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Major Agricultural Regions of the Earth

DERWENT WHITTLESEY

THE PROBLEM OF CLASSIFYING AGRICULTURAL REGIONS

Of all the modes of using land, raising crops and livestock covers the most space and is the most easily observed in the field. It therefore lends itself better than the others to geographic classification—that is to say areal analysis and synthesis.

Tillage of the soil and pasturage of animals are postulated on indefinite anticipated continuance of collaboration between man and the ground, a relation embodied in the term husbandry. In this respect these occupations differ from the extractive industries, which take from the earth nature's bounty with no provision for replenishment,¹ and also from manufacturing, trade, and the professions, which use the earth chiefly or solely as a localized site for their operations. Oddly, the English language has no term to cover both plant and animal husbandry. For lack of a more fitting word, "agriculture" is used in these pages.²

A good deal of information about agricultural geography is available. Descriptions of many regions in different parts of the earth are scattered through the literature of travel, exploration, agriculture, and anthropology, and there are a few studies from the viewpoint of modern geography. For a number of political areas a considerable body of statistics has been collected. By employing these resources to extend and check field observations, it should now be possible for geographers to recognize the principal agricultural systems of the earth and to distribute their component regions on a map. For the present most of this must be done on a qualitative, empirical basis, although some regions may be checked by statistical measurements.

¹ The existence of farmed forests, shellfish plantations, and closed seasons on game and fish are examples of provision for replenishment among industries usually extractive. Similarly, indulgence in overgrazing and in "soil mining" is plundering in a realm customarily agricultural. The shadowy border between extraction and husbandry illustrates the basic weakness of any definition or classification—its oversimplification of complex nature. The fluid merging of regions and types is replaced by static lines indicating clean cleavage.

² Some may feel that it is unfortunate to use agriculture, literally "field cultivation," to include pasturage of livestock on natural grassland, but there is ample precedent for doing so. Recent dictionaries even extend the term to include forestry, and most national governments place the supervision of pastoral occupations under the jurisdiction of their bureaus of "agriculture."

Both sorts of analysis have been made, but of particular areas only. The widely different standards taken as bases of recognition and measurement prevent comparison of these sporadic studies. A prime objective of the classification here presented is to range all agriculture into regions of the same order of magnitude.

There exist, to be sure, worldwide classifications of agriculture. Without exception they bear the imprint of climatic regions. So valued a contributor to the geography of agriculture as Engelbrecht could publish in 1930 a map entitled "The Agricultural Zones of the Earth," which merely restates the map of climatic regions in terms of crops, which explicitly quotes Köppen in delimiting "desert realms," and which, as a final obfuscation, distinguishes a type phrased in climatic terms, but actually based on landforms: "Continental Plateauclimate."³ This map groups regions in which the agricultural systems are utterly unlike. For example the "Sub-tropical Cotton Zone" is made to include the United States Cotton Belt, North China, Southern Japan, a small district in Queensland, a bit of south Africa comprising both High and Low Veldt, and a belt in South America reaching from the coast of southern Brazil into the Chaco and embracing part of Uruguay. The boundaries of these and other regions bear no discoverable relation to agricultural boundaries as reported by observers in the field. Engelbrecht and others, by forcing agricultural regions into the alien pattern of climatic distribution, stress the late start of analytic studies of agricultural land occupancy as compared with several other aspects of geography.

In the classification here presented regions are recognized and grouped into types on the exclusive basis of the inherent properties of the agriculture practiced. This is analogous to classifications of climate, all of which are founded on inherent characteristics—temperature, moisture, and air currents. It is so obviously sound procedure that it might go without mention but for the surprising fact that classifications of several elements of geography have been repeatedly attempted on a basis of extraneous conditions as well as inherent elements. This has been notably true of soils. It is still true of agriculture, as the classification cited proves.

In this paper an attempt is made to further comparative study of agricultural regions by ranging on a single map all the agricultural systems of the first degree of magnitude, and to clarify classification by restricting it to properties inherent in the agriculture itself. In addition it undertakes an enquiry into the kinds of data needed for sound and adequate classification

³ Engelbrecht, Hinrich: Die Landbauzonen der Erde. *Petermanns Geog. Mitt., Ergänzungsband* 45 (1930), 286–97.

of major types of agricultural land occupance. In so far as it succeeds, the *schema* presented may serve as a framework within which further refinements of method and more exact statistical criteria can evolve.

Classification in Geography

Basic among the scientific functions of geography is the regional distribution of the phenomena with which it deals. Recognition and distribution of the totality of landscape, natural and cultural, is indeed the first step in regional geography. To take it has proved as difficult as the first step of an infant, because it involves analysis and synthesis of every element in the landscape, tasks not yet accomplished. It is a simpler undertaking to recognize regional differentiation of each separate element of the geographic landscape. This work stands uncompleted, and its status respecting agricultural regions is the occasion for preparing the classification here presented.

Most of the elements of the natural environment have been analyzed, and the distribution of regional syntheses has been mapped over the whole earth or the better-known parts of it. Although there are disheartening exceptions, these studies disclose a trend from empirical, qualitative classification toward statistical, quantitative classification. This is sound. Recognizing regions and grouping them into types on a basis exclusively empirical and qualitative has at least two weaknesses. The procedure is based largely on personal judgment, a fruitful source of disagreement. It lacks objective elements out of which comparable studies of different regions may be built by independent workers. These crippling handicaps are eliminated by substituting for personal judgments, measurable criteria. These are the product of repeated observations in the field. In some cases they can be compiled into statistical form; in all cases they are expressed in uniform, standard terms. Thus personal judgments are tested and chastened by measured quantities.

Quantitative classification of climate has advanced further than that of any other element of the natural environment, thanks to the abundant data furnished by the weather bureaus of modern nations. The widely accepted scheme of Köppen is an excellent example. Tested in the field, this classification has required modification, but the refinements are based on measured data.⁴ The other elements of the natural environment lag behind

⁴ Köppen, V.: Klassifikation der Klimate nach Temperature, Niederschlag und Jahreslauf. *Petermanns Geog. Mitt.* 64(1918), 193-203, 243-8. Revised in Köppen-Geiger: *Klimakarte der Erde* (1:20,000,000). Gotha: Perthes, 1928.

Thornwaite, C. Warren: The Climates of North America. *Geog. Rev.* 21(1931), 633-55, and subsequent revisions by this and other authors.

climate, but promising beginnings have been made. Landform types have been synthesized in such regional subdivisions as that worked out for the United States by a committee of the Association of American Geographers. The measuring of relative relief⁵ is a tentative but perhaps a long step toward quantitative classification. Soils classifications combine qualitative and quantitative ingredients. The most recent and comprehensive is that of the United States Bureau of Soils.⁶ Somewhat more tentative, and restricted to lesser areas, are regional distributions of surface waters, ground water, and minerals. Plant ecologists have served geographers a good turn by distributing the major groups of plant associations. The regional allocation of animals is less advanced, particularly in respect to insects, the animal life most significant to geography of the present day. Herbertson was a pioneer in essaying a classification of the natural environment as a whole. His map bears an embarrassing resemblance to a map of climatic regions.⁷ Possibly a more successful classification of "natural regions" can be made when all the elements on which it must rest have been more exactly distributed than is now the case.

Compared to the regional classification of elements of the natural environment, analysis of the cultural elements in geography is in its infancy. Human geography is less advanced than physical geography, and in its less easily observed aspects, such as social landscapes, has scarcely been broached, much less classified. In large measure regional classification of political and social landscapes lies in the future. For certain modes of economic occupation it has already been essayed. In no aspect of economic life do existing data permit earthwide classification on a statistical basis. Quantitative studies have perforce been confined to regions where government censuses afford the needed accumulation of information, or to very small districts worked single-handed in the field by individual geographers.

Antecedents of the Present Classification

Among the great groups of economic occupations, the regional distribution of agricultural land occupation has been carried furthest. The analysis of land use, and its corollary the synthesis of agricultural regions, are rooted in an interest in commodities of commerce. In this study British

⁵ Fenneman, N. M. *et al.*: Physiographic Regions of the United States. *Ann. Assn. Am. Geogr.* 18(1928), 261-353.

Smith, Guy-Harold: The Relative Relief of Ohio. *Geog. Rev.* 25(1935), 272-84.

⁶ Marbut, C. F.: *Atlas of American Agriculture: Part III, Soils Regions of the United States*. Washington: U. S. Dept. Agric., 1935.

⁷ Herbertson, A. J.: *Natural Regions of the Earth* (Wall Map). Oxford: Clarendon Press, 1912.

geographers naturally⁸ took the lead, and the work of Chisholm⁹ may be singled out because of its wide influence. A little later German geographers began the attack on the regional distribution of agricultural zones, analogous to climatic zones.¹⁰ In these two streams of thought may be discerned, somewhat obscurely, germs of the later classifications in which types of agricultural land occupancy and the regional distribution thereof are recognized.

Until recently the British approach was dominant in the United States. The single most influential American work, while rounding out discussions of commodities, adhered to those commercially preeminent.¹¹ The first long step forward was the publication by the United States Department of Agriculture of an atlas which distributed on maps the principal plant and animal elements of commercial agriculture.¹² In this work the areal spread is introduced, and intensities of production are shown by means of dots. Whether wittingly or not, these concepts derive in part from German sources. This atlas, the first worldwide distribution of agricultural phenomena based on statistics, inevitably omitted production in areas where statistics had never been compiled. This threw it out of balance as a complete study of agricultural crops and livestock, a fact which occasioned no disturbance in the English-speaking world, where commercial crops dominated the study of agricultural geography.

Following the Atlas, the Department of Agriculture confined its attention to the United States, but evolved a quantitative classification of the agricultural regions within that vast and diverse area. In establishing agricultural regions, as distinct from commodity-production regions, the sea-change which British commercial geography had suffered in crossing to

⁸ "Naturally," because of the preoccupation of Great Britain with commerce which culminated in the free-trade century in which the pioneers worked. Cf. Whittlesey, Derwent: *Environment and the Student of Human Geography*. *Sci. Mo.*, 35(1932), 265-7.

⁹ Chisholm, Geo. G.: *Handbook of Commercial Geography*. London: Longmans Green, 1889 and nine subsequent editions.

¹⁰ Hahn, Eduard: *Die Wirtschaftsformen der Erde*. *Petermanns Geog. Mitt.* 38(1892), 8-12, with map entitled "Die Kulturformen der Erde."

Engelbrecht, Hinrich: *Die Landbauzonen der aussertropischen Länder*. Berlin: 1899. 2 vols. and atlas.

—: *Die Feldfrüchte Indiens in ihrer geographischen Verbreitung*. Hamburg: Friederichsen, 1914. This work, based on the census of India, influenced the classification presented in this paper as much as any single publication.

¹¹ Smith, J. Russell: *Industrial and Commercial Geography*. New York: Holt, 1913.

¹² Finch, V. C., and O. E. Baker: *Geography of the World's Agriculture*. Washington: Govt. Ptg. Office, 1917.

America became apparent. The interest in the United States had insensibly shifted to economic geography, *i.e.*, from preoccupation with the commodities of commerce to recognition of all commodities. This marks the final step in synthesizing the elements analyzed in the Atlas.¹³ It should be noted, however, that the elements involved are the associated crops and livestock within each region. These are the items most readily subjected to statistical control; they are not the whole of agriculture.¹⁴

In 1924 Sapper revived Hahn's approach by directing attention to the significance of agriculture not commercial, but vital for the sustenance of large populations.¹⁵ Just as the study of commodities eventuated in maps of the distribution of stock and crop associations, so the German interest in agricultural (pseudoclimatic) zones produced maps of world distributions dealing with several aspects of agricultural life. The most significant of these distributes methods of production—plow culture, hoe culture, horticulture, and so on.¹⁶

Before the American workers had refined their classification beyond the first Graphic Summary (cited above) the classification proffered in this paper was well under way. It derives from fifteen years of collaboration between the author and Wellington D. Jones. By 1926 a crude world-map of agricultural regions had been drawn and brief sketches of the several types recognized had been written. In January, 1931, photostat copies of their world-map were issued; in 1932 a revised map was published.¹⁷ In 1934 the author issued in mimeographed form a textual com-

¹³ Baker, O. E.: *A Graphic Summary of American Agriculture Based Largely on the Census. U. S. Department of Agriculture Yearbook, 1921.* The same, with data for 1930: *U. S. Dept. Agric. Misc. Pubn. No. 105.* Washington: Govt. Ptg. Office, 1922 and 1931, respectively.

—: *Agricultural Regions of North America. Econ. Geog.* 2(1926), 459, and subsequent issues.

Type-of-Farming Areas in the United States, 1930. U. S. Bur. Census in co-operation with Bur. Agric. Economics. With accompanying text by Elliott F. Foster. Washington: Govt. Ptg. Office, 1933.

¹⁴ *Vide* Foster, Elliott F.: *op. cit.*, 71–5 for statement of the basis of the classification.

Baker recognizes other aspects of the rural scene in his *Agricultural Regions cit.*, but does not analyze them.

¹⁵ Sapper, Karl: *Allgemeine Wirtschafts- und Verkehrsgeographie.* Leipzig u. Berlin: Teubner, 1924.

¹⁶ *Ibid.*, 133.

¹⁷ Respectively these were entitled as follows:

Jones, Wellington D., and Derwent Whittlesey: *Types of Agricultural Land Occupance. Preliminary Draft, Jan., 1931, on Goode's Homolosine Equal Area Projection.*

mentary on the agricultural types. The map published herewith is a revision of the preliminary work. The text is new. For both the author assumes full responsibility, while pointing out the large share of W. D. Jones in whatever merit the classification has.

Since the appearance of the preliminary studies by Jones and Whittlesey, others have made important contributions to an understanding of the character and distribution of agricultural types, and toward a world classification of agricultural areas. Among these, two cartographic studies have refined the definition of types and the delineation of regions in areas where statistics are available. The map, *Type-of-Farming Areas in the United States*, cited above, recognizes more than 800 agricultural districts, differentiated almost wholly by items in the stock and crop association. This wealth of detail far exceeds available knowledge for other parts of the earth. Therefore any balanced world-map of agricultural regions made at this time can use the information only in generalized form. Richard Hartshorne and Samuel N. Dicken's "A Classification of the Agricultural Regions of Europe and North America on a Uniform Statistical Basis"¹⁸ recognizes eight types in the two continents named. Their work, like that of Jones and Whittlesey, proceeds along lines laid down by Wellington D. Jones in his "Ratios and Isopleth Maps in Regional Investigation of Agricultural Land Occupance."¹⁹ It marks an advance in applying uniform statistical criteria to the areas analyzed. Like the Elliott map, its statistical base is confined to aspects of the crop and livestock association.

Three German works based upon careful cartographic distributions deserve mention in this connection. They do not, however, display the close statistical argument which is apparent in the studies by Americans. Indeed, that would scarcely be possible, since they were published before the authors could have seen Jones's "Ratios and Isopleth Maps." One of these studies covers Europe, another Argentina, the third South Africa.²⁰

———: *Types of Agricultural Land Occupance*. Issued as Figure B of a *Syllabus for Geography 102, The University of Chicago*. The University of Chicago Bookstore. The text of this *Syllabus* and the remaining maps are the work of W. D. Jones.

¹⁸ *Ann. Assn. Am. Geogrs.* 25(1935), 99-120.

¹⁹ *Ann. Assn. Am. Geogrs.* 20(1930), 177-95.

²⁰ Troll, Karl: Die Landbauzonen Europas in ihrer Beziehung zur natürlichen Vegetation. *Geog. Zeit.* 31(1925), 265-8.

Kühn, Franz: Eine neue Wirtschaftskarte von Argentinien. *Petermanns Geog. Mitt.* 73(1927), 65-9.

Schulze, Joachim H. Eine neue Wirtschaftskarte von Südafrika. *Ibid.*, 77(1931), 22-3.

The most comprehensive presentation of agricultural geography ever made is the series of articles which have been appearing in nearly every number of the periodical *Economic Geography*, beginning with volume 2(1926), page 19.²¹ In these studies each continent is divided into agricultural regions. Numerous maps of production, based on statistics, as well as maps delineating the synthesized regions, have been valuable in checking boundaries of the world-map herewith presented, particularly where statistics are wanting. The information presented in this notable series has done much to confirm the subdivision into thirteen major agricultural types (Fig. 1), made by Jones and Whittlesey, which has remained unchanged since the original map was drawn in the very year the first of the *Economic Geography* articles appeared. The series does not in itself constitute a uniform classification of agricultural regions, partly because of the varied authorship, and partly because of advancing comprehension of the subject during the decade in which the articles have been coming out.

Covering a narrower field and adopting a more restricted viewpoint, the symposium on pioneer settlement published by the American Geographical Society contains the only, or the most recent, information about many frontier agricultural regions.²²

Besides the publications cited many of the numerous treatises on agriculture contain valuable geography. In similar case are books and articles treating the regional geography of particular areas in which agriculture is one mode of land occupancy; the more important the agriculture of the region, the larger it looms in the regional handling. Both these sources have furnished many facts incorporated in the classification here presented.

More than half of volume 50 of the *Geographisches Jahrbuch* is devoted to a critical bibliography of economic geography.²³ Two thousand and forty-five titles are listed, a large proportion of them on agriculture. The annual volumes of the *Bibliographie Géographique* furnish more nearly complete coverage of French and English works, as the *Jahrbuch* does of German and Scandinavian. Some unpublished doctoral dissertations are noted in the *Jahrbuch*. There is a bibliography of dissertations, published

²¹ The authors engaged on this project are: O. E. Baker, North America; Clarence F. Jones, South America; Olof Jonasson, Europe; Samuel Van Valkenburg, South Asia and the archipelagoes; George B. Cressey, China; Robert Burnett Hall, Japan; Griffith Taylor, Australia; H. L. Shantz, Africa.

²² *Pioneer Settlement: American Geographical Society Special Publication No. 14*. New York: Am. Geog. Soc., 1932.

²³ Lütgens, Rudolf: *Wirtschaftsgeographie einschliesslich Verkehrsgeographie* (1908-34). *Geog. Jahrbuch* 50(1935), 135-318.

and unpublished, submitted in universities in the United States.²⁴ Several of the titles deal more or less exclusively with agricultural geography.

In view of the overwhelming flood of books and papers on the subject and the bibliographical aids mentioned, no attempt is here made to append a comprehensive bibliography. In the foregoing discussion of the classification, reference has been made to titles which have had direct bearing. Appended to the brief characterization of each type of agriculture which follows (pages 213-240), are listed papers which illustrate that mode of land occupancy and describe varied practices in the different component regions. Some of these studies have agricultural geography as their theme; others are regional investigations of areas in which agriculture monopolizes the scene. In selecting the titles, two groups with some claim to admission have been excluded. (1) Those which stress a viewpoint other than agricultural occupancy of the land—matters such as settlement forms, habitat, historical evolution, prediction. (2) Those which confine their treatment to commercial products. An exception is made in favor of plantation crops and specialized horticulture, wherever in these two agricultural systems the individual crops embody the whole agricultural geography of the small districts which they occupy. In agricultural systems having diversity of output, to focus the attention on commercial crops masks the reality of agricultural geography beneath the pseudomorph of agricultural economics.

In compiling these lists the principal geographic periodicals have been combed. Several of them yielded no items. North American publications are more fruitful than those from other parts of the world. This is not surprising, because the trend of thought in the United States has followed agriculture more tenaciously than in other lands. If the number of articles published may be taken as an index of interest, there was only sporadic attention to agriculture during the early 1920s, followed by growing absorption up to the latest date. Before 1919 so few articles appeared that no systematic search for them has been made. That post-war date may stand to mark the awakening of interest in human geography which has made possible the classification discussed in the following pages.

FORCES AND ELEMENTS IN THE CLASSIFICATION

No worldwide classification of agricultural land occupancy made today can be more than an essay—a target for criticism. The one here presented attempts to recognize agricultural regions of the first order of magnitude. Therefore it inevitably lumps regions which differ in details of their agri-

²⁴ Dissertations in Geography Accepted by Universities in the United States for the Degree of Ph.D. as of May, 1935. *Ann. Assn. Amer. Geogr.* 25(1935), 211-37.

cultural pattern, structure, and procedures. For the purpose of earthwide survey, these differences are believed to *be* details. If desired, each major agricultural region can be subdivided into lesser units on the basis of these differences. That is an intended refinement envisioned within the frame here outlined.

Classification is a device for correlating facts in such a way as to bring them into focus from a particular viewpoint. An ideal geographic classification might well begin with arranging the facts into a regional pattern. Within each region, its structure is built up of observable items in the landscape.²⁵ Not all the landscape forms are used. Only those are selected which disclose the collaboration of man and environment in agriculture.

In this classification of the geographic aspects of agriculture, the regional pattern is basically determined by two concurrent forces. One of these is the combination of environmental conditions which sets the limits of range for any crop or domestic animal and provides, within those limits, optimum habitats. The pertinent elements of the natural environment are climate, soil, and slope. (It is assumed that drainage and exposure are concomitants of the three dominant elements, and that altitude expresses itself in climate.) The other force is the combination of human circumstance which applies the habitat possibilities of plants and animals to human needs. The chief elements of the cultural circumstance are density of population, stage of technology, and inherited tradition. (Here again an assumption is made—that standard of living, fashion, and regulation by law are concomitants of the dominant elements.)

Climatic classifications have figured so crucially in the evolution of agricultural classifications that the areal correspondence of the two calls for particular consideration. Climate directly affects the number and character of plants that can be grown and the distribution of mature soils. From the map (Fig. 1) three groups of agricultural regions are seen to conform roughly to the climatic mold—dryland types, wetland types of the low latitudes, and wetland types of the middle latitudes. The most extreme climates—driest deserts, coldest high latitudes and altitudes—forbid agriculture. The more extensive areas thus handicapped are shown on the map, Figure 1. Climate somewhat less adverse, if coupled with other handicaps, such as infertile soil, ruggedness, slow drainage, or excessive exposure, creates unfarmable spots, most of which are too small to be mapped on the scale of Figure 1.

²⁵ By "observable items" is meant all those which are susceptible of being observed directly and also through some device, such as an instrument or a calculation based on enumeration. They are incomplete unless they include diurnal, seasonal, and cyclic variations.

Almost as obvious as the broad resemblance between maps of climate and agriculture, are the marked discrepancies. Dry interior Asia-Africa has not the same agricultural system as dry interior Americas and Australia. The types covering wide acreage in the humid middle latitudes of the northern hemisphere are not extensively spread in the southern. Most conspicuous of all, the agriculture of east and south Asia, notably China and India, does not parallel counterpart climates in the other continents. Differences spreading over such broad areas can not be attributed to variations in soil or slope, which are miniscule in comparison. They do correspond to what may be loosely defined as Occidental versus Oriental society and progressive versus backward cultures. Some of them correspond also to marked contrasts in density of population.

The major variables in differentiating regions of agricultural land occupancy may be summarized, without regard to order of importance, as climate, soil, slope, density of population, stage of technology, and tradition. Their interaction produces the forms of the cultural landscape which facilitate and at the same time express its functioning.

The functioning forms which appear to dominate every type of agriculture may be listed under five heads:

1. The crop and livestock association.
2. The methods used to grow the crops and produce the stock.
3. The intensity of application to the land of labor, capital, and organization, and the outturn of product which results.
4. The disposal of the products for consumption (*i.e.*, whether used for subsistence on the farm or sold off for cash or other goods).
5. The ensemble of structures used to house and facilitate the farming operations.

Each of these five items is susceptible of measurement, and therefore may ultimately be used in a quantitative classification of agricultural regions and types of land occupancy. As yet the data on most regions are insufficient in one particular or another, and for large areas any sort of statistics is lacking. At present a classification based on these five criteria seems sound. Increasing information about farming ought to prove or disprove their validity.

Every crop and livestock association appears to have its ultimate range fixed by climate. Within these limits certain areas are ruled out by unfavorable soil, drainage, or exposure. Optimum natural conditions cover only a part of the total possible range.²⁶ Until recent centuries many plants

²⁶ For a succinct discussion of climatic limits and optima see Huntington, Ellsworth, and Frank E. Williams: *Business Geography*, 15-31. New York: Wiley, 1926. Huntington has done much work on this subject, touched upon in several of his books.

and animals were restricted to the continent or subcontinent of their origin. Since Chinese, Polynesians, Arabs, and Europeans began to transfer useful species from one realm to another, too little time has elapsed for general adoption of the novelties, although all are now found in appropriate environments in every continent. That optimum growing conditions and the dominance of particular species do not correspond, is due to the momentum of traditional competitors and the inertia of farmers, everywhere a conservative class. The producer, reluctant to try a novel crop or breed of stock, is only expressing the age-old remoteness which so long kept him in ignorance of other regions having natural conditions similar to his own but different flora and fauna. Some plants and animals may be raised in regions below optimum as to natural environment, but well disposed to economic profit by virtue of location near market, or by adherence to a favoring political unit. Conversely some are grown in only a small part of their optimum range, because no market exists for larger production.

When the crop and livestock associations of all the agricultural regions are appraised, they appear to fall into four great groups:

1. Dominant animal rearing in regions too arid, rugged, or remote for successful crop raising.
2. Dominant production of crops, with animals minor or absent, but with crops varied due to a growing season never checked by cold.
3. Dominant production of crops, with animals minor, and with the number of crops strictly limited either by natural environment or by market.
4. Roughly equal production of crops and animals.

For use this classification is too coarse-meshed. It would throw together such different agricultural groups as the Khirghiz of Central Asia and the Argentine ranchers; or the Yorubas of Nigeria with the Cantonese and the Imperial Valley farmers. These comparisons suggest that the methods of production can sharply differentiate regions which have essentially the same crop and livestock association. Tillage may be accomplished by means of elaborate machines, by hand labor using efficient tools, and by hand labor limited to sticks and other crude implements. Cows may be milked by machines or by the calves. The amount of care used in selecting seeds and improving breeds is of comparable importance.

The essential thing about successful method is that it shall be organized to fit the circumstances. It must take account of the relative abundance of land, labor, and capital. Since land is the one factor in farming which can not be markedly varied, the best method is the one which uses the available land most wisely. For example, it has been found that in regions where sparse population makes large machinery a necessity for grain farming, market gardens should be operated mainly with hand tools.

Closely associated with methods, but not strictly parallel, is the intensiveness with which the land is worked, and the outturn of products. The application of fertilizer improves different soils in differing degrees, and is subject to diminishing returns on any given soil. Output can also be increased by increasing the application of labor, but with diminishing returns once optimum tilth is achieved. Most Americans take for granted that outturn rises in direct ratio to the amount of high-grade machinery employed. This is true only where the proportion of labor to land is low. A small number of men can work more land with machines than with hand tools—in some operations many times as much. But if abundant labor is available and land scarce, a higher outturn per acre of most crops or animals can be obtained by using well-made hand tools, than by the best machinery. Intensiveness of application and quantity of return points to a fundamental cleavage between (1) the occidental world which uses machinery, (2) the oriental world which uses much hand labor and obtains high outturn, and (3) backward regions such as interior Asia and much of Africa, where hand tools, often crude, produce small return.

One more primary conditioning element in the agricultural system must be taken into consideration: the destination of the farm products. They may be consumed on the farm by the household, or they may be sold off the place in exchange for other goods or for cash. No farming region lives wholly without exchange of surplus, but the percentage of goods exchanged in the total produced ranges from almost nothing to very nearly everything. The critical difference is the intention of the farmer. If he grows his crops or raises his animals with the object of selling, he is a commercial farmer; if he merely sells what he happens to have left over, or what he is forced to part with by emergencies, he is a subsistence farmer. This distinction more or less parallels the division between the progressive agriculture initiated by Western Europeans and their descendants and imitators, and peoples lightly or not at all touched by the occidental mode of life. Many districts within these vast tracts of subsistence agriculture have been made to produce cash products, especially plantation crops, and so belong with the Europeanized world in respect to this item in the classification scheme.

The four heads of the classification thus far discussed are subject to statistical determination in regions where agricultural censuses and trade figures are collected. It would be desirable to establish statistical norms for each of these major conditioning elements of the world's agriculture. Complete statistics are lacking, but even if they were available, it would be hazardous to entrust the geographic welfare to them. Statistics often mask landscape differences which are fundamental and critical, and as often imply distinctions which have little or no geographic validity when checked

on the ground. For example, Baker differentiates between a Corn Belt and a Corn and Winter Wheat Belt, in central United States.²⁷ This distinction Hartshorne and Dicken denounce: "Since the only elements which the different parts of [the Corn and Winter Wheat Belt] have in common are also found in the . . . Corn Belt, no logical reason is seen for separating them."²⁸ Then, on a basis of ratios between tilled crops and hay-and-pasture, these authors lump in a single agricultural region the more fertile half of Denmark and the wheatlands of Old Castile, while differentiating the Central Massif of France. According to the statistical basis they have ordained, their regions are doubtless correctly drawn, but their reliance on statistics entraps them into a failure to differentiate between dairying and mixed farming, while distinguishing between maize and small grains, a cleavage pertaining to a lesser order of magnitude. This astonishing departure from geographic reality does not invalidate the use of statistics, but it does point the need to provide for checking in the field. Provision should be made for a procedure which will impose choice of the most significant statistical ratios. It is chimerical to assume that statistics can safely be used to displace the practiced eye of the field observer. Sound craft will employ both.

Quantitative field sampling of typical and critical districts provides one useful field check. This is nothing else than the "microscopic geography" which has been assailed by critics who prefer to perform their field labor in automobile seats. The common parlance of the countryside is a trustworthy guide; the local people generally designate their business by a name which is the touchstone to its significance. Another check is set up under the fifth head of the functioning forms of agricultural land occupance: the ensemble of structures used to house and facilitate farming operations (p. 209). No experienced field geographer could mistake the layout of a dairy farmstead for that of a mixed farm, nor could he observe persistent differences in farm buildings between the American Corn Belt and the adjacent "Corn and Winter Wheat Belt." In some places the individuality of a farming region is so characterful that accurate outlines of it can be drawn from field observation without statistics; *e.g.*, a district of plantation crop tillage in the midst of subsistence agriculture.

Statistics are useful adjuncts to the study of geography. They can not be substituted for field study, because the areal reality which exists may not be accurately portrayed by statistical representations of it. In spite of

²⁷ Baker, O. E.: *Agricultural Regions of North America*. *Econ. Geog.* 3 (1927), 447-65.

———: *Graphic Summary of American Agriculture*, 1930, 4.

²⁸ *Op. cit.*, 106 footnote.

the apparent reliance of the field observer on that unreliable quality, personal judgment, experience proves that observers who have agreed upon the items to be noted can classify farmstead types with almost complete accord. This is an important discovery, since the ensemble of structures used in farming operations constitute functioning forms of agricultural land occupancy illuminating to the student and yet beyond the reach of statistics usually collected.

THE CLASSIFICATION

At the present time, before agricultural types have become crystallized on the basis of studies of one or two continents, or according to statistical formulae which leave out of account one or another basic item, it seems worthwhile to attempt a subdivision of the whole earth into agricultural regions and to group them into major types. The classification is largely empirical and qualitative, but it is based uniformly on the five criteria listed on page 209. Wherever possible, statistics are used to analyze more sharply the elements of the classification, and available field reports are employed as a check on the statistics. The field studies of the author and of W. D. Jones between them embrace every continent except Australia, and have played a dominant rôle in working out the classification.

Thirteen types of agricultural occupancy of the land are recognized, to which may be added a fourteenth head—land totally unused for agriculture. These are believed to comprise the major systems in vogue on the earth today. This is not the place for detailed consideration of the several regions which are allotted to each type. The classification itself is the topic under consideration.

The map (Fig. 1) distributes the thirteen types over the earth's surface. No map can give the total concept of reality, and the smaller its scale the less exact the picture. In using this small-scale world map of agricultural regions it must be clearly borne in mind that every region contains areas devoted wholly or in part to other occupations. This is obviously true of cities and towns, which, however, occupy little space. In contrast, forests are widespread, and in some large areas occupy more of the ground than does agriculture. The wooded mountain country between San Francisco Bay and the outlet of Puget Sound is a case in point. This map makes no attempt to portray the intensity of agricultural use. Areas of low productivity are grouped with districts of high productivity. Interspersion of widely different intensities is typical; *e.g.*, rugged hill and mountain country, where small valleys and basins generally dominate the farming of the whole. In contrast, small oases scattered about deserts and semi-arid lands are not shown because they do not dominate their surroundings. Intensities can

readily be worked out for regions covered by appropriate statistics, by applying the isopleth method in the requisite detail. Examples may be found in the work of O. E. Baker, and more particularly in the maps and discussions of dairying in the United States by Wellington D. Jones and by Richard Hartshorne.²⁹ Intensities, like all other quantitative studies, are important, but they can perhaps be more intelligently fitted in after geographers have come to tentative agreement as to what are the major types of agricultural land occupancy.

Nomadic Herding

The vast spaces of the earth too dry to produce crops, yet not utterly barren deserts, are utilized for rearing livestock. Methods are much the same the world over, but intensiveness, care in breeding, and consequent outturn differ widely. This difference is related without exception to the disposal. Where the animals or their products are sold, methods are progressive; where products provide subsistence only, methods are backward. This contrast is expressed in the two terms Livestock Ranching and Nomadic Herding (Fig. 1).

Nomadic herding might be called the aboriginal form of the livestock business. Its climatic range runs the gamut, if the Lapp and Eskimo herders of reindeer are included. No landform excludes itself from the migrations of the nomads, and in many cases the seasonal range of climate at different altitudes figures prominently in tribal itineraries. Two elements of the natural environment fix the length of stay in a place and determine the direction of migration: the amount and quality of drinking water and of forage (natural grassland). Of these the water is generally decisive, because it is the scarcer.

This simple agricultural existence is intimately dependent on the natural environment and subject to dire misfortunes brought on by the unreliability of rainfall in dry regions. It evolved in the Eurasian-African land mass, where all the domestic animals except the llama were first put to man's use. The stock which supports the agricultural system may be sheep, cattle, goats, or even camels or reindeer. Along with them a few work animals are kept—horses, asses, camels, or reindeer—to aid in herding, in roundups, and in moving camp. The animals provide nearly everything

²⁹ Jones, Wellington D.: Ratios and Isopleth Maps *cit.*, Figs. 6, 7, 8.

Hartshorne, Richard: A New Map of the Dairy Areas of the United States. *Econ. Geog.* 11 (1935), 347-55.

European geographers appear to have discussed intensities without mapping them. Cf. Schmidt, P. H.: Intensitätszonen des Landbaus [of Europe only]. *Geog. Zeit.* 33 (1927), 34-8.

their owners have. Diet is based on milk, clothing and shelter on skins or on cloth woven from animal hair, utensils and implements are of skin, bone, or horn, if possible. Paraphernalia is reduced to the minimum by the compulsion of frequent moving days. The habitation is a tent, a cave, or a snow hut, easily transported or replaced. The temporary settlements are widely scattered, and at unfavorable seasons vast areas are evacuated.

Nomads include physical types of great variety, but all alike cohere into tribal groups based on the family, and not on territory. Religious beliefs differ, but monotheism is widespread. Its principal form is Islam, born and bred in the heart of the nomadic country, and eminently suited to the spiritual needs of its people.

Nomadic herding regions are being encroached upon by livestock ranching, the commercial double of nomadism. In South Africa considerable land has been occupied by Europeans, and a little on the East African Highland. In Soviet Russia the government aims to settle the nomads upon fixed centers, either collective or state stock-ranches. Some reindeer meat and hides are sold from Alaska and Lapland.

No reliable statistics exist for Nomadic Herding regions. Further details of the agricultural life may be found in the articles cited below, and in the appropriate sections of the series "Agricultural Regions" in *Economic Geography*.

Jones, Wellington D., and Derwent Whittlesey: Nomadic Herding Regions. *Econ. Geog.* 8(1932), 378-85.

Forde, C. Daryll: The Habitat and Economy of the Northern Arabian Badawin. *Geog.* 18(1933), 205-19.

Merriam, Gordon P.: The Regional Geography of Anatolia [Agriculture]. *Econ. Geog.* 2(1926), 86-95, 101-5.

Frödin, John: Quelques traits de l'habitat pastoral de la Turquie du nord. *Geog. Annaler* 14(1932), 229-42.

Dardel, E.: Une région Malgache: Le Boina. *Ann. de Géog.* 37(1928), 527-83.

Wiklund, K. B.: The Lapps in Sweden. *Geog. Rev.* 13(1923), 223-42.

Hoover, J. W.: Navajo Nomadism. *Geog. Rev.* 21(1931), 429-45.

Livestock Ranching

Livestock ranching everywhere has been instituted by sedentary folk of European antecedents who have settled in dry country. They have taken with them habits, attitudes, and beliefs of humid regions, and with few and temporary exceptions, they have kept in contact with the outside world. Many of their inherited ways of life have become modified in the harsh and unsympathetic environment of their adopted lands. In extreme cases, as the Boers of South Africa, the pioneers had to turn nomadic, but succeeding generations are generally able to live a life more nearly in accord with

their humid-country traditions. This is largely owing to the improved transportation of the past 150 years, which has brought the livestock ranching regions progressively closer to the outside world—their market and their supply store.

Ranching postdates the discoveries of the New World by Europeans, because until cattle, sheep, goats, and horses were introduced to America and Australia-New Zealand, the basic elements of the business were lacking in the new continents. In the Americas some imported animals, turned loose, became progenitors of a half-wild race. The Indians promptly caught them and spontaneously became nomadic herders as an advance over their traditional practice of collecting what they could from the natural environment. This system was extirpated, along with the plains Indians, when a world market for wool, hides, and meat developed. This market is the creature of the Industrial Revolution and the consequent rise of cities full of people who raise no animal products for themselves. The regions of the new continents akin in natural environment to the nomadic herding regions of the Old World, are remote. They have been grappled to these growing city populations by instruments of the Industrial Revolution itself—the steamship and the railroad, the telegraph, and the refrigerator.

The livestock ranch is semi-sedentary. The ranch house forms a permanent center, where a good deal of capital is fixed in the shape of dipping vats, shearing sheds, and paddocks—facilities calculated to maintain the high quality of the products and to expedite their shipment. Usually the ranch is fenced, a refinement over the pioneer days of the open range. Some land may be tilled to raise forage for winter feeding in cool regions, or against the day of drouth. Wells or ponds distributed over the ranch supply the herds with water, which usually outlasts the forage. Ordinary movements of the herds are confined to the ranch, although in mountainous regions transhumance follows the seasons to remote pastures—often rented. During years of extreme drouth enforced nomadism drives stock from ruined grazing lands to less afflicted pastures. In all these movements “cowboys” attached to the ranch move with the herds, but at roundup and occasionally at other times they live briefly at the ranch house.

Great care is taken to improve the breed, and the rancher is a business operator on a large scale. Each region tends to specialize on the animal and the product for which it is best fitted. This is in line with the technical proficiency of the business.

Although all the leading ranching regions are in the new continents, inroads are being made on nomadic herding regions wherever railroads have tapped them. Stimulated by outside markets, European methods or settlers

are intruding themselves, notably in Russian Turkestan, in the Atlas, and in the East and South African highlands.

Statistics are available for the chief livestock ranching regions. In the stock and crop association the ratio of browsing animals—cattle, sheep, goats—to total area is very low, and the ratio of cropland—mostly hay—to the total area is even lower. The percentage of draft animal units in the total animal population is likewise very low. Careful methods result in a high return per animal. The land is used extensively, since it requires several acres to feed an animal. This means huge holdings and a small and scattered farm population. Isolation urges absentee ownership; some holdings are organized as stock companies.

Livestock ranching is likely to be the mode of occupying an expanding frontier. Near the margin of settlement the number of both people and animals may be negligible. This is notably the case in the southern part of the Amazon Basin, and scarcely less so in interior Australia.

This and each succeeding list of illustrative material is assumed to be an addition to the appropriate installments of the Types of Agriculture series in *Economic Geography*.

Chambers, William T.: Edwards Plateau, A Combination Ranching Region. *Econ. Geog.* 8(1932), 67–80.

Brown, Ralph H.: Belle Fourche Valleys and Uplands. *Ann. Assn. Am. Geogrs.* 23(1933), 128–56.

Hewes, Leslie: Huepac: An Agricultural Village of Sonora, Mexico. *Econ. Geog.* 11(1935), 284–92.

Halverson, L. H.: The Great Karroo of South Africa. *Jl. of Geog.* 29(1930), 287–300.

In summary comparison of the two types of agricultural occupance based on livestock and occupying the drylands of the earth, contrasts appear. One is a subsistence business, the other commercial. This results in a different cultural landscape and a widely divergent return for effort. It is a neat example of the utilization of essentially the same natural landscape in contrasting ways, the distinction being based on different stages of technology.

Shifting Cultivation

Within the humid low latitudes another pair of agricultural types may be recognized. Their character and regional distribution are less clean-cut, because the climate and interrelated vegetation and soils range from rain forest on laterite to park-savanna on friable soil, and from oceanic deltas to mountain basins at 14,000 feet elevation. Besides, there are large areas in almost identical natural environments which do not practice either of

these agricultural systems. Some historical relation between them can, however, be traced.

Shifting cultivation, the archetype, is widespread in the rain forest and on its borders. There lateritic soil, infertile at best, leaches and erodes rapidly when removal of the natural vegetation exposes it to sun and rain. This has led all primitive peoples inhabiting such lands to move their farmed plots every few years (usually from one to three, depending on local conditions), and to seek new land in the adjacent forest. After some years (five to a dozen), the plots being tilled are inconveniently remote from the village, and the tribe removes to a site in the deep forest, a new center from which another block of land is gradually cleared. The absence of domestic animals in aboriginal America restricted the farm products to crops, except for llama hair, as did the presence of the tsetse fly in Africa, save for poultry, pigs, and goats. In the true rain forest the large domestic animals languish, but in somewhat drier regions hardy strains survive, outside tsetse infected regions. Crops were few and monotonous until outsiders, especially Europeans, began moving from continent to continent, carrying seeds and slips, as well as livestock.

The forest dwellers live in small tribes, segregated from their neighbors by abandoned and jungly clearings or by virgin forest. They build huts of thatch, sometimes thatch over mud, and have no more paraphernalia than they can move when the old home has to be abandoned. They are likely to be animists, and no major religion has ever affected most of them.

Tillage is crude, fire being used to clear the ground, with some assistance from hand tools. Many tribes make sticks serve as plows and root up the plants by way of harvesting them. The return is inevitably very low, and food shortage is common toward the end of the growing period, after the old crop is consumed, and before the new one is ready for gathering. Little clothing is needed, and materials for housing are to be found everywhere.

Shifting cultivation extends beyond the rain forest, into several of the combinations of small trees and coarse grasses commonly called "bush." In this environment it lacks some characteristic features, and has to compete with nomadic herding or livestock ranching. Only in Africa, where the tsetse is the enemy of animal husbandry, does shifting cultivation spread far beyond the margins of the rain forest.

As in the case of Nomadic Herding, no statistics are available on the migrant tillers of the soil. Descriptions of their life and landscape are few, most of them being incidental notes tucked away in anthropological discussions, and incomplete from the geographic viewpoint.

Whittlesey, Derwent: Shifting Cultivation. *Econ. Geog.* (to be published in January, 1937).

Hörner, Georg: Die Waldvölker. *Petermanns Geog. Mitt. Ergänzungsband* 42(1927), 23-9.

Rudimental Sedentary Tillage

Here and there in regions of shifting cultivation are areas where the inhabitants remain permanently, unless some catastrophe sets them wandering. Some of these districts of rudimental sedentary tillage have become rather densely populated because of special environmental conditions. Such places are likely to be small islands, mountain valleys, and districts where the soil and the climate are favorable above the average. Either because the people inhabiting these districts have not the means to migrate, or because they refuse to leave a fertile spot for one less favored, they are compelled to reuse their fallow, abandoned clearings before the climax vegetation has had time to reclaim them. In forested areas, such land is jungly and requires much more labor for clearing than does the virgin bush. In open woodland the grasses have to be extirpated plant by plant, the native tools being too primitive to do the work as a plow would. Labor to perform this extra work is available, because the population is relatively dense. Because of crude tools and little or no knowledge of the value of fertilizing the soil, and because even the most fertile soils of low latitudes are not first-class, fields have to be left fallow for a few years between each two cultivations. Stock can graze on the fallow, unless domestic animals are unknown or the tsetse keeps them out. In effect, the tilled plots shift, but within an area than can be worked from a fixed village center. Adjacent villages are likely to be in contact with each other, and they may amalgamate into considerable units—social and political. Such were the pre-Conquest empires of the American highlands and the Maya lowlands. Similar although less extensive groupings were numerous in Africa and in many islands.

How far infiltrations of outsiders, singly or successively, may have aided in the fixation of migrant tribes is unknown. Certainly the intrusion of outsiders in historical time has tended to turn shifting cultivation into sedentary forms. With the coming of Europeans this tendency has been accelerated. The newcomers are eager to buy certain products, originally derived from forest or bush, but often easily grown continuously by the aborigines in districts accessible to market. Most of these are tree crops, which remain on the land for years, and which exhaust the soil less rapidly than do annuals. Cacao, oilpalm, cocopalm, abaca, hevea rubber, and tree cotton are leading crop trees. With the introduction of improved methods, especially the animal-drawn plow and fertilizer, annuals also may be grown for sale. Peanuts, a self-fertilizing crop, and annual cotton are chief among these.

The primitive farmer who sells for export must grow food for himself, as he never gets enough cash to buy all his supplies. The crops he requires for subsistence he grows among his cash-producing trees or on other plots which he fallows and tills by turns. In a few places the agriculture is so advanced as to resemble the still more highly developed oriental types of agriculture rather than the ancestral shifting cultivation. This suggests that land occupation in all regions of shifting and rudimental sedentary cultivation may continue to move toward more efficient use of the land.

On the map (Fig. 1) the separation of sedentary from shifting agriculture is incomplete. There are unmapped belts a few miles wide along many railways and well established roads, where tillage has become somewhat fixed, as well as districts near the larger cities. These can not be shown on the scale of the map. Others, in transition from shifting to sedentary, cannot be identified with certainty.

The dwelling of the rudimental sedentary farmer may be like that of his migrant ancestors, but it is more likely to wear a sophisticated roof of corrugated iron, or a homemade imitation fashioned from gasoline tins. Household equipment, while simple, includes imported articles, particularly tinware, enameled ware, and coarse crockery. Cloths of European manufacture supplement or replace the native clothing, except where local native tradition is advanced and strong, as on the highland of Latin America.

As in the case of other primitive agriculture, statistics are few. Differentiation from shifting cultivation has not clearly been made, even by students in the field. A very few descriptions disclose the variety of regions which have in common a tentative settling down upon a fixed piece of terrain.

Whittlesey, Derwent: The Fixation of Shifting Cultivation. *Econ. Geog.* (to be published in 1937).

Platt, Robt. S.: Six Farms in the Central Andes. *Geog. Rev.* 22(1932), 245-59.

Cook, O. F.: Milpa Agriculture. *Smithsonian Instn. Ann Rept.* 1919, 307-26. Washington: 1921.

———: Foot-Plow Agriculture in Peru. *Ibid.* 1920, 487-91. Washington: 1920.

Gillman, Clement: A Population Map of Tanganyika Territory. *Geog. Rev.* 26(1936), 353-73.

Intensive Subsistence Tillage with Rice Dominant

In the humid regions of South and East Asia and adjacent islands, another pair of agricultural types is found, very different from all the rest, but distinguished from each other chiefly by the presence or absence of rice in the crop association.

Where the season is long enough for paddy rice to mature, the highly intensive agricultural system supports the densest rural population found over large areas anywhere on earth. Although three sorts of crops are associated with three types of farmland, the key to this mode of land occupancy is the paddy—irrigable deltas, floodplains, coastal plains, and terraces planted to rice. Two crops a year are garnered where the climate is hot, one where water fails or a cool season intervenes. Rice yields more grain per acre than any other crop. Land out of reach of irrigation, but not too rough, is devoted to varied crops, chiefly grains, oil-seeds, and cotton. Hillslopes too steep to till are planted to trees—mulberry, tea, pepper, and others.

Waters as well as all types of lands are compelled to furnish a share of the food supply. Fish is taken from the rivers and backwaters, and cultivated in artificial ponds. Aquatic plants yield a living to numerous ducks, or are pulled to spread on the fields as green fertilizer.

All the work is performed by hand, except plowing the paddies. Plows are pulled by carabaos, animals which are at home in watery mud. Hand tools are moderately effective, being made of iron or steel, but plows and irrigation pumps are primitive. Some of the tasks are incredibly arduous. Grain must be hung up to dry after being cut, tea and mulberry leaves must be carefully gathered, and the rice plants must be transferred one by one from seed plots to fields. Besides the routine jobs water must be pumped on to the paddies, and irrigation works must be kept in repair.

Natural flooding, annually or occasionally, helps maintain fertility in the paddy silts. On unirrigable lands two or more crops may be planted in the same field to minimize drain on the soil. The seeds may be mixed or planted in alternate rows. Rotation is likewise a well understood principle. In these regions of few animals the land is fed by every available sort of fertilizer, including nightsoil.

Because of the careful methods in vogue and the excellent tilth maintained by hand weeding, it is doubtful if the introduction of farm machinery would increase production. More likely the yield would be less. Certainly the rice paddies would produce less per acre if transplanting should be abandoned.

In spite of indefatigable labor, per capita production is not high and the people are abjectly poor. They live in close-set and close-packed villages crowded upon the smallest possible acreage, to preserve the precious land for tillage, or standing, sometimes inconveniently remote from the fields, on sand spits, tongues of unirrigable land, or other inferior soils. In delta districts whole populations may dwell on houseboats. The furnishings of homes are meager.

Few statistics are published for China, but Japan and especially India are covered by numerous reports. Where an all-year growing season permits, two crops a year are grown on the same land. This results in more than 100% of the total cropped area being in crops in the course of the year. Rice occupies the ground during the favored season, when nearly the total tilled area may be under this one crop. Studies of particular regions are more detailed, if not more numerous, than for the agricultural types previously discussed.

Simkins, Ethel: The Coast Plains of South India. *Econ. Geog.* 9(1933), 19-50, 136-59.

Staats, J. Riley: India East Coast. *Jl. of Geog.* 31(1932), 93-111.

Cressey, George B.: The Fenghsien Landscape: A Fragment of the Yangtze Delta. *Geog. Rev.* 26(1936), 396-413.

Hall, Robert Burnett: The Yamato Basin, Japan. *Ann. Assn. Am. Geog's.* 22(1932), 243-74.

Trewartha, Glenn T.: A Geographic Study in Shizuoka Prefecture, Japan. *Ann. Assn. Am. Geogrs.* 18(1928), 127-259.

———: The Iwaki Basin: Reconnaissance Field Study of a Specialized Apple District in Northern Honshiu, Japan. *Ann. Assn. Am. Geogrs.* 20(1930), 196-223.

Intensive Subsistence Tillage without Paddy Rice

In regions which neighbor the rice country, that crop is ruled out by either lack of moisture or a short growing season, and a good deal of land is out of service during part of the year. These handicaps modify the agricultural system in subtle but profound ways. For the dominant rice, several cereals are substituted, none of them so productive of grain. The climatic limitations bespeak continental conditions, and the farming regions are more generally inland, where readily irrigable delta, floodplain, and coastal plain are absent or small. Hence irrigation, although practiced wherever possible, is on a smaller scale. If it were not for large expanses of fertile soils—derived from loess and lava—the area in crops would be considerably less than it is. Apart from rice, the crops are much the same. The same threefold subdivision into irrigated plots, unirrigated fields, and slopes in tree crops is the rule. Hand methods and intensive application of labor to the land differ little from those in use in the paddy country. The people live in the same congestion as their rice-growing neighbors, and they suffer the additional burden of frequent famines, due to drouth or flood, both of which are characteristic of these lands of erratic rainfall. Occidental technology has been of service in alleviating famine. Railroads quickly transfer food from favored districts to afflicted ones, and large-scale irrigation works insure a minimum output in regions where they have been

constructed. Except for regions notably favored by fertile soil the population is somewhat less dense than in the more productive rice country.

The two oriental types of agriculture neatly illustrate contrasts arising from a single basic difference in the crop association, a difference due to climate. The borderlines between the two sorts of regions can be drawn on a statistical basis. On the margins are zones where paddy rice is grown, but not dominantly. On the map (Fig. 1) the lines mark the limit of *heavy* rice production. In many studies these two agricultural types are discussed together. Articles in periodicals cover marginal regions, the major areas of neither type being treated.

Akin to this mode of agricultural land occupancy, in crop association, in intensiveness, in quantity of hand labor, and in outturn, is the agriculture of low latitude oases scattered across the desert of Inner Asia and North Africa. Of these Egypt is the most extensive and may be regarded as a large but otherwise typical example.

Irrigation alone permits the growing of crops in these oases, a fact which rules out dryland tillage, although some tree crops are grown in infertile soils. Despite this difference, the agricultural life is so nearly identical as to warrant grouping with cold China and dry India, except for the few oases which have turned to the production of some commercial crop, generally dates or cotton.

There is an arresting similarity in crops grown and in methods of growing them between the non-rice agriculture of the orient and places like the Kano District of the Sudan and the Mexican highland. Both these regions practice irrigation, both depend primarily on unirrigated fields, and both have some tree crops. Methods are much less intensive, however, the outturn per acre is correspondingly low, and the population light. It would not do to press the parallelism too far. True "oriental" agriculture does not extend westward and southward beyond the Sahara.

Davis, D. H.: Agricultural Occupation of Hokkaido. *Econ. Geog.* 10(1934), 348-67.
Stewart, John R.: Manchuria: The Land and Its Economy. *Econ. Geog.* 8(1932), 134-46.

Gemmill, Paul F.: Egypt is the Nile. *Econ. Geog.* 4(1928), 295-312.

Guardia, J. E.: The Agricultural Nile Delta. *Bull. Geog. Soc. Philadelphia* 25(1927), 163-86.

Commercial Plantation Crop Tillage

In a few districts where Intensive Subsistence Tillage dominated by rice has been the immemorial farm system, and in many places where Shifting Cultivation or Rudimental Sedentary Tillage formerly held sway, Europeans have superimposed a distinct mode of land occupancy—Commercial

"Plantation Crop" Tillage. Not even livestock ranching is so dependent upon the outside world. Nearly every bit of the cash crop is sold outside the region of production, and most of it moves to the middle latitudes. The capital required to develop the business comes from Europe or North America. The staff, both administrative and technical, is recruited from the same regions, and the machinery is made there. Even the fertilizer which feeds the fields, and the flour, dried codfish, canned goods, and other staples which feed the officers and workmen, are imported. Occasionally, although not usually, the crop is indigenous. More commonly the field hands are local, although in many places they too must be imported.

The plantation is a device to procure in desired quantities and of a standard quality, commodities which can not be produced in middle latitudes and which the low latitude inhabitants either do not grow (hevea rubber), or turn out in insufficient quantities (sugar), or of unreliable quality (tea). Commercial plantations were started as products of the newly discovered low latitudes ceased to be novelties and became regular items of consumption in the middle latitudes. Plantings were rapidly extended, and new crops were added as cities thrived on trade, on mining, and on manufacturing, and their redoubling populations created new markets. Inventions accelerated transportation. Refrigeration added perishables, like bananas, to the list of plantation crops. Improved machinery revolutionized processing, within the plantation district, of sugar, rubber, and other crops. Products not hitherto grown on plantations were discovered to possess value for a mechanized society—rubber, sisal, copra. New uses in industry were found for cacao, cotton, and vegetable oils. Sanitation improved the lot of the middle latitude staff, by decreasing the risk of disease.

In a plantation crop region the most efficient machinery of production and the latest gadgets for comfortable material living are juxtaposed to but not combined with the primitive life and labor of the aboriginal dwellers. No contrast could be more bald. In other respects also the commercial plantation business is paradoxical. Its normal state is chronic overproduction, and yet decreasing fractions of most products come from plantations. This results from the fact that nearly every plantation crop is grown on a very small part of the total area to which it is environmentally suited and from which it can profitably be marketed. Hence new land is constantly being cleared and abandoned plantations are often converted to new uses. More serious still, nearly all plantation crops can be grown by natives, particularly if they can be sold from the field without processing. These conditions combine to glut the market unless the demand happens to be rising strongly. Today the banana is the only crop grown exclusively on plantations, although sisal is a close second. Tea, coffee, and sugar reach the

market through the hands of planters, because natives can not manage the careful and expensive processing required. But a large fraction of these crops is grown on small holdings of the local inhabitants.

A good deal of one-time plantation land has lost its distinctive character. In some West India islands, Hawaii, and the oases of coastal Peru and northern Argentina, generations of planters have lived on or near their holdings and administer the business personally or through overseers. There irrigated districts closely resemble irrigation agriculture in places where plantations never did exist. For this reason the Peruvian and Argentine oases are mapped as belonging to Specialized Horticulture, even though the leading crops are neither fruits nor vegetables.

In the humid subtropical climate of the United States South and the Brazilian Highland, the two largest plantation regions, infertile lands have never been worked on a strictly plantation crop basis, and more and more plantations are being broken up, either by sale in small units, or by renting to share-crop farmers who work their few acres independently.

Commercial Plantation Crop Tillage occupies in the aggregate a very small acreage, compared to any of the other types of agricultural land occupancy which have been outlined. It has been stressed in geographic study, perhaps disproportionately, because of its commercial value to the middle latitudes and its nice expression of interacting natural and cultural forces.

The regions of production are too scattered and disparate to be readily brought into statistical focus. Plenty of data are available concerning each cash crop, but these do not suffice to picture clearly the regions of production, because some subsistence crops are grown by plantation laborers or by other indigines. With the blurring of the lines between plantation production and production on small holdings, statistical comparison becomes even more difficult. Most accounts of plantation agriculture are stories of the individual cash crops. Because the one crop is so overwhelmingly dominant, some of these accounts are listed below.

Foster, Alice: Sisal Production in Semi-arid Karst Country of Yucatan. *Jl. of Geog.* 29(1930), 16-25.

Whitbeck, R. H.: Geographical Relations in the Development of Cuban Agriculture. *Geog. Rev.* 12(1922), 223-40.

Platt, Robt. S.: Geography of a Sugar District: Mariel, Cuba. *Geog. Rev.* 19(1929), 603-12.

Kopp, A.: L'agriculture à la Guadeloupe. *Ann. de Géog.* 38(1939), 480-500.

Shaw, Earl B.: St. Croix: A Marginal Sugar-Producing Island. *Geog. Rev.* 23(1933), 414-22.

Coulter, John Wesley: The Oahu Sugar Plantation, Waipahu. *Econ. Geog.* 9(1933), 60-71.

- Van Valkenberg, S.: Java: The Economic Geography of a Tropical Island. *Geog. Rev.* 15(1925), 563-83.
- Coulter, John Wesley: Small Farming on Kauai: Hawaiian Islands. *Econ. Geog.* 11(1935), 401-9.
- Harrison, Lucia C.: Dominica: A Wet Tropical Human Habitat. *Econ. Geog.* 11(1935), 62-76.
- Whitbeck, R. H.: The Agricultural Geography of Jamaica. *Ann. Assn. Am. Geogrs.* 22(1932), 13-27.
- Platt, Robt. S.: Coffee Plantations of Brazil. *Geog. Rev.* 25(1935), 231-9.
- Chambers, William T.: Life in a Cotton Farming Community. *Jl. of Geog.* 28(1929), 141-7.
- Bratton, Sam T.: Land Utilization in the St. Francis Basin. *Econ. Geog.* 6(1930), 374-88.
- Browne, W. A.: Grand Prairie: A Progressive Rice Region. *Jl. of Geog.* 31(1932), 138-47.
- James, Preston, E.: A Specialized Rice District in the Middle Parahyba Valley of Brazil. *Michigan Papers in Geog.* 4(1934), 349-58.

Summary and Prospectus

In contrast with the two dryland types of agricultural land occupance, the five systems of the humid low latitudes are seen in review to depend largely on tillage. Livestock is excluded, wholly or with minor exceptions. Subsistence is the primary objective of the farmer except in the scattered spots where commercial plantation crops are grown by invaders from the middle latitudes, or where indigenes have been encouraged to produce a surplus of some of their crops and to grow plants hitherto unfamiliar, for sale to these same middle latitude consumers.

The seven types of agriculture thus far discussed cover a large part of the earth's tilled and grazed land, and they support nearly 70% of the world's population. The remaining six types occupy a position of importance disproportionate to their size, for dwellers in humid middle latitudes of the occident. They include the principal commercial systems. Some of these are of recent origin—experiments in agricultural land occupance. From these lands of agricultural progress has come the impetus that reaches out to transform dryland husbandry (in Livestock Ranching regions) and to modify low latitude and oriental agriculture (in regions of Commercial Plantation Crop Tillage and Rudimental Sedentary Tillage).

Mediterranean Agriculture

From the geographic standpoint, Mediterranean Agriculture is the most satisfactory of all the types. Probably because it represents an ancient and stable collaboration between man and the land. So vital has this proved that it stoutly maintains its character in the region of its origin, despite buffetings of the world-wide shift from isolation to interdependent economics.

The settlement by Europeans in the new continents has only emphasized the integrity of the type, by developing in each continent a region approximating its prototype in the Old World.

To begin with, the unique Mediterranean climate and its intimate association with mountains and hills, has created a distinctive stock and crop association of four interrelated functioning forms: winter crops grown with rain, all-year crops grown with rain, all-year or summer crops grown with irrigation, and livestock—mainly small animals—grazed on highlands in winter and on lowlands in summer. Natural environment coincides areally with crop and livestock association. The only possible exception is the doubtful case of southern Australia, where Mediterranean climate, *without the mountains* and suffering from newness and remoteness, has not bred all the characteristic forms of Mediterranean agriculture. In the Los Angeles Basin of Southern California the very recent settlers from humid regions (mainly people with money to spend), insist on cows' milk and door-yard lawns. These are ephemeral holdovers, sure to disappear with increasing pressure on natural resources, particularly the water supply. They were never features of the landscape in parts of California settled by people who went there to make a living.

Both subsistence and cash crops figure in the economy of every region of Mediterranean agriculture, although not of every farm. The relative emphasis on the several products varies with the rainfall. Thus North Africa produces more barley and goat-skins, South Europe more wheat and sheepskins. Tradition, market, and government favor may sway attention to this or that crop, but the elements remain constant. Southern France, Italy, and Chile stress wine, California and Spain stress oranges. More wheat is grown in Italy, where it is supported by tradition and tariff, than in California, which must compete with commercial wheat raising of interior United States. California markets its citrus and deciduous fruits fresh, and has an active canning industry for the perishable deciduous group; South Africa makes jams and preserves for the English market. Turkey grows cotton on the Adana Plain, and Russia is creating a truck farming district at the east end of the Black Sea.

Methods vary somewhat, but again the differences are details. Italy, Chile, and the Cape region employ little but hand labor. In California, where farmers can afford any machinery they care to use, all irrigating, most harvesting and planting, and much weeding must be done by hand. This leaves only plowing (on lands not too steep), and some weeding to be done by tractor-drawn implements. Small factories for processing surpluses are ancient in origin and widespread in all regions of Mediterranean

agriculture. The California cooperative achieves economic results not very different from the latifundia in Spain, Italy, or Chile.

The business is intensive except where large landowners are able to hold estates for pasturing animals (as for example ring bulls in Spain) or for growing wheat. This is an ephemeral phenomenon, the sort of discordance between natural and cultural forces familiar to the geographer but bound to be resolved by time. Not all the land is used with equal intensity, because its adaptability varies widely—inevitable where mountains alternate with plains and where rainfall and available ground water range from almost nothing to moderately abundant. As a rule each district is used to its maximum capacity. The return from lowlands is high, and some of the horticultural land has a very high valuation. The presence of much land of low grade, rugged or unirrigable, brings down the total aggregate outturn.

The cultural landscape is much the same everywhere. In times of insecurity folk live on defense points, and when no danger threatens they take to more accessible lowland sites. The new continents, peaceful ever since their seizure by Europeans, all have their farm villages on the lowlands, whereas on many Mediterranean shores people continue to dwell in their hilltop houses because they can't afford to abandon them and build new ones. Whether on hill or plain, nucleated settlements are the rule, because the horticultural character of the business enables a family to live on the income from a small plot, and because unit value is too high to warrant wasting garden land as a site for farmsteads. Few structures are needed, and houses are small in these lands of bright sunshine. Yet even the poorer peasants possess household goods more numerous and more valuable than the low-latitude or the oriental farmer can boast.

The transition zone to adjacent agricultural types is narrow and corresponds closely with mountain ranges which limit the climate on which the farming is based. The olive has long been recognized as the indicator of the spread of both Mediterranean agriculture and Mediterranean climate in the Old World. Hartshorne and Dicken have used it, along with other orchard crops, in ratio to total cropland other than hay. This criterion works admirably in Europe, but in the new countries where olives are not much grown and marginal land is used only a little, it leaves a deal of lightly farmed country in a limbo. This they group under the head "Forests and Unused." In the classification here presented the mountain boundaries are preferred, because there is some tillage and a good deal of transhumant stock-grazing in all the wooded borders of the intensively tilled lowlands.

Of the four articles on this agriculture cited below, two describe the commercial aspect of its horticulture.

- Gilbert, E. W.: The Human Geography of Mallorca. *Scot. Geog. Mag.* 50(1934), 129-46.
- Coulter, John Wesley: Land Utilization in the Santa Lucia Region. *Geog. Rev.* 20(1930), 469-79.
- Torbert, Edward N.: The Specialized Commercial Agriculture of the Northern Santa Clara Valley. *Geog. Rev.* 26(1936), 247-63.
- Halpern, E.: La Huerta de Valence. *Ann. de Géog.* 43(1934), 146-67.

Commercial Grain Farming

More than any other type of agriculture, commercial grain farming is the creature of the Industrial Revolution. It has no prototypes and does not antedate the day of the self-scouring steel plow and harvesting machinery, inventions of the 1830s. It depends slavishly on these inventions, as well as on the steamship (first successful in 1807) and the railroad (1825). The regions now devoted to commercial grain farming were previously used, if for any sort of husbandry, by nomadic herders or livestock ranchers. They lie on the border between humid and semiarid climate, and the summers are short, the winters cold. Most such regions are well inland.

The crop and stock association is simple and standardized. Wheat is the cash crop, with flax or barley subsidiary at times and in places. Oats and hay feed the draft animals, of which there are a good many, unless tractors have supplanted them. Other animals are kept for local supplies. No other association has been found which will provide a livelihood, except where standards of living are so low and population so dense that oriental agriculture can be adopted. This has taken place in Manchuria, the one region having sub-humid continental climate with short summers where commercial grain farming is not the dominant system.

The percentage of cropland in the total area is very high in favored districts. Some is left fallow, and partial or total crop failure is so common that it has to be expected once in a few years. The percentage of wheatland is likewise very high, comprising as much as half the total farmland in some places. The ratio of livestock to cropland is very low, and toward half the total number of livestock units is draft animals.

Methods are progressive but not intensive. By using much large machinery, much low-value land, and little labor, the outturn suffices to maintain a sparse population. The return per acre is low compared to regions where more intensive tillage is practiced. Fertilizer is unknown, and only recently has the straw been plowed into the fields.

Like his neighbor the livestock rancher, the commercial wheat farmer is at the mercy of unreliable rainfall and in competition with many other regions, the outturn of which bears no predictable relation to his own. But his immobile grainfields can not be moved to avoid drouth. Therefore

his fortunes fluctuate wildly, and he is the most politically-minded farmer on earth. From the commercial grain regions come chronic or epidemic demands for the government to regulate common carriers (of the cash crop, the machines, the extra hands, and the long list of clothing, luxuries, and even food imported), and to reduce or cancel indebtedness (incurred in a venture requiring large capital and ruinous after a few successive seasons of low prices).

Huge acreage separates each farmer from his neighbors and from town. Towns have a smaller ratio of residences to commercial buildings than in any other landscape. In all the new continents the farmstead and its equipment is first-class, except on marginal lands which ought never to have been plowed.

Some observers have supposed that commercial grain farming is merely a pioneer, destined to give way to some other type. This was the case with bonanza wheat farming of such regions as the Corn Belt, the Central Valley of California, and the maize region of the Pampa. But in the humid continental climate with short summers attempts to introduce other stock and crop associations have failed signally, with the sole exception of Intensive Subsistence Agriculture without Rice. The current Russian experiments in cooperative and state farming therefore hold special interest as perhaps paving the way for modifications of this very new and highly unstable system of agriculture.

The maps of Jones and Whittlesey and Hartshorne and Dicken agree on the outlines of these regions in North America. The border toward the North Pole has slowly expanded, thanks to the scientific propagation of hardier types of wheat. At times the dryland margins of all regions expand similarly, only to retreat during the succeeding spell of drouth years. The exact outlines of any region therefore fluctuate with the period for which statistics are chosen.

Although there are no notable variations in this standardized farming, nice distinctions from region to region demonstrate the delicacy of the balance between natural and cultural forces which prevails on this kaleidoscopic earth.

Platt, Robt. S.: Pirovano: Items in the Argentine Pattern of Terrene Occupancy. *Ann. Assn. Am. Geogrs.* 21(1931), 215-37.

Gibson, J. Sullivan: Agriculture of the Southern High Plains. *Econ. Geog.* 8(1932), 245-61.

Garland, John H.: The Columbia Plateau Region of Commercial Grain Farming. *Geog. Rev.* 24(1934), 371-9.

Andrews, John: The Present Situation in the Wheat-Growing Industry in South-eastern Australia. *Econ. Geog.* 12(1936), 109-35.

Tuliakov, N. M.: Agriculture in the Dry Region of the U. S. S. R. *Econ. Geog.* 6(1930), 54-80.

Commercial Livestock and Crop Farming

This mode of agriculture, often called "mixed farming," displays maximum diversity in detail amid essential uniformity in outline. It is one of three lineal descendants of the medieval agriculture of North Europe, all of which feature both crops and livestock in different associations and in varying ratios. Today it is found not only in Europe, but also in the humid middle latitudes of all the other continents except Asia.

Where the climate is warm enough, wheat, maize, and oats are the principal grains. Wheat is consumed by people, oats by stock, and maize by both. Where summers are cool or wet, or where soil is infertile, rye and barley take the place of corn and wheat. Root crops are grown everywhere, but more especially in the rye-barley regions. There potatoes for man, turnips and other roots for beast, and sugar beets are important. Hay is always present, often in the form of a legume. Surpluses of any crop may be sold, but the main cash products come from animals. Hogs and cattle and poultry predominate, with horses, mules, or oxen for draft. These diverse plants and animals suit the varied environment, which includes a wide range of soils, and the market, which is dominated by the nearby trading and manufacturing cities, with their multifarious demands. Vegetables and other minor crops add further to the variegated appearance of the farmed landscape. In the immediate vicinity of large cities spots of market gardening should be distinguished, and in the United States dairying districts likewise. On the scale of the map (Fig. 1) these areas are too small to show.

Methods include the employment of much machinery, careful attention to breeding and plant selection, a well established rotation in which legumes and hay play a part, and generous fertilization of the soil made possible by the considerable livestock density. Nowhere is the farmer more progressive than in these regions. He lives in the midst of the impedimenta of the machine age, and his objective is maximum mechanical efficiency on his farm.

The return is relatively high, being very high in some densely peopled countries of Europe where extra hand labor from families of factory workers may be had cheap at hoeing and picking seasons. In Europe national tariffs, subsidies, and other political devices go far to determine just which commodities are produced. Indirectly this affects the return per acre. Some crops, notably wheat, are grown on inferior land; some crops produce higher yields because subsidized sugar beets in the rotation maintain tilth at maximum efficiency.

The close interdependence between this farm system and centers of trade and manufacturing is disclosed by its weak development in eastern Europe and in the southern continents, even where the natural environment is satisfactory, and its absence in eastern Asia where intensive hand tillage held sway long before Europe outgrew the medieval three-field system of farming.

Nearly everywhere in North America the farmer lives on the acres he works, and this is likewise true of many regions in Europe and the southern continents. Since the farms are of medium size this does not impose severe isolation. Marketing towns are numerous, because in a cash system there is much trade. Parts of Europe have inherited the nucleated farm village from the distant past. It tends to persist because no one wants to abandon home and neighbors. The standard of living varies, but in every country it is relatively high, except in rugged or infertile districts where it is hard to produce enough from the niggardly ground to pile up a surplus for sale.

The percentage of cropland to total farmland is about the same as in regions of Commercial Grain Farming, but the ratio of animal units to crops is much higher. Of the livestock, more than two-thirds are meat producers, chiefly cattle and hogs. Regions are distinguished from their neighbors (Fig. 1) by a combination of both products and methods, rather than by a simple statistical rule of thumb. Something of the variety which prevails from region to region is portrayed in the articles listed below.

- Dodge, Stanley D.: Bureau and the Princeton Community. *Ann. Assn. Am. Geogrs.* 22(1932), 159-209.
- James, Henry F.: The Agricultural Industry of Southeastern Pennsylvania. *Bull. Geog. Soc. Philadelphia* 26(1928), 305-22; 27(1929), 87-126, 167-92.
- Perpillou, A.: L'évolution économique du Limousin méridional. *Ann. de Géog.* 36(1927), 509-27.
- Shaw, Earl B.: Land Use in the Upper Ardeche River Valley of France. *Econ. Geog.* 11(1935), 356-67.
- Richard, Marcelle: L'évolution agricole du Plateau de Langres. *Ann. de Géog.* 38(1929), 133-437.
- Capot-Rey, Robert: L'agriculture dans le territoire de la Sarre. *Ann. de Géog.* 32(1923), 97-118.
- Edwards, K. C., N. V. Scarfe, and A. E. Moodie: The Nowy Targ Basin of the Polish Tatra. *Scot. Geog. Mag.* 51(1935), 215-27.
- Peattie, Roderick: The Conflent: A Study in Mountain Geography. *Geog. Rev.* 20(1930), 245-57.
- Roucek, Joseph S.: Romanian Peasant and Agriculture. *Jl. of Geog.* 31(1932), 279-87.
- O'Dell, Andrew C.: Geographical Controls of Agriculture in Orkney and Shetland. *Econ. Geog.* 11(1935), 1-19.
- Darby, H. Clifford: Settlement in Northern Rhodesia. *Geog. Rev.* 21(1931), 559-73.

Subsistence Crop and Stock Farming

The second of the three types of agricultural land occupancy originating in North Europe is outwardly much like the first. The one prime difference is profound—the farmer produces for his own sustenance and sells little or nothing. Having no cash income he cannot buy expensive machinery nor can he save the best seed from his fields or buy breeding stock. His return is correspondingly low, and he cannot market his rare surpluses in competition with the high-grade and reliable output of commercial regions. Lacking the stimulus of a competitive market, methods are crude. Thus the vicious circle continues to roll round and round.

Wheat almost never is found in the crop association. Apparently if land can produce wheat, it can support a cash system of farming. Rye or maize is the chief grain food of the people, with potatoes and barley as other staples. Each self-dependent farm tries to produce all the varied commodities needed. For some of these the environment is unsuited and the outturn very low.

As a rule farmers are laborers on estates and they live in farm villages, relicts of serfdom not many decades gone. For most of them living conditions are miserable. The breakup of estates which has been going on in most of these regions since the end of the World War should profoundly modify the system. As Germany and Sweden have proved, similar natural environment can be administered on a cash basis. The efforts to improve farming in Russia are especially worth watching. As yet the results are not plain. Along railroads, commercial livestock and crop farming is replacing its prototype devoted to subsistence. Near cities market gardens and dairy farms appear to be evolving. It seems likely that in so far as the Russian agrarian reform tends toward large-scale operation, it will not be successful in regions of Subsistence Crop and Stock Farming. Nowhere has this environment been effectively organized except by individual farmers working their several holdings and rearing their own animals.

In the countries fringing Russia on the west a transformation in land occupancy is occurring, although less urgently pushed by the governments, all of which are devoted to private capitalism, as distinguished from state capitalism. Turkey has experienced more change than any other of these states. A recent map of agricultural systems in Poland indicates the persistence of the three-field system in the region under Russian domination before the World War, in sharp contrast with Commercial Stock and Crop Farming in the parts formerly ruled by Germany, and even by Austria.³⁰

³⁰ Müller, Wilhelm: Wirtschaftsgeographische Gliederung von Polen. *Geog. Anz.* 35(1934), 264–72. See also:

Hartshorne, Richard: Geographic and Political Boundaries in Upper Silesia. *Ann. Assn. Am. Geogrs.* 23(1933), 202–3.

Romer, E.: *Atlas of Poland*, 1916 and 1930.

As in all regions of subsistence agriculture, statistics are lacking or unreliable. Few detailed field studies have been made. The boundaries between the commercial and the subsistence aspect of mixed farming in east central Europe are based on studies made in the critical zones.⁸⁰

Inclusion of the Mexican Highland in this type of agricultural land occupancy is based on undeniable similarities, in spite of wholly different histories. The likenesses appear to derive in part from the aggregation of the land into huge estates, worked by a landless class of peasants. "Peon" is a close equivalent of "serf." As in many parts of Eastern Europe, the Mexican estates are now in process of subdivision as a result of the revolution in politics and society of the past quarter century. Whether the system of agriculture to be built upon small holdings will resemble Commercial Stock and Crop Farming or some other type it is too early to say. One clear result has been the elimination of plantation crop tillage, formerly paramount in some districts.

Platt, Robt. S.: *Magdalena Atlipac, A Study in Pattern of Terrene Occupancy in Mexico. Bull. No. 9, Geog. Soc. of Chicago. Chicago: 1933.*

Commercial Dairy Farming

The third form of agriculture to evolve from the medieval system of North Europe is dairying. Except where induced by an exceptional market, as in the vicinity of large cities in central and western United States, dairying makes its appearance where summers are too cool and moist for either maize or wheat, and where hay is the most satisfactory crop, year in and year out. Leguminous forage, root crops, oats, and two-row barley supplement the hayfeed of the cows, and rye or six-row barley and potatoes are grown for human consumption. In short, the members of the crop and livestock association are just about the same as in the two historically related types, but the emphasis is very different.

Commercial dairying pays only where the products can be sold to an urban market. By far the largest buyers of dairy products are the city populations of the North European type. The radius for shipping fresh milk is, roughly, overnight; for cream twice as far; for butter in refrigerators, across a continent on rails and from the antipodes in ships; for cheese, periods up to three or four years, depending on the kind. These facts explain the worldwide distribution of Danish and New Zealand butter, the special trade-mark value of many cheeses, chiefly of European origin, and the abundant supplies of milk and cream in the cities adjacent to the major dairying regions (Fig. 1).

Without careful preparation perishable dairy products would spoil in long-distance shipment. Every step in feeding, milking, and processing is

critical. The painstaking attention accorded cattle and milk is extended to the farmland. Manure fertilizer is abundant, but the infertile soils typical of dairying regions need all they can get. To supplement local forage, mixed grains and oilseeds are commonly imported. The dairy business is elaborately mechanized, and the capital investment in housing and equipment on high-grade dairy farms exceeds that in any other type of agriculture.

The dairyfarm landscape is noted for roomy barns—to house the cows and to store winter feed. This is true even of the mild-winter climate along the coasts of Northwest Europe. Holdings average larger than in adjacent stock and crop farm regions because hay is an extensive crop and there is a good deal of pasture besides, some of it wooded and of low carrying capacity.

This business, featuring animals, requires rather more labor than the crop farms, and there is no off-season during the year. The percentage of tenantry is low. Apparently the personal stake which keeps the owner on the job is a cornerstone of prosperity in this system of agriculture.

The return on successful dairy farming is high. Improvement of herds is a prime means of increasing income. Most "gentleman farms" run by city men for a hobby are dairy farms where pure-bred stock is featured. These estates in new countries, like entailed properties in the Old World, have often taken the lead in the advancement of a region to ever higher levels of efficiency.

Statistically dairying regions are differentiated from neighboring crop and livestock husbandry by high ratio of hay to grain, high percentage of dairy cows in the livestock total, and a higher density of farm population. The percentage of land in crops is about the same, and the number of animal units per square mile runs close to that in Commercial Livestock and Crop Farming. Local variations are considerable.

Bergsmark, Daniel R.: Agricultural Land Utilization in Denmark. *Econ. Geog.* 11(1935), 206-14.

Cajander, E.: Die agrargeographische Lage und die Landbauzonen Finnlands. *Geog. Zeit.* 34(1928), 220-7.

Leppard, Henry M.: Scottish Carse Agriculture: The Carse of Gowrie. *Econ. Geog.* 10(1934), 217-38.

Le Lannou, M.: Le Trégorois: étude de géographie agricole. *Ann. de Géog.* 40(1931), 24-38.

Arbos, Philippe: The Geography of Pastoral Life [French Alps]. *Geog. Rev.* 13(1923), 559-75.

von Wismann, Hermann: Die bäuerliche Besiedlung und Verödung des mittleren Ennstales. *Petermanns Geog. Mitt.* 73(1927), 65-9.

Hartshorne, Richard: A New Map of the Dairy Areas of the United States. *Econ. Geog.* 11(1935), 347-55.

Anderson, S. Axel, and Florence M. Woodard: Agricultural Vermont. *Econ. Geog.* 8(1932), 12-42.

Holmes, J. MacDonald: Geographical Factors in the Foundation of New Zealand's Wealth. *Australian Geogr.* 2(1934), 24-36.

Specialized Horticulture

Production of fruits and vegetables in kitchen gardens and home orchards is the rule in most agriculture of humid regions. Among the occidental systems of middle latitudes horticulture as an important phase of the business occurs only in Mediterranean agriculture. Elsewhere fruit and vegetable growing, if on a large scale, is specialized on exceptionally favored spots. Most of these areas are too small to be shown on the map (Fig. 1); the larger ones do appear, however. Each district concentrates on one or a very few crops, which it sells to a market as particularized as the producing area itself.

Perhaps the most ancient districts of specialized horticulture are the vineyards of Europe outside the Mediterranean climate. Some of them were instituted in Roman times, although they were put on a cash basis in the modern sense only two or three centuries ago. The most famous are the *côtes* of the Eastern Paris Basin, where southeast slopes and limestone soils offset the cool, dark climate and produce the prized light wines known under generic place names, such as Burgundy, Champagne, and Moselle. Similarly situated, and only a little less famous, are wines from slopes overlooking the Rhine, the Loire, the Swiss lakes, and the plain of northern Hungary. Near Bordeaux special soils and a quasi-Mediterranean climate produce wines ranking with Burgundies. In a very different climate and under irrigation, Argentina supplies itself with wine from the specialized oases, Mendoza and San Juan.

Other aspects of intensive fruit and vegetable growing had to await the market created by city populations which live by manufacturing, mining, and trading. Producing little or no food themselves, they purchase large quantities of horticultural crops.

This demand is satisfied in part by market gardens within a few hours trucking of populous cities. There, on the types of land which favor early harvest, intensive labor and consummate skill are devoted to raising the maximum of crops on the minimum of acres. Warm soils bring into bearing successive crops, each a bit earlier than in ordinary nearby gardens. Lavish application of purchased fertilizers enrich the light soil and produce high yields and quality. The value of market garden land averages higher per acre than that devoted to any other sort of farming. The crops are vegetables and bush fruits.

No outlay for housing is required, apart from a residence, unless the business has progressed to the stage of growing crops in winter or starting seeds under glass. In such cases greenhouses are built over the gardens, to utilize the same prized soil. During peak periods the farmer and his family must work almost incessantly. Therefore they usually live on the place in a small house, well-kept like the garden itself. This gives the market garden district the aspect of a scattered residential village.

Farther from the city market, in belts progressing into warmer climates, extend districts of truck farming. Lacking the market garden's advantage of nearness to market, truck farms make up for it by exceptionally favorable soil and by the climate, which matures the desired crops earlier than in their competitors' suburban gardens. Only in Europe and North America does the urban population induce truck farming. Districts in Europe lie in three regions. (1) Along the Channel coast of Brittany and the Netherlands, to supply the markets of Britain, Germany, and North France. In the Low Countries the business is conducted under glass as well as outdoors, and is favored less by climate than by soil, and by cheap labor with a long-standing tradition of meticulous tillage. (2) The narrow Rhône Valley, the bit of Mediterranean climate nearest to Northwest Europe, is a continuous ribbon of truck farm. The superposition of truck farming on the original Mediterranean agriculture entails merely a different group of crops and not a marked change in the character of agricultural land occupation. At the head of the Rhône Delta this belt changes direction and runs along the Riviera into Italy. (3) Similar districts, which market their vegetables and fruits still earlier in the season, are the Algerian and Tunisian coast of North Africa, the plains of Morocco, and the nearer oases in the Sahara.

In North America two zones extend southward from the major urban region. The larger follows the sandy soils of the Atlantic coastal plain. In Florida it merges into low latitude climate. The smaller follows the Mississippi Valley and the Gulf Coast, but only intermittently. In the Rio Grande Valley it occupies irrigated land which has some of the qualities of a low latitude desert oasis. A quite distinct area in which truck farming occurs is the dry country west of the 100th meridian. Scattered through it from southern Canada to northern Mexico are irrigated patches producing a wide climatic range of fruits and a number of vegetables. The climax of this region is the low latitude desert of the Lower Colorado Basin and the Mediterranean Climate of California. These areas are functional counterparts of the truck farms in the Sahara and on the shores of the Mediterranean Sea.

Commercial fruit orchards are found in many of the truck farming regions. All but hardy fruits, such as apples, cherries, and pears, are con-

finer to climates milder than the urban regions of either Europe or North America can boast. Irrigation has evolved the large and handsome fruits common in the United States. In humid regions there are orchard districts in favored belts and spots within the areas mapped (Fig. 1) as producing commercial crops, livestock, and dairy products. Islands of more favorable climate are created in the sea of continental conditions by water bodies, which retard blossoms in spring and frosts in autumn, and by hills which set up air drainage. Examples are the apple district of southwestern Germany, and the fruit zones of Nova Scotia, the Lower Great Lakes, the Middle Appalachians, and the Ozarks. The wine districts of North Europe also belong in this category.

The landscape of the truck farm district or fruit belt looks much like a market garden area. Small houses, each on its own land, crops very carefully tended, and no livestock, except perhaps a horse or mule for plowing and hauling.

Besides fruits and vegetables a number of other crops are produced as specialties, at least in some districts. Many a crop of this sort is only one item in several produced by every farmer of the neighborhood. Always it is sold for cash, and it may provide the principal income of the farm, even though the acreage occupied by it is but a small fraction of the tilled land. Sugar beets in humid regions, tobacco in the middle latitudes, flax and hemp for fiber, and many less widely distributed crops belong to this group. In the classification of major agricultural regions, these crops may properly be thought of as variants of the cash crops more usually characteristic of the association in which they are found.

Much the same sort of crop is cotton in humid climates. It is being grown increasingly as a specialty crop in regions which otherwise bear many of the earmarks of commercial livestock and crop farming.

In dry regions where irrigation must be practiced, cotton may dominate the business of small districts. Oases within Russian Turkestan, spots in the Levant, a district in the Argentine Chaco, coastal oases of Peru, and places in the Lower Colorado Basin are examples. Sugar beets in the Platte and Salt Lake oases of western United States, and sugar cane in irrigated districts of coastal Peru and northern Argentina are in similar case. On the map (Fig. 1) these irrigated spots are designated as specialized horticulture, because the agricultural system is much the same as in vegetable and fruit growing of nearby oases.

Specialized poultry production is a minor business, carried on chiefly in the United States, which resembles market gardening wherever it is found near large cities, and truck farming in the two large producing districts of California.

The small districts devoted to commercial horticulture and the other crop specialties rarely coincide with administrative divisions for which statistics are collected. In the field they are easily observed, because the break between horticulture and surrounding, extensive land utilization is sharp, adhering strictly to frost lines and changes in soil or slope. Some truck farms of the Atlantic and Gulf coastal plains, carved out of deep forest, are as strikingly set off as are irrigated oases in deserts. Perhaps because they are clean-cut, many garden and orchard regions have been carefully studied. From these studies a composite picture of this manifold agricultural system can be seen.

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Commercial Agriculture

With a single exception, everywhere on the wane, all the agricultural systems of the occidental middle latitudes are on a cash basis. The dependence of all this farming on the urbanized world created by the Industrial Revolution stands out clearly. The change-over from crude medieval agriculture began with the Commercial Revolution of the sixteenth century, but came into its own only with the advent of invention and science on a grand

scale. From almost exclusive dependence on agriculture, human existence broadened its material base to include trade, and then mining and manufacturing. Agriculture felt the repercussions of these mighty alterations of economic life. The market for its products was increased many fold, and the mechanism for intensifying production was provided in the shape of machinery, transportation, fertilizer, refrigeration, and scientific farm management, including plant and animal breeding. For the first time in history agriculture became specialized so that today commodities are generally produced where the natural environment is favorable. Exceptions to this rule usually have a political explanation, and not the least significant portent of the current rise of exclusive nationalism is its tendency to set back the hands of the agricultural clock, by restricting commodity production within national boundaries.

OUTLOOK

While efforts are being made to produce more variety of crops at home, the forces of the Industrial Revolution are being increasingly applied to expand commercial agriculture in the low latitudes and to a lesser degree in the Orient. In these two apparently conflicting tendencies lies a prime challenge to society. Can economic distribution and social control be so organized by political means as to commercialize the remaining agricultural regions of the earth? If so, will the accomplishment wreck the unstable structure of commercial agriculture already in existence?

Agriculture is the broad base on which economic society rests. Its future is one of the most critical problems of the next generation. Geography ought to hold some of the keys to its solution. A refinement of the classification of agricultural types here outlined, or the substitution of a more realistic classification than this one proposed, may be a means of discovering at least one of those keys, by clarifying man's comprehension of the limitations and opportunities which Nature poses as incentives and restraints to human ingenuity.

*Harvard University,
September, 1936.*

Distances are true on all meridians and on all parallels,
from the equator to latitude 40°

MAJOR AGRICULTURAL REGIONS OF THE EARTH- WESTERN HEMISPHERE

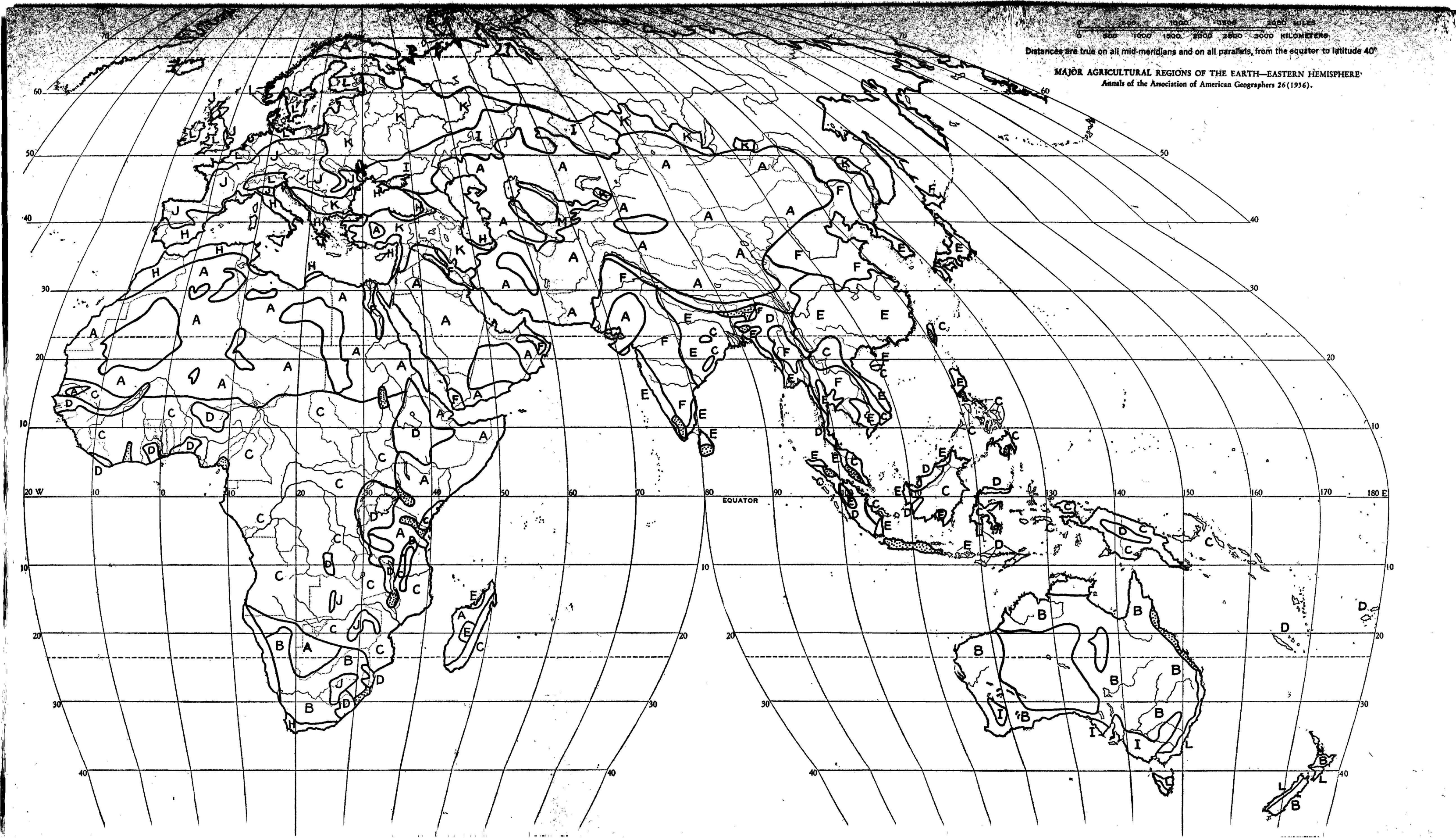
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MAJOR AGRICULTURAL REGIONS OF THE EARTH

- A. Nomadic Herding
- B. Livestock Ranching
- C. Shifting Cultivation
- D. Rudimentary Sedentary Tillage
- E. Intensive Subsistence Tillage, Rice Dominant
- F. Intensive Subsistence Tillage without Paddy Rice
- G. Commercial Plantation Crop Tillage (small areas stippled)
- H. Mediterranean Agriculture
- I. Commercial Grain Farming
- J. Commercial Livestock and Crop Farming
- K. Subsistence Crop and Livestock Farming
- L. Commercial Dairy Farming
- M. Specialized Horticulture (small areas solid black)

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0 500 1000 1500 2000 2500 3000 MILES
0 500 1000 1500 2000 2500 3000 KILOMETERS

Distances are true on all mid-meridians and on all parallels, from the equator to latitude 40°

MAJOR AGRICULTURAL REGIONS OF THE EARTH—EASTERN HEMISPHERE
Annals of the Association of American Geographers 26(1936).