, the desirable degree of control or the basis for determining this. Public Law 461 of Feb. 29, 1936, the Soil Conservation and Domestic Allotment Act, cites as objectives, among other things, the "preservation and improvement of soil fertility, promotion of economic use and conservation of land (and) diminution of exploitation and wasteful and unscientific use of national soil resources." Such a statement provides no guidance for determining either where private responsibility ends and public responsibility begins or where the ultimate limits to public responsibility are.

The Soil Conservation Service in cooperation with state and federal agricultural research agencies has developed the previously mentioned "maximum permissible soil loss" concept. Its field personnel use this as an objective to guide their planning of erosion-control measures. The soil type, depth of the topsoil and the type of material beneath the surface of the soil, together with other factors which determine the rate of soil formation, are all taken into account. By implication, this level of erosion control is the level dictated by the public interest, although only physical factors have been considered in its determination.

This goal excludes any consideration of the cost to either the farmer or the public of achieving a loss of no more than 5 tons of soil per acre annually. Neither are there explicit calculations of the benefits expected. There simply is an unspoken assumption that the benefits will be greater than the costs at this level of erosion control. There usually is a considerable public interest and benefit to be derived from some degree of erosion control, but the optimum degree of control may very well be different from this purely physical goal. An economic analysis built on the physical analysis is necessary to determine what the optimum is. Such an analysis will consider offsite damages and benefits and the cost, in terms of other inputs, of obtaining products of a given quantity and quality in the future if existing soil resources are allowed to deteriorate. To make such calculations, one must take into account the extent to which the quantity of products consumed at some future period would decrease if prices increased, as well as changes in technology and changes in the price relationships of the other resources which would probably be substituted to some degree for soil. Allowances must be made for the uncertainties involved in these estimates, but an analysis would not be impossible.

Even though the 5-ton soil loss goal was accepted without question initially in the studies reported here, the goal itself cannot be overlooked as a possible source of difficulty. Perhaps it is more important to determine whether, or how, the responsibility for meeting the costs associated with attempts to attain a given goal is to be shared. This is the critical question. The goal should dis-

tinguish between what the public has a right to expect will be accomplished by land owners and farm operators themselves and what portion of the job must be publicly financed.

There are a number of reasons why public and private interests in erosion control do not always coincide. There also are valid reasons why the level of erosion control that can be profitably undertaken on one farm may be quite different from that on another. Many of these reasons either have been illustrated specifically, or implied, in the foregoing description of the obstacle situations. Granted that many farmers may not now be doing all that is to their advantage to do, it may not be realistic to expect that a reduction of soil losses even to the level of 10 tons per acre, much less 5 tons, can be accomplished on some farms without a considerable amount of public effort and assistance. It is important for this reason alone to determine whether the 5-ton level is really the appropriate public goal for this area. Further research on this matter is now under way in a joint project of the U. S. Department of Agriculture and the Iowa Agricultural and Home Economics Experiment Station.

One of the difficulties of the present situation is the apparent disregard for the distinction between private and public interest. In "selling" erosion-control measures to farmers with the slogan, "conservation pays," it is implied that a full program of measures will be profitable for the individual farmer when this may not always be true.

Farm plans which are drawn up to accomplish the 5-ton level of control do not spell out the areas of individual and public responsibility. It is true, of course, that a technician of the Soil Conservation Service may be available to give, at no cost, certain technical assistance and advice to the farmer in establishing the recommended practices. Further, the participating farmer can take advantage of cost-sharing arrangements—the payments available through the Agricultural Conservation Program Service of the U. S. Department of Agriculture. But these payments often are considered to be only an incentive to stimulate farmers to adopt practices such as contouring or the use of fertilizers. Once farmers' initial reluctance to use the practice has been overcome, they usually can be expected to continue it without further financial incentive if it is profitable. Sharing a cost such as that involved in the construction of terraces is, in part, a different matter. Some initial inducement again may be necessary here, but cost sharing may also be a recognition of a public interest in the practice which exceeds the private interest.

The formula used for determining the share of these costs to be borne by the farmer and by the federal government is an arbitrary one. The division of costs does not necessarily reflect the portion of the total investment which is rightly a public responsibility. Such a share might be less; it might be more. One might also question whether the public benefit is always such that the federal government is the appropriate unit of government to bear the cost, particularly if the major bene-

ficiaries are largely within the same watershed.

The lack of a clear policy with respect to the division of financial responsibility for different levels of erosion-control means, in practice, that the desired erosion-control practices will not be applied if a farmer is expected to bear the cost of carrying land-management practices beyond the point where he could be reasonably expected to benefit from them. On the other hand, if the public is too liberal in the assistance it extends and the responsibility it assumes, when such assistance is not the crucial factor in bringing about the desired changes, this represents an inefficient use of public funds. Some of the present difficulties can be traced to the inadequate attention that has been given to these matters.

The technician who draws up the farm plan and works with the farmer surely appreciates that, no matter how effective the plan may be in its conception for controlling erosion, it is of little value unless it gains the farmer's acceptance. The technician faces the problem of compromising what he feels to be a technically complete and effective set of recommendations for something much less perfect in its ability to accomplish the desired level of erosion control. He and the farm operator may consider how the plan can be adopted to the farm operator's circumstances, but neither he nor the farm operator have accurate information to guide them in determining how much of the recommended plan would be economically feasible for the farmer. The ideal physical plan may in large measure be unacceptable to the farmer.

It is interesting to note in this connection that the 46 farms with complete Soil Conservation Service farm plans in 1957 had an average rate of soil loss of 10.3 tons. Although this was less than the average soil loss of 16.5 tons on the farms without a plan, it still exceeded the 5-ton-loss goal. Farms on which plans had only recently been completed showed an average annual loss of 14.7 tons per acre. Given more time the soil losses on the farms of these cooperating farmers may be further reduced, but under the present circumstances it seems unlikely that they will reach the 5-ton level.

Some of the frustration which the soil conservationist undoubtedly faces, if he must attempt a compromise between the ideal agronomic and engineering plan and the plan which has the best chance of adoption, might be avoided if the unique features of the particular farm being planned were recognized. The farm business of one farm family can differ from that of neighboring farms in various respects even though soils, topography, climate, etc. are nearly identical. Those practices which are not financially attractive for one farm operator may be quite profitable on another farm. It might be a different matter if the operator were able to add more land to his farm, if he had more working capital or if certain changes were made in the lease in the case of a tenant-operated farm, etc.

The technician could provide a useful service to the farmer if he were able to indicate those portions of the plan that would be profitable under

the operator's present circumstances and those which would require certain changes in his farm business before they would pay. Possibly some practices then would remain which, while desirable from a public point of view, would be unprofitable for the operator to undertake without outside financial assistance. The farmer then could be encouraged to carry out those parts of the plan that lay within his capabilities and be directed to the appropriate places for any assistance he might require to make the necessary changes in the organization of his business.

The farm planner may not have the training to permit him to make the economic analysis that has been implied here. It would be most helpful, however, if such an analysis were available, not only when the plan is presented to the farmer, but also at the time when the various agronomic and engineering features of the plan are considered.

Public funds which may be spent on private lands for the control of soil erosion are extremely limited in view of the funds which could be spent to an advantage in this way. To make the most of them, it is important that these funds are not substituted for private funds—either those of individual landowners and operators or those of several landowners with a joint interest in the benefits accruing from work done in a small watershed.

Private responsibility can, to a point, be equated with private profitability. It must be recognized, however, that there may be situations in which public activity of some sort is necessary to remove conditions that make certain erosion-control measures financially unattractive to farmers. However, the longer run benefits from additional protective measures which are progressively more costly and yield smaller and smaller immediate and on-site benefits are properly the area of investment for public funds.

The exact limit of each level of responsibility can be defined as the point at which the expenditure of an additional dollar for erosion control would yield an additional benefit of at least \$1 for the person, the group or the public making the investment but where, if an additional expenditure were made, the returns would be less than the investment. This guide can be followed to indicate the cut-off point for public investment in erosion-control activities by limiting further investment at a given site when there are other sites which would produce a larger public benefit for the same investment of funds. This is not the usual practice, however, but the marginal investment at a site should never exceed the marginal benefits.

The owner of land on which erosion is taking place will ordinarily receive the greatest immediate benefit from the first efforts that are made to reduce the loss of soil. If he is fully aware of the erosion losses and their significance to his farming operations, he can be looked to primarily to safeguard his own property. But he may find it possible to protect his own interests without taking the measures which would reduce off-site damages or would provide benefits realizable only at a time beyond the interests of the farm owner or operator.

These benefits would justify investments only on the part of the beneficiaries. Sometimes these persons can be identified easily, and it is fairly easy to negotiate the sharing of costs among them. In other instances these things can be done only with great difficulty. Where this is the situation, the unit of government with jurisdiction which most nearly corresponds with the affected geographic area should be the general sponsor of the required measures. It might act only as an agent for a small number of readily identifiable beneficiaries and assess them the costs in proportion to the benefits received, after the manner of drainage districts.

Determining the appropriate division of responsibility, or the extent of the federal government's final responsibility in these matters is not simple. Nevertheless, the economic logic of this division of responsibility is helpful in explaining some of our present difficulties, and it can serve as a guide in attempting to overcome them.

Improving Knowledge of Soil Erosion and Its Consequences

Soil losses on 33 farms in the sample studied averaged nearly 19 tons per acre in 1957, but the operators on these farms rejected the erosion-control plans laid before them largely on the grounds that they preferred to continue farming in their established manner. On 47 farms, soil losses averaged nearly 17 tons per acre. Yet, when asked why they objected to the proposed erosion-control measures, the operators said they could see no need for them. As indicated earlier, some farm operators and landlords had entirely erroneous conceptions about the effects of particular practices. Unless the farm operators and landowners on these farms, more than 57 percent of the sample, can be convinced that the rate of soil loss from their farms is great enough to reduce their incomes and that the recommended practices are effective and desirable, little or no additional progress can be expected.

Why is it possible after more than 20 years of efforts emphasizing the need to reduce soil losses to find situations of this sort on such a large proportion of a random sample of farms? Have the efforts to provide information been adequate for the job? Have the assumptions upon which such efforts have been based been correct? Has the necessary research support been available and has it been used? Have the educational efforts taken into account the social and economic circumstances in the area? Have farmers had a need for information or assistance of a kind that has not been available? Should more attention be given to increasing the appreciation and understanding of the problem among persons other than farmers in the farm community? Has too much reliance been placed upon the educational process? Most of these questions and others cannot be answered now but should be seriously considered by anyone concerned with the problem of erosion control.

There is no guarantee, of course, that there would not be other obstacles even if the effort to create increased awareness of the erosion problem

among these farmers and landowners were successful. However, the problem would be at least a step closer to eventual solution. If education is not enough to accomplish this, other measures may have to be used. Farm operators and farm landlords need a greater awareness of the seriousness, to them and to the public, of high levels of soil loss. Their knowledge of the economics of erosion and its control, some of which is still unknown, can be increased and their misconceptions corrected. But is it sufficient just to develop and make this information available to them? Can they be expected to take action voluntarily if they have previously been unmoved? Or must the information be coupled with a strong effort to persuade and convince them to accept it?

"Pressure tactics" often backfire and create increased resistance to change. Nevertheless, a less passive means seem to be required for dealing with those people who have never been very responsive to changes of any kind, for a public interest also is involved here. To the extent that public and private interests coincide, the public has a right to expect that the individual will do everything that is at least in his best interest to do.

It is possible to make reasonably reliable estimates of the current rate of soil loss on farms at a relatively small cost as was done in the studies reported here. These estimates might be used as a device to create an awareness of a problem where farm operators and owners appear to have no concern. The governing board of a soil conservation district might consider making a survey of all farms in a community or even a sample such as was used in the "National Inventory of Soil and Water Conservation Needs." Without specifying individual farms, they could make the average loss rate for the farms known to all residents of the area and perhaps contrast it with loss rates elsewhere. This might be followed up with a visit to each farm operator and landlord so that each could see where he stood with respect to other farms in the area. An estimate of the cost of this rate of loss not only to the operators and the landlords but also to the whole community would give an added measure of effectiveness to this technique.

To accomplish the job which remains to be done, the entire farm community, business and professional people as well as farm operators and owners, must be reached. All should be made more conscious of the problem, its causes and possible remedies, and the desirability of making the necessary changes.

New attitudes can be engendered. New skills can be learned. The farm community can do much to bring these things about if its members recognize and attempt to overcome the conditions which now make such changes difficult. They too can be made more aware of their stake in the problem and, if they are helped, to see the role they may play solving this problem. There are many opportunities for them to help by merely acting in their own capacities. Without overt pressure, many farmers can undoubtedly be moved to take action in response to community opinion.

While the community as a whole can assist in increasing farmers' awareness of the need for erosion-control, it may also assist—perhaps even more effectively—in breaking down customary ways of handling certain situations. Furthermore, it could help to establish new patterns under which erosion-control measures would be easier to adopt. Lawyers, bankers, real estate brokers, county government officials and others indirectly related to farming have much to offer. Their opportunity arises any time a farm operator, owner or prospective farm purchaser seeks their advice or assistance in drawing up a lease or a will, in borrowing money, in buying or selling a farm, in working out retirement plans or in filing an income tax return. But these persons must first have an understanding of the problems involved as well as the knowledge of how they can help.

Soil conservation district commissioners might wish to make greater and more extended use of this technique. With the assistance of the county extension director, representatives of the Soil Conservation Service, the Agricultural Stabilization and Conservation Committee, commercial and civic clubs and other interested agencies, it would be possible to plan and hold meetings at which the basic problems could be outlined to the business and professional people of the community and their cooperation solicited. A successful effort of this sort could uncover a number of ways of solving problems that currently face farmers who are attempting, or should be attempting, to apply certain erosion-control measures.

It would be less than honest not to recognize that obstacles have been created by some of the people in the educational and governmental agencies which have been attempting to advance the control of soil erosion. Although perhaps well-meaning, there has been friction between the personnel of various agencies doing parts of the over-all job. The failure to work in more close cooperation with each other and the mutual distrust and rivalry sometimes found have limited the progress that might have been made against the difficulties confronting farmers. These problems call for a variety of approaches. Actually the differences in the approaches and philosophies of the public agencies might well be an asset rather than a source of friction. The opportunities for coordinated and complementary activities, such as the meeting suggested above, are great. Petty opposition and needless competition only hinder the over-all effort.

Overcoming Income Difficulties

Some farm operators and farm landlords objected to the recommended erosion-control measures because they anticipated a loss of income as a result. Undoubtedly, these judgements often were correct. This difficulty, however, could have been overcome if additional investments had been made—perhaps in livestock or fertilizers—or if the resources they were then using had been reorganized and used in a more efficient manner. Others, particularly landlords as a group, were clearly misinformed or without information as to the actual costs involved and

the returns that might be expected to result from the use of the practices. Half of the landlords said that they would have to borrow funds if they were to install the recommended practices. And about half of these landlords indicated that they would not contract debt for this purpose.

Judging from the interviews with the landlords, much of the current educational program is missing them. Many are women who have little knowledge of the condition of their farms. Typically, they view any new capital outlay for improvements, no matter how profitable they might be, as a threat to their immediate economic security. (There are also male landlords in this category.) Many of these women, even the widows of former farm operators, have had little or no experience with farm management matters. The benefits to be gained from erosion-control practices still must be demonstrated to them.

An opportunity exists to provide both farm operators and landlords with information pertaining to the profitability of erosion-control practices. This material should be prepared keeping in mind the handicaps which these people may be facing in their operations and should suggest methods of overcoming these handicaps. One of the most effective current techniques is that of assisting farmers to plan their business enterprises. The farm management program of the Cooperative Extension Service gives this kind of assistance to farm operators, but it reaches only a small number of the farmers in the state. The farm plans prepared by the Soil Conservation Service technicians are somewhat different in that they are largely physically orientated. Both procedures have assisted in bringing about a reduction in soil losses. Improvements can still be made in both planning procedures, however, particularly if they are joined.

Farm planners need to consider economic as well as physical factors. The planning procedure should be flexible enough to accommodate changes in economic circumstances. Most conservation farm plans do not yet meet these requirements.

The techniques for controlling soil loss and the applicability of various practices are changed from time to time as research efforts bring new information to light. The farm plans prepared in 1949 for use in making the studies summarized here were partially obsolete by 1957 and required certain changes. If these plans were outdated, there can be little doubt that plans which had been drawn up for other farms in the area at earlier times were similarly out of date. With limited resources available from the Soil Conservation Service, the soil conservation districts have apparently chosen to extend their efforts to additional farms rather than to follow up those previously planned to make any changes that might be necessary. Changes in prices, changes in owners and operators, changes in planning horizons of operators and changes in other technology are all factors which require frequent revision in farm plans. No plan can be drawn up on a "once-and-for-all" basis. If no effort is made to keep the plan current, it can accomplish only part of the over-all job.

Comprehensive erosion-control plans, which could be revised without great difficulty, could be prepared by farm planners with the aid of electronic computers. The mechanics of planning would be changed, but the basic information about the farm business would still be obtained by the planner who has been assisting the farmer. These data should include the resources available, the operator's estimates of costs and prices, estimates of the productivity of the resources and the farmer's preferences. This information in turn could be tabulated in a standardized form and submitted to a central location for development into a farm plan. An operation of this type could be administered in much the same way as the soil testing service.

The solution or farm plan developed by this means would "specify" the amount and use of all resources in the farm business and give an estimate of net farm income. Alternative plans for the same resources which would result in slightly lower farm incomes, but which might be more acceptable to farm operators could also be developed. These plans then would be sent to the county agency representative who had obtained the basic data from the farmer. He could interpret the recommendations to the farm operator.

Agency representatives could periodically check with farm operators and owners to determine whether the farm plans were still acceptable. If a plan no longer fitted a particular farm situation, it and the data on the changes could be submitted to the computing center for revision. The revision could be easily and inexpensively made if the previous plan was still on file. The low cost and speed with which computers can process large volumes of data would result in the preparation and revision of more comprehensive plans. This could be done at a lower cost per plan than with the present procedure. The data on costs and returns which this procedure would require is also needed for farm planning as it is now done.

Perhaps the greatest advantage of this technique in planning lies in the fact that economic considerations could be taken into account in a much more effective way than is now possible. A farm plan that is nothing more than an agronomic and engineering prescription for reducing soil losses may be acceptable with only minor reservations or changes to a farmer with a relatively small erosion problem. The Napier silt loam soils, with slopes ranging between 0 and 5 percent, offer a wide range of combinations of practices which make it possible to increase the income from crops and simultaneously to reduce soil losses to 5 tons. The real problem comes with farmers who have a major portion of their cropland on the steeper slopes of the Ida and Monona soils. Here it is difficult, if not impossible, for a farm operator to maximize his immediate income from crops and still reduce soil losses to a 5-ton level. Here is an instance where public agencies will undoubtedly have to make some type of investment if soil losses are to be brought down to that level.

It can be argued, and cost and return calculations based on experimental results bear it out,

that, on eroded slopes of Ida silt loam with slopes in excess of 12 percent, a farm operator cannot stay in business **unless** he makes an effort to control erosion. He can expect to see enough of an increase in yields from such an effort not only to pay for the practices but also to turn a loss into a net gain.

This is best illustrated in table 1. The study from which the data in the table are taken is based upon a hypothetical farm situation. A farm of 120 acres was used. It has but one soil: an eroded Ida silt loam. It has no slopes less than 12 percent, but some are as great as 20 percent. Given such a situation, what happens to (1) the rate of soil loss and (2) the income from crop production with various changes?

Columns A through F represent the different crop rotations that might be followed. Rows 1 through 3 show the soil loss per acre expected from each rotation, but with three different basic methods of dealing with runoff and the loss of soil, and under two different farming systems. The cash-grain system assumes that all grain produced on the farm is sold. The livestock system assumes that the grain is fed to livestock. Rows 4 through 6 duplicate the different combinations shown in the first three rows but present information as to the total crop income for the farm under each situation. Thus, both soil loss and annual crop in-

Table 1. Soil losses and net crop income on eroded Ida silt loam (12 to 20 percent slope) under different rotations, soil management practices and farm management systems.

	Rotations ^a					
	(A) CCO	(B) CCO, CO, COMM	(C) CCOMM	(D) CCOMM	(E) COMM	(F) COMM
Soil losses, tons per acre						
1. No practices						
a. Cash crops..	319.5	213.0	106.5	95.8	63.9	42.6
b. Livestock	246.0	164.0	82.0	73.8	49.2	32.8
2. Terraces and contouring						
a. Cash crops..	48.0	32.0	16.0	14.4	9.6	6.4
b. Livestock	36.9	24.6	12.3	11.1	7.4	4.9
3. Fertilizers, terraces and contouring						
a. Cash crops..	36.9	24.6	12.3	11.1	7.4	4.9
b. Livestock	25.8	17.2	8.6	7.7	5.2	3.4
Net crop income for 120 rotation acres (\$)^b						
4. No practices						
a. Cash crops —	1,244	—444	—492	—740	—1,007	—1,414
b. Livestock ..	82	824	—19	—191	—547	—961
5. Terraces and contouring						
a. Cash crops —	1,007	—312	—180	—458	—681	—1,079
b. Livestock ..	420	1,172	347	222	—180	—594
6. Fertilizers, terraces and contouring						
a. Cash crops ..	270	665	392	205	—110	—352
b. Livestock ..	1,041	1,264	800	821	357	74

^aC, corn; O, oats; O_s, oats with sweet clover; M, meadow.

^bThe costs of practices have been depreciated over a 20-year period with interest at 5 percent. A value of 63 cents per hour has been placed upon the farm operator's labor. Terraces have been installed by the operator using a moldboard plow.

Source: Gordon A. Ball, Earl O. Heady and Ross V. Baumann. Economic evaluation of use of soil conservation and improvement practices in western Iowa. U. S. Dept. Agr. Tech. Bul. 1162. June 1957. Tables 6 and 14.

come for one situation can be compared with soil loss and income in any other of the situations shown.

Twenty of the 36 combinations show a farm business that is operating at a loss. If farm operators were fully aware of this, these combinations of enterprises, rotations and poor farming practices would less likely be followed. The income figure presented makes a wage allowance of 63 cents an hour for the operator's labor. Thus, what is shown, if it is not a loss, would be available to the operator as a return to his managerial ability or would allow a higher return for his labor. The cash-grain system which makes use of no practices would lose money for the operator no matter which rotation he selected. The loss would be minimized, however, with a rotation which would produce an estimated soil loss of 213 tons per acre annually, rotation B.

If mechanical practices were used without the use of fertilizers (Row 5a), each of the rotations on a cash-grain farm would result in a loss of money for the operator. Rotation C would minimize this loss, and it would also reduce soil losses dramatically from the situation in which no practices were used. The soil loss would be about 16 tons per acre. The use of fertilizers with these practices makes rotation B the most profitable, but this rotation would increase the soil loss rate to nearly 25 tons per acre. Only rotations E and F come close to achieving, or actually achieve, the desired erosion-control goal, and this is possible only with a livestock system of farming and the use of terraces and contouring. The use of fertilizers is necessary if a financial loss is to be avoided, but the combination of these practices with this system of farming will not produce a very attractive income.

The cropland of a typical farm in western Iowa would not be limited to the steep and severely eroded Ida soils such as were assumed in this situation. In actual practice where such cropland is found together with more productive cropland, the income earned on the more productive cropland would tend to offset the losses on the poorer soils. Because of this, many farmers may not be fully aware of the fact that they are losing money farming such eroded and low-yielding soils. Nor are they likely to be aware that with the right combination of mechanical practices, rotations and commercial fertilizers, these losses not only could be eliminated but crops on these soils could be made to produce an income instead of a loss.⁵

The soil-loss section of table 1 shows quite clearly why some farmers immediately indicate that they could not accept the recommended rotations for

their farms. First, it shows that **both** mechanical and agronomic measures must be used to achieve the 5-ton goal on the eroded Ida slopes. Without the mechanical measures, this goal can be achieved only if corn or other row crops are almost completely eliminated from the rotation. Even when mechanical measures are used, a drastic reduction is required in the percentage of rotation land devoted to corn.

The situation is almost identical on the eroded Monona slopes of similar gradient, although these data are not shown in the table. Only on the slopes of the Monona soils that are less severely eroded and are no steeper than 8 percent can the 5-ton soil-loss goal be approached by using rotations alone. Such rotations, like those on the steeper slopes on which mechanical practices must also be used, permit corn to be planted no more than 1 year out of 4 on a cash-grain farm, or 2 years out of 5 on a livestock farm. However, a farmer willing to use mechanical measures on these lesser slopes can produce corn in a rotation with oats and sweet clover 2 years out of every 3 and still keep his losses to less than 5 tons.⁶

The economic well-being of the farmer comes into conflict with the 5-ton soil-loss goal at this point. The income figures in the second section of the table dramatically highlight this. The combination of rotations and mechanical practices that permits a farm operator to maximize his crop income will not reduce soil losses to the desired 5-ton level. Similarly, the rotations which enable him to minimize his income losses do not minimize soil losses.

Farm planning that takes into account the economic as well as the agronomic and engineering aspects of erosion control is essential if greater progress in the reduction of soil losses is to be achieved. Economic planning can call attention to opportunities for gaining increased control over erosion without impairing farm income. But the relation between these two goals is not always complementary. Erosion cannot always be controlled without lowering farm income. Where there are conflicts between them, farm planning, as such, cannot eliminate the conflict. But it will provide the basis for determining the level of erosion control for which the farm operator or owner can reasonably be expected to be responsible. Likewise, the point at which this responsibility shifts outside the farm firm is similarly defined.

In short, farm planning demonstrates the potentials that can be developed from the existing resources of a farm and what might be done if additional resources were available. It demonstrates the results, both economic and agronomic, of alternative courses of action. Thus, if a farm plan is prepared, at least part of what may have been a lack-of-information obstacle is overcome.

Complete farm planning, though, is not the entire answer. Planning can make a big contribution, but it needs to be followed with efforts to remove

⁵ The cost and return data underlying the income figures for table 1 were built upon a set of assumptions which now tend to overestimate the income and underestimate costs. They were based upon an average of the prevailing prices and costs for the period 1948 through 1952 when these relationships were more favorable than they were in either 1957 or at present. Similarly, the cost of installing terraces varies according to the method used, and for these purposes, the **least expensive system** was selected even though it would be more realistic to substitute a more expensive system using a whirlwind terracer or bulldozer. The cost of the operator's labor was included, however; the charge for the investment was spread over a 20-year period at an interest charge of 5 percent. No provision was made, however, for any financial assistance that a farm operator would be eligible to receive under the federal cost-sharing Agricultural Conservation Program Service.

⁶ A. Gordon Ball, Earl O. Heady and Ross V. Baumann. Economic evaluation of use of soil conservation and improvement practices in western Iowa. U. S. Dept. Agr. Tech. Bul. 1162, June 1957, p. 19, table 9.

those remaining obstacles that (1) prevent the operator from achieving the potential specified in the plan and (2) prevent the attainment of that level of erosion control beyond the limits of private profitability but desirable from a public point of view.

Obtaining Additional Capital and Land

A thoughtful man usually asks, "What are the alternatives?" when he is not in position to do everything that promises to be rewarding. The same course of action may look bright to him at one time and dismal at another if there are changes in the attractiveness of his alternatives. Farmers in western Iowa were reluctant to borrow funds to install erosion-control measures, and there is reason to believe that, even if money were available, other investment opportunities open to them would absorb it first. The farm operators did not hesitate to indicate what they would do with more capital if it were available. They indicated that they would buy more livestock, buy fertilizer or improve buildings. Only 3 percent of the operators gave terraces a high investment priority. Grassed waterways and gully control also were mentioned by only 2 and 3 percent of the operators, when interviewed in different years, and then only after making investments elsewhere on the farm.

These responses are not surprising. The return from an investment in erosion-control measures in western Iowa is relatively low, at least during the early years of the investment period. Funds can often be absorbed elsewhere in the farm business where they will yield a higher return. The purchase of roughage-consuming livestock or commercial fertilizer, however, can often make an indirect contribution to erosion control. This is apparent from the data shown in table 1.

Half of the landowners in 1957 indicated that they would have to borrow funds to install the recommended erosion-control practices. Of these, half said that they would not borrow the funds, for they preferred not to go into debt for more livestock, terraces or grassed waterways. Because these studies have indicated that there is a tendency for soil losses to decrease as the ability and willingness of a farm operator to borrow funds for erosion-control practices increase, information as to what might be accomplished with the use of additional capital resources is a crucial matter.

A farm plan in which both farm enterprises and erosion losses are considered might have indirect effects here. With an indication of the changes in income which could be expected from various investments—information which a complete farm plan would provide—farm operators might be more willing to borrow the funds. Banks and other lending institutions might, with greater confidence, become more aggressive in seeking to make such loans. Efforts should be increased to extend such cost and return information to the persons who could use it.

Farm operators interviewed in the studies said that they could undertake to do more if the cost of erosion-control practices were spread over long

periods of time, in the same manner as the returns to the practices frequently are. Actually, it is possible to spread many of the indirect costs—for instance, those associated with converting to a live-stock system of farming—over a period of time. Ball, Heady and Baumann indicate in their study that the greatest need for additional capital would not be during the first year the plan was put into operation but somewhere between the fifth and tenth year of operation. Capital outlays would be required every year over a period of years, however, and the total investment would be large.⁷

Farmers who cannot obtain suitable credit on reasonable terms from other sources may obtain the necessary credit through either of two programs of the Farmers Home Administration: farm ownership loans and loans to install soil and water conservation measures.

The farm ownership loan program provides credit for farm enlargement and development up to 90 percent of the value of the borrower's farm. Loans for soil and water conservation are available to farmers or groups of farmers to pay the cash cost of projects related to soil conservation, water development and its conservation and use, and drainage. These funds come almost entirely from private lenders, but the loans are insured by the federal government.

Credit for the soil and water conservation loans has been available to Iowa farmers since 1954. In the 6-year period ending June 30, 1960, 103 borrowers in the state had used it, borrowing a total of \$379,266. However, of this total, only 16 percent was borrowed for erosion-control measures; 64 percent went into drainage projects. These statistics suggest that the credit problem, if a valid obstacle, now may be mainly a lack of knowledge of the credit facilities available, or an aversion to using credit for purposes such as erosion-control measures. Perhaps, too, the authority to make loans under this legislation could be expanded to include as a purpose the purchase of livestock and the making of similar investments indirectly related to the adoption of a conservation farm plan.

It is difficult for both owner-operators and tenants on farms of less than 120 acres to consider the adoption of erosion-control plans unless they have an above-average investment in dairy cattle, feeder cattle or some similarly intensive and specialized enterprise. Such enterprises are not within the means of all farmers, however. Intensive livestock enterprises require additional capital resources and managerial skill, and some involve greater risk than does a cash-grain system of farming. Furthermore, such small farms on the rental market are unlikely to attract tenants with these skills or resources, and the tenants found on such farms are often there only until they can find larger farms.

Consolidation of these smaller farm units through purchase is occurring and appears to be the most promising long-run solution, but this is something which will not necessarily take place at a rapid enough rate if left only to the vagaries of

⁷ *Ibid.*, p. 59.

the market. Nearly all the owners of the small farms in the study either held them in a life estate or would not consider selling them because they knew of no other investment better suited to their purposes. Consolidation of some units through field renting is taking place but is not always a satisfactory solution because of the uncertainty of long-term control over these tracts by the operator. Moreover, some of the small units are not convenient enough to the farms of those who desire to rent additional land.

In not too many years, since the average rate of farm ownership turnover in the area is 14 years, most of these small farms will have passed to other owners. Thought might well be given to the possibility of direct action to assure that the new owners create larger, more efficient units from these suboptimum units. Means by which this might be accomplished can only be suggested. They might follow the general pattern of that used in Sweden to deal with a similar problem of farm units of uneconomic size. There, in return for income subsidies, the farm owner agrees to give the government an option to purchase his property at such time as he himself no longer wishes to operate it, unless it is purchased for incorporation into another farm unit which would result in a farm of optimum size. Any purchase of land by the government, however, is made with the intent only to resell it to individual operators as soon as an opportunity arises to enlarge another small unit.

The problem of the undersized farm would not be so difficult if more capital were available and operators had the skill to develop intensive livestock enterprises instead of intensive crop enterprises. This places the solution of the problem back in the discussion of means to overcome capital limitations and managerial deficiencies. Similarly, if the operator were less dependent upon the farm to provide an outlet for his own labor, the problem would be less difficult. Semiretired farm operators in some instances welcomed an opportunity to reduce their hours of field labor and found that livestock and forage enterprises were sufficient to provide for their income needs. Likewise, farm operators with more than just occasional off-farm employment were under less pressure to plant every possible acre in the farm to corn than were the operators with growing family responsibilities and with large debt payments to meet. Consequently, many erosion problems could be solved either if the size of the farm business were enlarged by adding more land or more livestock or if regular off-farm work were available for underemployed farm operators.

REFLECTING SUSTAINED PRODUCTIVITY IN LAND PRICES

Although no farm operator specifically said that he had paid too much for the purchase or for the rent of the land he farmed to permit him to follow a less intensive cropping system, this was undeniably the situation on a number of farms. Consider, for instance, the relationship between prices farmers pay and the prices they receive.

Between 1941 and 1959, the index of prices that farmers paid for production items rose by 105 percent. The index of prices received for feed grains and hay rose by 75 percent. Thus, in terms of production items, the purchasing power of these farm products was much less in 1959 than in 1941. The price of farm land also increased during the same period, and the increase reflects considerably more than just a rise in the general price level. The price of the highest grade of farm land in western Iowa increased nearly 200 percent while that of the lowest grade increased 165 percent.⁸

An acre of Iowa corn land produced 27 percent more corn during the period 1957-60 than it did for the period 1938-41. However, this increase in productivity cannot be attributed to the land, but even if it could, this increase of itself cannot justify the increase in land prices just noted. Other factors have been responsible. Land has been considered a good hedge against inflation. Even more important, the pressure to enlarge farms also has pushed the price up. Thus, while farm enlargement may be one of the keys to erosion-control on small farms in the area, this becomes more difficult to accomplish when land prices shoot up. It is a less attractive solution, particularly as land prices move beyond the range of the income that the land can be expected to produce under a cropping system that must be less intensive than that now found in the area.

Valuations greatly in excess of the long-term agricultural productivity of land aggravate the erosion problem. Such values lead not only to excessively high fixed commitments which compete for funds needed for erosion-control outlays, but also to exploitation of the farm in an effort to meet these annual payments of principal, interest and taxes. The soil is permitted to deteriorate and erode; fences, buildings and other improvements are allowed to run down. This was the situation found on a number of the farms studied, particularly those on which a young farmer with extremely limited resources had borrowed money to purchase a farm in the period of very favorable corn and livestock prices immediately following the end of World War II and was struggling to produce as much income as possible.

Land prices theoretically represent the considered and rational calculations of well-informed persons who have estimated the future stream of income that can be attributed to the land and have translated this to a present worth. If there is a strong demand for land on the part of persons who wish to use landownership as a hedge against inflation, the price of land established in such a market will likely be much higher than that which would result in the absence of such buyers. Even without this factor, if the annual income which is used as the basis for capitalization consists in part of disinvestments in land through extensive soil erosion caused by rotations heavy in corn, the land value established as a result will be too high since it will be based upon an income which cannot be maintained.

⁸ Dwight Maxon Gadsby. Are Iowa farm land prices tapering off? Iowa Farm Sci. Vol. 14, No. 8, Feb. 1960. p. 4.

Many of the farm operators interviewed felt that if soil losses on a farm were not greatly in excess of those on other farms in the community, the value of the farm on the market would not reflect the failure to control erosion nor, if an effort had been made to control erosion, would the market value be enough greater to justify that effort. Their views seem to be well founded. Changes in land prices from 1949-57 apparently had no relation to either the change in erosion between those years or the level of erosion in 1957.

To meet this obstacle effectively is not a simple matter. One can caution those who appraise land for purchase and tax purposes to distinguish between income which results from the true productive powers of the land itself and that which is merely disinvested capital. This, however, may not be as simple as it sounds unless the appraiser has information derived from a study of the problem. He should also take into account future decreased yields and increased costs arising from soil erosion. Such information is not readily available now.

Improving Leasing Arrangements

The difficulties presented by existing leasing arrangements on farms in western Iowa were among the most important of the obstacles encountered on rented farms. Approximately half of the tenants mentioned the problem, but their concern in most instances was that their landlord would not permit the use of the plan because his income would be reduced. Such a reaction was usually an amplification of the operator's objection that the plan would severely reduce his own income. The reaction of many landlords also focused upon the reduced income they anticipated. Seldom did they see anything in the leases they were using that they felt should be changed to facilitate the adoption of recommended conservation practices.

If these objections were nothing more than a reiteration of the previously discussed obstacle of insufficient resources and the fear of increased expenses and reduced income, further discussion here would add little. There can be, however, a significant difference between the ability of a tenant-operator and that of an owner-operator to make the most economic use of the resources. This gives a different slant to the income problem than that discussed previously.

The function of obtaining and organizing resources for farm production purposes tends to be a divided responsibility on most rented farms. The landlord provides the land and buildings while the tenant provides a line of machinery, his labor and most of the operating expenses. The cost of some inputs is shared. Sometimes this creates little if any problem. At other times it presents a decided obstacle.

Some tenants saw beyond the immediate objections they felt the landlord would have to the reduced corn acreage and emphasized these difficulties. They noted that practices such as terracing, and possibly the construction of grassed waterways, would actually be the responsibility of the landlord. Many said that these were practices which they

could not consider undertaking unless they could be assured of a relatively long-term occupancy of the farm or unless they would eventually be compensated for their investment.

Scarcely mentioned, but obviously recognized, were the indirect investments that the adoption of an erosion-control plan would require to maintain or improve the income of landlord and tenant. Tenant operators, except those who were operating under a livestock-share lease, had at best only small livestock enterprises. To make more effective use of the roughage that would be produced under a shift to rotations with less corn, a livestock system of farming is necessary. While the livestock investment would be the responsibility of the tenant under a crop-share lease, the building and fencing requirements would almost of necessity be the responsibility of the landlord as the depreciation schedule for these investments would span a greater number of years than the tenant's expectancy of tenure. Yet, because the investment would primarily benefit the tenant, the landlord would have little incentive to make it unless he could raise the rent on the farm in some way or switch to a livestock-share lease. Even if he might otherwise be willing to make such an investment, there might well be other more profitable investment opportunities available to him.

The increased use of fertilizer, while of some direct value in the reduction of erosion, has a greater indirect value in establishing satisfactory stands of grass and legumes for grassed waterways and in the hay and pasture sequences of the crop rotation. It is also valuable in that when combined with terracing and contouring, which help retain additional water and increase soil moisture, higher corn yields are possible. On some farms this cost would be shared. On others, it would fall largely on the tenant, who would receive some, but not all, of the benefits of the investment. He would have little incentive to carry his investment in fertilizer to the point of its most profitable use, considering the returns to both tenant and landlord.

If there were more bargaining between tenant and landlord in establishing the terms of leases, presumably some of these difficulties would be resolved. Bargaining, however, is not as important with respect to some of the major terms of the leases in the area as is the custom of the community. Yield data collected in 1949 on the farms studied indicated a corn-yield difference of as much as 30 bushels an acre between farms. With a range in productivity as great as this, one would expect to find a fair degree of variation in the rental terms, yet in 35 cases out of 40 in which the crop-share lease was used, the landlord's share of the crops was half of the corn and two-fifths of the oats. Four of the five remaining farms divided both the corn and the oats crops equally.

There was somewhat more variation in the manner in which certain costs were shared. The cost of seed grain was usually shared by landlord and tenant when the crop-share lease was used. Half of the landlords paid the same proportion of the cost of seed corn as the proportion of the crop

they received. Twelve percent paid a somewhat lesser share of these costs, while the remaining 38 percent paid none at all. Fertilizer costs were generally divided equally, although, with only half of all farms in the sample using commercial fertilizers, there is no indication of how the costs would be shared on rented farms not now using it. Grass and legume seedings were the responsibility of the landlord on 95 percent of the farms using the crop-share lease, but in nearly every instance, the tenant paid a cash rent for the land in hay or pasture. Nevertheless, a few tenants not only supplied part or all of the seed for such seedings but also paid a cash rent on this land.

No attempt has been made to judge the relative equity of the different leases. Much more information than that which was obtained would be needed to do this. Some of the greater variation found in the manner in which the above-mentioned costs were divided could have been the result of an effort to deal with what may have been special circumstances on particular farms. However, it is unlikely that these differences could have been as great as the differences in the productive capacity of the different farms. If additional adjustments were deemed necessary, there would have been greater equity if the share of the crop paid in rent had been adjusted accordingly. Unless costs are shared in proportion to the benefits each party to the lease receives, and unless such adjustments are made throughout the lease, distortions can easily arise in which the incentive is destroyed for the landlord or the tenant either to make the investment initially or to push it to the level at which it would be at an optimum—considering the costs and returns to both parties rather than to one or the other alone.

Obtaining or maintaining permanent or semipermanent facilities—such as the buildings necessary for livestock production, fencing for contour farming and terraces—on farms with a crop-share lease may be handled in at least two ways. The concepts of property rights vest the ownership of such improvements, termed fixtures, in the landowner regardless of who makes the investment. Thus, if possible, it is desirable that the landlord make these investments. If he makes them, a specially designated “improvement rent” can be determined quite apart from, and in addition to, the shares established for the crop enterprises. Should the landlord be unable or unwilling to do this himself, he might be willing to safeguard his tenant’s investment by agreeing to some form of compensation for the tenant upon termination of his tenure.

There is no problem, of course, if both parties to a lease share the costs of the investment in the same proportions as they will share the benefits. The difficulty arises in determining what these benefits will be. For instance, preliminary research indicates that there are small current benefits to be gained from terracing. Grassed waterways and gully-control measures may yield some immediate returns as, for instance, reducing farm machinery operating costs in the process of producing crops. The same can be said for the savings in tractor

fuel which come from farming with the contour instead of up and down the slope. But there are also long-run benefits to the landowner which are of little concern to the tenant. The long-term value of the land, or, the long-term productivity of the farm, is safeguarded against the inroads of gullies which could destroy the usefulness of parts of the farm if not controlled or prevented.

It is reasonable to expect the tenant to share part of the cost of terraces, grassed waterways and gully-control structures, if they are profitable to the farm business, only if he is assured of receiving (1) benefits from them or (2) compensation for their unexhausted value when he leaves the farm.

A tenant, if willing to make such an investment, might still be financially unable to share in the cost. Credit then becomes a problem. Lending agencies would question the use of the proceeds of a loan to make an investment on property of another. But if the landlord were willing to sign the note with his tenant, credit would be less difficult to obtain. Should the tenant leave before the note was paid, the landlord could assume that portion of the note that would represent the amount of compensation due the departing tenant if the remaining benefits from the investment were equal to, or greater than, the amount of the loan.

On some farms it is important that attention be given to the protection of the rights of the landlord. The doctrine of “waste” found in common law theoretically protects the landlord from injury to his property. A tenant has the right to use the property and enjoy the benefits that can be derived from it if he maintains it in the condition in which he received it. He may not use the property in such a way as to lessen its value to the owner without being held accountable for the injury.⁹ Such injuries constitute “waste.” The question of what constitutes waste has usually been determined on the basis of what an owner exercising “good husbandry” would do. The Iowa Code allows injured parties treble damages for waste.¹⁰

With increasing importance being attached to erosion control and the problem of attaining it on rented farms, the doctrine of waste could be made to help serve this end. (An injunction to prevent waste could be used in life estate situations, too.) But the landlord need not wait for the courts to define “good husbandry” if a clause in the lease sets forth what will be expected of the tenant in the way of conservation measures. A provision to compensate the tenant for the unexhausted value of investments which he makes should accompany compensation of the landlord for any deterioration of the property or the liquidation of the “soil-capital” of the landlord.

The adoption of rental shares on a flexible basis might be one means of preventing waste on share-rented farms. This rests on the idea that lines can

⁹ H. T. Tiffany, *A treatise on the law of the landlord and tenant*, Vol. 1, Callaghan and Co., Chicago, 1912, p. 705.

¹⁰ Iowa Code, 1950:658, 1950. A case in point was that of *Rickers vs. Kroeger* in the District Court at Carroll, Iowa in 1948. The defendant plowed a hayfield and planted it to corn against the landlord’s wishes. During the crop season the field was subject to an increased amount of erosion. The jury awarded the plaintiff \$300 for actual damages and \$200 in exemplary damages.

be drawn between "soil-depleting" maintenance and "soil-building" rotations and practices. A rental arrangement might be worked out with a basic rental share. This share would apply when rotations and farming practices were used which tended to maintain the same level of fertility and the same and lower rate of soil loss which existed on the farm when the tenant took it over. To the extent that the rotations used by the tenant tended to reduce soil loss or build up the level of fertility, the rental share paid by the tenant would be reduced. To the extent that rotations and practices were followed which permitted soil losses to increase and depleted the level of fertility, the tenant's rent would be increased.¹¹ This procedure also would correct a situation in which the landlord made little or no contribution to increase the output of the farm.

The use of flexible rental shares would place the tenant more nearly in the same position as an owner-operator in making decisions about the use of crop rotations, soil management practices and erosion-control measures. Since exploitive practices would be reflected back to the tenant in the form of higher rent, there would be less incentive for him to farm in such a manner. The system would be flexible enough, however, to permit him to adjust to changes in economic conditions by making changes in rotations.

Rotations can be reorganized on many farms with only a small outlay of capital which would make possible an increase in income as well as a decrease in soil loss. To a limited extent, this has been shown in table 1. Corn is planted every other year on some fields of low-fertility Ida soil which will yield only 20 bushels to the acre or less. If these fields were taken out of corn and seeded with a grass and legume mixture, total corn production during the entire rotation would be reduced only slightly. In many cases the loss in corn production would be more than replaced by the higher yields that could be expected from the use of commercial fertilizer on the remaining corn land. The costs of seed, planting, cultivating and harvesting would be saved, which could more than offset the value of the corn that the land might have produced.¹²

In some farm situations, the landlord accepted the suggested erosion-control measures but was reluctant to push the tenant too far or too fast for fear of losing an otherwise desirable tenant. Tenants on other farms showed the same hesitancy to urge that particular changes be made. While they saw the desirability of the changes, they did not want to lose possession of the farm. In still other instances both the tenant and landlord were waiting for the other to take the initiative. But in some cases tenants had assumed the initiative and had succeeded in bringing about the desired changes. The tenants tended to rely on practices which required little cash outlay. Practices such as contouring, strip cropping and con-

tour listing save tons of soil at little or no cash expense. On both tenant- and owner-operated farms where the need for immediate income is urgent, these practices should be stressed as strongly as terraces are stressed to farmers who are better able to adopt a more costly, permanent control measure.

The use of incentive payments is certainly justified even if the practices do not involve a substantial cash outlay or are of sufficient immediate benefit to cover their costs to the user, provided the payment is stopped after the initial resistance has been overcome.

Is there any reason why these payments should not be applied to the related but more basic problems of landlord-tenant relationships? For instance, they might be used to induce landlords and tenants to reconsider and change their existing leasing arrangements if this is necessary to remove an obstacle to the use of certain erosion-control measures.

Increased emphasis on extension education on leasing arrangements is also desirable. This might take the form of "rental clinics" to which interested persons would be invited and encouraged to come for assistance in making changes in their leases. Changes from such conventional arrangements have long been advocated but with relatively little effect. Much of the resistance may be only inertia and a lack of understanding concerning the desirability of such changes. This resistance could be melted if considerably more effort were made to overcome it.

Some changes may be resisted if there is concern that the change will give undue advantage to one or the other party. The question of "what is equitable" is bound to arise when a change is considered where, as before, the question could be avoided. Changes will often require a written lease if there has been none before. This may require the assistance of an outside third party, most often a lawyer, country banker or real estate and insurance broker. To some people, this is merely a needless expense. If the job is done by someone without an understanding of the type of lease that will permit the optimum organization and use of resources on the farm, it may well be a needless expense.

If changes are to be made in leasing arrangements, trained people would be needed to give service in these matters. Farm renters and landlords would have to be educated to use such services. Public-spirited persons with an interest in obtaining wider use of erosion-control measures might well consider what might be done to provide such services. The directors of a soil conservation district, recognizing the importance of such services, might take the initiative to organize and promote an effort such as a rental clinic. The Cooperative Extension Service should be able to assist in this too.

Obtaining Cooperation Between Farmers

Up to this point we have considered the mea-

¹¹ The "Browning factors" used to determine the soil losses in this study also could be used to determine the net effect of simultaneous changes.

¹² Harald R. Jensen. Economics of crop rotations. Unpublished Ph.D. thesis. Iowa State University Library, Ames, Iowa. 1950. pp. 156-183.

asures necessary to bring about the degree of erosion control that is consistent with the economic interests of informed farm operators. To be realistic we must be prepared to accept something less than complete success in overcoming these obstacles and to recognize that it will take time to accomplish the remedial measures that are needed. But now attention will be shifted to the question of how the level of erosion control thus accomplished by individual farmers is likely to measure up to the goal of reducing losses to a maximum of 5 tons per acre. If farmers cannot achieve that goal by their own efforts, we should not overlook the fact that it may be within the power of a group of farmers to do part of the job.

Undoubtedly there are many farms on which erosion losses could be adequately controlled without undue economic hardship, but there are also farms on which this cannot be done. Indeed, there may be farms on which the erosion problem itself is minor and would not justify additional measures to reduce or control runoff. Yet, because of the critical location of a farm in a watershed and the manner in which property lines are drawn, water accumulating on this farm and flowing to lower farms is a source of great damage. The benefits from a system of soil and crop management practices which accrue to the property owner at the site on which they must be applied may not be sufficient to justify them. If the offsite benefits which these measures create could also be credited to them, however, it would justify their use. Legal devices of various kinds are necessary to "assemble" these offsite benefits in order to justify the costs of the required measures.

Means are available by which benefiting landowners may share the cost of erosion-control measures on the land of others, but little use is being made of them. The arrangements are new in their application to erosion-control problems but not new in themselves. The techniques have been important in solving similar problems which have arisen in connection with the drainage of agricultural land. There are undoubtedly many instances in which this procedure could be economically justified, but farm people will need to be acquainted with this possibility and encouraged to use the techniques. In some instances they will also need to be helped to initiate and negotiate the agreements.

In some situations the relatively simple and informal private agreements between several farmers are sufficient. The Agricultural Conservation Program Service of the U. S. Department of Agriculture has been helpful in this respect. It has permitted farmers to pool the financial assistance they receive from the agency to defray a portion of the cost of a measure jointly installed for their common benefit on the property of one of the co-operators. There were 106 of these pooling agreements in Iowa in 1957 and 144 in the following year. Payments per agreement averaged \$1,112 in 1957 and \$775 in 1958. This arrangement is still relatively unknown and unused, however.

Legal machinery also has been provided for more formal arrangements. In 1949, the Iowa 53d

General Assembly passed an act which empowered county boards of supervisors to establish conservancy districts when approved by (1) the soil conservation district within which they might lie, (2) the Iowa State Conservation Commission and (3) the Iowa Natural Resources Council. Two or more landowners may take the initiative for the establishment of such a district by petitioning their board of supervisors. After the provisions of the law have been met, the district can then make use of the county's authority to issue bonds and to levy and collect taxes on land in the district which is benefited. These funds are to be used for the purpose of establishing and maintaining erosion-control measures or other improvements in the watershed or drainage basin.

In effect, the legislation made it possible to create districts with powers similar to drainage districts. Subsequent legislation permits the soil conservation districts themselves to create sub-districts for watershed protection and flood prevention. These districts also have the power to levy a special annual tax, not to exceed four mills, on the assessed valuation of all real estate within the subdistrict. These monies are to be used for (1) the repair, alteration, maintenance and operation of the works of improvement of the subdistrict and (2) their organizational expenses.

Since the problem in situations such as these is usually one of how runoff water is to be handled, it is also important to note the rulings of Iowa courts on the rights and responsibilities of landowners in dealing with runoff from their farms and that coming onto their farms. This is a troublesome area at the moment, for the body of common law does not lend itself too well to matters of erosion control. Water, of course, must flow from higher to lower ground, and the courts have usually taken the point of view that little or nothing can be done about it. As long as the landowner on the higher ground does nothing to disturb the natural course of the runoff and does not increase its flow, he cannot be held legally responsible for damages to another's property. Responsibility for damages does occur if these conditions are violated, however.¹³

This rule was modified when drainage became of greater importance in Iowa.

... so that the upper proprietor may drain his land into natural water course without liability to a lower proprietor for resulting damages although the effect of such drainage is to throw the surface water in somewhat increased volume at times on the land of the lower proprietor But the principle has still been maintained that the upper proprietor may not discharge collected water upon lower land, even though in a water course, in an unusual manner or in unusual quantities.¹⁴

Thus, unless the operator of Farm A disturbs the natural course of the water or increases its flow "in an unusual manner or in unusual quantities," the operator on Farm B may do nothing about it. He may not even build levees or dams to

¹³ Livingston vs. McDonald (June 28, 1866) 21 Iowa 160.

¹⁴ Martin vs. Schwerty (May 15, 1912) 155 Iowa 347, p. 351.

keep the water off his farm. But if the operator of Farm A were to build terraces and grassed waterways and drain them in such a way that the water followed a different course across the neighboring farm, even if the volume of water was no more than that which had previously drained, the operator on Farm A might be liable for any damages on Farm B.¹⁵

New concepts in legal arrangements would be helpful in dealing with the problems of runoff and its damages. A foundation has already been laid for this in some of the decisions which have been made with respect to drainage problems.

An example of such a problem involved a dispute between two drainage districts which were using a common drain. The court was asked to decide whether draining water from higher to lower ground was always an undisputable right of the owners of higher land. It also had to determine whether the upstream landowners were free of any obligations or whether they received a benefit which carried an obligation to assist in paying the cost of dredging the downstream portion of the drain.

The court ruled that the right which the upper district claimed was no longer a natural right but a privilege because "unusual quantities" of water were being discharged upon the lower district. The court said,

... it is important to note that there is a limit to the manner and quantity in which water may be drained by the individual landowner from the dominant to the servient land.

... but when the individual landowner organizes a drainage district with his neighbors and there is included in such district the lands of various members thereof, the collective body, through the drainage district, may unusually increase the volume of water from the dominant estate enclosed by the district onto the servient estate below, although the single individual of the group draining his own land could not so do When organized into such a district the landowners may drain ponds, collected and gathered waters, and bring the waters from one watershed into another. That they could not have done as individuals.¹⁶

Conservancy districts faced with the problem of changes in water courses as a result of constructing terraces and waterways may find that the decision in this case establishes a valuable precedent for them.

With respect to benefits, the court pointed out that the privilege extended to the district to drain larger volumes of water, in contrast to the total volume that might be drained if each member of the district acted alone, established an interest on the part of the district in the condition of the lower drain. While a right had been created for the benefit of the district, it was also accompanied by an obligation. The court stated this obligation very simply as follows:

Obviously, it is equitable that the drainage districts

that discharge their waters into said common outlet, and thereby necessarily contribute to its becoming clogged with silt and debris, should bear their proportionate share of the cost and expense of cleaning out said ditch and maintaining it¹⁷

Such court decisions in drainage disputes have tended to strengthen the right of the upper landowner to drain onto a lower landowner without liability for damages. This concept is a desirable one in the relatively level areas of Iowa where internal drainage of the soils is poor. Until the water can be removed, the land is relatively unproductive. The doctrine owed its support, in part, to the interest which society had in expanding agricultural production.

The situation on hilly land is quite different. The problem no longer is that of removing excess water, for both surface and internal drainage are excellent, especially in the Ida-Monona soil area. Public concern in this area is for safeguarding production on that land which is being farmed and of reducing damages to other property. The courts in Iowa have had no occasion to re-examine the earlier rulings concerning runoff and its damages. It is conceivable that they might at some future time develop a doctrine which would hold that the landowner on the higher ground has the responsibility to minimize the damage to farms below him from runoff originating on his farm by using the appropriate cropping systems, soil management practices or mechanical erosion-control measures. Should this happen, it would be much easier to negotiate agreements between farmers for the sharing of some of these costs which are now separated by property boundaries from the benefits they create.

PUBLIC CONTRIBUTIONS TO SOIL EROSION CONTROL

There is a limit to the amount of soil erosion control which landowners who enjoy offsite benefits can afford to help finance on the property of others, just as there is a limit to what the individual alone can accomplish on his own land. If additional efforts cannot be justified by the benefits which the individual landowners or the neighboring landowners receive, if further efforts are justifiable at all, the responsibility for the cost of achieving them must be borne by the public body—a county, state or federal government—which is most representative of the principal beneficiaries of the additional erosion control desired.

The Public Role

Governmental units have several roles to play. Up to this point we have considered governmental units only in the role of facilitator. They provide the services, sometimes the financial assistance as well, that assist the individual and the group to overcome the obstacles which prevent them from making the greatest effort of which they are economically capable. We have seen how important public-supported research and education have been and the continuing need for these services.

¹⁵ H. W. Hannah. Soil conservation and the rule of law. *Jour. Soil and Water Conserv.* 5:106-110, 1950.

¹⁶ Board of Supervisors of Pottawattamie County vs. Board of Supervisors of Harrison County (June 24, 1932) 214 Iowa 655. p. 673.

¹⁷ *Ibid.*, p. 676.

We have given brief attention to technical assistance available from the Soil Conservation Service personnel assigned to work with the local soil conservation districts, to the incentive payments that are available through the Agricultural Conservation Program Service, to the educational efforts of the Cooperative Extension Service, and to the credit available through the Farmers Home Administration. In some instances these agencies could initiate valuable new services.

We have suggested how the soil conservation districts in Iowa, which are units of local government, might play an even more active role in coordinating these and other efforts. They appear to be the most logical organization to take the lead in initiating new efforts to lessen some of the more difficult problems that face farmers in reducing their soil losses. We have also noted that these districts now have powers that enable them to tax lands which benefit from certain erosion-control measures in order that these might receive the necessary maintenance. This is a power which Iowa counties also have.

A second role of public bodies is that of filling the gap between the level of erosion control which is economically possible for private persons or small groups and the additional effort which is deemed essential for the public good. This public role, in Iowa and most states, had been left primarily for the federal government to assume.

Governmental participation comes largely through activities administered by the Agricultural Conservation Program Service, which shares the cost of certain measures undertaken by farmers, and the Soil Conservation Service, which has administrative responsibility for the funds which are available under the Watershed Protection and Flood Prevention Act. There are, however, many situations in which the benefits are confined largely to the state or some definable part of it. Consequently, there is justification for expecting greater responsibility for such work from the states even though it seems unlikely that they will assume it.

Cost-Sharing Arrangements

Some, but not all, of the financial assistance provided by the Agricultural Conservation Program Service can be placed in this category of "filling the gap." The sharing of the cost of some practices in certain situations may be a means of supplementing the income of the participating farmer. Payments which share the cost of draining cropland, for example, would be nothing more than subsidies to the landowner to increase the productive capacity of his farm if the addition of this tillable land to his farm did not result in less intensive use of eroding land. Other payments, if carefully handled, can be used to cause farmers to adopt erosion-control practices which they have previously overlooked or resisted for some reason. They can also be used advantageously to stimulate farm operators and landlords to make other changes which would facilitate the adoption of erosion-control measures. The use of public funds,

however, does not necessarily fill the gap between what the farmer can do and what society desires. Such payments cannot be expected to do more than to secure the accomplishment of practices which a farm operator expects to be profitable.

If the public goal calls for a greater degree of erosion control than the farmer can reasonably accomplish, an estimate should be made of what it would cost the owner or operator to prevent the loss of the additional tons of soil. With this guidance, the public's share of the total cost of the erosion-control measures to achieve a particular goal could be determined. This payment might cover more than half the entire cost of some practices in some situations and less in others.

The Watershed Protection and Flood Prevention Act as amended, and as interpreted through policy and administrative decisions of the U. S. Department of Agriculture, is the medium through which the greatest public financial responsibility is now being assumed for measures on privately owned lands. These measures are designed to produce both private and public benefits. Although closely related to the problem of excessive erosion on agricultural land, the emphasis is first of all on water, particularly on flooding. But it is clearly recognized that the usefulness of the retention reservoirs and other devices on which a successful effort must depend can be jeopardized if erosion-control measures are not used on the land which lies above these structures. Thus, the legislation itself requires that at least half of the land in the watershed above such structures must be protected by appropriate conservation measures before federal assistance may be provided for the structure.

Some of these land-treatment measures conceivably can be financed with the assistance of the previously discussed cost-sharing arrangements of the Agricultural Conservation Program Service. Often the federal government also bears an additional share of the cost of certain measures, because the Act defines works of improvement for flood prevention to include both structural and land-treatment measures. Further, the Act authorizes the federal government to assume the entire construction and engineering costs of any measures which have the purpose of flood prevention or flood control.

There are many local beneficiaries in such projects who bear no share of the cost of these measures because the federal government assumes all of them. Thus, the pendulum has moved to the opposite extreme in depending too much upon the public at large to bear costs which a more limited public might be expected to bear. Nevertheless, this does provide one solution for financing some of the land-treatment measures which appear to be in the public interest but are beyond the capabilities of the landowner or small groups of landowners.

The watershed approach provides an opportunity and a convenient framework within which to secure the cooperation of neighboring land-

owners in applying what can come the closest to being an integrated system of practices and erosion-control measures which complement each other from farm to farm. This integration goes a step farther as a result of the authority given to the counties by the Iowa General Assembly to take part in the watershed projects. Thus, with this delegation of authority, mutual problems of farmers and the county government, with respect to gullies that destroy roads and bridges as well as cropland, can be handled more effectively.

All the resources of the public programs now operating are needed if such a project is to succeed. Even so, this may not be sufficient, considering the requirement that the local sponsoring group must secure the cooperation of the owners of at least half of the critically situated land in the watershed which the Act requires before the project can proceed. Additional means, however, may be placed at the disposal of units of local government. One of these is the property tax and possible modifications in it that might make it easier to obtain the necessary changes in land use to reduce erosion losses.

Tax Adjustments on Farm Property

Taxes on Iowa farm land have increased at almost the same rapid rate as farm land values in recent years. An index of taxes levied per acre, with the 1945 average equal to 100, shows the levy for 1950 equal to 159 and that for 1957, 206. It rose to 228 in 1959.¹⁸ Taxes on farm property in Iowa were greater in total than the expenditures made for fertilizer, lime and seed in 1959. They were about equal to the combined outlays for hired labor and seed.¹⁹ Certain tax concessions or adjustments may provide sufficient incentive to landowners to cause them to adopt certain erosion-control measures.

As an example of what might be done, the taxes levied on cropland might be reduced if specified erosion-control practices were installed on lands subject to heavy soil losses. In some instances this might be an additional incentive for farmers to remove row crops from steep slopes and to establish sod crops on them. The public benefits from this and similar changes in land management practices might easily justify such a policy. A precedent for action of this sort can be found in the special tax treatment afforded by Iowa law for owners of land on which orchards and forest reservations have been established.²⁰ Compliance with the provisions of this law governing the size of the tract, planting density, species planted and management practices followed entitles the owners to an assessed valuation of only \$4 an acre. A provision of this type should have great attraction during a period of declining farm prices when production costs and taxes tend to remain high. Dur-

ing such a period, some land to which a law of this nature would apply would then likely be near enough to the margin for corn production that tax relief would be sufficient incentive to bring about a change in its use.

If tax incentives such as the type mentioned became important, counties in which there was a large proportion of this type of land would eventually be forced to raise all tax rates. This would tend to overtax the remaining cropland unless county expenditures were reduced or new tax sources found. In some instances, counties might require state aid to make up lost tax revenues. The immediate effect of special tax treatment is likely to cause a loss of tax revenue. The long-run alternative of inaction would lead to similar results. On the other hand, the tax incentive to protect the productive capacity of the benefited property could result in its continuation on the tax rolls producing something instead of gradually becoming worthless with a lien of unpaid taxes against it and little possibility of restoring its productivity.

Use of Public Control Measures

Perhaps it is of no immediate concern to anyone whether a landowner or farm operator applies such erosion-control and water-disposal measures as are profitable to him. There are, however, methods of farming and use of the land which produce significant offsite damages, or seriously jeopardize the present or future well-being of others. In these cases, the way in which privately owned land is used and managed is of the utmost importance to other property owners and the public at large.

If the property owner controls a strategically located area of land and persuasion fails, and if offers of technical assistance and financial assistance are spurned, is there justification for the use of some type of coercion?

This question immediately stirs up a storm of controversy. True, such action is generally undesirable if other means will accomplish the public purpose. Coercive methods have not often been used to secure a particular use of land, but there are precedents. And the moment one moves away from agricultural uses of land, there are many instances in which the police powers of the state have been and are being used.

The rights in property that an individual enjoys are exclusive but far from absolute. Further, they are separable, meaning that certain rights may be reduced without destroying other rights. Private property is subject to taxation. In certain situations and under certain conditions, private property may be taken in part or in whole by a governmental body if it chooses to exercise its right of eminent domain. Due process of law must be observed, and the property owner must, of course, be justly compensated. Then there are the various police powers which the states enjoy and which can be delegated by them to subordinate units of government.

The police powers have been used in Iowa on problems concerning agriculture. They have been

¹⁸ U. S. Department of Agriculture, Agricultural Research Service, Agr. Finance Rev. Vol. 22, Sept. 1960.

¹⁹ U. S. Department of Agriculture, Agricultural Marketing Service. The farm income situation, supplement, July 1960. State Estimates of Farm Income, 1949-59.

²⁰ Iowa Code, 161:1-15, 441:5, 1958.

used in the efforts to eradicate bovine tuberculosis. Various regulations have been imposed upon dairy farmers to assure that consumers have a safe and clean supply of milk. There are the weed laws which are closely related to the land and the manner in which it is managed. If noxious weeds infest a farm and the owner takes no steps to destroy them, local units of government have the power upon due notice, to enter the property and destroy the weeds before they have a chance to infest the farms of others. The cost of destroying the weeds is charged as a lien against the property. These applications of the police powers to agricultural problems are now firmly established in Iowa.

The police powers could be employed to obtain soil erosion-control measures by enacting land-use ordinances or rural zoning. Both techniques use the police power. Although it is exercised by the state government, it is delegated to subordinate units of government. However, it has never been delegated to soil conservation districts in Iowa. Land-use ordinances provide a method whereby a local unit of government, if given this power by the state, may specify the uses which may be made of the land under various circumstances as well as the erosion-control practices that must be carried out. Such ordinances, formulated by the governing board of a soil conservation district, must be approved by the required majority of qualified voters. The regulations should govern the use of land in the interest of preventing or controlling soil erosion. They could cause the discontinuance of an existing use of land, or, on the positive side, require the use of particular practices.

Colorado is the only state in which there has been any extensive experience with land-use ordinances. The technique has worked there where the local leadership has been "strong and capable" and the land owners have been well informed. Nevertheless, it has been termed "... a drastic tool to be employed only in situations that demand drastic action."²¹

Zoning ordinances, widely used in urban areas to regulate land use, have had much more limited use in rural areas. As a technique to secure socially desirable use of land, they have much less immediate effect than land-use ordinances. They usually permit a continuation of existing but nonconforming uses and, consequently, the desired changes are slower to be realized. If elimination of the nonconforming use can be handled by other means, perhaps by compensation, a zoning ordinance would provide a useful function by preventing a return to the former undesired uses or practices.

The most desirable solution to the problem of conflicting interests between an individual and the public is one in which the conflict can be resolved without diminishing the welfare of either. For this reason the attention of this study has been focused on removing the obstacles which prevent the individual, or the group, from undertaking those erosion-control measures which would otherwise

be profitable for them. The use of the police power, however, would seem justified if, after efforts had been made such that an individual could overcome all obstacles, he still refused to adopt the measures which were to his interest to use. To the extent that noncooperation in such an instance would mean the continuation of offsite damages and would prevent others from reducing the soil losses on their property to the fullest possible extent, an even stronger case can be built for granting the soil conservation districts authority to use the police powers.

Production Controls and Soil Erosion Control

Success in achieving greater control over soil erosion also depends upon the measures that are taken to deal with another problem—that of adjusting resource use and the production of farm commodities to the normal requirements of the nation. Man-hours of labor used in agriculture dropped 32 percent from 1950 through 1960, and cropland used for crops decreased nearly 6 percent during the same period. But it was possible to meet consumer demands without fully using all the land and labor resources which are now committed to agricultural production.²²

If adjustments in farm production were made by making less intensive use of land most vulnerable to soil washing, efforts to control farm output would make erosion control easier to accomplish. But no deliberate effort has been made to concentrate such adjustments on this type of land. The statistics on the compliance of farmers with their corn acreage allotments, when these existed, indicate that a much smaller percentage of the farmers in western Iowa reduced their corn acreage than was the case for the state as a whole. Nevertheless, the acreage allotments were a factor in reducing soil losses on some of the farms studied.

The lower rate of compliance in western Iowa undoubtedly reflects the importance given to livestock production in that area. Farm operators who expected to sell a significant amount of their corn crop found it more advantageous to comply with their allotments to become eligible for the direct benefits of the support price given corn. Farmers feeding most of their crop to livestock more often found it advantageous to ignore the acreage restrictions. Corn acreage allotments were abandoned in 1959. This step made it possible for any farmer to take advantage of the price-support benefits given to corn without restrictions on the acreage planted, and thus forage crops were put at an even greater economic disadvantage as competitors for cropland.

As long as they existed, acreage allotments were a problem to administrators who were concerned that all farmers be treated equitably and that efforts to achieve adjustments in production be compatible with the objective of reducing soil losses on farms. The legislation authorizing corn allotments specified that the acreage necessary

²¹ Stanley W. Voelker. Land-use ordinances of soil conservation districts in Colorado. Colo. Agr. Exp. Sta. Tech. Bul. 45. 1952, p. 55.

²² Changes in farm production and efficiency. U. S. Dept. Agr. Stat. Bul. 233. 1961. Tables 4 and 15.

to produce the required supply of corn for the nation should be apportioned to the various counties of the commercial corn-producing area on the basis of the acreage each county had planted to corn in the previous 10 years, with allowances for abnormal weather and "for the promotion of soil-conservation practices." Nevertheless, even if such "promotion of soil-conservation practices" were desirable, no county's allotment could be reduced by more than 2 percent on this account. Within the counties, the allotments were to be apportioned among farms by local committees of farmers "on the basis of tillable acreage, crop-rotation practices, type of soil, and topography."²³

This discretionary power given to local administrators to take account of differences in the erosion hazard between farms and the extent to which various operators were dealing with it was laudable, but even the most conscientious committees had little leeway with which to make such adjustments. Because compliance with allotments was voluntary, a farmer who felt that his allotment was too low might elect to ignore it entirely if there was a good probability that the crop income from the acreage in excess of his allotment, even at the unsupported price, would at least equal his income from the lesser acreage at the support price.

If a national allotment was too high (or failed to take into account that increased use of fertilizers could readily substitute for a reduction in crop-acres) farm incomes tended to improve, but supplies in excess of normal requirements accumulated as federally owned stocks. And there was no assurance that lands highly vulnerable to erosion were being removed from corn production. Allotments which would more nearly correct these shortcomings would seriously reduce farm income if they were complied with. If farmers rejected them, the goal of production control would be frustrated again. Compulsory compliance through the use of marketing quotas, such as are used with tobacco and wheat, was authorized for corn in the basic legislation for a number of years but was judged to be both administratively and politically infeasible to enforce.

What might appear to be undue preoccupation with matters of farm income at the expense of erosion control should not be criticized without recognizing that, in periods of depressed incomes in agriculture, many farm operators will exploit the soil resources at their disposal to the fullest in an effort to survive. This may happen even though it may cause heavy losses of soil which, over a longer period of time, might seriously harm the landowner and the public as well. This has been reflected in the increased importance that farmers in these studies have attached to the possible income effects of the recommended erosion-control practices.

Programs to achieve production adjustments may be complementary in some respects with efforts to reduce erosion losses, and this should be

given more active attention. Deliberate plans for the removal of the most erodible soils from intensive production are needed. The decision to cooperate in this effort cannot be left entirely in the hands of the owners and operators, but provision should be made to justly compensate them for any damages they suffer. A possibility which has already received some attention is the purchase of land-use easements by the federal government. At the least, it is important that consideration be given to the effect which public efforts to secure production adjustments may have so that these efforts themselves do not become obstacles to the control of erosion.

Continuing Nature of Soil Erosion Control

The task of soil erosion control is a continuing job on the part of all individuals and governmental agencies sharing these responsibilities. Many people in western Iowa, both farmers and government representatives, seem to feel that once a farm operator has accepted most of the erosion-control measures recommended for his farm, little remains to be done. This attitude conflicts with the findings of the studies made in western Iowa. They emphasize the continuing nature of all efforts toward soil erosion control. There are several reasons for this.

First, owners of land change frequently. Over a 14-year period, all of the land in the area of this study, on the average, changes ownership. This means that, each year, 7 percent of the land changes ownership. It also means that continuing efforts are needed to work with new owners each year in understanding and in remedying their erosion-control problems.

Second, operators of the land change even more often than owners. The average rate of change in operators is such that a different operator could be expected on any farm after a period of 9 years. This means that each year a change in operators will have taken place on 11 percent of the farms. Continuing efforts are needed to work with these new operators each year in understanding and in remedying their erosion-control problems.

Third, economic conditions are in a continuous process of change. Prices and costs change so that what is profitable or possible for the individual at one time may be unprofitable at another time. Erosion-control recommendations must be altered or the means for applying them must be adjusted in keeping with changing economic conditions.

Fourth, natural factors beyond the control of individuals, such as drouth, floods, frosts, insects and disease, disrupt any given set of erosion-control plans and practices. These kinds of natural environmental factors require consistent follow-up efforts to keep erosion-control plans in tune with changes in such factors.

Fifth, technological changes are continually coming about as a result of research and the application of research findings. New fertilizers, new crop varieties, revised rotations, mechanical devices, weed and insect control measures and changed specifications for terraces are a few ex-

²³ 52 Stat. 52.

amples of technological changes that are continually taking place. These changes demand reassessments of erosion-control measures with resultant changes on individual farms.

Sixth, government programs of acreage allotments, price supports and related measures change. With changes come repercussions in erosion-control measures.

Thus, erosion control is a task set in an exceedingly dynamic environment. It calls for an equally dynamic total effort for erosion control if erosion-control measures are to keep pace with the changing conditions of our times.

If the erosion-control objective set by society is to be reached with the limited funds available for the job, efforts must start with the individual farmer and landowner. He must be informed and motivated to accomplish those measures which are profitable for him. The public must be ready to help remove the obstacles that the individual cannot overcome alone. Beyond the level of what is profitable to the farm operator are measures that can be accomplished only by two or more farm operators working together. Public responsibility for more direct assistance in financing the re-

quired changes begins at the point where the groups of farmers can do no more.

If the gap between present erosion losses and the public soil loss goal is to be eliminated, it will come about through the use of various tools and techniques used in different combinations to meet the problems that arise. An effective erosion-control program cannot be built around the use of a single technique. Problems not only are different from farm to farm but are different on the same farm over a period of time. What was acceptable to an operator under a particular tenure situation, with given price and cost ratios, with a given financial situation and given objectives and with a given attitude toward the problem of erosion may be unworkable with changes in any of these factors.

The control of erosion is a continuing problem rather than one which is amenable to a permanent "once-and-for-all" solution. Even so, it can be less of a problem in the future than it is now if the socioeconomic factors which make it a problem are more fully understood and if the techniques used to cope with it are kept flexible to meet changing economic and social situations.

use is infinitely less than the total value of its successively developing installments of service. A piece of land may return \$100 a year throughout an infinite series of years, but its value is not \$100 multiplied by infinity. Indeed, it is not even \$100 multiplied by a *thousand*, nor yet by a *hundred*, but rather by about *twenty* and hence actually about \$2,000. And the exhaustion quota falls absolutely to zero. A piece of land of which the current rendition of service is worth \$100 returns that *whole* \$100 net. The land always continues to be the same land it was before. The very remote renditions of service belonging to the centuries that lie one hundred years, two hundred years and a thousand years in the future have such extremely small value that they can add virtually nothing to the present value of their bearer, and the "ultimate" installment of use which would be the one to determine the exhaustion quota is entirely without present value because of its infinite remoteness.

That constitutes the final reason why land rent represents net income. And this principle furnishes us for the first time with a method of attacking the problem of land rent which leads to genuinely definitive solution. Previous land rent theories supplied no more than a partial and introductory fragment of the solution; and their promulgators, strange to say, had not the vaguest notion that their attempts at a solution never remotely approached the innermost essence of the problem. All previous attempts at a solution, among which Ricardo's is pre-eminent, contented themselves with establishing, more or less convincingly, one single fact and the reason for it. This fact was, that the annual services rendered by a piece of land have economic value or yield an economic return. But the return from those renditions of service is in essence only a *gross return*. The fact that for the owner it is a *net return*, a *net income*, has nothing to do with fertility, location, kind of soil and so forth. It results solely from the lower estimation in which future goods are held and the resulting determination of the present value possessed by the piece of land itself. Let us assume that after deduction of all recognized costs a quarry yields an income—it is in this sense a net income—of \$1,000 per year over a period of one hundred years. Now if the future renditions of service *were not* discounted as against present ones, the quarry would simply be valued at 100 times \$1,000. The owner of the quarry would admittedly be pocketing receipts of \$1,000 per annum. But not one cent of that would be "land rent" in the modern sense, nor would it be net income, but only a slow consumption of the principal itself having a value of \$100,000. And the difference between the quarry and any other piece of land is not one of kind but only of degree. Suppose a parcel of arable land to be calculated as capable of producing crops for a thousand years, or for that matter, two thousand years. (Literal infinity is "out of bounds" in human affairs.) If now the future renditions of service are accorded the same value as present ones, the estimated value of that arable land will attain some such extravagantly exorbitant height as \$1 million or \$2 million. And the yearly receipt of \$1,000 will take on the character of a nibbling away of the principal. It will be much slower than

in the case of the quarry, but it will still be a *consuming of the corpus* and not a net income. Landlords would be the lords of gigantic sums of wealth, but would receive no net income.

And so the theoretical explanation of land rent in its concluding stages coincides with the explanation of interest on durable material capital. Land rent is nothing in the world but a specialized manifestation of interest derived from durable goods. There is just one reason why the two explanations fail to coincide throughout their entire course and why, on the contrary, the prevailing land rent theories exhibit a content so radically different from that of the capital theories. That reason lies in the necessity for an interpolation in the line of explicatory reasoning followed in the case of land rent—an interpolation that is quite superfluous in the case of the interest on durable capital. Moreover, because of their failure to understand the problem of land rent completely, the theorists allowed the interpolation, which was not common to both problems, to loom so large as to appear to constitute the whole problem. For it is self-evident in the case of all products of labor and hence of all capital goods, that their renditions of service have economic value; otherwise they would not be produced. But in the case of the uses of land that is not self-evident. Therefore it was first necessary to go to the trouble of proving why and under what circumstances uses of land attain value and command a price. Use of the right theory of value, and application of the doctrines of marginal utility and complementary goods would have made that proof possible with no more than a few strokes of the pen. Without such help, and entangled in the meshes of the labor theory of value, the proof had to be far more circumstantial and ponderous than would otherwise have been necessary, and even then it was not quite satisfactory in principle. Ricardo's land rent theory is essentially the one that has been most widely held hitherto. The theories of his opponents Carey and Rodbertus are totally untenable. It would be a succinct characterization of Ricardo's theory to describe it as an abundance of truth conveyed in a formulation that is erroneous in principle. It is a brilliant piece of logic which lacks nothing but a point of contact with the one correct and all-clarifying principle. That is the reason why it casts so bright a light upon some span of the road toward an explanation, only to languish into obscurity and error. And that is also the reason for the curious fate which has befallen Ricardo's theory. It satisfies no one fully and completely. Even its friends are able to discover a host of weak points in it, and its most generalized pronouncements are for the most part its weakest ones. And yet it contains an indestructible kernel of truth which continues to cling to life through the most multifarious vicissitudes and which has to this very day supplied the major portion of the content of the land rent theory.⁶⁴

But how far can we get with the Ricardian theory of rent or with any other land rent theory heretofore promulgated, even if it were correct on all disputable points? We get no further than we do on the question of interest on capital by proving that a threshing machine yields an annual *gross interest* (and why it does so), after deduction of all other costs.

What constitutes the end of the Ricardian theory is in actuality the end of the *interpolation* that was unnecessary in the case of movable capital goods because of its axiomatic nature. He just gets to the point where the real main question of the problem arises, namely, "Why does that gross interest which is yielded by the year's rendition of service on the part of either the threshing machine or the piece of land, after deduction of all other costs, still contain some net interest?" That question has hitherto been left entirely unanswered by the land rent theory. And the only possible way to answer the question—be it machine or be it land—is to point to the inferiority in value of future goods and future renditions of service.⁶⁵

4. Conclusions

LET US cast our glance backward. Every mode and manner of acquiring interest goes back to one identical cause. It is always a matter of the growth of future goods as they mature into present goods. It is thus with the originary interest of the entrepreneur who transmutes into consumptible products the future good "labor" which he has purchased. The same is true of landowners and houseowners and other possessors of durable goods who allow the remoter renditions of service on the part of their goods to ripen gradually, and then garner their harvest when it has matured into its full value. And it is also true of loans. Even in this third case the enrichment does not consist, as might at first blush be supposed, in the mere fact that the creditor gets back a larger number of units than he parted with, for the units that he acquires through the transaction were at the outset of inferior value. No, it lies in the circumstance that the indebtedness comprises something which was originally less valuable and which gradually grew to be worth more until at the moment it became due it burgeoned into the full measure of its present value.

What sort of person, then, is the capitalist? To put it very briefly, he is a *merchant who offers present goods for sale*. He is the fortunate possessor of a stock of goods which at the moment he does not need for his personal wants. He therefore exchanges them in one form or another for future goods, and then allows the latter to mature, while in his keeping, until they too attain the status of full-value present goods. Some capitalists make this transfer once and for all. Consider the man who puts his capital into the building of a house, the buying of a piece of land, the purchase of a life annuity, the granting of a loan to run fifty years. He is exchanging all or part of his present goods for goods or renditions of service which belong to a distant future, and is thus procuring for himself at a single stroke the opportunity for a growth in value and a receipt of interest that will run for a very long time. Conversely, the man who discounts ninety-day paper or conducts a producing enterprise with a turnover period of one year must reinvest his capital frequently. The future goods he acquires will attain full value as present goods after the passing of only three months or one year. With the new present goods trading is resumed, new bills of exchange, new labor, new raw materials