5.

Principles of Land Utilization

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THIS CHAPTER IS CONCERNED PRIMARILY WITH UTIlization of land for agricultural purposes. Other uses are discussed only incidentally, or as they are involved in shifting uses of land.

As a field of economic research, agricultural land utilization has been defined as "the study of the land resources of a nation or other geographic unit with a view to determining for what and how they may be most economically employed." [1] The term "other geographic unit" implies that the area of study could be the entire world, or at the other extreme, an individual farm. Economic studies of agricultural land utilization, however, usually deal with areas of land larger than individual farms, which are delimited from surrounding areas by their similarity of use opportunities or use problems. Some of the broader aspects of land utilization indeed may encompass the entire world. Studies concerned with the adequacy of land resources to meet the food needs of increasing world population are in this

[1] "Research in Agricultural Land Utilization," Social Science Research Council Bulletin No. 2, June 1931.

category. And we should bear in mind that land utilization is not solely an economic problem. A physical and biological foundation is necessary for adequate analysis of the economic phases; and in addition, there are important social and political aspects.

Land is utilized for the benefit of the people who share a common resource base. Within that general framework, the economic aspects of land utilization involve one over-all objective—that of maximizing the net value product when land is used in combination with other resources. As both present and future benefits must be considered, it is necessary to strike the kind of balance between present and future uses that will maximize the net value product when both are considered.

Efficient utilization of land is guided by several principles governing the economic productivity of land. Diminishing returns and the principles of specialization, location, and comparative advantage are perhaps the most important. These principles are discussed in most general texts on economics, and their special applications to land utilization are elaborated in the textbooks on land economics and farm management.[2] This chapter deals more with the application of these principles than with a discussion of them in abstract terms.

It might be profitable, however, to mention certain of the special properties of land as compared with other capital goods because these unique features of land require different approaches to efficient utilization. Land is a natural resource in the sense that land as such cannot be reproduced. Certain types of use may result in permanent damage to a given land base. Land is distributed over space and is almost completely immobile. It has to be utilized where it is found. The immobility and spatial features give special significance to location factors in the use of land.

The value of land derives from its economic productivity, that is, from the current and expected value of its marginal product. The basis for this economic productivity is partly physical and partly location and situation with respect to a given economic environment. Land of high natural fertility, and physically suitable for a number of crops, may be located in an area relatively isolated from the market for the products that can be grown on it. Lack of profitable market outlets for other products might mean, for example, that its most profitable use was from grazing. Although highly productive in a physical sense, its economic productivity per acre still would be low. On the other hand, land that is naturally quite infertile may be located close to a population center. Farmers might find it very profitable to fertilize such land heavily in order to grow fresh fruits

[2] See especially, "Land Economics," chap. 5 by Roland R. Renne, and "Farm Management," chaps. 16–18 by John D. Black *et al.*

and vegetables to be sold in the local market. The economic productivity of such land, therefore, would be quite high.

But we need to note that this land must have certain minimum physical characteristics that enable users to apply fertilizer and other resources to it in order to achieve a profitable production combination. In other words, it must have capacity to use other resources in an efficient combination for that particular market situation. An example of land that does not have such capacity is the area surrounding the mining towns of Butte and Anaconda in Montana. These towns are located on a high mountain plateau; and the surrounding land has a high altitude, low rainfall, and is rough and stony. As a consequence, fresh fruits, vegetables, and milk are shipped in from the irrigated valleys farther west. If the adjoining land were suitable for cultivation it would have location advantage over the more fertile lands which now supply this market.

Within a given area, the economic productivity of land varies directly with its natural fertility and its physical suitability for producing those commodities yielding the highest net return over nonland costs. In other words, differences in physical productivity explain most of the variations in economic productivity within the same locality or general market area. But factors of location and economic situation may be of over riding importance in determining economic productivity of land in different locations.

BALANCING PRESENT AND FUTURE BENEFITS

Conservation is the land utilization problem that is currently in the spotlight. The economic aspects of this problem involve the over-all economic objective of maximizing the net value product when land is used in combination with other resources and more especially the balancing of net products from present and future uses. This raises the question of how to predict future events as a basis for deriving estimates of demand for the products of land comparable with estimates of our future capacity to produce farm products.

In this country our land resources seem ample for the markets that we are now supplying and for those that are likely to be available to us over the next few years. But what about the long-term future? Our population is growing and it is possible that demands on our food production resources from other countries will become greater as the years go by. Is it likely that a short-term surplus will be followed by a long-term shortage?

One view of our ability to supply long-term future needs for the products of agricultural land is that increasing population and gradual soil deterioration may eventually result in heavy pressure of population on food supplies, even in this country. Another view is that research, invention, and discovery will continue to increase the output from our land resources, and that population increase will tend to slow down.

Other chapters in this book deal more in detail with the factors supporting each of these two points of view. In this chapter we are more concerned with how to strike a balance between present benefits and those accruing in the future in order to maximize the net value product when both the present and the future are considered. This problem has its beginning in the concept of efficient use of land at any point in time.

Efficient utilization of agricultural land involves a combination of land with labor and other resources that will yield as high returns from additional units of labor and capital as they would earn if utilized in other lines of production. If the returns in agriculture are lower than in other lines it would be desirable to use less labor and capital in agriculture and relatively more in other lines—in other words, to use the land less intensively. Conversely, if the return for additional labor and capital is higher in agricultural production than in other lines, this calls for more intensive use of land, and perhaps for the development of new land.

The economic aspects of conservation center on the problem of maintaining this concept of efficient utilization of land over a period of time. When efficient utilization of land is considered both currently and over a period of time, the use of labor and capital resources must be allocated in such a way that marginal returns are equalized among the following major alternatives:

1. Current production in agriculture
2. Current production in other lines
3. Future production in agriculture
4. Future production in other lines

If the returns from additional units of labor and capital invested in current agricultural production are lower than if they were invested in current production in other lines; or lower than if they were invested in future production, either in agriculture or other lines; it is obvious that labor and capital should be shifted to the most remunerative investment alternative.

Under certain conditions investment in conservation for future agricultural production becomes the most profitable alternative. From an economic standpoint investment of labor and capital should be shifted toward the most profitable alternatives until returns on additional units of investment are equalized between agriculture and other lines, both currently and over a period of time.

This reasoning recognizes that labor and capital resources are potentially productive, and that our society is interested in employing them in their most productive uses. For example, if cotton supplies were pressing on available markets, part of the resources used for cotton production should be shifted into other uses. Cropland now used for cotton might be shifted into hay and pasture for meat and milk production, and if this involved larger farms and less intensive use of land, a part of the labor supply might be more productively employed in nonfarm work. If the most profitable alternative use of some of the land is in forestry, tree planting would illustrate an investment alternative on which returns can be obtained only in future years, and land used for hay, pasture, and trees would promote conservation of soil resources.

The returns that can be expected from investments in future agricultural production will depend largely upon the following factors:

A. On the supply side
   1. Land depreciation or land improvement
   2. Land development
   3. Technological advances (including new sources of food)
   4. Trade policy
B. On the demand side
   1. Population growth
   2. Per capita income and its distribution
   3. Changes in food habits and new developments in nutrition
   4. International trade, and size of trading area drawing on given food production resources.

If we estimate the future demands for food and fiber, we can compare this estimate with expected supplies over the same period and arrive at some conclusion concerning relative farm prices and costs. [3]

If such analyses point toward increasing prices for farm products, we have an indication that investments in future productivity sufficient to meet the increased demand would be likely to pay. We must bear in mind, however, that the investment could be made currently or later, when the higher demand develops. If investment in fertility maintenance or improvement today results in a large immediate increase in output which cannot be absorbed profitably in the present market, such investment may be postponed profitably until the market demand has increased. The only type of investment which probably cannot be postponed economically is that which is necessary to avoid permanent damage.

The possibility of postponing certain investments in conservation brings out the important point that there are alternative ways of

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[3] For one attempt at estimating future prices under specified conditions, see a "Study of Selected Trends and Factors Relating to the Long-Range Prospect for American Agriculture," H. R. 80th Congress, 2nd Session.

achieving conservation. Economists should help to determine the ones that are most in accord with efficient land utilization, both currently and over a period of time.

Looked at in this way, striking a balance between the present and the future involves maintaining efficient utilization of resources through time. This means more or less investment for fertility maintenance or improvement today that results in higher production tomorrow, depending upon prospective demand for farm products—and more or less intensive use of land in other ways. It also means that investments which yield returns only in future years are likely to be the most profitable alternatives in periods of recession, when returns on investment for current production are low, or nonexistent. Because of these counter-cyclical effects on the general economy, investment in conservation might well be increased when the economy is experiencing a recession. But increases under those conditions probably would have to be made as public investments, or with some form of public insurance of future returns.

The central point to bear in mind, however, is that capital investment is potentially productive—either now or in the future. The net value returns on investments yielding an income only in future years must be high enough at some stage in the production cycle to equalize returns between current and future production, if they are to be equal to returns on investments that yield current income.

One way of comparing investments that yield a current income with those that provide income only in future years is to convert the future net product to present worth at an appropriate discount rate, such as that prevailing for long-term government bonds. A private discount rate would be too high because it reflects many risks that are not incurred in public investments, and we are concerned here with maximizing the net product to the entire social group. Suggestions have been made that no discount rate should be used for investments where public interest is involved.[4] But unless it is discounted, an investment made today that will yield its first return 100 years from now would be just as valuable as one maturing next year, and returns from the latter investment could be reinvested in productive enterprises again and again over the entire period. If public funds were to be invested with no discount on future maturity, there would be no economic protection against shifting too large a proportion of present income into long-term public investments. A relatively riskless rate provides a basis for establishing priority ratings for investments that mature at different future dates.

[4] "Watershed Flood Control: Performance and Possibilities," by Bernard Frank and E. N. Munns, Journal of Forestry, Vol. 43, No. 4, April 1945.

The above analysis is dependent on an estimate of the most probable future situation. We all know that future events cannot be predicted with certainty. The very uncertainty of future needs for food gives emphasis to protection against permanent damage of soil resources, even though technical advances may overcome part of the effects of such damage. Because our objective is that of maximizing the net product, we must take account of land depreciation. In other words, if the physical productivity of land is permitted to deteriorate in the production process, that is one of the costs to be subtracted before arriving at the net product used in comparing returns on investment from present versus future production.

When it comes to placing a value on land depreciation, however, we encounter many difficulties, both practical and theoretical. In the first place, we need to distinguish between fertility depletion and permanent damage to soil resources. Depletion of fertility can be restored at a cost. From a depreciation standpoint it is analogous to the wearing out of a building. Sometimes the cost of restoration is high. And if we trace the materials back to their source, some irreplaceable resources may be involved. But if restoration is possible, depreciation can be calculated by comparing the cost of restoration at a given time with the cost of maintaining the physical productivity year by year. The cost of restoration becomes the upper limit on expenditures for fertility maintenance.

The problem is quite different if land depreciation involves permanent damage to soil resources. By definition, such damage cannot be restored. Our physical plant consisting of productive land now in agricultural uses therefore is made permanently smaller than it was before the damage took place. If such permanent damage were extensive and the long-term future should bring increasing demands for food and fiber, we might indeed have pressure of population on food supplies. But this outcome must be tempered by the possibilty of land reclamation, by allowance for the possibility of substituting other resources for land, and for changes in population growth. Technological advances in products and processes that substitute for land resources may proceed at an even faster rate than in the past. But we should not count too heavily on their offsetting permanent damage to soil resources. The potential losses to society from permanent damage should be carefully evaluated.

If we could foresee a future food shortage created by permanent damage to soil resources we also would be able to predict an upward trend in relative prices of farm products. The upward turn of prices under those conditions would reflect a social loss of part of our food production base. Investment in land conservation to insure future productivity in order to prevent such a loss would then show relatively high returns even when discounted to present worth. But we must guard against assuming that this constitutes adequate protection against such damage. Investment in conservation, even under those conditions, is frequently retarded by conflicts in public versus private interests, and by other factors. Conflicts between individual and public interests may arise out of particular tenure arrangements because individuals can avoid bearing the full cost of exploitation. Also, and perhaps more important, because the social group can and should give more attention to future needs and noneconomic considerations than it is possible or profitable for individuals to do. And public investments for conservation usually are not made solely on the basis of economic criteria.

We also need to guard against reaching the conclusion that if food prices rise in the future as a result of permanent land damage this would result in higher incomes to farm operators. Although some farmers might benefit for a short time from rising prices of farm products and of land, production expenses would increase and the higher incomes on farms not adversely affected would soon become capitalized into land values. In this way returns to farmers would tend to be equalized with other groups. But society as a whole would be worse off because of less productive resources, and we are interested in maximizing the net product not only to particular groups of individuals but to the entire social group.

As already indicated, a part of the necessary protection against permanent damage may show relatively high returns when a balance is struck between investments for current versus future production. But even the part on which probable returns cannot be calculated with any degree of accuracy probably should have relatively high priority on funds for public investment. The continued existence and progress of our society must be protected. This calls for a contingency reserve of soil resources which could be drawn upon should unforeseen food emergencies develop. We learned during the recent war how quickly the food supply situation could change from one of burdensome surpluses to relative scarcity. The contingency reserve, however, should be over and above protection of the needs which can be estimated. [5]

We might summarize our attempt to balance present and future returns from agricultural land in this way: (1) Efficient land utilization requires achievement of equal returns on additional investments of labor and capital in agriculture and other economic

[5] For further development of the concept of a contingency reserve, see "Farming Systems in Relation to Soil Conservation," a paper prepared by the author for the United Nations Scientific Conference on the Conservation and Utilization of Resources, Lake Success, 1949.

activity—currently and over a period of time. (2) Efficient utilization over a period of time involves an estimate of future food needs and of our ability to supply it. (3) Protection against permanent damage to soil resources should have high priority for investments in conservation and should be distinguished from fertility depletion that can be restored at a reasonable cost. (4) Investment in fertility maintenance or improvement that increases current production above the quantities that can be absorbed profitably in the present market may be quite uneconomic, because the resources invested could be more profitably used in supplying more urgent current needs for other products, or future needs for farm or other products. (5) Land resources can be maintained in very extensive uses—hay, pasture, and forest. These may be the most economic uses in the absence of more profitable markets for other products. This gives special point to evaluating the alternative ways of conserving soil resources. (6) Because of the uncertainty of future events, it is in the public interest to develop and maintain a contingency reserve of soil resources over and above that ncessary to meet the needs which can be estimated with some degree of accuracy.

SHIFTING MARGINS OF MAJOR USE

Conservation programs frequently involve changes in major uses of land. Most of such changes, however, are made in response to changing needs for the products of land as reflected in market demands. Shifts in major uses will affect the output of farm products over a period of years. They can be made intelligently only on the basis of estimates of future demands for food and fiber in relation to our ability to supply those demands. Therefore, some of the same background information is needed for this problem as for the solution of conservation problems.

Too little attention has been given to the problems involved in the shifting margins of both major and minor uses of land. Frequently the response to the changing outlook for farm products is too slow to keep up with a new source of demand. And then once the shift is started it may go too far. This leads to maladjustments in the use of land because after major changes have been made the process is not readily reversible.

These problems are well illustrated by the changes in wheat acreage in the great plains states. In that region much of the change in the acreage seeded to wheat involves a shifting of grassland to wheat or vice versa. Shifting between use of the land for crop production and for grazing usually is regarded as changing the major use of land.

Table 1 shows the seeded wheat acreage in these states: for 1919, after the increase drive of World War I; for 1937, the high point in the 1930's; for 1942, after the acreage had been reduced by drought, low prices, and adjustment programs; and for 1949, after the expansion brought on by World War II. The seeded acreage in the Great Plains increased over 23 million acres from 1942 to 1949, or by 62 per cent. The acreage in Colorado increased 157 per cent.

TABLE 5.1

ACREAGE OF WHEAT SEEDED IN GREAT PLAINS STATES, AND THE UNITED STATES, 1919, 1937, 1942 AND 1949

State and Region	1919	1937	1942	1949	Percentage Increase from 1942 to 1949
	(Thousand acres)	*(Thousand acres)*	*(Thousand acres)*	*(Thousand acres)*	*(Percentage)*
North Dakota	10,222	9,583	7,478	10,643	42.3
South Dakota	4,322	3,648	2,730	4,312	57.9
Nebraska	4,438	5,104	3,024	4,587	51.7
Kansas	11,671	17,110	10,861	15,805	45.5
Oklahoma	4,723	5,784	4,086	7,552	84.8
Texas	2,490	5,315	3,935	7,630	93.9
Montana	3,281	4,678	3,373	5,579	65.4
Wyoming	202	278	244	390	59.8
Colorado	1,405	1,620	1,374	3,526	156.6
New Mexico	140	430	388	554	42.8
All Great Plains States	42,894	53,550	37,493	60,578	61.6
United States	77,440	80,814	53,000	83,173	56.9

The appraisals that are now being made of our prospective markets for wheat indicate that, unless we have another food emergency, much of the recent increase in wheat acreage may need to go back into other uses—mainly hay and pasture. Such uses, by the way, would constitute a contingency reserve of food production resources. But once the sod lands have been plowed, the shift is not readily reversible—at least not from the farmers' point of view. It is difficult to re-establish a grass cover. In most areas the net income per acre obtainable from grass and livestock would be lower than from wheat. This would mean a writing down of investment in land and equipment. It probably also would require larger farms and fewer farmers.

Land use adjustments of this type are desirable from the standpoint of the national interest, but how to make them profitable to farmers and in that way promote the needed changes still constitutes one of our major land use problems. The cost of transferring the use of these resources becomes the source of conflict between public and private interests in land use. In some instances this conflict might be resolved by public investment in the cost of transferring the land resources to the new uses.

In considering some of the underlying factors in shifting the uses of land, we might begin by listing the major uses in their usual order of competition for land, and then try to analyze the factors determining the margins of each use under given conditions. The "order of uses" that most frequently seems to prevail is the following:

1. Urban
2. Suburban
3. Part-time and residential in rural areas
4. Full-time farming (arable land)
5. Forestry
6. Grazing

In addition, we have service uses, such as roads, and the following special uses that sometimes compete with those listed above:

1. Mining
2. Watershed protection
3. Recreation
4. Fish and wild life

The various urban uses compete with and supplement each other in somewhat the same way as the different agricultural uses. But the urban users of land have little difficulty in outbidding other users. Why? The basic explanation goes back to the factors which have determined the location of cities and towns. The larger ones owe their size chiefly to location on commercial trade routes or especially easy access to raw materials and power for manufacturing industries.[6] But trading centers are necessary parts of the community structure in all areas where land is used for any purpose. Even small trading centers will take some land away from agricultural uses. To the point of saturation of the economic need for such sites they represent a more intensive use. More labor and capital are combined with a given area of land, which increases the economic productivity of that land.

The higher economic productivity of the land in urban uses is attributable primarily to its location or site value for those purposes. Just as on individual farms the economic limit to the production of one farm product is the greater profitableness of another, so also in the competition among major uses of land the margins are determined by the relative profitableness of competing uses.

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[6] Edgar M. Hoover, Jr., *Location Theory and Shoe and Leather Industries,* chap. 17. Harvard University Press, Cambridge, 1937.

Suburban uses of land can be thought of merely as less intensive urban uses. Frequently, however, difficult land use problems arise in suburban areas because this is the margin of transference between urban and rural uses. Some land is held by speculators for possible urban uses that for some time to come might be utilized best for agricultural purposes. But the income expectancy for suburban development is too high to premit farm uses. Frequently, also, overly enthusiastic real estate promotion results in suburban developments that are not as well located with respect to their urban centers as other areas that remain in agricultural use. This, of course, is a problem in urban land planning.

We also have a great deal of strictly rural land now utilized for residential and part-time farming purposes. These uses of land are primarily residential and represent a more intensive use than full-time farming. They, therefore, usually compete successfully with strictly agricultural uses even in the more productive farming areas. The lands suitable for part-time farming and rural residences usually possess certain location advantages, such as proximity to an urban area or at least to a place of nonfarm employment, hard surfaced roads and other public facilities. The location features of land for these uses usually are more important than the productivity of the land for agricultural use. Although a part-time farm can be operated more successfully on physically productive land than on poorer land, the disadvantage of poor land may be offset by greater access to nonfarm employment, and also by the availability of schools, churches, and other home-site advantages. We find, therefore, a great deal more part-time farming in the eastern forested areas when they are located adjacent to urban centers and other resources of nonfarm employment than in the fertile plains of the Midwest. Frequently, the less productive farming areas have some advantages for rural living in the way of good scenery and recreational opportunities that partly offset the poorer land.

It is in the less productive farming areas, that are also suitable for timber production, where farming and forestry uses impinge on each other. Similarly, in other areas arable farming and grazing are competing uses. Land that is unsuited for arable farming is not always suited for either forestry or grazing, however. Too often the assumption is made that land which is unprofitable for arable farming necessarily is good forest land, or good pasture land. It may be very poorly suited to either of these uses, and if they do furnish the best alternative use it may be on a very extensive basis. These uses also may be supplementary in certain areas.

The special uses of land that were listed above sometimes conflict with other major uses, but frequently they are supplementary. For example, mining is sometimes carried on in areas that are also used for farming with little conflict between the two operations. But where mining does conflict with other uses, the returns from mine operations usually are sufficiently greater to compete successfully with the conflicting uses. Watershed protection often is accomplished with good forestry management or with a combination of forestry and grazing uses. But exploitive cutting of timber or overgrazing seriously conflict with watershed protection. Individual and public interests are likely to be in conflict on the question of watershed protection because the losses that would be incurred without protection would not impinge directly on those who profit from overgrazing or from cutting the timber on a watershed area.

Recreational uses also frequently are supplementary to other forms of land utilization. But where areas are set aside solely for recreational use they are likely to possess unique scenery, other natural features, or uniqueness with respect to a given location. Yellowstone National Park is an area possessing such unique natural features. If it were not for the geysers, hot springs and the magnificent scenery the land probably would be used as a forest reserve and also would furnish grazing for cattle and sheep. In fact, western stockmen have criticized the Jackson Hole acquisition because cattle and sheep grazing was prohibited when it was set aside for recreational use.

Uniqueness with respect to a given location is illustrated by the Lake Michigan waterfront in the cities of Chicago and Milwaukee. Several hundred miles of Lake Michigan shoreline probably are as well suited physically for recreational use as that part now devoted to parks in those two cities. But location with respect to the number of potential users is unique to the cities of Chicago and Milwaukee. Recreational use of this type, of course, competes with other urban uses, but once established it also enhances the value of other uses. When recreational areas are provided at public expense, it is difficult to compare values of land for this use with competing uses. But government bodies have to determine their value on the basis of need for recreational facilities from the standpoint of health and morale, and the potential enjoyment derived from such facilities. Their decisions to outbid other potential users for the property necessarily are based on nonmonetary consideration.

Perhaps the use of land for fish and wild life conflicts less frequently with major uses than any other special use. Even in this field, however, we find a certain amount of competition. In the western states, big game utilize grazing that otherwise would be available for cattle and sheep. Ponds may be used for ducks and geese that if drained would make good farm land. Even fish ponds now are established on land that could be used for farming.

It is apparent from the above discussion that we have an array of major uses that do compete with each other on their respective margins. And, as previously indicated, the limit of one major use frequently is determined by the relative profitableness, or the net value product, of a competing use. But there are many obstacles to rapid shifting of the major uses of land. The deterring effect of transfer costs has been mentioned, i. e., the possible writing off of old investment and the necessity for additional investment before the land is suitable for the new use. Since we cannot predict the long-term market prospects for the products of land with a high degree of accuracy, the hesitation shown by private investors in changing the major uses of land is quite understandable. But often, as in the wheat illustration, such hesitation gives rise to conflicts between the public and private interests in the use of land. We need to discover ways of overcoming such conflicts in order to prevent serious maladjustments in land use.

One of the more difficult and unresolved questions in land use relates to lands that are suitable for multiple uses. This is especially true of the western public lands where often watershed protection is of major importance. Timber, grazing, big game, and recreation are possible multiple uses and, while they supplement each other for the most part, they may also to a certain extent compete and conflict with each other on the same area of land. The problem then is one of determining the most effective combination of uses when both private and public interests are considered.

LAND CLASSIFICATION AS A GUIDE TO IMPROVED UTILIZATION

From this brief review of the application of some of the principles of land utilization, it is apparent that economic use of land is founded on the common body of principles used in general economic analysis. But special problems arise in their application to land utilization research. And as previously indicated, the social and political aspects of certain land use problems sometimes are more important than the purely economic considerations. The following four broad objectives seem to characterize economic studies of land utilization:

1. Description of present situation
2. Development of criteria for establishing optimum use
3. Determining the extent of maladjustment in use
4. Developing suggested measures for achieving optimum use

This section deals with efforts to classify land for the purpose of guiding improvements in land use. Some land classification activities have attempted to serve all four of the objectives mentioned above. Most classification studies, however, have been confined to the first three.

Economic land classification work received a great deal of emphasis during the drought and depression years of the 1930's. The work subsided during the war but interest in this field now appears to be reviving. There is a tendency at this time to examine critically the methods used in prewar years as a basis for improvement of the work to be undertaken. [7] The discussion that follows is an attempt to further the critical examination of purposes and procedures in land classification work.

Many attempts have been made to classify lands in accordance with their suitability for different uses. The National Resources Planning Board report on Land Classification in the United States lists the following five major types of land classification that were under way at the time this report was published: [8]

Type I. Land Classification in Terms of Inherent Characteristics
Type II. Land Classification in Terms of Present Use
Type III. Land Classification in Terms of Use Capabilities
Type IV. Land Classification in Terms of Recommended Use
Type V. Land Classification in Terms of Program Effectuation

The first three of these types are largely physical classifications in terms of inherent characteristics, present uses, or physical use capabilities. The last two involve economic considerations, primarily in terms of the first three of the broad objectives in land utilization studies. Some of these land classification studies are designed to guide the shifting of major uses of land, and others point toward improvement of minor uses, e.g., more efficient use for farming.

Let us consider, first of all, the land classification objectives aimed toward guiding the shifts in major uses of land. Obviously, this is an attempt to determine the combination of uses in which a given area of land will contribute the greatest economic and social product. We already have discussed the hierarchy of major uses and how competition among these uses frequently works out. But suppose we want to classify a specific area of land to determine whether it should be used for farming, part-time farming, or forestry. How do we determine this? On the basis of relative incomes from farming versus part-time farming versus forestry? Obviously, we cannot determine the margin of economic use between part-time farming and full-time farming on the basis of relative incomes from farming uses alone. Consideration needs to be given to the residential value of such land for persons who are employed outside of agriculture a part of the time.

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[7] Howard E. Conklin and Sherwood O. Berg, "A Preliminary Report on Developments in Land Classification Methods," Mimeo. report A.E. 688, Dept. of Agr. Econ., Cornell University, December 1948.

[8] "Land Classification in the United States," Report of the Land Committee to the National Resources Planning Board, March 1941.

We have not developed adequate techniques for measuring the economic contribution of a given area of land in these two competing uses. Use of land for rural homes and part-time farming involves primarily the direct consumption or home uses, whereas land devoted to full-time farming is utilized primarily for the production of farm products for sale. Residential uses of land in rural areas should be evaluated in the same manner as they are in urban areas. In other words, we need to consider locations with respect to nonfarm employment, the likelihood of growth of nonfarm employment opportunities, availability of public services such as all-weather roads, schools, and public utilities; also other community facilities. When rural land is appraised for its part-time farming potential, the evaluation process is necessarily that of evaluating direct consumption goods. Appraisal of the same land to determine its potential value in full-time farming, on the other hand, involves largely the determination of its capacity to produce income in agricultural production. The competitive margin between these two uses probably works itself out in such a way that smaller tracts of land will be used for rural homes and for part-time farming in the more productive farming areas. On the other hand, larger tracts of land, that were formerly used as full-time farming units, are likely to be occupied as part-time farms or rural homes in the less productive farming areas. Objective methods for determining the lands best suited to part-time farming are still to be developed.

Let us turn now to the problem of determining whether land should be used for full-time farming or for forestry or grazing. More adequate measures have been developed for this determination. On the farming side, we can determine by farm budget analysis the income expectancy from different types and sizes of farms that might be adapted to the area. Such analysis, however, depends for its accuracy on reliable input-output data and on a good physical classification of land suitability. The way in which these materials should be used in land classification work is discussed later under economic productivity classifications for farm lands.

Often there is a considerable gap in income between farming and forestry or grazing uses. And whether land can be used for farming depends upon a test of submarginality in that use. This means that we need to determine the areas where farm income is normally too low or too unstable to pay operating expenses, maintain the farm plant, and yield a return to farm families which they consider necessary for a living, including the support of public and private community institutions and services. The return that farm families consider necessary will, of course, depend upon their other employment opportunities. Theoretically, their net earnings in agriculture should be equal to their potential earnings in other lines, but it will be necessary to establish an approximate standard for the analysis of an area. The test of submarginality then can be made with farm budget analyses to ascertain whether any type and size of farm can be organized in the area on a self-supporting basis. Some areas, of course, are physically unadapted to cultivation. The margin between farming and other major uses is then based entirely on physical considerations. In still other areas the question of unsuitability for farming is fairly obvious and no detailed analysis is necessary.

Some workers have approached the problem of testing submarginality for farming uses by developing indicators of distress, such as tax delinquency, condition of buildings, relief payments, etc. Others have depended primarily on records of past farm income experience in the area. Both of these types of data certainly furnish useful evidence for the decision. They should be utilized whenever they are available. The direct farm budget approach, however, has the following advantages:

1. Income expectancy is analyzed directly instead of depending upon indirect measures of distress that may have their roots in other causes. The budget analysis is oriented to future income expectancy rather than to past conditions.
2. It permits analysis of other farming alternatives than those which have prevailed in the area. For example, the legumes and grasses which have been developed in recent years and the new methods of fertilization may permit development of profitable farming systems in areas that were formerly submarginal for farming.

In areas where the prevailing sizes and types of farms are the most profitable ones that can be established, the same results would be obtained by using records of income experience as by the farm budget methods, provided farm records are sorted to reveal the most profitable of existing sizes and types. If historical data are available, net returns series can be constructed for different sizes and types of farms that run back over a period of years.[9] These series also could be projected forward to include results of new developments.

Suppose our analyses of income expectancy in farming uses indicate that successful farms as previously defined cannot be organized in the area. Should measures then be developed to aid in shifting the land to a more extensive use, e.g., forestry or grazing? One further test is needed before drawing a conclusion. Would public investment in area-wide improvement programs make farming profitable? By

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[9] For his approach see Wylie D. Goodsell, Ronald W. Jones and Russell W. Bierman, "Typical Family-Operated Farms, 1930–45, Adjustments, Costs and Returns," U.S.D.A. BAE processed 1946.

these means present investments in the entire community structure might be protected. This possibility is discussed in the next chapter.

Some land classification studies are designed to develop a ranking or grading of the economic productivity of land that is best suited for farming. (Similar grading is required for land in forestry or grazing uses, but we are concerned here with farming land.) This approach has been called an "economic opportunity classification" of farm land.[10] The purpose to be served may be to provide a more equitable basis for taxation, to furnish background information for farm appraisal work or to guide potential users and purchasers of land.

In specialized farming areas with few alternative uses a physical productivity rating based on relative yields of the special commodity, assuming a given set of practices and inputs, can be interpreted rather easily in economic terms. For example, the Montana approach to classification of wheatland has been in terms of probable yield of wheat per acre when summer fallow is practiced.[11]

Determination of the relative economic productivity of land having a number of alternative crop and livestock uses is a much more complex job. In approaching this problem we need to consider: (1) the form in which land classification materials need to be prepared, and (2) the way that such analyses can be used to establish productivity ratings for farm lands with alternative uses. With respect to the form in which land classification materials are made available, we should recognize first of all the need for separating the physical and economic relationships that are involved. The economic analyses will need to be reworked from time to time. But the physical relationships are much more stable. If the two sets of data are presented separately, it will be easy to rebuild the economic structure on the foundation of a physical land suitability classification.

The chief reason why the physical and economic materials need to be kept separate is that most farming land does not have a single unique use or capability. The economic margin of use for different products changes with changing economic conditions and other external factors. Even land that is continued in the same crop rotation will be farmed more or less intensively in accordance with economic conditions. Those who recognize the need for changing both the major and the minor uses of land, and especially intensity of use, in accordance with economic conditions have some difficulty in accept-

[10] Conklin and Berg, Mimeo. report A.E. 68, Dept. Agri. Econ., Cornell University, December 1948.

[11] "Land Classification in the U.S." Rpt. of Land Com. to the Natl. Res. Planning Board, Fig. 43, p. 135.

ing an objective such as the following: "To provide permanently for using the nation's land in accordance with its capabilities and the treating of it in accordance with its needs."[12] The wording here implies one set of uses for agricultural lands, based on inherent physical capabilities, and that the same intensity should prevail regardless of economic conditions. It is primarily because most farming land has alternative uses, and changes in intensity are needed from time to time that we should separate the physical and economic relationships.

The natural science data needed for an economic classification of land in a specific area includes a physical inventory of the land, which contains information on soil type, slope and erosion hazards, and which indicates the part of the area which is physically suitable for cultivation. Within the margin of physical suitability one can then determine income expectancy under specified conditions by the use of farm budget analysis. In order to do that successfully, however, the physical yield expectancy of the different crops that can be grown in the area must be known, together with the rotation practices and the treatments that are needed to maintain the soil in the alternative uses that are being compared. In other words, a physical classification of land according to the types that will respond approximately in the same way to give rotation practices and treatments is needed. In addition, we need a quantitative measure of yields to be expected from each crop with given practices. The data on yield expectancy for various crops and pasture uses, and practices and treatments needed to maintain the land in these uses, should be furnished by workers in soils and crops. It is part of the physical job of classification.

With this information available, economists can analyze income possibilities of different sizes of farms on each land type. This should be done by determining the highest net income alternatives, with given levels of managerial ability.[13] It is necessary also to develop price and cost data that constitute longer term expectancy. Economic analyses of this type, based on a solid foundation of physical and biological data, would pérmit a rating of land types in accordance with net income expectancy. Some land types would be found submarginal for farming uses in accordance with previous discussion.[14]

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[12] H.R. 4417, 80th Congress, 1st Session, under declaration of policy.

[13] Frequently improved systems of farming require a higher level of managerial ability than now prevails in an area. The question then arises as to whether the requisite managerial skills can be developed by the rank and file of farmers in the area. If the required skills are not attainable the proposal is not a feasible alternative.

On land types that are economically suited for farming, returns may be compared and used as a basis for grading the economic productivity of different areas of land. Comparison should be made for the sizes and types of farms best adapted for each land type.[15] Proper allowances have to be made for varying inputs of capital and labor under different systems of farming, but with careful work a valid index of economic productivity can be constructed. It must be realized such an index rating or grading of economic productivity will change if some of the economic forces that affect returns from the types of farming under comparison are altered. For example, new crops, higher yielding varieties of old crops, new methods of fertilization, or other technological changes may alter the rating of economic productivity.

A rating of this kind will reflect economic productivity differences when the land is used for full-time farming. It will also serve as a guide to more equitable taxation and as background for farm appraisal work. It should be understood that the rating is not one of income experience with the sizes and types of farms that have prevailed in the area, but rather a rating of the most profitable types and sizes of farms that could be developed for the area and that could be operated by farmers with a given level of managerial ability. This means that in what now are considered "poor land" areas, characterized by small farms and low incomes, an attempt would be made to analyze the income possibilities for systems of farming that are better suited to the physical and economic conditions of the area and which would take advantage of recent developments in technology. In other words, the possibilities of achieving a better balance between labor, land, and other capital resources would be explored.

There has been much discussion of the need for an economic classification of land by local areas because the land market does not fully reflect differences in economic productivity.[16] The less productive land, and usually the smaller farms, sell at relatively higher

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[14] With the previous qualification that public investments in area-wide improvement may change the income expenctancy. Also if it is not possible to maintain certain soils, we may decide to mine them and to continue their use in farming. There is the further possibility that no better alternatives are available for the people who are now farming this type of land.

[15] See notes on "Poor Land" and "Submarginal Land" by John D. Black in Journal of Farm Economics, Vol. 27, No. 2, 1945, for the suggestion that if sizes and types of farms are adapted to the productivity of the land the income *per man* might tend toward equality on different grades. But Black also states that a rating of productivity *per acre* is useful for taxation and related purposes.

[16] See table of lending experience by land classes in "Research Work in Minimum Financial Requirements and Related Considerations for Beginning Farming," by W. L. Cavert, in Journal of Farm Economics, Vol. 28, No. 1, 1946.

prices in proportion to their income expectancy than the larger farms that have more productive soil and that can be operated more efficiently. That the land market does not fully reflect income differences on different grades of land is not questioned. But other factors are involved that may be even more important explanations of the tendency for land of low economic productivity to be valued relatively higher than more productive land. Perhaps the first and foremost reason for this in areas where low income farms are concentrated is the lack of mobility of farm people. If farm families had knowledge of other income opportunities, and if such opportunities actually were accessible to them, it is possible that enough farm families would shift out of the poorer areas to permit less intensive farming of the land. If this hypothesis is correct, the most effective land use adjustment measures in areas of this type would be those that open up the avenues of escape.

Another factor that we need to consider, of course, is the home value of small farms, which already has been mentioned in connection with part-time farming. Also more families are in the market for that kind of a place because it is as large a farm as they can afford to buy, and frequently a farm family occupying a place of this size can make an acceptable living on it if they have no indebtedness. In other words, they can use both the income from the land and from their labor for living expenses. It also is probable that there is some selectivity in grades of managerial ability of present operators on the small farms of lower productivity that are located in the same area as the larger and more productive farms. There is no guarantee, therefore, that if operators of the small farms were to shift to larger farms they would increase their income expectancy proportionately to the incomes that are now being obtained. This is only one of the reasons for the desirability of a complete array of sizes and types of farms to fit the capacities and efficiencies of individual operators and their special personal situations.

By now it probably is apparent that land classification designed to grade the economic productivity of farming lands is not a beginning reconnaissance job that serves as a foundation for other economic research in an area. It is more the end result of area studies in production adjustment and efficient land utilization. Moreover, the economic ranking may change with improvements in technology and changes in economic conditions. Economic classifications, therefore, cannot be thought of as a fixed frame of reference for other research. Classifications based on physical characteristics are much more stable. However, if economic classification studies were made as outlined above they would be sufficiently stable to help guide individual farmers in the use of land and provide a basis for equitable taxation and for farm appraisal work.

AREA LAND IMPROVEMENT PROGRAMS

In the previous section very little was said about the area and inter-area effects of possible changes in land use that might be based on land classification studies. Any change in the use of land will have repercussions on other segments of the economy of the area, and on other areas as well. However, the assumption is frequently made in land classification studies that if the change results in higher net incomes to farmers within the area the effects are generally favorable. More funds will be available for support of both the public and private community institutions. But the potential area effects of such changes need to be analyzed systematically. Some unfavorable effects are possible, especially on competing areas. And where we are dealing with large areas the potential inter-area effects should be considered.

Sometimes area-wide improvement programs can be undertaken which result in more profitable farming within the area. They involve developments which cannot be undertaken by individual farmers. Such programs for irrigation, drainage and flood control have a long history in this country. The soil conservation districts, organized under state laws, and the large federal multipurpose regional projects represent more recent developments. The Missouri Valley Development Program probably is the most ambitious of these regional improvement programs. Obviously, detailed discussion of such programs is outside the scope of this chapter, but a few general remarks are in order. Research and planning for area-wide improvement programs would come under the fourth of the broad objectives listed in the last section. Namely, developing suggested measures for achieving optimum use of land. The obstacles encountered in shifting the major uses of land in response to changing conditions have been mentioned. Development of area improvement programs involves ascertaining the specific impediments to optimum adjustment in the area, and determining the types of measures that are needed to achieve more efficient utilization of land resources, including shifts in the major uses of land.

Programs of this type usually involve both public and private investment. Since returns on such investments accrue over a period of years the discussion under "Balancing Present and Future Benefits" is applicable to this problem. In fact, conservation measures usually are a part of an integrated area improvement program. It is especially pertinent to emphasize that an improvement which results in an immediate increase in output, which cannot be profitably absorbed in the present market, probably should be postponed until the market demand has increased. The wisdom of such a decision may rest on the present situation within the area in relation to other areas. Increased production may be incidental to prevention of permanent damage to resources. There might be acute need for improving the income position of those now living in the area. Perhaps this can be accomplished with only minor repercussions on the market, and thus with little effect on other areas. For example, opportunities may exist for developing irrigation of valley lands that will greatly increase and stabilize the productivity of the surrounding range and dry-farming lands. Such benefits cannot be assumed without analysis of both the benefits and the offsetting costs. The potential effects of a suggested program need to be analyzed in terms of the probable impacts on farmers within the area, the total economy of the area, and the possible repercussions on other areas, both favorable and unfavorable. The potential returns on public investments necessary for area improvement programs should be judged in comparison with alternative uses for public funds.

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