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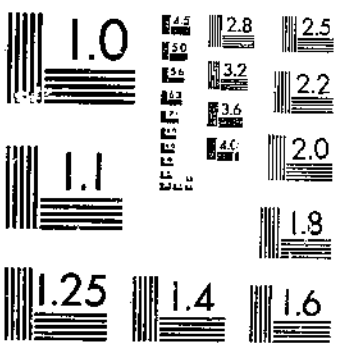

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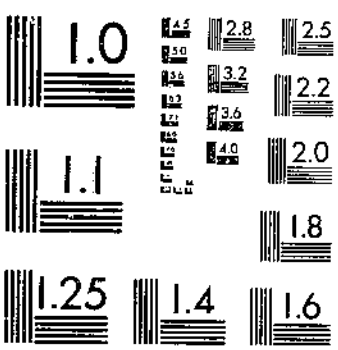

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Technical Bulletin No. 1082 ● *October 1953*

UNITED STATES
DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

Major Uses of Land in the United States [1]

An Inventory of the Land Used for Agriculture, With Special Reference to Cropland, Pasture, and Grazing-Land Potentials

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CONTENTS

THE LAND AND ITS HISTORY

The 48 States that comprise continental United States contain a little more than 1,904 million acres of land. This broad expanse of land is made up of many different kinds. There are the fertile corn-

[1] Submitted for publication, May 15,1953.

lands of the Midwest; the loam of the river valleys; the pasture and grasslands, the timber and woodlands; the cotton, tobacco, rice, and sugarcane lands of the South; the range areas of the Mountain States; the truck-crop areas near large industrial centers; and finally, the land that is used for our great cities, our seaports, our villages, our rural homes, and the many other purposes for which land is needed.

Climate, depth of soil, slope of the surface, and development of land all vary widely.

How has the land been used? Will the same use suffice 25 years from now when to feed our increasing population we will need more of the products that can be produced from the soil?

Originally about half of the land in this country was covered by forests and another two-fifths by grass and herbaceous plants. The remainder—about a tenth—was arid land covered with shrubs, or was barren, desert, rock, and other land (*19, 41*).[2]

Before the first white settlements were made, most of the humid East was in relatively compact forests. Only here and there did scattered prairies and savannahs appear. To the west, beyond the Great Plains, were smaller scattered forests in mountains interspersed with dry valleys and basins. The West had less than a fifth of the original forests of commercial quality

Grasslands were limited in States east of the Mississippi. They included the prairies of the Corn Belt and the Lake States, the black-belt lands of Mississippi and Alabama, the Florida Everglades, and small additional areas, especially along the coast.

In the West, the tall grasses extended into the Great Plains. Farther west, short and desert grasses were found—about half the forage there was made up of short and other grasses associated with limited rainfall. Areas of shrub vegetation were associated with scant rainfall and high desert temperatures.

Today, the area in forest is only 66 percent of the original forest. More than half of the forest land in the East has been cleared and is now used for other purposes. The commercial forests of the West have been reduced by about 25 percent.

Most of the original tall-grass land has been converted to cropland and improved pasture. The tall-grass prairies of the Central States now comprise one of the best farming regions of the country. The better lands of the short-grass regions farther west are used for irrigated or dry-farm crops and the remainder is used for grazing. Areas covered with shrub vegetation have been less subject to change. Only relatively small tracts have been irrigated. In some areas shrub-type plants have replaced short grasses and bunch grass and thus have extended the acreage of shrub vegetative cover.

Around four-fifths of the land area of continental United States is now used in direct agricultural production. Including ungrazed forest, combined uses for agriculture and timber take up more than nine-tenths of the land; the remaining tenth is used chiefly for urban sites, for special uses, and for miscellaneous areas (table 1 and fig. 1).

Shifts in Use of Land

The years from 1880 to 1950 saw agriculture expand in the country as a whole. Acreage of cropland more than doubled (table 1). Grass-

[2] Italic numbers in parentheses refer to Literature Cited, p. 96.

PREFACE

Many changes have occurred in land utilization since Miscellaneous Publication 663, Inventory of Major Land Uses in the United States, was issued in 1948. The present publication is the outcome of an increasing interest on the part of public and private agencies for additional information concerning the utilization of land in the United States. There is constant demand for data that will show major land uses such as cropland, grazing, forest, and others, and for interpretations of land use and changes in use, based upon currently acquired data.

In response to this interest, the Bureau of Agricultural Economics has compiled and published at intervals during the last 30 years, figures that show acreages used for crops, pasture and grazing, forests and woodlands, and other major land areas. In general, this report follows these past inventories as to scope and in the procedure used for the assembly of data. Coverage by States and regions is now more complete than formerly, owing to improvements in mapping by aerial photography and in statistical and other surveys of agriculture, soils, land use, and conditions affecting use.

The present publication is intended to supply an account of the extent and distribution of the major agricultural land uses and a general analysis of the land use situation and the expected future needs for agricultural land in this country. Information on acreages of land devoted to the chief purposes provides a comprehensive picture of the use of all land in the United States, of trends in land use, and of the elements that affect use.

It is evident from present rates of consumption of food and growth of population that we can look forward to a gradually increasing demand for food in this country. Where needed adjustments should be made and how our national land resources may be best used 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 needs require careful consideration by public and private agencies before the changes actually become necessary. But a wholly satisfactory estimate of future agricultural land requirements cannot be made unless an accurate inventory of the uses of land is kept current.

Among the chief sources of the data used are reports and records of the following: Bureau of the Census, Department of Commerce; Bureau of Land Management, Department of the Interior; and the Forest Service, Soil Conservation Service, Division of Soil Survey of the Bureau of Plant Industry, Soils and Agricultural Engineering (now in the Soil Conservation Service) and the Bureau of Agricultural Economics, all of the Department of Agriculture; as well as reports and records of many State and other agencies.

It is not possible here to give adequate recognition to all State and Federal workers who aided significantly in this study. The references cited indicate to a limited extent the sources consulted.

Special acknowledgment is made to E. H. Wiecking, under whose direction the study was carried out, for many valuable suggestions, and to M. M. Regan for aid with sections dealing with water resources and land development.

The manuscript was prepared by H. H. Wooten, with assistance from L. A. Reuss on western rangelands; F. J. Marschner for special-use areas and illustrations; R. D. Davidson for data on public land; and J. R. Anderson for assistance in analysis of the agricultural census reports.

TABLE 1.—*Trends in major land uses, continental United States, specified years, 1880–1950*

Land use	1880	1890	1900	1910	1920	1930	1940	1950
	Million acres	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*
Cropland [1]	188	248	319	347	402	413	399	409
Available pasture and range (nonforested) [2]	935	892	831	814	750	708	723	700
Forest and woodland [3]	628	604	579	562	567	607	602	606
Other [4]	153	160	175	181	185	176	180	189
Total [5]	1, 904	1, 904	1, 904	1, 904	1, 904	1, 904	1, 904	1, 904
Land in farms	536	623	839	879	956	987	1, 061	1, 159
Land not in farms	1, 368	1, 281	1, 065	1, 025	948	917	843	745
Total [5]	1, 904	1, 904	1, 904	1, 904	1, 904	1, 904	1, 904	1, 904
Pasture and rangeland available for grazing (grassland and grazed forest)	(6)	(6)	1, 131	1, 121	1, 066	1, 042	1, 065	1, 045
Land used for crops and pasture	(6)	(6)	1, 450	1, 468	1, 468	1, 455	1, 464	1, 454
Land used for agriculture and forestry [7]	(6)	(6)	1, 782	1, 780	1, 777	1, 773	1, 768	1, 759

[1] Cropland harvested, crop failure, and cropland idle or fallow, exclusive of cropland used only for pasture. Cropland and pasture use relates to the preceding years.

[2] Grassland pasture, including cropland used only for pasture, and other nonforest grazing land. Includes idle grassland which probably existed in significant acreages only prior to 1900.

[3] Exclusive of forest land in parks, game refuges, military reservations, etc. Includes commercial and noncommercial forest land and including woodland grazed.

[4] Includes "special land-use areas," such as urban areas, highways and roads, farmsteads, parks, game refuges, military reservations, etc., and also land having slight surface-use value except for wildlife and watershed protection and recreation (desert, rock, sand dunes, etc.).

[5] Remeasurement of the land area of the United States in connection with the 1950 census indicated an approximate land area of 1,904 million acres. Total acres previously reported as 1,905 million acres in 1910, 1,903 million in 1930 and other years have been revised here.

[6] Data not available.

[7] All land in farms plus nonfarm grazing land and forest land.

land available for grazing declined somewhat as sodlands were plowed and as more land was used for cities, parks, roads, and other nonagricultural purposes. From 1920 to 1950, shifts in use of land that were important both regionally and locally occurred—new cropland was developed in some areas; in others cropland was converted to pasture or was allowed to revert to forest—but overall acreages in major land uses were relatively stable.

Although the total acreages of cropland and pasture have remained about the same for the last 30 years the acreage of land in farms has increased steadily. In 1880, farms and ranches included 28 percent of the total area of land; in 1920, they included 50 percent; and in 1950, 60 percent. Land in farms now includes more of the public and private

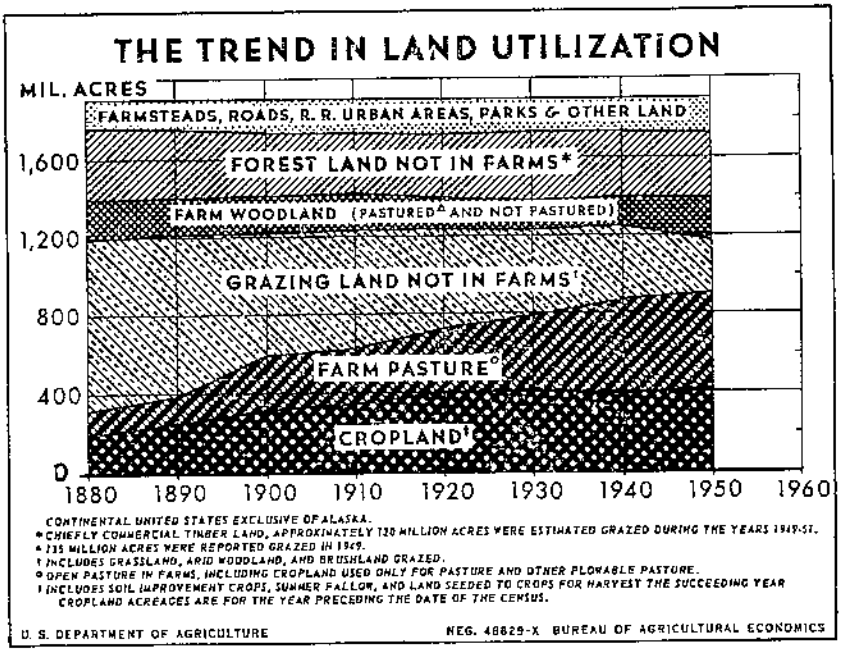

FIGURE 1.—Since 1880 notable shifts have occurred in the use of land. The total acreage of land in farms, in crops, and in pasture has increased generally in the West, whereas in many parts of the East the acreage of land in farms has decreased. Incorporation of grazing land into farms and ranches in the West has not always resulted in changed use; but in the East abandonment of cropland usually has meant a shift to pasture and eventually to woodland.

grazing land not previously enumerated thus. Therefore, although the changes in acreage of land in farms represent mainly the agricultural development of the country, they also represent partly the changes that have been made in methods of classifying and reporting land.

The notable shifts in the use of land since 1900 have been partly counterbalanced by regional changes. For example, acreages of cropland and improved pasture have increased generally in the West and in the lower Mississippi Valley, but in many parts of the Northeast and the Southwest, acreages of cropland have decreased.

Large transfers among uses have taken place. From 1900 to 1930 the acreage of cropland increased by more than 90 million acres but acreages of pasture and rangeland decreased by about 120 million acres. Since 1930 the changes in total acreages of cropland and pasture have not been so great. Acreages of forest and woodland remained about the same. Much land has been cut over and cleared but in the East large acreages of crop and pastureland have reverted to forest.

In 1950 the combined acreage used for crops, pasture, and range was slightly lower than in 1910 but so far as the proportions in these three uses were concerned, they have changed greatly. In 1910, less than 24 percent was cropland; in 1950 cropland made up 28 percent of the total acreage. Nonfarm grassland and forest land grazed have

declined since 1910. Similarly, the acreage of land used for agriculture and forestry together has become smaller.

At present, development of new farmland only about equals the shifts of farmland to other uses. Areas occupied by cities, towns, parks, airports, reservoirs, and other special uses have increased greatly since 1910, rising from 53 to 93 million acres in 1950, an average of a million acres a year.

From 1930 to 1950, the total acreage of cropland (exclusive of cropland used only for pasture) showed a net decrease of 4 million acres, mainly because of conversion to other uses.[3] Development of new cropland in these years is estimated at about 20 million acres. But this new land was more than offset by a shift of 24 million acres of cropland to permanent pasture, woodland, and nonfarm uses.

Changes in acreage of cropland and in production per acre since 1920 have not been uniform among the geographic divisions of the country. West of the Mississippi River the acreage of cropland has increased; east of the Mississippi it has decreased. For the country as a whole, the acreage of cropland has been relatively stable and production per acre of crops has trended upward.

In the East and South, a good deal of the land that had been cleared for farming has reverted to trees one or more times, then has been recleared for farming. It is estimated that 150 million acres have been involved in this long-time rotation of forest, cultivated crops, and pasture. Reclearing the land is frequently less laborious and less expensive than the original clearing, so that in the Eastern States much land passes back and forth from cropland and open pasture to woodland. These shifts depend upon the need for land, the relative profitability of crops and pastures, and the varying availability of other employment to farmers.

Although recently conversion of cropland to pasture and forest cover has been emphasized, little attention has been paid to the natural reversion of such land to more extensive uses, a reversion that has been going on for many years. Until 1930, the total acreage of land in crops increased fairly steadily, but the acreage of cleared land in farms in 1,870 originally forested counties east of the prairies reached its peak before 1930 and then declined. From the peak year to 1930, this decline amounted to more than 61,000,000 acres; and from the peak to 1950, it amounted to more than 80,000,000 acres. The decline is continuous but its rate is now slower because: (1) Much of the poor land was retired before 1940, and (2) improvement and development of land is adding to the acreage of cropland and pasture (fig. 2).

These shifts in land use may be explained by the fact that larger acreages of eastern seaboard lands were developed for cultivated crops and pastures than could be maintained in competition with the more fertile midwestern lands when they were brought into large-scale production for agriculture. The farms of the East, which had been carved from the forest at great cost in labor and time, therefore con-

[3] Before the Agricultural Adjustment Administration program began in 1933 farmers usually thought in terms of "gross areas," which did not make allowances for land occupied by ditches, fence rows, turnrows, and building sites. In later years they have thought more in terms of "net acres." This change in method of reporting doubtless affected somewhat recent estimates of acreages of individual crops and of total cropland, probably making them comparatively less than for the years just prior to 1933.

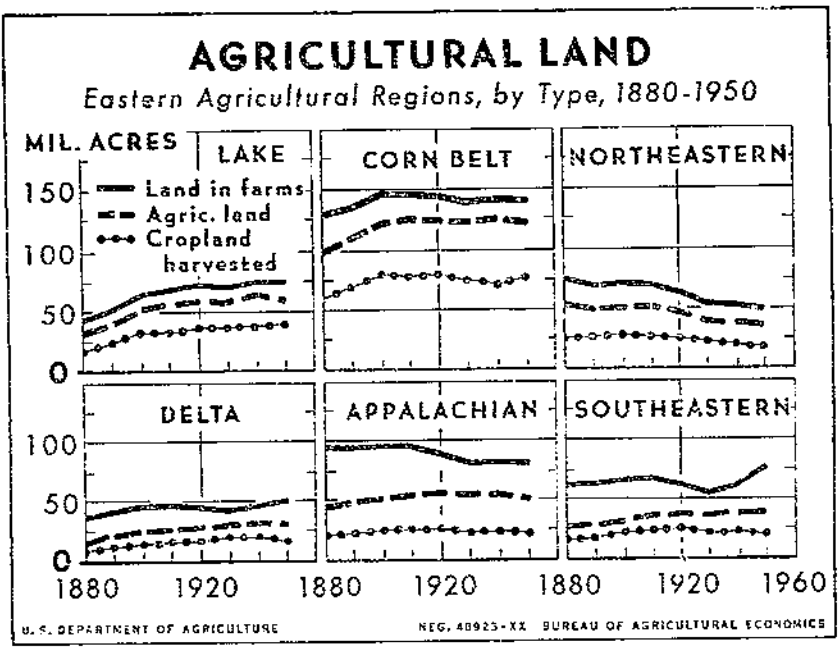

FIGURE 2.—From 1880 to 1940, in the New England and Middle Atlantic States, land in farms, agricultural or improved land, and crops harvested declined. From 1940 to 1950, an increase occurred so that the downward trend is apparently checked. From 1880 to 1920 the originally forested parts of the Central and Lake States showed consistent increases in land used for cultivated crops and pasture. Since 1920, a leveling off has occurred. In some parts of the South, such as the Mississippi Delta, the area used for farming has greatly increased because of clearing and drainage of new land, and in Texas through the plowing of grassland. In other areas in the Piedmont and hill sections of Virginia, Georgia, and Mississippi, large acreages of cropland have been converted to pasture and large tracts have been permitted to return to forest.

tracted. As agriculture pushed westward, the greater quantity of farm products needed were easily provided until about 1900. With the rapid rise in population, expansion of industry, and growth of cities, the cheaply exploitable new lands were taken up by about 1910.

Along with occupation of these western lands, came a short lag in farming on the older lands of the East. The greater demand and higher prices of World Wars I and II shortened this lag. Improved agricultural technology has contributed increasingly to improvement of farmland and to an enlarged output of farm products.

After 1910, also, our eastern cities began to need more of the fresh, perishable, and bulky food products than were produced in their localities. This caused a revival of agriculture in some areas of the East. Outlets developed for greater quantities of truck crops and fruits from the South and this region began to diversify its agriculture. More milk, poultry, and fresh vegetables were salable from New England and the Middle Atlantic States and thus many older farms were maintained in production. Some of the more successful farmers bought or rented additional land for pasture and crops, thus lessening

the costly process of abandonment of good land and buildings and reversion to brush and inferior tree growth.

Our Outlying Territories

In addition to the land area of the 48 States, or continental United States, there are the outlying territories of Alaska, Hawaii, Puerto Rico, the Virgin Islands, Guam, and American Samoa, and eight smaller inhabited islands. These territorial areas contain more than 372 million acres of land, or about a fifth as much as is contained in continental United States (table 2). Available estimates indicate that together the territories have about 2 million acres of improved cropland, 1.5 million acres of farm pasture, and 1.5 million acres of woodland and other land in farms, or a total of about 5 million acres of farmland.

Table 2.—*Use of land in the outlying territories of the United States, 1950* [1]

Land use	Acreage	Percentage of total
	1,000 acres	*Percent*
Cropland [2]	1,910	0.5
Farm pastures [2]	1,386	.4
Woodland and forest [3]	154,526	41.5
Other land [4]	214,223	57.6
Total land area [2]	372,045	100.0

[1] Alaska, American Samoa, Guam, Hawaii, Puerto Rico, and Virgin Islands. For data on each State and territory refer to Supplement to Major Uses of Land in the United States (U. S. D. A. Technical Bulletin 1082), Basic Land Use Statistics for the United States, 1950.

[2] U. S. Bureau of the Census, U. S. Census of Agriculture, 1950 (*59*), supplemented by information from publications of the Departments of Agriculture and Interior.

[3] More than 150 million acres of this woodland and forest area are in Alaska.

[4] This is chiefly tundra and other nonforest and nonagricultural land in northern Alaska.

Parts of Hawaii, Puerto Rico, and the Virgin Islands are intensively developed agriculturally and a great deal of their land is in cultivation or in pasture. The first two have about three-fourths of the territorial land that is used for agriculture. Land used for agriculture in Alaska is limited to small areas around the chief towns. About half of the land of Alaska is in forest and wild grassland. In the far north large areas of treeless tundra and semiwasteland abound.

In the text and tables that follow, data for the outlying territories are not included. The remainder of this report is devoted to the use of land in continental United States. Preservation of comparability of data between continental United States and the territories, makes it desirable to conform to previous reports which covered only the land in the 48 States. An additional report on the territories is needed to complete the land use picture of the United States and her territorial areas as a whole.

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THE BROAD CATEGORIES OF USE

A fourth of the land in continental United States is cropland and more than half is permanent pasture and grazing land. The remainder is covered with forest or is in miscellaneous other uses. In round numbers, the present distribution of the land area of the country among major uses is as follows: Cropland 409 million acres, including 15 million acres of wild hay, but excluding 69 million acres used only for pasture; grassland pasture, 700 million acres; woodland and forest, 606 million acres, including around 320 million acres of woodland pastured; and special uses and miscellaneous other areas 189 million acres.

Land Used for Agriculture

In 1950 acreage of land in farms and land used for grazing outside farms totaled 1,559 million acres, or more than four-fifths of the total land area of the country. Approximately 1,121 million acres, or 60 percent of the total, were used more or less exclusively for production of crops and livestock. In addition, there were woodland and forest areas subject to grazing, farm woodland, and miscellaneous other farm areas.

This leaves 345 million acres of land that are not used for agriculture. This land is made up of commercial forests, urban and special-use areas such as parks, wildlife refuges, highway, road and railroad rights-of-way, and military reservations.

Cropland

The acreage devoted to cropland has increased since World War II. During the last 5 years an average of about 6 million more acres has been used for this purpose than during the war. This increase was brought about by plowing up pasture and grazing land, and by clearing, draining, and irrigating additional land. These new estimates of major land uses are based on recent studies of land use made by the Land Grant Colleges and the United States Department of Agriculture (*62*), the 1950 Census of Agriculture (*60*), and data assembled from publications and records of the Bureau of Agricultural Economics and other Federal and State agencies.

Of the total cropland area, 387 million acres were used for crops in 1949, 22 million acres for cover and soil-improving crops, not harvested or pastured, and idle cropland. An additional 69 million acres of cropland were used for pasture. Thus, available for use as cropland were 478 million acres.[4]

However, only about 75 percent of this total area of cropland can be called really good land for cultivated crops. Lack of fertility, steep slopes, and either too much or too little water are rather severe handicaps on 25 percent or more of the land in cultivation.

Around 20 million acres of cropland in various parts of the country are idle each year because of wet weather, drought, lack of capital, soil erosion, low fertility, or other reasons. Much of this idle land could be improved by erosion control, cover crops, clearing of brush, drainage, or irrigation.

[4] As wild hay land is not ordinarily adapted to other field crops, it is excluded from some estimates of the cropland area available for cultivation.

The total tillable (arable) acreage in continental United States, including all cropland and permanent pasture feasible for cultivation without further improvement, is estimated to be in the neighborhood of 509 million acres.[5] Other countries which have large acreages of tillable land include Argentina, Australia, Brazil, Canada, China, France, Germany, India, Pakistan, and the Soviet Union. All of Europe, except for that part of the Soviet Union that lies in Europe, has only about four-fifths as much tillable land as the United States. The Soviet Union as a whole is reported to have about 500 million acres of tillable land (*17*).

Pasture and Grazing Lands

More than a billion acres (1,020 million acres), were grazed in continental United States in 1949. This acreage included 69 million acres of cropland used only for pasture, 631 million acres in permanent grassland pasture and grazing land, and some 320 million acres of woodland and forests grazed part of the year.[6] In addition, 80 to 90 million acres in planted fields are estimated to be pastured for short periods. These include fall and winter pasturage of small grain, and after-harvest pasturage of wheat, hay, and cornstalk and stubble fields. The acreage of crops pastured varies from year to year, depending upon the weather and the crop residues available. Considerably more than 90 percent of all pasture and rangeland is grazed for some period each year.

At present, more than a third of the feed for livestock comes from pasture and grazing land. The average yield per acre for unimproved grazing land, however, is low compared to that from cropland. Large areas of this land furnish pasture for only a few weeks in certain seasons of the year. More than a third of the grazing land is publicly owned. With respect to agriculture, much of it can be used only for grazing; it is not suitable for cultivated crops or for other intensive uses. Even though pasture and grazing lands have been improved by seeding and other practices, increased production from pasture has been less rapid than from cropland in recent years.

Approximately a third of the land area (606 million acres) of continental United States is covered by farm woodlands, commercial foresis, and other forested areas, exclusive of forests in parks and other special-use areas (*66*, p. 3). A little more than three-fourths of this is commercial forest land, and the remaining fourth is valuable chiefly for fuelwood, posts, cover, and grazing. More than a third of the forest land (215 million acres) is publicly owned under either

[5] In general, tillable or arable land, as used in the reports of the Food and Agriculture Organization of the United Nations (*17*) from which the above comparison is drawn, includes all acreage in crops, plus rotation pasture and meadow and fallow land. The term "permanent meadow and pasture" varies in definition from country to country, but it is believed to include most of the land used for grazing in some countries. Areas of tree and bush fruits are not available for all countries; consequently they are not always included in estimates of tillable land.

[6] The term "grassland" or "open pasture and grazing land" includes all land used primarily for pasture and grazing exclusive of the woodland and forest pastured or grazed. It includes the shrub and brushland types of pasture and grazing land such as sagebrush, mesquite, and other shrub types in the West, some scattered brushland pastures in the East, and all tame and wild or native grasses and legumes and other forage used for pasture or grazing.

Federal, State, or local government administration. Details on major uses of land in continental United States are shown in table 3 and figure 3.

URBAN AND OTHER AREAS

Urban and industrial areas, villages, parks, wildlife refuges, highway, road, and railroad rights-of-way through nonfarm areas, mili-

TABLE 3.—*Major uses of all land in continental United States, 1950* [1]

Land use	Acreage	Percentage of total
	Million acres	*Percent*
Land used for crops, pasture, and forest:		
Cropland used chiefly for crops:		
Cropland harvested, failure, and fallow	387	20. 3
Land in soil-improvement crops and idle cropland not harvested or pastured	22	1. 2
Total [2]	409	21. 5
Cropland used only for pasture	69	3. 6
Total cropland available for crops	478	25. 1
Pasture and grazing land, not cropland and not woodland	631	33. 2
Woodland and forest: [3]		
Pastured	320	16. 8
Not pastured	286	15. 0
Total	606	31. 8
Special use [4]	105	5. 5
Miscellaneous [5]	84	4. 4
Grand total	1, 904	100. 0

[1] Estimates based on data assembled from current records and reports of State and Federal agencies dealing with agriculture and public land management, and from the releases of the Bureau of the Census for the 1950 Census of Agriculture (*13, 60, 62, 66*).

[2] Total cropland used chiefly for crops in 1949; cropland harvested 355 million acres (including an estimated 11 million acres of crops, gardens, and orchards not otherwise reported, and 15 million acres of wild hay harvested); crop failure 10 million acres; summer fallow 22 million acres; cropland in soil-improvement and cover crops not harvested or pastured, or used for another crop 7 million acres; and temporarily idle cropland 15 million acres.

[3] Woodland and forest, excluding 14 million acres withdrawn from primary forest use for parks and other special public-use areas. The total woodland and forest area is approximately 620 million acres, according to the report, "Basic Forest Statistics for the United States, as of September 1950." (*66*) and more recent survey data available for Kentucky and Montana.

[4] Urban areas, towns, industrial sites, farmsteads and feed lots, highway and railroad rights-of-way, parks, wildlife refuges, airports, military reservations, and other special-use areas.

[5] Includes miscellaneous unaccounted-for areas, waste, rock, desert, sand dunes and other lands which now generally have low value for agricultural purposes but which have social utility for wildlife and recreational use and potential value for minerals.

For data on each major use for each State and Territory see publication listed in footnote 1, table 2.

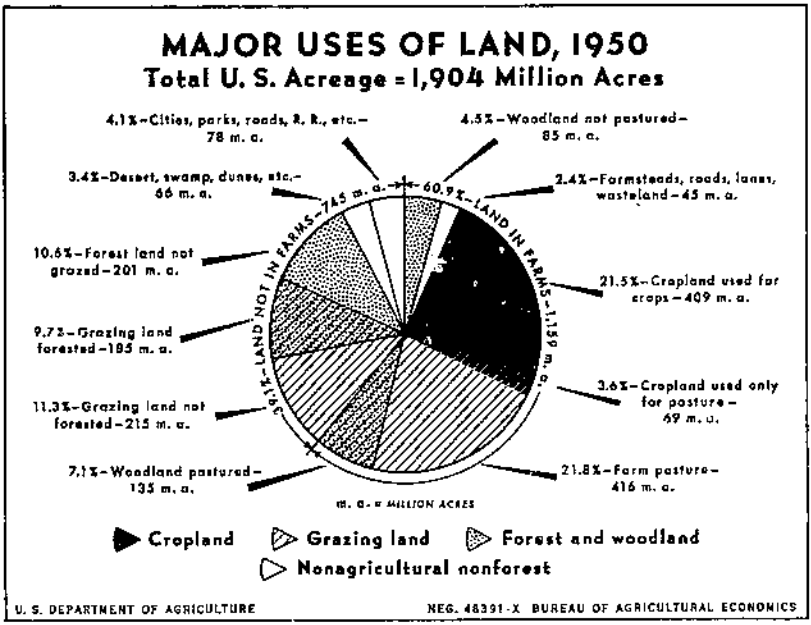

FIGURE 3.—A fourth of our country's land is cropland; half of it is pasture and grazing land; and a fourth is in forest not pastured and various other uses. Of the cropland, about 80 percent is used for crops each year, and much of the remainder is pastured in rotation with crops. All cropland is in farms, but the acreage of pasture and grazing land not in farms comprises two-fifths of the total pasture area. About 60 percent of the grazing land not in farms is publicly owned. Urban areas, residential and industrial sites, farmsteads, highways, roads, railroads, airports, parks, and other special uses are high in value. Finally, several million acres of semidesert, bare rock, marsh, and sand dunes are worth little for agricultural use, but they have utility for wildlife and recreational use.

tary reservations, and other special uses occupy about 78 million acres of land. Farmsteads, feed lots, farm roads, and highway rights-of-way through farmland take up 27 million acres. Miscellaneous other land, mostly of low value to agriculture, such as bare rock, sand dunes, salt flats, deserts, rough mountain peaks, open swamps, and severely eroded areas comprise the remainder. This miscellaneous land is variously estimated at about 84 million acres—18 million in farms and 66 million not in farms.

Growth of population and spread of residences, shopping centers, and factories into rural areas have called attention to these demands on the supply of land available for agriculture. Although exact figures are not available, records of incorporation of land into towns and cities, construction of factories, highways, airports and reservoirs, and new homes during the last 10 years show that probably as much as a million acres of rural land is absorbed annually by urban and related nonagricultural uses. Much of the land taken up for residential and urban purposes was tillable. As with agriculture, highways and urban developments tend to follow level and valley areas.

The importance of this increased use of land for essentially urban purposes is indicated by proposals for study of problems connected with this shift in land use in California, Michigan, and other States that have had recent large gains in urban development. "Know California's Land," published in 1952 by the California Department of Natural Resources and the United States Soil Conservation Service, mentions that an ever-increasing acreage of good land is used for urban development, highways, and other nonagricultural uses (*78*).

In 1950, estimates of areas occupied by cities, towns, villages, industrial sites, highways, railroads, commercial airports, reservoirs, and rural residences indicated that approximately 60 million acres, or around 1.5 acres per family, were required for living and working space (exclusive of farming, ranching, mining, and forestry). National and State parks, wildlife refuges, and national defense installations are not included in this estimate. Thus with the average increase in number of families per year of more than 600,000 between 1940 and 1950, as much as a million acres of additional land may have been absorbed annually for residential, commercial, and industrial purposes.

MAJOR LAND USE REGIONS

The 3 major geographic subdivisions and the 10 agricultural production regions of continental United States used in this report are as follows:

I. *Northern States*: (1) Northeastern States—Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont; (2) Corn Belt States—Illinois, Indiana, Iowa, Missouri, and Ohio; (3) Lake States—Michigan, Minnesota, and Wisconsin; and (4) Northern Plains States—Kansas, Nebraska, North Dakota, and South Dakota.

II. *Southern States:* (1) Appalachian States—Kentucky, North Carolina, Tennessee, Virginia, and West Virginia; (2) Southeastern States—Alabama, Florida, Georgia, and South Carolina; (3) Mississippi River Delta States—Arkansas, Louisiana, and Mississippi; and (4) Southern Plains States—Oklahoma and Texas.

III. *Western States*: (1) Mountain States—Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming; and (2) Pacific States—California, Oregon, and Washington.

The 10 agricultural production regions listed above are shown in figure 4.

From the viewpoint of possible use of land for crops, the 3 major geographic and the 10 production regions of continental United States require special consideration in a land-use inventory. In the originally forested counties of the Northeastern States, much acreage formerly cultivated has been used for residential and industrial purposes or has been permitted to revert to brush and woodland. Reasons for these shifts are the greater agricultural advantages of other sections of the country and the greater opportunities for employment in industrial occupations.

The Southern States also have had major changes in land use. In these States land has shifted from cotton to grain crops and improved pastures; crop yields are higher; and production of livestock is increasing. Some tillable cropland has reverted to forest in the Southeast and the crop acreage in the Mississippi Delta has expanded because of clearing and drainage and through irrigation in Texas. The fertile prairie lands of the Corn Belt and other North Central States

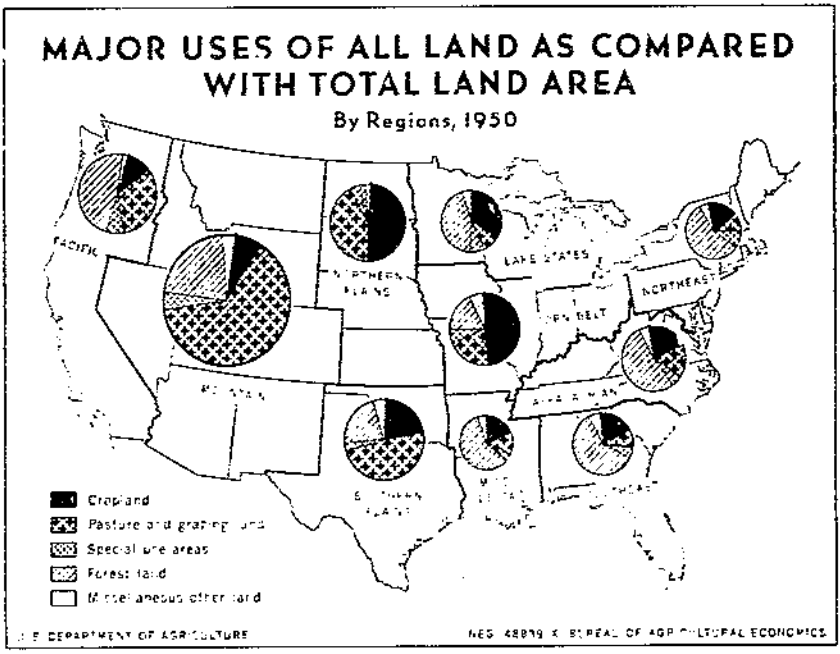

FIGURE 4.—Total acreage in cultivated crops and pasture varies greatly among regions. For example, nearly 50 percent of the Corn Belt and the northern Plains States is used for crops each year, while in the Northeast and the South only 20 percent is used for crops annually, and in the Mountain and Pacific States combined less than 10 percent is so used. Pasture, grazing land, and woodland and forests are inseparable from arable farming over immense acreages. The grazing land, both open and forested, that lies outside farms supplements land in farms. Altogether, 1,559 million acres (82 percent of the total land area) were used for production of food and fiber in 1949.

have continued to gain in agricultural production because of mechanization and other technological improvements. In the Western States changes have resulted from improvement for farming of extensive grazing lands and fertile valleys, plus development of newly irrigated lands to supply the demand for fruit, truck crops, and feed for the range-livestock industry.

UTILIZATION OF LAND BY REGIONS

Cropland and grassland pasture make up from 70 to 90 percent of the land area in the Corn Belt and the northern Plains, with about 45 percent in the Lake States. In the Northeastern and Southern

States east of Texas, cropland and grassland pasture comprise about 30 to 45 percent of the area. In addition, in the Southern States, more than 50 percent of the forest land is grazed at some time during the year. In the southern Plains States of Texas and Oklahoma forest areas are grazed to an even greater extent. Almost 70 percent of the southern Plains region is in cropland and grassland pasture and range. Approximately 65 percent of the land in the 11 Western States is in grassland and range, with additional areas of forest grazing. Only the three Pacific States have an equal division of land, with approximately half in cropland and nonforest pasture and half in forest.

The relative areas of cropland and grassland pasture and grazing land for the chief agricultural regions of continental United States are summarized in table 4 and figure 4.

More than half of the total cropland lies in the 12 North Central States. In these States the land is comparatively level, soils are productive, and the climate is usually favorable for production of crops. Almost 50 percent of the land area of the 5 Corn Belt States is used for crops. In the Lake States, a third of the land is devoted to production of crops; a fifth is so used in the other central and eastern regions; and a tenth or less is in such use in the 11 Western States (fig. 5).

TABLE 4.—*Major uses of land by regions, United States, 1950* [1]

Region [2]	Acreages in major uses					Total land area [8]
	Cropland [3]	Pasture and grazing land [4]	Forest land [5]	Special use areas [6]	Miscellaneous other land [7]	
	1,000 acres	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*
Northern:						
Northeastern	20,340	11,145	62,759	11,713	6,421	112,378
Lake States	40,680	11,881	54,562	9,184	6,404	122,711
Corn Belt	81,017	31,502	29,455	10,507	12,902	165,383
Northern Plains	95,994	81,727	4,718	7,744	5,249	195,432
Total	238,031	136,255	151,494	39,148	30,976	595,904
Southern:						
Appalachian	26,158	20,320	64,476	7,421	6,253	124,628
Southeastern	23,616	11,079	74,926	7,572	7,049	124,242
Mississippi Delta	18,403	11,897	52,715	4,348	5,492	92,855
Southern Plains	45,026	103,022	47,184	7,068	10,528	212,828
Total	113,203	146,318	239,301	26,409	29,322	554,553
Western:						
Mountain	35,463	352,073	117,615	24,366	19,152	548,669
Pacific	21,809	65,764	97,160	15,196	4,770	204,699
Total	57,272	417,837	214,775	39,562	23,922	753,368
United States	408,506	700,410	605,570	105,119	84,220	1,903,825

See footnotes at end of table.

TABLE 4.—*Major uses of land by regions, United States, 1950* [1]—Con.

Region [2]	Percentage of total land area					
	Cropland [3]	Pasture and grazing land [4]	Forest land [5]	Special use areas [6]	Miscellaneous other land [7]	Total land area [8]
Northern:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Northeastern	18.1	9.9	55.9	10.4	5.7	100.0
Lake States	33.1	9.7	44.5	7.5	5.2	100.0
Corn Belt	49.0	19.0	17.8	6.4	7.8	100.0
Northern Plains	49.1	41.8	2.4	4.0	2.7	100.0
Total	39.9	22.9	25.4	6.6	5.2	100.0
Southern:						
Appalachian	21.0	16.3	51.7	6.0	5.0	100.0
Southeastern	19.0	8.9	60.3	6.1	5.7	100.0
Mississippi Delta	19.8	12.8	56.8	4.7	5.9	100.0
Southern Plains	21.2	48.4	22.2	3.3	4.9	100.0
Total	20.4	26.4	43.1	4.8	5.3	100.0
Western:						
Mountain	6.5	64.2	21.4	4.4	3.5	100.0
Pacific	10.7	32.1	47.5	7.4	2.3	100.0
Total	7.6	55.5	28.5	5.2	3.2	100.0
United States	21.5	36.8	31.8	5.5	4.4	100.0

[1] Compiled from Census of Agriculture, 1950; publications and records of the Bureau of Agricultural Economics and Federal and State land-management and conservation agencies.

[2] For lists of States and regions, see p. 12.

[3] Cropland harvested, crop failure, and cropland fallow or idle and in cover or soil-improvement crops in 1949, from the U. S. Census of Agriculture, 1950 (*60*).

[4] Pasture and grazing land (nonforested) in farms, including cropland used only for pasture as reported by the U. S. Census of Agriculture, 1950; plus estimates of open or nonforested grazing land not in farms from Federal and State land-management and conservation agencies.

[5] Woodland and forest areas from the U. S. Forest Service exclusive of woodland and forests in parks and certain other special-use areas.

[6] Estimates of areas in highways, roads, and railroad rights-of-way; farmsteads; urban and town areas; parks, wildlife refuges; airports and military posts, etc.

[7] Miscellaneous unaccounted-for areas, including marshes, sand dunes, bare rock and desert.

[8] Approximate land area as reported by the 1950 Census of Agriculture.

About 85 percent of the total land in continental United States used for grassland pasture and range lies in the Mountain and Plains States. More than half of the total grassland pasture and range is in the Mountain States. Here, three-fifths of the land area is devoted to this use. Open grazing and pasture lands occupy nearly half of the land area in the southern Plains; more than two-fifths in the northern Plains; almost a third in the Pacific States; approximately a fourth in the Lake States; and about a tenth or less in most other regions.

The greater part of the forest and woodland suitable for grazing is found in the Southern and Western States. More than 60 percent of

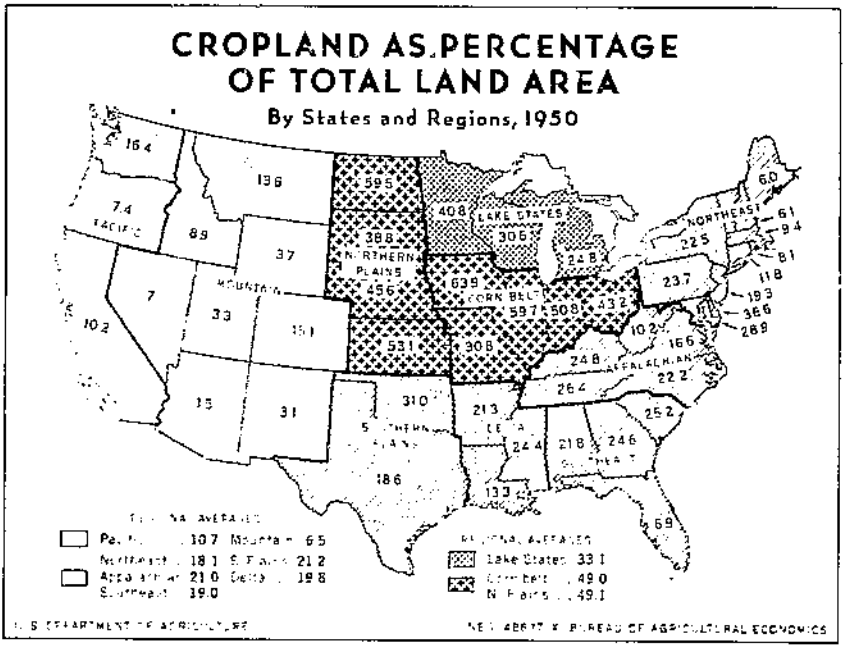

FIGURE 5.—In 1950 approximately a fourth of the total land area of the United States was cropland. This map shows the general distribution of all cropland used for crops. Cropland used only for pasture is not shown. More than 40 percent of the cropland was concentrated in the nine Corn Belt and northern Great Plains States. More than half the total land area in Iowa, Illinois, Indiana, North Dakota, and Kansas was used for crops. The Western States occupied two-fifths of the land area but contained only slightly more than an eighth of the land used for crops. Texas, although it had the largest acreage of cropland of any State, used less than a fifth of its total area for this purpose.

the woodland area in these regions is grazed. More than 40 percent of grazed forest and woodland lies in the Western States. The Southern and Western States account for 85 percent of the total area in multiple pasture and forest uses. Only in the Southern States, however, does woodland used for grazing make up half or more of the total pastured acreage.

Crops and open grassland pasture are complementary uses in the sense that they jointly contribute to production of livestock and livestock products and are more or less interchangeable in the process. In 1947 it was estimated that 34 percent of the total feed units used for livestock were supplied by pasture and range (*25*). When pasture is converted to a cropland equivalent by computing the acreage of tame hay required to provide feed supplied by pasture, it equals about 150 million acres of cropland. Thus the pasture-equivalent, plus cropland used for crops in 1945–49, makes a total cropland-equivalent area of approximately 560 million acres. The acreage of land used for pasture in producing livestock products may be greatly reduced by using supplementary feed produced on arable land, or vice versa. Therefore, requirements for pasture land are somewhat more variable than are those of land for arable use.

UTILIZATION OF LAND FOR CROPS, PASTURE, AND FORESTS

Land in Farms and Land Not in Farms

Land used for agriculture in continental United States customarily is divided into two broad classes: (1) Land in farms; and (2) land not in farms. Roughly three-fifths of the total area of land in continental United States, or 1,159 million acres, is in farms, and two-fifths, or 745 million acres, is not in farms (table 5) (*60*).[7] All land not included in the Censuses of Agriculture as land in farms is classified as land not in farms. Most of the privately owned land, including Indian land used primarily for agriculture and about 50 million acres of publicly owned land, is operated in farms and ranches, or in such close connection with them that it is usually characterized as land in farms. In the West and South, however, large acreages of grazing land, woodland, and forest not in farms, both private and public, supply considerable pasturage for cattle and sheep at certain seasons of the year.

All the cropland and nearly all the improved pasture are in farms.[8] As shown in table 5 large acreages of unimproved pasture and woodland are also contained in farms. Farmsteads, feed lots, road and ditch rights-of-way and other service uses occupy several million acres of farmland. In the Corn Belt and other fertile cropland regions farm boundaries are easily identified and it can be seen that nearly all the land used for agricultural purposes is in farms. In the range country of the West and the forest areas of the East it is often difficult to distinguish farm and ranch land from other rural land.

More than half of the land not in farms, or 400 million acres, is used for grazing. But much of this large area is used jointly for other purposes, including forests, wild game preserves, and watersheds to supply water for irrigation, power, and other uses. Ungrazed forest, primarily commercial timber, covers a little more than 200 million acres not in farms. The remaining acreage not in farms is in special uses and miscellaneous areas. Urban and industrial areas, villages, parks, wildlife refuges, highway and railroad rights-of-way, and other special uses occupy nearly 78 million acres. Miscellaneous other areas, such as ungrazed desert, rock, sand, rough mountain peaks, and wasteland comprise the remainder, which is estimated at 66 million acres.

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[7] *Farms:* In the 1950 Census of Agriculture, places of 3 or more acres were counted as farms if the value of agricultural products, exclusive of home gardens, amounted to $150 or more in 1949. Places of less than 3 acres were counted as farms only if the value of sales of agricultural products amounted to $150 or more in 1949. All land controlled by an individual or by a partnership was included as one farm. Control may have been through ownership, or through lease, rental, or cropping arrangements. (As used here the term, "farm," or "farms," also includes ranches.)

[8] Acreage designated "land in farms" in the 1950 Census of Agriculture includes land actually under cultivation, land used for pasture or grazing, and woodland owned by farm operators or included in tracts rented from others, unless such land was held for other than agricultural purposes or unless the acreage of such land held by an individual farm operator was unusually large. In such cases, any woodland and wasteland not grazed in excess of the acreage used for agricultural purposes, generally was excluded from the farm area. Except for range and grazing lands used under Government permit, grazing land attached to farms and ranches or used with them was included as land in farms (*60*).

TABLE 5.—*Major uses of land in farms and not in farms, continental United States, 1950*

Land use [1]	In farms	Not in farms	Total acreage	Percentage of total
	Million acres	*Million acres*	*Million acres*	*Percent*
Cropland:				
Used chiefly for crops	409	----------	409	21. 5
Used only for pasture	69	----------	69	3. 6
Total [2]	478	----------	478	25. 1
Pasture and grazing land:				
Open pasture and grazing land	416	215	631	33. 1
Woodland pastured	135	185	320	16. 8
Total	551	[3] 400	951	49. 9
Forest and woodland not pastured	85	201	[4] 286	15. 1
Special use areas	[5] 27	[6] 78	105	5. 5
Miscellaneous other land	18	66	[7] 84	4. 4
Grand total	1, 159	745	1, 904	100. 0

[1] Estimates of major uses of land in continental United States based on data assembled by the Bureau of Agricultural Economics, and from releases from the 1950 Census of Agriculture (*60*); and reports of the Land Grant College—United States Department of Agriculture, Agricultural Productive Capacity Survey, 1951 (*62*).

[2] Total acreages of land are for the calendar-year 1950. Acreages of cropland and pasture are for 1949.

[3] Land not in farms estimated to have been actually pastured at some time during the preceding year 1949. Grazing land not in farms consisted of 215 million acres of open grassland and shrubs and 185 million acres of forest and woodland. Some 20 to 25 million acres or more of additional land are believed to contain areas of grass or other forage of value for grazing that were not used during the year. Accordingly, estimates of land grazed that is not in farms are subject to revision.

[4] The total woodland and forest land in farms and not in farms including that pastured and not pastured, covers about 606 million acres, including 457 million acres of commercial forest; and 149 million acres of noncommercial woodland; and exclusive of 14 million acres of forested areas set apart for parks and other special uses.

[5] Farmsteads, feed lots, lanes, ditches, roads, highways, and miscellaneous other areas in farms.

[6] Other land not in farms includes about 78 million acres of urban areas, industrial sites, parks, road and other rights-of-way, and other special-use areas.

[7] Miscellaneous other land areas, including barren land, rock, open marsh, sand dunes, and desert.

Of the grazing land outside farms, 215 million acres are open or nonforested land and 185 million acres are in woodland and forest. A large part of the 215 million acres of nonforested grazing land outside farms is publicly administered, although most of it is used by farmers and ranchers in connection with their privately owned land. About 250 million acres of the grazing land not in farms is public land (*13*, pp. 21–34, 47–50). Of the forested land grazed outside farms, around 100 million acres are publicly owned and adminis-

tered by State, Federal, or local Governments. Most of the Federal grazing land outside farms is privately used under a grazing-permit system.

Nearly 60 percent of all land not in farms in continental United States is in the 11 Western States. A little more than a fifth lies in the South and the remainder is in the Northern States. The percentage of the total land area not in farms is about 25 to 30 percent in the North and the South, whereas in the West considerably more than half of the area of land is not in farms.

Most of the nonforest grazing land not in farms is western public land. Small scattered areas of nonforest grazing land are found in the South, especially along the Gulf Coast. For the most part these areas are included in the forest and brushland areas grazed. Much of the noncommercial woodland grazed is also in the West. This consists for the most part of arid woodland and brushland grazed in the Mountain and Southwestern States. Texas also contains large acreages of semiarid woodland pasture.

In the South, including Texas and Oklahoma, are some 239 million acres of forested land. About 60 percent, or 140 to 150 million acres, have some value for grazing, for at least a part of the year. Not all of the total forested area having forage of value for grazing, however, is grazed regularly. Of the farm-woodland area in the South, 55 percent is pastured. Of the 220 million acres of farm woodland in the country as a whole, 135 million acres, or three-fifths, were reported by the Census of Agriculture as pastured in 1950.

Commercial timberland grazed in the West is both privately and publicly owned, the latter predominating, whereas that in the South is largely in private ownership. Grazing on commercial timberland in some sections is not extensive. In others, particularly in parts of the South, forest land is grazed the greater part of the year, although the forage is highly nutritious for only a few weeks in spring and early summer. Although the relatively limited areas in openings of grass, cane and weeds throughout the forests are important sources of forage, in most forested areas a great part of the forage actually is obtained in the forests themselves. Some openings or parks and scattered, thinly stocked timber areas are heavily grazed, more so than forage under the trees. Also, acre for acre, they probably produce more forage. But the total forage obtained on openings and parks often is small compared with that from the forests, because of the relatively large acreage of the latter.

How Cropland Is Used

The acreage of cropland used for crops is made up of cropland harvested, crop failure, summer fallow, and soil-improvement crops. Acreages of farm gardens, orchards, citrus groves, vineyards, and planted nut trees are included in cropland used for crops. Ordinarily acreages of soil-improvement crops not used for any other purpose, are not enumerated in the acreage of cropland used, although they are necessary factors in production in the South and are similar to the practice of cultivated summer fallow preparatory to seeding wheat in dryland farming areas.

From 1948 to 1952 an average of 379 million acres of cropland were used to produce crops (table 6). Wild hay accounted for 15 million

acres of the total for each year. In addition to the acreage used to produce harvested crops, from 7 to 8 million acres were estimated to be in cover and soil-improvement crops, which were neither harvested, pastured, nor plowed under and used for a different crop in the same year. About 20 million acres of cropland were idle. Rotation pasture and other cropland used for pasture occupied about 70 million acres. Thus, there were 480 million acres of land in the cropland rotation.

TABLE 6.—*Cropland: Cropland harvested, failure, fallow, pasture, idle and other cropland, United States, 1948–52* [1]

Cropland use	Acreage					
	1948	1949	1950	1951	1952	Average 1948–52
	Million acres	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*
Cropland:						
Harvested [2]	351	355	340	339	344	346
Crop failure [3]	8	10	11	16	11	11
Summer fallow [4]	19	22	23	24	24	22
Total	378	387	374	379	379	379
Used for pasture [5]	68	69	70	71	72	70
Other [6]	30	22	36	32	33	31
Grand total	476	478	480	482	484	480

[1] Estimates based on annual data assembled by the Bureau of Agricultural Economics; Releases of the 1950 Census of Agriculture (*60*); and Reports of the 1951 Land Grant College—U. S. Dept. of Agriculture, Agricultural Productive Capacity Survey (*62*).

[2] Cropland harvested, including an estimated total of 8 to 11 million acres in crops, gardens, orchards, citrus groves, vineyards, and planted nut trees not otherwise reported; and 14 to 15 million acres of wild hay.

[3] Cropland on which there was complete crop failure, not harvested, pastured, or planted in another crop.

[4] Cropland cultivated to conserve moisture, kill weeds, or otherwise prepared for a crop.

[5] Cropland used for pasture includes rotation pasture and other pasture land used for cultivated crops. However, it does not include all plowable pasture.

[6] Other cropland includes an estimated total of 7 to 8 million acres in cover and soil-improvement crops not harvested, or pastured and not plowed under and used for another crop during the crop year, with the remainder of idle land.

Cropland cultivated as summer fallow, to store moisture and kill weeds preparatory to seeding, covered about 22 million acres. This acreage is rightly considered as land used for crops. When summer fallow and soil-improvement crops are included in the acreage of cropland used for cultivated crops, the acreage used from 1948 to 1952 ranged from approximately 385 to 390 million acres.

Reported acreages of cropland fluctuate as new land is developed, permanent pasture or grazing land is plowed up and seeded, or when cropland becomes permanent pasture. Cropland is also put to other more intensive uses, such as residential and industrial. In some areas

cropland is abandoned and allowed to lie bare or to revert to forest; or it is planted with trees.[9]

ACREAGES USED FOR PRINCIPAL CROPS.—From 1946 to 1952, acreages of the 52 principal crops planted or grown (including 15 million acres of wild hay) ranged from 353 million acres in 1946 to 365 million in 1949, a 4-percent fluctuation. For the 7 years, acreages in these crops averaged 358 million acres. This included acreages of both tame and wild hay. It also included some land planted to two or more crops in the same year. Therefore, this figure is not comparable with those given in table 7, in which multiple-use acreages were excluded.

Fruits, planted nuts, and minor crops added 8 million acres to the crop acreages planted or grown, making a total of 366 million acres of crops planted or grown, exclusive of cover and soil-improvement crops and cropland used for pasture. When adjustments of 8 million acres are made for multiple cropping, cropland actually used for crops amounted to 358 million acres. This included wild hay but excluded cover crops and fallow.

Turning from acreages of crops planted to acreages harvested, records show that the 52 principal crops harvested in the United States increased from an average of 334.7 million acres in 1930–39 to an average of 346.9 million in 1945–49, a 13.2 million-acre increase (table 7). Increases were greater in the Corn Belt and the northern Plains than in the other major eastern and central regions. In the Western States the increase was large also.

From 1949 to 1951 the total harvested acreage of the 52 principal crops dropped to approximately 336 million acres because of several factors, which included reductions in acreages of wheat and cotton planted in 1950 and the considerable crop losses caused by adverse weather in 1951. This was a drop of more than 10 million acres from the 1945–49 average harvested acreage. It resulted in depletion of stocks carried over from previous years. But in 1952, the larger acreage planted resulted in a harvested acreage of 340.9 million acres.

CHANGES IN USE OF CROPLAND, 1920–50.—Although the total acreage of cropland increased only slightly during this period, significant changes occurred. New lands were developed and added and some of the old cropland was abandoned or converted into other uses. Perhaps most important were the increases in acreages of legume hays, cover, and other close-growing crops, as contrasted with acreages of intertilled crops. Summer fallowing in the Great Plains and the Western States was practiced on larger acreages preparatory to seeding wheat. At the same time, acreages of wheat were increased in the northern Plains and Northwestern States by breaking grazing land.

[9] Definitions and classifications of cropland also vary among reports for different purposes. Usually the descriptions of cropland list the particular uses included: One widely used definition of cropland available includes in its scope the total of cropland harvested, crop failure, summer fallow, cropland used only for pasture, acreage used solely for cover and soil-improvement crops, and idle cropland (*60, 62, 71, 75*, pp. 1–4). This definition of cropland was followed in compiling the information given in table 6. But as indicated in other parts of this report—for example, in tables 1 to 4—figures on cropland used for crops include cropland used only for pasture as a separate item. In table 6, cropland used includes cropland harvested, land on which there was crop failure, and summer fallow land.

TABLE 7.—*Acreage of the 52 principal crops harvested, by regions, United States, averages 1930–49, annual 1952*

Region [1]	Average			1952 [3]
	1930–39 [2]	1940–44 [2]	1945–49 [2]	
Northern:	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*
Northeastern	19, 325	18, 896	18, 224	17, 210
Lake	36, 023	36, 720	37, 585	37, 325
Corn Belt	72, 723	73, 311	76, 344	77, 818
Northern Plains	69, 474	74, 839	80, 863	81, 666
Total	197, 545	203, 766	213, 016	214, 019
Southern:				
Appalachian	22, 747	23, 293	22, 026	20, 805
Southeastern	23, 624	21, 642	18, 179	16, 657
Mississippi Delta	17, 369	17, 359	15, 114	13, 979
Southern Plains	41, 481	40, 610	40, 606	35, 441
Total	105, 221	102, 904	95, 925	86, 882
Western:				
Mountain	19, 581	22, 163	24, 288	25, 688
Pacific	11, 323	12, 608	13, 708	14, 346
Total	30, 904	34, 771	37, 996	40, 034
United States	333, 670	341, 441	346, 937	340, 935

[1] For lists of States by regions see p. 12.

[2] United States Department of Agriculture, Agricultural Statistics, 1936, 1942 and 1952 (*64*). For some years, especially 1936 to 1939, included are 44 crops and 45 crops respectively. If the acreages for the additional 7 to 8 crops were included the total acreage for the 52 crops for these years would be approximately 1 million acres greater.

[3] Revised acreages, Bureau of Agricultural Economics, 1952, Crop Production Annual Summary, 1952 (*58*), and similar sources, published and unpublished data.

Acreages of cotton and other intertilled crops declined substantially in the Southeastern States. Part of the acreage that was released from cotton was planted to corn, hay, and many other crops, including pasture. The acreage of cotton increased to some extent in the Mississippi Delta, the Texas High Plains, New Mexico, Arizona, and especially in California. In Florida and California larger acreages were planted to citrus and truck crops. Utilization of cropland in intertilled, close-growing, and sod crops at different periods from 1928–32 to 1950 is shown in figure 6.

In the Corn Belt and the Great Plains, increased acreages have resulted from planting pasture, grazing, and idle land to grain crops. In the Western States some grazing land has been seeded to wheat. New cropland is being added by irrigation developments that supply water for larger acreages of truck crops, fruit, sugar beets, potatoes, cotton, and other crops. Irrigation has also contributed to the increases in acreages planted in western Texas and in the Southwest generally. Growth of cities and of industrial uses has absorbed much

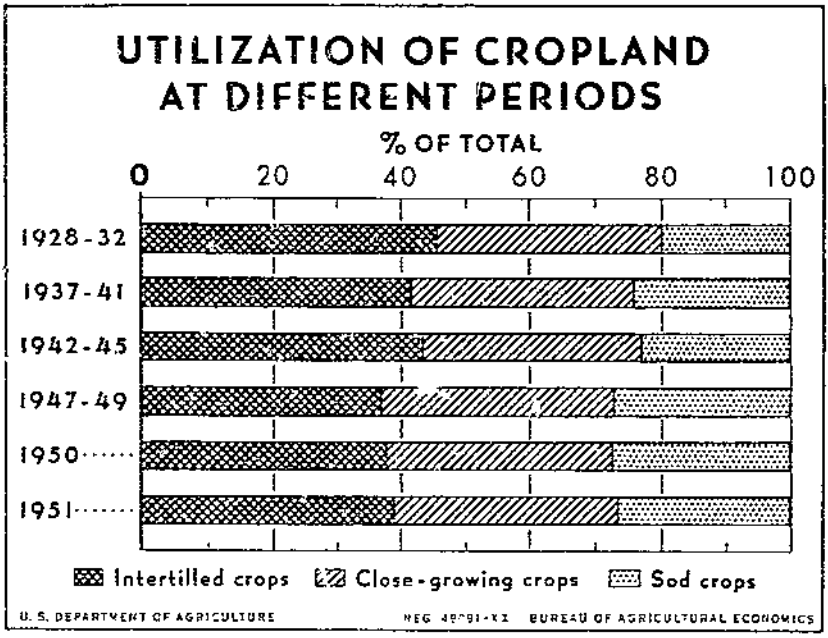

FIGURE 6.—From 1928 to 1952, when viewed as a whole, acreages of intertilled crops decreased; acreages of close-growing crops stayed about the same; and sod crops more than held their own. But there were ups and downs. From 1934 to 1936 drought cut the sod and close-growing crops. From 1939 to 1944, war demands increased intertilled crops. From 1946 to 1952 growth of population and foreign needs absorbed the products of moderately increasing acreages of all groups of crops. The increasing acreages of cropland devoted to close-growing and sod crops in recent years may be accounted for chiefly by the greater demand for meat and dairy products and the efforts to use cropping programs designed to maintain soil resources.

irrigated cropland in California, where in the last few years population has greatly increased. Clearing, drainage, and flood-control measures have resulted in expansion of the acreage of cropland planted as well as the acreages of improved pasture in the Mississippi Delta.

Acreages planted in the Northeastern and Lake States recently have remained fairly stable, whereas, in some areas of the Appalachian and Southeastern States, acreages planted have decreased. Extensive improvement of land is under way in the East by reversion to brush and forest and shifts to residential and industrial uses are almost equally extensive (*80*). Much of the land developed and improved goes into pasture rather than cropland. Cropland also is being seeded to pasture; therefore, it is no longer reported as cropland planted.

MEETING INCREASED NEEDS FOR CROPLAND

Among the main factors contributing to the increased farm production without a corresponding increase in acreage of cropland are the following: (1) Improvement of existing crop and pasture lands by drainage, irrigation, and other types of land improvement; (2) transfer of crops to more productive lands both within farms and between

areas and regions; (3) increased use of fertilizer and lime; (4) improved crop varieties and better livestock; (5) more effective control of plant and livestock diseases and pests; (6) widespread farm mechanization; and (7) a favorable price-cost relationship that made it possible for farmers to pay for these additional inputs.

By reducing the cost of producing wheat and corn, tractors, combines and cornpickers have indirectly promoted a shift from grazing to more wheat in the Great Plains and the Western States and to more corn in the North Central States. Likewise, the adoption of machinery and improved techniques, in the production of cotton in the Mississippi Delta, West Texas, and the Southwest have indirectly influenced the change from cotton to more corn, hay and pastures, and livestock production in the Appalachian and Southeastern States. Increased efficiency of livestock in utilizing feed and other causes has resulted in a saving of perhaps 50 million acres of cropland. These changes were accompanied by generally favorable prices for farm products and rising costs of operation from 1940 to 1952, which accelerated the recession of cultivated crop farming from hill, eroding, and inherently poor lands and concentration on the more fertile lands.

Much has been said about the remarkable achievement in expanding farm output by nearly a third since 1940. This expanded production has been attributed largely to mechanization, fertilization, and improvement in crop production. These are important factors. But it has not always been pointed out that drainage of 17 million acres and irrigation of 8 million acres of additional farmlands, extensive improvement of existing farm drainage in the South and in the Corn Belt, and provision of supplemental irrigation water in many areas where needed in the West, have also played important parts in this increased farm output.

Among the things necessary for abundant crop and pasture production are: Getting excess water off the land at certain seasons in some fertile Eastern areas; and, in contrast, getting needed water to the land in the right amount and at the right time in Western areas where irrigation is feasible. Virtually little arable cropping would be possible in some of our Western States without irrigation. In Nevada, Arizona, and Utah from 90 to nearly 100 percent of all crops are grown by irrigation, while around three-fourths or better of the production of crops in California, Idaho, and Wyoming are produced on irrigated land, and two-thirds in New Mexico and Colorado are grown under irrigation. Extensive public drainage systems serve 50 million acres of farmland in the Corn Belt and Lake States and 35 million acres in the South. Crop losses have been materially reduced on much of this land by drainage.

Although population increased by almost 20 million from 1940 to 1950, the acreage of cropland used for domestic consumption remained at a little more than 2 acres per capita and pasture and grazing land at about 6 acres per capita. These are the lowest per capita acreages in our history. So far the needs of our people for food and other products of the land have been supplied with only a moderate increase in new cropland, as a result of the increased production of crop and livestock products, the shifts in consumption to products requiring fewer acres, and the number of acres released for crops for human use, through substitution of tractors for horses and mules. Numbers of

horses and mules are at an all-time low and only a few million more acres of cropland can be released for production of food by substituting tractors for the remaining workstock.

Therefore, today agriculture has reached a point at which future additional gains must come from higher per acre yields and from greater livestock production per animal unit, or the acreage planted to crops must be increased.

How, then, are we to obtain the additional cropland when needed in the longer-term future? Some additional acreage could be obtained by planting to crops more of the pasture and idle cropland, as was done in 1951 and 1952. Drawing upon the acreage of plowable pasture could further expand the acreage used for crops. But this would probably reduce pasture production and would interfere with long-time soil-improvement rotations, unless more pastures were fertilized and seeded. Thus the gain in production that would result from planting pastureland to crops would not equal the gain that might be obtained from entirely new cropland.

If we are to meet the future needs of our expanding population, the solution apparently lies in continuing to increase yields per acre on present crop and pasture land and in improving a moderate acreage of new land for cultivation.

Effects of Higher Production Per Acre.—In 1951 crop production was the third largest of record; it was exceeded only in 1948 and 1949. Production of crops was high also in 1952, when it ranked fourth largest in history. This crop output exceeded the average of the previous 10 years, the most productive period in our agriculture. Farmers attained these results despite heavy abandonments in acreages of several important crops and growing seasons which in many respects were unfavorable. The average yield per acre in 1951 was the second best of record; it was exceeded only in 1948. A prolonged fall season for maturing and harvesting crops helped to improve both the quantity and quality of the outturn.

Although the total acreage of cropland planted has changed very little since 1920, higher yields per acre have contributed materially to greater farm production. These higher yields resulted primarily from increased use of fertilizer, more productive hybrids and varieties of seeds, more spraying and dusting, application of soil-improvement and conservation practices, additional irrigation and drainage, and more favorable weather in recent years. On the livestock side, both the greater number of breeding units and higher production per unit have increased production of meat animals and animal products. Our farms are equipped for high production and the possibilities of farm technology are far from exhausted (*27*).

As a result of varying combinations of these factors, average yields of wheat from 1945 to 1949 were nearly a fourth higher than in 1920–39; yields of corn were up about a third; and yields of tame hay showed a 15-percent increase (table 8 and fig. 7).

The feed value of hay has been greatly improved. More high-protein legume hays are produced and this in turn has contributed in part to an increase of 15 to 20 percent in production per animal unit. Yields per acre of many principal crops in 1951 were lower than the record yields in 1948, although they were virtually the same as those of 1950; and only slightly lower than those of 1949 and 1946.

TABLE 8.—*Specified crops: Yields per harvested acre, averages 1910–49, annual 1950 and 1951*

Crops	Unit	Average yields per harvested acre				
		1910–14	1915–19	1920–24	1925–29	1930–34
Wheat	Bushel	14.4	13.9	13.8	14.1	13.5
Rye	Bushel	13.2	12.1	13.4	11.8	10.6
Rice	Pound	1,611.0	1,746.0	1,768.5	1,930.5	2,119.0
Buckwheat	Bushel	16.8	15.1	17.0	15.8	16.0
Corn	Bushel	26.0	25.9	27.3	26.4	22.1
Oats	Bushel	29.3	32.5	29.8	29.5	26.3
Barley	Bushel	21.6	23.1	22.1	23.3	20.1
Sorghum (grain) [1]	Bushel			17.6	16.8	13.1
Soybeans [2]	Bushel				12.6	14.3
Cotton lint	Pound	209.9	175.6	161.9	179.2	192.5
Peanuts	Pound	796.4	740.6	679.9	723.1	671.4
Flaxseed	Bushel	7.6	6.9	8.2	7.1	5.5
Beans, dry (edible)	Pound	777.7	645.3	667.2	655.5	714.1
Potatoes (Irish)	Bushel	99.7	94.8	107.6	114.0	107.6
Sweetpotatoes	Bushel	94.4	97.3	92.8	93.9	81.1
Sugar beets [3]	Ton		9.6	9.8	10.9	11.1
Tobacco	Pound	815.7	802.7	772.9	772.5	784.1
All hay	Ton	1.1	1.2	1.2	1.2	1.1
Wild hay	Ton	0.9	0.9	0.9	0.8	0.7
Tame hay	Ton	1.2	1.4	1.3	1.3	1.0

Crops	Unit	1935–39	1940–44	1945–49	1950	1951
Wheat	Bushel	13.2	17.1	16.9	16.5	16.1
Rye	Bushel	12.1	12.2	12.5	12.3	12.5
Rice	Pound	2,234.0	2,046.0	2,117.0	2,388.0	2,250.0
Buckwheat	Bushel	16.1	17.5	16.9	17.5	16.6
Corn	Bushel	25.0	32.0	35.7	37.4	36.2
Oats	Bushel	29.2	31.8	34.3	34.6	36.1
Barley	Bushel	22.1	23.7	25.5	27.2	27.1
Sorghum (grain) [1]	Bushel	12.8	17.4	17.9	22.6	18.9
Soybeans [2]	Bushel	18.5	18.3	19.6	21.7	21.2
Cotton lint	Pound	236.6	271.8	284.7	269.0	274.5
Peanuts	Pound	741.1	697.0	684.0	893.0	802.0
Flaxseed	Bushel	7.6	9.2	9.8	9.8	8.7
Beans, dry (edible)	Pound	854.7	897.9	1,026.0	1,117.0	1,231.0
Potatoes (Irish)	Bushel	117.2	136.7	196.5	253.4	240.7
Sweetpotatoes	Bushel	84.9	87.4	97.1	101.2	91.8
Sugarbeets [3]	Ton	11.6	12.7	13.6	14.6	15.1
Tobacco	Pound	886.5	1,026.0	1,176.0	1,270.0	1,281.0
All hay	Ton	1.2	1.3	1.3	1.4	1.5
Wild hay	Ton	.8	.9	.9	.8	.9
Tame hay	Ton	1.3	1.4	1.5	1.5	1.6

[1] Data not available until 1920.
[2] Data not available until 1924.
[3] Data not available until 1913.

United States Department of Agriculture, Agricultural Statistics, 1936, 1942, and 1952 (*64*) and Crop Production, Annual Summary 1952 (*58*).

The aggregate volume of crop production in 1951 was high compared to most recent years—129 percent of the 1935–39 average. This index was below the record 131 percent in 1948. It was equal to that of 1949, but it exceeded that of any other season.

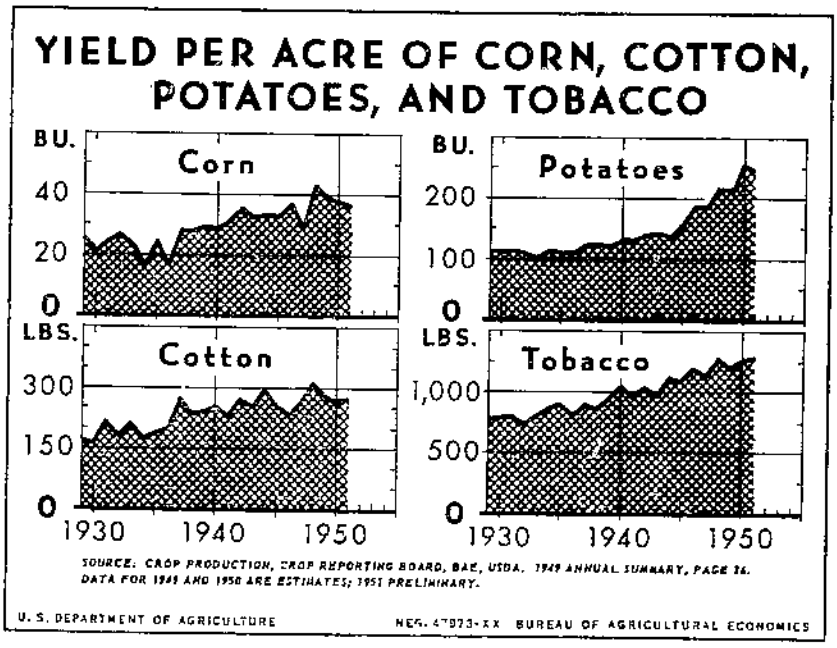

FIGURE 7.—In the last 15 years the trend in yields per acre has been upward. Back of these increased yields are the favorable weather of the last few years; the use of improved varieties; the soil- and moisture-conserving practices; increased use of fertilizer; mechanization of farm operations, which increases timeliness of operations and reduces losses; and better selection of land adapted to the particular crops grown. But even with all these the effects of the drought of the midthirties are apparent.

The 1950 and 1951 seasons emphasized the importance of farm mechanization. Power machinery enabled producers to wait out periods of adverse weather and to make rapid progress with field preparation, planting, cultivation, or harvest when conditions become more favorable. The kinds of labor needed did not meet all demands. For instance, numbers of tractor operators and dairy workers available fell short of the demand for such workers.

Mechanization has improved productive efficiency by making planting, cultivating, and harvesting operations more flexible and more adjustable to weather. Both improved varieties and mechanical power have reduced the hazards of weather. Because of shorter maturity periods or drought-resistant characteristics of many improved varieties, mechanical power provides a greater opportunity to plant and harvest crops on time despite adverse weather. All of these benefits are in addition to the greatly increased quantity of marketable products permitted by the displacement of horses and mules by tractors.

COMPARISON OF CROPLAND AND OTHER INPUT TRENDS.—Among the data needed in any analysis of land used for agriculture at different periods is a comparison of trends in cropland and other inputs. The increased farm output from 1900 to 1920 was associated with an increase of nearly 25 percent in cropland used—from 300 million acres to 374 million. Use of other resources increased sharply, except for

labor, which was roughly the same in 1920 as in 1900. By 1949 the acreage of cropland used had risen to 387 million acres, or 13 million above the 1919 figure. Since 1920, however, neither periods of low farm prices nor prosperous periods with high prices have influenced the acreage of cropland planted or used as much as have other developments.

The total acreage used for crops decreased from 1919 to 1923; during the 1929–33 depression it increased slightly; and from 1939 to 1943 it again increased. But with the exception of 1949, it remained at about the same average level from 1944 to 1952 (table 9). Labor employed in agriculture dropped in 1929–33 and again from 1939 to 1943. Between 1940 and 1949 power and machinery on farms increased greatly. Most current expenses (inputs) such as those for fertilizer and seed, increased. From 1939 to 1943 farm output increased by more than 20 percent, and from 1944 to 1950 it rose by an additional 10 percent.

Among the more noticeable changes in farming in the last decade were the increased volume of farm power and machinery, the decrease in number of farm workers; the decline in number of farm workstock, and the greater use of fertilizer and lime. Also important was the greater acreage planted with improved seed; the substitution of legume

TABLE 9.—*Total acreage of cropland planted, farm employment, volume of farm power and machinery, and fertilizer used, and farm output, United States, specified years 1919–51* [1]

[Index numbers 1935–39=100]

Year	Total acreage of cropland planted or used [2]	Input					Farm output [7]
		Man hours of farm work	Power and machinery [3]	Fertilizer consumed [4]	Insecticides and fungicides [5]	Total input [6]	
1919	100	112	124	67	----	102	85
1923	98	110	118	75	----	104	90
1929	101	110	118	101	----	108	97
1932	103	108	113	55	----	104	101
1939	98	99	105	109	106	106	106
1943	101	100	120	168	118	110	128
1945	100	95	126	195	126	115	129
1949	104	90	156	270	131	128	140
1950	100	84	163	301	178	130	138
1951	101	89	170	330	----	----	146

[1] Bureau of Agricultural Economics. Farm Production Practices, Costs and Returns. Statis. Bul. 83, October 1949. (*49*). See also (*64*).

[2] Total acreage of cropland planted and fallowed, or all cropland used, including acreage multiple-cropped only once.

[3] Volume of farm power and machinery valued in 1935–39 dollars.

[4] Fertilizer used in tons.

[5] Insecticides and fungicides volume in 1935–39 dollars.

[6] Total inputs of labor, power and machinery, fertilizer consumed, insecticides and fungicides, etc.

[7] Farm output measures the volume of production available for eventual human use through sales from the farm or consumption in farm households.

for grass hay; the use of improved pastures and the adoption of better feeding practices for livestock.

These data apparently indicate that, in the short run, the supply function of land for use in crop production has a relatively low elasticity so far as price is concerned. This is partly owing to the quickly available alternative production materials. But it is also partly because only slight changes in acreage can be made readily in a short time through investment and "disinvestment," for instance, by development of new land or by exhaustion of productivity (*26*).

Retirement of cropland.—Land use surveys made in 1934 and 1935 showed that approximately 75 million acres of farmland were unsuitable for cultivation at that time. Of this, 55 million acres were in crops and pasture, and 20 million acres were in woodland. If allowance is made for changes in land use, land improvement, and public purchase since 1935, this estimate is comparable to a 45-million-acre estimate of cropland unsuitable for cultivation, made by the Soil Conservation Service (*24*).

In the submarginal-land-purchase program of the middle thirties, approximately 11.3 million acres of land were bought by the Federal Government and shifted chiefly into grazing, forest, and wildlife uses. At the time it was purchased, about two-thirds of this land was in crops and pasture. Of the land acquired in that program, 7.5 million acres are now used chiefly for grazing and forest and the remainder for forests, wildlife, and recreation. Statistics on agricultural land from agricultural censuses and other sources indicate that from 1930 to 1950 approximately 15 million acres of cropland went out of cultivation. Much of this land was poor and eroded, or it was in drought areas. In the same period several million acres of new land were developed by clearing, drainage, flood control, and irrigation. This more than replaced production from land retired from farming. Thus, to some extent, production has been concentrated on the better land areas.

Submarginal land bought by the Federal Government during the 1930's has been devoted to nonarable uses. An estimate is not available as to the privately owned submarginal land on which cultivation has been recently resumed. For example, in the last few years both weather and prices have been favorable to improvement and cultivation of marginal land. A report by the Northern Great Plains Council and data from other sources indicate that, from 1944 to 1951, 7 million acres or more of grass and other stabilized land was broken for wheat (*47*). Under the low prices of former years much of this grazing land was considered of low value for crop farming. Above-average precipitation and recent good prices for wheat have encouraged the breaking of sod land. Surveys by Soil Conservation technicians indicate that some of the newly plowed grazing land in the Great Plains cannot be maintained permanently in cultivation because of the character of the land and the hazards of weather and erosion (*10*).

Abandonment of land used for farming in the Eastern States, in the last 20 to 30 years as well as earlier, now appears to have resulted less from soil erosion, mistakes in land settlement, and ignorance of good land management and use, than from social and economic forces, such as demand for land and its products, changes in population, and avail-

ability of places to live. Much farming now carried on in abandoned farm areas is supported partly by outside income (*12*). When this support stops, as it does during business depressions, the problems of the less productive grades of land reappear. Many people think that almost any piece of land is worth something for crop farming, that machinery, hard work, and new methods can make it pay. This results in attempts to cultivate poor land and delays economic development of these areas by private forestry, grazing, and other extensive land-using enterprises.

Careful investigation of the economic returns promised by alternative uses of abandoned farm land, such as grazing, recreational, wild game, forests, and other extensive uses are desirable. Abandoned farm buildings accessible to community facilities might conceivably be used to advantage. Some observers are beginning to question whether large acreages of this land should not be added as pasture to adjoining or nearby farms.

Improved agricultural technology affects both good and poor land. It may make profitable a larger outlay of capital goods and a general intensification of farming on good land. When it does this it increases yields per acre. Improved technological know-how may also so reduce costs that it makes profitable the farming or grazing of land formerly considered submarginal for some particular agricultural use. The effects of improved technology need to be considered further with respect to the use of abandoned farms in the East and of cutover lands suitable for grassland farming in other areas (*29*).

PASTURE AND GRAZING LANDS

As pasture and grazing lands together make up by far the largest single item of land use—they involve about 1,020 million acres, or more than 53 percent of the land area of the country—their importance cannot be overemphasized. Included in the 1,020 million acres are about 69 to 70 million acres of cropland used only for pasture, some 416 million acres of open permanent pasture and grazing land, and 135 million acres of farm woodland grazed to some extent during parts of the year (table 10). The remaining 400 million acres of land used for grazing is outside farm boundaries.

Acreage used predominantly for pasture, exclusive of cropland and commercial forest grazed, consists chiefly of 630 million acres of nonforested grazing land or grassland. Around 70 million acres of cropland are used alternately for crops and rotation pasture, making a total of 700 million acres of grassland pastured.[30] Some temporary grazing also occurs on 80 to 90 million acres of cropland, such as winter-grain fields, stubble fields, harvested cornfields, and hay aftermath for short periods at certain seasons.

[30] This acreage excludes commercial forest and farm woodlands pastured but may include also some scattered areas of brush and semiarid shrub land. The term "grassland pasture," or "open pasture and grazing land," is intended to include all pasture and range land exclusive of the woodland and forest land grazed. It includes the shrub and brushland types of grazing land such as sagebrush, mesquite, creosote bush, black bush and other shrub types, as well as all tame and wild or native grasses and legumes and other forage used primarily for pasture or grazing.

TABLE 10.—*Land used for pasture and grazing, United States, 1950* [1]

Pasture and grazing land	Acreage	Percentage of total
	Million acres	*Percent*
In farms:		
Cropland used only for pasture	69	6.8
Open permanent pasture	416	40.8
Woodland pastured	135	13.2
Total	620	60.8
Not in farms:		
Open grazing land	215	21.0
Woodland pastured	185	18.2
Total	400	39.2
Grand total	1,020	100.0

[1] Pasture in farms, U. S. Census of Agriculture, 1950, (*60*); and grazing land not in farms, Land Grant College—United States Department of Agriculture, Agricultural Productive Capacity Study, 1951, (*62*) and BAE Land Use Inventory Project 1951.

Several million additional acres contain some forage of value for grazing at certain seasons. Much of this area is woodland and other rangeland in the South and West. Some of it is abandoned or unused farmland in poor-land areas of the East, in the neighborhood of large cities, in industrial and mining sites, and in gas and oil fields. Although not enough information is available to indicate more than a rough approximation of these acreages, they may total as much as 20 million acres. Among the reasons for not grazing all land having some forage are infestation with poisonous plants, lack of water, drought, inaccessibility, sparse nature of the forage, costs of providing fences, insufficient feed for winter use, and the necessity to reseed or otherwise restore badly depleted areas.

In general, the productivity per acre of pasture and grazing land for crop production is lower than that of the cropland now in use. Large areas are grazed as the only feasible agricultural use to be made of them. This land is important in agricultural production and it supplies more than a third of the feed for all livestock. Studies of feed values indicate that on the average approximately 7 acres of pasture and grazing land will produce as much as 1 acre of cropland. All pasture and grazing (including the value of aftermath and other crop pasturage) are equal to approximately 150 million acres of cropland, when converted to a cropland-equivalent basis by computing the acreage of tame hay required to provide the same quantity of feed supplied by pasture (*25*).

Of the 700 million acres of grassland and other nonforest land pastured, some 200 million acres, or 1.3 acres per capita, are in humid and subhumid nonforest pastures. In addition, there are about 500 million acres of semiarid and arid nonforest grazing land. Nearly

half of this is within farm boundaries and most of the remainder is in publicly owned range.

Converting the semiarid and arid grazing lands to the equivalent carrying capacity of the humid and subhumid pastures indicates that the total area in pasture would represent an equivalent of about 2.0 acres of humid and subhumid pasture per capita (not counting land in hay aftermath, stubble fields, and winter-grain pastures, or in pastured forest lands). A lower per capita acreage of pasture would be possible if more feed crops were used to supplement pasture, as is done in Europe. However, per capita use of livestock products is lower in Europe.

In this country the ratio of cropland to the total grassland or nonforested pasture and grazing land area is now about 4 acres of cropland to 7 acres of pasture. In France, this ratio is about 1.7 acres of cropland to 1 acre of pasture and in England it is almost 1 to 1.

Changed Significance of Pasture

With the growth of population and the development of agriculture and industry in the United States, the acreage in pasture has tended to decline but the quality has increased. This has resulted from use of pasturelands for cultivation and from seeding of more grasses and legumes. From 1889 to 1950 the area reported used predominantly for pasture (exclusive of cropland and commercial forest grazed), decreased by more than 300 million acres, or from about 20 acres per capita to a little less than 5. To some extent this decline was offset by the general expansion of the improved farm-pasture area at the expense of land not in farms, but after about 1880 it was at the expense of the open range. In general, however, much of the poorer land has been left in range and this has tended to lower the importance of pasture as a feed in comparison with cultivated crops.

The rise in cattle numbers from 1948 to 1952 brought renewed attention to pasture as an economical source of feed. Farmers everywhere, and especially those in the Southern and Western States, are improving their pasturelands (*50*). In January 1953 cattle numbered nearly 14 million head more than the 10-year average. Sheep numbers are approximately a fourth below the 1942–51 average. The number of hogs also decreased substantially, being about 8 million head below the 10-year average. Horses and mules numbered only 5.7 million head as compared to the peak inventory of 26 million in 1920.

IMPROVED PASTURE

It is estimated that some 200 million acres of pasture have been improved. This includes cropland used for pasture. The increased interest in improved pasture is shown by the many pasture and grassland production and utilization studies that have been published.[11] Review of several of these publications shows that costs of developing

[11] A list of publications by United States Federal and State agencies on grassland agriculture and related subjects selected for display at the Sixth International Grassland Congress at Pennsylvania State College, State College, Pa., August 16–23, 1952, included 456 bulletins, circulars, and leaflets dealing with the various phases of pasture development, management, and use.

improved pasture, including plowing, fertilizing, liming, seeding, and planting often range from $50 to $60 an acre on land already cleared. If clearing, drainage, irrigation, or fencing is necessary, costs are higher. Consequently, farmers generally are interested in ways of reducing costs and of ensuring good returns from investments in pasture improvement.

That improved pasture is increasing in extent is indicated by the 52 million acres of pasture and grazing land seeded and reseeded under the agricultural conservation program from 1936 to 1951 (*72*, pp. 46–49). The 300,000 or more farmers who cooperated in the pasture program during these years annually seeded or reseeded mechanically an average of nearly 4 million acres of pasture a year. An additional 15 to 20 million acres of pasture may have been seeded or reseeded, thus making a total of 75 to 80 million acres or more.

Natural reseeding of pastures by deferred grazing was practiced each year, ranging on an average from 3 to 32 million acres, or a total of more than 200 million acres in the 16 years. For the country as a whole, about half of the total number of farms participated in the agricultural conservation program. Many small, part-time, and highly specialized farms did not take part. Accordingly, there is reason to believe that considerable acreages of improved pasture seeded or reseeded on farms are not included in the foregoing totals.

Improvement of pasture and grazing land offers opportunities and presents problems in all regions. Altogether the country has nearly a billion acres of pasture and grazing land. It includes much low-production land—the kind that cannot be used successfully for crops without expensive improvement. In the West, much of the grazing land is range on which per-acre yields of forage are low because of limited rainfall. In the South, large areas grazed are brush and woodlands and badly depleted croplands.

A larger acreage of pasture is attainable in some areas, without reducing the acreage of cropland. But the greatest opportunity for increasing production of forage is through improvement of yields on acreages now used for these crops.

The combination of better grassland and more livestock has built up yields of grain and other crops. Remarkable improvements are being made through use of better and more rugged legumes and grasses. Experience has shown that old, neglected pastures can be renovated to bring them back into heavy production. The expansion in rotation pasture in the regular cropland rotation has aided pasture improvement and production.

Profit from pasture depends upon the combined results of forage produced and the livestock production. More information is needed on yields of pasture in terms of production of livestock and livestock products. Accurate, easily applied standards, similar to those for yields of grain per acre, are lacking (*35*). Management practices in use for pastures and methods of establishing and maintaining pastures need scientific overhauling. For example, farmers know that getting a stand with small-seeded grasses and legumes is far from certain. Experiments show that, given sure methods, farmers could plant approximately 3 to 4 times as much acreage with the same quantity of seed they now use. Further tests are needed to determine the

advantages of rotation grazing, if any, over continuous grazing, and the effect of various grasses and legumes and combinations of forage feeds on production of livestock. Other problems involve development of improved varieties; use of simple pasture mixtures instead of complex mixtures (that is, two or three species of grasses and legumes vs. five or six, or more); control of harmful insects; and prevention of diseases in pasture crops.

Agronomists who have studied pasture improvement tell us that in the North Central and Northeastern regions the potential productivity of the grasslands has not been reached (*33*). For example, they have learned that in the Northeast 2 acres of improved pasture can provide all the forage needed for one dairy cow during the pasture season—that the Northeastern and North Central regions could carry substantially greater numbers of animals than they now carry by using improved methods of producing hay and pasture.

For a long-time cropping program to maintain soil fertility and produce feed economically, State Agricultural Productive Capacity Survey Committees recommended in 1951 that pasture occupy a more important place in the rotations of the Corn Belt and the northern Plains (*62*, pp. 21, 47–49). They estimated that about 10 percent more acres of rotation pasture than were used in 1951 are needed for a balanced production program. The pasture-improvement program suggested by State committees for the Northeast would include an increase of about 7 percent in acreage of rotation pasture.

Opportunities for improvement of carrying capacity per acre of pasture and grazing land, measured in animal-unit months of grazing, are quite large, as improved practices have been used less in pasture production than in production of other feed crops. State committees east of the Great Plains estimated in 1951 that an increase of about 20 percent in carrying capacity of an average acre of rotation pasture would be possible by 1955 through the use of improved practices, including application of more lime and fertilizers and better seeding mixtures. Each group of States would be close to this average, except the Northeastern States (36 percent) and the Southeastern States (12 percent).

The carrying capacity of permanent pasture could also be increased by about 25 percent with management practices in use in 1950. In two groups of States, the Appalachian and Southeastern, the attainable increases for permanent pasture are 33 and 64 percent, respectively. A comparable figure for the Lake States is 22 percent, for the Corn Belt 20 percent, and for the Northeastern States 13 percent.

In 1951 State committees in the Great Plains and States farther West, except those in the southern Plains, estimated increases in carrying capacity of rotation pastures. The estimated attainable increase for the northern Plains was 14 percent, for the Mountain States 19 percent, and for the Pacific States 25 percent. But for the rangeland and permanent pastures in the Mountain and Pacific States, little if any increase in carrying capacity was expected by 1955. In the northern and southern Plains, the estimated increases are 4 and 6 percent, respectively. These estimates indicate a need for studies of both the physical and economic aspects of improvement of rangeland and pasture in the Western States.

UNIMPROVED GRAZING LAND

Unimproved grazing land consists mainly of undeveloped land which, because of rough topography, poor or unsuitable soil, insufficient precipitation, lack of irrigation water, or other reasons, cannot be successfully used for crops and improved pastures, without considerable improvement. This land is suitable for grazing by domestic livestock and capable of supporting uncultivated and unfertilized forage, primarily native grasses and other forage plants.

Unimproved grazing land is generally considered to include forage-producing forest land economically suitable for grazing by domestic livestock. To this extent, grazing and forest lands overlap. Grazing land does not include forest land on which forage is insufficient for domestic livestock, even though such areas are contiguous to areas suitable for grazing use.

The principal native or unimproved grazing lands are found in the West and the lower South. Those of the West are predominantly grasslands or desert shrublands too dry for arable farming, although an important part is mountain woodland, which is moist enough for trees but is generally too rough for tillable farming. Those of the South are principally forested grazing lands in the Coastal Plains, together with some important areas of wet prairie and marsh.

Just where the line should be drawn between unimproved grazing lands suitable for grazing and low-capacity lands, such as deserts, on which grazing of domestic livestock is not feasible, is often a problem. Such land is not usually considered grazing land.

Ordinarily much depleted unimproved grazing land can be restored to higher productivity more economically through management than through cultivation. Control and limitation of grazing in accordance with carrying capacity, allowance of growth for natural seeding, artificial reseeding of open areas and abandoned fields and removal of competing brush are among the chief methods of restoring grazing land. Abandoned fields that are submarginal for crop production and need reseeding to grass are classified as grazing land. Unimproved grazing land (including forested areas) now used is estimated at approximately 820 million acres.

The Main Pasture Regions

The percentage of the total land area devoted to pasture and grazing land by States and regions is given in figure 8. Because these lands represent a major source of our supply of food and fiber the three main pasture and grazing divisions of the country are described in some detail. These three divisions are the 23 Northern States, including the Northern Plains; the 14 Southern States including the Southern Plains; and the 11 Western States. The States in each division are shown in figures 4 and 8.

About three-fourths of the land in the 11 Western States is used for grazing at some time during the year. The carrying capacity is low for many areas, but the feed is important to the livestock industry. Pastures also occupy large shares of the land in the Northern States and in the Southern Plains States. Because of general similarity in crops, production practices, and types of farming and the customary

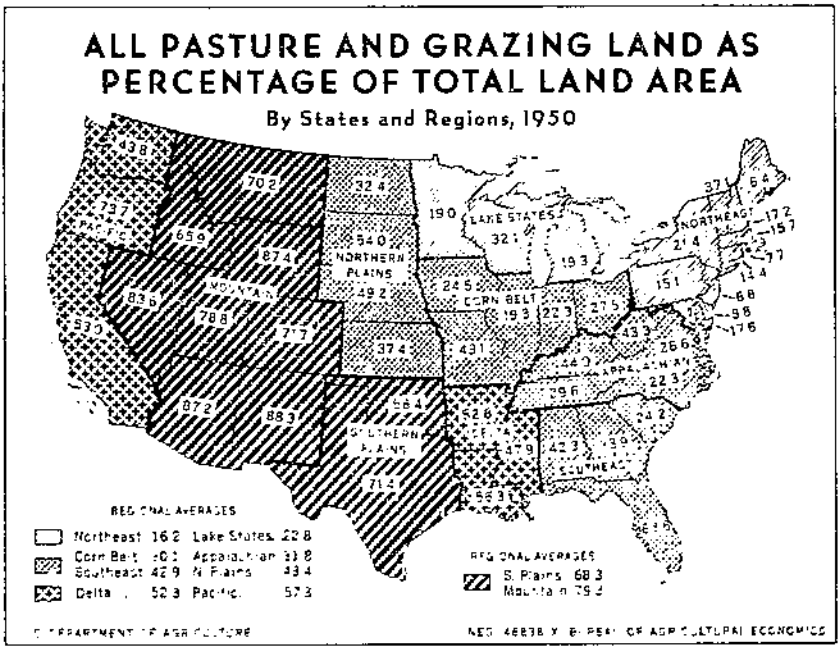

FIGURE 8.—Pasture and grazing land (including plowable and nonplowable grassland and pastured woodland and forest) is the largest acreage of land use in the country. It accounts for more than a billion acres, or nearly 55 percent of the land area. Many types of pasture and grazing land are included, such as the highly productive pastures in the Northern and Central States; the irrigated pastures and natural grasslands of the Great Plains and the Western States; and the woodland grazing areas of the South and West.

geographic groupings in the agricultural census, the Northern Plains States of North and South Dakota, Nebraska, and Kansas are included with the Corn Belt and other States comprising the Northern division, and the Southern Plains States of Oklahoma and Texas are grouped with the Southern division. Ranches in the Nebraska Sand Hills, the Osage Flint Hills, and the Arbuckle Mountain area have the characteristics of "stock farms." Combination wheat and cattle ranches are found especially in the western parts of the Great Plains States from the Dakotas to Texas.

Pastures are significant likewise in several other regions of the Northern and Southern States, including New England, New York, Pennsylvania, Wisconsin, Missouri, Kentucky, Tennessee, Virginia, the Mississippi Delta States, and Florida. Although pastures are usually associated with dairy and beef-cattle farms, there are large numbers of farms on which combinations of various staple crops and livestock raising make pastures important. Such combinations include cotton and rice plantations of the lower Mississippi Valley and Texas; citrus, truck, and livestock farms of Florida; timber and livestock producers of Florida, Georgia, and other Southern States. In the Northern States also there are numerous combinations of grain and livestock farming and dairying.

NORTHERN PASTURES

The Northern States include within their boundaries more improved pasture than is found in any other region. The permanent pastures in the Northeastern and North Central States taken as a whole are among the best in the country (*44*). Many of these pastures will support a cow or a steer or more per acre throughout the pasture season. This part of the country has a little more than an acre of improved permanent pasture per animal unit. About 30 million acres of cropland are used for pasture in rotation with hay and other crops. Much of this land is highly productive. In all, approximately 136 million acres of grassland pasture and 45 million acres of woodland which are grazed temporarily at certain seasons—a total of 181 million acres pastured or grazed—are found here (table 11).

Pasture is well suited to the Northeastern and Lake States. Nearness of markets for milk and other dairy and livestock products has stimulated production of these products. The rough and rolling topography of much land in the Northeast makes it poorly adapted to growing grain and other feeds, and dependence upon forage as a

TABLE 11.—*Pasture and grazing land and animal units of roughage consuming livestock. Northern division, by regions, 1950*

Region	Grassland pasture [1]	Woodland and forest pastured [2]	All pasture [3]	Animal units [4]	Acres per animal unit [5]
	1,000 acres	*1,000 acres*	*1,000 acres*	*1,000 units*	*Acres*
Northeastern	11, 145	7, 097	18, 242	5, 625	3. 24
Corn Belt	31, 502	18, 314	49, 816	12, 305	4. 05
Lake States	11, 881	16, 118	27, 999	8, 321	3. 36
Northern Plains	81, 727	3, 067	84, 794	9, 410	9. 01
Total or average	136, 255	44, 596	180, 851	35, 661	5. 07

[1] Cropland used only for pasture, open permanent grassland pasture in farms, and open or nonforested grazing land not in farms.

[2] Woodland pastured in farms and woodland and forest land pastured not in farms.

[3] Total acreage of grassland pasture and woodland and forest pastured in farms and not in farms. For acreages of specific classes of pasture and grazing land by regions and States refer to supplement, previously noted in footnote 1, table 2.

[4] United States Department of Agriculture, Animal Units of Livestock Fed Annually, 1947–48 to 1950–51, Supplement to F. M. 61, April 1951 (*52*). An animal unit is the equivalent in consumption of feed of one average milk cow in a year. Animal units of roughage-consuming livestock are intended to show the number of all kinds of livestock combined that consume hay, silage, stover, straw, pasture, range forage and other roughages. Animal units were calculated from the numbers of roughage-consuming livestock on farms January 1 and those raised during the year. The following kinds of live-stock were included as roughage-consuming live-stock: Milk cows, other cattle, all sheep, goats, horses, mules and colts, and hogs.

[5] Average acreage of pasture and grazing land per animal unit of roughage-consuming livestock.

source of feed is increasing. Land in the Lake States is well suited to pastures and forage crops and the climate favors their growth. Although the largest acreage of agricultural lands in permanent pasture is in the Northeast, a large part of the land area in the Lake States is also in permanent pasture.

Early settlers in the Corn Belt and Lake States found forested lands in the northern and eastern parts of the region and tall-grass prairies in most of the remainder. Almost continuous plowing and cropping of the virgin lands in the early years destroyed grass and depleted soils. The native grasses could not compete with the cultivated cropping and usual grazing practices and they failed to reestablish themselves. During the last 50 years especially, they have been largely replaced by introduced forages.

After extensive livestock enterprises had been built up in the Corn Belt and Lake States, pastures of tame grasses and legumes were seeded on large acreages. Grass and legumes for use as pasture and hay and, to a lesser extent, for green manure, grass silage, and production of seed are vital everywhere in the various farm enterprises. In Indiana, Michigan, Missouri, Ohio, and Wisconsin, the combined acreages of pasture and hay exceed those of corn and small grains. In Illinois, Iowa, and Minnesota, they approximate those of corn and small grains.

The four northern Plains States, from North Dakota to Kansas, inclusive, now have in grazing use about 85 million acres, a slightly greater acreage than the combined pasture acreage of the adjoining Corn Belt and Lake States. Here native short grasses, principally grama and buffalo grasses, are found although tall grasses predominate toward the eastern margin of the area and on deep sandy soils. The Flint Hills area in eastern Kansas and the Sand Hills of Nebraska are among the few extensive areas of native grazing land remaining in the humid, tall-grass prairie region. The Flint Hills area lies just east of the Great Plains proper, while the Sand Hills are within the plains area.

Although much higher than in the 11 Western States, the average carrying capacity per acre of northern Plains pasture and grazing land is less than half that in the Corn Belt. This fact is indicated roughly by the average acreages of pasture and grazing land used per animal unit of forage-consuming livestock for the different regions, as shown in tables 11, 12, and 14. For example, the average acreage of pasture and grazing land per animal unit of roughage-consuming livestock is from 3 to 4 acres in the Northeast, Corn Belt, and Lake States; 9 acres in the northern Plains, 14 acres in the South, including the southern Plains States of Oklahoma and Texas, and more than 38 acres for the 11 Western States as a group.

It should be borne in mind that these are average acreages embracing considerable brushland, woodland, and forest in the Northern and Southern regions, and immense areas of sagebrush, mesquite, and other shrub types, as well as woodlands in the Western States. Actually much of the acreage is not true grassland pasture or grazing land and in many cases it includes little grass. The term "grassland pasture," as used in the text and tables in the section dealing with pasture and grazing lands includes all pasture and range grazing land exclusive

of the farm woodland pastured and other forested land grazed. Lack of sufficient statistical information on the acreages of tame grass and legume pastures, wild or native grass and legume pastures, brushlands and shrub rangelands grazed, and woodland and forest areas used for grazing, makes it difficult to describe and evaluate the pasture and grazing lands of the various regions.

PASTURES IN THE SOUTH

The place of pastures among the farm crops in the South is growing in importance. Since 1930 numbers of cattle have increased markedly (*60*). Production of livestock is usually carried on in combination with other farm enterprises.

The 14 southern States contain about 116 million acres of permanent pasture in farms and more than 30 million acres of cropland used for pasture. These 146 million acres of grassland pasture in farms, which are supplemented by aftermath grazing of hay fields and other crop residues, such as peanuts, velvet beans, soybeans, corn, and wheat, and by occasional temporary grazing of winter grain and cover crops, furnish most of the pasture for dairy cattle and herds of improved beef cattle. A large acreage in pasture, however, and one that has potentialities for becoming of greater value—lies in certain woodland and forest-type areas which contain forage useful for grazing (table 12).

Of the total forest area in the South, which amounts to 239 million acres exclusive of parks and other special-use areas, nearly 140 million acres, or more than 50 percent, is now grazed, according to estimates compiled from various agricultural sources. The area grazed in the

TABLE 12.—*Pasture and grazing land and animal units of roughage-consuming livestock, Southern division, by regions, 1950*

Region	Grassland pasture [1]	Woodland forest pastured [2]	All pasture [3]	Animal units [4]	Acres per animal unit [5]
	1,000 acres	*1,000 acres*	*1,000 acres*	*1,000 units*	*Acres*
Appalachian	20, 320	19, 296	39, 616	4, 976	7. 96
Southeastern	11, 079	42, 193	53, 272	2, 782	19. 15
Mississippi Delta	11, 897	36, 652	48, 549	2, 947	16. 47
Southern Plains	103, 022	42, 309	145, 331	9, 872	14. 72
Total or average	146, 318	140, 450	286, 768	20, 577	13. 94

[1] Cropland used only for pasture, open permanent grassland pasture in farms, and open or nonforested grazing land not in farms.

[2] Woodland pastured in farms and woodland and forest land pastured not in farms.

[3] Total acreage of grassland pasture and woodland and forest pastured in farms and not in farms. For acreages of specific classes of pasture and grazing land by regions and States refer to Supplement previously noted in footnote 1, table 2.

[4] United States Department of Agriculture. Animal Units of Livestock Fed Annually, 1947–48 to 1950–51, Supplement to F. M. 64, April 1951 (*52*).

[5] Average acreage of pasture and grazing land per animal unit of roughage-consuming livestock.

lower South and the Ozarks includes about 50 million acres in free or open range, that is, unfenced land subject to grazing in common by the people of the community (where grazing is permitted legally or by common custom). Range-management studies have indicated that in addition to the 140 million acres of forest land actually grazed, additional areas could provide some grazing for cattle at certain seasons of the year with careful management to prevent damage to timber trees (*6*, *79*, pp. 210–211).

The long growing season and the abundant rainfall in winter and spring favor rapid and rank growth of native forest vegetation. Pastures in the Coastal Plains region consist primarily of wire grass, bluestem, broomsedge, beardgrass, switch cane, and other broad-bladed grasses, weeds, and swamp plants. The protein content of these grasses, and hence their nutritive value, drops sharply as they mature in summer and fall, and cattle do not thrive long on such forage alone. The palatability of the grasses is rather low, but in spring they furnish good grazing for about 90 days. In winter, in the past, livestock owners often burned accumulations of dead grasses on open ranges so that fresh feed might be more readily available to livestock in the spring. That the effects of uncontrolled burning are often injurious to both grass and trees is becoming more widely recognized. The time appears ripe for adoption of better management practices.

THE FREE RANGE AREAS.—Free range is peculiar to the Ozark, South Central, and Gulf States. Alabama, Arkansas, Georgia, Louisiana, Missouri, and Mississippi have laws that permit residents of certain counties and townships to use unfenced land as free range. If free range is permitted, residents of the community may graze their livestock on any unfenced lands in the area. In limited areas, partial stock laws allow free grazing for cattle, horses and mules, but hogs, goats, and sheep are prohibited. In other extensive areas, stock laws make it illegal to permit stock to run at large on unfenced lands and public highways. Promotion of greater safety on highways has been a deciding factor in adoption of stock laws.

Apparently grazing on free range succeeds best where large contiguous areas of fairly open forest occur, such as the turpentine pine forests and other open woodlands of the lower coastal plain of Georgia. Grazing on free range is an important source of feed for cattle in the wire-grass section of this area. Areas of heaviest grazing are in the open pine and flatwoods country, extending from Savannah to Valdosta, Ga., near the Florida State line. Even though grazing on free range may be legally permitted, many farmers in the upper Coastal Plains are fencing their lands and improving their pasture. This is an example of what is happening throughout the former free-range areas. As pasture and cattle become more valuable, better management practices, more fencing, and other types of improvements are installed.

SOUTHERN COASTAL PLAIN FOREST RANGE.—A principal southern forest range area lies in the longleaf-slash pine belt of about 38 million acres, which extends through the Coastal Plain from North Carolina to Texas. This forest range is characterized by numerous openings, abundant herbaceous vegetation, and relatively high forage yields. Vegetation consists of two subtypes—wire grass and bluestem. Range specialists regard 40-percent utilization as the safe upper level for grazing (*7*, *8*).

The wire-grass type of forage occurs mainly in the longleaf-slash pine flatwoods of South Carolina, Georgia, Florida, and Alabama. From mid-March to early July wire grasses furnish reasonably good grazing. From July to the first of October, grazing is only fair. In fall and winter, forage is poor. When the grass dries it becomes wiry and unpalatable. From 7.5 to 30 acres per cow are recommended for 6 months' grazing.

With local variations, the bluestem type of forage occurs mainly in Mississippi, Louisiana, east Texas, eastern Oklahoma, and Arkansas. Five acres of open well-grassed forest land are required for 6 months' grazing for one cow. This is top capacity on the best bluestem range. Twenty acres of wooded range is needed to carry a cow for 6 months.

On Louisiana's upland pine-forest land, which comprises about a third of the total area of the State, grazing is important. Much of this land has relatively open stands of trees and yields about a half ton of grass per acre (dry weight), in addition to its major product, timber. Nearly half of the cattle in Louisiana graze on forest range for at least a part of the year. Thousands of farmers benefit by this forage, yet under the prevailing free-range custom, production and cash returns from beef are lower than could be had with a better system of management. One reason for this low production is that although native forage is good only in spring, many beef cattle graze the range year-long. Use of the native forage at its best season, with permanent pasture and supplemental feed for other seasons, would mean increased incomes.

The longleaf-pine area in central and southwestern Louisiana and eastern Texas is more than 80 percent forest and is only 6 to 8 percent cultivated. It has been so heavily cutover that more than a fifth of the forest land is quite open. Space for abundant grass and other forage growth is ample. But not more than half of this native forage is used because the improved pastures and farm feeds necessary to furnish a balanced feeding program for the full year are lacking. Accordingly the value of native forage is difficult to estimate. On the one hand, the value is higher because pastures are scarce. On the other, grazing on the open range is regarded as an inherent right and livestock owners are not inclined to pay grazing fees. Increased recognition, however, is now given to the value of sole grazing rights on fenced forest range.

Native grasses grow well in the second-growth longleaf-slash pine forests in southern Mississippi. In most of these areas, moderate cattle grazing is not only feasible but desirable, at least during certain periods in the growth of timber. Forage is abundant in young open stands, moderately abundant in fairly well-stocked stands, and slight in densely stocked and timber areas.

In the lower coastal plain region of southern Alabama and western Florida, forest forage is an important source of feed for cattle (*4*). According to a recent survey by the United States Forest Service, this forage furnishes about 60 percent of the feed for the cattle in the area. Cattle management falls into types based on dependence of cattle upon forest forage and upon level of nutrition. One type, for example, is entirely dependent upon forest forage. By contrast, another type uses woodland only for incidental, or supplemental grazing.

Southern Alabama and western Florida have six general grazing areas based on characteristics of cover, each with a special forest-

grazing situation. For the region as a whole, the full value of forest-land forage is not realized because of inadequate feed at certain seasons and inadequate care and management. Development of sufficient feed to supplement seasonal forest-land grazing and overall better management of woodlands and cattle would do much to increase incomes.

An example of forest grazing in the upper South is the extensive use made of private forest lands to pasture cattle in the coastal plains area of North Carolina. Despite some conflicts between forest grazing and burning and growth of trees, there are indications that cattle raising and production of timber can be combined to the advantage of farmers, particularly in parts of the coastal plain area. Requirements for proper integration of cattle and timber production have not been well established, but progress is being made on the problems involved in woodland grazing.

The cane-forage type of North Carolina furnishes some of the best native grazing in the South. Although it was once widespread, extensive stands of this kind are now confined largely to the swampland of North Carolina and Virginia and to the bottom land of the Mississippi Delta. It is still the most valuable type of native forage in the coastal plain of North Carolina and Virginia. Here the more extensive stands occur with pond pine, but they occur also with lowland hardwoods and loblolly pine. There are almost 2 million acres of pond-pine hardwood forest land—about 20 percent of the total forest area—in the coastal plain area of North Carolina. Switch cane is a stable source of forage (*43*).

Of the farmers interviewed in eastern North Carolina in a survey of forest grazing and production of beef cattle in 1941, 75 percent said they used their forest land both for growing trees and for grazing. The survey revealed that forest pastures furnished about a third of the year-long keep of all herds included in the survey. Some herds were grazed on woodlands throughout the year. Data indicate that in some counties 75 percent or more of the forest land is grazed, and that most of it is handled in individual units rather than in common as is done in parts of the lower South (*18*).

The 1941 survey also found that cattle can have real value in forest protection by reducing fire hazards. Besides consuming large quantities of herbaceous material, grazing animals knock down and trample the loose forest litter. By bringing the litter in contact with the soil the fire hazard is reduced and decomposition is hastened. The cost of upkeep of fire lanes can be reduced by grazing. Cattle are usually attracted to the new growth that invades fire lanes; thus by keeping the vegetation closely grazed, they prolong the lane's usefulness.

The coastal plain area of the Carolinas offers promise for combining production of timber and cattle. Supplementary feed or pastures are necessary during part of the year in order to make the best use of the native forage. The kind and quantity of supplemental feed needed for a specific range-grazing program depend upon the type of native forage available. During recent years, with improved breeding and management, the cattle business has developed and interest in woodland grazing is increasing.

In the Piedmont, use of forest areas for pasture has been less extensive than in the Coastal Plains. Abandoned fields and pine

woodland could be used more widely for limited grazing at certain seasons. Broomsedge is the most common native grass in the Piedmont, but it is of low value for grazing. It is generally abundant in recently abandoned fields. As the forest stand grows, however, forage plants become less plentiful, except in open areas.

Properly managed and coordinated with timber growing, range-livestock raising should contribute materially to incomes in extensive forest areas of the Coastal Plains. Such a program needs sound research and adequate extension of desirable practices among those raising range cattle. It will require, among other developments, the clearing and seeding of considerable acreages of fertile, low-lying, well-watered woodland if improved pastures are to balance the feed supply.

A supplemental annual income from cutover or poorly stocked land through production of cattle may encourage farmers in the Southern States to hold and manage their forests for future timber harvests. Trials have shown that breeding herds of beef cattle can be satisfactorily maintained during certain seasons on some types of forest range at less cost than on cultivated land.

THE WESTERN RANGE

The western half of the United States has long been known as "The Western Range." This is a vast region with a diverse agriculture. Throughout much of the region use of land for cultivated crops is limited by low precipitation, unfavorable topography, limited supplies of water for irrigation, shallow soils, and other adverse factors. For much of the land, grazing is the main feasible agricultural use.

Rangelands include many types of vegetative cover, such as grasslands, desert shrubs, brushlands, woodlands, and open forests. In all, about 552 million acres are used for pasture and grazing in the 11 Western States. This includes about 10 million acres of cropland, 90 million acres of other improved and semi-improved pasture, 318 million acres of grassland, brushland, desert-shrub range, and about 134 million acres of woodland and forest grazed. Thus, of the 552 million acres used for grazing in the 11 Western States, about 450 million acres may be considered rangeland. This is exclusive of improved pasture, wild-hay land cut for hay, wheat pasture, stubble, or similar crop-aftermath forage. Permanent farm pastureland in non-range-livestock type-of-farming areas in the Great Plains States, such as the Wheat Belt, also are not included (table 14).

The main body of the western range lies west of an irregular line running north and south through the Great Plains from North Dakota to Texas (fig. 9) (*79*, pp. 205–206). Separate small blocks of the range occur in the Osage-Flint Hills in Kansas and Oklahoma, the Arbuckle Mountain area in Oklahoma, the Canadian River Breaks area in Oklahoma and Texas, and the north-central grazing area of Texas. These areas are included in the Northern and Southern regions.

Rangelands surround many important irrigated valleys and dry-farming areas. In some areas the greater part of the agricultural income is derived from food and specialty crops and dairy and poultry enterprises which are largely independent of the rangelands. In

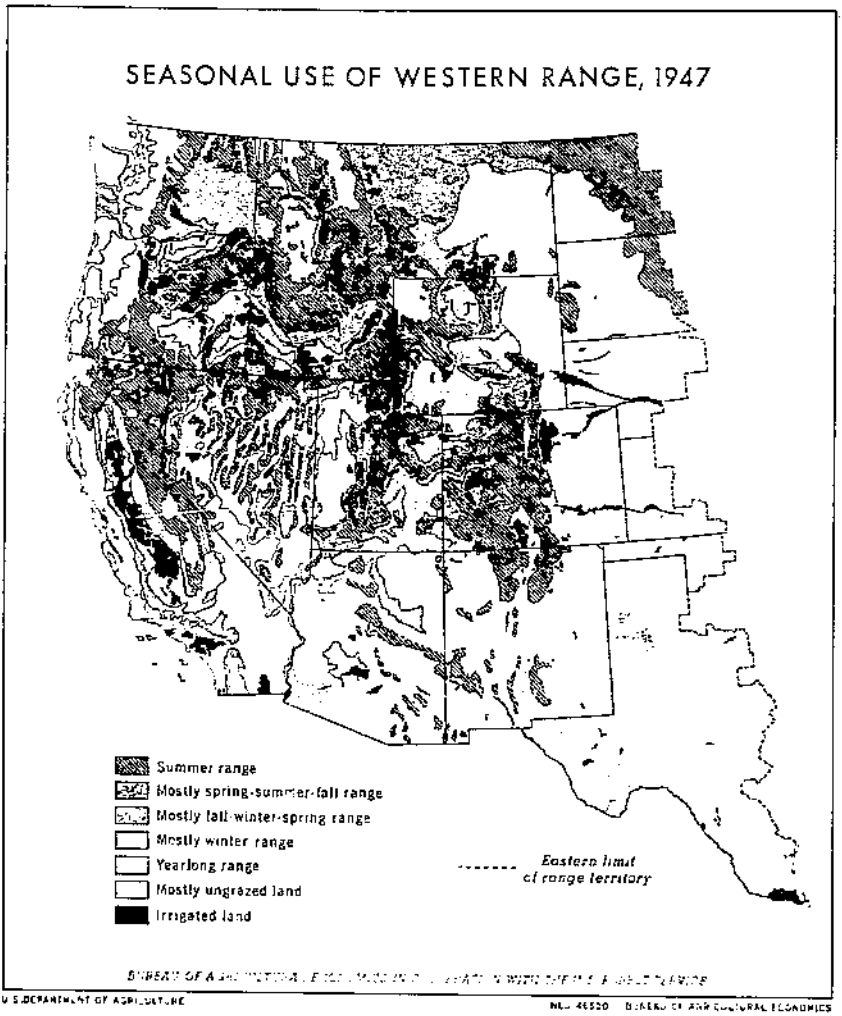

FIGURE 9.—The differences in climate and land in the Western States mean differences in grazing seasons as well as in type and value of grazing. Higher areas furnish 3 to 6 months of summer grazing. Foothills and plateaus are available for most of the year but ordinarily these ranges do not carry animals more than 6 to 8 months without change of pasture. Arid or winter ranges lack water in certain seasons. They are used by stock only in winter. A large acreage in the extreme southern semiarid area is almost unusable for livestock, but wells and irrigation are making more of it available. In winter range livestock are fed in the irrigated valleys.

other areas, range sheep and cattle enterprises are the principal sources of agricultural income. In some areas livestock operations are based on use of rangeland as enterprises secondary to farm operations. Individual operators may own only small numbers of range livestock. In other areas, ranches are large. For example, ranches using 20,000 to 30,000 acres or more are not unusual in parts of the

West; many ranchers in the Southwest have more than 500 breeding cows in their beef herds and some herds contain 2,000 or more; and a few operators in parts of Wyoming and other Mountain States own as many as 10,000 head of sheep.

CONTRIBUTION OF RANGELANDS.—Although the range-livestock industry predominates in many parts of the West today and grazing remains the principal agricultural use of most of the land, the trend has been toward production of food and specialty crops and farm herds and flocks. The increased production of dairy products, poultry, poultry products, vegetables, fruits, wheat, and cotton are in point. In Wyoming, New Mexico, and Nevada, farm income comes largely from livestock; livestock income comes mainly from cattle and calves, sheep and lambs, and wool rather than from such nonrange-livestock enterprises as dairy and poultry; and feed for beef cattle and sheep originates chiefly on rangeland and other dry lands rather than on irrigated lands. The agriculture of these States depends greatly upon rangelands (*10, 38*).

Utah, Colorado, Arizona, and Montana occupy an intermediate position and are rated as having "medium high dependence" upon rangelands. Crop values are important in these States, and especially so in Arizona and Montana. Although a large part of the farm income in Utah and Colorado is derived from livestock, in Utah dairy and poultry enterprises are important, and in Colorado and Idaho range livestock consume much feed raised on irrigated lands. Oregon and Idaho are rated as having "medium-low" dependence on rangeland. Crop values are important in both States, and dairy and poultry enterprises are notable in Oregon. In California and Washington dependence upon rangelands is rated as "low." In these States crop income is high relative to livestock income and dairy and poultry are important relative to beef cattle and sheep (table 13). However, within each State and each subregion of the West, wide differences are found in size and types of farms and ranches and in importance of rangelands to individual operators.

Year-long grazing is widely practiced in the southern part of the Western range. Cattle tend to predominate on the short-grass areas, sheep on the browse areas, and goats on the rougher and brush-covered range of the Edwards Plateau of Texas. Except at high altitudes winters are mild. Supplemental feeding is fairly common, in late winter, early spring, and dry years, especially as applied to bulls, bred cows, and ewes. Cottonseed cake is a common supplemental feed and cattle hay is used. The range livestock enterprises in the large rangeland subregions are independent of the irrigated and dry cropland subregions, although some feeder stock are fattened in irrigated valleys.

Seasonal grazing is practiced throughout most of the central and northern parts of the Western range. Great expanses of grassland and brushland surround mountain ranges. These grasslands and brushlands are used for winter and spring-fall grazing and the mountains provide summer grazing. Sheep are commonly kept on the open range throughout the year and receive supplemental feeding only in case of heavy snowfall. In much of this area bands of sheep are moved from one seasonal range to another—to desert lands in winter, to foot-

TABLE 13.—*Generalized index of dependence of agriculture upon range lands, and factors indicating dependence, 11 Western States, 1939* [1]

Item	Dependence of agriculture upon range [2]	Percentage distribution of—					
		All income		Income from livestock		Income from range livestock and products originating from—	
		Crops	Livestock and products	Poultry, hogs, and dairy products	Range livestock and products	Irrigated land	Range and other dry land
Dependence:							
High:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Wyoming	60	20	80	15	85	15	85
New Mexico	55	30	70	15	85	5	95
Nevada	55	15	85	20	80	20	80
Medium-high:							
Utah	30	30	70	45	55	20	80
Colorado	30	35	65	25	75	40	60
Arizona	30	50	50	25	75	20	80
Montana	25	50	50	35	65	25	75
Medium-low:							
Oregon	20	45	55	60	40	15	85
Idaho	15	50	50	50	50	40	60
Low:							
California	10	65	35	60	40	20	80
Washington	10	60	40	75	25	15	85

[1] Based on LONGTERM OUTLOOK FOR WESTERN AGRICULTURE, by MARION CLAWSON and WENDELL CALHOUN (*10*). Percentage figures were rounded to the nearest number divisible by 5.

[2] Income from wool, cattle, calves, sheep, and lambs originating from range and other dry land as a percentage of all income.

hills in spring, to the high mountains in summer, and to the foothills again in fall. Cattle are usually fed during winter, carried on hay or crop fields or spring-fall ranges during spring and fall, and grazed on mountain ranges in summer. The extent of feeding depends upon the weather and the feed available. Native meadows provide both hay and pasture and are important to cattle enterprises. Pasturing of crop aftermath is fairly common and wheat pasture is important in areas that border the Wheat Belt.

From approximately 1860 to 1900, when the livestock industry was getting under way in the West, straight range-livestock raising was widely practiced, and supplemental feeding, usually of wild hay, was done only to the extent dictated by the severity of winters or the duration of droughts. However, the area of available rangeland has gradually shrunk because of development of irrigated and dry-farming

lands, growth of cities and towns, and withdrawal of lands for such uses as recreation, watershed protection, and military reservations. As range forage is the cheapest feed and as winter feeding above a good maintenance level does not usually produce greater returns on a year-long basis, most operators plan to provide only a maintenance winter ration and to make gains in weight on summer ranges. Thus for feeder production under the price relationships that have prevailed, integration on cropland and rangelands is limited.

To a considerable degree, development of new irrigated lands has made possible development of food- and specialty-crop, dairy, and poultry enterprises. These are largely independent of the range-livestock enterprises. As the area of available rangeland has decreased, feed and forage from rangelands and croplands have become more important to ranchers. More rangeland has been brought under fence; water holes have been developed, brush removed, mountain meadows and other suitable areas improved and irrigated, lands reseeded, and more supplemental feeds used. New methods for effective burning of brush, removal of brush mechanically and by use of chemicals, and reseeding of selected areas of good soil offer promise. Range-management and economic studies are under way in the Western States to develop proper methods of selection of suitable land for improvement, controlled burning and other forms of brush removal, and reseeding within feasible limits of cost.

Specialized feed-lot operations in irrigated valleys have increased. Those who graze livestock on the remaining "wild lands" are finding that competition from uses for recreation, wildlife, and watershed protection is increasing. Rapid increases in population in the far West are causing changes in the competitive position of alternative uses of the various types of land found in the western range area.

Pastures, Native Meadows, and Rangelands.—Grazing lands differ widely as to characteristics and as to the quantity and quality of forage produced. Although the lands may be divided into three major classes: (1) Pastures, (2) meadows, and (3) rangelands, dividing lines between classes are often indistinct. Pastures are usually grasslands located near the farm or ranch headquarters, and they are often fenced and otherwise improved. However, some rangelands are also fenced and improved. Meadows are made up principally of wild hay, which may be pastured, cut for hay, or both. Pasturelands include limited rotation pasture areas that are irrigated, are highly productive, and are used interchangeably in rotation with croplands. Other irrigated pastures are capable of cultivation if drainage and irrigation facilities are provided. But much of this land is of doubtful arability because of the characteristics of the soil, the heavy cost of development, or other factors. From the standpoint of soil and topography, some dry-land pastures could be developed as cropland but, because of insufficient precipitation and irrigation water, they will probably remain in pasture. Much development work has been done on these pastures in fencing, development of water supplies for stock, and reseeding. There remains the bulk of the grazing land, especially that within the rangeland category. Within these classes of grazing land, the types of soil, the topography, the plant species, and the season of use to which they are adapted vary greatly.

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The extent to which western grazing lands are designated as pastureland and rangeland varies from one part of the western range to another. In the Mountain region, the term "pasture land" is usually applied only to irrigated grasslands not cut for hay and nonirrigated (dry-land) plowable grasslands (suitable for growing cultivated crops, if water were provided) (*41*). In the Mountain region grazing follows mainly a pattern of seasonal migration or of year-long grazing. Much of the land is publicly owned, and grazing areas are largely unfenced, or are fenced into large units, and unimproved. Pastureland is commonly estimated at about 2 percent of all land and rangeland at 80 to 90 percent (*46*, p. 542). Furthermore, pasturelands are largely irrigated and associated with farm and ranch headquarters which are located in the valleys. Nonirrigated or dry-land pastures are mainly small, fenced tracts of valley and foothill land near farm or ranch headquarters. They are suitable for cropping, except that precipitation and water storage are inadequate.

In the Great Plains part of the western range, grazing lands are in the main privately owned; grazing is generally nonmigratory; and a larger part of the land is fenced and can be described as pastureland.

The acreage of irrigated pastureland in the western range area, exclusive of irrigated rotation cropland pasture, is not known precisely, but it is probably about 4 million acres. These lands are irrigated, largely by flood irrigation, and productivity is moderate compared to productivity on the irrigated cropland pasture.[12] Irrigated pastures are important to dairy farmers as well as to ranchers. Nearly 65 percent of the irrigated pastureland is located in the Mountain region; 31 percent is in the Pacific States; and only about 4 percent lies in the Great Plains.

Acreages of dry-land pasture (excluding rangeland) in the Pacific Coast region and the Great Plains portion of the western range area probably exceed that in the Mountain region.

Direct data are not available concerning the acreage of dry-land pasture (as distinguished from rangeland). Acreages of "cropland used only for pasture," as reported in the Census of Agriculture, are sometimes used as indicators of the acreage of pastureland, even though presumably rotation pasture is included and nonplowable pasturelands are excluded. On this basis, cropland used as pasture in the western region was estimated at 9 million acres in 1949, including irrigated as well as dry-land pastures (*60*).

WESTERN GRAZING LANDS BY REGIONS.—Three main grazing regions—the Mountain, Northern and Southern, and the Pacific States—in the 11 Western States are recognized here for the purpose of presenting Statewide statistics. Pasture and other grazing lands now used, exclusive of cropland used only for pasture, occupy approximately 542 million acres in the 11 Mountain and Pacific States combined. This is the largest grazing area and one of the most im-

[12] George Stewart writes of the Mountain region as follows: "* * * only about 10 to 20 percent of the pasture land is handled under intensive management." Again, "* * * perhaps 80 to 90 percent of irrigated pastures are only moderately productive or less. The most common difficulties are waterlogged lands, accumulation of salts, poor management and poor species of plants (*46*, pp. 543–547)."

portant in the country.[12] In addition to the area used for grazing in the West from 1949 to 1951, it is estimated that several million acres of western grazing land were not used because it is infested with poisonous plants, lacks water, is subject to drought, is inaccessible, and it is necessary to close and reseed or otherwise restore badly depleted or overgrazed areas (table 14).

TABLE 14.—*Pasture and grazing land and animal units of roughage-consuming livestock, Western division, by regions, 1950*

Region	Grassland pasture [1]	Woodland and forest pastured [2]	All pasture [3]	Animal units [4]	Acres per animal unit [5]
	1,000 acres	*1,000 acres*	*1,000 acres*	*1,000 units*	*Acres*
Northern Mountain	223, 755	56, 190	279, 945	7, 275	38. 48
Southern Mountain	128, 318	26, 673	154, 991	1, 926	80. 47
Pacific	65, 764	51, 541	117, 305	5, 114	22. 94
Total or average	417, 837	134, 404	552, 241	14, 315	38. 58

[1] Cropland used only for pasture, open permanent grassland pasture in farms, and open or nonforested grazing land not in farms.

[2] Woodland pastured in farms and woodland and forest land pastured not in farms.

[3] Total acreage of grassland pasture and woodland and forest pastured in farms and not in farms. For acreages of specific classes of pasture and grazing land by regions and States refer to supplement previously mentioned in footnote 1, table 2.

[4] United States Department of Agriculture, Animal Units of Livestock Fed Annually, 1950–51, Supplement to F. M. 64, April 1951 (*52*).

[5] Average acreage of pasture and grazing land per animal unit of roughage-consuming livestock.

In the three regions of the Western States, about 400 million acres may be classed as semiarid and arid range, an area almost equal to the national acreage used for crops. The carrying capacity of large acreages in this area is relatively low. Even if cropland were pushed virtually to its physical limits, almost 350 million acres would still be left for grazing in this region.

In much of this region weather varies greatly over a term of years. Drought may reduce forage to a point at which animals over large areas must be sold or shifted to other areas where pasture is available. Supplemental feeds from irrigated and other areas help to provide a year-round feed supply. Because of the low carrying capacity, a large acreage is needed to support an economic operating unit.

[12] The classification of pasture and grazing lands used for grazing in 1949 and 1950 was necessarily determined largely by the available statistics on land in use, or open for grazing, which are compiled chiefly by States, counties, and other large units, such as grazing districts and national forests. In some instances, data on acreages used for grazing are available only by States or major geographic divisions of the country. From both agronomic and economic viewpoints, the classification is inadequate, as statistics are lacking in breakdowns of acreages by kinds of pasture and forage plants and respective carrying capacities, as well as the total acreages suitable for grazing if properly managed.

Even though much of this western land has a comparatively low carrying capacity, it is excellent for grazing. Many grasses and other forage plants are palatable and nutritious, and the fact that some of them cure on the ground and afford winter feed is an advantage.

FOREST RESOURCES

Forests are a basic resource. A huge quantity of forest products is needed for industrial and other uses. Together the forest-products industries are an important segment of the industrial strength of the Nation. Each year they produce several billion dollars worth of lumber and other commodities. The forestry industry as a whole, including harvesting, manufacture, transportation, and use of products made of wood, is a permanent source of livelihood for several million people. In 1946, for example, it afforded work equivalent to 3.3 million full-time jobs and wages totaling 6.3 billion dollars (*65*).

Productive forests are needed for much besides their timber. Today, they are needed to help protect soils and watersheds, to guard against rapid run-off, erosion, and damage to water supplies. It is in the national interest to build up and protect forests so they can contribute more to our annual national income and to other needs, such as recreation and watershed protection. This in brief is the broad economic and social setting of forestry in this country.

The forest-land areas in 1950, as reported by the Forest Service in Basic Forest Statistics (*66*, pp. 3–7), and related reports, contained 620 million acres. Of this area, some 457 million acres were classified as commercial forest and about 163 million as noncommercial, including 14 million acres of forest withdrawn for parks and other special purposes. Ownership of commercial forests was as follows: National Forest 73.5 million acres; other Federal 15.4; State, county, and municipal 27.1; private farm 135.3; and private industrial and other 205.9 million acres. About 116 million acres of commercial forest were in public ownership and 341 million acres were privately owned. Large blocks of forest are found in parts of the three major divisions of the country, North, South and West. Of the board-foot volume of saw timber on commercial forest land in 1945, however, 65 percent was in the West, 21 percent in the South, and 14 percent in the North.

Because of cutting, growth and other changes, maintaining a national inventory of the forests is a continuing job. This is especially necessary because heavy cutting during the World War II period and normal depletion and growth before and since have combined to bring about great changes in the forest cover and in the volume of timber produced. The general distribution of forest land in farm and nonfarm areas, commercial and other, as determined by the Forest Survey made by the United States Forest Service, is given in table 15.

The subject of our forest resources is only briefly touched upon here. It has been well covered in the publications issued by the United States Forest Service (*37*, *65*, *66*).

MULTIPLE USES OF LAND

The many types and classes of rural lands and the varying local conditions, customs, needs, and practices, necessarily have led to multiple uses of the same areas. This diversity has meant variations

TABLE 15.—*Land in woodland and forest, United States, 1950* [1]

Woodland and forest	Acreage	Percentage of total
	Million acres	*Percent*
In farms	220	35.3
In special uses [2]	14	2.1
Other forest not in farms	386	62.6
Total	620	100.0
Commercial forest	457	74.2
In special uses	14	2.1
Noncommercial	149	23.7
Total	620	100.0

[1] Woodland in farms, 1950, Census of Agriculture (*60*); total forest and woodland, commercial and noncommercial, United States Forest Service, Basic Forest Statistics, Sept. 1950 (*66*), and recent survey data for Kentucky and Montana.

[2] Withdrawn or set apart for special uses such as parks and other noncommercial timber uses.

in management governing the principal agricultural uses. Management of cultivated cropland and improved pasture differs from that of unimproved range and forests in such elements as intensity of use and degree of investment. Accordingly, these uses tend to restrict cropland and improved grazing land to a single primary use, with possibly one or more limited supplemental uses. Because of their cover and their less intensive use and management, unimproved grazing land, woodland, and forest often have several multiple uses that are almost equal in value to their primary uses.

For example, in some areas, in addition to timber and wood, forests and woodlands produce forage that is of considerable value to livestock growers. Much forest grazing supplements existing farm pastures at certain seasons of the year. When properly managed, grazing produces a significant supplemental income and also reduces fire hazards. The income from grazing often enables a woodland owner to carry his timber crop to an age most suitable for profitable marketing.

Recreation and production of wildlife are important multiple uses of forest and grazing lands and to a more limited extent of cropland and pasture. Estimates of the values of recreation and wildlife have been made at times. Whether or not these values can be reduced to monetary terms, growing of wildlife and meeting the recreational needs of the public are noteworthy aspects of our national life.

The influence of forest and grazing lands goes beyond production of timber, livestock, wildlife, and recreation. A far-reaching benefit of these lands to agriculture, other industries, and the whole economy lies in watershed services. In no other functional use is the proper management of land more essential. Some 25 million acres of land are irrigated with water from watersheds that are chiefly in forest and grassland. Most Western streams have their sources in forest or grassland areas. They supply a large part of the water for irrigated areas, as well as water for domestic and industrial uses and for power. The services of forested watersheds in the Central and Eastern States

are increasingly needed for domestic and industrial water supplies, for navigation, and for power.

A publication of the United States Forest Service, "Our Forests: What They Are and What They Mean to Us," (*37*) issued in 1944 included this statement:

"One-half of our forest area exercises a major influence on stream flow and an additional quarter a moderate influence. The area of major influence, however, feeds streams that flow through nearly every part of the country. Therefore, practically our entire population directly or indirectly benefits from forest protected waters."

It is recognized that much rural land is used for several purposes simultaneously and that more than one of these uses are often of significant value. In this report, each kind or area of land is assigned to its major or primary use. No attempt is made to estimate acreages of additional, secondary, or supplementary uses.

A considerable part of the public land—land administered by Federal, State, and local government—is reserved primarily for use as service areas, parks, recreation and wildlife areas, highway rights-of-way, and for schools, institutions, and other special purposes. Some of these reserved areas include forested, grass, and barren land. Here forestry and grazing are subordinated or prohibited for the benefit of the special use indicated. To be most productive, cropland and improved pasture must be devoted primarily to agricultural production, although with proper management they may yield secondary benefits from certain wildlife species, watershed protection, and scenic values. Although many multiple-use values are relatively low per acre, in terms of adding to the total assets of townships, counties, or regions, they are large.

Wildlife and Land

An appraisal of wildlife production on agricultural land was published in 1942 by the United States Fish and Wildlife Service and the Bureau of Agricultural Economics (*33*). This study summed up the general situation somewhat as follows:

The aggregate of wildlife on agricultural lands of the United States is large and its estimated value is impressive. Although locally, worthwhile revenue may be obtained, the values per farm or per acre when averaged are low. Hunters also are numerous and when the game is distributed among them each can obtain only a limited number of pounds. Because of the need to devote the good agricultural land to high-income crops, frequently only inferior lands can be used primarily for wildlife and their production of game as of other crops often is relatively low.

The report showed that more than 85 percent of the huntable land was in private ownership or control, and that economic necessity for its most efficient use reduced production of wildlife to a secondary status. On the basis of area, agricultural land provides a large percentage of the wildlife habitat of the country.

Wildlife specialists have estimated that about 1,150 million acres, or 60 percent of the land area of the country, provides significant quantities of food and cover for wildlife. Some 300 million or more additional acres could provide food and cover for wildlife, thus mak-

ing a potential huntable area of about 1,450 million acres. In 1935 approximately 6 million hunting licenses were issued. In 1950, the number had risen to 12.7 million. This did not include all farm boys and other local hunters who, in some areas, were permitted to hunt certain game during open seasons on their own or nearby lands without licenses. The estimated potential huntable area per license was 114 acres. Since 1947 the number of hunting licenses issued has increased by 15 percent. In addition to hunting licenses, approximately 16 million fishing licenses were issued in 1950.

Today, the demand is even greater and multiple use of land for agriculture and for wildlife is of concern to farmers, stockmen, hunters, trappers, and conservation and game officials. Numbers of many species of wildlife have been greatly reduced. But numbers of a few species have increased because of the protection and management measures afforded in recent years. For example, deer and elk have increased in parts of their former ranges. On some grazing areas competition between forage-consuming wild game and domestic livestock has become too intense for best results to either. Safety measures to prevent overcrowding and overgrazing are necessary to protect both the animals and the land (*20*, *77*). Those concerned with the management of wildlife are faced with two problems (1) Providing hunting grounds that will both satisfy and benefit all groups of citizens; and (2) regulating numbers and feeding areas of wildlife to prevent (a) overcrowding and starvation, and (b) undue losses in production of cattle, sheep, hogs, poultry, and farm crops necessary for human food and clothing.

Recreational Use of Land

The greater demand for public recreational areas in recent years is based on several factors. Hours of labor have been reduced; automobiles and good roads stimulate travel; parents and educators have recognized the importance of outdoor recreation for children and young people; an increasing number of business and other organizations have encouraged their employees to engage in healthful outdoor recreation; and with the growth of cities and the development of farms and industrial plants, many private woodland, stream-bank, and lake-front areas formerly available for recreational activities have been occupied for other purposes.

Although exact figures concerning recreational areas are not available, it is known that the total acreage covered by Federal and State rural parks, wildlife areas, and forests open to camping, picnicking, hiking, boating, bathing, and other outdoor sports is upward of 200 million acres (table 16). In addition to public recreational areas one of the principal uses of an estimated 150 to 200 million or more acres of private land also is for summer and winter homes, lake, river, and mountain cottages, campsites, beaches, picnic areas, and other recreational facilities. Many of the better public and private recreational areas, however, are either in the far North, the Northeast, the deep South, or the Appalachian and Rocky Mountains, away from the main centers of population.

Usually recreation is only one of the uses made of the land in much of the territory that has recreational value. Some public recreational areas produce timber or forage for grazing livestock, and serve as

TABLE 16.—*Federal and State rural recreational areas, 1950* [1]

Classes	Primary areas	Supplementary areas	Total
Federal land:	*1,000 acres*	*1,000 acres*	*1,000 acres*
Park and recreational areas	25, 390	20, 326	45, 716
Wildlife	4, 187	127, 777	131, 964
Reservoir and water supply	----------	11, 502	11, 502
Total	29, 577	159, 605	189, 182
State land:			
Parks	2, 385	5, 358	7, 743
Wildlife	4, 761	14, 022	18, 783
Total	7, 146	19, 380	26, 526
Grand total [2]	36, 723	178, 985	215, 708

[1] Compiled from various Federal and State Reports (*13*).
[2] County and municipal parks and wildlife preserves are not included.

habitats for wildlife and as sources of water supplies for irrigation, power, and domestic purposes. Private areas also are used partly for timber, pasture, cultivated crops, and other purposes. The land cover and variety of use are often attractive features for recreationists from distant places.

Recreational use of land is significant to agriculture for several reasons. Large recreational centers provide markets of considerable magnitude for farm products. Much land that is marginal for farming can be used effectively for recreation. This use of land affords public revenues for maintenance of roads and local public services. Recreational property is often a source of employment and income for local people and thus strengthens the economic base of many rural communities.

Development of summer homes and cottages in New England, the Appalachians, the northern Lake States, the Ozarks, and the Rocky Mountain and other western areas, as well as along the sea and gulf coasts, rests upon a broad and expanding base. Varied personal preferences have given many types of rural properties potential value for recreational use. In recent years the trend has been toward increased purchase of recreational properties by middle and lower income groups. Many urban residents have returned to areas of former visits to buy vacation homes and campsites.

In New England, the Appalachians, and the Ozarks, purchase of country homes has followed periods of abandonment or changes in the situation of former owners. For example, summer residents have followed on the heels of a declining agriculture; they have not displaced active farm operators. In some New England towns, local sources have estimated recently that in summer half or more of the dwellings are occupied by summer residents. Here summer residents have not halted the general trend of reversion to forest cover which, on most properties, was under way before transfer to summer use. But they have kept

some of the more fertile small-garden, orchard, hay, and pasture areas open. Old farm buildings have been restored and many historic structures have been saved from collapse. Property values have been strengthened and new income has been brought in. Here the "recreation industry" ranks high as a source of income.

Continued development of summer homes in New England and in other regions with suitable natural resources is probable and desirable. In many rural areas of the country, transfer of land to recreational use and to full-time residential use represents the best adjustment that can be made. Encouragement of use of land for summer homes by public and private action, such as zoning, police protection, and necessary public services can facilitate orderly development and minimize the maladjustments that accompany change.

Somewhat similar to the use of land for summer homes in areas of temperate summer climate in the Northern and Mountain regions has been its greater use in both the Southeast and the Southwest for winter homes and vacation areas. A significant part of the increase in population and in income in Florida and California has come from people who seek warmer climates where more outdoor living is possible. People are turning more and more to quiet spots in the country for outdoor living, either for a few weeks each year or for full-time homes.

Although parks and other recreational areas have been expanded, recreational facilities have not kept pace with the demand created by the present-day attitude toward outdoor recreation and the increase in leisure time. They show great diversity, both as to natural advantages and as to accessibility to numbers of people. Millions of persons most in need of recreational areas either cannot afford the facilities available, or they lack access to such facilities. A serious problem is the providing of recreational facilities in some of the thickly settled rural areas where land and water are not available, or are not well-adapted to such use. Further study of recreational areas is needed to help make them available geographically and economically to those who want and need them.

RELATION OF LAND USE AND OWNERSHIP

The character of its ownership affects the use and treatment of land, its improvement and development, the stability of its management, and the kind of action needed to keep it on a permanently productive basis. Thus, character of ownership is a significant factor in the land-use situation and outlook. Private ownership, which accounts for more than 70 percent of all the land in the United States, is necessarily influenced mainly by returns. As a rule, agriculture must yield incomes (without long waiting) that will cover costs, including interest on investment, and will give operators a living wage. It therefore centers on those enterprises, crops, and livestock, that will produce adequate returns annually or, at most, within a relatively few years.

Approximately 1,342 million acres of land, including both rural and urban areas, are privately owned. Private land assessed for taxation on an acreage basis makes up almost seven-tenths of the land area, or 1,326 million acres (table 17 and fig. 10). This represents the bulk of the private land, as only about 10 million acres of urban land are assessed as lots and are not reported in acreage. Relatively limited

TABLE 17.—*Acreage of land by classes of ownership, United States, 1949* [1]

Classes	Acreage	Percentage of total
	Million acres	*Percent*
Private land: [2]		
Private land assessed as acreage for taxation	1, 326	69. 7
Urban areas assessed as lots	10	0. 5
Areas not assessed (estimated)	6	0. 3
Total	1, 342	70. 5
Indian land: [3]	57	3. 0
Public land: [3]		
Federal land	398	20. 9
State land	80	4. 2
County and municipal land (estimated)	17	0. 9
Total	495	26. 0
Highway and road rights-of-way unaccounted for, etc. [4]	10	. 5
Grand total	1, 904	100. 0

[1] Compiled from State and Federal reports and records. Subject to revision.
[2] Private land includes individually owned, partnership, and corporate owned.
[3] Davidson, R. D., Federal and State Rural Lands, 1952, (*13*, pp. 66–69).
[4] Composed of highway and road rights-of-way not already covered in private and public land.

areas of private land are not assessed for taxation. Completely exempted private areas and other areas not assessed probably do not exceed 6 million acres.

Public lands—Federal, State, and local government lands—and Indian land comprise approximately 562 million acres, including public highway and road rights-of-way not included in private and public lands. Information concerning Federal and State land was provided by an inventory of these types of public holdings. Exact data for county and municipal lands are not available. Therefore, the total figures can be considered only as approximations. Small areas of land owned by local governments may be unaccounted for and estimates of private and public land may include some duplication. For example, in many areas highway and road rights-of-way have customarily been included in the total acreages of both the private and public land tracts through which they pass. Only in recent years, have acreages in rights-of-way been deducted from private holdings in assessment and other land records.

Public records and reports prepared by State revenue, or State tax commission officials for 40 States, plus data for the remaining 8 States from various publications and public agencies, served as the source of data on ownership, that is, on private land assessed for taxation. In 18 States data were available by major uses and grades of land. In several States in the last few years assessment rolls have been re-

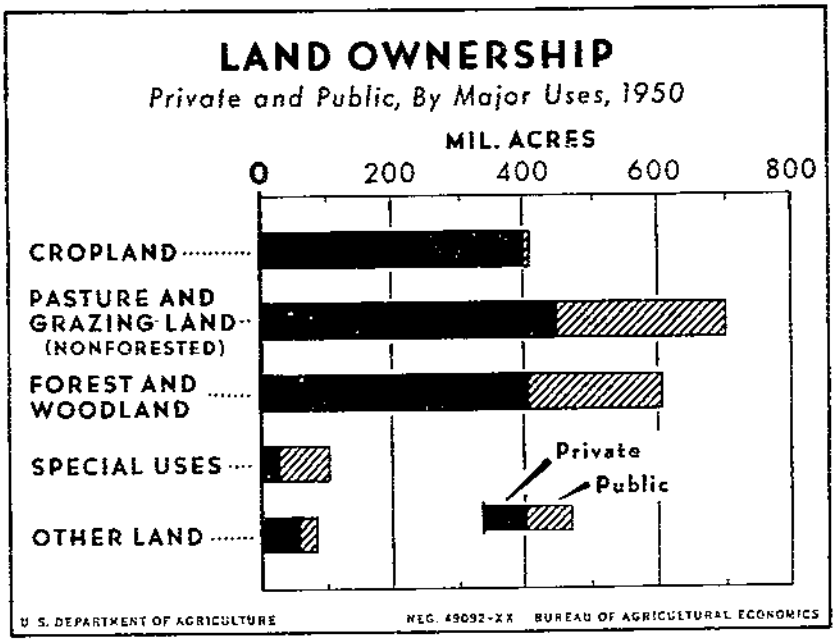


FIGURE 10.—Nearly all cropland is privately owned; only small areas are publicly owned. These include some State, school, and Indian lands, and land held temporarily for a specific public purpose. About a third of the grazing and forest lands are publicly owned; much of this is in arid and mountainous areas that are not well-adapted to full-time agricultural use. Special-use areas—parks, highways, reservoirs, and military posts, which are on land that has slight surface value for agriculture—make up a considerable part of the publicly owned land.

viewed; air photographs have been used to map and account for all land; and field inspections have been made to improve classifications and to enroll all property. Thus, the total acreages of land compiled from assessment rolls probably are reasonably complete.

The proportion of privately owned land varies significantly by regions, ranging from 80 to 90 percent generally in the Eastern, Southern, and Central States to 35 to 50 percent in the Mountain and Pacific States. In States such as Maine, Vermont, Alabama, Florida, Indiana, Missouri, Ohio, Iowa, and Nebraska about 95 percent of the land is in private ownership. In Kansas and Texas more than 97 percent is privately owned. In Arizona, Nevada, and Utah, less than 20 percent of the land is privately held. In Colorado, California, Montana, and Washington more than 50 percent of the land is privately owned.

Use classifications of land for tax-assessment purposes made in the eight Mountain States show the following: Cropland, both irrigated and dry land, 37.3 million acres; pasture and grazing land, 134.9 million acres; other private land, 22.2 million acres; total assessed, 194.4 million acres, or 35 percent of the 549 million-acre land area.

Ownership of Cropland, Pasture, and Grazing Land

At present nearly all the cropland of the country and about two-thirds of the pasture and grazing land are privately owned. Less than 2 percent of the cropland actually used is publicly administered and this is chiefly Indian land. More than a third of the grazing land of the country is either State, Federal, or local-government land. Most of this public grazing land is in the Western States; it is arid, of high elevation, or rough, and is suitable for grazing during part of the year only. Two-thirds of the forest land is privately owned.

Of the 347 million acres of publicly owned grazing land used in 1949, about 256 million acres were federally owned; 44 million were Indian lands; and the remaining 47 million acres belonged to States and counties. Open or nonforested grazing land covers 250 million acres and woodland grazed covers 97 million acres of the publicly administered grazing area. A classification of pasture and grazing land according to whether privately or publicly owned is presented in table 18. About 45 million acres of the publicly owned grazing lands are reported by the 1950 Census of Agriculture as in farms. This is about 7 percent of the total acreage of pasture and grazing land in farms. Publicly owned land leased to individual farms and ranches is reported as in farms, while areas used under permit or in common with others are not usually considered as farmland. Three-fourths of the Indian land, or 42 million acres, also is included in farms. This includes the major part of the Indian land used for farming and grazing.

Comparatively few livestock operators in the Western States own in fee simple all of the rangeland required by their livestock. Use of leased land or of grazing permits in connection with varying acreages of owned land is a common system of grazing land tenure throughout the West. Control of grazing land varies from the stockman who owns no land to the operator who owns a home ranch and all necessary rangeland. Between these two are many combinations of ownership, leases, permits, and some unauthorized use. Significant factors that influence control and use are: (1) The variegated pattern of private and public landownership in the West; (2) location with respect to watering places and natural means of ingress and egress to grazing areas; (3) purchase prices, leasing, and permit costs of land; (4) form of Federal reservations of public land for public purposes; (5) extent of public land available under various forms of permits; (6) methods of handling livestock on the range; and (7) to some extent the customs of occupation and use of land since the beginning of settlement in the West.

Productivity and Economic Value

In addition to the actual quantity and type of forage available, the value of grazing on publicly owned land depends upon such factors as season of use and length of time the land can be used, availability of water, accessibility as governed by topographic features and distance to grazing and hay land to be used at other seasons (*68*, pp. 8–9). The time and expense incurred in driving or shipping the animals back and forth from the home base to grazing areas are important. Tracts

TABLE 18.—*Major uses of land in private and in public ownership, United States, specified years, 1920–50* [1]

[In millions of acres]

Land use	Private [2]				Public [3]			
	1920	1930	1940	1950	1920	1930	1940	1950
Cropland [4]	398	409	396	402	4	4	3	7
Pasture and grazing land (non-forested)	440	434	476	450	310	274	247	250
Forest and woodland	407	431	393	406	160	176	209	200
Special-use areas [5]	22	23	26	27	29	41	51	78
Miscellaneous other land [6]	72	62	62	57	63	51	42	27
Total [7]	1,339	1,359	1,353	1,342	566	546	552	562

[1] Compiled from various sources, including State and Federal publications and records and reports of numerous State agencies. Total figures should be regarded as approximations of the acreages of land held by private parties and public groups and in different major uses rather than results of detailed enumeration.

[2] Private land includes all land owned by individuals, private groups, and corporations. It includes the major part of the farm land and the urban and residential areas of the country.

[3] Public land includes Federal, State, county, municipal, and Indian land under Government administration. Indian land comprised nearly 57 million acres in 1950. Considerable acreages of public land are included in farms and ranches or used with them for grazing, but most of the public land is not suitable for arable farming.

[4] The greater part of the cropland reported in public ownership is Indian land and State school and other land leased to farmers for farming.

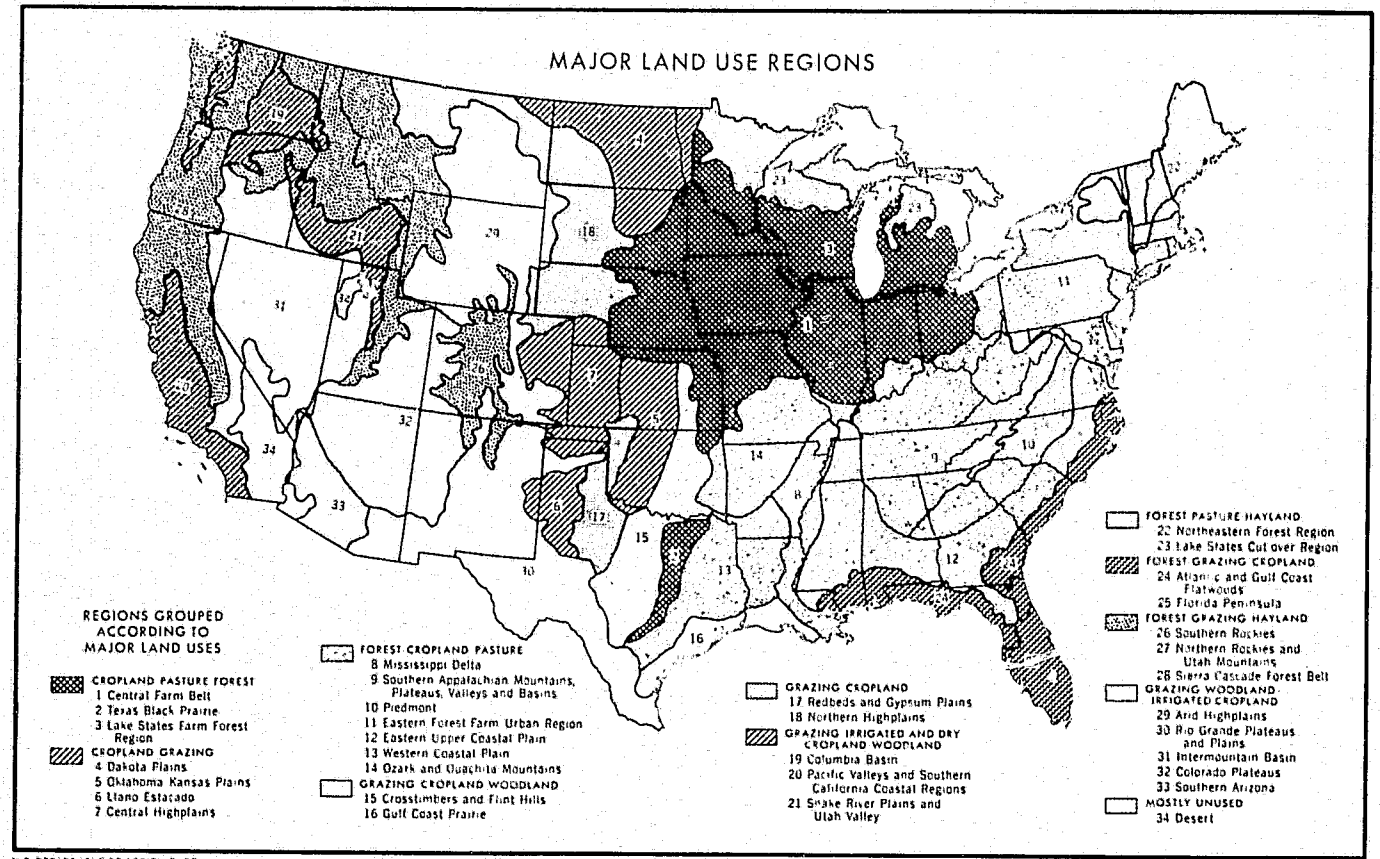
[5] Towns, cities, farmsteads, highways, roads, parks, wildlife refuges, water-supply areas, and military lands.

[6] Land chiefly of low value for agriculture.

[7] Individual items adjusted to total. The total land area was calculated as 1,905 million acres in 1940 and prior years, but adjustments made for absorption by large reservoirs and minor revisions in a few State areas, reduced the total in 1950 to 1,904 million acres.

of land can be so scattered that moving the animals from one to another uses up the profit. Grazing values reflect to some extent not only the value of forage, they take into account also the size of areas to be grazed, the season of year, the number of weeks or months available, and the distance from the operators. Whether the forage will only support life or whether it will add weight to the animals grazed is also a consideration.

Grouping and consolidation of permits are reducing the expense of moving the animals. Allotments to individuals and small groups are now encouraged and are increasing in certain areas. Operators or stockmen can add fences, wells, and even buildings to public land by arrangement with the public land-management agency that administers the land. They can remove fences and buildings under the agreement. In some instances, fences and even sheds or small buildings are added with public funds when it appears in the public interest to do so. Reseeding and seeding of desirable pasture plants, and removal of harmful and uneconomic weeds and shrubs, also are under


MAJOR LAND USE REGIONS
REGIONS GROUPED ACCORDING TO MAJOR LAND USES
CROPLAND PASTURE FOREST
1 Central Farm Belt
2 Texas Black Prairie
3 Lake States Farm Forest Region
CROPLAND GRAZING
4 Dakota Plains
5 Oklahoma Kansas Plains
6 Llano Estacado
7 Central Highplains
FOREST CROPLAND PASTURE
8 Mississippi Delta
9 Southern Appalachian Mountains, Plateaus, Valleys and Basins
10 Piedmont
11 Eastern Forest Farm Urban Region
12 Eastern Upper Coastal Plain
13 Western Coastal Plain
14 Ozark and Ouachita Mountains
GRAZING CROPLAND WOODLAND
15 Crosstimbers and Flint Hills
16 Gulf Coast Prairie
GRAZING CROPLAND
17 Redbeds and Gypsum Plains
18 Northern Highplains
GRAZING IRRIGATED AND DRY CROPLAND WOODLAND
19 Columbia Basin
20 Pacific Valleys and Southern California Coastal Regions
21 Snake River Plains and Utah Valley
FOREST PASTURE HAYLAND
22 Northeastern Forest Region
23 Lake States Cut over Region
FOREST GRAZING CROPLAND
24 Atlantic and Gulf Coast Flatwoods
25 Florida Peninsula
FOREST GRAZING HAYLAND
26 Southern Rockies
27 Northern Rockies and Utah Mountains
28 Sierra Cascade Forest Belt
GRAZING WOODLAND-IRRIGATED CROPLAND
29 Arid Highplains
30 Rio Grande Plateaus and Plains
31 Intermountain Basin
32 Colorado Plateaus
33 Southern Arizona
MOSTLY UNUSED
34 Desert
U S DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS

way. Other conservation and restoration work is done each year, the amount depending upon the funds available.

The privilege of use of rangeland in the West does not always insure the grazier control of his areas to the exclusion of others. Many grazing areas are used in common by several ranchers who individually own, lease, or obtain use permits on widely scattered and intermingled tracts of land, among which may be public land, either State or Federal. Grazing in common may have advantages over exclusive control in many instances, as there are savings in fencing and other costs and larger and more diversified grazing areas are availal

Approximately 300 million acres are used under permit, and with the 200 million acres rented, farmers and ranchers graze their livestock on 500 million acres or more of private and public land that they do not own. More than 200 million acres of pasture and grazing land in farms are rented by tenants and part owners. This includes both private and public land leased. Pasture and grazing land make up nearly half of the farm land rented by farm operators. Farmers and ranchers in the Western States who own part of their land rent much of the grazing land that is rented.

PHYSICAL FACTORS THAT AFFECT USE

Use of land in the United States conforms generally to certain natural rather than to State and county boundaries. Land use areas cannot be designated accurately by political boundary lines. However, the Major Land Use Map, (*50*), and the Type-of-Farming Map (*51*), recently prepared in the Bureau of Agricultural Economics, show the relative boundaries of the main regions in the United States.

A generalized copy of the map showing the major uses of land in the United States, published in 1950, is presented in figure 11 to help provide a background for discussion of the physical factors that influence the use of land.

The overall pattern of land utilization is affected by physical, economic, and social conditions. Within the framework of the require-

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FIGURE 11.—The major land use regions of the United States vary from small semidesert regions like number 34 in the Southwest, which furnish little in the way of agricultural or forest products to the large agricultural regions, 1, 2, and 3, in the North Central States and in Texas, where half to three-fourths, or more, of the land is used for crops. The proportions are similar in adjacent regions, 4, 5, 6, and 7, in the Great Plains States, but the rest is almost entirely in pasture.

Between these extremes are many variations. In the Eastern and Southern States, 8, 9, 10, 11, 12, 13, and 14, about a third of the land is in crops but the major part of it is in forest. Much of the cropland lies in the valleys and basins. The proportion of cropland is even less in parts, 22, 23, 24, and 25 of the Lake States, Maine, and the Southern coastal tidewater areas.

In the forested mountain areas of the West, 26, 27, and 28, cropland makes up less than 5 percent of the land area. Forestry and grazing are predominant uses. In contrast, in the arid parts of the Southwest, 29, 30, 31, 32, and 33, cropland is only about 2 percent of the total and is confined almost exclusively to irrigated land. The remainder is in rangeland. Much irrigated and dry-land farming is carried on in the greatly diversified Pacific valleys and plateaus, regions 19, 20, and 21.

ments for land established by the needs of a diverse economy, such as our own, the physical factors that affect land use become increasingly significant. These factors largely determine the limits of the productivity of available land resources, as well as the costs either of intensifying uses or of bringing new lands into production.

Altitude, topography, climate, soils, location, and relation between land and water, either singly or in combination, principally influence the use of land and its production. It is estimated that about a tenth of the land in this country lies at an elevation of 6,000 or more feet, about a third is between 2,000 and 6,000 feet, and almost three-fifths is less than 2,000 feet. As elevation rises, the growing season shortens. Most of the land above 6,000 feet is rugged mountain land, suitable mainly for grazing and timber production. Only here and there are areas adapted to cultivated crops.

The length of the growing season and the fertility of the soil also influence significantly the use and productivity of land. However, the extent of rainfall and the supply of water are the prime physical factors that limit the suitability of land for agricultural production.

Water and Use of Cropland

Several significant interrelationships exist between use of cropland and water. These include limits on lands used for crops in moisture-deficient areas; problems of excess water in wet-land areas and those subject to overflow; vegetal cover in relation to sedimentation and stream flow; condition of land in relation to ground water; relationship of ground water to supplemental irrigation and domestic water; and drainage and soils in relation to salinity.

Based principally on precipitation, the country can be divided agriculturally into two main parts—the East and the West. The dividing line approximates longitude 100° and the 20-inch precipitation zone. The climate of the East is mainly humid or subhumid; the West may be characterized as arid or semiarid, except in the Pacific Northwest, parts of the Columbia Plateau, and mountainous areas at higher altitudes. The East further divides into regions according to latitudes and temperatures. Although these conditions also influence types of agriculture in the West, they are overshadowed by the extent of rainfall and the supply of water for irrigation.

Drainage and Flood Control

In contrast to the moisture-deficient areas of the West, on large acreages of land in the East and South, water is overabundant at certain seasons for effective use. Here drainage and flood protection become the principal problems relating to water. Our country includes within its boundaries 125 million acres of undeveloped wet and swamp lands which are subject to overflow. With proper drainage and protection, an estimated two-fifths of this area, or 50 million acres, would be physically suitable for crop or pasture use. The remainder would be valuable chiefly for forest and wildlife use (*2*).

Areas of excess water are to be found principally along the Atlantic seaboard, the Gulf Coast, and the lowlands that bound the larger rivers in the Coastal Plains, and in the flat plains and depressions in the

glacial areas of the North. Although substantial areas have fertile soils and would be suitable for crop production if drained, cleared, and protected from floods, many large areas have imperfect natural drainage and would be of questionable quality even though drained and otherwise improved. Improved techniques of drainage and clearing have increased the feasibility of reclaiming wet lands with inherently fertile soils and good natural drainage (fig. 12 and table 19).

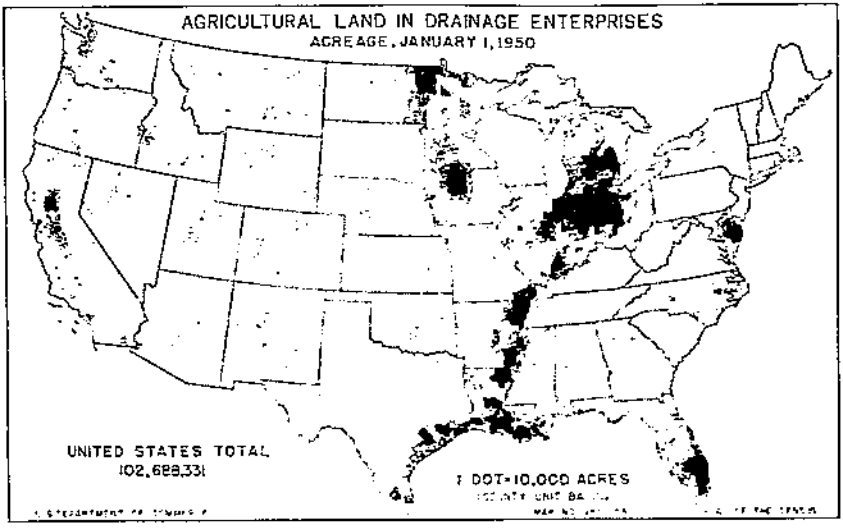

FIGURE 12.—More than 100 million acres are included in organized drainage enterprises. About four-fifths, or 82 million acres, are improved. Of the unimproved land, 4 million acres are classified as suitable for development. Approximately 50 million acres outside of organized districts have been improved by farm drainage.

TABLE 19.—*Agricultural land in drainage enterprises, United States, specified years, 1920–50* [1]

Year	Acreage in enterprises	Improved land	
		Acreage	Percentage
	1,000 acres	*1,000 acres*	*Percent*
1920	65,495	44,288	67.6
1930	84,408	63,514	75.2
1940	86,967	67,389	77.5
1950	[2] 102,688	[3] 82,138	[3] 80.0

[1] U. S. Bureau of the Census, Drainage of Agricultural Lands 1940, table 1, page 1; (*56*) and Drainage Agricultural Lands 1950, Vol. 4, 1952, table 1, page 2 (*57*).

[2] Includes 4,109,573 acres reported drained by irrigation enterprises.

[3] Estimate based on increase in improved land 1930 to 1940, and increase in land in drainage enterprises, 1940 to 1950.

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Artificial drainage has been provided for more than 100 million acres, but about 30 million acres of this land needs additional improvement if it is to grow normal crops each year (*2*). Of the area drained, more than 82 million acres are improved. Many million acres of the best land in the Corn Belt and Mississippi Delta have been developed by drainage. Additional areas of fertile land in the Mississippi Valley and the Atlantic and Gulf Coastal Plains could be reclaimed when justified by demand.

Farming practices and type of cropland use in the upper reaches of a watershed may materially affect the extent of downstream floods, scouring, sedimentation, stabilization of stream flows, maintenance of channels, other problems of drainage, and quality of water, as well as the underground-water level. In developing any comprehensive program of use and control of land and water, these interrelationships must be taken into account. In the lower reaches of many rivers, depositions of silt from flood waters are often beneficial and overflows may not damage the land. But frequently the land is seriously depleted or ruined because of scouring, movement of soil, and obstruction of drainage outlets. Thus the fertility of the land is lowered and the capacity of storage reservoirs is reduced.

The degree of flood protection that may prove economically feasible for agricultural land varies from essentially complete protection provided by a system of levees, supplemented by upstream reservoirs and watershed-treatment measures, to partial protection which merely reduces frequency of flooding in the crop season but which may permit an increase in the value of agricultural production over that otherwise possible. Lands affected by flood-control projects are given protection which ranges between these extremes. The high degree of control necessary for urban areas is not so essential for agricultural lands and reasonable use may be obtained in the latter, even though protection is provided only against the more frequent floods.

A close relationship exists among flood protection, drainage, and clearing of lands to be used for crop production. If additional flood-protected lands are to be used for crop production, an estimated 70 percent of these areas would have to be cleared. Most of the new areas of cropland also need to be drained to some extent.

Irrigation

In the Great Plains and the Mountain States, the average annual precipitation decreases from about 35 inches in the eastern Plains to less than 10 inches in parts of the Southwest. It covers the transition from a humid to an arid climate. Crops that can be grown successfully at the minimum levels of rainfall are limited and risks are high. Seasonal distribution of precipitation also influences markedly the type of crops that can be successfully produced.

About 40 percent of the land in the United States is markedly deficient in precipitation for use as cropland. This consists largely of the 740 million acres that have an average annual precipitation of less than 20 inches. Although dry-land farming is practiced in areas with precipitation near the upper limits of this class, operations are hazardous and summer fallowing of land is common. Additional

areas in both West and East are subject to droughts of less intensity and frequency.

In the 17 Western States, nearly 25 million acres of crop and pasture land were irrigated in 1949 (fig. 13 and table 20). California and Texas lead in number of acres irrigated. Much of this irrigation is done by pumping water from wells. Colorado, Idaho, Utah, and Washington also have large acreages of irrigated land and irrigated agriculture is important in the other Mountain and Pacific States. Of the Eastern States, Arkansas and Louisiana lead in irrigation.

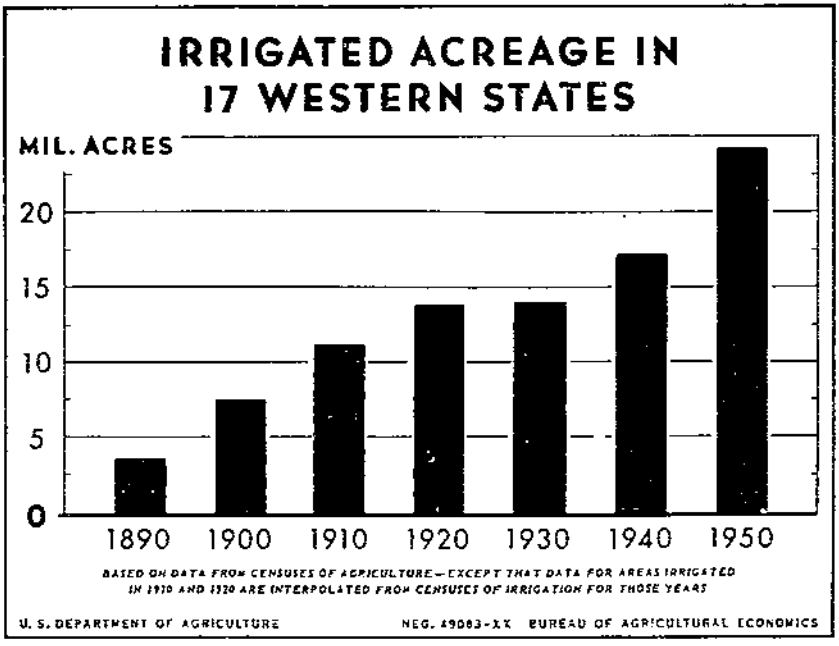

FIGURE 13.—In 1950 the area under irrigation was about 25.8 million acres. Nearly 95 percent of this was in the 17 Western States. Several Western States have large areas of irrigated land. Many additions are being made, both in extent and in location of irrigated acreages, as new projects are developed in the various drainage basins of the West. Irrigation is increasing also in the rice areas of the South and in Eastern truck-crop areas.

Production of rice in these States depends upon irrigation. Irrigation of truck and fruit crops in Florida and other eastern specialty-crop and improved-pasture areas has increased greatly in recent years.

Lack of proper drainage and control of salinity also may hinder development of new cropland in some irrigated areas. The need for drainage often becomes apparent when the soil becomes too toxic for crops because of alkaline accumulations. In areas that depend upon pump irrigation, the costs of pumping, the drain on underground supplies of water, and the rate of replenishment of underground water are all interrelated with type of agriculture, use of cropland, and irrigation practices.

TABLE 20.—*Acreage irrigated in the United States, specified years, 1890–1950* [1]

Year	Acreage irrigated [2]		Total
	17 Western States [3]	31 Eastern States [4]	
	1,000 acres	*1,000 acres*	*1,000 acres*
1890	3,632	85	3,717
1900	7,543	246	7,789
1910	11,259	[5] 408	[6] 11,667
1920	13,883	[5] 599	[6] 14,482
1930	14,086	[5] 603	14,689
1940	17,243	740	17,983
1950	24,271	1,517	25,788

[1] U. S. Bureau of the Census, Census of Agriculture, Vol. 1, parts 1 to 34, (*60*); Irrigation of Agricultural Lands 1940, (*56*); and Irrigation of Agricultural Lands, 17 Western States, Arkansas, Louisiana and Florida, Census of Irrigation, Vol. 3, parts 1 to 18, (*58*).

[2] Acreage irrigated as reported by the agricultural census for the year preceding the date of the census. It should be noted that there are two official sources of irrigation statistics, (1) the census of agriculture which has provided irrigation statistics since 1890, and (2) the special census of irrigation enterprises, begun in 1910, in the States where irrigation is most extensive. The census of agriculture data for irrigated acreage are given in this table as they appear to be more consistent with the acreages of cropland and pasture reported used for the respective years than the total acreage under irrigation (subject to irrigation) reported in the census of irrigation enterprises.

[3] 17 Western States, including 6 Great Plains States, 8 Mountain States and 3 Pacific States.

[4] 31 Eastern States including Arkansas, Louisiana, and Florida. The acreages irrigated reported by the Census of Agriculture in 1950 for the three States were as follows: Arkansas 422,107; Louisiana 576,775; and Florida 365,421.

[5] Arkansas and Louisiana. Data for the other 29 Eastern States not available.

[6] Data for 1910 and 1920 for 17 Western States are interpolated from censuses of irrigation for those years.

In brief, the relationship between land and water is unbalanced throughout large areas of the country. A good deal of the land has too much water at certain seasons for effective use; other areas have too little. Drainage, flood protection, and irrigation are ways of bringing the two resources into better balance for more effective agricultural utilization.

RELATIONSHIPS BETWEEN WATER AND GRAZING LAND

Water is necessary for growth of forage on rangeland as well as for use by the livestock that graze the range. The carrying capacity of rangeland is determined primarily by precipitation, which in turn affects the type and density of grass and other forage. Seasonality of precipitation also affects use of rangeland. Areas in higher altitudes furnish 3 to 4 months of summer grazing. Foothills and plateaus are available throughout much of the year, although the rate of growth is usually not sufficient to carry animals for more than 6 months. Desert and winter ranges are usually areas of low rainfall

and low productivity, although they provide forage when other sources are scarce. Irrigated or other types of improved pastures and hay lands form a necessary base for successful use of rangelands.

In the more arid range areas, rangeland has little value for grazing unless water from wells, ponds, and water holes is available for livestock within reasonable distances.

Significant relationship between grazing land and water is that between land cover and water runoff. Improved vegetative cover is a recognized method of stabilizing stream flow and reducing damages from erosion, sedimentation, and flooding. Improved cover may serve multiple purposes in reducing runoff and conserving moisture on the range. Although some of the reduction in surface runoff may be partly counterbalanced by increased subsurface runoff, the quantity of water available for production of grass is likely to increase. Increased infiltration may also improve ground-water levels.

Influence of Forests

The relationship between cover and water runoff in the case of forest lands is similar in principle to that of rangelands. Improved forest cover reduces rapid surface runoff and stabilizes stream flow (*37*). Since its initiation, a principal justification for a national forest program has been its relationship to stabilization of stream flow and reduction of floods in navigable streams. Increases in frequencies and magnitudes of floods in originally forested areas have often been attributed in substantial part to the clearing of extensive areas of forests on the headwaters.

ECONOMIC AND OTHER FACTORS THAT AFFECT USE

The acreage of land that is needed for production of food, fiber, and other agricultural materials depends principally upon domestic demand, productivity of the land, livestock production per unit, and extent of foreign trade in farm products. If probable future trends in acreages of crop and pasture lands are to be estimated, it is first necessary to explore the effect that these factors will be likely to have on future needs. In studying these influences, it should be noted that the diet of our people has changed to some extent during the last three decades and that, because of this, shifts in acreages of certain crops have been made. But in recent years the per capita acreage utilized in producing food for domestic consumption has changed very little, although the total acreage probably will continue to increase gradually to care for the needs of the growing population, unless crop yields per acre and livestock production per unit are increased substantially. Temporarily large stocks, such as those accumulated in 1948–49, have tended to be evened out because of later fluctuations in production, expanding requirements, and development of better methods of distribution and storage.

Size of Population

In the years ahead, the population of the United States is expected to increase considerably over the 1952 population of 158 million per-

sons (*59*). According to a projection assumed by the President's Materials Policy Commission in consultation with the Bureau of the Census with medium growth by 1960 our population will be around 171 million, and by 1975 it may be 193 million or more (*69*, Vol. 1, pp. 6–7 and Vol. 5, p. 63).[14] But study of available resources shows that, with present efficiencies in production, and a continuation of current progress in improvement of agricultural land, many more people could be supported on good diets, with the use of only moderate additions to our tillable land and improved pastures.

Trends in Diets

During the 1940's the average diet improved markedly. If high levels of employment and income are maintained in the 1950's, some further advances in dietary levels are likely to be made, including the spread of better diets to more income groups. Recent studies show that changes in demand for food are closely related to employment and income (*5*, *63*, *69*, v. 5, pp. 63–64). An adequate diet at moderate cost, as described in publications issued by the Bureau of Human Nutrition and Home Economics, for the 1952 population of 158 million people, would require the equivalent of 90 to 92 percent of the present acreage of cropland with average recent crop yields. But shifts among crops would be desirable to permit more livestock products, fruits, and vegetables (*67*). The liberal diet described by that Bureau for the 1952 population, would necessitate considerable increase in consumption of livestock products, particularly milk and milk products and high-grade meats, and probably would require a shift of several million acres from crops in plentiful supply.

From 70 to 80 percent of the harvested cropland of continental United States is used to produce food for human use and feed for livestock. Of the total used for food and feed, about three-fourths is used to produce livestock or livestock products for food. Hence, changes in diet that affect consumption of livestock and livestock products greatly influence requirements for land. From 1910 to 1935 several significant changes occurred in the character of consumption of farm products. Consumption of cereals and potatoes for human food decreased and per capita consumption of fruits and vegetables increased. The latter foods, however, require relatively small acreages of cropland. Consumption of dairy products increased, except for butter which decreased; per capita consumption of fats and oils increased; and per capita consumption of meat, poultry, eggs, and fish also increased, especially after 1940.

A study by the Bureau of Agricultural Economics of the food resources available to meet these different standards of diet published in 1948 concludes, with respect to land resources, that with average 1941–45 yields about 160 million people could be furnished the average 1943–45 civilian diet from the then used cropland equivalent (*9*). Further, with the 1941–45 yields and the necessary changes in produc-

[14] These are called the 1952 medium projections of the Bureau of the Census and were based upon recent trends and certain assumed factors of population growth. If these factors change from the present outlook or differ from those used, then population may vary upward or downward from the estimates cited.

tion of individual products, about 140 million people could have the liberal-cost adequate diet from the then used cropland resources, about 170 million the moderate-cost diet, and 200 million the low-cost adequate diet, described by the Bureau of Human Nutrition and Home Economics.

In the aggregate, however, from the beginning of World War I to 1952, the per capita acreage required for production of food increased only slightly because of increased yields per acre. The acreage needed to supply domestic consumption of cotton was fairly constant for several decades before 1929 but during the depression of the 1930's, and in later years, it declined somewhat. Reasons for the decline were increased yields per acre, substitution of other materials for cotton, and other factors. Domestic consumption of tobacco increased steadily and this resulted in a noticeable increase in acreage.

Economies in Consumption

Since 1941–45, the period for which these estimates were made, consumption in the United States has changed even more than was indicated earlier. Although important from the viewpoint of nutrition, the increased use of fruits and vegetables does not increase the requirement for cropland in the same degree as does the shift to livestock products. But the shift to fruits and vegetables is a consideration in certain irrigated and drained areas and in other areas adapted to production of such crops.

From the viewpoint of land requirements, the trends indicated above are more than a change toward a more adequate and palatable diet. As a whole they indicate a shift to higher rather than smaller per capita acreage requirements, because of the large acreage needed to produce livestock products.

The per capita acreage of cropland used in densely peopled countries such as Germany and Japan is small, despite the fact that these countries depend very little upon foreign sources of supply. This small per capita acreage is possible because consumption of livestock and other products which require large acreages of land in proportion to the quantity of food produced is low and because of methods of production which result in a much higher yield per acre than has been achieved here. Although we have made great progress in increasing production per acre of crops and per unit of livestock we now use less grain and potatoes and more livestock products, factors which tend to increase requirements for agricultural land rather than to reduce them.

Reduction in Acreage Used for Support of Horses and Mules

Since World War I, substitution of motor vehicles and tractor power for horses and mules in cities, towns, and on farms has released more than 70 million acres of arable land and about 50 million acres of pastureland formerly needed to produce feed for horses and mules. The sharp drop in numbers of these animals since 1939 has released 24 million acres. Large acreages of pastureland have been diverted from maintenance of workstock to production of livestock products for human use.

Mechanization and other advances will probably further affect land use in the next few years. But additional mechanization cannot continue to release as large acreages from production of feed for workstock to other uses as it has done in the past. As the limit of substitution of mechanical power for horsepower is approached, more cropland will probably be required.

Quantities of Exports and Imports

Until the early forties, acreages used to produce agricultural products for export had shown a downward trend. From a peak of 64 million acres of harvested cropland so used in 1921, the acreage cultivated for production of exports fell to a low of 13 million acres in 1941. From 1943 to 1952, under the impetus of lend-lease and mutual aid programs, acreages devoted to exports approximated those of 1910–20 (*49*), averaging about 45 to 48 million acres a year. Judging by past trends in exports, year-to-year fluctuations with upswings and downswings in line with demand and supply and exchange factors may be expected.

Agricultural products now imported that could be produced here satisfactorily are moderate in terms of acreage required. Imports include coffee, copra, bananas, tea, silk, sugar, jute, sisal, rubber, and some types of wool, cotton, wheat, vegetables, fruits, and seeds. Some of these products require a semitropical climate and their production is not commercially feasible in this country. All the agricultural imports that could be produced satisfactorily probably would not require more than the equivalent of 15 to 20 million acres of cropland.

Agricultural exports from 1951 production were valued at approximately $4 billion, probably an all-time high in total value. But in 1952 the total value of exports dropped to $3.4 billion. Total receipts from agricultural exports averaged $3.5 billion for 1947–51, and were higher than that for any other 5-year period in our history.

Although in recent years exports have been persistently high, from 1920 to 1945 they showed a declining trend in relation to total farm production and income. In 1920–24, agricultural exports valued at shipside were equivalent to 23 percent of cash receipts from farm marketings. During the interwar and the immediate postwar periods the relationships were as follows (*48*):

Calendar-year averages:	*Percentages*
1920–24	23
1925–29	17
1930–34	13
1935–39	9
1940–44	8
1945–49	12

This relationship overstates moderately the importance of farm exports, as the export value of farm products exceeds the farm value by the amount of transportation, processing, and other charges.

From 1939 to 1941 the value of agricultural exports was low. After World War II the value of these exports rose rapidly, reflecting the disruption of agriculture in Western Europe and extensive foreign aid during the war. A large increase in quantity and a larger increase in price contributed to the rise after 1941.

Foreign aid has been a factor in the larger volume of agricultural exports during the last 5 years. But the percentage of agricultural commodities financed directly by aid funds has declined steadily since 1949. In 1951, only about 20 percent of our exports were bought with aid funds.

In recent years agricultural imports, similar to agricultural commodities produced commercially here, together with all others interchangeable to any significant extent with such commodities, have ranged from 40 to 50 percent of the value of all agricultural imports. Imports not produced commercially in the United States, such as natural rubber, coffee, bananas, raw silk, tea, and spices make up the remaining 50 to 60 percent of the value of agricultural imports. Altogether the value of agricultural imports into the United States since World War II has been about 80 percent of the value of agricultural exports.

Crop and Livestock Production Per Unit

From 1948 to 1952 crop production per acre in this country was the greatest of record. The sharp increase in production per acre and per animal unit of livestock since 1940 has been a major factor in the high levels of farm production in the last decade.

Production per acre and per unit of livestock averaged 28 and 12 percent greater, respectively, in 1945–49 than in 1935–39 (fig. 14).

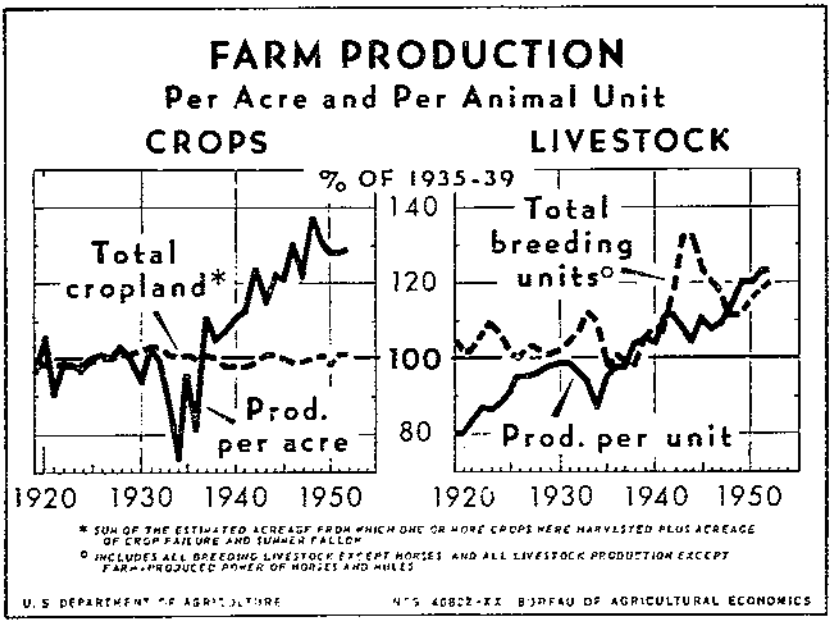

FIGURE 14.—Favorable weather has contributed somewhat to the sharp rise in farm production in recent years, but greater use of fertilizer, better seeds, better management of livestock, and adoption of other improved practices have been the major reasons. The total acreage of land used for crops has increased very little in the last 30 years, but the significant improvements made and the substitution of better land for poor land have helped to meet the demands for more food.

These sharp increases in productivity are an unprecedented departure from previous trends. Usually changes in farming develop slowly. Often they pass unnoticed until the record for some years is examined.

Back of the higher farm output lies a combination of forces. Not only have crops been shifted to better lands both on an area-wide basis and on individual farms, but considerable acreages have also been improved by drainage, irrigation, and soil-building practices. Greater use of fertilizer, lime, and improved seeds, control of insects and diseases, better feeding and livestock breeding, mechanization, and timeliness of operations were all factors in the larger output.

A word of caution is occasionally heard lest we become too complacent about our progress in agriculture. For example, T. W. Schultz, in his book "Production and Welfare of Agriculture," says that ". . . farming in the United States taken as a whole does not come near meeting the standard of efficiency set by the American economy" (*40*). A recent study of crop yields made at Cornell University concluded that these yields are the net result of many diverse forces, some of which cannot be controlled, and whose effects cannot be measured separately (*30*).

Present Condition of Agricultural Land

In the last two decades farmers have seen their per acre yields increase at an average rate of 1 percent a year. These higher yields resulted from the use of more fertilizer and better seed, and improved practices of cultivation and harvesting. The question now is whether they can be continued indefinitely without increased expenditures to maintain the agricultural plant and to permit its utilization to capacity.[35]

Soil Erosion and Fertility Situation.—The expanded production of grain and forage in recent years increased the drain on our land. Increased use of fertilizer, manure, cover crops, plant residues, and better farming practices were not sufficient to prevent continuing depletion of land. Rather, depletion has been partially obscured by the increased yields that have resulted from improved varieties, better practices, and more favorable weather (*3, 11, 31*).

It is estimated that even before World War II, soil was lost from cropland at an annual rate of 3.9 tons per acre in the northern Plains, 7.4 tons in the Lake States, and 15 tons in the Corn Belt. In the Southern States the rate of soil loss, as indicated by changes in land use, has been reduced, but the average for the country as a whole showed an increase of 3.4 percent in 1943–44 over prewar (*11*). From 1942 to 1949 these losses were aggravated because of the expanded acreages of wheat and of intertilled crops, even though greater attention was given to conservation practices. The greatest increase in loss, 6 percent, was in the Corn Belt (*39*).

[35] A recent study of crop yields made at Cornell University cautions against concluding that this can be done. The conclusion reached there was that the many variables that influence yields are such as to prevent measurement of the separate effects of erosion, depletion of soil, improved varieties, better farming practices, and weather, and hence that generalizations concerning the course or cause of changes in yields were open to question (*30*).

The Soil Conservation Service estimates that about 10 percent of the present cropland in the Midwest should be used only for grazing or in limited areas as woodland. Another 10 percent can be safely used for crops only in occasional years (*75*, pp. 34–107), and much of the remainder is so subject to erosion or depletion that it can continue its present level of production only if soil-conserving practices are established.

In any case, if the higher productivity of recent years is to continue, accelerated adoption of soil-conserving practices, including shifts to less intensive use of croplands subject to erosion, conservational management, and fertilization of lands remaining in crop production are likely to be needed (*45*, *63*).

Of the cropland in use in 1949, the United States Department of Agriculture estimated that something like half is subject to erosion in greater or less degree. Despite more than a decade of widespread application of lime, phosphate, and other fertilizers, and such practices as contour farming, strip cropping, terracing, and turning under cover crops, farmland still needs greater use of all these materials and practices. To prevent further deterioration, some 45 million acres of land now in crops should be shifted to hay, pasture, and forest, and conservation practices should be adopted on much of the remainder.

With good conservation methods, about 365 million acres of our present cropland, 100 million acres of land now in open pasture, and 20 million acres of woodland, could be safely used as permanent cropland. Thus, land suitable for cultivation totals approximately 485 million acres, assuming clearing, drainage, and irrigation where necessary. An additional 95 million acres of pasture and woodland are classified as fairly well suited for limited or occasional cultivation in rotation with hay and pasture, in case the products from this acreage are needed, provided some improvements are made and conservation practices are used to prevent rapid loss of soil (*24*, *45*, *69*, v. 5, pp. 70–72).

Conservation Needs.—Land use capability and soil surveys show that about 90 percent of the estimated permanently arable area will require a great deal more protection than it now gets if it is to be maintained regularly in cultivation. According to estimates of conservation needs prepared by the United States Soil Conservation Service, essential protective measures for cropland are as follows: (1) Cover crops annually on 34 million acres; (2) green-manure crops on 55 million acres; and (3) crop rotations on 213 million acres (*75*, pp. 12–13).

If these measures are to be carried out, a reduction in grain and other soil-depleting crops will be necessary to permit planting cover and green-manure crops and to install rotations containing hay and pasture crops.

If the requirements for protection and maintenance of the land are to be met, it will mean slowing down production not only of grain crops but of other cultivated crops. An equivalent of 20 million acres or more of cropland is estimated to be necessary to permit working space for proper rotations with year-long cover and soil-improvement crops to maintain and increase production. Otherwise, present production rates cannot be maintained nor can needed increases in productivity be achieved.

Cover and soil-improvement crops would make suitable for occasional cropping much of the eroded and depleted moderately sloping land. In the long run, this treatment would be less expensive than developing new land by clearing, drainage, or irrigation. But shifts of many steep slopes and rough or rocky areas permanently to grass and trees would be necessary.

Studies of the economics of crop rotations, land use, and conservation in Iowa show that much can be done in controlling erosion by substituting vegetative cover for mechanical structures, and soil-improvement crops for other sources of nitrogen and organic matter needed to maintain soil fertility (*22*). Recent studies in Iowa, Pennsylvania, and North Carolina also indicate that good land use and systems of conservation farming may well be considered as alternatives to development of new land. Investment opportunities under these various alternatives deserve careful study if facts are to be available for decisions on needed farming adjustments, conservation measures, and future development of new land (*23, 34*).

On all farms the system of farming should be planned in accordance with the character and condition of the land. This planning should include: (1) Rotations with adequate proportions of the cropland in legume-grass-hay, pasture, and cover crops to help control erosion and improve or maintain organic matter, tilth, and fertility of the soil; and (2) water control through the use of proper water-disposal practices, such as grass waterways, contouring, terracing, and tile and open-ditch drainage. Adoption of conservation practices alone will not insure satisfactory incomes on all farms. But as a rule, the practices mentioned, together with proper size of business and efficient management, will improve incomes over previous levels. An effective maintenance and improvement program covers a great deal more than just keeping the land from washing or blowing away. It involves many problems of fertility, soil structure, and drainage. Much information about the practices needed to cope with these problems is available.

Pasture and Range Situation.—Forage produced on pasture and rangeland makes up a substantial part of the feed for production of meat, wool, and other livestock products in the Western States. Some western rangelands have suffered through overuse. This has damaged many of the highly valuable watersheds where irrigation agriculture is located.

Overgrazing, depletion of grasses, and resulting erosion of grazing land has been less of a problem in the humid East than in the more arid West. With the clearing of forests in the East, the introduced species of grasses tended to replace the native grasses and the grazing land was incorporated into farms. Here pastures were secondary to feed crops as a source of forage for livestock. Prolonged droughts did not occur or were infrequent. Nevertheless, throughout the country, overgrazing and neglect have caused erosion and displacement of good grasses by weeds, poor grasses, and brush. The spread of poisonous plants, such as halogeton, poses a new threat to western rangeland.

Brush, such as mesquite, prickly pear, sagebrush, and similar shrubs, also tends to develop with overgrazing. Some 30 million acres of Texas rangelands are badly infested with mesquite, and over 20 mil-

lion more are seeded with it. In all, more than 70 million acres in the Southwest are brush-covered where 25 years ago there were open range and good stands of grass. But weed-killing chemicals and mechanical means offer promise for control of these and other types of undesired growth, if properly used. Their cost and the expense of thorough application limit more widespread use (*1, 68, 81*).

Cutting with heavy power brush mowers and choppers, use of heavy rollers and drags, power saws, bulldozers, pullers, poisons, and controlled burning are all effective and have been successful to some extent. But the problem is to find an economical way of destroying the brush with the least damage to land and good forage plants. For example, removal or burning of brush may remove soil and organic matter, leaving the land bare and causing serious erosion. Reseeding is often necessary. In many instances, however, native grasses have come in fairly rapidly following clearing or burning. Livestock gains on the resulting improved rangeland are generally reported good.

Experiment stations and ranchers are testing and observing several brush-control practices. The agricultural conservation program and various public land-management programs are cooperating with ranchers and farmers in spreading successful brush-control and removal practices. Several million acres have been covered already and more work is planned. Capital and operating investments for brush-control and rangeland improvement are high compared to the value of the land per acre (*81, 82*).

For decades in the western natural grassland area, which has a climate that ranges from arid to subhumid, extensive areas of public land were available for relatively uncontrolled grazing. The numbers of livestock that could be carried in periods of high rainfall proved impossible during droughts and resulted in overgrazing and depletion of vegetation.

The number of forage-consuming livestock has been high in recent years but favorable weather, improved pastures, and adoption of better management and conservation practices have made pasture and range areas better able to withstand intensive use. Overgrazing and depletion of the forage base may occur today in some areas, even though average production of forage on the range as a whole has remained fairly high. The increase in numbers of cattle has been especially high in the northern Plains and the adjoining Mountain States, where acreages of wheat also increased greatly. The numbers of livestock that can be carried in the future will depend mainly upon the rainfall and moisture conditions that will prevail in the next few years and upon prompt action by farmers and ranchers to prevent severe damage to the range, especially in the event of drought. Whether additional range areas should be closed temporarily to grazing in the next few years to permit restoration, or whether, because of favorable weather, the other improved programs of range management and conservation will be enough to prevent additional damage, stabilize conditions, and permit increased production of forage cannot now be foreseen (*68*).

With farm improvement and development of irrigated land, a continuously increasing proportion of the total feed supply in the West has come from farmland. But the feed obtained from rangeland in the West still amounts to half the total feed for all livestock.

EXPECTED TRENDS IN REQUIREMENTS FOR AGRICULTURAL LAND

In making a long-range estimate of the acreage needed for production of food and fiber, the economic supply of land must be balanced against the demand for land and its products. The first step in this process is to determine the extent and nature of the effective demand for land and to gage this demand in terms of acreage requirements. Once these requirements for acreage have been determined, the problem becomes one of finding sufficient land to meet them. This may call for more efficient use of the existing economic supply of land, additions to this supply, or recalculation of acreage requirements in terms of price levels or institutional arrangements that may be needed to bring new lands into use or to make the available supply suffice.

This section discusses the supply of land available for use in the United States and the extent to which this supply can meet the nation's demand for food and other products that come from the land. In discussing the requirements for land, the requirements for production of food are emphasized. However, the requirements of land for production of fibers, other nonfood crops, and other essential uses must also be considered. Some of these requirements involve multiple land uses. Others involve interchangeable uses or uses that may be in conflict, depending upon the extent of the demand for each use and the relative emphasis placed upon the use of conservation practices.

The Supply of Land

Viewed in the aggregate the economic supply of land must be measured in terms of use or productive capacity rather than in terms of physical area. The extent of this supply depends upon the operation of numerous variables. It reflects the physical supply of land that is both available and suitable for cropland or other uses, its native productivity, the intensity with which it is used, man's use of technology in its culture, the effect of weather, insects, pests, and plant diseases upon crop yields, and the user's decision to exploit the land or to conserve it. It also reflects the operation of several significant economic and institutional factors. Among the more important of these are: Price levels for the products of land and the effect of prices in allocating resources; production controls and production subsidy programs; costs and programs of land development; structure of transportation and marketing costs; problems of exports and imports; and the demands of the growing national economy and industrialization (*28*).

Changing Demand for Crop and Pasture Lands

The overall joint effect of population numbers and nutritional standards on the demand for food and other products of the land is particularly important in the computation of requirements for agricultural land because it provides a measure of the total production of food and other items desired. With this production goal established and with the available data on land productivity, the approximate acreages needed for production can be indicated. In a study of land

requirements, attention should be given to the changing demands for crop and pasture lands over a period of years and to the many factors that affect future requirements for these types of land.

The significant gains of the 1940's in dietary and other living standards added to the increasing demand for agricultural products from the growing population. This trend, if it continues, does not suggest long duration at any one time of the problem of finding farm markets that plagued our agriculture throughout most of the interwar period and at other briefer intervals subsequently. What it does suggest is that in the longer run the domestic demand for food products, and more particularly the demand for milk, meat, and other animal products, may become such that our ability to continue expanding the output of these products may be more fully utilized than heretofore (*14*). During temporary periods, as in 1948, 1949, and 1952, stocks of specific agricultural products may be larger than are required for the current year, but generally, as indicated by recent trends in production and requirements, fairly good stocks are in the public interest.

In addition to the increase in population and improvement of diets, the decade of the 1940's witnessed other trends and developments that affect the demand for crop and pasture lands. Among these were the increased use of farm power and machinery, the decrease in number of farmer workers, the decline in numbers of farm workstock, and the increase in use of fertilizer and lime. Also important were the increases in acreages planted with improved seed, the substitution of legume for grass hay, and improved pastures and better feeding practices for livestock.

An insight into the changing requirements of land for production of food in this country is provided by comparing some of the basic data for 1918–22 with those for 1940–44. Both of these were periods of high farm and industrial activity. In 1940–44 the total population of the United States was approximately 26 percent larger than in 1918–22. Yet on the average, in the later period each person consumed nearly 10 percent more farm products than in the earlier period, and at the same time harvested acreages for all uses decreased about 3 percent.

More than 50 percent of the increased production available for the larger population has come from improved crop and livestock yields. About 30 percent resulted from the crop acreage formerly required to feed the many horses and mules needed before tractors came into farm use, and about 20 percent from acreages formerly required to produce products for export.

A significant change lies in the fact that the number of persons living on farms in 1950 approximated 25 million, some 7 million fewer than in 1910 when the total population was about 92 million. Less than 1 person in 6 is now a farm resident; 40 years ago 1 in 3 lived on a farm. Between 11 and 12 million persons, including family labor, are employed on farms. Many of those now living on farms are engaged in other than agricultural work at least part of the year.

Acreages Used as Cropland.—The general trend in cropland use for specified purposes between 1910 and 1949 is shown in table 21. From 1945 to 1949 on the average, 375 million acres were used for

crops. Of this total, 297 million acres were used for food, fiber, and tobacco for domestic consumption, 48 million for producing export products, and 30 million for producing feed for horses and mules. Of 365 million acres used for crops in 1920–24, 55 million acres were used to produce products for export: 85 million were used for feed for horses and mules, and 225 million acres produced food, fiber, and tobacco for domestic consumption (*70*, v. 1, pp. 157–158; *49*, pp. 22–23).

TABLE 21.—*Acreage and utilization of cropland for specified purposes, United States, averages 1910–49* [1]

Period	Cropland [2]		Acreages used for producing				Total population, July 1
			Export products	Feed for horses and mules	Food, fiber, and tobacco for domestic consumption		
	Total	Per capita			Total	Per capita	
Average:	*Million acres*	*Acres*	*Million acres*	*Million acres*	*Million acres*	*Acres*	*Millions*
1910–14	337	3. 55	44	90	203	2. 14	95
1915–19	359	3. 49	52	92	215	2. 09	103
1920–24	365	3. 32	55	85	225	2. 05	110
1925–29	374	3. 14	48	74	252	2. 12	119
1930–34	381	3. 05	31	64	283	2. 26	125
1935–39	373	2. 89	21	55	294	2. 28	129
1940–44	371	2. 75	20	42	309	2. 29	135
1945–49	375	2. 60	48	30	297	2. 06	144

[1] Cropland acreages planted or seeded, and cultivated or fallow land, excluding cropland used as rotation pasture and cropland temporarily idle.

[2] 5-year averages of total cropland acreages for chart "Changes in American Farming," by S. E. Johnson, U. S. Dept. Agr. Misc. Pub. No. 707, Dec. 1949, (*27*) and revised table on utilization of harvested cropland, June 27, 1950.

Among the facts shown by table 21 are the general stability in the requirement of cropland for domestic consumption, around 2.1 to 2.3 acres per capita from 1910 to 1949; the great decrease in acreage of cropland required to feed farm workstock; and the wide fluctuation in cropland used to produce commodities for export. The cropland requirements for domestic consumption, exclusive of feed for workstock, averaged 2.06 acres per capita during 1945–49. The total acreage of cropland for all purposes averaged 2.6 acres per capita.

REQUIREMENTS FOR PASTURE LANDS.—Theoretically, crops, pastures, and forests compete for specific areas of land on the basis of comparative advantage. At times such competition may be significant locally, particularly as between cultivation and use as high-grade pasture. Even in a country as crowded as England, it is found that pasture is more profitable than cultivation on considerable acreages of high-grade land. But from a broad national viewpoint, crops ordinarily

have first choice, and pasture or grazing uses and forests are the residual claimants.

As previously mentioned, crops and pasture are complementary uses, in that they jointly contribute to production of livestock and livestock products and are capable of being used more or less interchangeably in the process. In 1947 an estimated 34 percent of the total feed units used for livestock were supplied by pasture (25). When all pasture and rangelands are converted to a cropland-equivalent basis, this area equals approximately 150 million acres. 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.

Any substantial increase in pasture area would come at the expense of either cropland or forests. Replacement of large acreages of crops by pasture is unlikely, other than temporarily in periods of surplus crop production, except for arable areas which have deteriorated seriously from erosion or overcropping, and some of the high-hazard cropland in the western edge of the Great Plains. However, there are possibilities for increasing acreage and production of pasture in parts of continental United States, as in the Southeast. This can be done by improving, fertilizing, and reseeding present pasture, as well as by clearing and seeding abandoned cropland, brushland, and suitable bottom land areas.

The carrying capacity of humid and subhumid pastures in the United States as a whole is considerably less than the carrying capacities of Wisconsin, Michigan, Pennsylvania, and several other States, as well as those of England and other countries of western Europe. This suggests the possibility of meeting some of our pasture requirements by improved methods of utilization. Pasture and grazing-land resources, requirements, and means to develop and maintain forage resources, deserve continuous study in connection with current agricultural programs.

Outlook for Expansion of Crop and Pasture Lands

In view of our knowledge and assumptions regarding: (1) Our population and the medium projection rate for growth of the population by 1960 and 1975, (2) current domestic consumption, and (3) average yields and their effect on the general requirements for cropland for various purposes, it is now possible to consider objectively the outlook for future requirements for crop and pasture lands in this country. Estimated cropland requirements for domestic consumption and other purposes in 1960 and 1975, assuming continuation of 1945–49 consumption and yields per acre are summarized in table 22.[18] The

[18] This statement is based on available materials in 1952 as to the prospective requirements for agricultural products and the outlook for production of the needed products from 1950 to 1975. Some of these sources are listed for comparison. It was the purpose to bring out additional points on the land-requirements angle of the problem. It was assumed that: (1) A high-level national defense would be maintained with gradual progress toward peace; (2) a high employment and high consumer purchasing power would be maintained; (3) farm cost-price relationships generally favorable to high farm production but with some ups and downs of reasonable proportions, would prevail; (4) the 1945–49 level of

TABLE 22.—*Projected cropland acreage requirements for 1960 and 1975 based on 1945–49 average level of consumption and acreage yield*

Item	Actual average		Projection	
	1935–39 [1]	1945–49 [1]	1960 [2]	1975 [2]
	Millions	*Millions*	*Millions*	*Millions*
Population [3]	129	144	171	193
Cropland				
	Million acres	*Million acres*	*Million acres*	*Million acres*
Cropland used chiefly for producing food, fiber, and tobacco for domestic human consumption [4]	294	297	352	398
Other cropland requirements:				
Export	24	48	40	40
Feed for horses and mules [5]	55	30	15	7
Cover and soil-improvement crops [6]	35	31	25	25
Total cropland requirements	408	406	432	470
Cropland equivalent of pasture and grazing land [7]	156	150	164	183
Total cropland equivalent	564	556	596	653

[1] Actual cropland acreage requirements, including cropland harvested, crop failure, summer fallow, cover and soil-improvement crops, etc.

[2] Projected cropland acreage requirements including items specified in footnote 1.

[3] Population estimates and projections are from census data presented in the President's Materials Policy Commission Report, (*69*, v. 5, p. 63; and the President's Water Resources Policy Commission Report, (*70*, v. 1, p. 154).

[4] Includes acreage for growing feed for livestock used in producing livestock products and relatively small acreages used for producing certain industrial products.

[5] Requirements for feed for horses and mules: 10 million head, 1945–49; 6 million, 1960; and 4 million, 1975.

[6] Reserve for cover and soil-improvement crops. Includes idle cropland in 1935–39 and 1945–49.

[7] Cropland equivalent of pasture is in terms of feed produced. Requirements for 1960 and 1975 are in proportion to 1945–49 requirements.

Unpublished data and calculations from the U. S. Department of Agriculture. Compare President's Water Resources Policy Commission, A Water Policy for the American People, 1950, p. 159. (*70*)

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farm production would be maintained through improved technology; (5) the medium population projection developed by the Bureau of the Census in 1950 to 1952 would be realized; (6) the 1945–49 level of consumption of food and nonfood products would be maintained; and (7) there would be a fair level of exports and imports.

Cf. (1) Johnson, Sherman E., Prospects and Requirements for Increased (Agricultural) Output (*28*); (2) Shaw, Byron T., Land Resources for Increased Agricultural Output (*42*); (3) U. S. Bureau of Agricultural Economics, Long Range Agricultural Policy (*48*); U. S. Bureau of Agricultural Economics, Reserve Levels for Storable Farm Products (*54*); (4) U. S. Department of Agriculture, Agriculture's Capacity To Produce (*62*); (5) U. S. President's Materials Policy Commission, Resources for Freedom (*69*); (6) U. S. President's Water Policy Commission, A Water Policy for the American People (*70*); and (7) U. S. Department of Agriculture, Agricultural Programs of the United States, Current and Prospective—A Report to the Food and Agriculture Organization of the United Nations (Nov. 1952) (*63*).

estimated requirements for cropland for the same periods, with assumption of certain specified upward adjustments in levels of consumption and productivity of acreage are indicated also.

Assuming the same cropland rate per capita as that from 1945 to 1949—2.06 acres for domestic consumption—352 million acres of cropland will be required for the expected population of 171 million in 1960.[17] In addition, it is estimated that 15 million acres will be required to feed necessary workstock in 1960. To maintain the cropland, 25 million acres must be allowed for cover and soil-improvement crops. Production of crops for export would possibly add 40 million additional acres, to bring the total acreage of cropland required to 432 million by 1960. This is 26 million acres greater than the average acreage used from 1945 to 1949.

By 1975, if the 1945–49 levels of production and consumption and the medium projected rate in growth of population are followed, approximately 470 million acres of cropland will be needed to supply necessary products for the expected population of 193 million people and to meet other requirements. If an adequate diet, as defined by the Bureau of Human Nutrition and Home Economics, were supplied to the whole population expected in 1975, the present level of consumption would probably be raised by about 15 percent. This would add another 70 million acres of cropland and would make the total required 540 million acres with the 1945–49 yields (exclusive of the cropland equivalent of pasture.)

If crop yields and efficiency of livestock production were to be increased by 20 percent from 1950 to 1975, the acreage of cropland required to supply an adequate diet might be only about 26 million acres above the acreage used in 1949–51. Thus, even with a substantial increase of 20 percent in productivity per acre, an adequate diet for the whole population would require 432 million acres of cropland in 1975, 26 million more than were used in 1945–49. A gain of 25 percent in productivity per acre, or an average increase of 1 percent per year, probably would be necessary in order to supply our needs for food and fiber in 1975 from the acreage of cropland available in 1950.

Because we depend upon livestock and livestock products for a substantial part of our food supply, requirements for pasture and grazing land must also be considered. The cropland equivalent of pasture and grazing land based on feed value was estimated at 150 million acres for 1945–49. When the cropland equivalent of pasture required at the 1945–49 production level is added to the acreage projections for cropland, based on 1945–49 consumption levels and acre yields (table 22), total cropland equivalents of 556 million acres in 1945–49, 596 million acres in 1960, and 653 million acres in 1975 result. That is, to maintain present levels of consumption an increase of approximately 20 percent in pasture production will be needed by 1975, either from a gain in productivity per acre, or from a greater acreage of improved pasture, or possibly from both.

But the gain in productivity of cropland and pasture depends upon continued research in improvement of crops and livestock and control

[17] Total planted cropland and fallow acreages, without cover and soil-improvement crop acreage and the equivalent of pasture acreage.

of pests, as well as upon rapid dissemination and acceptance by producers of modern technological methods of production. Likewise, improvement of dietary standards depends upon maintaining high average incomes for all workers and widespread adoption of more adequate diets by large groups. These figures are only projections of current trends, based on stated assumptions as to changes in production, consumption, and population, but they indicate the magnitude, the complexity, and the significance of the problems involved in future requirements for agricultural land.

Maintenance and improvement of the present cropland and pasture base to provide for the expansion in production as needed in the next decade will be desirable from a national standpoint. From 1950 to 1975 systematic improvement for cultivation and rotation pasture of 50 to 60 million additional acres of the best undeveloped land is likely to be desirable, to ensure its availability for crops when needed and to increase its carrying capacity as pasture. This could be accomplished by developing 2 to 2.5 million acres a year. In addition, more efficient methods of producing and using pastures should be sought. These improved methods would make profitable more feed in the form of pasture and would enable farmers and ranchers to produce more livestock and livestock products for the same, or possibly for less, expenditure than with mechanically harvested feeds.

HOW THESE NEEDS CAN BE MET

By Expanding Production on Existing Cropland

The possibilities of expanding production within the next few years were examined in detail in recent cooperative studies made by the Land Grant Colleges and the Department of Agriculture (*27, 48, 62*). It has been estimated, for example, that farm output could be increased 20 percent over a period of 5 years under average weather conditions, without materially increasing total cropland and pasture acreages, if improved production methods now available were adopted to the extent to which they would be profitable, if farm price-cost relationships were favorable, and if necessary soil-improving practices were put into effect.

But there is always the possibility that overall production of food might be cut by as much as 10 to 15 percent because of severe droughts, disease, or damage from insects. Between these two limits is a possibility of maintaining the 1952 production level. These three levels of production would make possible widely different levels of consumption for the population expected in 1960. If exports and imports of food products are the same percentage of total food production in 1960 that they were from 1935 to 1939, per capita consumption could be increased with increased production. But crop failures similar to those of the drought years of the 1930's would result in curtailment of exports, increase of imports, and possibly a decline in consumption.

Productive capacity studies for agriculture, for example, have disclosed that increased use of fertilizers and lime, better control of plant and animal pests, improved seeds, and additional mechanization can add greatly to production. As tonnages of fertilizer and lime used on cropland and pasture have mounted, crop yields and total production

have risen. Much that is new in use of fertilizer has taken place since the end of World War II. Anhydrous ammonia and other new forms of fertilizer, for example, have been found effective in obtaining high yields of corn and hay in several areas. Proper use of fertilizer probably can help to supply the country's agricultural needs during the next two decades with only a very moderate increase in acreage of cropland.

An increase in agricultural production to provide good diets for the increased population probably will result in more intensive agriculture, improvement of existing cropland, application of more fertilizer, better control of losses from pests and diseases, conversion of plowable pasture land to crops, and more intensive use of remaining pasture lands, as well as some clearing, draining, and irrigating of potentially usable areas. Therefore the need for increased crop acreage to meet our food requirements, if it comes, probably will develop gradually. It will not present an overnight emergency. Adoption of improved technological methods of production and expansion of research to find new and better ways of farming and to meet farm problems as they arise likely will make it possible to supply most of our food and fiber needs for the next two decades from the cropland and pasture acreage available in 1950.

By Development of Cropland and Pasture

Since 1946, because of the increased demand for farm products, farmers and others in many parts of the country have renewed their interest in land improvement and development practices, such as drainage, irrigation, removal of stumps and stones, clearing brush from pastures and range, and clearing woodland for tillage. In some of the older farming areas, these practices have been carried on chiefly to improve the layout of fields, to remove wet spots and small irregular patches of brush and trees, and thus to make possible more efficient operation of farms with machinery and to increase production. In addition, much irrigation, especially of the sprinkler type in some of the humid States, has been used to maintain pastures in dry seasons and to increase production of truck and fruit crops. In certain areas large acreages of new land are being cleared, drained, and irrigated. They include numerous large additions to farms and creation of some new farms.

Apparently, then, three principal types of land development are under way: (1) Small jobs of a few acres each that are needed to make existing farms more efficient; (2) medium-to-large projects where new fields of 20 to 40 acres or more are developed on present farms; and (3) limited areas on which new farms are being developed.

If population growth continues at the current rate, it appears that within the next decade greater demands for farm products may absorb the increased productivity of existing agricultural acreage to a point where more improved land available for crops will be desirable. But in view of the desirability of adjusting production of certain crops more closely to foreseeable consumption and market demands in the next few years, investment in development of new land should be made only when it is clearly justified by increased requirements and greater efficiency in the use of land and other resources.

Analyses of land requirements indicate that by 1975 the United States must find the equivalent of several million additional acres of cropland, either through development of new land, or from a material increase in productivity of existing cropland. It seems logical to assume that both of these production potentials will be developed. If demand is sufficient to maintain favorable prices, in relation to costs, farmers will be encouraged to continue to adopt practices that will increase yields per acre. It is expected also that reclamation of new cropland and pasture through drainage, flood control, clearing and irrigation, and improvement of existing cropland, will move forward together in several regions. Careful examination is needed of the areas in which land improvement will be most profitable from the viewpoint of farmers making the investments and of supplying the Nation's needs for food and fiber most efficiently.

Land Already Developed

Already improved by clearing, drainage, flood protection, and irrigation are an estimated 450 million acres of cropland and grassland pasture in continental United States. Nearly 160 million acres of the present cropland, however, was originally grassland that needed only to have the sod broken and the acreage of such land is in addition to the estimate of areas developed by major types of mechanical improvement (table 23).[16] Land cleared from forest and woodland and now in use for cropland, pasture, and other nonforest purposes is estimated at 385 million acres. Around 150 million acres of our total area of crop and pasture land get too much rain, or at certain seasons too much runoff water from other areas, for safe general farming, unless given artificial drainage and protection from floods. Most of this acreage now has some degree of drainage or protection from overflow. The protected area includes land improved by farm measures alone.

Nearly half of the improved land in drainage enterprises and about three-fourths of the irrigated land are grassland areas. Costs of development of cropland in grassland areas included: Costs of: (1) Drainage ditches and tile; (2) leveling for irrigation, irrigation ditches, dams; and (3) extra costs of the heavy plowing required to break the sod. The costs of development of the cropland in the forested areas included: (1) Clearing of trees, brush, and stumps; and (2) drainage and irrigation where necessary.

Approximately half of the improved land in drainage enterprises is in forested areas. Possibly a fourth of the irrigated land required clearing. In the Western States, clearing involved removal of mesquite, chaparral, and other desert shrubs, while in parts of Arkansas and Louisiana rice districts bottom-land hardwoods had to be cleared. In both forested and grassland areas developed for farming a good deal of farm drainage work was done by farmers in addition to that reported in public drainage enterprises. A con-

[16] Areal statistics concerning land improvement by clearing, drainage, flood protection, and irrigation indicate farmland development in a general way only. Gross areas improved by the different measures do not always exclude duplications in acreages where more than one measure was required. For example, many areas needed both clearing and drainage, or flood protection. Most irrigated areas also had to be provided with drainage after irrigation and some had to be cleared also.

TABLE 23.—*Major types of land development*

Item	Million acres	Item	Million acres
Land developed for cropland and pasture by major types of improvement:		Land developed, etc.—Con.	
By clearing woodland (alone) [1]	340	By breaking grassland (alone)	159
By clearing, drainage, and flood protection [2]	45	Total improved cropland and pasture	609
By drainage and flood protection	40	Land in remaining areas:	
By irrigation [3]	25	Grassland pasture and grazing land [4]	500
Total land developed by clearing, drainage, flood protection, and irrigation	450	Woodland and forest [5]	606
		Special-use areas [6]	105
		Miscellaneous [7]	84
		Total	1, 295
		Grand total	1, 904

[1] Includes land requiring only farm drainage in addition to clearing.
[2] Includes land in publicly organized drainage and flood-control enterprises.
[3] Includes 5 to 6 million acres of land that required clearing.
[4] Primarily native pasture and grazing land, seldom or never plowed.
[5] Woodland and forested area exclusive of parks and other special-use areas.
[6] Urban areas, parks, wildlife refuges, highway and road rights-of-way, and other special areas.
[7] Includes desert, rock, barren land, sand dunes, open swamp, and other unclassified areas.

siderable acreage developed after 1890 in the grassland areas of the country did not require clearing but did need drainage.

Fragmentary estimates of costs of development of farm land indicate that the total cost of clearing, draining, irrigating, and original plowing of sod on present cropland was in the neighborhood of 20 to 25 billion dollars, which represented average costs of $20 to $100 per acre at the various times the work was done. Costs of buildings, fences, and roads were additional. Costs of development of farmland have varied greatly from region to region and from area to area, according to whether the land was covered by grass, brush, or trees, character of soil, slope, degree of stoniness, precipitation, need for drainage, and other factors. Since 1890 costs of land development have included increasingly large amounts spent for drainage, flood control, and irrigation (*21*). Costs also have varied from period to period somewhat in line with other farm costs, including labor, equipment, and materials.

It is estimated that from 1948 to 1952, farmers developed 1½ to 2 million acres of new cropland and improved pasture a year, including development by clearing, drainage, and irrigation (*72*, pp. 36–68 and *74*, pp. 2–3, and *76*). Recent sample surveys and review of public records of agencies concerned with land improvement and conservation indicate that from two-thirds to three-fourths of this land was developed by either drainage or clearing, or by the two combined, and the remainder by irrigation, with possibly some clearing also.

A large part of this new acreage, however, is not a net gain in cropland and improved pasture. It replaces land that has gone into building sites for towns, industries, strip mining, gravel and clay pits, airports, roads, flood control, power and water-supply reservoirs, parks, national defense installations, and other nonfarm uses, or it takes the place of rough and eroded land converted to unimproved pasture and woodland. Much of the new acreage was used to enlarge farms that had too few crop acres.

Land Potentially Available

Agricultural and other surveys made in continental United States from 1945 to 1950 have indicated that about 20 million acres of undeveloped woodland represents areas susceptible and physically feasible for development for long-time regular cultivation by a combination of clearing, drainage, flood control, and other practices. In addition, 100 or more million acres of grassland pasture are adapted to use as cropland with certain improvements, thus making 120 million acres that would make good cropland. Some of the grassland would require drainage, other areas would need irrigation, but much of it could be put into cultivation merely by plowing up the sod. About 60 million acres of present cropland also need major supplemental improvements. Development and improvement of this land, however, probably should be spread over a period of years to allow time for its efficient incorporation into the agricultural plant as demand for the products from it materializes.

Offsetting this land that could be developed is 45 million acres now in cropland that should be in either grassland or woodland. Conversion of 120 million acres of grassland and woodland to cropland and the retirement of 45 million acres of poor cropland to grassland and woodland would result in a net gain of about 75 million acres of cropland, provided no more cropland was abandoned or absorbed by other uses (*24, 69*, v. 5, pp. 70–72, *69*.)

Approximately three-fourths of the grassland and woodland that is best adapted to development is in farms; and about 85 percent of the land not in farms suitable for development is privately owned. Thus only comparatively limited areas suitable for development are publicly owned. The areas indicated by the surveys made from 1945 to 1950 that appear most susceptible of development are as follows:

By Drainage and Clearing.—Generalized data indicate that there are some 50 million acres of wet and overflow lands in continental United States which with adequate drainage would be suitable for a more productive agricultural use. Approximately 30 million acres in these areas are now partly in cultivation and 20 million acres are undeveloped.[19] Of the 50 million acres of inadequately drained wet lands suitable for agricultural use, about 60 percent is within the boundaries of existing drainage enterprises, but it would benefit from improved drainage, especially from better outlets and additional farm drainage. The remaining 40 percent is undeveloped land which

[19] In addition, there are roughly 75 million acres of wet lands that would not be suitable for agricultural use under existing conditions but that are adapted to wildlife, forests, and uses other than cultivation.

needs a complete program of clearing and drainage (*2*, *70*, v. 1, pp. 159–162).

For the most part, the 50 million acres of undeveloped and partially cultivated lands are in areas of fertile soils of proved agricultural value. Much of the land is in densely populated agricultural sections and is adapted to the prevailing agriculture. A good deal of it can be brought under cultivation or utilized more intensively without new settlement. Development of wet lands will enable many farmers to put eroded hill lands and poor lands into pasture and timber and to shift cultivated crops to the more fertile bottom lands. When new farms are developed, they can usually be settled by nearby farmers, who will frequently be able to continue the types of farming with which they are familiar.

Recent estimates by technicians of the United States Department of Agriculture indicate that some 7 to 8 million acres of fertile but undeveloped Mississippi River Delta lands in Louisiana, Mississippi, and Arkansas are physically suitable for crop production and pasture (*21*). Most of these lands would need to be cleared and drained and some would need additional protection from floods and major drainage-channel outlets.

Much undeveloped wet land that is physically feasible of drainage is found in the Southeastern States. The Soil Conservation Service estimates that approximately 7.5 million acres of undeveloped land in this region are physically suitable for cultivation if drained and cleared (*75*, *80*). Large areas are located in already partly developed farming areas in North Carolina, South Carolina, Virginia, Georgia, Alabama, and Florida. Most of this land is on existing farms. Clearing of brush, cutover trees, and stumps is usually necessary. Very little of the woodland growth on the areas thought suitable for development is of marketable saw-timber size and quality. Acreages estimated as physically feasible to drain and clear make up only a little more than 5 percent of the woodland and forest area of the Southeast.

Much of the Southeastern area is well adapted to food and feed crops, although many farmers need to improve their lands for better-balanced farming (*15*).

By Clearing Primarily.—In continental United States, the new areas of land suitable for farming that could be brought into cultivation primarily through clearing and some farm drainage are large (*69*, pp. 70–72). Much of this area is now grazed. The alternative costs and returns of placing this land in crops and improved pasture over returns from production of timber and grazing need to be studied before clearing operations are undertaken. The desirable commercial timber species already on much forest land may in the long run afford as good or better returns than clearing for farming.

By Irrigation.—The Bureau of Reclamation has estimated that sufficient water is available to irrigate about 17 million acres of new western land with an adequate supply, and to provide nearly 9 million acres of presently irrigated land with additional water in the 17 Western States (*74*, p. 13). These estimates are based on recognized requirements for engineering feasibility, but economic justification of all individual projects has not been fully considered.

Yields from irrigated land, on the average, have been estimated as about 50 percent higher than those from nonirrigated land. It has

been estimated that delivery of additional water to already irrigated lands will on the average increase yields by about a third (*70*). Thus, it appears that the combined total of 26 million new irrigable acres and the areas that could be improved by adding supplemental water would contribute greater total productivity than an equivalent acreage of average cropland.

COSTS OF NEW DEVELOPMENT.—Available information concerning the costs and benefits of draining and clearing lands for agricultural use is fragmentary. Comprehensive data on a project basis for the large acreages that require drainage are practically nonexistent. Detailed studies are needed to ascertain in specific terms the acreages and costs of the areas that appear profitable to develop, the timing of such developments, and the relative advantages and disadvantages of increasing agricultural production in the same or adjacent areas through improvement and better use of established agricultural lands, as contrasted with drainage, clearing, and irrigation of new lands.

Many variables affect the cost of clearing and limit the significance of any general average. Costs vary with species, size, and character of forest growth, scale of operations, and methods of clearing. The results of scattered studies throughout the United States over an extended period of years show a wide range in costs of clearing. In general, the costs of clearing pasture and grazing land of old stumps and brush run considerably under that of most other types of clearing. In areas in which heavier timber or heavier stumps are encountered, costs generally range much higher than for brushland and thinly stocked areas. The few estimates of cost that are available indicate that generally the cost per acre of land-clearing operations on which large-scale machinery is now used ordinarily compares favorably with the cost of much of the hand clearing done in former years.

Data as to costs and returns from specific areas of new farmland that could be developed through clearing alone are insufficient so far as economic feasibility is concerned. However, indications are that the economic feasibility of bringing substantial areas of new cropland into production through clearing alone is limited, unless the land is of above-average productivity for farming. Costs would appear to run less than those for reclaiming land through drainage and clearing, but on the average the land would probably be considerably less productive. Thus during the next decade, reclamation of land through clearing alone is likely to be significant principally in increasing the size of fields, improving the farm layout, and thus adding to the efficiency of farming operations on existing farms in more or less localized areas. It is not likely to be a major medium of meeting increased national requirements for food and fiber.

The average cost per acre of developing irrigation varies widely according to the type of project and other improvements required. Costs usually include both public cost for construction of major works, such as reservoirs and dams, drainage and irrigation ditches, and private cost for farm ditches and leveling land. The cost varies for individual farms, depending upon the character of the needed improvement.

The cost per acre of new land in irrigation projects has tended upward since most of the least costly areas have been developed. Prospective income from power and other benefits, however, have made it possible in the Columbia Basin and in other projects to

allocate a substantial part of the cost to be paid from these sources (*61, 73*).

In case of necessity perhaps an estimated 200 million acres or more now in pasture, range, and woodland in continental United States could be improved and planted to crops with good care in management and long-time rotations (including areas described in foregoing sections). Of these, more than 100 million acres are open pasture and grazing land, nearly all in farms. About 100 million acres of potential cropland are now in woodland, about half of it in farms. A major part of the remainder was once in farms but it has been allowed to return to woodland in various stages because of competition with newer lands.

Under economic conditions such as those that obtain in Western Europe most of these 200 million acres of grass and woodland would be placed in the cultivated crop rotations. But the conclusions reached by the Soil Conservation Service and other surveys indicate that only a small part of this acreage is likely to be converted to cropland use by 1975 (*62, 63, 69*, v. 5, pp. 70–72). Taking into account the increases in production likely to come from raising the productivity of present crop and pasture lands, it is estimated that agricultural requirements can be met by 1975 by adding only moderately to the total acreage of cropland and rotation pasture.

Feasible Development by 1975

Review of current and potential land-development projects indicates that about 35 to 40 million acres of new cropland would be brought into cultivation by 1975 if present public programs and related farm improvements go forward at about their presently projected pace. The areas in which this development is likely to take place are given in table 24. The acreage estimated as likely to be developed is comprised of about 5 million acres of new land to be irrigated from projects now under construction or authorized; 15 million acres likely to be developed by a combination of drainage, clearing, and flood protection; and 5 million acres by clearing alone. In addition, current land-use conversions indicate that possibly 15 million acres of permanent grassland sod will be broken for cultivated crops. The net increase in cropland from these sources of probable new cropland will probably be about 25 to 30 million acres, as current trends indicate that 10 million acres or more of cropland and pasture must be used to meet the expanding needs of cities, roads, airports, reservoirs, and other similar uses. Thus, a total cropland acreage of approximately 434 million acres is indicated by 1975 (fig. 15).

Grassland classified for use as cropland is fertile land that has been found by soil and conservation surveys to be well adapted to cropping, and which would fit into the present farming systems of the regions where located. It represents land that is available for use as cropland almost immediately. Additional grassland is suitable for use as cropland and could be brought into cultivation when needed. Plowing grassland pastures would reduce pasture production and therefore would not be a net gain in crop production.[20]

[20] Supplemental improvement of existing cropland consists of supplying additional water where a partial supply is available, improving existing drainage on present cropland, clearing small acreages of brush and hedgerows on farms already developed, and other measures.

TABLE 24.—*Land physically suitable for cultivated crops which appears susceptible of development by 1975 assuming continuation of the 1945–52 trend*

[In millions of acres]

Type of development	Development of new cropland [1]	Supplemental improvement of existing cropland [2]	Total equivalent in new cropland [3]
Drainage, flood protection, and clearing [4]	15	[5] 30	25
Clearing alone [6]	5	0	5
Irrigation [7]	5	[8] 9	8
Breaking grassland pasture	15	0	15
Total	40	39	53

[1] Land largely in farms in 1950, or nonfarm land adjacent to agricultural areas.

[2] Supplemental or additional improvement of existing cropland consists of rehabilitating present facilities and adding to them where needed and feasible.

[3] Supplemental improvement of existing farmland has been estimated to increase the production by a third, that is, 3 acres with supplemental improvement add to present total production the equivalent of 1 acre of average new land obtained by that type of development.

[4] Includes approximately 2 million acres of grassland and other nonforest areas that would not require clearing.

[5] Drainage development requiring some additional flood protection and only small amounts of clearing.

[6] Primarily removal of stumps, scattered trees, spots of brush, strips of woodland, hedgerows, stone, etc., in existing cropland areas.

[7] Irrigation development requires provision also for drainage, and for some clearing and leveling. Estimates of irrigation are for the 17 Western States.

[8] Land within the areas to be supplied supplemental water under the planned and authorized irrigation program.

This table was derived from several sources (*2, 70, 74, 75, 80*).

Supplemental improvement of existing cropland in continental United States by provision of additional water for irrigation, by drainage of wet fields and pastures, and by flood protection of fertile bottom lands on 40 million acres is estimated as increasing total production by a third, or the equivalent of 13 million acres of new cropland (table 24).[21] Thus, by 1975, counting both new development and supplemental improvement, it would seem that the equivalent of an additional 50 million acres or more of cropland could be made available by continuing and expediting the current land-development and improvement programs, and by breaking some permanent grassland sod.

[21] Supplemental improvement is estimated to increase production on the average by a third. For example, 3 acres of cropland now inadequately watered, given the needed supplemental water supply would, it is assumed, be equal in new or increased production to 1 acre of new cropland receiving a full supply. Similar assumptions are used relative to land now partly drained, or partly protected from floods (that is, the increased production resulting from supplemental improvement is given a rating in terms of the new acreage required for an equivalent in new production).

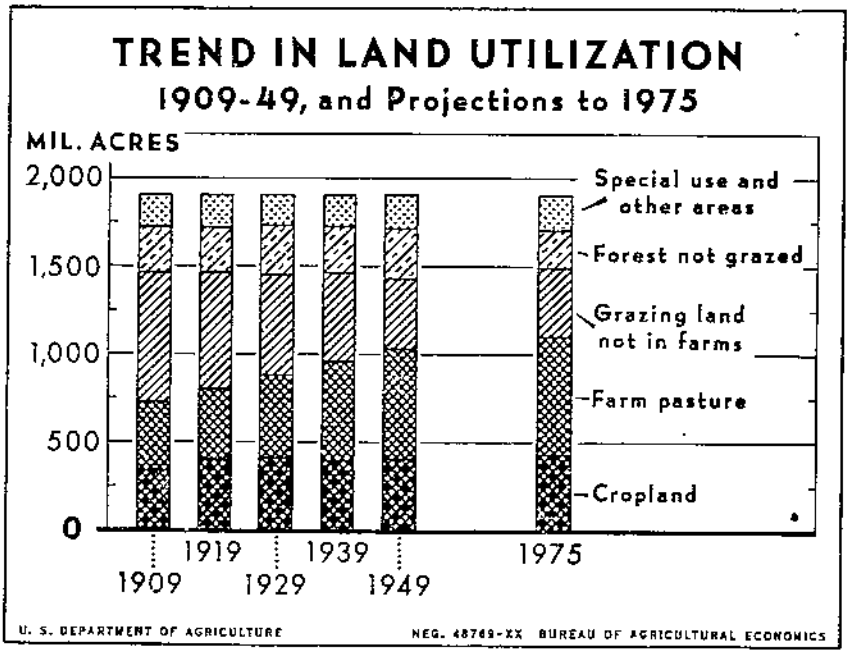

FIGURE 15.—This chart presents the overall land-utilization picture in the United States since 1909. What the possible situation with respect to overall land use possibly will be by 1975 is indicated in the right-hand section of the chart. This estimate takes into account current trends in development of new land and other projects either approved or planned. A net increase of about 1 million acres of new cropland per year, a total of 434 million acres, or 25 million acres above the 1949 acreage, is projected for 1975. In addition, it is estimated that the establishment of some 50 million acres of new improved pasture is feasible. These estimates of possible new acreages do not represent the total potential developments that would be possible if economic and other conditions were compelling enough to warrant improvement of additional areas of suitable undeveloped lands.

In 1950, 478 million acres of cropland and pasture were in rotation with crops. About 45 million of these acres are unsuitable for cropland, mainly because of high-erosion hazards. Before 1975 most of them should be converted to grassland. But about 80 million acres of open permanent pasture should be improved so that they can be used in a rotation of crops and pasture. To improve this land will require mostly fertilization, liming, plowing, and reseeding. The net results of 35 million acres from these shifts between cropland and pasture use, plus the net addition from development of new cropland of 25 million acres, would result in a total acreage of cropland and rotation pasture of 538 million acres by 1975, or an increase of 60 million acres over the 1950 acreage.

OUTLOOK FOR LAND DEVELOPMENT

Estimates given on pages 89–91 are based on current rates of new land development and current plans and proposals for development.

Growth of population in the West and South will bring new demands for development of more cropland and improved pasture. New towns and homeseekers in the Mountain and Pacific States and in the Southern States likewise require additional development of land and water.

More of the physically feasible irrigation projects in the Western States than of the physically feasible drainage works in the Southern and Eastern States are now authorized. Although it is known that it is physically feasible to irrigate large acreages, estimates and surveys of potential irrigation developments are not available for the eastern half of the United States. The Federal authorizations for irrigation and the numerous irrigation projects undertaken with Federal aid in contrast with the smaller amounts allocated for drainage, are major factors in the outlook for development of land by irrigation and by drainage.

In appraising this outlook, the extent to which private and local drainage enterprises represent a part of the Nation's reclaimed agricultural land should be recognized. More than a fifth of the cropland is in these drainage enterprises. With national recognition of the importance of drainage probably will come much additional agricultural development in fertile but poorly drained areas, especially on existing farms. An important question in planning land development and improvement is: Where and what types of additional capital investments in farming will yield most? Information on costs of land improvements is quite limited, and as yet we know little about the economy of obtaining additional farm output from capital investments for irrigation and drainage, as compared to increased investments in fertilization and a combination of other farm practices.

SUMMARY OF RECENT CHANGES IN LAND UTILIZATION

SHIFTS IN LAND USE INVOLVE MILLIONS OF ACRES.—The chief change in the land use situation in the United States since the end of World War II is the continuation of the gradual upward trend in acreages of land used for crops, fallow, and improved pasture. Land used for crops including fallow, preparatory to cropping, totaled 8 million acres greater in 1947–51 than in 1941–45. Since 1945 improved pasture has been increased by more than 10 million acres. Part of the increase in acreage of land used for crops, however, may be temporary since acreages of wheat and cotton may be reduced, as has occurred at other periods when stocks became extra large. This may result in additional acreages being used for pasture.

Some 19 States showed increases in land used for crops. Most of these are in the western and central parts of the United States. A few other States showed gains. Florida once again registered an increase. This is a result of an increase in citrus growing, truck farming, and livestock raising. In 18 States land used for cultivated crops declined slightly. These were primarily Middle Atlantic and Southeastern States. Only slight change was shown in 11 States. Several of the central States appear on the average to be about stationary. However, for the immediate long-time future the trend for the United States as a whole is upward.

Significant shifts have been made among crops. For example, acreages devoted to cotton, corn, wheat, and potatoes were reduced in 1950

while acreages of hay, pasture, oats, grain sorghums, vegetables, fruits, and clover and grass seed crops were increased to some extent. Acreages of grains and cotton, however, were increased in 1951 and 1952. This shift was partly in response to programs to curtail production of crops in 1950 when plentiful stocks were on hand and to increase those in short supply in 1951 and 1952, as well as to voluntary action on the part of farmers in changing their systems of farming in response to income factors. Such shifts up and then down in acreages, as occurred from 1949 to 1953, may be expected in response to demand for certain crops and the supplies of these crops on hand.

The total acreage utilized for crop production increased about an eighth during the last four decades, with most of the expansion occurring between 1910 and 1920. From 1910 to 1950, population increased about three-fifths, with the result that the acreage of cropland per capita declined materially. Total cropland averaged 3.55 acres per capita in 1910–14, compared with 2.60 acres per capita in 1945–49.

Decreases in acreages required to feed horses and mules and in acreages used to produce export products were the chief sources of the increased acreages available for producing products used for domestic consumption. From the 1918 peak to 1951, 70 million acres of harvested crops were released by the sharp drop in the number of horses and mules which resulted from mechanization. This development also released feed from large acreages of pastureland for production of livestock and livestock products for human use.

Changes in Cropland.—Increases occurred from 1948 to 1952 in acreage planted and in acreage summer fallowed. The increase in cropland resulted chiefly from improvement of idle cropland and development of new land by erosion control, clearing, drainage, and irrigation, as well as from the plowing up of pasture and grazing land for cultivation. Acreage of improved pasture, however, increased also, thus indicating that land improvement and development represented much of the increased acreages in both cropland and improved pasture. In some States, however, idle land was greater in 1949 and 1950 than in 1944 because of reduction in certain crop acreages and the omission of steep and eroded areas from the area planted and fallowed. Improvement of old land and development of new land was offset to a considerable extent by reversion of poor cropland to brush and shift of considerable acreage to nonfarm uses in urban, industrial, and mining areas.

Significant gains of 5.0 million acres, or 16 percent, in cropland planted and fallowed occurred in the Mountain States. This gain resulted from the plowing up of grazing land for wheat, as well as from the increased emphasis on development of land by clearing and irrigation. Acreage planted to cotton increased in the Southwest and in California. The northern Plains region gained 3.7 million acres in cropland, or 4 percent; the Pacific Coast States, 1.6 million, or 2 percent; whereas the Corn Belt, the Lake, and the Northeastern States maintained about the same acreage. The increase in cropland used resulting from plowing up grazing land and to some extent the increase in developing other cropland may be curtailed as some reductions in acreages of certain crops may occur in response to slackening demand.

The Southeastern and Appalachian States had a decline in acreage of cropland because of reduction in acreages of certain crops like cotton, soybeans, and peanuts; and increases in pastures and shifts to other uses. Reduction in these two groups of States averaged 7.5 percent. The total net decrease was 1.1 million acres. Greatest decreases occurred in South Carolina, Georgia and Alabama, while North Carolina maintained about the same acreage, and Florida had an increase. The Delta States and the southern Plains States as a whole maintained the same acreage, although in parts of the Mississippi River Delta area significant increases in cropland resulted from development of new land.

INCREASED DEMAND FOR PASTURE AND GRAZING LAND.—Demand for grazing and pasture lands boosted use of idle grass and brushlands as well as woodlands in many States from 1946 to 1951. Improved pasture practices in the South and West also were pushed upward sharply. An increase in livestock farming was one cause in the South. Here large acreages of cropland were seeded to pasture. In nearly all regions, increases in pasture also have come from clearing and drainage and other types of land improvement. Many farmers and ranchers buy or rent adjacent or nearby tracts of private and public lands to enlarge their operations. This has added to the acreage of pasture in farms. These farmers find that fenced pastures under individual control permit better care of livestock and more efficient use of the land. This expansion in acreage of pasture has not run its course; further increases in acreage of pasture in farms and ranches and in quality of pasture are likely.

Farmers in the livestock and dairy areas of the Central and Northern States, as well as in other regions, are planting more permanent pasture and improving the quality of the pasture. More cropland is going into rotation pasture. While in pasture, this land not only will add to the farm income, but it will be improved and ready to produce increased yields when needed for cultivated crops. Alfalfa and some grass and other combinations of mixed legumes and grasses are used in new and reseeded pastures.

Because of heavy demands for seed for pasture and hay crops, seed crops are increasing in importance and State, Federal, and farm cooperative assistance is afforded farmers who produce good seed for sale to other farmers. This assistance takes the form of help in distributing original seed stocks, grading, and marketing in areas where seeds are most needed.

The pattern of land use is changing, in the Southern States particularly. These shifts include: (1) A considerable reduction in acreage of cash crops, primarily cotton in some areas, which has been accompanied by higher yields per acre and somewhat lower total production; (2) rapid increases in production of hay, largely a result of bigger acreages; (3) a continuous increase in improved pastures and fenced pastures of all types, along with an increase in numbers of the better types of beef and dairy cattle. The shifts in land use have been toward those which require less labor per unit of other input factors. In mechanization the change has been slower in the South but there has been a steady upward trend in substitution of mechanical power and associated equipment for workstock, man labor, and less effective implements.

As a result of these shifts pressure has been continuous for such improvements as terracing, leveling gullied and eroded land, clearing, stumping, drainage, irrigation, and seeding and fencing of permanent pastures. Acreages of improved pasture have increased significantly in all South Atlantic States, because of diversion of cropland and improvement and development of abandoned fields. Clearing and drainage of bottom land have added to the increase.

The greater productivity and longer grazing period afforded by improved over unimproved pastures emphasize the economic advantages of pastures: (1) In the economic production of livestock and livestock products; (2) for economical use of land, particularly for land not well adapted to regular cultivation each year; and (3) in the crop rotation to protect and maintain soil fertility. Increases in acreage and use of pastures have stimulated interest in livestock and have raised questions relating to annual returns that can be expected from pastures and methods of grazing and management for best results.

PRODUCTIVITY OF AGRICULTURAL LAND.—From 1945 to 1949, the output of farm products available for human use averaged a third higher than in the prewar years 1935–39, and about two-fifths higher than the average of the predrought years 1923–32.

A combination of forces, both economic and physical, was behind the increase that has occurred in total farm output since 1935–39. First, the farm product price-cost relationship for most products was generally favorable for much of the time from 1941 to 1952. Increased crop production per acre was a main source of total gain in production, as the area of land used for crop production changed very little during the last three decades. Since 1920 improved feeding and livestock breeding also caused an upward trend in livestock production per animal unit. Rapid progress in mechanization resulting in the substitution of mechanical for animal power had a direct effect on farm output available for human consumption, as it increased the share of the farm production available for market.

The increase in crop yields per acre from 1945 to 1949 averaged about a fourth higher than in 1935–39. Although weather has been more favorable for crop production in most recent years than in the 1930's, the influence of weather has been less noticeable than changes in a number of other physical factors. The greater use of fertilizer, lime, and improved varieties, and more effective control of insects and diseases have operated to increase production per acre. In addition, crops have been shifted to better lands, both areawise and on individual farms, and the productivity of many farms has been improved by soil-building and conserving practices. Farm production has been increased both by expanding inputs and through greater production per unit of input.

The increased output of food from 1945 to 1949 was sufficient to allow for an increase in per capita civilian consumption of about 12 percent above 1935–39 and fairly large exports and military uses. To indicate the magnitude of the change, it is estimated that at prewar dietary levels the increased output of food in recent years would be enough to feed more than 50 million more people than were fed by the average production of 1935–39. Stated in another way, had production and utilization continued at 1935-39 levels, an increase equivalent

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to more than 100 million acres in cropland would have been required to provide the 1945–49 farm output. Most of this increase in acreage would have been needed to compensate for the increase that has occurred in production per acre, and the remainder—about 25 million acres—to balance the reduction in acreage required to feed horses and mules.

RATES OF AGRICULTURAL PRODUCTION AND CONSUMPTION.—From 1910 until the late 1930's, no substantial changes occurred in either per acre yields or per capita consumption. During this period, acreages needed to meet the consumption requirements of an expanding population were obtained mostly through diversion of acreage from workstock and exports, and by an expansion in total acreage of cropland. With yields and per capita consumption fairly stable, acreage requirements for domestic consumption remained fairly constant at approximately 2.2 acres per capita, including harvested cropland, crop failure, and fallow.

Although acreage requirements for workstock have continued downward during the last decade, a number of new developments have become apparent. Per acre yields have advanced substantially and per capita consumption has been at higher levels. Also, because of World War II and resultant needs of other countries, exports from 1943 to 1952 were substantially greater than at any time since the early twenties. Changes in per acre yields and in per capita consumption, however, probably indicate a more permanent change. Thus far, the increase in productivity has been greater than the increase in per capita consumption, with the result that acreage requirements for domestic consumption have been lower in recent years.

Improved practices that are helping to swell present farm production include, in some sections, such items as land drainage, irrigation, and improvement in size of fields and layouts of farms so that machinery can be used more efficiently. In some instances, this involves clearing brush and trees from spots or strips of land, and removal of stumps, stones, and other obstructions. In all types of land improvement, the available technical means, such as soil 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 which cause serious wastage of soil, and forest and other resources. The rapid increase in births, the lower mortality during the last decade, and the approach of a larger permanent population indicate that the problem of how to make productive use of our land resources is permanent, not transitory.

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