

CHAPTER 4

EXPLOITATION OF VIRGIN FERTILITY AND THE INTENSIVE AND EXTENSIVE MARGINS

VIRGIN FERTILITY AND COSTS OF PRODUCTION

The exploitation of large areas of land with accumulated stores of moisture and fertility means that the costs of production on such areas are lower than they would be if fertility were maintained. This affects the intensive and extensive margins not only of the areas possessing the virgin fertility but also of areas not possessing this initial gift. The effect depends upon whether exploiting the virgin fertility, thereby reducing costs and increasing supply, results in lower prices, or whether the lower costs simply result in higher net returns to the owners of land having virgin fertility with little effect upon prices because the supply did not increase more rapidly than population and demand. In either case any development towards an appropriate organization of factors under exploitive conditions means that maladjustments inevitably arise as the virgin fertility is used up and costs increase. Historically we know that the development of the vast areas of chernozem soils in the western prairies lowered the prices of grains and, coupled with reduced transportation costs, affected the agriculture on the podzolic soils not only in the east of the United States but also in Europe. During this period land values and rents were low, and the assumption that reduced costs due to virgin fertility were largely passed on to consumers appears justified. This might be referred to as the initial exploitation which took place as the westward migra-

tion across the continent occurred.¹ During the first world war, however, a second exploitive period set in, resulting from abnormally high prices for crops due to curtailed production in Europe. In this case the lower costs resulting from the exploitation of virgin fertility did not prevent a rapid rise in prices, and the net income to land increased so that rents and land values also rose rapidly. This second exploitive movement was associated with an increase in cash expenses through the introduction of tractors, and a reduction in the numbers of horses and mules; not only were the western plains plowed up for wheat, but the acreage in permanent pasture and meadow on individual farms was also reduced to make larger acreages of grains possible.

EXPLOITATION AND LAND VALUES

Exploitation tends to result in lower prices and higher current net income to enterprises utilizing land, but the relative change in each will depend upon a number of factors. If virgin fertility gives rise to lower costs of production during the period of exploitation, it means that although prices do fall the net income accruing to the land will be higher than it would be when fertility has to be maintained; where prices do not fall it simply means that this differential will be greater. The immediate results of this high net income on soil types having exploitable stores of virgin fertility is a land valuation which is too high for the enterprise when it is placed on a fertility maintenance basis. Areas which would be submarginal when fertility had to be maintained are marginal or supramarginal while the native fertility lasts. A further important result is that the capacity of the farm enterprise may be increased and net income further raised and with it land

¹See Ralph H. Hess, "Conservation and Economic Evolution" in *The Foundations of National Prosperity*, *op. lit.* pp. 99-112.

values. As a final result the intensive and extensive margins² of competing enterprises are established at positions which cannot be maintained when the decline in productivity makes higher costs inevitable.

A further complicating factor arises when the problem of real estate taxes is considered. These taxes, which are usually based upon the valuation of the farm, are collected in part to pay for improvements and services demanded and made possible by the high net income resulting from the virgin fertility. As this income declines the improvements and services remain, and where bonds are outstanding and services continued, they must be paid for from the declining returns which result as the original fertility is exploited. In some areas tax delinquency may result in higher tax rates on the better land, and the problem is then greatly intensified.

PRICE RATIOS OF COMPETING PRODUCTS

A further effect of the exploitation of virgin fertility is the establishment of price ratios between competing farm products which of necessity reflect the supply determined by the intensive and extensive margins established under the exploitive system. A simple example may serve to illustrate the general line of argument. If wheat production were more profitable

²At the intensive margin of an enterprise the marginal returns from inputs of variable factors applied to land just equal the marginal costs.

At the extensive margin of an enterprise the marginal returns to a unit of land applied to the other factors of production when these are kept constant will just equal the marginal cost. The marginal cost of the land will be its net returns per unit from the nearest competing enterprise or its opportunity costs. Thus at the extensive margin the net returns per acre from enterprises competing for land are equal whether on the farm, between regions, or at the margin of utilization where net returns become zero.

Changes in prices and costs would cause both of these margins to fluctuate providing that all the factors were perfectly divisible and mobile. For an excellent discussion of the limitations of these concepts, see "The Concept of Marginal Land," by G. M. Peterson and J. K. Galbraith, *Jour. of Farm Econ.*, Vol. XIV, No. 2, pp. 295-310, April, 1932.

than raising beef cattle on western lands, while exploitation of the original fertility keeps cost down to a minimum, these areas would be taken over by the more intensive system. More capital and labor would be applied in the area, and rents and land values would rise. Wheat production is increased, and the area available for cattle production is curtailed. As a result the price of wheat relative to the price of cattle is different from what it would have been if the area of wheat cultivation had not been expanded, and this holds true regardless of changes in demand factors. The curtailment of the supply of cattle will tend to raise prices, rents, and land values in the grazing areas. If the increased output from the areas having virgin fertility lowers the price of wheat, then the areas of wheat production where fertility maintenance and improvement is an important cost will also be affected but in the opposite direction. This has been true of many of the podzolic soils of the east; farms which were marginal under the old price structure became submarginal, and readjustments in land use became inevitable. Fertility maintenance and improvement for the production of crops was no longer profitable in the older areas, and farms were ruthlessly exploited and abandoned.

The effect of exploitation upon the margins of production would not be important if the process were easily reversible, but in many cases this is not so. When the initial fertility of the land is reduced to the point where conservation becomes economic, several alternatives are possible. These alternatives will depend upon the comparative advantage of the exploitive over the conservation system, the relationship of primary and secondary production, the question of whether the various factors are divisible and flexible, and the rigidity of the institutional factors developed under the exploitive system.

ADJUSTMENTS WHEN NO CHANGE IN TYPE
OF FARMING IS REQUIRED

In order to analyze this problem of the effect of original fertility in lowering the costs of production and affecting the intensive and extensive margins, the intensity of land use, the relative prices of products competing for land, and the effect on conservation, three specific examples may be considered separately.

The simplest case is where original fertility has meant only a lowering of costs of production, and no change in the type of farming is necessary in order to achieve conservation. In this case the resistences to the adoption of conservation would not be serious, and costs of production would be increased in order to maintain yields and maximize net returns.³ However, either rents and land values must decline or the level of living or labor income of the farmer must be lowered. Under actual farming conditions the comparative bargaining position of the landlord and tenant will tend to determine the share of the extra costs which each will bear. If the costs of maintaining the soil resources are not met and the exploitive system is continued, then net returns will decline beyond the point where conservation becomes economic, and the losses will be greater than if costs had been increased and income maintained. In this case the intelligence of the farm operator and his security of tenure, which should permit him to reap the benefits of increases in costs such as liming and fertilizing, would seem to be the main factors governing his decision whether or not to practice conservation.

A variation of this case occurs when, because of high rents and land values resulting from exploitation, a corresponding increase in intensity of use of labor and capital per acre takes

³ Prices and technique are assumed constant in order to simplify the picture, although the same relationship holds when these vary.

place. In this case (assuming family farm labor) the size of the farm will be smaller under the exploitive system than it would be if conservation had been followed from the beginning, and more capital per acre in buildings and machines may be applied. This increases total output and total costs per acre and, as the original soil resources are depleted, not only would rent and land values have to decline, if the level of living is to be maintained, but capital might have to be disinvested and farm size increased (or hired labor decreased). Under these circumstances the labor income of the operator would probably be curtailed and possibly remain depressed. Whether conservation will be adopted depends largely upon the type of costs involved: if capital expenditures for terraces, moving fences, liming, and fertilizing are required, the lack of income and inability to disinvest or earn interest on capital already invested might become almost insuperable obstacles to the adoption of conservation farming even though such added investments are necessary to prevent further declines in income.

Large numbers of our general or mixed type of farms would fit into this first group. The problem of conservation is largely one of educating the farmers so that they realize that continued exploitation will lead to lower incomes and that conservation farming is economic after a certain period of exploitation has passed. At the same time suitable conservation measures must be demonstrated, and specialists should be available to help the farmer plan his farm and make a farm budget. At the same time, tenure on farms should be made more secure, real estate values, debts and taxes adjusted as far as possible to the new income levels, and small "re-conditioning" loans (at reasonable interest rates and amortized over a suitable period) made available for initial capital outlays needed to establish conservation practices.

ADJUSTMENTS WHEN TWO AREAS COMPETE

2. The second example of the effect of lower costs resulting from the exploitation of virgin fertility is the case in which exploitation in one area induces conservation in another. A typical example is the change from grain farming with low elasticity of production to mixed or dairy farming with high elasticity that takes place in one area as a result of the development of exploitive grain farming in another. This is quite typical of the historical development of this country. Grass and timber land was first farmed exploitively to produce grain but later returned to a more conservational system as the exploitive grain area moved westward. This adjustment is still continuing, as the rapid increase in dairying in many states indicates; it will probably continue in the future because, as the fertility of the exploitive grain area is reduced, the comparative advantage of the exploitive grain farm over the more conservational mixed or dairy farm is reduced. Where this change in the comparative advantage of alternative systems has occurred, the problem of soil conservation is not usually acute, and the adoption of conservation practices together with some internal rearrangement of land use may be all that is required in the older grain-producing areas.

The basic problem is often one of land values. As the production of dairy products increases and prices tend to fall, the older established dairy areas face increased competition reflected in lower returns to the farm family or lower rents and land values. Where rents and land values are rigid the farmer may face a lower level of living and be driven to seek security by establishing areas of monopoly control in order to modify the force of competition. To the extent that this reduces the price of milk outside the control areas, it will tend to discourage the movement to a more permanent agriculture as well as maintain consumers prices above the competitive level.

ADJUSTMENTS WHEN THE EXTENSIVE MARGIN
OF ARABLE FARMING IS AFFECTED

The third and most difficult problem is that which occurs when the existence of virgin soil resources causes an area to shift from a non-exploitive permanent system to a more intensive system with higher capacity and an exploitive use of soil resources. A typical example of this is the breaking up of pasture areas and development of grain farming. In this case the reserves of moisture, fertility, and organic matter in the soil make an exploitive system of grain farming yield a much higher net income during the early stages of exploitation of the land than is possible under a permanent grazing system. As a result the type of farming moves towards the system with the higher comparative advantage, and a more intensive system of farming develops. As a result more labor is applied (i.e., family farms become smaller) and more capital is invested in buildings and machinery. Rents and land values increase and tend to force all land possible into the more intensive use. Then, as the soil assets are depleted, yields fall, drouth hazards are increased, and as the organic matter is depleted, soil blowing and drifting occur. In order to maintain the soil resources, costs might increase so greatly that grain farming would yield smaller net returns than a grazing system, and wheat farming would become submarginal.

It is under these circumstances that it is most difficult to deal with the problem of conservation. Virgin fertility in this case leads to an exploitive system of farming with higher capacity, and land values which reflect this condition cannot be maintained. While this process is going on (and to some extent it has developed in some areas in almost all states), population density increases, and farm size decreases. Marketing resources that are suited to the exploitive system develop, villages, social institutions and their concomitant taxes are built up, and an institutionalized system founded upon a

false basis develops. The problem of the conservationist in these areas is to estimate whether it is cheaper to move part of the population and return the area to a less intensive type of agriculture with a lower capacity, or to retain the present population and try to develop a new type of agriculture which will maintain the soil and yield a labor income acceptable to the farm family if rent and land values decline.⁴ The final decision depends upon the people, the physical conditions of climate and soil, the possibility of modifying the institutionalized economic factors of rent, taxes, and land values, the possibility of developing secondary production, and the nature and adequacy of public assistance.

In all cases the relationship of primary to secondary production is of fundamental importance, because any changes in land use necessary to achieve conservation will have repercussions upon secondary production. Adjustments in farm size, rents, land values, etc., which may be implied by changes in primary production might be offset by changes in the intensity of secondary production. If, for example, wheat or cotton farms could develop secondary production by purchasing feeds and producing dairy or poultry products, then the changes in farm size and land values might be much less drastic. The essential point that needs to be stressed is that conservation planning is not purely concerned with land use and primary production but must also deal with secondary production if it is to be practical and realistic.

EFFECT OF DECLINING COSTS OR RISING PRICES

Apart from the exploitation of virgin soils affecting the margins of production as outlined above, a long period of rising farm prices or declining costs followed by a decline in

⁴ For an analysis of this problem, see the article by Sherman E. Johnson, "Definition of Efficient Farming," *Land Policy Review*, Vol. II, No. 5, Sept.-Oct., 1939, p. 18.

farm prices or increase in costs would raise similar problems of adjustment. A further complicating factor has been the historic development of land settlement. The 160-acre homestead available in all areas regardless of soil and climatic conditions need only be mentioned. The transitions from grazing to grain and then to mixed farming have characterized the western development. Older, once prosperous, rural areas have seen abandonment and decay due to the lowering of competing costs as new virgin soils were brought under the plow. Today our agriculture is suffering from the inability of the farming system to adjust the intensive and extensive margins of production of competing enterprises, particularly the extensive margins of arable land, to the new margins which have become necessary to correct the errors of the past, including the faulty cost structure which has resulted from neglecting to account for the exploitation of virgin fertility. It is suffering because the system has failed to place farming on a permanent basis of maintaining soil fertility in those areas where exploitation is no longer economic nor socially desirable, and because the system has failed to relate the ratios between the rent of various lands and the prices of their products so that they represent the true relative scarcities of productive resources in relation to demand.

It is impossible to separate the effects of exploitation of virgin fertility from the effects of prices and costs in determining the intensive and extensive margins. Maladjustments in land use patterns (as indicated by low levels of living, high relief loads, and high tax delinquency) and soil erosion may result from the fact that virgin fertility was available or from large fluctuations in prices. *If, under the present institutional arrangements of farm size, taxes, population density, and rents, a level of living acceptable to the people cannot be maintained when conservation is introduced, it is a waste of public funds to attempt to induce conservation without remedying the basic maladjustments.* In order to make

any decision as to what the income from any particular organization is likely to be, it is essential that we be able to anticipate relatively stable prices and price relationships. Theoretically, the intensive and extensive margins should fluctuate with changes in prices, but the rigidities of the farm organization and institutional factors prevent this from occurring, so that maladjustments may continue for long periods of time with exploitation and uncontrolled erosion being concomitants. Under these circumstances conservation is but one phase of the problem of agriculture as a whole and is linked up with industrial prosperity, international trade, and the whole complex economy of the nation.