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Production Economics Research Branch

LAND INVENTORY AND LAND REQUIREMENTS IN THE UNITED STATES

By H. H. Wooten and J. R. Anderson, Agricultural Economists 1/

Paper for the Soil Conservation Society of  
America, October 17, 1956

This paper is intended to describe briefly the use of land for agriculture and the possible effect of the growth of our population on land requirements. It includes an explanation of any special relationships and how they came about. To explain these relationships, a brief account must be made of significant changes in land use that are in progress or in prospect, and of some of the factors that affect them. This is an assignment of large proportion, for changes in land use and population growth are so interrelated that it is difficult to describe and evaluate them properly. However, I have brought together some significant facts and projections that indicate possible trends in land requirements under certain assumptions as to productivity, employment, income, consumption and population during the next 20 to 25 years. These facts are taken from recent studies of land use, long-term prospects for agriculture, and land-capability surveys made in the Department of Agriculture, and from population studies of the Bureau of the Census. 2/

Land inventories show that the land which comprises the continental United States is made up of many different kinds. 3/ Roughly, three-fifths of the total area of land in the continental United States, or 1,158 million acres, is in farms, and two-fifths, or 746 million acres, is not in farms. Nearly half the land not in farms, or 353 million acres, is used for grazing. But much of this large area is publicly owned and is used jointly for other purposes, including forests, wild game preserves, and watersheds to supply water for irrigation, power, and other uses.

Depth and fertility of the soil, slope of the surface, elevation, vegetative cover, water supply, length of growing season, productivity, and value of the land of this country all vary widely, thus affecting the use made of the land. Changes in the demand for field crops, livestock, timber, and other products and services that affect relative profitability have influenced decisions as to the use of land at different periods. Economic considerations should be emphasized as a major factor in the past abandonment of much cropland and its reversion to forest in the East, the conversion of grassland to cropland in the central States and West, and the clearing of forest land for cultivation in the Lower Mississippi Valley and in certain Coastal Plain areas.

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1/ This paper reflects the personal views of the authors, and does not necessarily represent the views of the Production Economics Research Branch, ARS, or the U. S. Department of Agriculture.

2/ See attached list of references.

3/ For definitions of land in farms refer to: United States Bureau of the Census, 1956. United States Census of Agriculture, 1954. 2 Vols. Washington, D. C.

## Trends in Requirements for Crop and Pasture Lands

Theoretically, crops, pastures, and forests compete for specific areas of land on the basis of comparative income. At times, this competition may be significant, particularly on millions of acres in the South as between cultivated crops, high-grade pasture, and use for timber. Even on the fertile prairie soils of the Midwest, pasture is profitable on considerable acreages of high-grade land. But ordinarily, from a broad national viewpoint, crops have first choice wherever they pay best, and pasture, or grazing uses, and forests are the residual claimants. 4/

Crops and pasture, however, are complementary uses, in that they contribute jointly to production of livestock products and they are capable of more or less interchangeable use in the process. The area of land used for pasture in production of livestock products may be greatly reduced by using supplementary feed produced on arable land, or vice versa. Therefore, pasture requirements are somewhat less absolute than are those for arable uses.

Growth in agriculture depends primarily on expansion in demand for farm products. Growth of population will contribute much to demand for agricultural products in the next two decades. This paper assumes a population increase of about one-third from the 1951-53 average to 210 million people by 1975. This compares with a range in Bureau of the Census 1953 projections of 200 to 221 million. 5/ According to 1955 studies by the Bureau of the Census, if population continues to grow as rapidly as in recent years, by 1975 the population could well be at the high of the range projected by the census in 1953, or 5 percent greater than the foregoing estimates.

At present, development of crop and pasture land is encouraged somewhat by shifts of farmland to use for living and working space for the growing non-farm population. Areas occupied by cities, towns, parks, airports, reservoirs, highways, and other special uses have increased greatly since 1910. 6/ The average rate of absorption of land into these special intensive uses recently has been about a million acres per year, of which about one-third each is estimated to be cropland, pasture, and woodland. Thus, over a long period competition may again become keener among cultivated crops, pastures, and forests for the lands needed to supply the increasing demands for agricultural and forest products.

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4/ Johnson, V. Webster, and Barlowe, Raleigh. 1954. Land Problems and Policies. 422 pp. illus. McGraw Hill Book Co., pp. 196-228.

5/ U. S. Bureau of the Census, Current Population Reports, Population Estimates, Series P 25, No. 78, August 21, 1953 and No. 123, October 20, 1955.

6/ Wooten, H. H. 1953. Major Uses of Land in the United States. U. S. Dept. Agr. Technical Bulletin 1082, 100 pp. illus.



Cropland and Pasture Resources

A fourth of the land in continental United States is cropland and a third is permanent pasture and grazing land. The rest is covered with forest, or it is in miscellaneous other uses. In round numbers, the present distribution of the cropland and pasture area of the country is as follows: Cropland 465 million acres, including 399 million acres used primarily for crops, and 66 million acres used for pasture in rotation with other crops; with 633 million acres in grassland pasture and range. The grassland pasture is exclusive of 301 million acres of woodland, which is pastured at certain seasons. 7/

With the growth of population and the somewhat greater demand for farm products, moderate shifts from pasture and forest to cropland are expected in the next 2 to 3 decades. If recent trends continue in the next 25 years, some 20 to 30 million acres of permanent grassland suitable for cultivation likely will be brought into the cropland-pasture rotation. In addition, possibly 10 million acres of fertile farm woodland and brushland likely will be cleared for cropland and rotation pasture, chiefly to improve the layout and add to the tillable acreages of existing farms in the farm-forest regions.

Thus, with continuation of recent trends in land improvement, the total acreage of cropland, including rotation pasture or cropland used for pasture, might be in the neighborhood of 500 million acres by 1975, as compared with 465 million acres in 1954. While these trends indicate a larger acreage of improved pasture, the total area of pasture and grazing land might remain about the same as at present, as a considerable acreage of pasture likely would be shifted to rotation pasture in the cropland rotation. Close competition from forestry as a profitable farm enterprise likely would discourage large-scale clearing of good commercial timberland for pasture. Other sources of increased pasture acreages are noncommercial forest land, idle and wasteland; however, these areas frequently need expensive improvement to make them suitable for pasture.

This projection of cropland and rotation pasture acreage is based on trends in the last 15 years and on planned land improvement and reclamation developments. More land would be available for development if it were economically desirable. It is a question of the relative economy of alternative ways of increasing output - by use of more land - or by higher yields per acre.

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7/ Wooten, Hugh H. and Anderson, James R., "Agricultural Land Resources in the United States - With Special Reference to Present and Potential Cropland and Pasture," U. S. Dept. of Agriculture, Agriculture Information Bul. No. 140, June 1955.



Land Potentially Available for Cropland Use

Cropland Suitable for Regular Cultivation,--Land-capability estimates of the Soil Conservation Service in 1949 showed that 388 million acres of cropland in that year were in land capability classes I, II, and III. This land is suitable for regular cultivation with proper farming practices under good management. <sup>8/</sup> Another 49 million acres of cropland was class IV land, which is severely limited as to possibilities for cultivation. Most of it is suitable only for occasional cultivation in longtime rotations. In addition, 40 million acres of land in classes V, VI, VII, and VIII, or about 10 percent of the presently cultivated cropland, are not suitable for use as cropland. This land is too steep, too eroded, too stony, or otherwise poorly adapted to cultivated crops. Thus, of the presently cultivated cropland, 80 percent is adapted to full-time cultivation, and 10 percent can be cultivated to a limited extent if suitable precautions are taken.

Overall Shifts from Grassland and Woodland to Cropland.--As indicated by the land-capability estimates, some 215 million acres, or more, in pasture, range, and woodland in continental United States are physically capable of improvement and planting to cultivated crops, with longtime rotations and good care in management. Of these, more than 110 million acres are open grassland pasture and grazing land, most of which is in farms. An additional 105 million acres of potential cropland are in woodland, about half of which is in farms. Most of the rest is privately owned. Much of it was once in farms, but it has been allowed to revert to woodland in various stages because of competition with newer lands. Shifting woodland to cropland would reduce the acreage available for woodland production just as the shift from grassland to cropland would reduce the acreage of pasture.

These estimates of grassland and woodland capable of use for crops are the potential additions for agriculture, based on physical capability of the land to stand up under cultivation, especially from the standpoint of erosion hazards. It is not suggested that all land physically suitable for cultivation should be used for cultivated crops, as a balanced enterprise on many existing farms requires use of some lands in classes I, II, or III for pasture and woodland.

Development of suitable permanent pasture and farm woodland as cropland and bringing it into the rotation normally takes several years. Plowing of pasture and clearing of woodland and use for cultivated crops would reduce the acreage available for pasture and woodland products. It would substitute one kind of production for another, and some changes in the systems of farming followed in different regions would be required.

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<sup>8/</sup> Revised data from the land-capability estimates made by the U. S. Soil Conservation Service in 1948-49, adjusted slightly to the total acreage of cropland reported by the U. S. Census of Agriculture in 1950. A partial summary of these data and definitions of the land classes appeared in the President's Materials Policy Commission Report in 1952.

Moderate shifts of suitable areas of grassland pasture and farm woodland to the cropland rotation, however, are physically feasible and possibly desirable in the case of many individual farmers, especially those who have suitable unimproved land and who have too few crop acres for reasonable farm incomes, if the conversion is spread over several years. Experimental tests and farm trials have shown that rotation pastures produce more forage than permanent pastures, and that at the same time they result in increased yields per acre of other crops in the rotation.

Shift of Cropland to Grassland and Woodland.--Partly offsetting the potential shifts of grassland and woodland to cropland are 40 million acres of cropland which the Soil Conservation Service has classified as best suited to grassland and woodland. Thus, the net potential shifts in land use from grassland and woodland to cropland which appear to be physically feasible are about 175 million acres. Much of the shift from grassland and woodland to cropland when it occurs should be to replace necessary conversions of poor cropland areas to grass and trees.

In reviewing potential shifts in land use mention should be made of the soil bank program. The conservation reserve part of the 1956 soil bank program provides encouragement for the shift over a period of years of 20 to 25 million acres of cropland to grass, trees or water storage. This would be a long-range adjustment in the use of some of the Nation's land resources. A temporary withdrawal from crop production of another 20 to 25 million acres, or more, is possible under the acreage reserve part of the soil bank program. The acreage reserve is a temporary program designed to reduce the current production of certain crops that are in large supply. Thus, transfer of some 40 to 50 million acres of cropland to other uses or to a standby status is possible during the next few years.

#### Requirements for Agricultural Products

In 1954, the volume of farm marketings and home consumption of agricultural products in the continental United States was about 50 percent more than the 1935-39 average. Civilian per capita food consumption in 1954 was 12 percent greater than in 1935-39, while the indications for 1956 are that it will be 14 percent greater than this base period. Much of the increase in demand for agricultural products can be attributed to the growth in population from an average of 129 million persons in 1935-39 to 162 million for 1954 and 168 million in 1956. The median projected estimate of population for 1975 is 210 million. 9/

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9/ United States Bureau of the Census. 1955. Revised Projections of the Population of the United States, By Age and Sex. 1960 to 1975. Series P 25, No. 123; and Provisional Estimates of the Population of the United States, August 10, 1956, Series P 25, No. 141.



A projection of long-range prospects for agriculture by Daly, Barton, and Rogers indicates that if this population growth occurs, requirements for farm products by 1975 will be around 40 to 45 percent above 1953, under conditions of full employment, rising consumer incomes, higher levels of consumption per capita, and a moderate volume of exports. If the higher population assumption of 220 million people is used, projected utilization and needed farm output would be another 5 percent higher. 10/

Under this projection, livestock products as a whole would need to increase more than 40 percent from 1953 to 1975 - more for meat animals and poultry, and less for dairy products. With crop output in excess of requirements in 1952-53, an output increase from that base year of about one-fourth in total crop production would meet prospective needs. A smaller output of food grains, with sizable increases in feed grains, many vegetables, and fruits would be indicated for 1975 under projected consumption rates.

Different rates of growth in demand and trends in agricultural technology on the supply side will make supply increases and adjustments more difficult for some commodities than for others. For example, the job ahead, including the need for land, varies considerably among crop and pasture groups. A tentative conclusion from the studies quoted on land resources, consumption and production is that the production job may be done by a combination of factors. These include (1) overall increases in production of as much as 20 percent per acre for crops and 30 percent for pasture and (2) shifts in acreage from crops in excess supply to those in greater demand, including pasture, as well as (3) additions of 5 to 7 percent to the cropland base. Although large acreages of grassland and woodland are suitable for improvement as cropland, fulfillment of production needs in 1975 through increases in area of cropland and pasture, alone, would represent a sharp departure from recent trends of increased production through adoption of research results and exploitation of presently known technology. Chief reliance on meeting production needs by 1975 probably will depend on our ability to increase crop and pasture production per acre.

From an overall viewpoint, and judged by past trends, the size of the production job ahead is not likely to exceed the improvements that agriculture can attain. However, some of the important problems involved in attaining our production needs can be seen more clearly when the pattern of future production needs is considered. The greatest increase needed in crop production would be in feed crops, feed grains, hay, soybeans, and especially pasture. Crops for which little or no increase in production would be needed to meet requirements include major food grains, potatoes, and cotton.

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10/ Daly, Rex F., The Long Run Demand for Farm Products, Agr. Econ. Res., July 1956, Vol. 8, No. 3; and Barton, Glen T., and Rogers, Robert O., Farm Output, Past Changes and Projected Needs, U. S. Dept. Agr. Agr. Inform. Bul. 162, August 1956.

## Conversions in Use of Land to Meet Future Needs

Conversions in use of land are continuous but the rate is now slower than formerly because (1) much of the poor cropland was shifted to other uses in the soil conservation and other agricultural programs before 1940 and (2) improvement and fertilization of existing cropland and pasture is adding to production without great additions in acreages. Indications are that further large natural reversions of cropland to woodland cannot be expected in the Eastern States. Neither will there be large-scale clearing of forested land. The outlook for forestry in much of the remaining cutover and predominantly forest regions is better than for farming, except for fertile land that is especially well adapted to farming near population centers. However, probably there will be some gains for the country as a whole in the cropland and improved pasture area in the next 2 decades.

## Important Economic Factors in Meeting Land Requirements

The acreage of land that is needed for production of food and other agricultural materials depends mainly on domestic demand, productivity of the land, livestock production per unit, and extent of exports and imports of farm products. In studying these influences, it should be noted that not only has population increased substantially, but that in addition, diets and certain other consumption items have changed in the last three decades. Because of these changes, shifts in acreages of certain crops are in progress. The total acreage of improved cropland and pasture probably will need to be increased gradually to care for the needs of the growing population for food and fiber, unless crop yields per acre and livestock production per unit are increased very substantially.

Where needed adjustments should be made and how the land resources may best be used to meet impending needs for agricultural and forest products are therefore of major importance. Present and future needs for cropland, grazing land and forests, the extent and location of areas available for the various uses, and possible changes in land use to meet these demands require careful investigation by public and private agencies before the changes actually become necessary.

We need more research and planning to raise crop and pasture yields and to lower costs per unit so that more efficient use can be made of our cropland and pasture. Considerable research effort will be needed just to maintain high-level yields. An additional part of the job ahead is the need for increasing the efficiency with which feed and labor are used in livestock production. In the past, livestock production per unit of input has risen at a much slower rate than has crop production. Greater effort also needs to be directed to research and planning that will assist orderly adjustments in acreage and production in order to produce the commodities most in demand. Since uncertainty exists as to the demand for food and as to the supply, say by 1975, there is need for continued research on this problem as related to population growth.

In all types of land conversions and investments, such as shifts from forest to cropland or from cropland to forest, the available technical means, such as soil, slope, forest, and land-capability surveys should be used to guide



selection of the best land for improvement and to discourage improvement of uneconomic areas for crop production, or cultivation of areas that cause serious wastage of soil, water, forests, and other resources. The approach of a much larger population and the increase in demand for farm products indicate that the problem of how to make productive use of our land resources is a permanent one.

The chief justification for land inventories - both physical and economic - must be in terms of adjusting production to both present and future needs, and in conservation of the land resources to meet these needs. This does not mean, however, that all land physically suitable should be improved, or brought into agricultural use immediately; instead, we should carefully examine our land resources from time to time to see what will be needed over a period of years from the standpoint of individual farmers and businessmen, local communities, and the country as a whole. These changes - improvement and development of farmland on the one hand, and shift of farmland from production to other uses on the other - should be guided by the facts as to how the land is being used now and how it may be used in the future.

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