Essays on Agricultural Typology and Land Utilization

Geographia Polonica 19

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Essays on Agricultural Typology and Land Utilization

Edited by
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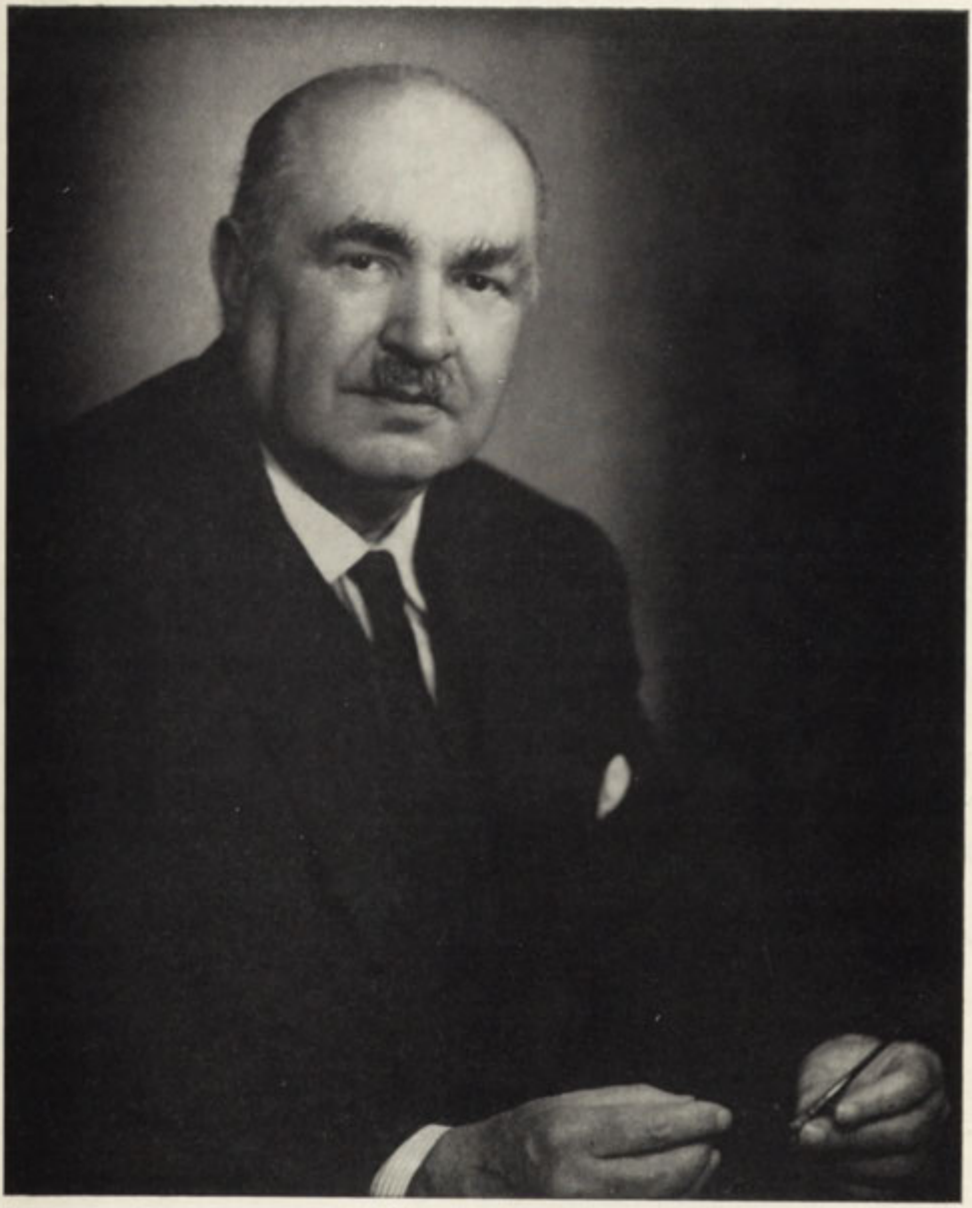
To the memory of
SIR LAWRENCE DUDLEY STAMP
excellent scholar
unforgettable master
magnificent man



Sir Lawrence Dudley Stamp (1898—1966)

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PREFACE

The present volume contains 20 papers read at the meeting of the Commission for Agricultural Typology of the International Geographical Union, held in New Delhi in December, 1968 during the XXI International Geographical Congress. One of those sessions was organized jointly with the IGU Commission on World Land Use Survey, thus the scope of the present volume has been extended to cover some fields dealt in common with by both Commissions.

The volume starts with the report by the Chairman of the Commission for Agricultural Typology on its organizational and methodological achievements. Next, some theoretical articles presenting various views on agricultural typology or its individual problems are followed by papers discussing different concepts of the typology of world agriculture. The regional part starts with three Polish studies which comply closest with the recommendations of the Commission. Then, several authors review typological problems encountered in their respective countries. The last group of papers deals with land use problems in relation to agricultural typology. A theoretical article on agricultural typology and land use closes the whole volume.

As all the papers had been prepared before the Commission met in India, and since for some authors it was the first contact with the Commission's activities, both the terminology applied and methodological approach to agricultural typology vary considerably.

It is to be hoped that this publication will contribute to further unification of both the terminology and the approach to agricultural typology, as well as to the fulfilment of the ultimate task of the Commission, which is to lay down uniform foundations for world typology of agriculture.

The Editors

GEOGRAPHIA POLONICA 19, 1970

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AGRICULTURAL TYPOLOGY. SUMMARY OF THE ACTIVITIES OF THE IGU COMMISSION FOR THE YEARS 1964—1968

ORGANIZATION OF THE ACTIVITIES

The Commission for Agricultural Typology was established by the General Assembly of the International Geographical Union at the meeting held during the XXth International Geographical Congress in London, in July 1964. The following membership was there set up: Jerzy Kostrowicki (Poland) — chairman, Nicholas Helburn (USA) — secretary, Ernest A. Boateng (Ghana), Andrei N. Rakitnikov (USSR), Peter Scott (Australia) and Fukuo Ueno (Japan) — regular members. Professor Daniel Faucher (France), one of the early initiators of agricultural typology, was elected the Commission Honorary Chairman.

The Commission first met immediately after the Congress to discuss the program of its activity. The main tasks ot the Commission were summarized as follows[1]:

1. to establish the principles, criteria, methods and techniques of agricultural typology

2. to initiate, to promote and to coordinate the regional studies aiming at identification of agricultural types of various order based on criteria and methods recommended by the Commission

3. to work out the typological and regional classifications of world agriculture.

According to this program two questionnaires were prepared and distributed among persons likely to be interested in agricultural typology. The first questionnaire contained questions on principles, basic notions and criteria, the second — on methods and techniques of agricultural typology. Over 50 indi-

[1] See *IGU Newsletter*, 16, 1965, 1, pp. 37—38.

vidual answers[2] were received as well as two summaries of the discussions held at the special meetings organized in France and the Soviet Union, in which many people participated.

Most of the answers came from the Western (21) and Eastern (15) Europe. There were some answers from Anglo-America (7) and Asia (6), a few from Latin America (2) or Australia and New Zealand (2). No answer came from Africa. It should be noted, however, that a number of European and other correspondents have a large experience based on research carried on in other continents or else from the study of agricultural problems on a continental or world scale.

The respondents represented various backgrounds and experiences. Although geographers clearly predominated, a number of agricultural economists also took part in the discussion.

The answers to the questionnaires have brought rich and interesting material, a wealth of stimulating ideas, remarks, and criticisms. Some of the answerers gave so comprehensive and profound analyses of the problems concerned that these alone could serve as a basis for an extensive discussion.

The answers to both questionnaires, arranged and commented by the Commission chairman were distributed among the correspondents and other interested persons[3]. They were also used to draw preliminary conclusions as to the principles and methods of agricultural typology[4].

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[2] The following persons answered to one or to both questionnaires and thus were acknowledged as the Commission corresponding members: J. Bonnamour (France), J. C. Brookfield (Australia), I. Crkvencic (Yugoslavia), G. Enyedi (Hungary), G. J. Fielding (N. Zealand), P. Flatrès (France), F. Fliri (Austria), D. A. Gillmor (Ireland), P. Gourou (Belgium), W. D. Graewe (German Democratic Rep.), H.F. Gregor (USA), F. Gribaudi (Italy), J. Fraser Hart (USA), W. Hartke (German Federal Rep.), V. Haüfler (Czechoslovakia), B. Hofmeister (German Federal Rep.), O. Inchauspe (Argentina), H. Isnard (France), A. H. Kampp (Denmark), Y. Kedar (Israel), H. J. Keuning (Netherlands), V. Klemenčič (Yugoslavia), T. Luna (Philippines), V. P. Manley (USA), P. Marthelot (France), H. A. Moisley (Gr. Britain), E. Molnar (Rumania), L. F. Mukomel (USSR), A. N. Rakitnikov (USSR) — regular member, L. Reeds (Canada), M. Shafi (India), H. Shirahama (Japan), C. P. G. J. Smit (FAO — Netherlands), J. E. Spencer (USA), J. A. Taylor (Gr. Britain), A. B. Tschudi (Norway), J. Torrente del Valle (Cuba), V. Tufescu (Rumania), W. Van Royen (USA), C. Vanzetti (Italy), U. Varjo (Finland), L. M. Zaltsman (USSR).

[3] IGU Commission for Agricultural Typology, *Principles, Basic Notions and Criteria of Agricultural Typology*. Discussion on the Commission Questionnaire No. 1, Warsaw 1966, 66 p. + 38 p. conclusions (mimeographed); *Methods and Techniques of Agricultural Typology*. Discussion on the Questionnaire No. 2. (Boulder, Colorado 1967), 88 p. (mimeographed).

[4] J. Kostrowicki, N. Helburn, *Agricultural Typology. Principles and Methods. Preliminary Conclusions*, (Boulder, Colorado 1967), 37 p. + appendix 12 p.

Together with two other papers, these methodological conclusions[5] served also as a basis for the discussion at the 2nd Commission meeting held during the IGU Latin American Regional Conference in Mexico City, in August 1966. Many new ideas brought out in the discussion were either confirmed or questioned. This finally led to some new solutions.

The following program for the next two years was outlined in the resolution accepted by the participants of the meeting:

1. topical studies on methodological problems of agricultural typology should be continued;

2. as many as possible case studies on different scale and level, testing the proposed criteria, methods and techniques of agricultural typology should be undertaken;

3. the results of both kinds of studies should be discussed at the 3rd Commission meeting in India in 1968.

According to this programme a number of studies were initiated and carried on[6] in various countries. Due to the scarcity of time, however, or because of the high travel costs and rather inconvenient period of time for many people, most of these studies could not be finished before 1968, and thus could not be presented at the third Commission meeting held during the XXI International Geographical Congress in New Delhi, in December 1968.

Two business and four paper sessions (two of them organized jointly with other IGU Commissions) have taken place.

At the lst business session the report of the Commission chairman was read and discussed.

The 2nd paper session was devoted to the general and methodological problems of agricultural typology. Six papers[7] were presented and discussed.

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[5] J. Kostrowicki, Tipologia geografica de la agricultura mundial. Principos y metodos, *Union Geografica Internacional*, *Conferencia Regional Latinoamericana*, v. 2, pp. 793—807. aswell as O. Ribeiro, Consideraçoes em tomo duma tipologia da paisagem rural americana, *Ibidem*, pp. 808—817; J. W. Birch, Acerca de las propiedades geograficas de los sistemas agricolas, *Ibidem*, pp. 818—819 (summary only).

[6] See the report by J. Kostrowicki, Commission for Agricultural Typology. *The IGU Newsletter 19*, 1968, pp. 60—62.

[7] 1. C. W. Olmstead (USA), *The Phenomena, Functioning Units and Systems of Agriculture. A Provisional Model.* 2. J. Kostrowicki (Poland), *Types of Agriculture in Poland. A Preliminary Attempt at a Typological Classification.* The author incorporated in his paper two other Polish papers whose authors were absent: W. Stola, Agricultural Typology of a Mezoregion as Exemplified by Ponidzie, Central Poland (see *Geographia Polonica* vol. 14, 1968, pp. 283—290) and W. Biegajło, Types of Agriculture in North Eastern Poland. Białystok Voivodship (*Geographia Polonica*, vol. 14, 1968, pp. 275—282). 3. A. B. Tschudi (Norway), *The Problem of Farm Size as a Criterion of Identifying Types of Agriculture.* 4. P. P. Courtenay (Australia), *An Approach to the Definition of the Plantation.* 5. Fukuo Ueno (Japan), *Agricultural Combination Types in Japan.* 6. P. Flatrès (France), *Les travaux de géographie rural en France depuis* 1964.

The 3rd meeting of the Commission was held jointly with the IGU Commission on World Land Use Survey. Six papers [8] constituted the basis for discussion.

A paper by the Commission chairman: Agricultural Typology, Agricultural Regionalization, Agricultural Development[9] was a contribution of the Commission for Agricultural Typology to the joint meeting of the Congress Section of Economic Geography and the IGU Commissions on Quantitative Methods, Applied Geography and Agricultural Typology.

At the third paper session nine regional or sample studies [10] were presented.

As the General Assembly of the International Geographical Union decided almost unanimously on the continuation of the Commission's activity for the next four years, the discussion at the last business meeting was concentrated mainly on the membership and program of the activities of the Commission for the years 1968—1972.

In the past period, most of the Commission regular members, being excellent scholars, could not — for one reason or another — participate actively in the Commission work, the latter having been based mainly on the cooperation between the chairman and the corresponding members. To avoid such a situation in the future and to assure a better cooperation between the Commission regular members, the following membership, reflecting also the need for certain balance in representation of the world major regions, has been proposed and agreed in the discussion: Jerzy Kostrowicki (Poland) — chairman, John W. Birch (Great Britain) — secretary, Kenneth B. Cumberland (New Zealand), Clarence W. Olmstead (USA), Andrei N. Rakitnikow (USSR), Mohammad Shafi (India) — regular members.

It has been agreed that considering the tasks of the Commission, the number of corresponding members and particularly those representing the developing countries, should be greatly increased.

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[8] 1. C. Vanzetti (Italy), *Land Use and Types of Farming*. 2. G. Enyedi (Hungary), *The Land of Hungary and Types of Its Utilization*. 3. A. N. Duckham, G. B. Masefield (Gr. Britain), *Farming Systems of the World* (in the absence of the author read only by title). 4. H. Ishida (Japan), *A Conceptual Model of Four Types of World Agriculture*. 5. S. Bhatia (India—USA), *A New Approach to the Study of Cropland Use: A Case Study of Uttar Pradesh, India*. 6. J. Kostrowicki (Poland). *Land Use Studies as a Basis for Agricultural Typology of East-Central Europe*.

[9] See *Geographia Polonica*, 14, 1968, pp. 406.

[10] 1. G. Benneh (Ghana), *The Huza Strip Farming System of the Krobo of Ghana*. 2. R. S. Odingo (Kenya), *Agricultural Change in the Kenya Highlands*. 3. Kardono Darmojuwono (Indonesia), *Preliminary Studies on Agricultural Typology in Indonesia*. 4. R. D. Hill (Singapore), *Peasant Systems of Rice Cultivation with some Malaysian Examples*. 5. H. Shirahama (Japan), *Geographical Investigation on the Characteristics of Japanese Agriculture from the Point of View of Typology* (in the absence of the author read by title). 6. Chung-Myun Lee (S. Korea — Malaysia) *Agricultural Regions of South Korea*. 7. A. H. Kampp (Denmark), *The Time Factor and the Agricultural Regions of Denmark*. 8. K. Ivanicka (Czechoslovakia), *Sub-types of Agriculture in the Area of Bratislava — Slovakia*. 9. E. Ahmad (India), *Spatial Associations between Kharif and Rabi Crops*.

The following programme of the Commission activities for the next four years (1968—1972) has finally been accepted:

1. The topical studies on some unsolved as yet methodological problems should be continued.

2. Sample studies of various scale and order, testing the criteria, methods and techniques of agricultural typology as proposed by the Commission, should be continued and extended over as many countries and regions as possible.

3. Taking use of the accumulated material, the outline typology of world agriculture, based on the criteria and the methods already accepted, should be worked out as a provisional framework for further regional studies. It will be subject to all changes and transformations resulting from these studies. This outline typology should be submitted before acceptance to a broad discussion.

4. The instruction on the criteria, methods and techniques of agricultural typology to be used in the investigations of various scale and order should be worked out. Before acceptance, the instruction is to be distributed for comments and discussion among interested persons.

5. On the basis of both the outline typology and the instruction, regional studies on agricultural typology should be initiated and carried on in individual countries and regions under the Commission's supervision and coordination. Those studies will serve as a basis for final multi-level world agricultural typology. Several regional subcommissions should be organized to proceed with those studies.

6. Special attention should be paid to the practical applicability of typological studies in general and particularly in programming agricultural development. Therefore still closer contacts and cooperation with FAO are desirable.

As most of the discussion, on the Commission questionnaires as well as the conclusions drawn have already been published in one way or another[11], the emphasis has been put in the following parts of the present report on some still unsolved or controversial methodological problems.

THE OBJECTIVES OF AGRICULTURAL TYPOLOGY

In their responses to the questionnaires most of the answerers stressed the inadequate, sketchy, ill-formed and often contradictory character of most of the previous studies on agricultural typology. Great disparities of views as to the principles, criteria and methods of agricultural typology, and the inadequate awareness of the global typifying features make impossible the use of resulting classifications for any kind of synthesis. The variability and multiplicity of concepts, methods and terms used, most of them lacking universal appli-

[11] J. Kostrowicki, N. Helburn. Agricultural Typology... *op. cit.*; J. Kostrowicki, Tipologia geografica... *op. cit.*; J. Kostrowicki. Agricultural Typology, Agricultural Regionalization... *op. cit.* as well as J. Kostrowicki, Geographical Typology of Agriculture in Poland. Methods and Problems. *Geographia Polonica* 1, 1964, pp. 111—146.

cability and commensurability, make also difficult any comparison of their results and their application for solving important practical problems.

It should be also noted that the general development of scientific methodology and changes in the distribution and development of world agriculture that have occurred during the last decades, also made most of the earlier classifications largely out of date.

Consequently most of the answerers agreed as to the need and importance of establishing the foundations of a new world agricultural classification based on clearly defined methodology, uniform principles, comparable criteria and measurable methods and techniques.

There have been, however, some reservations as to the possibility of constructing such a comparable typology taking into account both the present state and reliability of the statistical and other informations, as well as the difficulty to persuade people to work along the same line on the agreed programme. These all are important difficulties but the author is optimistic and hopes that difficulties of both kinds will be overcome if only the knowledge and good-will of the Commission regular and corresponding members, supported at least by a part of those who expressed their interest in cooperating with the Commission are focused, for a certain period of time, on establishing of the methodological foundations of agricultural typology and on their testing and application to respective countries.

What are, however, the purposes of such an uniform agricultural typology?

Classification is fundamental for the advance of any science and any valid classification is to be based on the commonly agreed principles. In this respect geography is still in its premature stage.

Consequently the scientific objectives of agricultural typology could be summarized as follows:

1. developing agricultural geography as a scientific discipline;

2. putting into order the present-day knowledge of world agriculture and its areal similarities, differences and interrelationships;

3. contributing to a better understanding of agriculture as a complex phenomenon on a world, continental, and national scale;

4. creating better foundations for further synthetic studies of agriculture on different scales and levels.

A better knowledge of agriculture and sharper methods and tools of its investigation derived from typological studies may also be of some practical importance[12]. In particular they may be used for:

[12] For more extensively see: J. Kostrowicki, Agricultural Typology, Agricultural Regionalization, Agricultural Development, *op. cit.*

— a better assessment of the present use of natural resources and other conditions of agricultural development by various forms of agriculture, as well as of their future possibilities;

— a better assessment of agricultural properties impeding the development of individual forms of agriculture and of the other properties that accelerate such a development;

— based on a better understanding of properties and achievements of the same or similar forms of agriculture — a better definition of directions of further agricultural development through the transformation of the present forms of agriculture into others, more effective ones.

BASIC CONCEPTS AND SCOPE OF AGRICULTURAL TYPOLOGY

Although the term agriculture (*agricultura*) means, strictly speaking, field cultivation, it is also used in most countries to cover all the activities connected with crop growing and livestock breeding for productive purposes. It is also reflected in the very name and official publications of the United Nations Food and Agriculture Organization (FAO) which has also given the definition as to what it is to be understood under the term agriculture[13]. For all these reasons it is suggested that the term „a g r i c u l t u r e" in its broader sense is to be applied in typological studies in both IGU official languages (English and French) along with the English term „farming" and with the corresponding traditional forms accepted in other languages (*selskoye khozyaystvo, Landwirtschaft, rolnictwo, etc.*) as synonymous.

What remains, however, disputable it is whether some pre-agricultural forms of utilizing of biotic resources such as primitive gathering, hunting and fishing should or should not be included in agricultural typology. There is also some hesitation whether some specialized forms of utilization of biotic resources, such as forestry, fishing or collecting various plant and animal resources, are to be considered by agricultural typology.

An a g r i c u l t u r a l h o l d i n g, in the sense as defined by FAO[14], viz. as the only real unit of operation, should be regarded as a b a s i c u n i t (an individual) in agricultural typology. At the same time, however, despite all its defficiences, it is permissible to use other units (administrative or whatever convenient) in macro-scale studies, and particularly when dealing with a large number of small-scale holdings for which no separate data are available (village agricultures etc.). One should be aware, however, that in doing so he has to deal with aggregate data for the areas in which the whole variety of characteristics of various agricultural holdings have been submerged in miscellaneous ways. This is the reason why even in macro-scale studies the detailed sample investi-

[13] *Program for the 1970 World Census of Agriculture*, FAO. Rome 1965, 82 p.

[14] As above.

gations that not only check the magnitude of divergences between various holdings of a given unit but also assess the accuracy of statistical data, are recommended whenever possible. On the other hand, once the agricultural types and their typifying (diagnostic) characteristics are distinguished on the basis of sample studies of individual holdings, the analysis of the range or distribution of those types can be continued based on statistical data reflecting only those characteristics. As the examples in the present volume will show, agricultural typology could proceed both ways - from general to detail, or from detail to general. In the last case, however, the problem of sampling method should be resolved.

Between the lowest order of typology based on the investigation of individual holdings and the highest one, i.e. the world types of agriculture, several levels of types or subtypes could be distinguished.

Irrespective, however, of their order and the area concerned, the identification of types of agriculture should always be based on the same general principles and criteria. The difference is that the lower the hierarchy, the search for more detailed differences, would require the use of more indices and sharper and more detailed techniques. On the contrary, the higher the hierarchy, the indices and measures applied in agricultural typology could be more and more general and less numerous.

The incompleteness and scarcity of data available in some countries makes it necessary to base some typological studies on estimates rather than on statistical data. But even in the most developed countries agricultural statistics often do not provide all the items required for a sound agricultural typology, and are seldom fully accurate.

This leads to a conclusion that although the use of most accurate methods and techniques is always advisable, one should be conscious that the results obtained are only approximative and the conclusions drawn cannot be more precise than the material used. Another conclusion is that one should not avoid the use of assessments and estimates based on other than statistical information. A lot of synthetic agricultural studies could have never been made without using such estimates.

The use of estimates is even inevitable in the countries where adequate statistical data are lacking or are incomlpete. If the problem and the area under study are sufficiently known to a scholar, such estimates are not only inevitable but they might yield even better results than when using unreliable statistics.

The FAO pilot studies have shown that if only some skilled workers, some means and only a minimum of statistical or other data are available, a very useful work can be done in revealing agricultural characteristics even in the countries that are "not as well developed as they might be"[15].

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[15] From the answer to the Questionnaire No. 1. by W. Van Royen.

In principle it makes no difference what terms are applied to various concepts of agricultural typology. The only problem is that they should be clearly defined and applied in the same way by all who deal with these problems. This calls for a certain agreement on terminology of typological studies.

Taking the results of the questionnaires as a basis it is proposed that in both IGU official languages the term type of agriculture (type of farming) or *type d'agriculture,* being a most comprehensive one, is accepted for the supreme notion in agricultural typology, rather that "system of agriculture" (or farming) or "*système d'agriculture*", or others. It is so not only because the majority of the answerers have expressed themselves in favour of this term, but also because the term "system" is usually understood as a coordinated body of methods or as an orderly way of getting things done. Most of the answerers understood it as concerning functional, i.e. organisational or technical aspects rather than all aspects of agricultural activities. It should be noted that even those respondents who are in favour of the term "system" ascribe to it usually either organizational or technical, sometimes also social, rather than all of the aspects of agriculture.

In the light of the above remarks, despite certain traditions existing in some countries, one should agree with those who consider that "type" and "system" should not be understood as synonymous; that the term "type of agriculture" is broader and if the term "system of agriculture" is to be applied despite possible confusion, it should rather be used as a synthetising notion of all functional aspects of agriculture, and understood as "an ensemble of means and practices aimed at the achievement of agricultural production and at maintaining soil fertility"[16], irrespectively of the social and production aspects of agriculture. Of course, the place of agricultural types or systems in the general theory of systems should be clarified.

Since agriculture is one of the ways by which man utilizes Nature to satisfy his needs and in doing so he organizes and transforms space, it is obvious that the type of agriculture, being a specific and concrete form of this utilization, cannot be conceived irrespectively of a concrete portion of this space, i.e. of the earth surface. Therefore, there seems to be no need to supplement the term "type of agriculture" with any additional adjective as "geographical" or "territorial" which could make a wrong impression that there may exist non-geographical or non-territorial types of agriculture, or that types of agriculture may differ not in their essential characteristics but according to the discipline in which they have been distinguished.

Since despite all the differences in approach, both agricultural typology and agricultural geography have been founded by both agricultural economists

[16] Definition by a Polish outstanding agricultural economist Z. Moszczeński, *Nauka urządzania i prowadzenia gospodarstw wiejskich.* Warszawa 1934.

and geographers and because further contribution of these scholars as well as of some others (historians, anthropologists, sociologists, etc.) to the development of agricultural typology would be most significant, such a division would be very harmful to the realization of the objectives of the Commission.

To sum up the results of the above considerations it is proposed that type of agriculture:

1. should be considered as a supreme notion in agricultural typology;
2. should be understood as a hierarchical notion encompassing types of various orders;
3. should be understood in a broad meaning, including all forms of crop growing and livestock breeding for productive purposes;
4. should be understood as a complex notion, combining all essential aspects or characteristics (properties, traits, attributes) of agriculture;
5. should be understood as a dynamic notion, which changes evolutionarily or revolutionarily along with the change of its basic characteristics.

Typology is very often confused with regionalization[17] not only in agricultural geography. In spite of the fact that both type and region are synthetic concepts, they belong to two different categories. Type is a systematic or taxonomic concept and its definition is based on similarities or affinities between properties or characteristics of individual cases or phenomena. Particular groupings or swarms of individual cases, characterized by similar sets or associations of properties, clustering around certain most commonly repeating ones, considered as typical, constitute types. Since certain similar associations of characteristics occur repeatedly in time and space, the same types could be found in various periods or areas. As those sets of characteristics usually occur in space in a mosaic-like pattern, the distribution of resulting types does not necessarily form any contiguous areas, but individuals of certain type are usually dispersed and intermingled with each other.

Region, on the contrary, is a defined spatial or territorial concept based on the differences between individual areas rather than on the similarities or affinities. Consequently, the region is a contiguous portion of the earth's surface extending within determined limits, and characterized by a peculiar association of characteristics differing from all the others that, render its unique character.

Both type and region are of hierarchical character. Based on their similarities, individual types of lower order are grouped together into types of higher order irrespective of their distribution on the earth's surface, while regions of a lower order always form territorial parts of higher order regions.

When agricultural typology is already worked out the delineation of agricultural regions is limited to the generalization of a more complicated pattern

[17] For more about — see: J. Kostrowicki, Agricultural Typology, Agricultural Regionalization..., *op. cit.*

of agricultural types to a simpler picture of agricultural regions based on the dominance, co-dominance, or co-existence of particular types over a given territory.

CRITERIA AND METHODS OF AGRICULTURAL TYPOLOGY

According to the opinions of most of the answerers and to the logic of every classification, the indentification of the type of agriculture should be based solely on i n h e r e n t c h a r a c t e r i s t i c s, or properties of agriculture itself. External characteristics, or rather conditions in which agriculture develops, although important they may be for the explanation of the reasons why, and why exactly, in a given time and space, a particular type of agriculture has developed, are not appropriate for identifying the types of the agriculture.

These e x t e r n a l characteristics or c o n d i t i o n s include both natural and social, technical, economic or cultural properties of a given place and time, expressed in natural fertility of soils, water and climatic conditions, land forms, etc., as well as such conditions of location as access to transport lines, markets and centres of processing agricultural goods, marketing conditions depending on world prices and governmental policies (subsidies, tariffs etc.), and also law regulations, cultural habits etc., etc.

It is astonishing how often these conditions, that are suppəs coocriause the distribution of the phenomena, are confused with the charaest tptics or the properties of the objects classified. In agricultural typology or regionalization such a confusion leads to a subjective approach in indentifying the agricultural types, as the scholar tends to ascribe more importance either to some of the external conditions or to the properties of agriculture itself. Also the practical utility of the units determined in such a way is less, since it does not allow for drawing the conclusions as to the changing relations between agriculture itself and the conditions in which it develops, on the proper utilization of these conditions. It neither permits to find whether there is any gap between those conditions or potentialities and their utilization, and what are the reserves of further agricultural development that could be mobilized, as well as what possible change of agricultural type and its properties could occur through transformations of the conditions, etc. All these will be possible if the conditions and properties of agriculture are considered separately.

As type of agriculture is considered to be of a complex character combining all the essential aspects of agriculture, its definition or identification should be based on a number of criteria reflecting the inherent characteristics of given agricultures. These characteristics could be grouped in the three main categories: that of social, organizational cum technical, and production nature [18].

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[18] For more extensively see: J. Kostrowicki, N. Helburn, *op. cit.* as well as the list of criteria and measures representing them in the appendix to that paper.

Accordingly these three categories should be considered as defining jointly the type of agriculture, and none of them, for comparative reasons, could be omitted although their importance for the identification of various types of agriculture may vary greatly. This does not challenge the need for other classifications based on one of these groups, or on one or several elements of agriculture. They all are acceptable and often beneficial for the progress of agricultural geography or even agricultural typology. None of them, however, is to be considered as full agricultural typology.

Social characteristics are generally those indicating who is the producer, what is his relation to the land and to the others working the land. It is, however, debatable whether the size of the farm is to be considered a social or an organizational characteristic of agriculture. It is obvious that in the size of a farm or of the land being at the disposal of a farmer, both the scale of farm operation and social status of the farmer are reflected in various proportions. Since, however, in most of the countries this second function of the characteristics seems to be more important, it is proposed that the size of holdings will be included in the social characteristics of agriculture.

From the methodic point of view social characteristics cannot be expressed in quantitative indices. Some of them, however, could be expressed in structures or in formulas representing them, but this requires both uniform classification and definition of dividing thresholds or classes. In particular the establishment of the uniform classification of world land tenure systems would be highly desirable and helpful in typological studies.

The organizational and technical characteristics are those that respond to the question of how, a produce is obtained and, what means and practices are applied to achieve agricultural production. Many of these properties could be expressed either by indices or structures as a result of using various conventional units (of land, manurial units, units of power, animal units etc.). There are, however, others that could not be presented in a quantitative way. Another difficulty is the great number of organizational and technical practices, some of which are connected with particular crops or animals only, with particular agricultures, or have a clearly local character.

This situation has resulted in the development of a number of semi-synthetic notions and classifications, sometimes contradictory or overlapping and lacking usually more defined bases for criteria and methods of their identification. The following classifications could be mentioned here:

(1) systems of field pattern based on their shape, fragmentation and dispersion often connected with the types of rural settlement;

(2) systems of land cultivation according to the principal tools and draught power used, eg.: hoe, plough, with or without mechanical power;

(3) systems of land or crop rotation (land rotation, crop rotation with or without fallow, irregular, regular, free, no crop rotation, two-, three-, or mo-

re-year crop rotation, double, triple cropping, perennial use of land, uniform or intercultivated, etc.);

(4) systems of irrigation (gravity flow, pumping from open waters, from ground waters with the use of man-power, animal power, mechanical power, sprinkling, etc.);

(5) systems of livestock breeding (nomadic herding, transhumance, open grazing, enclosed grazing, chain grazing, stable keeping, etc.);

(6) land use and crop combination systems based on the definition of leading land uses or leading crops.

All the above mentioned classifications should be tested as to their objectives, bases, universality, practicability, etc., before they could be used in agricultural typology.

Another problem is that of intensity of agriculture which is often confused with productivity or, defined based on productivity. Both approaches have developed since a long time and both are erroneous.

Intensity of agriculture does not mean the amount of effects or outputs obtained but the intensity of means and practices applied, i.e. the amount of labour and capital inputs applied to get an agricultural output. Whilst it is obvious that the principal aim of any input is to get an output, the relations between inputs and outputs are by no means direct. The output depends both on labour and capital inputs and on natural properties of land. In fact agricultures differ considerably as to the degree to which their productivity depends on inputs on the one hand, and natural properties of land, on the other. Accordingly one may distinguish land, labour and capital oriented agricultures in which production is obtained with a minimum input of labour and/or capital, through heavy inputs of labour with a minimum capital, or with capital inputs dominant.

The first type — land oriented agriculture — is usually called an extensive one, whereas the second and the third are considered as intensive, labour and/or capital absorbing agricultures.

Labour inputs are relatively easier to be measured in man/hour or man/day ratios per unit area or, less accurately, by a number of persons employed in agriculture or even by the density of agricultural population per unit area, despite some possible inaccuracies resulting from the fact that a part of of man-power could not be fully utilized, thus forming labour surpluses.

The capital inputs measured by a volume of fixed and floating assets or only by the latter, are much more difficult to measure as there are usually no data except for some large-scale farming or selected small farms, where book-keeping of farm accounts is carried on. As a result both capital intensity and total intensity as well as the proportion between labour and capital inputs could not be determined, except in the typology of the lowest order and only for some holdings.

This is the reason why a number of indirect methods of measuring intensity have been introduced particularly to the macro-scale studies. Among them the methods of measuring symptoms of intensity, the one based on scoring particular elements of agriculture and that of selected indices should be mentioned here[19]. None of them, however, could be recommended as fully satisfactory for measuring accurately both total intensity and its components and structure.

Since, however, the intensity of agriculture is a very important typological criterion, the elaboration of methods of measuring intensity to be applied in agricultural typology is most significant. Until this is done, some partial or indirect methods should be tested as to their applicability to agricultural typology.

Production characteristics of agriculture respond to the question of how much, what and what for it is produced, i.e. what are the effects of agriculture and the disposal of its products.

The first methodological question here is in what units the agricultural production is to be measured. As products are very different measuring in natural units such as weight or capacity is useless, and a common measure has to be applied. Obviously, easy to manage and thus most frequently used are monetary units. When applied to the spatial studies they could bring, however, unpromising results. Being inevitably based on prices of agricultural goods which constantly change in time and vary greatly in space, the volume of agricultural production if expressed in monetary units may hardly by comparable. To eliminate changes in time, various so-called fixed prices are used, which are more or less artificial. Still more difficult is to eliminate changes in space particularly when several countries are involved. Because prices are seldom now the results of free interplay of demand and supply, and owing to various governmental policies (tariffs, subsidies etc.) they differ widely between particular countries and even between particular regions. In some countries there are also several different prices for the same agricultural goods. Finally, for products not destined for the market, particularly in subsistence or semi-subsistence agricultures, any price seems to be irrelevant.

To overcome these difficulties a number of conventional units have been introduced in various countries, some of them having been based on labour inputs required to produce a certain amount of crops or animal products. For the reasons stated above, inputs do not reflect directly outputs. On the other hand, the amount of inputs used to produce the same amount of products could vary greatly from country to country or even from region to region, especially in larger and more diversified countries, depending on the general level of agriculture and on the natural conditions in which farmers operate.

[19] For a more extensive discussion of those methods see: J. Kostrowicki, Geographical Typology of Agriculture in Poland, *op. cit.*

The most popular, at least in Middle European countries, are grain units based on protein and starch content in particular agricultural products. Their defficiency, however, consists in that products which are not meant for protein or starch as, e.g. fibre crops, tobacco, wool, rubber or even such food crops as fruits could hardly be expressed in these units. Although the usability of grain units has been extended by some scholars to almost all agricultural products on the basis of their input-output comparisons, the evaluation of these products in grain units remains artificial and disputable. Several criticisms have also been made, indicating that animal production is underestimated if it is evaluated in terms of grain units based on the amount of fodder used to breed animals. The use of grain units precludes also the investigation of the whole sphere of such economic or financial problems as capital input, revenues, income, capital efficiency etc., which can be expressed in monetary units only. On the other hand, the use of grain or other conventional units being independent of price fluctuations, assures full comparability, both in time and space, of the results obtained, which is particularly important in typological studies.

Since all units of aggregate production, when used in areal studies, present certain advantages and disadvantages — a special study would be required to compare the results of using all those measures in typological studies to decide which one of them or, in some particular cases, more than one, should be chosen to measure agricultural production.

Another general methodological problem is what production is to be used to define various production characteristics of agriculture: gross production, i.e. total, directly obtained agricultural output, or final production, i.e. gross output less the products utilized within an agricultural unit for reproduction purposes such as fodder, litter, seeds, green manures etc. Taking gross production as a basis one should be aware of the fact, that some components of production might be counted twice (e.e. feeds counted once within crop production and, for the second time, as submerged in animal production); this could overestimate both their role in the total agricultural production and of crop production as compared with animal production. At the same time certain labour and capital inputs are made both when the fodder, seeds or green manures are produced and when they are utilized. Thus, when estimating labour or capital productivity, they could not be dropped out from the account. Another question is that despite the difficulties in assessing some minor components of gross production, it is still more difficult in the areal studies other than those based on individual holdings, to split the production of each particular crop according to its various destinations (use for reproduction purposes, for home consumption, for sale etc.).

Taking into account all these reservations, most of the answerers tend to conclude that although final production would perhaps better serve the purpose, gross production, being easier to estimate should be accepted in typological studies. It seems, however, that whenever possible both gross and final production should be calculated. In less developed agricultures where the bulk of fodder crops produced is used on the farm, and where seeds are also produced on the spot, final production could approximately be assessed simply by substracting fodder crops and those required for seeds from gross production.

Even in the countries having detailed and reliable statistics, data on some components of gross or final production are lacking and they are to be estimated. This makes the assessment of agricultural production a most tiresome part of the typological investigations. The situation is still more difficult in the countries where the evaluation of agricultural production is to be based wholly or largely on estimates. Since, however, production characteristics are a most important part of agricultural typology, every effort should be made to calculate, at least approximately, the total agricultural production for the areas under study. As production characteristics usually differ greatly in particular agricultures if only their range is properly calculated it might often be sufficient for agricultural typology.

Most important production characteristics of agriculture are productivity and commercialization.

A g r i c u l t u r a l p r o d u c t i v i t y, could be expressed by the indices of land productivity, i.e. total output per unit area, labour productivity, the ratio of total agricultural output to labour inputs and capital productivity, the ratio of agricultural output to capital inputs.

In some countries where there is a great disparity between the productivity of particular agricultural land uses (e.g. intensively cultivated field and perennial crops on the one hand, and extensively used rough pastures, on the other), land productivity should perhaps be calculated separately for cultivated land and for non-cultivated land.

Labour productivity (labour efficiency) could be estimated either on the bases of the real amount of work done, measured in working hours or days, or in conventional working units based on coefficients for male, female, youngster's and old people's work or, with less accuracy, in more general studies, as an index of agricultural output per one person employed in agriculture or even per head of agricultural population.

As to the capital productivity (efficiency), its determination is more difficult for the reasons already explained in the discussion on capital intensity.

The estimation of commercial production is easier than that of gross production since the only statistical data available are often those on commercial production, usually different from self-subsistence production. Also for large-scale farming commercial production could easily be established. On the contrary, it is most difficult in small-scale peasant farming, partly commercial, partly subsistence, where sales are irregular, go different ways and corresponding data are either scattered or not available at all.

Commercialization of agriculture could be expressed best through two complementary indices: (1) the percentage ratio of commercial production to the total (gross or final) production, i.e. the degree of commercialization which seems to be the most important index, and (2) the amount of commercial production per unit area which may be called a level of commercialization. The other possible indices, i.e. those of commercial production per labour or capital inputs have not been tested as to their validity.

Other production characteristics are those that indicate the leading elements of agricultural production. In many languages other than English they are usually called orientations of agricultural production. The question arises whether this term is to be promoted to be introduced into the English terminology or substituted by another acceptable term that would not lead to confusion.

Whatever term would finally be used in English, the notion as such has been considered to be of importance for agricultural typology. The problem remains what methods of defining agricultural orientation are to be adopted. In highly specialized agriculture where production is limited to a few products, agricultural orientation could be defined directly, based on the role of dominant components grouped at the most in either crop (vegetal, plant) or animal products. In mixed farming, however, where numerous products of similar or complementary kind, use or destination are obtained, the definition of orientation is more complicated and it requires grouping of those products. There are numerous grouping systems in use in various countries. It is suggested that to define agricultural orientation, the grouping is to be made from the point of view of what kind of product is obtained or what it is used for, rather than according to their destination (used on the spot or sold) or agronomic properties, the last being of use in the definition of crop combinations. In any case, in order to assure the comparability of the results obtained, a uniform method of defining the agricultural orientation should be established or adopted.

The same method could be applied to define the orientation of commercial production (of specialization). The only question is whether in view of a smaller number of commercial products the components of commercial production are to be grouped or not. What is to be emphasized here is that orientation of agricultural production could by no means be replaced by orientation of commercial production. Only in the case of highly commercial agriculture the orientation of commercial production would be close to agricultural orientation. In most cases, however, and particularly in the mixed and only partly commercial agricultures — and such are still most widespread in the world — the differences in the composition of total and commercial production are quite impressive. Indeed they increase with the decreasing role of commercial production. Obviously, in purely subsistence agriculture any indices representing commercialization of agriculture are irrelevant.

S p e c i a l i z a t i o n of agriculture seems to be understood in two different ways, viz. either as an orientation or emphasis on the production (or sale) of particular (cash) crops and/or animal products or as a degree to which agriculture is concentrated upon least number of products. Only in the last sense one can speak about high or narrow specialization when one or few leading elements are involved, and about low specialization when commercial production consists of many products.

As a result of the discussion on the criteria of agricultural typology, a list of differentiating or typifying characteristics and of the measures that represent them has been compiled for testing their relevance, universality, practicability, etc., through as many sample studies as possible. It is expected that as a result of these investigations some of the measures will be eliminated but it is possible that a number of new measures characterizing non-European agricultures, that have been overlooked, will have to be introduced. Another problem is that the list contains both elementary and synthetic measures, the importance of which in forming agricultural types may be of unequal weight. It is hoped that the final list will involve measures of more or less similar weight, representing the three main groups of agricultural characteristics to be used as a minimum in all typological investigations for characterizing any possible type of agriculture of any order. According to the specific character of particular areas, this list could be supplemented with additional measures of local character.

As a result of the typological procedure a set of measures representing various properties of agriculture is attained for each of the basic units of study (agricultural holdings, administrative units, etc.).

The next step is to group these units of study according to the similarities of the sets of their characteristics. As it has been stated above, the difficulty is that not all agricultural characteristics could be expressed in indices which in turn are measured in various units; some of them can be expressed in structures or combinations whereas other cannot be expressed quantitatively at all. For all these reasons the problem of selection of the most appropriate method of grouping the indices and structures representing various agricultural characteristics is difficult and it has not been solved as yet.

Several methods of comparing multiple-feature units as to their similarities or differences have been developed by various scientific disciplines. They range from the most primitive and most subjective, such as cartographic superposition of girdles, cross-tabulation or scoring, through various graphic methods, methods of measuring association or deviation from model types, average differences or similarities, nearest neighbour analysis, dendrite linkage tree or latent structure analysis, to the most sophisticated mathematical methods. Among the latter multifactor analysis has recently gained some popularity.

These methods have to be tested as to their applicability and practicability to agricultural typology. In view of the material used it is not necessary that the most refined method is finally accepted. The method should, however, be most objective and versatile, serving best the purpose of grouping numerous units (each characterized by a set of indices and structures representing various agricultural properties) into types of different order.

In any case, similarly to the previous stages, this last stage of the typological procedure, i.e. the grouping or integrating various agricultural characteristics, even though some of them may be based on estimates rather than on accurate data, should not be made intuitively.

Various approaches to agricultural typology are presented in the following studies based on the papers read at the Indian meeting of the IGU Commission on Agricultural Typology.

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THE PHENOMENA, FUNCTIONING UNITS AND SYSTEMS OF AGRICULTURE

At the expense of over-simplification, one may identify several different approaches or emphases which have successively characterized the study of agricultural geography in the United States. These include:

1. Commodity studies, especially studies of individual crops.
2. Small-scale studies of crop-land relationships.
3. Large-scale field studies of agricultural land-use and landscapes.
4. Studies using the cultural-historical approach.

and

5. Studies using a theoretical-quantitative approach.

I would propose a sixth approach to the geographical study of agriculture, which I will call the systems approach. I believe that it can encompass all of the best objectives and methods of each of the previous approaches. It is a conceptual framework designed to accommodate within a single interrelated body of knowledge the comparative study of any or all of the diverse elements and varieties of agriculture that exist in the world.

THE SYSTEMS APPROACH: CONCEPTUAL STATEMENTS

Such a systems approach is based on the following premises:

1. That the geography of agriculture is more than the geography of the crop and livestock products that result from agriculture.
2. That the geography of agriculture is concerned with agricultural or farming systems, and with the elements, operating units, functions, characteristics and interconnections of those systems.
3. That the basic or fundamental unit in which agriculture is organized and functions is the individual production unit or farm. Consequently, each farm may be said to have a farming system.

4. That the farming system of an individual production unit or farm results from (a) the appraisal, by the farm operator, of the total resources or elements of his farm, of his circumjacent environment, and, to a greater or lesser degree, of the more remote environment; (b) the selection, on the basis of this appraisal, of certain crop and/or livestock products to be produced; and (c) the organization of the resources within his control into a system for the production of the selected items.
5. That a farming system is comprised of interrelated and overlapping sub-systems.
6. That the form or nature of some of the sub-systems is, in large part, determined by factors external to the individual farm.
7. That others of the sub-systems are, at least in theory, more largely organized within the individual production units or farms.
8. That the most significant characteristics of agriculture are characteristics of the farming systems and/or of the individual production units or farms within which the systems function.
9. That there is a flow or interchange of energy between an individual production-unit-system on the one hand, and systems both agricultural and non-agricultural, of the circumjacent and distant-centred environments, on the other.
10. That the nature of a farming system may change in response to change, or to the operator's recognition of change, in any element (a) within his farm, (b) within the circumjacent environment, or even (c) within the distant-centred environment. Further, a change in one part of a farming system or interrelated systems may affect, and call for changes in, other parts of the farming system.
11. That different farms and farming systems in different parts of the world will possess similar categories of elements, sub-systems, functions, energy flow, and characteristics, even though the nature of the elements, sub-systems, functions, energy flow or characteristics may differ greatly.

THE SYSTEMS APPROACH: BRIEF EXPLANATION

Following is an attempt briefly to explain the systems approach with the aid of simple diagrams.

THE FARM WITHIN ITS ENVIRONMENT (Fig. 1)

No farm exists unto itself. The operation of a farm — whether it be a modern, highly-commercialized unit, or a primitive, subsistence one — involves degrees of co-operation and competition, aid and interference, with or from the agricultural and non-agricultural phenomena and activities of the surrounding area

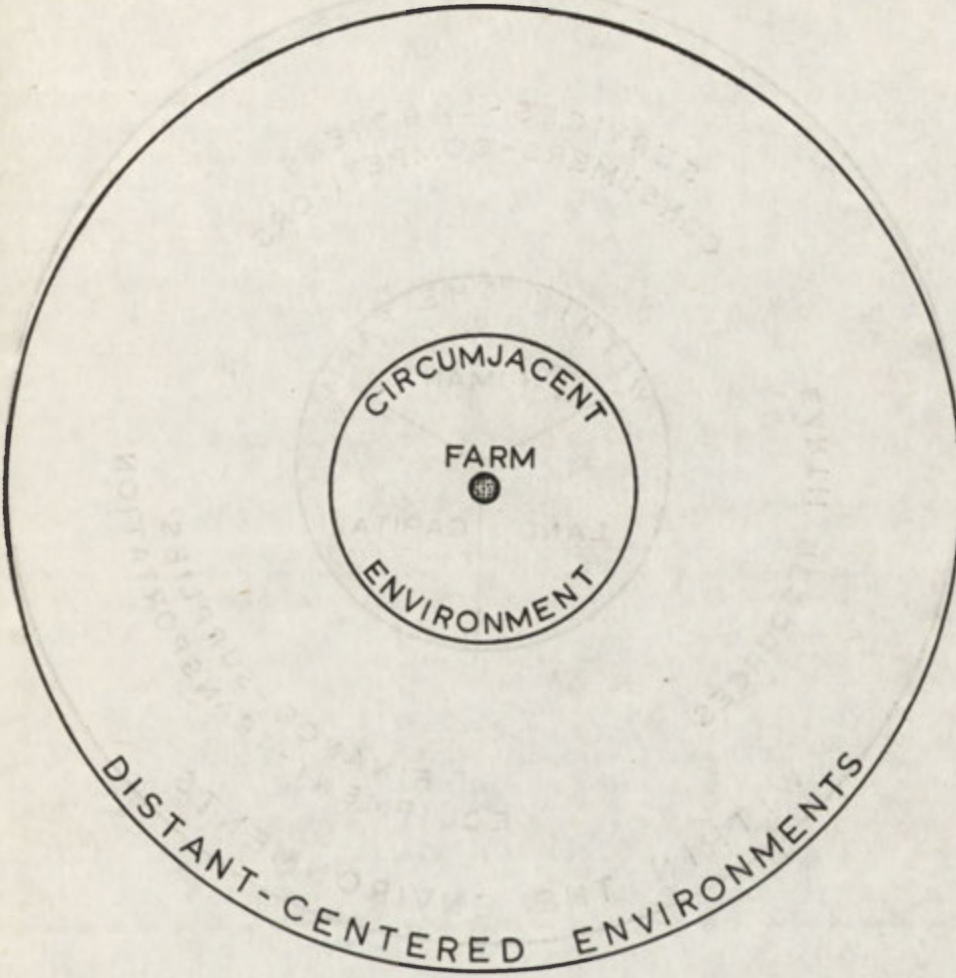

Fig. 1. The farm within its environments

here labelled the Circumjacent Environment. Numerous examples come to mind: an invasion of insects or a storm, the exchange of labor or advice, the attraction of a new market or alternative opportunity. The interaction may reach beyond the circumjacent environment to distant-centred ones, such as the whole nation or the world. For example, new technology or a new national or international policy, developed in a distant center, may reach out to affect the farm and its farming system. The identification, for particular sets of farms or farming systems, of the hierarchy of environments within which they operate, and of the kinds, degrees and spatial forms of the environmental relationships, pose significant problems for geographic investigations.

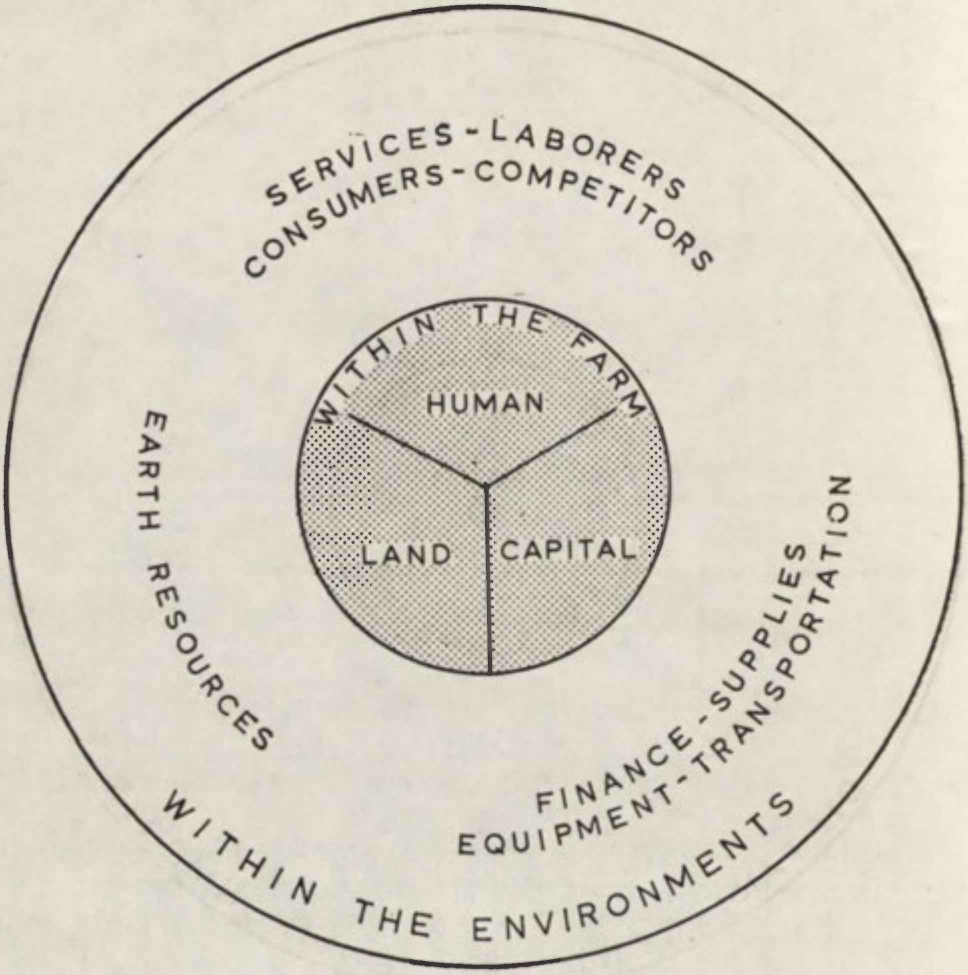

Fig. 2. The resources for the farming system

THE RESOURCES FOR THE FARMING SYSTEM (Fig. 2)

The design, or modification, of a farming system by a farm operator is based upon his appraisal of the resources within his own production unit, and of the resources, conditions and opportunities within the surrounding environments. Obviously, such appraisal of resources, and design of system, are governed by the state of the operator's accumulated knowledge, experience and values.

The resources within the farm may be categorized as human, land and capital resources. The human resources include the operator or decision-maker, and labourers. The operator may be a single individual who also performs the labour of the unit. Or the operator may be a group of persons separate from the labourers.

Regardless of the difficulty of determining with whom the function of decision-making lies, it is important for the comparative study of agriculture to recognize that it always exists and is carried out in one form or another. The land resources include the phenomena of terrain, soil, water, climate and those plants, animals and microorganisms (other than those purposely produced) which inhabit the land. Capital resources include the producing plants and animals (e.g. work animals or breeding animals or an orchard), the field structures and improvements, farmstead structures and improvements, tools and equipment, energy or power resources, various kinds of material such as feed for livestock, fertilizer or insecticides, and working capital.

Phenomena outside the production unit may also be considered as potential resources, or hazards, for the farm operation. Earth resources such as air, water, or animals cross the farm boundary. A modern farm operation is critically dependent upon outside resources for advice, credit, insurance, supplies, equipment, labour, transportation, processing and marketing. But even the most primitive farmer must also cope in decision-making with the effect of storms, insects, people or ideas from outside his farm.

THE FARM WITHIN SYSTEMS OF THE ENVIRONMENT (Fig. 3)

The relationships between the individual production unit and its hierarchy of environments are functional and dynamic. The farm is a functioning system within larger functioning systems. In this simplified illustration of the concept, the larger functioning systems are represented by four categories and, again, at two scales, that is, the circumjacent and the distant-centred environments. If one imagines a new farm being established in a previously undeveloped area, then one may visualize as already existing in the area a complex of ecosystems, that is, systems of functioning interconnections between living plants and animals and their environments. As soon as the farmer disturbs the existing organisms or environmental conditions, or introduces new ones, he is modifying or destroying the old ecosystems and attempting to establish and control new ones. In similar manner, the farm operator must design, and occasionally modify, his own farming systems so as to fit into the functioning political, social and economic systems of both the circumjacent and the distant-centered environments.

SUB-SYSTEMS PRIMARILY OF THE ENVIRONMENT (Fig. 4)

As with any system, the farming system of an individual production unit is comprised of interrelated and overlapping sub-systems[1]. The forms of some of these sub-systems are largely beyond the control of the individual farm

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[1] The term s y s t e m is used in this paper in the larger sense: that is, so as to include both the concept of a functioning system, such as a system of crop production, and also the concept of an organizational or procedural system, such as a system of land division or land holding.

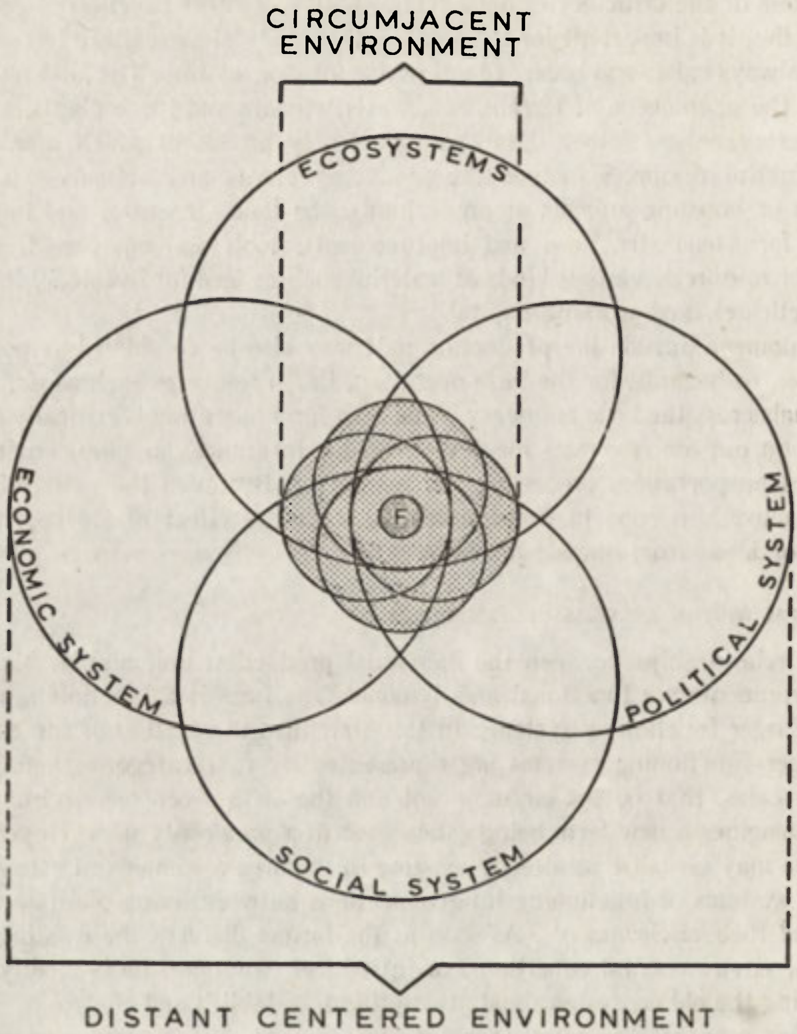

Fig. 3. The farm within systems of the environment

operator. They may be the products of long-term cultural evolutions which are remote from the individual farm not only in distance but also in historical time.

The sub-systems include the system by which the land is surveyed, subdivided and identified. Closely related is the system by which ownership or the right to use land is recognized, held and transferred. Closely related also is the system of settlement involving both spatial arrangement and relative degree of permanence. Finally, there is the system by which operators and their asso-

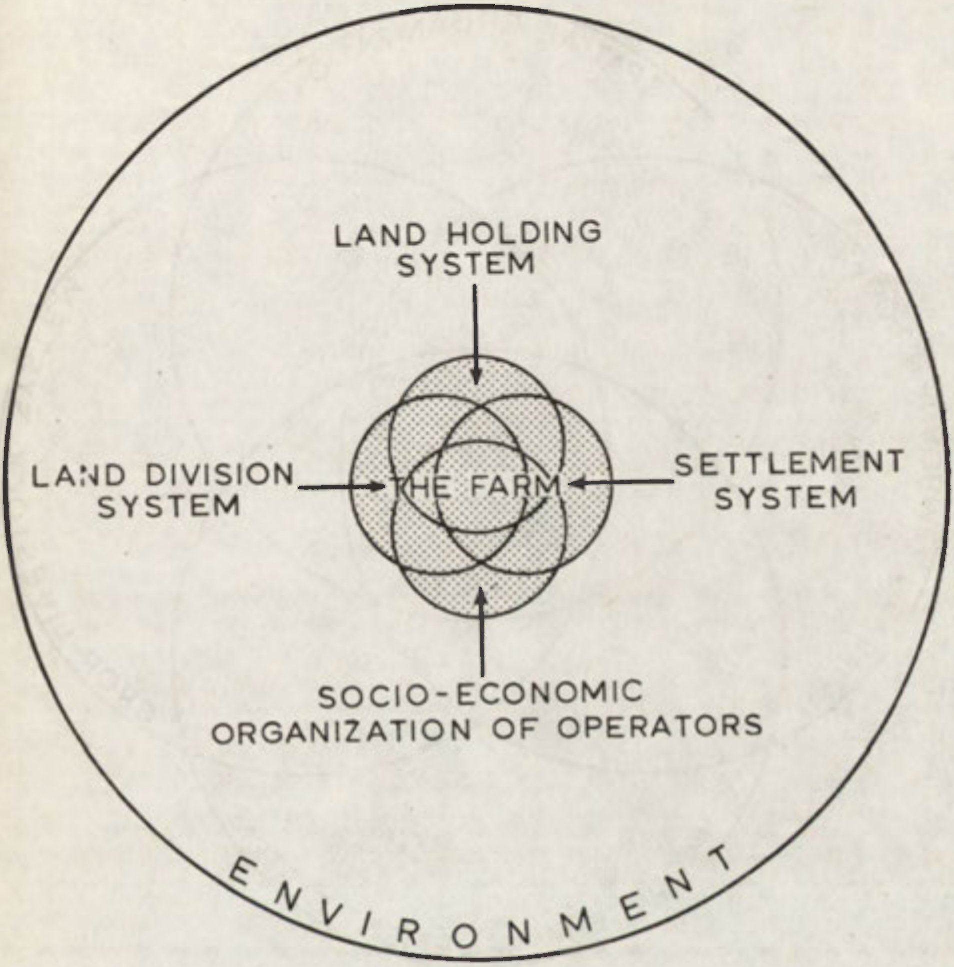

Fig. 4. The farm as a system. Sub-systems primarily of the environment

ciates are organized into socio-economic units for the purpose of farm operation. The organization may be in the form of an individual or restricted family, a kinship group such as an extended family or clan, or a non-kinship group such as a public corporation, co-operative or collective.

SUB-SYSTEMS PRIMARILY OF THE PRODUCTION UNIT (Fig. 5)

Other sub-systems are more largely within the control of the individual farm operators. One which is only partly so, because of its close relationships to the sub-systems of land-division, land-holding and settlement, is the morphology or system of spatial arrangement. This includes the kinds, numbers, sizes,

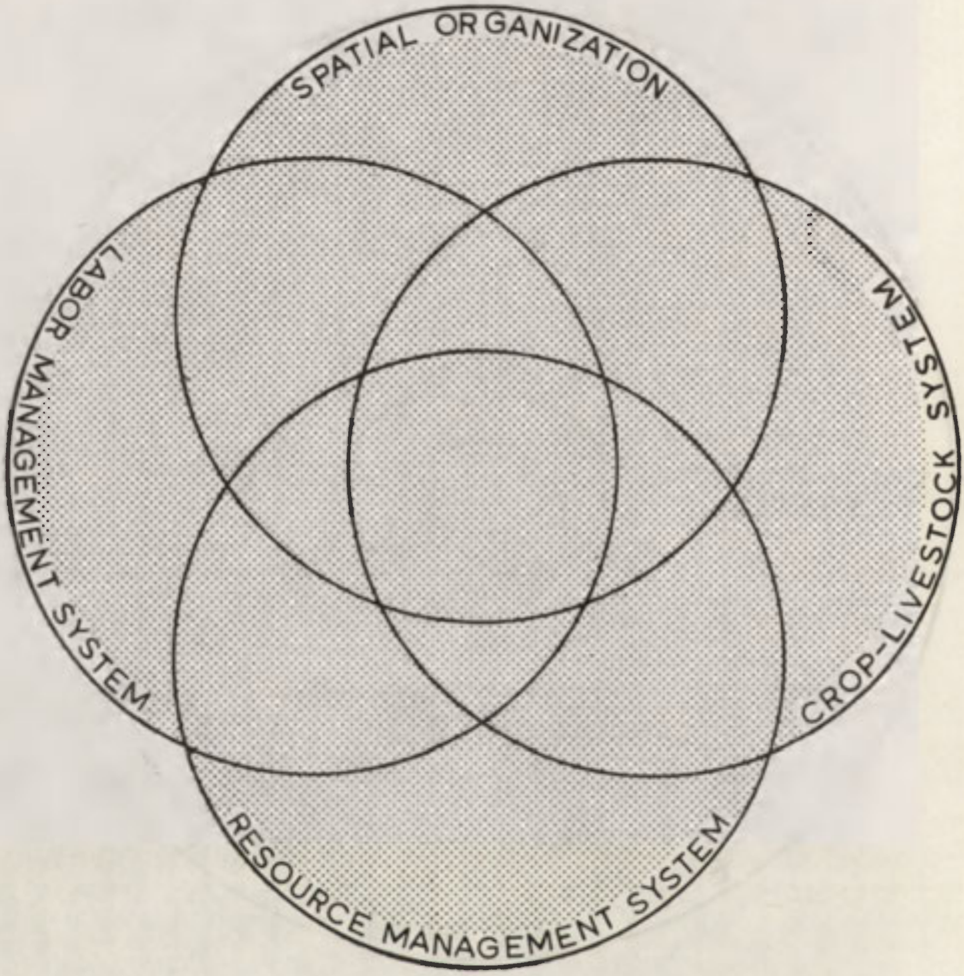

Fig. 5. The farm as a system. Sub-systems primarily of the production unit

forms, functions and spatial arrangements of farm parcels, fields and structures. Other sub-systems within the farm include the crop-livestock production system, the resource-management system and the labor-management system.

These last three interrelated and overlapping sub-systems together may be called the production system, that is the system by which all of the farm's resources are used and maintained or improved in order to produce the selected items or to meet the operator's goals.

FLOW WITHIN AND BETWEEN SYSTEMS (Fig. 6)

Like most systems which involve plants, animals or man, a farming system is an open system. There is flow of energy, ideas and materials across the farm

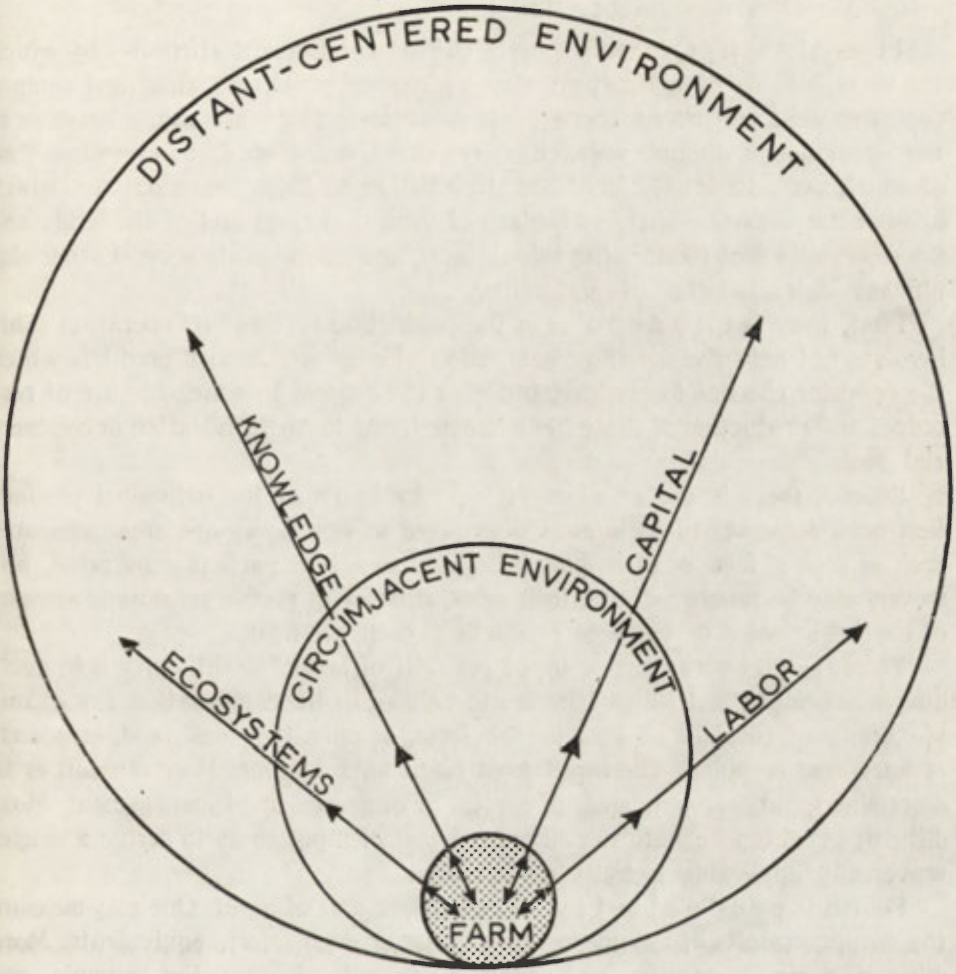

Fig. 6. Flow within and between systems

boundaries to and from the ecosystems and the political, social, and economic systems of the surrounding environment. Through the circulation of sun energy, air, water, animals or plant seeds, the ecosystems of the farm are interrelated with those outside. Ideas and information are exchanged across the farm boundary, as are labour, and capital in its various forms. The interconnections may be most numerous and active with the agricultural sector of the circumjacent environment, but they may also connect with nearby or distant centers of supply, market or policy-making within other sectors of the economy and society.

CHARACTERISTICS OF AGRICULTURE

Finally, let us try to identify some of the most significant attributes by which the diverse kinds of agriculture may be characterized, classified and compared. The most important characteristics of agriculture are characteristics of the individual production units, their resources, and their farming systems, all of which we have briefly identified. In addition to these characteristics which involve the amounts, kinds and mixes of farm resources, and of the kinds and interconnections of the farming sub-systems, one may identify several other significant characteristics of agriculture.

First, there is the p u r p o s e of the production unit and its operation. This involves not only the specific combination of crop or livestock products which the operator chooses to produce, but also the degrees to which his use of resources and production of those items are designed to meet utilitarian or commercial goals.

Second, there is the s c a l e o f o p e r a t i o n of the individual production unit. Measures of scale most often used in geography are areal measures such as area of farm or of cropland. Equally useful for particular purposes, however, may be number of livestock units, number of people employed, amount of capital invested or value of production, each per farm.

Third, is i n t e n s i t y, or input per unit of land. The difficulty is in deciding which input and which land are to be used in the computation. For example, one may consider all land in the farm, or only improved land, cropland, or harvested cropland. The input most often used is labor. More difficult is to determine input, per unit area, of capital or of energy or of management. Most difficult of all is to equate the different forms of input so as to derive a single, universally applicable measure of intensity.

Fourth is p r o d u c t i v i t y, or output per unit of input. One may measure the output in units of volume, weight, value or even calorie equivalents. More difficult, again, is selecting and equating the units of input. For example, one may attempt to compute value of output per unit of area, per animal unit, per man hour of labour, per unit of farm value or per value-unit of input.

To identify the final characteristic, one may again refer to Figure 6. This characteristic has to do with t h e k i n d s a n d a m o u n t s o f f l o w between the individual farms and the interrelated systems of their environments. In would seek to describe or define the kinds and degrees of interconnection and interdependence. As such, it would include but would be more revealing than the commonly used but seldom defined terms, "subsistence" or "self-sufficiency". Since any change in a given farm, or in agriculture, must almost certainly be stimulated by change in the flow along one of the lines suggested in the diagram, it is this characteristic which is perhaps the most significant key to understanding not only the complex areal differentiation of agriculture over the world but also the continuous change in that pattern.

CONCLUSION

It is assumed that the fudamental objective of the geographical analysis of agriculture is to further the understanding of the spatial arrangement of functioning agricultural systems over the world.

Consequently the spatial arrangements or spatial relationships of any of the following should be appropriate subjects for geographic study:

(a) Any elements or resources which are parts of, or significantly related to, farms and farming systems, whether they be elements produced or elements of the production environments;

(b) Any parts or assemblages or interconnections of farming systems or sub-systems, whether of the production units or of the circumjacent environments; or

(c) Any characteristics of systems, sub-systems or assemblages of systems-any of these should be appropriate for geographic study — provided that it is responsibly recognized that the single element, function or characteristic is not independent but is part of or related to a functioning system.

The systems approach, it seems to me, brings together the theoretician and the empiricist, the generalist and the particularist, the mass data processor and the field man. Each needs the others. The individual element or farm has little meaning unless related to the functioning whole of which it is part. And the theory of the whole is not likely to be sound unless it is based on detailed and accurate knowledge of many particulars.

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FARM SIZE AS A CRITERION IN IDENTIFYING TYPES OF AGRICULTURE

INTRODUCTION

Size is perhaps the most important single characteristic of any type of agriculture. Hence, the first step in identifying different types is usually to consider the distribution of farms (units of operation) by size groups within the area(s) selected for study.

Throughout this paper a farming system is taken to mean the combination of individual farms. Type of agriculture is reserved for the dominating enterprise combination in an area or region. Where no single enterprise combination is dominant, as is often the case, the type of agriculture should be characterized by the composite structure of farming systems, defined as a specified percentage distribution of the separate systems identified in that particular area.

THE NEED FOR AREAL EQUIVALENTS

As a measure, the physical size of agricultural area has the advantage of being fairly precise and the most easily obtainable, but its deficiencies are obvious. First, acreage figures do not take account of the fact that farm land may be scattered, due to either conditions of terrain or tenure. Where parcellation is caused by morphological features, individual parcels are frequently small and tend to have irregular shapes which make them cumbersome or even impossible to work with mechanized equipment. Parcellation caused by pressure of population on land may have rather similar effects. Dispersal of farm land, in whichever form, is virtually equivalent to a reduction in area, but this is not easily quantified. A recent attempt to arrive at indices for size, shape and location (6) was based on aerial photo interpretation of holdings in Lyngdal (see Fig. 1) where scattering is widespread due to relief.

Fig. 1. Locational map showing place names mentioned in the text
F: Finnøy, L: Lyngdal, B: Brandbu

Secondly, areal measurement disregards aspects of quality. However, properties of farmed land, especially those which depend directly on the climate, strongly influence the development of divergent patterns of farming systems as well as their productivity. In the least technically developed regions, physical properties of soil and groundwater and the vagaries of weather, constitute relentless forces. The controversial but increasingly relevant question of the productive potential of agricultural land is also waiting to be considered.

Thirdly, acreage as a measure is not unambiguous and may conceal important discrepancies. Acreage data for arid regions are for instance misleading unless they explicitly refer to either cropland in the sense of arable, which includes fallow, or to cropped area, i.e. area sown or harvested. Actually, figures for both should be given whenever possible. Confusion is also caused by difficulties in handling insufficiently specified acreage figures for regions where double-cropping (or multiple cropping) is extensively practiced. To compare acreage size groups, say, between Japan and Western Germany would be misleading unless some kind of index were applied to adjust acreages of holdings for large parts of Japan. In the census tables they are given by size of cultivated area and by size of agricultural area. The rate of utilization, which is an index of double-cropping, is available for prefectures but not calculated for size groups.

In this context it may be appropriate to voice the need for a vocabulary with definitions on an elementary semantic level as well as on an advanced professional level. Examples are: crop area-tillage-arable; sown area-cropped area-harvested area; intercropping-interplanting-double-cropping. Which are just synonyms? And what should be the precise meaning of those which are not? The former type of definitions could be helpful, particularly as an increasing number of geographers, whose native tongue is not English, participate in the exchange of ideas and work results in this language. Correct terms in a general sense may be just as crucial to the meaning conveyed as the proper use of uniform terms, i.e. concepts which imply uniform distinctions because they are based on commonly accepted assumptions. Clarity on this count will moreover facilitate both the introduction of new concepts and refinement of old ones.

The conclusion is to stress the need for grouping agricultural land in capability classes, as well as adjusted acreage size groups of farms, and according to land use. This calls for more inventory of land and some new methods.

The above reflections may seem too obvious to deserve mention. Their function is, however, to draw attention to a distinction of significance when considering the problem of size, namely between deviations in real acreage values from a postulated norm, due to natural factors which are hard to overcome and those, on the other hand, which must be ascribed only or mainly to divergencies in the human approach and, accordingly, are more changeable. The former call for the invention of even better conversion factors in the measurement of equivalents. Examples of the latter are differences between long and short leys, and between grass cropped for hay only, or for both silage and hay, and perhaps grazed as well.

These and other variant forms of land use may well occur within short distances in the same climatic region. They are reflected in output per man, the more intensive ones normally yielding a bigger output. Attempts to introduce "arable equivalents" similar to "livestock units" may be useful for comparison (1). However, variant practices of the kind exemplified above raise a type of problem which belongs to a diferent category altogether, not related to the size of a farm's production basis but to its management.

Questions regarding farm management are sometimes treated as if they concerned the physical basis of production. The lately much criticized system, prevalent in Atlantic countries, of using imported concentrates to feed a larger livestock than otherwise possible is often referred to as one way of expanding the size of farms. Questions related to the ability of farmers to draw on resources from outside their own land should, however, be dealt with under the heading of scale of operation.

To discuss this system, sometimes labelled neo-colonial exploitation, is outside the scope of this paper, but the substance of the problem deserves the attention of geographers. It should be treated as one of how to utilize the varying regional resources of the world most rationally. That may imply increased exchange of agricultural products, viz. exports of feed from some climatic regions in return for imports of livestock products from other regions, which may at present be better endowed in some respects for this particular kind of protein production, but whose productive potential is not fully utilized. In other words, should geographers welcome the diffusion of this system, lately spreading in Japan, to countries with similar structural problems and potentials? This, of course, leads on to the question of markets and differences in the infrastructural basis of farming.

The concept, scale of operation, allows for a measure of size which is applicable to both the above mentioned categories of problems. This measurement, variously defined as value of production or gross income, sometimes even net income, is superior in the respect that it permits comparison between size groups within so widely disparate types of farming as cattle ranching on The High Plains, hill sheep farming in Scotland, and poultry raising in battery houses with automatic catering. The use of this method is, however, extremely limited for two reasons: lack of the necessary data from accounts kept by individual farmers, and problems of currency conversion. The latter is of course magnified by the closely related and actually intertwined problem of different levels of living.

Economic classification of farms has clear advantages in describing size structures and providing a fair degree of comparability, in analysing enterprise combinations, in measuring change, etc. The use of economic criteria is, however, practicable and meaningful only for countries with a thoroughly commercialized agriculture (2,3).

Size influences the farmer's choice of enterprise combinations. Generally speaking, the smaller a farm unit is the narrower is the farmer's choice within the frame determined by nature and market conditions. He is likely to work his land as intensively as possible with the labour force at his disposal. That is, if he derives his sole or major income from farming. Where farming is just a subsidiary source of income, empirical studies have revealed a tendency towards more extensive use of land. In other words, farm size is not the only factor influencing systems of farming.

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A. B. Tschudi — *Farm Size as a Criterion in Identifying Types of Agriculture* pp. 46—47

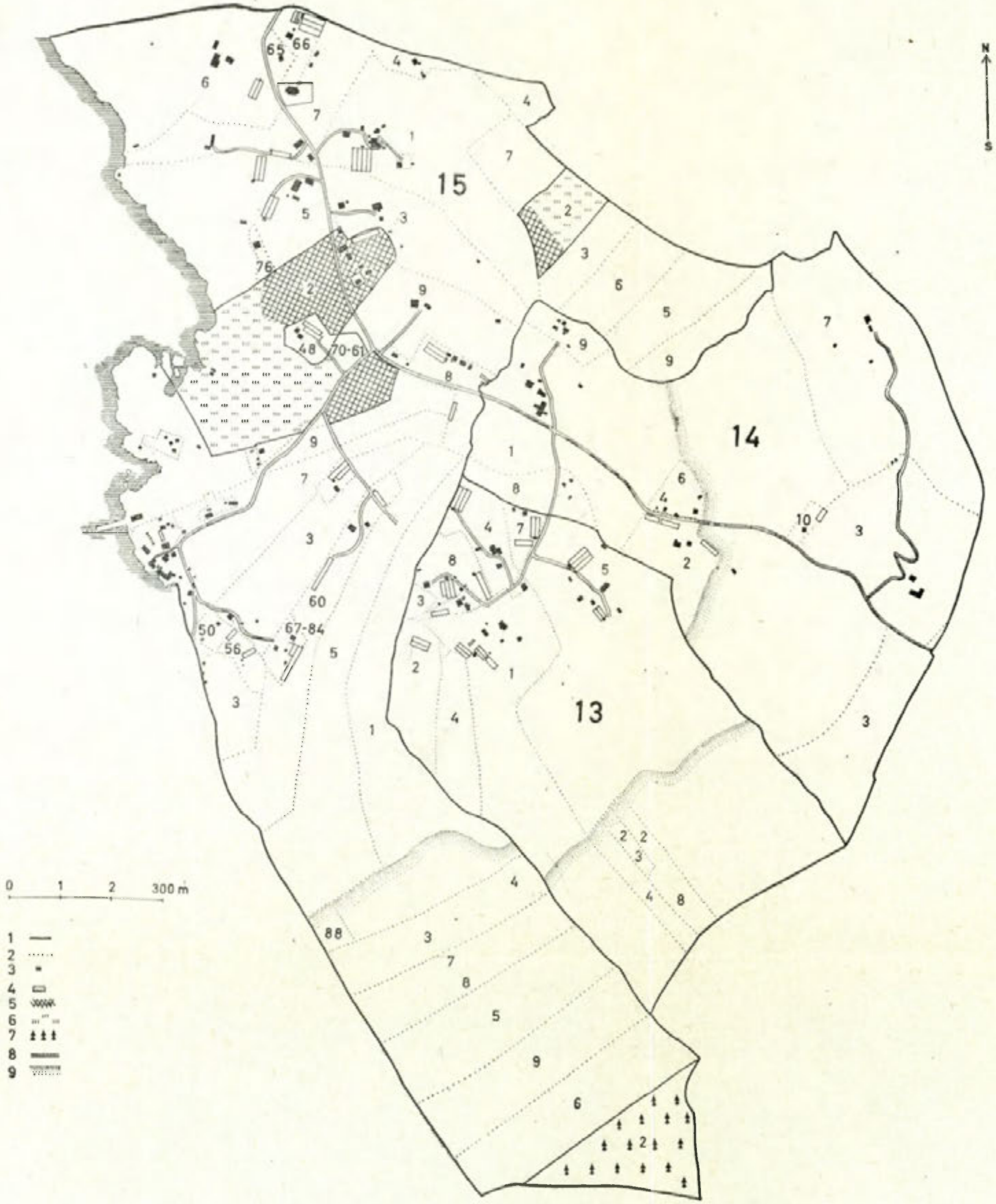

Fig. 2. Distribution of land between holdings in a neighbourhood in Finnøy, Southwest Norway
Nos. 13—15: originally undivided farms, still recorded as units in the land registry. Small numerals for holdings indicate sequence of subdivision. Numbers are not given for lots of hothouses without attached fields, non-farm dwellings, and holiday cottages near the sea. Land use is shown for one holding (No. 15,2)

S1 — boundaries of the once undivided farms, 2 — boundaries of present holdings within these, 3 — buildings, 4 — hothouses, 5 — arable, 6 — permanent grass, 7 — planted to conifers, 8 — roads, 9 — old limit of unenclosed forest and moor, used for gathering and rough grazing, now in parts farmed

PWN 1970

WDL
720 + 165

TYPE OF FARM VERSUS FARMING SYSTEMS

Type of farm is a concept regularly used to take care of the supplementary income factor. Part-time and spare-time holdings may then be grouped as special types and their characteristics dealt with separately. Methods for distinguishing these types may be based on either sources of income or on labour requirements as criteria.

The purpose in separating these groups is often preparatory (5), the main object being either to identify the farming systems practised among the remaining full-time units in a region or to analyse problems of structural rationalization. In the latter context, proper criteria for the so-called family farm as a viable unit have occupied a great deal of attention. For comparison between West European countries hours of man-labour have been used. The limits of this criterion are apparent from the very beginning, as variations in the average size of farm families have to be considered before deciding on a breaking point between full-time farms and the remaining units. Moreover, how shall one solve the problems posed by differentials in labour efficiency and standard of living? (8,11).

In their agricultural policy the Nordic countries have determined empirically defined lower acreage limits for viable farm units. These limits vary considerably from the one country to the other, and their relativity is further exposed by the fact that lately they have been moved upwards several times in keeping with the increasing efficiency brought about by technical developments.

A case might be argued for classifying holdings with big outmark areas as a separate type of farm. Outmark is here applied in the archaic sense of an area which belongs to a farm's territory but is largely uncultivable. Such space was highly valued in the subsistence economy as a source of fuel and game, fish and wild berries, rough grazing in summer and fodder for wintering a larger herd than the farmed area proper could sustain. An outmark still represents an asset which at times may amount to a virtual enlargement of a farm's resource basis. In favourable circumstances it may for instance be put to renewed use, in parts as improved grazing, in parts developed for recreational purposes, afforested, or both.

Typical patterns of space relationships between outmark and farmed area proper are shown in figures 2 and 3 for communities in southwestern and southern Norway. Apart from minor differences due to topography, their outlay is very similar, resulting from repeated divisions of ancient larger farm domains with no clear-cut boundaries. Land use patterns are, however, rather dissimilar.

The dispersed settlement structure in Finnøy (Fig. 2) originated when farmsteads were moved after consolidation in the latter half of the 19th century.

Fig. 3. View towards East of the intensively utilized farm land in Finnøy, surrounded by outmark, used in large part for pasture. The farms no. 13 to 15 of Fig. 2 are seen in the central part

Photo V. Widerøe

This pattern has been reinforced through excessive subdivision in recent decades in conjunction with the growth of a hothouse industry and a general intensification of farming. The one holding for which a somewhat more detailed land use is shown has planted conifers in its share of the once unenclosed outmark, because the distance from the farmstead makes it inconvenient for grazing cows. The outmark has yielded two new homesteads on reclaimed land (no. 3 and 7 within farm no. 14). The remaining part is uncultivable and now largely turned into improved and regularly topdressed grazing. This is then a case of maximized utilization of total farm resources.

In the Lyngdal neighbourhood (Fig. 4) the settlement pattern is one of loosely nucleated clusters, reflecting a rugged relief and scarcity of cultivable soil. Holdings are smaller than in the above example. Around the homesteads, there is some contiguous agricultural area, the remainder is scattered in the outmark which in this case is increasingly disused. An exception is one holding where the outmark has been enlarged through purchase of adjacent abandoned land and profitably put to the mixed use of afforestation and grazing, currently an unorthodox combination. In this particular region, which is abundant in idyllic lakes, outmark areas offer possibilities for developing recreational faci-

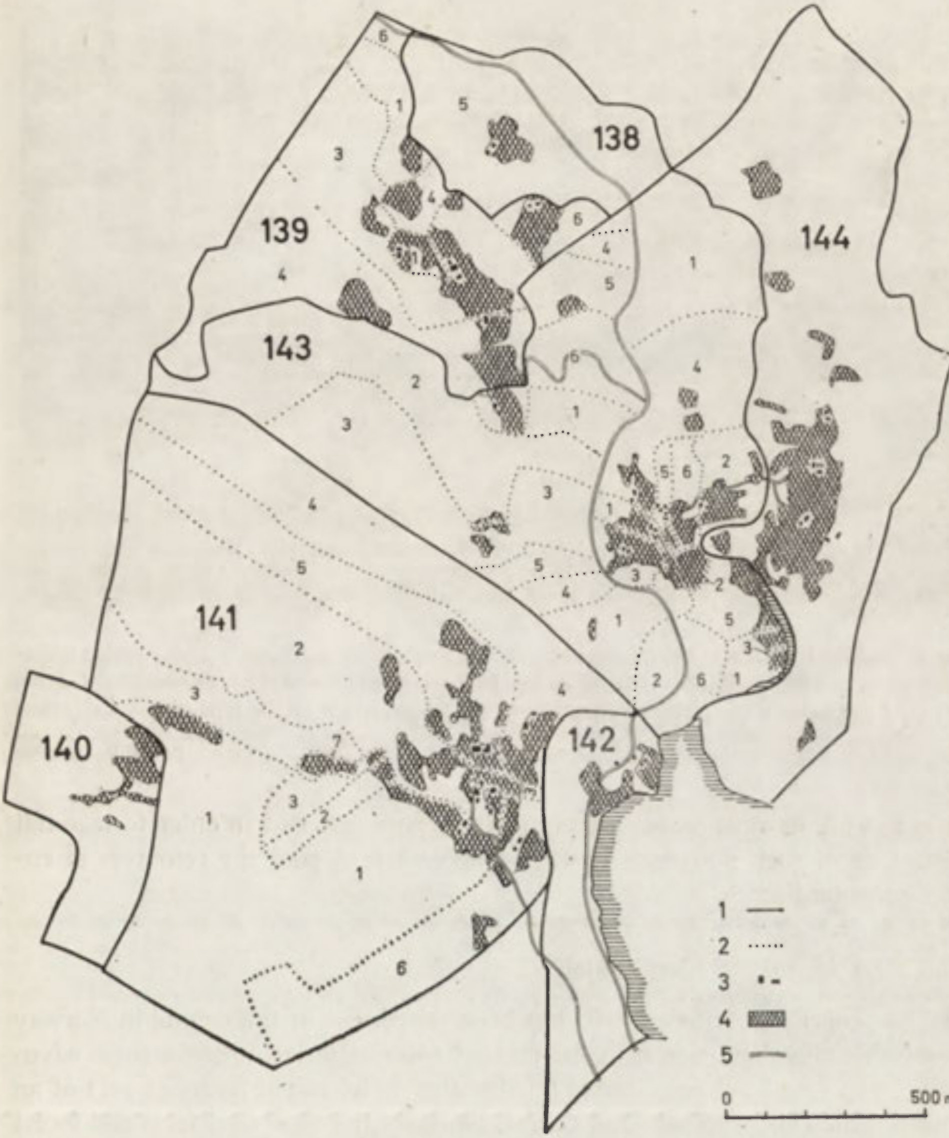

Fig. 4. Land tenure and land use in a farming community in Lyngdal, Vest-Agder, South Norway

1 — boundaries of the once undivided farms (nos. 138—144), 2 — boundaries of present holdings (small numerals), 3 — buildings, 4 — agricultural area, 5 — roads. Open space denotes fell and forest, mainly stands of deciduous trees.

Note: separate holdings are not shown for farm no. 144, nos. 140 and 142 have remained undivided.

Fig. 5. Looking East across the Lyngdal river plain, enclosed by hilly country with sparse settlement, mostly located near lakes or tarns, as seen in the left background. The nieghbourhood shown in Fig. 4 lies outside the picture to the left in the continuation of the hills in the foreground

Photo V. Widerøe

lities as well, in other words a truly multipurpose use. But in order to take full advantage of such potentials it will be necessary to pool the resources of entire communities.

FORESTRY AS A FARM ENTERPRISE

The proper use of forest land has been prominent in the debate in Norway about objectives and means in the current rationalization process, some advocating that forest holdings should be allocated to udersized farms as part of an official deal. This proposal is, of course, based on the view that farm and forest land constitute an integrated whole.

Politics apart, the role of woodland in a typology of agriculture deserves serious attention. Should forestry be recognized as an enterprise on a par with "normal" farming enterprises in regions where considerable forest land belongs to and are worked by owner-occupiers of farms? If so, these farms would constitute special enterprise combinations. Or should they rather be classified as a separate type of farm, like part-time and spare-time farms which they resemble in certain respects. Moreover, in regions where farm domains frequently comprise both wood- and farmland these types are bound to be represented by smallholders who supplement their income from farming with paid work in other peoples' forests.

These questions have been too easily dismissed by geographers. Explicitly or implicitly they usually make a clear distinction between forest industries and agriculture, although sometimes admitting that there is an overlapping (9).

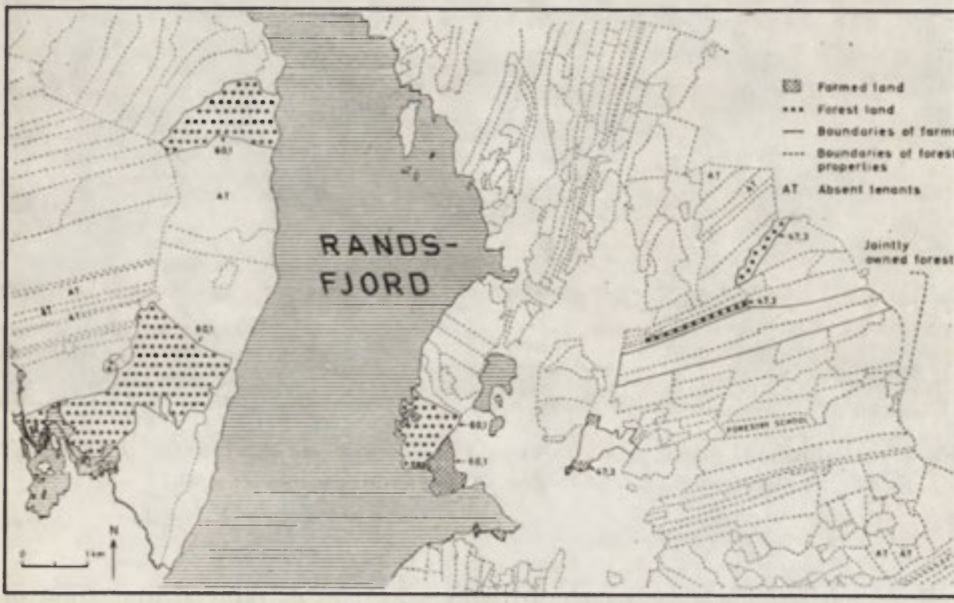

Fig. 6. Forest property of two farms in Brandbu, Oppland, East Norway
The open space in the centre is agricultural and settlement area. Numbers are not given for holdings other than 61,1 and 47,3. Numerals to left and right of comma denote registry number of the ancient undivided farms and of present holdings respectively. The larger of these management units (comprising more than one old farm) has 41 hectares of tillage, 15 of grazing, and 522 of wood. The smaller one has 7 hectares of farmed area, and 38 of wood. Boundaries of forest properties redrawn from a section of map by Holt-Jensen

Fig. 6 shows a fairly typical layout of farms forests in a region with extensive woods. Except for a large jointly owned forest in the northeast and a handful of holdings owned by non-locals, all forest properties are attached to farms. They are mostly small and frequently have a bad shape, due to notions of equitable division in a premechanized era. In spite of these drawbacks, which call for rationalization, forest holdings are as a rule well managed, worked by the farmers themselves as an integral part of their farm operation (4).

To conceive of farm-forest combinations as belonging to the category of regular farming systems has become facilitated by modern techniques of silvi-

Fig. 7. Part of the agricultural area with surrounding forested land shown in Fig. 6. In the left foreground the inlet of Lake Randsfjord with the farm no. 60,1

Photo V. Widerøe

culture and farming alike. Combined with principles of rational utilization of resources they tend to make farming and forestry optional to a degree so far unknown. Clearing of woodland has become relatively cheap, whereas mechanized farming has made it desirable to reforest a great deal of sloping land. To crop these areas is no longer the economic necessity it used to be in the subsistence economy. Whether to use them for grass or for silviculture has increasingly become a matter of choice and a question of rational management. However, farmland which has now been afforested may again be cleared if the current population growth should require that it be reconverted to agricultural land. This would amount to a modern form of area rotation.

The main reason for including the operation of forest land among regular farm enterprises is, however, its truly complementary function in a majority of farming systems in regions where farm domains frequently comprise some woodland. Figures 8 and 9 demonstrate the importance of forest land as a source of employment in the slack winter season lasting from October — November to the end of April (10).

Clearly it would be misleading to base the size structure of farms in such regions on acreage of farmed land only, no matter how sophisticated a measure-

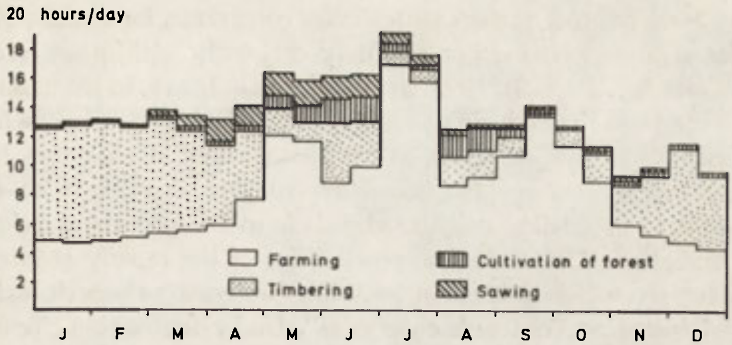

Fig. 8. Distribution of work between farming and forestry in Aust-Agder and Vest-Agder, South Norway

Mean values for 12 management units, studied during the period 1950—57. Mean agricultural area 5,3 hectares, mean forest area 84,5 hectares. Labour hours spent in farming varied from 4000—1700 per year. Labour. hours per m^3 wood produced varied from 5,2—8,2, depending i.a. on distance from farmstead

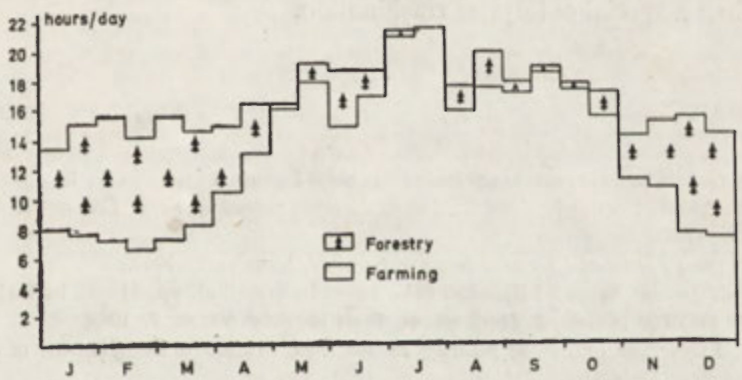

Fig. 9. Distribution of work spent in farming and forestry on one farm, comprising 7 hectares of farmed land (in crops or grass) and ca. 50 hectares of forest, with a yearly production of ca. 100 m^3 wood

Source: A. Thormodsæter

ment of equivalents were applied to different kinds of tillage and grazing. Forest land would have to be included in any measure of size, suitable for comparison. If a flexible breaking point is introduced between non-viable and viable family farms, models of these may vary in size according to both system of farming practiced and quantity of timber felled. In research on this problem, net aggregate return has been expressed as a function of agricultural area, system of farming and "normal" felling quantity, the latter determined by current regrowth (7).

In Norway as in other regions with similar conditions, farms may, in addition to some forest, own moor, either privately or jointly with other farms in the community (see figs. 2 and 3). Moor and wood, the outmark, in mountain districts of ten extending into the high alpine region, used to be highly valuable in yielding summer grazing and hunting space, as mentioned above. Lately they have been invaded by holiday makers and mountain summer dairying with gathering activities centred in shieling neighbourhoods is in the process of being substituted by recreational activites. The possibilities of the rapidly growing tourist industry have given rise to ideas of initiating systematic research and training in what is labelled an "outmark enterprise". Under favourable circumstances, a smallholder may, of course, succeed in turning an otherwise undersized smallholding into a viable unit by supplementing his farm labour with catering for the various needs of townspeople, recreating in cottages built, owned, and let by him or in their own private cottages on leased ground in his outmark. Whether earnings of this kind can be classed as output from a farm enterprise is highly doubtful. Although the income is derived from nothing but a shift in the use of land it belongs rather to the part-time and spare-time category of outside earnings. Accordingly, it should be designated a special type of farm rather than a special enterprise combination.

BIBLIOGRAPHY

[1] FAO, *Output and expenses of agriculture in some European countries*, 1, 1953, p. 295.

[2] E. W. Grove, Economic classification of farms. *Journal of Farm Economics*, 47, 1965, pp. 1545—1571.

[3] E. Higbee, *Farms and farmers in an urban age*, New York, 1963.

[4] A. Holt-Jensen, Skogen i Brandbu (The forest in Brandbu), pp. 31—42 in Tschudi, Aa. B., Myklebost, H., Hadeland. Jordbruk og Pendling, *Ad Novas*, 7, 1969.

[5] R. B. Jones, *The pattern of farming in the East Midlands*, Departament of Agricultural Economics, University of Nottingham, 1954, 176 pp.

[6] A. Nordgård, Bruksstruktur og rasjonalisering (Farm structure and rationalization), *Norsk geografisk Tidsskrift*, 23, 1968, pp. 1—14.

[7] Norges landbruksøkonomiske institutt, *Områdeplanlegging i jord og skogbruk* (*Regional planning in farming and forestry*), Oslo, 1965, 47 pp.

[8] OEEC, *The small family farm*, 1959, 103 pp.

[9] E. Otremba, *Allgemeine Agrar-und Industriegeographie*, Bd. 3 in Erde und Weltwirstschaft, Stuttgart, 1960, 392 pp.

[10] A. Thormodsæter, E. Elstrand, *Driftskombinasjonen i jordbruk-skogbruk* (*The enterprise combination farming-forestry*), Norges Landbruksøkonomiske institutt Særmelding nr. 17, 1960, 120 pp.

[11] P. L. Yates, *Food, land and manpower in Western Europe*, London, 1960, p. 294.

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THE LOCATION AND INTENSITY OF FARMING SYSTEMS[1]

THE CLASSIFICATION OF FARMING SYSTEMS

There in so recognised international farm classification, although the Commission for Agricultural Typology of the International Geographical Union may produce one. Most systems classify by intensity or by land use or both.

Some classify intensity by climate or by land capability; others by type or rate of production (e.g. grain-yields, gross or net primary production, proportion of cash sales from different enterprises, value of sales per unit area, etc.); others again by particular inputs (e.g. manpower or capital per unit area, etc.), or by size of farm, or, in respect of grassland, by stocking rate (which is, biologically, more a measure of conversion capacity of livestock than of production or input, though economically it is obviously a capital input). However, at least in temperate countries, productivity and farming systems are increasingly influenced by the sum and the balance of the inputs of capital, labour, machinery, power, fertilizers, pesticides, etc. A classification based on input intensity per unit area of farmed land seems, agriculturally, to be the most useful. Intensity, therefore, means the actual sum of inputs (other than "natural" ecological factors) used to exploit a given ecological site. Each such site has a productive potential (which can be quantified) but which can only be fully exploited by optimal inputs. The ratio of actual inputs to optimal inputs is the input ratio. Either actual total inputs or input ratios can be classed into very-extensive, extensive, semi-intensive and intensive (see Table 1).

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[1] This paper is condensed from Part II Chapter 1 and Part III Chapter 1 of Duckham and Masefield *Farming Systems of the World* (in the press).

TABLE 1. Classification of farming systems

	TREE CROPS		TILLAGE with or without livestock		ALTERNATING tillage with grass, bush or forest		GRASSLAND or GRAZING of land consistently in "indigenous" or man-made pasture	
	Temperate	Tropical	Temperate	Tropical	Temperate	Tropical	Temperate	Tropical
Very Extensive Examples	Cork collection from Maquis in Southern France.	Collection from wild trees, e.g. shea butter.	None	None	Shifting cultivation in Negev Desert, Israel.	Shifting cultivation in Zambia.	Reindeer herding in Lapland Nomadic pastoralism in Afghanistan.	Camel herding in Arabia and Somalia.
Extensive Examples	Self-sown or planted blueberries in N.E. of U.S.A.	Self-sown oil palms in West Africa.	Cereal growing in Interior Plains of N. America, pampas of S. America and in unirrigated areas, e.g. Syria.	Unirrigated cereals in central Sudan.		Shifting cultivation in the more arid parts of Africa.	Wool growing in Australia. Hill sheep in the UK. (Sheep in Iceland) Cattle ranching in U.S.A.	Nomadic cattle herding in East and West Africa. Llamas in South America.
Semi-Intensive Examples	Cider apple orchards in U.K. Some vineyards in France.	Cocoa in West Africa Coffee in Brazil.	Dry cereal farming in Israel or Texas U.S.A.	Continuous cropping in congested areas of Africa. Rice in S.E. Asia.	Cotton or tobacco with livestock in S.E. of U.S.A. Wheat with leys and sheep in Australia.	Shifting cultivation in much of tropical Africa.	Upland sheep country in North Island, New Zealand.	Cattle and buffaloes in mixed farming in India and Africa.

Intensive Examples	Citrus in California or Israel.	Rubber in S.E. Asia. Tea in India and Ceylon.	Corn Belt of U.S.A. Continuous barley growing in U.K.	Rice and Veg. growing in south China. Sugar-cane plantations throughout tropics.	Irrigated rice and grass beef farms in Australia. Much of E and S of UK, and Netherlands, N France, Denmark, Southern Sweden	Experiment stations and scattered settlement schemes.	Parts of Netherlands, New Zealand, England.	Dairying in Kenya and Rhodesia highlands.
Typical Food Chains	*A*	*A*	*A,B*	*A*	*A, B, C, D*	*A* [*C*]	*C* [*D*]	*C*

Land use classifications show an equal diversity. But, basically, there are only four agricultural land use systems even though more than one of them may be found on the same farm or in the same area. The four systems are (I) Perennial Tree or Shrub Crops, (II) Tillage (annual crops with or without livestock), (III) Grazing or Grassland (pasture and ruminant livestock) and (IV) Alternating between Tillage and either Grassland, fallow or bush (see Table 1). Neglecting Tree Crops, for present purposes, a tillage system is assumed, arbitrarily, to have 75% or more of the land in annual or more frequent crops; a grassland system to have 75% or more in pasture or grazing; and an alternating system to have less than 75% of land area in tillage and less than 75% in grassland.

Each farming system consists of one or more of the four food chains, viz: (*A*) Tillage Crops — Man, (*B*) Tillage Crops — Livestock (mainly pigs, poultry and some cattle) — Man, (*C*) Grassland or Grazing — Ruminant Livestock — Man, (*D*) Tillage and Grassland — Ruminant Livestock — Man. The relation of these chains to land use systems is shown at the bottom of Table 1.

THE SPECTRUM OF TEMPERATE FARMING SYSTEMS

In highly developed temperate regions where resources per head are ample, there is, for a region or countries (such as U.S.A. and Canada, North West Europe, Australia and New Zealand), in which socio-economic factors can be regarded as constant, a well marked spectrum of farming systems[2]. The spectrum (Fig. 1) ranges from extensive grazing systems in warm, dry areas (Bands I and II) and then, through tillage (Band III), alternating (IV) and cultivated grassland systems (V), back to extensive grazing systems in cold or cool wet mountain areas or on cold, often dry, scrub and tundra (Bands VI and VII).

The spectrum (and its apparent influents and resultants) is not intended to be precise and is necessarily somewhat arbitrary. But it does suggest that, in the centre, there are Bands (III-Int, IV, V-Int.) where either mean annual precipitation (P) is not greatly in excess of mean potential evapotranspiration (T) in the thermal growing season or where T does not greatly exceed P. These Bands may be called hydrologically neutral; in them, the hydrologic ratio, i.e. h in Model (1)[3] or H in Figure 2 is, say, greater than 0.8. Mean actual estimated transpiration (A) is a very useful climatic parameter[4]. In these Bands this value is usually over 20 inches (500 mm) in the thermal growing season (or, in warm semi-arid areas, in the hydrologic growing season) and is relatively reliable from year to year. Such Bands can usually support intensive systems with high actual

[2] For interesting eco-climatic gradients in Africa and India see R. O. Whyte, p. 308—315 in Hills 1966.

[3] See Appendix.

[4] See Duckham and Masefield, Part I, Chapter 2

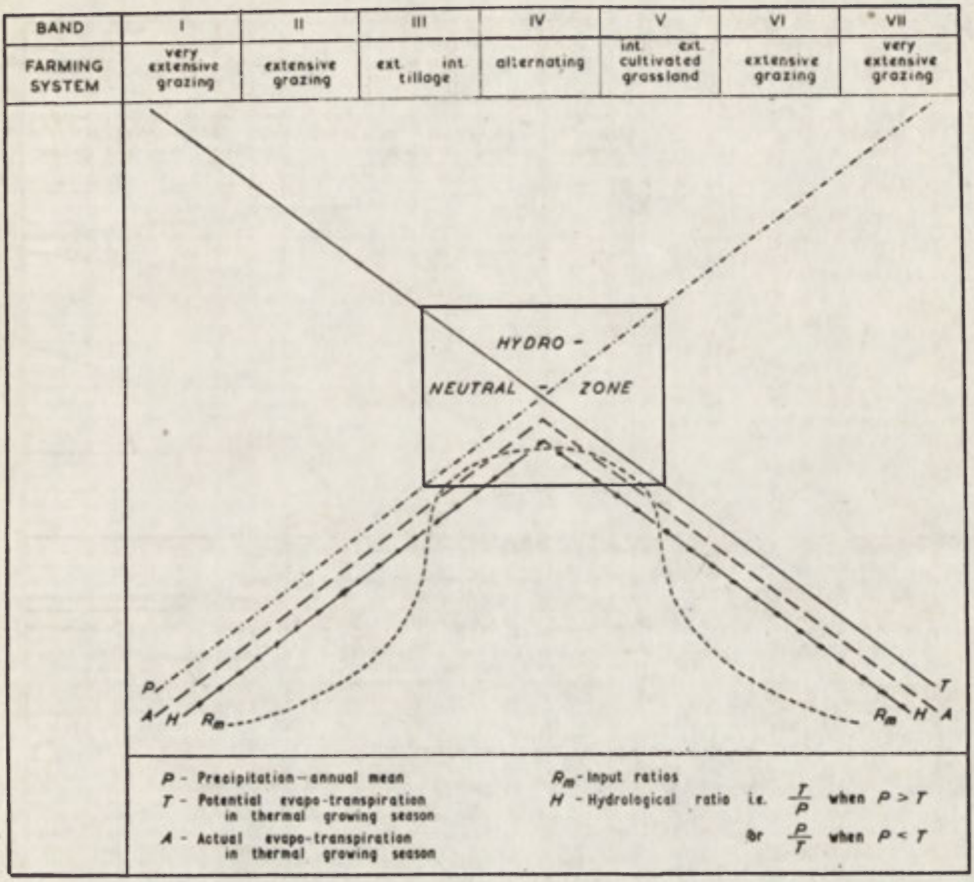

Fig. 1. Relation between temperate farming systems, climate and input rations

(other than inter-farm) inputs, or high input ratios, even though such land is not always intensively farmed (e.g. as in Uruguay).

Within the hydro neutral zone there is flexibility in farming systems as well as in input intensity. Thus, the "hydro-neutral" Canterbury Plains of New Zealand, now in intensive grassland and intensive alternating, could be in tillage systems; but limited access to distant markets and high transport costs make the conversion of the primary plant production, in this case grass, into animal products the better land use. In Argentina, the limited, tall grass "hydro-neutral" area (Band III-Int.) could probably be in intensive tillage, as in the U.S.Corn Belt, but is in extensive grassland and extensive tillage. Or again, within the hydro-neutral zone, the proportion of tillage may vary in time with changes in economic or external pressures or with technology, e.g. the great increase in tillage area in the United Kingdom in the 1914-18 and 1939-45 wars and the recent development of "continuous" cereal growing.

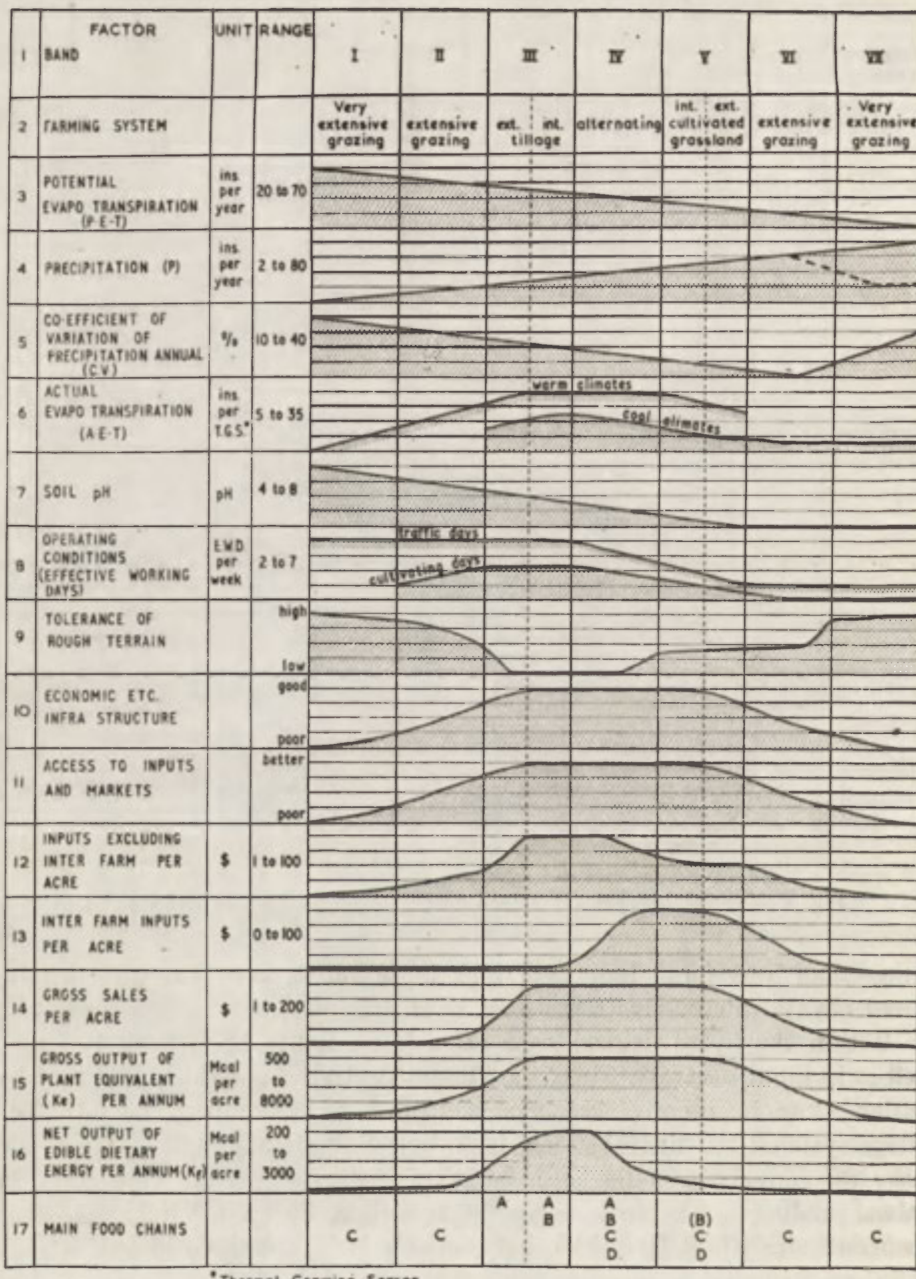
FACTOR
1 BAND
UNIT
RANGE
I
II
III
IV
V
VI
VII
2 FARMING SYSTEM
Very extensive grazing
extensive grazing
ext. int. tillage
alternating
int. ext. cultivated grassland
extensive grazing
Very extensive grazing
3 POTENTIAL EVAPO TRANSPIRATION (P-E-T)
ins per year
20 to 70
4 PRECIPITATION (P)
ins per year
2 to 80
5 CO-EFFICIENT OF VARIATION OF PRECIPITATION ANNUAL (C.V.)
%
10 to 40
6 ACTUAL EVAPO TRANSPIRATION (A-E-T)
ins per T.G.S.*
5 to 35
warm climates
cool climates
7 SOIL pH
pH
4 to 8
8 OPERATING CONDITIONS (EFFECTIVE WORKING DAYS)
E.W.D. per week
2 to 7
traffic days
cultivating days
9 TOLERANCE OF ROUGH TERRAIN
high
low
10 ECONOMIC ETC. INFRA STRUCTURE
good
poor
11 ACCESS TO INPUTS AND MARKETS
better
poor
12 INPUTS EXCLUDING INTER FARM PER ACRE
$
1 to 100
13 INTER FARM INPUTS PER ACRE
$
0 to 100
14 GROSS SALES PER ACRE
$
1 to 200
15 GROSS OUTPUT OF PLANT EQUIVALENT (Ke) PER ANNUM
Mcal per acre
500 to 8000
16 NET OUTPUT OF EDIBLE DIETARY ENERGY PER ANNUM (Kf)
Mcal per acre
200 to 3000
17 MAIN FOOD CHAINS
C
C
A
A B
A B C D
(B) C D
C
C
*Thermal Growing Season

Fig. 2.

Within this zone, relatively small differences in soil type (e.g. in clay content) or in soil moisture status may have great influence on systems and enterprise choice. W.C. Visser, in Rutter and Whitehead 1963 at p. 356—365 brings this out very well. He shows that, in the Netherlands, soils with high water tables are more frequently in permanent grass and that low water tables are more frequently in tillage crops. Neglecting such local influences however, w i t h i n the hydro-neutral zone as one moves towards the drier Bands, i.e. as $T > P$ and as h in model (1) decreases, then comparative advantage normally lies with tillage crops. These have, in general, a lower leaf area duration and hence have lower transpiration water needs than pasture swards, and also require more cultivating and traffic days (Duckham 1963, p. 333) than grassland systems. Towards the wetter and coolor bands, i.e. as $P > T$ and as h in model (1) decreases, the advantage lies with grassland systems. The latter have greater moisture needs but less exacting operational requirements than tillage; they start and

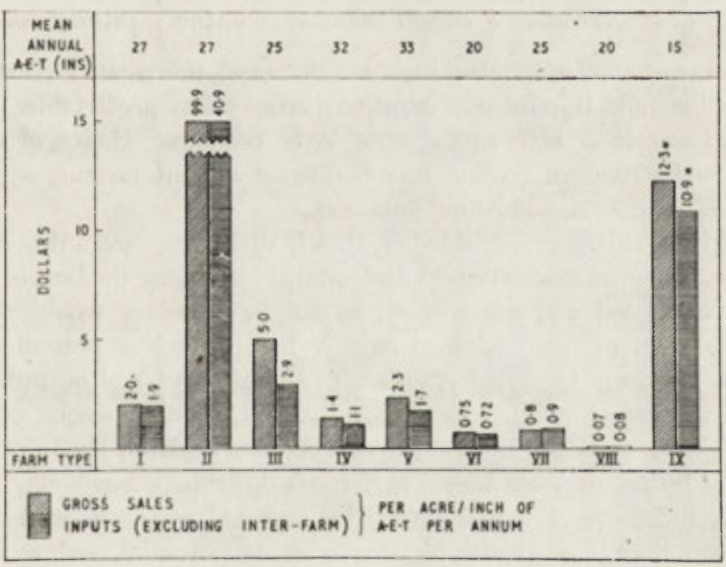

Fig. 3. Gross sales and input per acre of A-E-T for nine U.S. farm types

Relation between farm type and hydrologic ratio

Farm type		
I — N.E. Dairy (grass	0.7	Wet
II — N.E. Eggs	0.6	Wet
III — Corn Belt (alternating)	0.9	Wet
IV — S.E. Peanuts, cotton (tillage)	0.8	Wet
V — Delta cotton (tillage)	0.7	Wet
VI — N. Cereals (extensive tillage)	0.6	Dry
VII — S. Cereals (extensive tillage)	0.7	Dry
VIII — S.W. Ranching (extensive grass)	0.1	Dry
IX — S.W. Tillage (excluding irrigation)	0.6	Dry

end the growing season with leaf area index (L.A.I.) of 1.0 or more; if well managed they can (in contra-distinction to annual tillage crops which often use only half the thermal growing season (Duckham 1963, p. 308) grow, as in parts of Sweden, throughout a season which may be too short for the seeding, growing and harvesting of tillage crops.

To the left of the hydro-neutral zone, in Band III — (extensive) and Band II, the choice of systems, enterprises and economic species is increasingly limited. A falls, excess of T over P increases (i.e. the $\frac{P}{T}$ ratio and h decrease), pH and salinity rise, precipitation (P) becomes less reliable (i.e. has a higher annual Coefficient of Variation). Therefore, high actual inputs or high input ratios are not justified; hence systems become more extensive, enterprise choice becomes limited and crop yields, stocking rates and cash outputs become lower. This is well shown in Fig. 3 for the U.S.A.

To the right of the hydro-neutral zone, i.e. in Bands V — Ext. and VI, A falls, excess of precipitation P over T increases (i.e. the $\frac{T}{P}$ ratio and h decrease), leaching increases, effective working days decrease, the mean thermal growing season declines and its effective duration becomes less predictable. Therefore, high actual inputs or high ratios cease to be economic; choice of systems is restricted and extensive grazing becomes the dominant farming system with forestry and tourism as competing land uses.

Thus, at the extremes (viz: Bands I, II, VI, VII) tillage, even if operationally practicable, is uneconomic. The best agricultural way to use the land is to employ livestock to harvest and concentrate, as muscle tissue or wool, what little vegetational growth there is. Ecologically, the productive potential is poor, often partly because the relief is difficult. Actual input and outputs per acre are low and human population is usually sparse. (Not surprisingly, even within rich countries such as the U.S.A., Sweden or New Zealand, the infra-structure tends to be poorer in these Bands (e.g. roads difficult, schools may be a long way away, the doctor a day's journey by car) and access to market is often locally poorer than in areas with higher productive potential, such as the U.S.A. Corn Belt).

However, in Bands II and III — Ext, and occasionally in Band I (e.g. irrigated valleys in the arid S.W. mountains of the U.S.A.), especially in warm climates, any increase of effective moisture by irrigation raises both A and its reliability. Such areas can thus become effectively hydro-neutral, and naturally enjoy not only high solar radiation receipts but also more effective working days than, say, Eastern England or the Netherlands. Enterprise and system choices are therefore widened. These factors justify high actual inputs and high input ratios into intensive systems, especially where relief is no problem. The combination of high radiation receipts, ample water and high input ratios often results in very high crop or livestock yields if salinity is controlled (e.g. San Joaquin Valley in California, Murray River area in Australia, valleys in Southern Spain, parts of Israel). Finally, if the terrain and soil are suited to mechanisation, extensive unirrigated tillage (e.g. the Plains of Western Texas, parts of Australia, Israel) is found in Band III even though the hydrologic ratio (*h*) is below 0.5.

The preceding paragraphs are summarised in diagramatical form in Fig. 2 whilst the supporting climatic data will be presented in Duckham and Masefield (3).

THE INFLUENCE OF SOCIAL AND ECONOMIC FACTORS

How is this spectrum, which so far assumes advanced economies and easy to mass consumer markets, affected by other social and economic factors?

EFFECT OF INFRA-STRUCTURE AND LEVEL OF ECONOMIC DEVELOPMENT

The positive correlations between (*a*) infra-structure and level of economic development and (*b*) potential and/or actual farming productivity as measured by the level of available industrial inputs and by cereal yields, have been examined by Duckham 1968 and Duckham and Masefield, who give some relevant regression equations. "Rich" countries have high input ratios, a high output of plant equivalent[5] per head and obtain more of their dietary energy from animal products; these latter, depending on ecological factors or national consumer demands, may come either from tillage systems, grassland or alternating systems. But, where both market access is limited and infra-structure and "real" living standards are less well developed (as in Argentina, Uruguay and Chile which are, in fact, nearer rich mass markets than Australasia but are "poorer") then the tendency is to grassland systems, even in potentially alternating or tillage areas (see model (2)). Further, actual inputs, input ratios and output per unit area and/or per man are all lower than in e.g. New Zealand. Paradoxically, this results in as high % of animal calories in the diet as in "rich" countries.

POPULATION DENSITY

Where the total population per unit of farmed area is high, farming is usually as intensive, in relation to productive potential, as the level of economic development permits. Input ratios are positively correlated with level of economic development. Where both population density (D_s) and economic deve-

[5] The plant equivalent of a diet is the dietary *Kcal* from crop plant sources plus 5,5 times dietary *Kcal* from animal products (Duckham and Masefield).

TABLE 2. Population density and farming systems in temperate zones (1965 or nearest available year)

1 Country	2 National Population per hectare of farmland (D_s) (Number) 1965	3 Dietary Energy (Kcal, K_f and K_a per head per day 1964	4 Plant Equiv. Consumption ($K_f - K_a + K_a \cdot 5{\cdot}5$) Kcal per head per day 1964	5 Ecological Potential ($A-E-T$ in $T-G-S$) (A)	6 Operational Potential	7 Level of Development „Real" consumption per head (*B*) (Beckerman 1960)	8 Fertiliser Usage kg per head of population (as indicator of industrial inputs) (1965/66)	9 Cereal Yield kg/ha. per annum 1963/65	Major Farming Systems
NETHER-LANDS	0.83	2,890 (840)	6,670	20.5"—24"	Good	45.0	45.7	3,842	Intensive Tillage Intensive Alternating Intensive Grazing
JAPAN	2.31	2,320 (255)	3,468	19"—34"	Medium/ /Poor	29.7	19.7	4,256	Intensive Tillage
EGYPT	1.84	2,930 (176)	3,722	0"—7"	Good	6.4	10.3 (1964/65)	3,313 3,313	Intensive Tillage
URUGUAY	0.03	2,970 (1,306)	8,847	31"—36"	Good	16.2	12.0	972	Extensive Grazing
MOROCCO	0.06	2,480 (n.a.)	—	2"—25"	Poor	8.1	3.3	758	Extensive Grazing Extensive Tillage Tree Crops
LIBYA	0.02	1,910 (153)	2,598	0"—19"	Poor	n.a.	3.2 (1961—62)	307	Extensive Grazing

Notes: (a) In Columns 3 and 4 K_f = total calories, K_p = crop calories, K_a = animal calories in Kcal per head per day.
(b) In Column 3 the figures in brackets are animal Kcal per head per day.
* Without Irrigation

lopment (B) are high and the farm input intensity is absolutely high, and the input ratios are high, then the animal products which are prominent in the diet may, in hydro-neutral zones, as just noted, come from tillage, alternating or grassland systems (U.K., Netherlands).

In Japan, the population density is high, the living standards (B) are rapidly rising but still not markedly high, and input ratios are fairly high. Here, despite great excess of P over T and the fact that h (the hydrologic ratio) is only about 0.5, the emphasis is on tillage crops for humans, though imports of animal products are increasing. Where population density per unit farm land area is high but economic development is relatively low (e.g. Egypt[6]) and where the area is hydro-neutral (or is made so by irrigation) then input ratios tend to be low and the imperative need for energy foods, or for foreign exchange to buy dietary calories, places the emphasis on tillage systems for food and export crops, e.g. cotton, as in the U.A.R. (Egypt). Where population density is low, then farming systems tend to be more extensive and more in grassland (Uruguay and eastern Argentine) dispite h being greater than 0.8 and, to some extent, irrespective of stage of development (B) and of productive potential. Where population density, economic development and productive potential are all low, systems are extensive (Morocco). Tabele 2 attempts to illustrate these generalisations by a few examples.

DISTANCE FROM MARKET

Almost irrespective of productive potential, poor market access forces farmers into crop enterprises which either have high value outputs per unit weight (e.g. cotton or dried raisins) or into livestock which can concentrate land and climatic resources by converting grass into transportable high value meat or milk products or wool that can bear heavy transport costs. Areas of poor market access, which also have low and unreliable A (actual estimated evapo--transpiration) and which are outside the hydro-neutral zone, are often in extensive grassland systems with the emphasis on wool or livestock breeding and raising without fattening (e.g. parts of Australia and New Zealand). Tariff and other trade or disease control barriers in export markets have a broadly similar effect in reducing the proportion of tillage area in exporting countries. Finally, (as noted above) remote flat semiarid area (with $h>0.8$) are often suitable for tillage, especially transportable cereals; they make an important exception to Model (1).

[6] The high cereal yields in the U.A.R. (Egypt) reflect in part plant nutrient input from the annual inundation by the river Nile.

FARMING SYSTEMS IN THE TROPICS

In the tropics it is less easy to generalise about farming systems or suggest quantifiable models both because of the paucity of statistics and because in many areas there has been lees stability due to the frequency of political changes. Instances given by Duckham and Masefield exemplify the fact that, in the tropics, the theoretically environmental possibilities for plant growth, i.e. the production potential, often cannot be fully exploited because a perfect "fit" of cropping plan to climate cannot be obtained for either natural or economic reasons. Thus it is impossible to plant all crops exactly at the beginning of the rainy season when they would derive most benefit from it, both because the soil may have been too hard to cultivate in the preceding dry season and precious weeks have to be wasted in this operation after the soil has been wetted, and because so much simultaneous planting would present an impossible demand on labour resources. Again, with a single wet season of say five months, and a choice of crops each of which matures in three or four months, the planting of any of these crops will "waste" one or two months of useful rain, which is however too short a period in which to mature a second crop. Another difficulty in applying meteorological data to agriculture for model making in the tropics is that, with rainfall variability (i.e. high coefficients of variation), statistics of mean annual rainfall provide little indication of the risk to the farmer in growing crops with a certain rainfall requirement. A statistic which is therefore now coming widely into use is the probability of a certain minimum rainfall being attained in a year. Two interesting maps on this basis have been published by the East African Royal Commission (1955) showing the percentage probability of a minimum rainfall of 20 and 30 inches respectively being attained in any one year in different parts of the region.

The i n t e n s i t y of farming systems in the tropics is often determined not by the natural environment but by the density of the human population. In a subsistence economy, denser human populations must tend to produce smaller individual farms and at the same time a greater abundance of farm labour, thus inducing more intensive production from the land whether or not it is best suited for such use. The extreme case is a Chinese farmer with less than an acre of land, whose farming becomes indistinguishable from horticulture and who may take five or six crops of vegetables a year, fertilizing them largely with his own excreta and watering them manually, irrespective of the soil type or trainfall.

Population density also affects technical methods in farming. Thus transplanting of rice, which generally gives a higher yield but needs more labour than sowing direct into the field, is commonly used in the rice-growing regions of Asia which are densely populated but is rarer in the more sparsely populated African continent. Stall-feeding of cattle, as opposed to grazing, is another adaptation to dense human population and is practised in some heavily populated islands in the West Indies, Bermuda and Mauritius, and in certain densely populated parts of India. This very important factor of population density is itself, in the tropices, as often as not, unrelated to particularly favourable factors of the environment but simply due to historical accident.

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APPENDIX

TENTATIVE PREDICTIVE MODELS FOR TEMPERATE ZONES

a) System Location Model

Very broadly, the land use (viz: plantation, tillage, alternating, grassland (Table 1) of temperate farming systems in a given site or district may be expressed, and theoretically predicted, in terms of five main variables:—

I[7] A = Actual evapo-transpiration in the thermal growing season or, in warm dry climates, in the hydrologic growing season.

II h = the ratio of mean annual precipitation (P) to potential evapo-transpiration (T) in the thermal growing season with the smaller quantity used as the numerator thus:

$h = \frac{T}{P}$ where $P > T$, i. e. on the wet side of the point of hydro-neutrality, or

$h = \frac{P}{T}$ where $T > P$, i. e. on the dry side of the point of hydro-neutrality.

III L_o = the adverse effect of local difficulties (e. g. awkward relief, frost pockets, liability to flood, unworkable clay soils, etc.) and

L_m = the adverse effect of difficulties of access to market (including transport facilities, actual mileage, tariff, quota exchange rate and disease barriers, etc).

IV D_s = Human population per acre of farm land (*superficie agricole*).

V B = Index of socio-economic development, when U.S.A. = 100 as measured, for simplicity, by the *Beckerman Index* (in Simantov and Tracy 1966).

Study of available data suggest that if the proportion of farm land surface devoted to tillage is S_t and to grassland or grazing (e. g. of scrub) is S_g then, as a first approximation.

Model (I) $$\frac{S_g}{S_t} = g.\ A.\ h - i\ (L_o + L_m) + j.\ D_s - k.\ B$$

where g, i, j and k are constants.

Thus, as A declines, as aridity or wetness increases (i. e. as h decreases) and as local constraints and/or market access constraints increase so there will be a tendency for tillage systems to give

[7] T, P and A are all taken from Thornthwaite Associates 1962—65 which are based on Thornthwaite and Mather 1955. The limitations of the Thornthwaite method are recognised.

way to grazing or grassland systems. However, where population density (D_s) is high and development (B) is medium (Japan) or low, the need for "edible calories", i. e. for tillage crops for human use, may offset the effects of climate and local difficulties which elsewhere would result in grassland. Further, as noted in the text, in areas where $T > P$, e. g. parts of Australia, extensive tillage or alternating may be found where $h = 0.55$.

This model part of which is illustrated in the notional diagram, Fig. 2, neglects plantation systems (e. g. permanent orchards) and does not specifically identify the location of alternating systems. But, applying the definitions in paragraph 1, it implies that alternating systems (viz: where tillage is $\leqslant$ 75% and $\geqslant$ 25% of the farmed area and tillage and grassland are alternated), will not be found where $\frac{S_t}{S_g} > 3$ or $\frac{S_t}{S_g} < 0.25$ but are likely, although not certain, within areas where $\frac{S_t}{S_g} \leqslant 3$ and $\geqslant 0.25$. (The existence of alternating systems cannot be shown by analysing census statistics of areas sown or cropped because more than one system may be found on the same farm or in one district).

b) Input Ratio Intensity Model

The input ratios are, broadly, positively correlated with development level (B) and probably with $A. h$ (see Fig. 3)[8].

So input ratios (R) will, as a first approxomation, be

Model (2) $$R = m.\ A.\ h. - n.\ (L_o + L_m) + q.\ B^f$$

where m, n and q are constants and B^f is the development level (*Beckerman Index*) corrected for the proportion of total consumer income spent on food. Income elasticity of demand for food is higher in developing countries with a low B than it is in advanced countries; (see Simantov and Tracy 1966 for some useful data on income elasticity).

In brief (I) input ratios are positively correlated with development (B) and probably with $A. h.$, local problems, and market access; (II) plant equivalent consumption (K_e) per head is closely positively correlated with input ratios and, in turn, with development level (B). Thus, both input intensity per unit of productive potential and plant equivalent supply (which is the same as food resource consumption per head) (K_e) tend to rise as level of development (B) increases. But low $A. h.$ as well as major local difficulties (L_o) and poor market access (L_m) may depress input ratios (i. e. depress actual input intensity per unit of productive potential).

c) The above models relate to an hypothetical temperate area which neither imports nor exports foods. They fail to take account of non-food enterprises (e. g. cotton, wool) which may be grown and exported to earn foreign exchange to buy other foods (e. g. wheat), consumer-goods or capital goods and services for development. But despite their defects, the models may serve, firstly to clarify the complex of factors determining the location and intensity of farming systems and their relation to economic development, population density and food consumption standards; and secondly to encourage others to test the hypothesis and to produce better models.

Fig. II summarises the climatic aspects graphically but notionally; it also shows the relation between $A. h.$ and input ratios in developed region in which socio-economic conditions are geographically constant.

Fig. III shows the gross sales and inputs per inch of A (i. e. per inch of Thornthwaite's A-E-T) for 9 farms in the U.S.A. and relates them to annual A in inches and to h. Farm type II is intensive poultry farming near New York and not therefore subject to climatic controls.

[8] Fig. 3 shows the input and output (in dollars) per inch of A for 9 types of U.S. farming and relates them to A and h.

BIBLIOGRAPHY

[1] A. N. Duckham, *Agricultural Synthesis: The Farming Year*, London 1963.
[2] A. N. Duckham, *Chemistry and Industry*, p. 903—908,6 July, London 1968.
[3] A. N. Duckham, G. B. Masefield, *Farming Systems of the World* (in the press — to be published by Chatt and Windus, London).
[4] East African Royal Commission 1953—1955, *Report Cmd.* 9475 H. M. Stationery Office, London 1955.
[5] E. S. Hills, (ed)., *Arid Lands: a Geographical Appraisal*. London 1955.
[6] G. B. Masefield, *Food and Nutrition Procedures in Times of Disaster*, FAO, Nutritional Studies No. 21, Rome 1967.
[7] H. J. Rutter and S. H. Whitehead (eds), 1963, *The Water Relations of Plants*, Oxford 1963.
[8] A. Simantov, M. Tracy, *O. E. C. D. Observer 22*, p. 30, O.E.C.D. Paris 1966.
[9] C. W. Thornthwaite, and Associates, *Publications in Climatology* 1962—1965, *15*, *2*; *16*, *1*; *16*, *3*; *17*, *1*; *17*, *3*; *18*, *2*; Centerton, New Jersey.
[10] C. W. Thornthwaite and J. R. Mather, *Publications in Climatology* 1955, 8, 1; Centerton, New Jersey.

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CONCEPTUAL MODEL OF FOUR TYPES OF WORLD AGRICULTURE

PREFACE

This conceptual model of world agriculture is built up in light of the tact that most of the world's population live on farms, and most of these are peasants, and that the instability of the world is closely connected with them. It aims at understanding the geography, as well as the agricultural geography, of the world.

The motive which generated this idea arose from my travels and research experiences in East and Southeast Asia, the South Pacific and in the United States as well as in Japan. The time-consuming research in erstwhile tribal society in New Zealand made in reconsider "peasant agriculture", which was studied mainly in the fields of anthropology and economics, from the standpoint of geography. This idea was further encouraged through my intensive investigation of the farming on a large scale operated by the Europeans in New Zealand. My close contact with peasant agriculture has been of great value to my field research in New Zealand, and I have been further stimulated by the discussion with K.B. Cumberland and G.J. Fielding, and some pioneering papers in the sphere of geography[1].

Jerzy Kostrowicki and Nicholas Helburn: *Agricultural Typology, Principles and Methods* (cyclostyled, 1967) have clearly pointed out three major criteria for agricultural typology: social characteristics, functional (organizational and technical) characteristics, and production characteristics. I agree

[1] G. Pfeifer, The Quality of Peasant Living in Central Europe. in William L. Thomas (ed.), *Man's Role in Changing the Face of the Earth*, University of Chicago Press, 1955, pp. 240—277. E. Estyn Evans, The Ecology of Peasant Life in Western Europe, *Ibid.*, pp. 217—239. H. Bobek, The Main Stage in Socio-Economic Evolution From a Geographical Point of View/in Philip L. Wagner and Marvin W. Mikesell (eds.), *Readings in Cultural Geography*, The University of Chicago Press, 1962.

with them completely. I have tried to go further to build up a "conceptual model of four types of world agriculture". There may be discussion about the relation between typology and a model, but the paper by Professors Kostrowicki and Helburn has also pointed out the necessity of building up model types. In my view, agricultural typology may be the base for models concerning world agriculture. In this connection, the theoretical-deductive method has also been applied in this paper.

GENERAL STATEMENTS

My theoretical framework for building up a conceptual model of world agriculture is along the lines of the functional-cultural (social) approach. As dichotomy between the two lines of approach, functional organization and cultural origin, has been long urged, my proposed approach may sound strange. It is well known that the "functionalist" school focusses its attention upon investigating into functional organization today while the "historical" school considers the cultural origin. My research experiences of several societies of different cultures made me realize how functional organization was deeply rooted in social and cultural structure. The agriculture in "developing countries" may be understood with due regard to cultural origin. This may be very true with the agriculture in India.

As a criterion land tenure is adopted here in constructing a conceptual model for world geography (the highest level): Land tenure is the base for farming and social activities. Productivity and stability are most desirable for agriculture in any country. Thus, stability, productivity, and land tenure were adopted in this paper as operational concepts: productivity and stability are deeply rooted in land tenure. The model built up by applying tenure as an operational concept of the first importance is significant in view of its social cultural aspects as well as with regard to productivity and stability. The above fourfold models were constructed by giving a distinct place to "peasant" as opposed to "tribal", and "capitalistic" agriculture.

The term "peasant" was first introduced into the academic field by A.C. Chayanov (1923), and R. Redfield (1941), and many scholars have contributed to this theme. I have also contributed several papers [2].

[2] H. Ishida, A Schedule to Frame a Conceptual Model for a Classification and Regional Division of the Pacific and Outer Asia on the Basis of Traditional Socio-Economic Complex, *Geographic Sciences*, No. 23, 1964. pp. 231—244. Idem, *A Geography of Contemporary Maori Agriculture*, Unpublished Ph. D. Thesis, University of Auckland, 1965. Idem, A Geographical Study of Pastoralism and Traditional Rough Grazing Area in Japan (3), *Bulletin of School of Education; Okayama University*, No. 18, 1965. pp. 78—118. Idem, An Introduction to a Geography of Contemporary Maori Agriculture, *Bulletin of the School of Education, Okayama University*, No. 21, pp. 57—70, 1966. Idem A Conceptual Model for Agricultural Geography. *Review of Historical Studies*, Hiroshima University, No. 100, pp. 173—181, 1967.

Many stimulating books and papers have recently appeared concerning "peasants"[3].

A. TRIBAL, SUBSISTENCE AGRICULTURE

Tribal agriculture is based on the customary use of tribal land, although varieties of land tenure are now practised. Multiplicity of owners of the same land is the most characteristic trait of tribal agriculture. Instead of ploughs, crude implements are usually used. Fertilizer is seldom applied. Thus tribal agriculture is land-extractive, and although the tribes live in compact villages, they are willing to shift when necessity compels. Community activities are more dominant that individual activities. Togetherness and organic coherence are preserved, and enforced by traditional sanctions and ancestral social bonds. Tribal agriculture may be subdivided into the following major phases according to land tenure:

a) communal use of tribal land
b) customary use of tribal land, on family group level
c) customary use of allotment of tribal land, on family group level

Each subdivisions may be further divided according to "shifting-swidden-sedentary" continuity.

B. PEASANT AGRICULTURE

Peasant agriculture is distinct from tribal agriculture in land tenure; peasant agriculture is based on land individualization; tribal agriculture on communal land tenure. In this regards, there is no distinction between peasant agriculture and individualistic, capitalistic agriculture. However, there are big differences in the scale of holdings, technological levels, production and productivity. Peasants live on small holdings, using ploughs as well as spa-

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[3] S. H. Franklin, Reflections on peasantry, *Pacific Viewpoint*, vol. 3, No. 1, 1962, pp. 1—26. T. G. McGee, The Rural-Urban Continuum Debate, The Preindustrial City and Rural-Urban Migration, *Pacific Viewpoint*, vol. 5, No. 2, 1964, pp. 159—181. S. H. Franklin, System of Production: Systems of Appropriation, *Pacific Viewpoint*, vol. 6, No. 2, 1965, pp. 145—166. D. Thorner, Peasant Economy as a Category in Economic History, *Economic Weekly*, pp. 1245——52, 25: 28—30. L. A. Fallers, Are African Cultivators to be called "peasants"? *Current Anthropology*, 2,2, Chicago, pp. 108—110. M. Nash, *Primitive and Peasant Economic Systems*. Chandler Publishing Company. E. R. Wolf, *Peasants*, Prentice-Hall, 1966. James M. Blaut, A Geography and the Development of Peasant Agriculture (in) Saul B. Cohen, *Problems and Trends in American Geography*, pp. 200—220, Basic Books, Inc. London, 1967. G. Dalton (ed.), *Tribal and Peasant Economics.* The Natural History Press, New York, 1967. L. Symons, *Agricultural Geography*, B. Bell and Sons, Ltd. London, 1967. M. Moerman, *Agricultural Change and Peasant Choice in a Thai Village.* University of California Press, Berkeley and Los Angeles, 1968. Wayne S. Vucinich (ed.), *The Peasant in Nineteenth-Century Russia*, Stanford University Press, California, 1968. Jack M. Potter, *Capitalism and the Chinese Peasant. Social and Economic Change in a Hong Kong Village*, University of California Press, 1968.

des and hoes. Productivity per capita is low even though productivity per unit area is high. Attachment to the individual holding and to the results of human toil have characterized peasant agriculture. A strong family sense and attachment to the locality have given peasant agriculture and peasant society great stability, but they have also caused the stagnation of this type of agriculture.

In an old established compact village, fragmentary parcels of land and animal-powered cultivation are characteristic features of peasant agriculture. The multiplicity of parcels of land and the stratified socio-economic interaction of tenants, small holders and landlords are the most serious problems of peasant agriculture. Land reform is the keystone for the improvement of peasant agriculture. The significance of land reform for peasant agriculture is as important as is title improvement to tribal agriculture. There is an urgent need for the establishment of individualistic, commercialized farms which are economic units.

Some catchwords, such as "The peasant dilemma"[4], "The paradox of peasant existence", have evolved, and some more fundamental concepts have been described as follows: "defensive ignorance", "cultural broker" and "the dyadic contract". Such conceptual tours de force have permitted fresh integrations of previously unrelated aspects of culture and society.

Peasant agriculture may be subdivided into the following three categories: subsistence peasant agriculture, semi-commercial peasant agriculture and commercial peasant agriculture.

The transformation pattern may be classified as follows:

1) conservative transformation pattern
2) gradual transformation pattern (with development of productivity per unit are and/or per capita)
3) rapid transformation pattern

A.H. Franklin constructed a model for "peasantry" as opposed to "capitalist" and "socialist" in the field of geography, and subdivided peasant agriculture into the following three categories:

1) peasant agriculture as part of a predominantly industrial economy
2) peasant agriculture in an area where the peasants find their position becoming worse owing to the accelerated rate of population growth and much poorer industrial development. They can not receive subsidies from a richer industrial sector but must pay a significant proportion of the cost of economic development.
3) peasant agriculture in a society which is composed of agriculturalists who are not sedentary cultivators, or who lack many elementary features of peasant life, but who, if the plans of western experts are imp-

[4] Eric R. Wolf, *Peasants*. pp. 12—17, Prentice-Hall, 1966. S. H. Franklin, Reflection on the Peasantry. *Pacific Viewpoint*, vol. 3, No. 1, 1962. M. Moerman, *op. cit.* p. 19.

lemented, will acquire many of the features of a modernized peasantry. Some of these societies are faced with shortage of land and the majority are experiencing rapid population growth. Again, their industrial sectors are of negligible size and in some case the endowment of natural resources is unfavourable for industrial development.

Some general characteristics of the peasant are that he does not choose to be a peasant but is born into peasantry. He takes it his being peasant for granted. His way of life and strong sentimental attachment to the locality are reflected in family-sized holdings of land and low productivity. Despite different features of physical and climatic environment, the peasantry of the world has a common appearance, material culture and value orientation.

C. INDIVIDUALISTIC, CAPITALISTIC AGRICULTURE

Individualistic, capitalistic agriculture is based on land individualization There is an essential similarity between peasant, semi-commercial agriculture and individualistic, capitalistic agriculture in that in both we find land individualization and attachment to personal holdings.

Dispersed homesteads on consolidated farms are distinctive of the landscape in areas where individualistic, capitalistic agriculture is established. Individual activities, active participation on the principle of self-help and mutual help are dominant in this type of agriculture. Sophisticated farming techniques, together with effective business acumen, have been reflected in high productivity per capita as well per unit area. The produce from highly commercialized production has contributed much to international trade. These characteristics make individualistic, capitalistic agriculture distinct from the peasant and tribal systems.

D. CO-OPERATIVE AGRICULTURE

Co-operative agriculture is based on the co-operation of farming. In order to overcome major problems associated with small or medium-size individually operated farms, co-operative agriculture has recently been recommended. The co-operative movement represents a growth of practice rather than of theory. It has been recognized only recently that the co-operative was really one of the economic miracles of the last century. Co-operative work is no more communal work than is tribal economy "primitive communism". In co-operative work, a man works as a member of a functional society and individuality does not disappear. This contrasts sharply with communal work in tribal agriculture where a man works as a member of primary group and thus loses his individuality in the group activity.

There are two distinct types of co-operative agriculture:

a) Communistic, collective agriculture

b) Capitalistic co-operative agriculture

(a) Communistic, collective agriculture

"Collective farms have been tried for a variety of reasons. This is secondary to a religious or ideological aim. It is wrong to judge all by an economic standard"[5].

Collective farms are features of communist countries in both Europe and Asia. Both Russia and China began their revolutionary governments by a distribution of land to individual peasants and the encouragement of co-operatives. Collective communistic agriculture was begun after the opportunity provided by the confiscation of landlords' property, which was followed by a re-distribution to collective farms.

b) Capitalistic, co-operative agriculture

Capitalistic, co-operative agriculture has most often gradually developed in countries where individualistic, capitalistic agriculture has been established, while the communistic, collective agriculture has been quickly applied in countries where peasant agriculture was dominant.

The need for amalgamation of one-man farms has become evident with the development of farming mechanization and bussiness. "In the United States cooperate farms (some of them still family units, but others virtually "factories in the field") account for 12 percent of all farm units, forty percent of the area in farms, sixty percent of the value of all farms and seventy percent of employed labour on farms"[6]. In New Zealand, where productivity per capita is highest of the world, amalgamation of farms and "industrial" operation are now recommended by many agricultural experts. However, the one-man farm philosophy has hitherto been too strong to permit co-operative farming to develop.

APPLICATION OF THE FOURFOLD CONCEPTUAL MODEL TO SOME COUNTRIES

People engaged in tribal agriculture are certainly in the minority, however vast its area may be. Tribal agriculture as a geographical category is significant in understanding world agriculture. The customary way of allotting tribal lands in the Tonga Islands in the Pacific may be significant in understanding how the *Gieng Tien* (allottment) system in China and the *Handen* (allottment) system in Japan came about. Remnants of tribal tenure are seen in individualistic, capitalistic agriculture as well as in peasant agriculture. The development process of Maori agriculture shows how tribal land tenure and the associated sentimental attachment to the locality checked the smooth development of its agriculture. In countries where peasant agriculture is dominant,

[5] Louis P. E. Smith, *The Evolution of Agricultural Co-operation*, Oxford 1961, p. 74.
[6] *Ibid.*, p. 37.

de facto common land still comprises a large part of the mountains. In a predominantly industrial country like Japan, for example, where peasant agriculture has been profooudly modified, folk land remains unindividualized on a large scale in mountain areas. Maori agriculture, which could best be described as "shifting cultivation", passed directly from its traditional Polynesian tribal form to its contemporary pattern on a large scale, without going through the intermediate stage of small-scale individual subsistence operation, that is, without at any stage having the form of peasant agriculture on a family basis. Though Maori farmers are apparently individualistic, capitalistic and co-operative farmers, they are still deeply rooted in multiple ownership. The complex tenure of the Maori has retarded the development of individual, capitalistic agriculture and co-operative farming.

In the United Kingdom, as much as 4 percent of land still remains as common land, the larger part of which is used for grazing. The common land is considered to have been the remnant of the ancient communal land and is of popular concern, today[7].

Peasant agriculture developed into individualistic, capitalistic agriculture in western Europe as a result of the agricultural revolution, the industrial revolution and emigration to the United States. However, there were differences of agriculture even in one country: southern France was still confronted with remnants of peasant agriculture while northern France was witnessing the development of individual, capitalistic agriculture. And there are striking contrasts in the social aspects as well as in production. The legacy of sentimental attachment, associated with peasant agriculture, has long persisted in individualistic, capitalistic agriculture. Strong attachment to individual holdings has often been reflected in a philosophy completely replaced by that of agriculture as a source of personal income in the case of individualistic, capitalistic agriculture. English Society until the mid-eighteenth century was a predominantly rural and a peasant society[8]. Even today, "Farming is a way of life" is one of those peculiarly cherished statements which is on the way out. It lingers on in the pages of women's magazines and in the pages of those publications which deal seriously with sport and sentimentally with family"[9].

Japanese agriculture today is best described as a profoundly modified peasant agriculture in an industrialized and urbanized society[10]. It is characterized by

[7] L. D. Stamp, The Common Lands and Village Greens of England and Wales, *Geographical Journal*, vol. 130, 4, pp. 457—469.

[8] J. Thirsk, *English Peasant Farming*, Routledge and Kagan Paul, 1957.

[9] K. Dexter, D. Barber, *Farming for Profits*. Penguin Book, p. 32, 1961.

[10] In this respect, precise terminology for agricultural operators in Japan has rarely appeared. The following descriptions are among the few that exist: By the same token, it would be adequate to speak of "farmers" as a general term, "peasant" being much more congent. (S. Tobata, *An Introduction to the Agriculture of Japan*, Agriculture, Forestry, and Fisheries Productivity Conference, Tokyo, 1958, pp. 48—49).

a high productivity per unit area and also by a slow shift to a capitalistic and co-operative agriculture.

Characteristics of peasant agriculture are still evident in Japanese agriculture: fragmentary plots, small holdings, low productivity per capita, compact villages and strong village ties, the importance of the family as an operational unit of agriculture, fairly strong kinship ties. High productivity per unit area, a high degree of application of fertilizers, and mechanization are rather similar to individualistic, large scale capitalistic agriculture. The inconsistency and instability of productivity in the operation of the newly developing dairy-farming can be contrasted with the consistency and stability of productivity in the operation of the long-established rice-culture. *De facto* folk land (common land) is still existent on a large scale in mountain areas and has retarded the utilization of the mountains. Japanese farming has not fully operated on the principle of capitalism: farming is not financed by banks. Few farmers present a balance sheet of farming operation. The consolidation of fragmentary plots as well as the enlargement of small holdings have not yet been evident, as is seen in Table 2. Co-operative farming is still in the test stage. It is vital for Japanese agriculture to remove the remnants of peasant agriculture. Historical perspective must be taken into account for the persistent survival of peasant agriculture in Japan. The predominance of small-size holdings in Japan is generally attributed to the natural conditions of the rugged topography of the island and also to the inherent features of rice cultivation, but this is not the whole explanation.

Individualistic, capitalistic agriculture on a large scale was strongly recommended in the 1870's. The ranch system was also recommended, though in a modified form, in mountain areas where traditional rough grazing was operated on a communal basis. Those who advocated capitalistic agriculture on a small scale were routed from the Government by those who advocated peasant agriculture on a small scale. Thus, it became more profitable for a landlord to rent

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The *peasants* uprisings that arose frequently towards the end of the Tokugawa rule were mainly for protests against the high rate of taxes. The operating landowner's land was reduced to 3 *cho* and since the measurement of acreage to be held by landowners and the qualifications of the resident landowners were strictly defined, the actual acreage that was to be finally released to *peasants* and *tenants* surpassed the original plan (p. 93). ...According to the Survey of Farm Household Economy, the *farmers* who manage land over 2 *cho* can cover their expensives only with their agricultural income. But mere 10 per cent of total households belongs to a group of those, and 90 per cent of total households, of which petty *peasant* holdings less than 1 *cho* constitute 75 per cent, must make both ends meet of their family finance with some non-agricultural income (p. 113). *A Century of Technical Development in Japanese Agriculture*, Japan FAO Association, 1959 use term *peasant* as opposed to *farmer*, *tenant*).

The word "peasant" comes readily to mind when we think of those who work the soil in such diverse regions and with such differing economic organisations as are to be found in Greece, Chile, Japan and Russia. (L. Symons, *Agricultural Geography*, G. Bell and Sons, London, p. 58.).

this land to tenants than to operate all his land himself by employing labour. The enclosure of a fairly large part of the common lands in mountains was carried out by the Government towards the beginning of the 20th century.

It was revealed by statistics that the ratio of the number of middle size holdings, by Japanese standards, to the total number of holdings increased in contrast with the decrease in the ratio of large-size holdings and small size holdings. And this gave a standby to those who advocated peasant agriculture on the traditionally small scale. In 1923, one of A. V. Chayanov's theories *Die Lehre von der bauerlichen Wirtschaft* was translated from German into Japanese, and won a reputation in Japan[11]. In Japan, where small-scale holdings were predominant, only a few capitalistic farms by world standards were operated, but most of them did not last long. At the time of the land Reform of 1948, approximately 624 farms may be said to have been capitalistic farms on a large scale, by Japanese standards. Particulars are shown in Table 1.

TABLE 1. Capitalistic farms in Japan in 1948

Types of ownership	No. of farms
Farms operated by landlords who rented a part of their land to tenants	219
farms operated by owners	216
owner farms	82
part owner farms	112
leased farms	22
farms composed of leased lands and the self-owned land, a part of which is rented too	12

Source: Kuzuo Fukumoto, (—) *A sketch of the development of capitalistic agriculture in Japanese agriculture*, Kaihosha, Tokyo 1949.

Land reform played an important role in emancipating tenants from landlords and in opening the way to democracy, but the average size of the cultivated unit has decreased from 2.4 acres in 1944 to 2 acres in 1950. Furthermore, the Agricultural Land Law was enacted in 1952 with the object of defending emancipated peasants against the revival of landlordism. However, economic and social environments have changed, and now tend to accelerate urban movement, resulting in an increase in part-time peasants and the social breakup of farming. As a result, the Agricultural Land Law has now come to retard the enlargement of farming holdings: Table 2 reveals how stagnant the enlargement of farming holdings has been.

[11] For detailed information see A. V. Chayanov, *The Theory of Peasant Economy*, Preface, Richard D. Irvin, 1966.

TABLE 2. Number of farming households and their average area of holdings

Year	No. of farming households	Average area (in acres)
1955	6,042,945	2.1
1960	5,975,000	2.5
1965	5,976,000	2.4

An Agricultural Land Amendment Law is to be proposed to the National Diet by the Liberal Party with a view to encouraging the enlargement of opertors' land holdings by liberalizing transactions in farm land.

GEOGRAPHIA POLONICA 19, 1970

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AN APPROACH TO THE DEFINITION OF THE PLANTATION

To point out that there are many problems in attempting both to classify agricultural systems and to find adequate definitions of them is clearly quite unnecessary. For those whose interests are specifically in the economic geography of the tropics, however, there is a particularly intractable problem in any attempt to give a degree of precision to the use of the term plantation which, like so many lacking exact definition, tends to mean different things to different people. There appears particularly to be a major difference of opinion as to exactly what type of agricultural system should be described as a plantation between writers on the opposite sides of the North Atlantic. North American writers on the topic, understandably, have often been strongly influenced by the traditionally so-called plantation system of their own south[1] — indeed M. Prunty goes so far as to state that "there has been a semi-automatic association of 'plantation' with 'cotton'"[2] but not to qualify his statement by any phrase such as "in the United States". On the European side of the Atlantic on the other hand, experience has primarily been gained from work in tropical dependencies — especially in Asia and Africa — so that, to the British geographer for example, the term is much more likely to be associated with rubber or tea than with cotton production.

The danger that characteristics observed in the area in which individual geographers are particularly interested should be thought of as typical circumstances or trends is ever present, so that H. F. Gregor — apparently with extra-tropical experience primarily in mind — speaks of the continuation of the

[1] In E. T. Thompson, "*The Plantation: A Bibliography*", Pan-American Union, Washington, 1957, 513 references are listed under the sub-heading B. The South (pp. 34—62). The same bibliography includes 99 on the West Indies and Guianas (pp. 62—68) and 26 on Malaya, South-east Asia and the Dutch East Indies (pp. 74—76).

[2] M. Prunty, The Renaissance of the Southern Plantation, *Geographical Review*, 45, 1955,

"mechanization of hand procedures"[3], whilst the Malayan or Indian grower knows that rubber trees are still tapped by hand and tea bushes still hand--plucked. In some areas — for example the U.S.S.R. and, probably in the near future, North Queensland — tea is plucked by a machine somewhat reminiscent of a lawnmower, and in Japan light hand shears have been in use for more than half a century[4], yet the bulk of the world's tea is still plucked by hand, and likely long to remain so, in those parts of the world where the super-abundance rather than the cost of labour is most marked.

An historical approach to the problem of the plantation provides a number of clues to its distinctive character, but it seems hardly necessary to trace it as far back as the Middle Ages or to the Irish plantations[5], whose purpose was primarily political and which were imposed on the Irish countryside in an economic environment very different from that which existed after the Great Age of Discovery, when the West European nations aimed to produce tropical crops for their home markets. The first plantations in the western hemisphere, for example in Virginia, were admittedly plantations of colonists, but basically, as J. S. Mill[6] noted way back in 1848, the European powers' plantation colonies were places where they found it "convenient to carry on the production of sugar, coffee and a few other tropical commodities". The production of crops such as tobacco, sugar or coffee which could, in the days of small sailing vessels, satisfy a demand in a metropolitan market 4 to 5 thousand miles away, required considerable field work especially at planting or harvesting but also, in a tropical environment, for weeding, pruning and general cultivation. In the relatively empty parts of the tropics where sufficient suitable land was available for the necessary large scale production, imported labour was needed and provision had to be made for its housing and feeding as well as for essential activities such as carpentry and blacksmithing. There thus evolved a typical, largely selfcontained commercial unit characterized by the large scale production, by labour-intensive methods, of tropical crops for export, and these characteristics — large size, labour-intensive methods, tropical export crops — have traditionally been accepted as distinguishing the plantation. Government statisticians have seized various of these readily measurable criteria as bases for their own definitions of the plantation, but have done so in different, and therefore frequently not comparable, ways — so that an area of 100 acres or more distin-

H. F. Gregor, The Changing Plantation, *Annals of the Association* of *American Geographers*, 55, 1965.

[4] C. R. Harler, *The Culture and Marketing of Tea*, London, Oxford University Press, 3rd ed. 1964, p. 65.

[5] R. A. Butlin, Urban Genesis in Ireland, 1556—1641, pp. 211—226 in R. W. Steel, and R. Lawton, (eds.) *Liverpool Essays in Geography*, London, Longmans, 1947.

[6] J. S. Mill, *Principles of Political Economy*, London, Longmans, Peoples Edition, 1867, p. 415.

guishes a plantation from a smallholding in Malaya, 50,000 trees in Brazil, a labour force of at least five tenants in the thirteenth census of the United States (1910), and a specified list of crops in the British government publication "Plantation Crops".

The traditional plantation in the Americas, which may perhaps be typified by the West Indian sugar plantation described in 1793 by planter and historian Bryan Edwards[7], which covered about 1000 acres, of which 200 to 300 acres was under sugar cane and an equivalent area under each of food crops and woodland, underwent considerable changes consequent upon the emancipation of the slave labour force, begun in the British territories in 1843 and completed throughout the western hemisphere by 1888. Especially noticeable has been the modification of the systems of cultivation of those crops such as sugar, cotton, tobacco and coffee, whose production is located primarily on the tropical margins or in the subtropics. The traditional cotton plantation of the United States "south" was modified into varieties of fragmented "sharecropping" units[8,9]; many of the West Indian sugar plantation areas turned to the smallholding production of alternative crops — limes, cotton, arrowroot, groundnuts, etc[10]; whilst coffee — after having pioneered the frontier of southern Brazil in a distinctive manner using *colono* settlers — is increasingly grown by smallholders or on farms in conjunction with other crops[11]. R. O. Buchanan[12] has suggested that a major reason for the modification of the methods of production of these traditional sub-tropical plantation crops has been the fact that the annual planting required for most of them and the seasonal nature of all their harvests, calls for a large and consequently expensive labour force at certain periods of the year only, the maintenance of which on a permanent basis is therefore uneconomic. This situation is clearly less true of perennial crops grown in equatorial or near-equatorial climates, for which replanting is a relatively minor job and harvesting a continuous or near-continuous one. It is in the production of such low-latitude crops, amongst which rubber is the pre-eminent example but which include tea, oil-palm, sisal, coconuts and the readily-ratooning banana, that a permanenent labour force can be more efficiently employed.

The development, for example, from the mid-nineteenth century onwards of tea and rubber growing on European owned and managed properties in south-

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[7] B. Edwards, *History of the British Colonies in the West Indies*, London, John Stockdale, 1793, p. 250 et seq.

[8] M. Prunty, *op. cit.*

[9] P. S. Taylor, Plantation Agriculture in the United States: Seventeenth to Twentieth Centuries, *Land Economics*, 30, 1954.

[10] O. P. Starkey, Declining Sugar Prices and Land Utilization in the British Lesser Antilles, *Economic Geography*, 18, 1942.

[11] J. W. F. Rowe, *The World's Coffee*, London, H.M.S.O. 1963, p. 41.

[12] R. O. Buchanan, A Note on Labour Requirements in Plantation Agriculture, *Geography*, 23, 1938.

ern Asia and parts of Africa, of the production of bananas in the lands on the shores of the southern Caribbean and of oil-palm in central Africa and south--east Asia, has been distinguished by many criteria that clearly relate the resulting forms of production to the traditional plantation. These include the occupation of large areas of land per unit of control (generally one thousand or more acres[13]), the employment of a large labour force (measured in hundreds[14]) and specialization on one crop intended primarily for export. Such enterprises are most distinguished, however, by the use of "industrial" methods — the scientific management of land; the employment of skilled personnel (both technical and operational); the organized recruitment, housing and supervision of labour; and the constant seeking after improved crop varieties, better cultural practices and more efficient processing techniques. It is this aspect of their character that justifies their classification as a distinct type of agricultural activity, whilst their similarities to the traditional plantation justify their description by that term.

Many attempts have been made to define the plantation by using various of the criteria already mentioned and different writers have laid their prime emphasis on different aspects[15]. Frequently, definitions have hinged on criteria

[13, 14] The following examples of areas and labour force sizes are not a random sample in the statistical sense but each is considered typical by its author.

Enterprise	Area (acres)	Labour Force	Source
Bananera Plantation, Costa Rica (bananas)	800	160	J. P. Augelli, Bananera: A Tropical Plantation on the Pacific Lowlands of Costa Rica, Ch. 6 in R. S. Thoman, and D. J. Patton. (eds.), *Focus on Geographic Activity*, New York, McGraw Hill Inc. 1964.
Kuala Jelei Estate, Malaya (rubber)	1684	238	P. P. Courtenay, *Plantation Agriculture*, London, G. Bell and Sons Ltd., 1965.
Khoomtaie Estate, Assam (tea)	2900	1510	Courtenay, *op. cit.*
Hacienda Sacapuc, Yucatan (henequen)	6859	250	R. E. P. Chardon, *Geographic Aspects of Plantation Agriculture in Yucatan*, Washington, National Academy of Science 1961.
Diamond Estate, British Guiana, (sugar)	12436	n. a.	R. T. Smith, *British Guiana*, London, Oxford University Press, 1962.

[15] I) "A unified agricultural organization of considerable size under one management, of practically a continuous tract of land, operated as a single unit with respect to the methods of control of labour and products".

C. O. Brannen, *Relation of Land Tenure to Plantation Agriculture*, Washington, Government Printing Office, 1924, p. 9.

(II) "The plantation system connotes the acquisition of a limited but fairly extensive area for the cultivation of a particular crop, the actual cultivation being done under the direct supervision of a manager, who in some cases may himself be the actual proprietor. A considerable number of persons (the number may run as high as 4000) are employed under his control in the same way as the factory workers are under the control of the factory manger, but there is one important difference in that the work is essentially agricultural and is not concentrated in a large building".

Royal Commission on Labour in India, 1931 quoted in C. R. Fay, Plantation Economy, *The Economic Journal*, 46, 1936.

(III) "A plantation is, therefore, a large agricultural and industrial enterprise, managed as a rule by Europeans, which, at great expense of labour and capital, raises highly valuable agricultural products for the world market".

L. Waibel, The Tropical Plantation System, *The Scientific Monthly*, 52, 1941.

(IV) "Plantations are largely concentrated in the tropics, not because of climate, but because, in the present world community, tropical regions constitute a highly important and accessible trade and agricultural frontier, and the plantation is always an institution of the frontier. The tropics constitute a frontier where there are exploitable agricultural resources attractive to capital and which are nearer to consuming in terms of transportation costs than are the vast areas of sparsely peopled but potential agricultural lands in the temperate zones. Plantations have developed along nontropical frontiers in the past and conceivably may in the future".

E. J. Thompson, The Climatic Theory of the Plantation, *Agricultural History*, 15, 1941.

(V) "We may thus define the plantation, for the purposes of this investigation, as an agricultural settlement in which all factors of production and a highly rationalized organization of economic activity are assembled in an area whose ecology, culture, or economic character is not "European-American". The plantation is an economic and cultural-extension of western industrial-urban civilization in an area of non-European (i.e. not industrial-urban) culture. It involves the importation, and generally some local adaptation, of European (in the broad sense) management, methods of cultivation, technology, capital, and organization, along with a labor force which generally is of non-local and non-European composition, into a sparsely populated area with relatively low land costs. The plantation is definitely commercial and exports its cash product to a mass industrial-urban market, generally distant from the plantation area".

R. E. P. Chardon, *Geographic Aspects of Plantation Agriculture in Yucatan*, Washington, National Academy of Sciences, 1961, p. 8.

(VI) "Reduced to its simplest definition, the "plantation is a technique for organizing land and labor in the tropics or subtropics to supply middle-latitude markets with certain products (bananas, rubber, sugar, copra, palm, oil tea, and so on)".

J. P. Augelli, Bananera: A Tropical Plantation on the Pacific Lowlands of Costa Rica, Ch. 6 in R. S. Thoman, and D. J. Patton, (eds.) *Focus on Geographic Activity*, New York, McGraw Hill Inc., 1964, p. 35.

(VII) "However, it seems that the plantation system possesses sufficient identity to be acknowledged as a separate form of large-scale agriculture. In both forms of organization, there is heavy specialization of the factors of production, but the plantation commonly possesses two features which distinguish it from large-scale company farming; employment of a large, relatively unskilled, labour force combined with a lack of mechanization of harvesting activities, and partial processing of the product at the site of production before marketing".

P. Laut, *Agricultural Geography*, Melbourne, Thomas Nelson (Australia) Ltd., 1968, p. 204.

that have proved to be impermanent, and have been criticised in consequence — though a definition based on an impermanent criterion need not be faulty, provided it is accepted that the institution so defined ceases to exist when the criterion does. However, there seems to be no reason why a definition of the plantation may not be found that will enable the institution to evolve without completely losing what many writers consider to be its distinguishing features.

Of the criteria that have been used in attempts to define the plantation, but which have proved or are proving impermanent, may be included origin of labour force, foreign financial and executive control, specialization on one crop, and pioneering function. It is, without doubt, true that the traditional plantation depended for its labour force upon non-indigenous people, though initially, in Virginia and the West Indies these were neither coloured nor slaves[16], and also that the 19th and 20th century tea, rubber and other estates of Assam, Ceylon, Malaya etc. needed to import labour — even if merely from another district of the same political unit, as in Java and Assam. Basically the import of labour was necessary owing less to the absolute scarcity of labour, though this was often the case especially in the western hemisphere, than to the scarcity of *suitable* labour. The plantation, whether traditional or modern, introduced a system of disciplined "industrial" employment into environments in which such organized day-by-day work was foreign, or in some cases insufficiently profitable — the 1889 annual report for the state of Perak, Malaya stated for example that a Malay

> "absolutely refuses to hire himself out as a labourer on any terms that a planter could accept. The mines (Tin Mines) absorb the attention of the Chinese, who prefer failure there to steady work and wages on an estate, and the planter's only chance of a labour force on which he can rely depends upon the natives of Southern India...[17]"

That such immigrant labour was cheap — as is often claimed — is open to doubt since it had to be recruited, transported, and housed, and many recruits were often of poor quality, both in physique and ability to do outdoor work[18]. In order to obtain labour for his rubber plantations in Liberia in the 1920's, Harvey S. Firestone was obliged to pay the highest prevailing wage in the country, provide free housing, health and education, subsidized foodstuffs and household items and give compensation to paramount chiefs[19]. Important though immigrant labour was in the early years of plantation development, however, increasingly it is provided locally. On many Assam tea estates, for example,

[16] P. S. Taylor, *op. cit.*

[17] Perak Annual Report 1889, quoted in R. N., Jackson, *Immigrant Labour and the Development of Malaya, 1786—1920*, Kuala Lumpur, Government Printer, 1961, p. 95.

[18] J. C. Jackson, Oil Palm: Malaya's Post-Independence Boom Crop, *Geography* 52, 1967.

[19] W. C. Taylor, *The Firestone Operations in Liberia*, Washington National Planning Association, 1956, p. 66.

children get the preference in filling vacancies in the labour force, as their parents get old and infirm[20], whilst nearly one quarter of the labour force of the Dunlop Malayan Estates Ltd. now consists of Malays[21] and this is not atypical. The tendency for plantation labour to be locally born will clearly increase both as generations pass and as economic development familiarizes previously subsistence cultivators with the work habits of industrial economies. Lim Chong Yah has recently described the problem of stopping

"the long queues of Malays at many of the labour exchanges from getting longer[22]".

In addition to the growing component of locally born and indigenous people in the basic labour force, managerial personnel and even financial and executive control are ceasing to be as universally foreign, i.e. European as they were before the Second World War[23], and such overseas control is therefore no longer as useful a criterion in defining the plantation. The increasing Chinese and Indian ownership and operation of rubber estates in Malaya, and government control in Indonesia and Cuba have not basically altered the nature of the undertaking concerned, although European and American proprietorship and direction have been replaced.

Crop specialization does largely remain a characteristic of the plantation, particularly in those cases where local processing is essential — as with tea, sugar, oil-palm and sisal — for the simple reason that the cost of the optimum-sized processing factory, which may frequently run into hundreds of thousands or even millions of pounds sterling, clearly requires an extensive area of its raw-material crop, and an orientation of all operations, managerial, marketing, research, etc. towards it. Crops such as coffee and rubber, which require less expensive on-site processing are more likely to be grown in conjunction with other crops, however, and are, for this and other reasons, favoured crops for smallholders. The downward trend of natural rubber prices and growing competition from synthetics, whilst palm-oil prices have risen, has, for example, persuaded many rubber estates in Malaya to diversify especially into oil-palm production since 1958[24]. Although in general, therefore, plantations retain emphasis on one crop, it seems unnecessarily rigid to make monoculture a pre--requisite for recognition of a plantation.

The notion that plantations are an institution of the economic frontier and therefore, by implication, impermanent, is one particularly associated with E. J. Thompson who, in rejecting climatic theories of the plantation, explained the concentration of plantations in the tropics by claiming that:

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[20] Personal correspondence from Manager, Khoomtaie Tea Estate, Assam, 1964.

[21] Personal correspondence from Manager, Dunlop Plantations Ltd., 1964.

[22] Lim Chong Yah. *Economic Development of Modern Malaya*, Kuala Lumpur, Oxford University Press, 1967, p. 122.

[23] R. O. Buchanan, *op. cit.*

[24] J. C. Jackson, *op. cit.*, p. 99.

> "in the present world community, (he wrote in 1939)... tropical regions constitute a highly important and accessible trade and agricultural frontier, and the plantation is always an institution of the frontier"[25].

It is, perhaps, possible to recognize two major types of enterprise, both of which have characteristics in common and have been termed plantations. The first of these might be called the pioneering or "frontier" plantation, the principal function of which has been the opening up and initial development of both tropical and extra-tropical regions by the production and export of crops for the European and North American market. Such frontier plantations, like the mining operations with which they have often been contemporary, have been a spearhead of European enterprise in underdeveloped and often unsettled countries, and have grown a wide variety of crops. They have typically been faced with transport difficulties, which have limited their distribution first to tide-water and then to places within easy reach of railways, and have needed to recruit labour from afar — slave, indentured or free immigrant — to provide a workforce. What distinguished the frontier plantation most, however, was its abundant use of cheap land and relatively cheap labour and it thus managed profitably to grow a wide range of crops, some of which today cannot normally yield a surplus over labour costs sufficient to cover the overheads of plantation management. The majority of traditional (i.e. slave-owning) plantations were of the frontier type.

With the increasing cost of labour, first by the abolition of slavery, then by the organization of plantation workers and the provision of more welfare services, the situation was gradually brought about whereby certain of the crops that had been grown by the frontier plantation could be produced more cheaply on smallholdings or farms. This seems particularly to have been true of the annuals, such as tobacco and cotton and to some extent of sugar, leaving the perennial tree-crops to provide the basis of modern plantation enterprise and their production to have become highly organized in what might be called the "industrial" plantation[26].

The industrial plantation is concerned with the constant output of its product in order to employ its expensive labour force fully all the year round and to meet an all season demand for goods of both high and constant quality, often in the face of a number of types of competitive suppliers. It wishes to ensure the smooth flow of a standard raw material from its trees at all seasons, and consequently has come to be located principally in the equatorial and tropical monsoon lands. Of the perennial tree or bush crops that had been taken up by the frontier plantations, tea, rubber, oil palm and sisal possess most nearly the ideal requirements of the industrial plantation. It may be claimed that

[25] E. J. Thompson, The Climatic Theory of the Plantation, *Agricultural History*, 15, 1941.

[26] P. P. Courtenay, *Plantation Agriculture*, London, G. Bell and Sons Ltd., 1965, p. 141.

such an industrial plantation, with its emphasis on highly organized production, the efficient use of labour and the utilization of advances in scientific agriculture, many of which it may itself initiate, is highly rational at the present time and has a firm place in maturing tropical economies. Its scale of production, in the present relatively, especially industrially, underdeveloped economies of the tropical nations, means that the industrial plantation is still primarily concerned with producing for an export market but this, again, is a circumstance that needs not be a permanent one.

Most recent writers on the plantation[27] are agreed that a meaningful modern definition must be based on the method of organization of production rather than on type of crop, area of land occupied or size or nature of labour force, though certain of these characteristics seem to be closely associated with methods of organization. In this context the characteristics already listed as typifying the industrial plantation — highly organized and unified production under one management, the efficient use of factors of production, the utilization of research findings, efficient grading and marketing and so on — would seem to be the appropriate criteria on which a possible definition of a plantation might primarily be based. It has been noted, however, that such characteristics may be recognized in agricultural undertakings in very many parts of the world — amongst tomato growing enterprises in California, collective farms in the U.S.S.R and sugar beet farms in north-west Europe[28]. The question arises, therefore, whether such agricultural enterprises should also be considered plantations, or whether there exists a recognizable and significant difference between the highly organized and mechanized agricultural undertaking of, say, north-west Europe and the similarly organized enterprise growing, say, rubber in south-east Asia. In other words, is there a case for limiting the use of the term plantation to the tropics?

An examination of the organization and operation of a rubber estate, which may fairly be considered typical of the tropical plantation, suggests that it has certain characteristics not shared by the most specialized sugar beet farm or grain collective. These characteristics are production from crops whose planting is necessary once only in a period of years (perhaps 30 or 40) rather than from crops annually sown; continuous production of the harvested portion (fruit, latex, leaf or fibre) at least for a period of many months of the year and in some cases for twelve months of the year; and the use of a "large input of cultivating power per unit area" (to borrow a phrase from Prunty[29]) which still, in most instances, means a large labour force. The long or continuous period of production makes possible the spread of overhead costs, especially,

[27] Writers (I), (II), (III), (V) and (VII), cited under reference 15, all emphasize the organization of production as a basic criterion in their definition of the plantation.

[28] H. F. Gregor, *op. cit.*

[29] M. Prunty, *op. cit.*

where relevant, of the processing factory thus contributing to its economic operation, and also helps maintain the differential between value of product and operating costs, especially of harvesting. Such continuous production, which makes the plantation defined by these criteria resemble a factory production line more than a farm with its seasonal operations, is clearly most readily attainable from a perennial crop, or one like the banana which readily ratoons, grown in a region warm enough at all or most seasons to liberate harvesting from the marked seasonal rhythm imposed by non-tropical climates. That such tree or bush crops, and even sugar cane, are *planted* rather than *sown* gives a happy verbal significance to the term plantation if it is limited to such types of tropical agricultural organization.

It is suggested, therefore, that the use of the term plantation be limited to those agricultural enterprises involved in the large scale production of crops by a uniform system of cultivation under central management, that make use of scientific methods and efficient processing techniques and whose harvest, from planted perennials or ratooning annuals, is largely free of seasonal rhythm. It remains therefore largely tropical, especially equatorial, in location but is not tied by definition to any particular historical phase of development, type of labour force or control, imperial, liberal or socialist economic system, or export or home market.

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PEASANT RICE CULTIVATION SYSTEMS WITH SOME MALAYSIAN EXAMPLES

According to Spencer, the geographer must view the methods of combining fields, crops and cultivation practices, that is cropping systems, from the perspective of the whole culture of their practitioners[1]. This is highly desirable. Yet it is the imperative "must" that is objectionable. Cropping systems can also be conceived of as having an independent existence. The development of classifications of cropping systems has thus its own justification merely because the systems exist. There are also other aims. Detailed descriptions of cropping systems enable adequate comparisons to be made both in space and, given adequate source materials, in time. Furthermore such descriptions permit the review of conventional terminology and its modification if necessary. These considerations naturally apply to rice cultivation systems, which are almost as diverse as the peoples practising them.

This diversity of practice leads in two directions. One is in the direction of terminology that is so broad as to be of very limited value except at the highest level of generalization. What, for example, is included in the categories "wet rice", "dry rice" or "irrigated rice"? In the other direction is the way towards elaborate and complex classifications in which diversity may be subsumed. Thus no apology can be made for the complexity of the tentative scheme which follows.

TENTATIVE SCHEME OF CLASSIFICATION

This scheme comprises eight basic categories of which the first two refer to the physical environment and the remainder refer to actual cultivation. These eight categories are further sub-divided into varying numbers of sub-categories; a total of fifty-eight in all (see Fig. 1).

[1] J. E. Spencer, 1966, p. 64.

A. Topography
- 1a. Naturally flat plains or terraces
- 1b. Artificial terraces
- 2. Slopes

B. Season of Rice Cultivation
- 1. Wet
- 2. Dry
- 3. Both wet and dry seasons

C. Cycle of Cultivation
- 1. Permanent cultivation
- 3. Temporary cultivation leading to perennial crops
- 3a. Shifting cultivation, shortcycle, 1—2 years crop, 1—3 years brush fallow
- 3b. Shifting cultivation, medium cycle, 1—4 years crop, 4—8 years brush fallow
- 3c. Shifting cultivation, long cycle, 1—3 years crop, more than 8 years fallow under brush and forest
- 3d. Shifting cultivation, cycle within cycle, 1—3 years crop, 1—3 years abandoned, 1 year crop, more than 4 years brush fallow.

D. Annual Rotation
- 1a. One rice crop, monoculture with a few month's fallow
- 1b. One rice crop, rotation with other crops
- 1c. One rice crop, promiscuous cultivation i. e. mixed cultivation in same field
- 2a. Two rice crops, rice/rice
- 2b. Two rice crops, one or both, promiscuous cultivation
- 3a. Continuous rice/catch crop/rice
- 3b. Continuous, rice, promiscuous cultivation
- 3c. Continuous, rice/rice/rice

E. Water Supply and Control
- 1a. Rain and/or flood, fields flat, bunded with artificial drainage
- 1b. Rain and/or flood, fields flat, bunded without artificial drainage
- 1c. Rain and/or flood, fields flat and unbunded
- 1d. Rain, fields sloping and unbunded
- 2a. Irrigation, river or lake and gravity canals
- 2b. Irrigation, river and current-driven pumps
- 2c. Irrigation, river or lake and animal-powered pumps
- 2d. Irrigation, river or lake and mechanical pumps
- 2e. Irrigation, tanks and gravity canals
- 2f. Irrigation, tanks and animal-powered pumps
- 2g. Irrigation, tanks and mechanical pumps
- 2h. Irrigation, wells and animal-powered pumps
- 2i. Irrigation, wells and mechanical pumps

F. Preparation for Planting
- 1. Slash only
- 2. Slash and burn
- 3. Animal trampling
- 4. Hoe
- 5. Plough, animal-drawn
- 6. Plough, mechanical

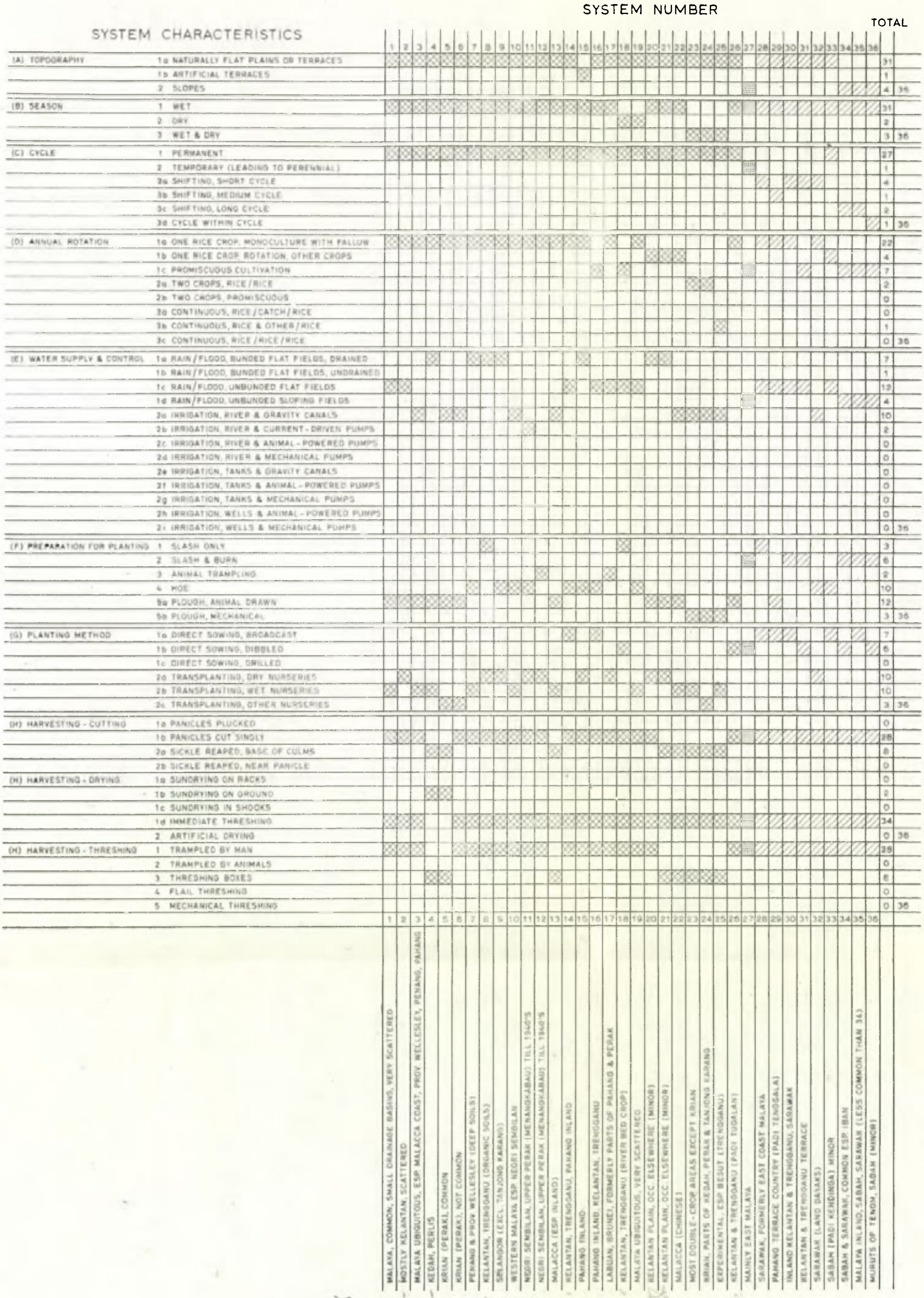

Fig. 1. A scheme of classification of rice cultivation systems

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G. Planting Methods
- 1a. Direct sowing, broadcast
- 1b. Direct sowing, dibble
- 1c. Direct sowing, drill
- 2a. Transplanting, dry nurseries
- 2b. Transplanting wet nurseries
- 2c. Transplanting, other types of nursery

HA. Harvesting — Cutting
- 1a. Panicles plucked
- 1b. Panicles cut singly
- 2a. Sickle reaping, base of culms
- 2b. Sickle reaping, near panicles

HB. Harvesting — Drying
- 1a. Sundrying on racks
- 1b. Sundrying on ground
- 1c. Sundrying in shooks
- 1d. Immediate threshing, no drying
- 2. Artificial drying

HC. Harvesting — Threshing
1. Trampling by man
2. Trampling by animals
3. Threshing boxes
4. Flail threshing
5. Mechanical threshing

CRITICISM

Each system as recognized here consists of an array of features that are in the short term fairly stable. Nevertheless changes of practice at periods beyond a year do occur. For example in the Malaysian peninsular states of Kelantan and Trengganu, when the north-east monsoon rains are late, transplanting may be omitted and seed sown directly into the fields. The scheme does not provide for such changes although clearly longer term changes could be observed by successive mapping.

A notable omission is that non-rice crops grown on rice farms, are disregarded if they are not grown in rice-fields. Such crops may form a not inconsiderable proportion of total farm production. It seems illogical that, for instance, citrus and rice grown in the same field, as they sometimes are in Trengganu for instance, should be included in this classification, but citrus and rice grown separately should not. At the field research level this may be a real problem. For instance, to obtain data concerning the heterogenous mixture of fruit trees, rubber, cocoanuts, vegetables and spices that in Malaysia goes under the term *kampong* cultivation, the researcher must get down to the level of the individual plant. If he wants production data he must watch them all for a year!

Another problem is that of defining a rice farm or a rice area. In Malaysia a rice farm is one with at least 75 per cent of its area in rice. At the regional level the problem of definition is graeter. What is a rice area? Is it one in which at least 75 per cent of the farms are rice farms? Or would 50 per cent be a better figure?

Because the present classification is concerned with rice cultivation systems and not rice agriculture as a whole other features have been omitted. Soil and climate, except season of cultivation, are two of these even though they obviously have major influences upon cultivation systems, not only directly upon rice as an organism but also upon the selection of particular strains for particular circumstances both as these vary from place to place and as they vary temporally in one place. The varieties of rice sown and especially their maturation periods, could form other variables of use in classification. But their relationships with physical factors and cultural preferences are so complex, and for many parts of the rice-growing world, so poorly understood, that it was felt safer to accept the fact that rice grows where it grows, and thus to omit the graeter portion of the ecological factors in rice-growing.

The scheme also omits such important factors as land tenure, size and fragmentation of holdings and settlement patterns associated with rice-farming. Some are as much attributes of rice-farming peoples as of farming itself. Their inclusion would be highly desirable if this classification were to be extended to rice agriculture as a whole. Thus in Malaysia, usufruct rights to land are a concomitant of long-cycle shifting cultivation in the Central Ranges of Malaya and in Sarawak and Sabah. In Kedah and Kelantan states, northern Malaya, but not elsewhere, a high incidence of landlordims is a characteristic of lowland transplanted rice culture.

Throughout the nation farms are almost all less than two hectares in size, the average being about 0.8 hectare. No data exist to permit the analysis of any correlation between farm size and system of cultivation, though for Malayan lowland transplanted rice as a whole, these data do exist. They show a definite correlation between average size and form of tenure, as well as a definite tendency for rice farms in the western states of Malaya from Selangor northwards to be larger than rice farms elsewhere[2]. Farm size nevertheless remains a highly desirable feature for inclusions in a classification system. Nor has sufficient research been done to establish more than the general facts that long-cycle shifting cultivation in Malaya is associated with small clusters of huts (both Malay and aboriginal), that the same system in Borneo is largely but by no means exclusively associated with long house settlements, and that elsewhere, lowland systems are associated with village-dwelling with the notable but minor exception of a few recently developed *sawahs* in which houses are set in the

[2] R. D. Hill, 1967, pp. 107 and 114.

middle of the fields recently developed by Government agencies. Thus land tenure and settlement, though obviously functionally related to crop systems, are parts of a greater whole and are thus much less important in differentiating such systems than are the characteristics of cropping systems themselves.

THE SCHEME IN PRACTICE

It cannot be claimed that the tentative scheme is universally applicable as it stands, although it goes some distance towards this. Despite the enormous number of theoretically possible combinations of sub-categories only 36 distinct systems are recognised in Malaysia and cultivation systems are as diverse in Malaysia as anywhere else in the world of peasant rice-farming. The areal extent of the systems in detail is unknown but Figure 3 indicates roughly their prevalence. However, grouped data show the following:

TABLE 1 Area under various systems of cultivation (in thousand hectares)

Malaya (1963)	Lowland, transplanted, unirrigated, one annual crop	335 8
	Lowland, transplanted, irrigated. one annual crop	21.6
	Lowland, transplanted, irrigatad, two annual crops	20.0
	Lowland, non-transplanted, non-irrigated (all types)	10.5
	Upland, non-transplanted, non-irrigated	10.7
Sabah (1964)	Lowland (all types)	26.2
	Upland (all types)	10.1
Sarawak (1963)	Lowland (all types)	40.8
	Upland (all types)	73.4
		549.1

Flat land systems are most numerous: artificial terracing is rare. Sloping land systems are not common except in Sabah and Sarawak where 28 and 64 per cent respectively of the total rice land is in hill rice. In most systems, including all the hill systems, wet season cultivation is the rule. To be extended outside the humid tropics, simple temperature criteria (warm season or cool season) would need to be included. All but two of the systems which include permanent annual cultivation are on flat land but not all flat land systems have permanent cultivation as a feature. Flat land shifting cultivation, mostly short-cycle, is on the whole of minor importance though of some significance locally and historically.

Monocultivation with one annual crop followed by fallow is usual among flat land permanent systems but other rotations such as rice followed by vegetables, rice growing promiscuously with other crops and two rice crops per year are found. Shifting systems are mostly either monocultivation or promiscuous cultivation.

No great variety of water control practices exists. Although unbunded flat fields are common to many systems, bunded fields, either rain-fed or river-irrigated, occupy larger areas and form large homogenous blocks especially in Malaya. Of the irrigation systems, all are now gravity-fed from rivers although some areas have limited mechanical pumping facilities as a standby. Current driven pumps on the pattern of the Cambodian *noria* were confined to Menangkabau peoples of Sumatran origin, but the use of such pumps died out during the Second World War. Tanks and wells on the Indian, Ceylonese or Khmer pattern are unknown.

In a surprisingly large number of systems, the hoe takes precedence over the plough although the latter is now more widespread especially in Malaya. In both plough and hoe cultivation slashing of weeds and grass precedes actual cultivation of the soil. In the past the hoe was more common. Even late in the nineteenth century in Malaya, and in present-day Sarawak animal drawn ploughs were rare. Mechanical ploughing by means of tractors or small rotary cultivators is an introduction of the last ten years and is largely confined to double rice crop areas.

Planting methods are also very varied, ranging from simple broadcasting, common amongst shifting cultivators, through dibbling, which reduces seed losses, to transplanting from either wet or dry nurseries. The former give quicker-growing and rather more vigorous seedlings but the latter allow a longer period in which seedlings may be kept in the nursery awaiting favourable conditions for transplanting.

The commoness of harvesting by cutting the panicles of the rice plant one-by one and the persistence of this practice, inefficient as it may seem, is a reflection of two factors. The first and much more important, is the strong belief amongst both Malays and aborigines in the "rice soul", which would be disturbed by such cavalier treatment as sickle cutting at the base of the culms. The second factor is that rice fields frequently ripen unevenly so that successive selective cuttings allow harvesting only when each panicle is thoroughly ripe. Panicle harvesting is invariably associated with immediate threshing carried out by human trampling. Sickle harvesting also results in immediate threshing but into boxes placed in the fields, much on the Vietnamese pattern. Sickle harvesting was practised to a limited degree in the Krian district of Perak state before the Second World War but the practice has spread to some degree into most other parts of Malaya, especially in double rice crop areas, since then.

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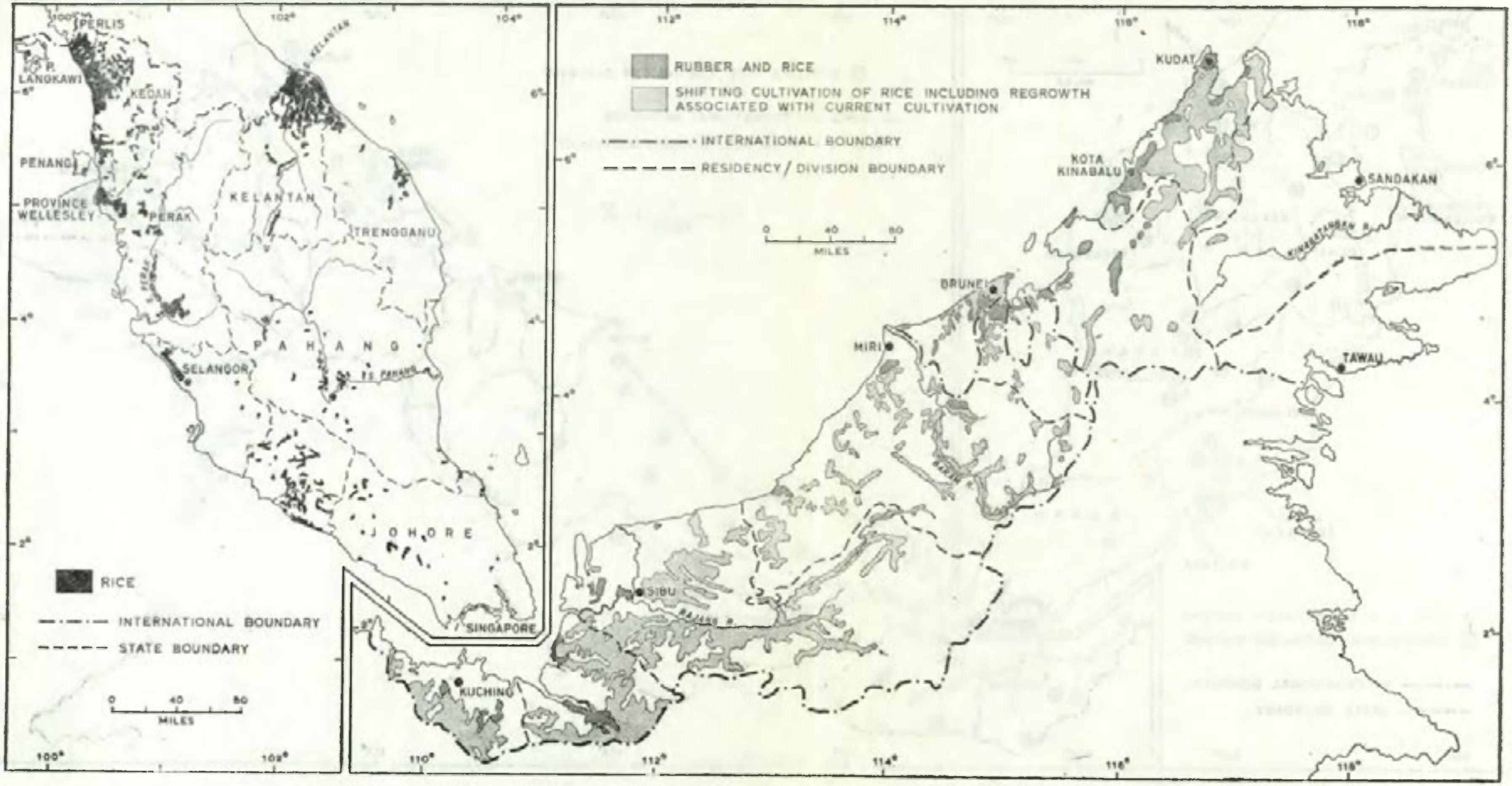

Fig. 2. Rice — growing areas of Malaysia

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WDŁ
720 + 165

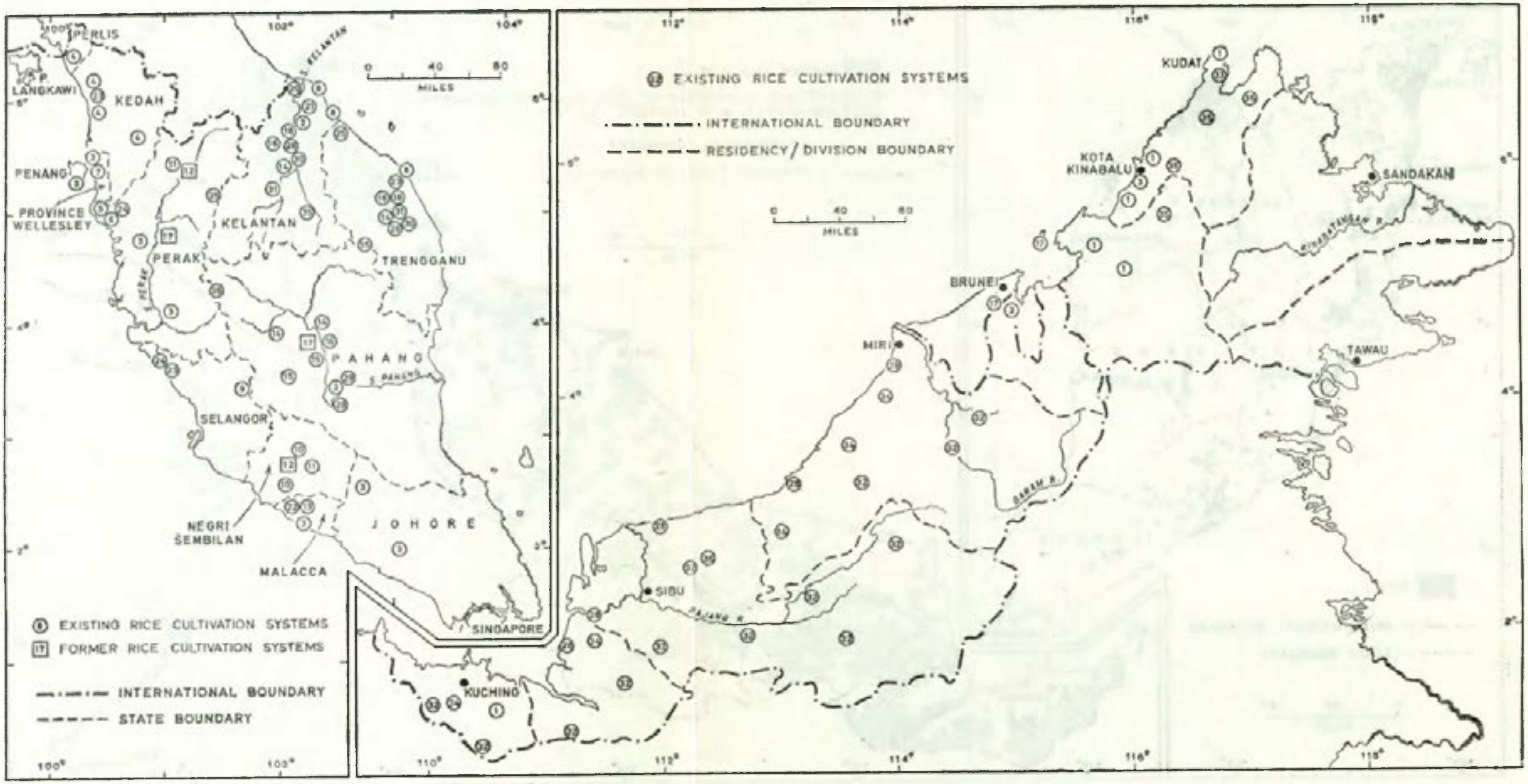

Fig. 3. Locations of various cultivation systems

CONCLUSION

Thirty-six distinct systems is rather too large a number for satisfactory mapping at the scale of the large region but the scheme seems to offer some rational basis upon which various systems might be combined. Although there are a number of possible combinations, three fundamental systems can be distinguished; flat land permanent cultivation, flat land shifting cultivation and sloping land shifting cultivation. A further sub-division of flat land permanent cultivation could be made on a number of bases; number of crops per year, or water control, i.e. rain rice and irrigated rice or again planting methods, i.e. transplanted rice and non-transplanted rice.

The great advantage of this system of classification is that generalizations can be readily made from it and that the precise characteristics of lower orders of categories are known when these lower orders are grouped to form higher orders of categories.

Another possible line of enquiry is also opened up, in that a basis is provided for historical investigations. Systems such as unirrigated short-cycle shifting cultivation of swamp margins (System 28) or its elaboration, System 32 which adds irrigation to shifting cultivation, may represent survivals of primitive systems. This cannot be elaborated here but the evolutionary sequence of Malaysian rice cultivation seems to begin with unirrigated short-cycle shifting cultivation of the swamp margins. From this the line of evolution forks into shifting cultivation of the uplands on one hand, and on the other, flat land systems involving hoe-using permanent broadcast-seed cultivation, elaborating into permanent hoe-using dibble-seed cultivation, in time developing into plough-using dibbling systems as one sequence. Another branch of the permanent hoe-using broadcasting technique may have evolved towards the use of transplanting in bunded rain-fed fields, followed later by the introduction of the plough, and by irrigation, some forms of which may have been introduced during the Menangkabau migrations of the fourteenth century. Double-cropping of rice, sickle-harvesting and threshing boxes are effectively the innovations of the last twenty years.

BIBLIOGRAPHY

[1] G. E. Coombs, Notes on the production of dry-land rice, *Agricultural Bulletin. Federated Malay States*, 6, 1917—18, pp. 321—327.

[2] Economics Branch, Department of Agriculture, S. S. and F. M. S., Padi planting methods in Malaya, *Malayan Agricultural Journal*, 27, 1939, pp. 40—59.

[3] W. R. Geddes, *The land Dayaks of Sarawak*, London 1954.

[4] D. H. Grist and Syed Abdul Rahman, The cultivation of tenggala padi, *Agricultural Bulletin Federated Malay States*, 9, pp. 5—22, pp. 131—257.

[5] J. D. Freeman, *Iban agriculture*, London 1955.
[6] R. D. Hill, Note sur la culture du riz sec dans les états Malaysiens de Kelantan et de Trengganu, *L'Agronomie Tropicale*, 6, 1964, pp. 499—505.
[7] R. D. Hill, Rice cultivation systems in Malaya, *World Crops*, 18, 1966 a, pp. 72—74.
[8] R. D. Hill, Dry rice cultivation in peninsular Malaya, *Oriental Geographer* 10, 1966 b, pp. 10—14.
[9] R. D. Hill, Agricultural land tenure in West Malaysia, *Malayan Economic Review*, 12 1, 1967, pp. 99—116.
[10] H. W. Jack, Rice in Malaya, *Malayan Agricultural Journal*, 11, 1923, pp. 103—119, p. 168—212.
[11] Y. L. Lee, Some aspects of shifting cultivation in British North Borneo, *Malayan Forester*, 24, 1961, 2, pp. 102—109.
[12] Y. D. Lee, Paddy production and further settlement in Borneo, *World Crops* 16, 1964, pp. 2—7.
[13] J. Nagaĭ, *Japonica rice: its breeding and culture*, Tokyo 1959. U. Narkswasdi and S. Selvadurai, *Economic Survey of Padi Production in West Malaysia*, Report No. 1, 1967, Selangor, Kuala Lumpur.
[14] Sabah Government, *Annual Report* 1964, Jesselton.
[15] Sarawak Government, *Annual Report* 1963, Kuching.
[16] J. E. Spencer, *Shifting cultivation in Southeastern Asia*, Berkeley and Los Angeles 1966.
[17] B. J. C. Spurway, Shifting cultivation in Sarawak, *Malayan Forester*, 6, 1937, pp. 124—128.
[18] K. Sugimoto, Result of study on rice culture, in Kyoto University, Center for Southeast Asian Studies, *Rice Culture in Malaya, Improvements in Rice Culture in Malaya by Japanese Experts*, Kyoto 1965.

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TYPES OF AGRICULTURE IN POLAND. A PRELIMINARY ATTEMPT AT A TYPOLOGICAL CLASSIFICATION

There are two principal methodological problems in agricultural typology:

1. The choice of criteria and their adequate expression in terms of indices or structures representing various properties of agriculture.

2. The method of combination or integration of these properties or, in another word, of grouping the individual basic units of study according to their similarity as to the characteristic pattern of their agricultural properties.

In the selection of criteria the present attempt is based on the up-to-date results obtained by the IGU Commission for Agricultural Typology[1]. The typology is based on the internal or inherent characteristics — or properties of agriculture only — while the external natural and other conditions in which agriculture develops serve to explain why the particular type of agriculture has been developed and formed at a given time and place.

The type of agriculture, understood as a supreme notion focusing all the important properties of a given agriculture, is to be determined on the basis of the three principal groups of criteria:

1. Social and ownership criteria responding to the question, "Who is the producer?" 2. Organizational and technical criteria responding to the question, "How — by what means is production obtained?" 3. Production criteria responding to the question, "What is produced and for what?"

Since the IGU Commission has not recommended as yet any particular method of combining the characteristics representing these criteria, the graphic method of typograms[2] has been applied, the autor being fully aware of all its shortcomings.

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[1] J. Kostrowicki, N. Helburn, *Agricultural Typology. Principles and Methods. Preliminary Conclusions*, I. G. U. Commission for Agricultural Typology, Boulder, Colorado, 1967, 37 p. as well as the Commission Chairman's Report in the present volume.

[2] Known also in cartographic literature as star-diagrams, radiographs or radiograms being the evolution of econographs introduced many years ago by Griffith Taylor.

The following indices representing various agricultural characteristics have been accepted and used to construct typograms for each county (*powiat*).

A. Social and ownership characteristics:

1. Average size of small-scale private holdings.
2. Percentage share of agricultural land under large-scale socialized (state and collective) farming.

B. Organizational and technical characteristics:

3. Density of agricultural population per 100 ha of agricultural land.
4. Animal power — number of horses per 100 ha of agricultural land.
5. Mechanical power — number of tractors per 100 ha of agricultural land.
6. Organic manuring — number of farm animals in conventional units per 100 ha of agricultural land.
7. Mineral fertilizing — the amount of fertilizers in pure content (NPK) per 100 ha of agricultural land.

C. Production characteristics:

8. Land productivity — gross agricultural output in grain units per 1 ha of agricultural land.
9. Labour productivity (labour effectiveness) — gross agricultural production in grain units per 1 person of agricultural population.
10. Level of commercialization — commercial production in zlotys per 1 ha of agricultural land.
11. Degree of commercialization — percentage share of commercial production in gross agricultural production.

These indices were distributed on the branches of typogram in the way illustrated by Figure 1. Figure 2 illustrates a possible arrangement of indices in comparative studies of broader extent covering different countries.

The structural characteristics that could not be expressed by indices, defined and presented in a formalized way (by formulas[3]), were marked by colours in the center of each typogram. They include:

12. Orientations in land utilization.
13. Orientations in utilization of arable land (crop combinations).
14. Orientations in agricultural (gross) production.
15. Orientations in commercial production of agriculture.

On the basis of the size, shape and colour of their typograms, individual units (powiats) were grouped into types of various order. In case of powiats

[3] Cf. appendix to 1. For more details see: J. Kostrowicki. Some Methods of Determining Land Use and Agricultural Orientations as Used in the Polish Land Utilization and Typological Studies. *Geographia Polonica*, 18 (in print).

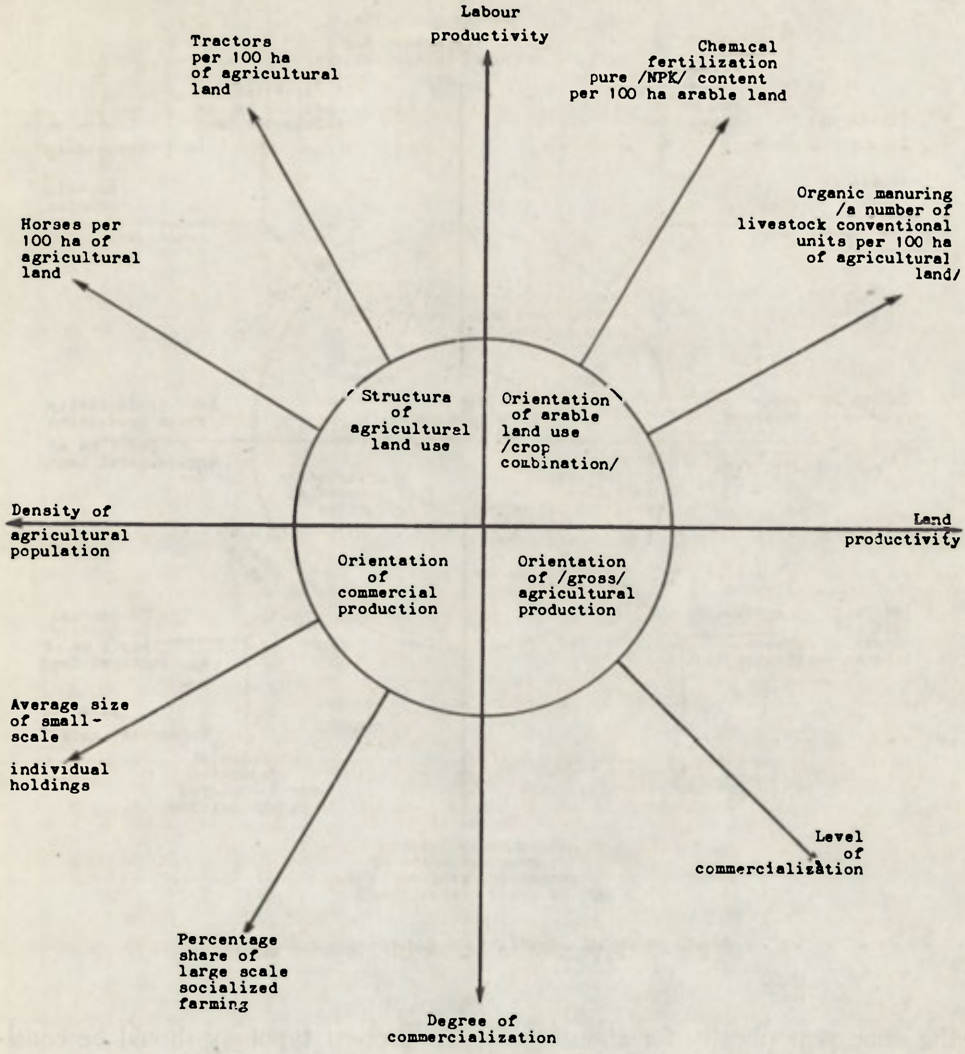


Fig. 1. Typogram used at the present study

of transitional character the ranges of particular types were corrected on the basis of literature and various studies made at the Department of Agricultural Geography of the Institute of Geography, Polish Academy of Sciences. As this involves certain subjectivity, these units could otherwise be classed as being of transitional character.

As not all of the accepted indices are considered to represent the best particular characteristics, and since some others, while important, could not be applied for various reasons, and as not all the data used were computed for

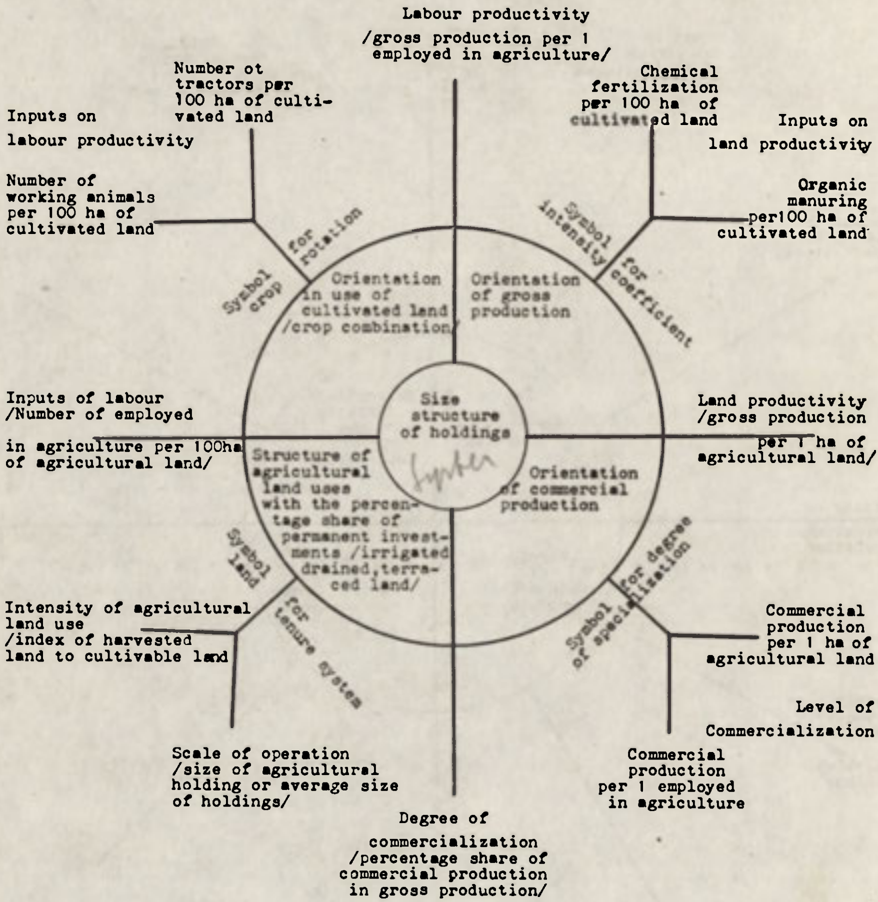


Fig. 2. Typogram to be used in broader studies

the same year (mostly for about 1960), the present typology should be considered as a preliminary attempt only, outlining the path for future investigations rather than accurately solving the problem. The use of combined indices for private and socialized farming in the framework of powiats could also be explained by the lack of separate data. The problem of nomenclature to be used for the defined types also has not been solved as yet. The use of geographic names means really nothing; those based on agricultural characteristics are usually too long and too complicated. Consequently, the types were only numbered provisionally and then characterized.

Without considering the place of particular types in the whole system of agricultural types of Europe or of the World, eight types of agriculture were distinguished in Poland, differing first and foremost in their specific arrange-

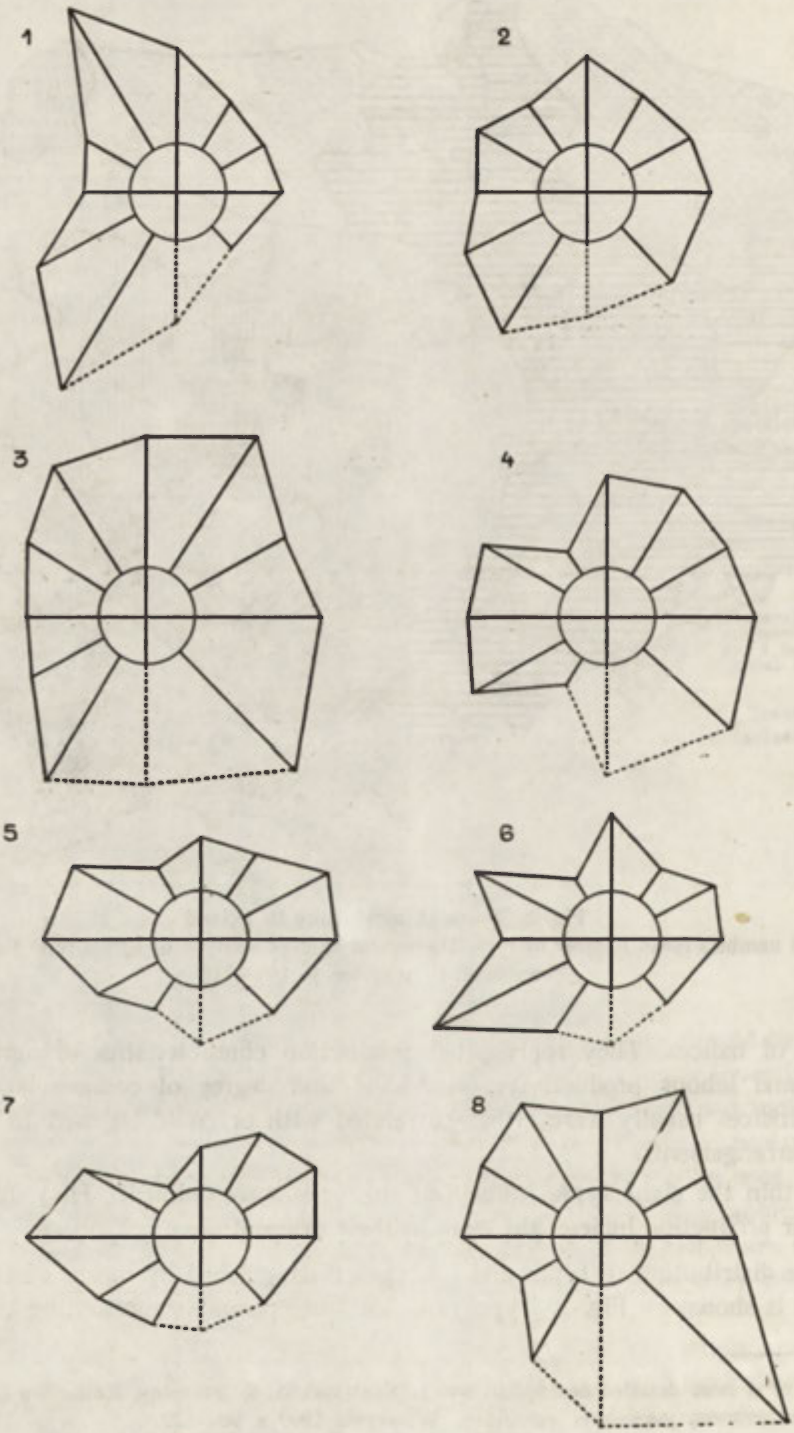
Fig. 3. Types of agriculture in Poland
First numbers mean number of type, the second that of subtype of agriculture. For the description in text see p. 105—110

ments of indices. They represented production characteristics of agriculture (land and labour productivity, and level and degree of commercialization), other indices usually were either correlated with or could be used to explain these arrangements.

Within the eight types, numerous subtypes were defined[4]. They differ less in their production indices but more in their orientations.

The distribution of types and subtypes distinguished by means of this procedure is shown on Fig. 3. Typograms for some powiats representing them are

[4] For a more detailed description see: J. Kostrowicki, R. Szczęsny. Rolnictwo (in) *Struktura przestrzenna gospodarki narodowej*, Warszawa 1969 s. 98—122.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presented on Fig. 4. The brief characteristics of particular types and some remarks concerning their dynamics and future possibilities are as follows:

1. Medium or highly effective (over 50 grain units — *GU* — per one person of agricultural population — *AP*), medium commercial (2—4 thousand zlotys per hectare of agricultural land — *AL*), low productive (below 24 GU per one ha — *AL*) agriculture, dominating in northern and north-western Poland, is in fact of dual character. Large-scale, socialized, mainly state farming, with low inputs of labour, high mechanization and high chemical ferlitizing, occurs together with individual private farming derived mainly from the post-war settlement, with farms of medium size (7—10 ha) with medium inputs of labour. They are less mechanized and apply less chemical fertilizers and medium organic manuring. The most common production orientations are rye or rye-oats with potatoes (sometimes also with clover or meadow hay) and dairy-cattle breeding. In commercial production dairy products come to the forefront with rye and potatoes (sometimes also wheat, sugar-beet or pork) as secondary elements. A similar type of farming is practised in the Sudety Mountains (Subtype 16).

The extent of this type of agriculture is gradually shrinking and is being replaced by the more productive type two, particularly in Szczecin and Zielona Góra Voivodships. As land productivity is at a minimum there, further development of this type of agriculture, in view of low labour resources, ought to be based on the increase of capital inputs — mainly fertilizing — and on the introduction of more productive crops and animals.

2. Medium effective (40—60 GU/1 *AP*), medium commercial (2—4 thousand zlotys per hectare *AL*), and medium productive (20—28 GU/1 ha *AL*), agriculture with prevalent private farming, medium inputs of labour, low or medium mechanization, medium or low chemical fertilizing, and medium organic manuring. Socialized farming, which plays a less important role, does not differ from the preceding type. This type of agriculture is practised mainly in the large areas surrounding the province of Greater Poland (Wielkopolska) from Northwest, West and Southwest. This is not without reason, as these areas have been colonized following World War II, mainly by settlers from Wielkopolska. Agriculture in the western bordering powiats of Olsztyn Voivodship is of similar character.

The production orientation does not differ much from the Type 1. It is usually rye with potato, rye-potato or rye-meadow hay with serradella, clover sometimes with wheat, as well as with dairy cattle. In the orientations of commer-

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Fig. 4. Typograms of agricultural characteristics for selected powiats representing various types of agriculture

1 — Gołdap (type 1), 2 — Gorzów Wielkopolski (type 2), 3 — Gostyń (type 3), 4 — Radziejów (type 4), 5 — Wyszków (type 5); 6 — Suwałki (type 6); 7 — Nowy Targ (type 7); 8 — Pruszków (type 8)

cial production, animal production (dairy products and pork) is a leading element with crops such as rye, sometimes wheat, potatoes, and sometimes sugar-beet playing a seccondary role.

In general, Type 2 could be considered of transitional character between Type 1 and Type 3.

Because of the level of production indices, highly differentiated Cassubian agriculture (Subtypes 21, 22) with predominant private farming was also included in this type.

The further development of this type of agriculture through its intensification and the resulting increase in productivity ought to tend toward assimilation with the Type 3, because of the poorer natural conditions in its less productive form.

3. Highly effective (over 50 GU/1 *AP*), highly commercial (over 4 thousand zlotys/1 ha *AL*), highly or medium productive (over 28 GU/1 ha *AL*) agriculture with preponderant medium size or larger private farming, with medium inputs of labour, relatively high mechanization, high chemical fertilization, and high organic manuring. Large-scale socialized, state, and collective farms that obtain similar production results are less numerous there. On more fertile soils wheat (sometimes with malting barley) — sugar-beet orientations with clover, lucerne or meadow hay and cattle-raising (sometimes also pig) are prevailing. In less favourable natural conditions they are substituted by wheat-rye, rye or rye--potato orientations (sometimes with sugar beets) with cattle and pig breeding.

The agriculture of this type, the best in Poland, is practised in its various subtypes over large areas of Wielkopolska, along the lower Vistula including polder agriculture on its delta (Żuławy) as well as in Lower and Opole Silesia. In the future it ought to develop harmoniously all its essential characteristics, following the demands of the country's economy.

4. Highly productive (over 32 GU/1 ha *AL*), highly commercial (4—6 thousand zlotys/1 ha *AL*), but medium effective (40—60 GU/1 *AP*) agriculture with high dominance of medium or small-size private farming, with high labour inputs, but medium or low mechanization, medium or low fertilization, and medium or high manuring, is dispersed in some areas of central and southern Poland. Production is oriented there toward rye or rye-wheat with potatoes and sometimes sugar beet, clover, as well as cattle and pig breeding. In the commercial production industrial crops, such as sugar beets and more locally tobacco, come to the fore-front together with animal, both dairy and pork products, with cereals — rye and wheat playing a secondary role.

Unlike the Type 3, highly productive results are obtained there on the fertile soils with traditional methods of farming, with high labour inputs rather than with capital inputs. In contrast to the Type 3 which has spread from the best sites to less favourable areas using high capital inputs and modern farming methods, Type 4 is in fact limited to areas with the best natural conditions. It should be stressed, however, that in the last years the territorial scope of the Type 4 has been extending on the fertile loess and chernozem soils in the South, as well as in the North where the Subtype 41, the closest to the Type 3, has been spreading over less fertile soils formed on glacial sediments. While in the South the extent of the Type 4 is limited to the best soils, and does not even cover all of them, in the Northwest it extends beyond the good soils and is closely connected with the distribution of sugar factories. This trend shows also the direction of the further development of this type of agriculture. As labour productivity is at a minimum there, the progress could be achieved mainly by capital inputs for the mechanization and "machanization" of labour. With an increase of chemical fertilizing the expansion of this type of agriculture over less favourable sites will be greatly facilitated.

5. Medium or high productive (24—36 GU/1 ha *AL*), low or medium commercial (2—5 thousand zlotys/1 ha *AL*), and low effective (below 50 GU/1 *AP*) agriculture, with the dominance of medium or small size private farming, with medium or high labour inputs, low or medium mechanization, low or medium chemical and medium organic fertilizing. This type of agriculture is most common in central Poland. Production orientations of potato, rye-potato, or rye with potatoes, with clover or serradella, as well as with cattle and pig breeding are dominant here, while in the commercial production pork and/or dairy products lead, with rye and potatoes as secondary elements. In some of these areas the range of commercial products has recently been extended to include tobacco or fruits and vegetables, forming different Subtypes (52).

As both labour productivity and commercialization of agriculture are at a minimum there, the future development should envisage not only the further increase of high productive, although labour-absorbing branches of crop cultivation and animal breeding, but also the increase in the size of farms caused by outflow of agricultural population to other branches of economy. In some places such a development would lead toward transformation of this type into Type 4.

6. Low commercial (below 3 thousand zlotys/1 ha *AL*), low productive (below 24 GU/1 ha *AL*), and medium effective (40—50 GU/1 *AP*) agriculture with the dominance of medium size farming, medium labour inputs, low chemical fertilizing, and low or medium organic manuring. The orientations in agricultural production do not differ greatly there from the preceding type; they are, however, less extensive. Rye or rye-oat orientations with potatoes, meadow hay, serradella or lupine, as well as cattle and pig breeding are dominant there, with dairy and pork commercial orientation and rye and potatoes playing a secondary role. In the Subtype 63 the commercial orientation has been enlarged by the postwar introduction of tobacco.

Because of unfavourable natural and historical conditions and peripheral position in the Northeast, this type represents the most retarded agriculture in Poland, with a number of relics from the past such as high land fragmentation, field compulsion, and three-field system with bare or cultivated fallow, common pastures, etc. It is also characterized by traditional methods of land cultivation with low-effective hand-tools and little machinery. Medium level of labour productivity results there from both the larger size of farms, often containing the extensive areas of low-productive meadows and pastures, and not so high density of agricultural population. As land productivity is at a minimum there, its increase could be achieved only by intensification of farming, i.e. by the increase of labour and capital inputs which are directed towards more intensive orientations of crop and animal production. The recent expansion of more intensive Subtype 52 in the areas of Type 6 and the intensification of formerly backward agriculture in the areas between the middle Vistula and the lower Bug, now Subtype 52, and finally the recent trends in agricultural development in the central part of Białystok Voivodship, all these demonstrate that such an intensification is possible on the condition that fragmented villages are consolidated, there are higher inputs on land improvement and fertilizing, and other means increasing land productivity are introduced.

7. Low effective (below 40 GU/1 ha *AP*), low or medium, seldom high productive (20—36 GU/1 ha *AL*), low or medium commercial agriculture with predominant small — or very small-scale private farming, with highly fragmented lands, high labour inputs but low mechanization, low mineral fertilizing and high organic manuring, with production orientations consisting mainly of mixed crop-animal, with predominant dairy-cattle breeding, and commercial orientations based highly on animal (mainly dairy) products. This type is characteristics for large areas of southern Poland. According to the elevation above the sea level and the quality of soils, various crops, such as wheat, rye and oats among cereals, and clover and meadow hay among hay crops dominate there. Potatoes are cultivated everywhere.

As labour productivity is in minimum there, further development of agriculture would require both the outflow of labour surpluses and the introduction of more productive, although labour-absorbing orientations of agriculture. As this type occurs partly in the mountains where the mechanization of agriculture is difficult or impossible, the modernization of agriculture might lead to the withdrawal of agriculture from some most unfavourable sites and their conversion into forests, or else to the transformation of the arable system of land use to mixed, intercalary, field-pastoral or pastoral systems little known in Poland, and in some cases to permanent crop (fruit trees) or mixed fruit crop — pastoral system applied in the mountainous areas in other countries.

8. Highly commercial (over 6 thousand zlotys/1 ha *AL*), highly or medium productive (over 28 GU/1 ha *AL*), medium effective (below 50 GU/1 *AP*), mostly private farming, specialized in vegetable, fruit or mixed vegetable-fruit production, with high inputs of labour, low mechanization, high organic manu-

ring and medium chemical fertilizing, this type has developed not only in the suburban zones of big cities but also is some other areas, although on a smaller extent. The largest area covered by this type of agriculture is around Warsaw, which supplied the market of St. Petersburg with vegetables already before World War I. In the interwar period this agriculture expanded but not to such a degree as during the postwar two decades. Now it supplies not only the Warsaw market and those of other big Polish cities but sends increasing amounts of fruit and vegetables for export. At the same time a sectorial pattern of agricultural specialization has developed in the suburban zone of Warsaw with each sector specializing in various kinds of vegetables, early or late potatoes, hard or soft fruit, strawberries, fresh milk, etc. Besides these commercial products

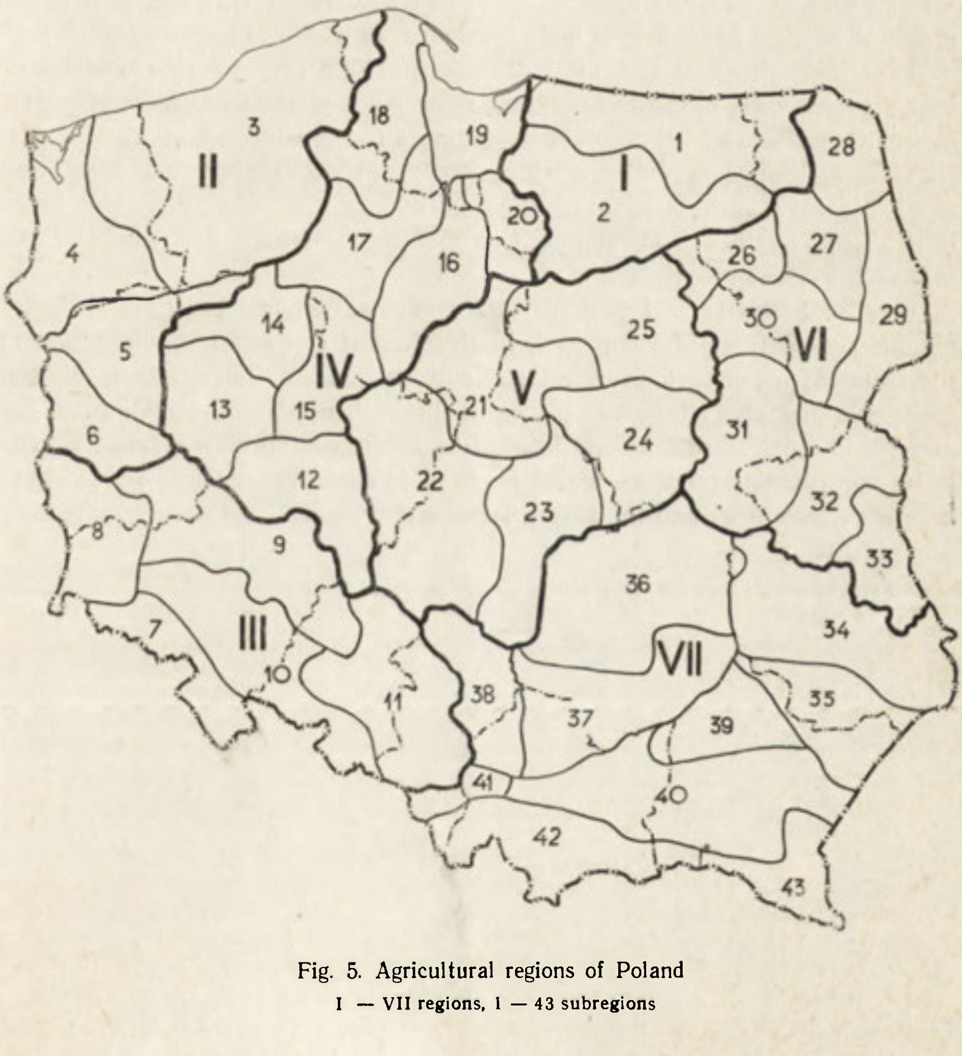

Fig. 5. Agricultural regions of Poland

I — VII regions, 1 — 43 subregions

some cereals or legumes are cultivated for farm internal consumption or for agronomic reasons. They usually rotate with vegetables and potatoes or are intercultivated with fruit trees and shrubs. For the same reasons some cattle or pigs are kept everywhere while poultry is bred mainly for the market.

The generalization of the more complicated picture of agricultural types, based on the dominance or co-dominance of particular types or subtypes in particular areas has led to the delimitation of seven agricultural regions and 43 subregions (Fig. 5)[5].

Information presented so far may lead to a conclusion that with the development of agriculture and the change of its characteristics, the areal extent of agricultural types and the limits of regions are continuosly changing. For this reason the given picture as presented here is already, at least partly, out-of-date and the study is to be repeated for 1970. This contributes also to the practical utility of typological and regionalization studies of agriculture.

Observing the past and present tendencies one may foresee some future trends in the development. Analysing some more productive, more effective, and more commercial types, one may evaluate the possibilities of transforming the less developed agriculture which occurs in similar external conditions. One may also suggest eliminating the conditions or characteristics which being in minimum, hamper its development, or creating conditions that would stimulate such a development.

Finally, agricultural typology and regionalization are the best basis for planning agricultural development. In this case it can mean the definition of the future types of agriculture and agricultural regions, that are desirable and attainable in a given time and place, on the basis of the investigations of the present external conditions and forecasting future conditions and demands. The last stage in this procedure would be to determine the manner in which to pass from the present to the future types and regions.

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[5] For explanation — see footnote 4

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PROCEDURE OF AGRICULTURAL TYPOLOGY. THE CASE OF PONIDZIE. CENTRAL POLAND

The present paper presents some conclusions of a more extensive study[1], the first results of which have been already published in Geographia Polonica[2]. The study as a whole is an attempt at an agricultural typology of a relatively small area (5,500 sq km), which is, however, greatly differentiated. It extends over five powiats in the Kielce Voivodship and includes 170 "gromadas" — minor administrative units accepted as basic units of study. Types of agriculture (3, 4, 9) were determined exclusively on the basis of their internal properties; agriculture was treated as a complex, and all its essential features were included in the analysis.

Out of the social and ownership characteristics forms of land ownership, the size structure of farms and their fragmentation were investigated. Among the organizational and technical characteristics the inputs of labour, the system of crop rotation, land use orientations (separately for arable land and agricultural land), livestock numbers and breeding systems, organic and mineral fertilization, the degree of mechanization, and the intensity of agriculture were studied. The production properties under investigation included orientations in gross and commercial production, land and labour productivity, and the level and degree of commercialization.

Many of the features listed above were expressed in quantitative indices commonly used in the areal studies of agriculture, the others were determined by means of methods established at the Department of Agricultural Geography of the Institute of Geography, Polish Academy of Sciences (6, 9, 10).

Agricultural types described in the study that has been published[3] were determined by means of superposing the territorial ranges of the investigated

[1] W. Stola, *Próba typologii rolnictwa Ponidzia*, [Prace Geograficzne IG PAN 81, Warszawa 1970, 147 s.

[2] W. Stola, Agricultural Typology of a Mesoregion as Exemplified by Ponidzie, *Geographia Polonica* 14, 1968, s. 283—290.

[3] See above.

features. Five areas were thus distinguished with agriculture characterized by similar sets of indices or structures representing the investigated properties. However, the distinguished areas seem to correspond more to the notion of the agricultural regions, as the method applied did not provide accurate foundations to classify individual units of study (i.e. of gromadas), as belonging to one or another agricultural type or subtype.

In search for a more objective and more accurate method which could enable to compare simultaneously all the diagnostic features of agriculture in all units under investigation, the graphic method of star diagrams (typograms) was finally applied.

The most essential features were selected that covered all the three groups of properties described above, mostly synthetic and measurable, with low degree of correlation beetween each other but strongly correlated with the remaining features, not included into the diagnostic ones.

The agricultural typology was finally based on the following indices or structures representing individual agricultural properties:

1) The degree of land subdivision (the share of farms 0 to 5 hectares in the total area of agricultural holdings).
2) Agricultural population per 100 hectares of agricultural land.
3) The determinant of intensity — I (according to B. Kopeć).
4) Land productivity (gross production per hectare of agricultural land).
5) Productivity (efficiency) of labour (gross production per head of population employed in agriculture).
6) The degree of commercialization (the share of commercial production in gross production).
7) Orientations in land use.
8) Orientations in arable land use.
9) Orientations in gross production.
10) Orientations (specialization) in commercial production.

The first six indices (1—6) were presented graphically for every investigated unit by means of an index typograms (9, 11). The further four (7—10) features, which are of a structural character, were presented in colours in separate fields between the axes of the typogram.

The above diagnostic features were, therefore, shown in measurable way on the six typograms as the sections of axes of specific length (features 1—6), or as the magnitudes of angles in the case of the elements composing the structural characteristics (7—10). The graphic form of the typograms are presented on Figure 1.

Although the method of typograms, as well as other graphic methods can hardly be treated as the final solution of the problem of how to integrate or to compare the diagnostic features of agriculture, the method applied does not seem less accurate than any of the so-called taxonomic methods (1, 2, 12),

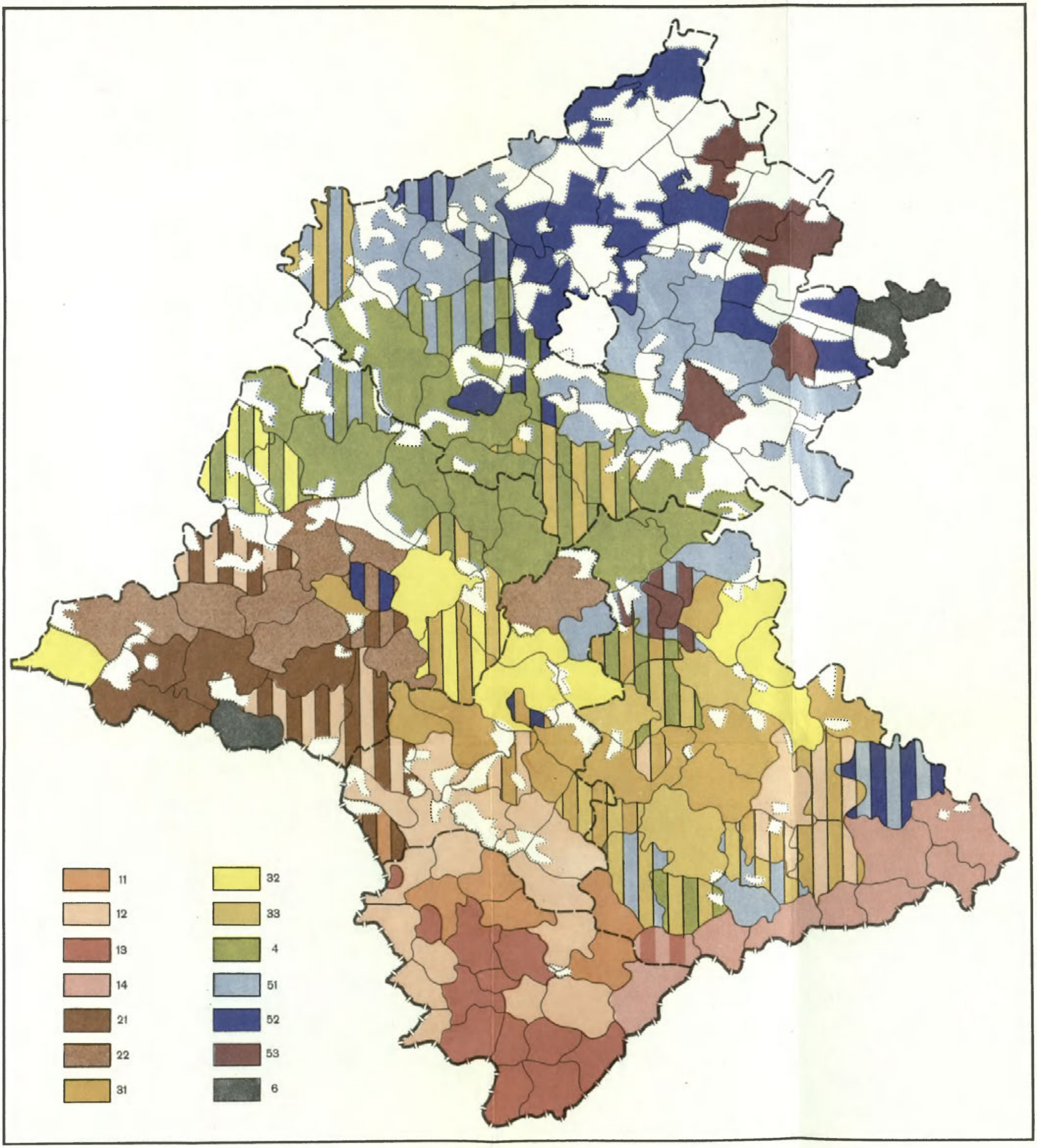

Fig. 1. Map of agricultural types

PWN, 1970

Drukarnia: ZG PWN, Łódź, Gdańska 162
Nakład: 720 + 90

while it is less laborious and therefore more appropriate when a great number of units is investigated simultaneously. There exist, however, differing opinions in the literature, and no method has met with general approval and has been accepted as the best one for comparing sets of diagnostic features of agriculture expressed in various measures for individual areal units of study. The IGU Commission for Agricultural Typology has not as yet expressed its final opinion in this respect too.

By comparing the typograms for individual units of study as to their shapes determined by the first six features, and to the colours representing the next four characteristics, it has been found that most of these units tend to concentrate around five distinct arrangements of the diagnostic criteria that have been eventually recognized as principal types. As no respective nomenclature has been established they were given single Arabic numerals.

Subtypes, denoted by double Arabic numerals (9), were differentiated on the basis of recurrent regular deviations within the principal types.

The deviations were usually confined to the structural features; different orientations in gross or commercial production were, for example, found in the most productive and commercial agricultural types (1 and 2) oriented towards: cultivation of vegetables or sugar-beet and cattle breeding, or cultivation of tobacco, or seed production and pig breeding. Differences in structural features were usually correlated with the values of indices representing other production properties, such as land or labour productivity, and the degree and level of commercialization.

Due to the limitations of space reserved for this study, only the basic differences between the types differentiated (Fig. 2) during the research are discussed below.

The most intensive, effective, productive and commercial type of agriculture was found in the powiat of Kazimierza Wielka, and in the southern gromadas of the Pińczów and Busko powiats. These are characterized by very high land productivity (45—55 grain units per hectare of agricultural land), medium or high labour productivity (60—90 grain units per head of population employed in agriculture), a high degree (from 30 to over 40 per cent) and level (14 to over 20 grain units per hectare of agricultural land) of commercialization. Other features of this area are a very high degree of land subdivision (holdings from 0 to 5 hectares account for than 80 per cent of the total), a considerable density of agricultural population (from 80 to over 120 persons), and a high index of agricultural employment (50 to over 70 persons per 100 hectares of agricultural land). There is also a very high degree of intensity (I = over 4.0), as evidenced also by the intensity indices and symptoms.

This type of agriculture can be subdivided into four sub-types, characterized by a considerable degree of specialization in the cultivation of sugar-beet,

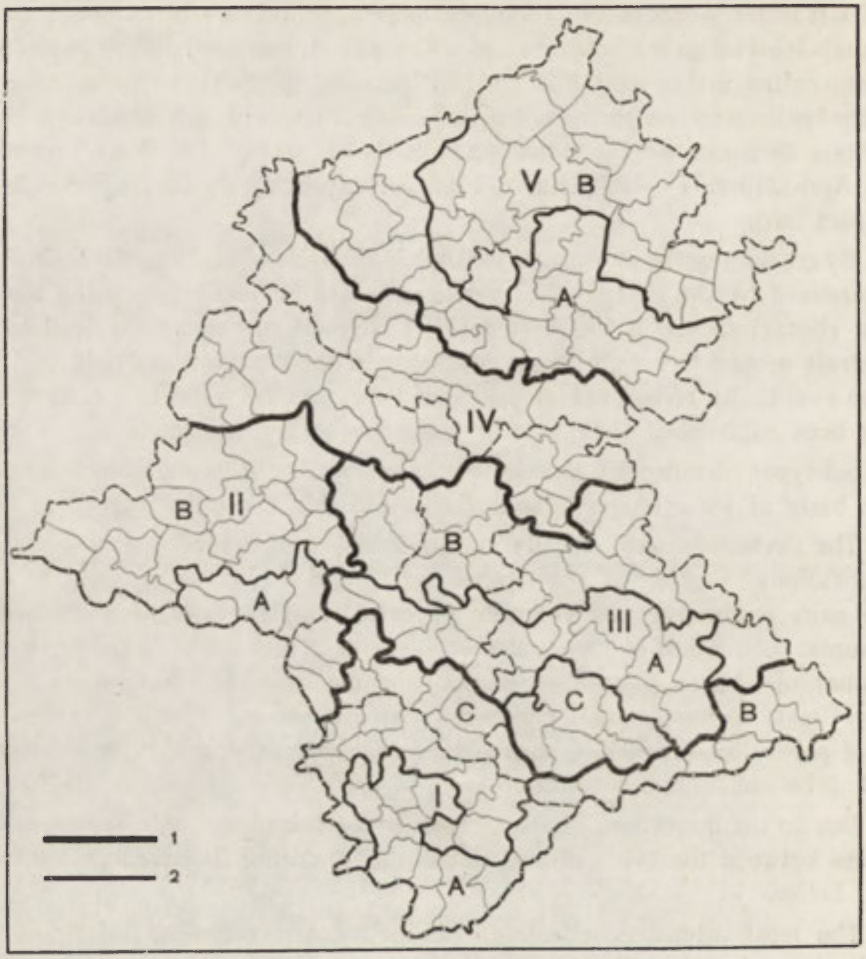

Fig. 2. Ponidzie. Agricultural regions
1 — regions; 2 — subregions

tobacco or vegetables. In all three subtypes pigs and cattle for meat and milk dominate in animal production.

Type-one agriculture has been shaped in very favourable natural conditions (especially as far as soils are concerned — predominance of Class I and II); on the very little industrialized area, with only a few food-processing factories.

Type-two agriculture is characterized by high labour productivity (70—90 units) and medium land productivity (30—40 grain units); a medium or high degree (30—40 per cent) and level (12 grain units) of commercialization; a very high degree of intensity (I = 3.0 — 3.5). This results from high numbers of livestock (about 80 big animal units per 100 hectares of agricultural land), which facilitate good manuring, as well as to relatively high degree of "machinization". Wheat and rye with potatoes, clover or lucerne are dominant crops. This type of agriculture with its two subtypes prevails on fertile soils of the southern part of Jędrzejów powiat.

Type-three represents a transitional type of agriculture which falls between types one and two, on one hand and type four on the other. It is characterized by a great differentiation of production orientations and of other features as well, what makes it possible to distinguish three subtypes.

The type-five agriculture found in the Świętokrzyskie Mountains (Holy Cross Mts) has been developed in completely different natural and economic conditions. Here medium or low efficiency and productivity (30—35 grain units per 1 hectare of agricultural land), is accompanied by a very low level of commercialization (below 20 per cent). Similarly as in type one, there is a high density of agricultural population, and holdings are very small. The field pattern is defective and agricultural methods are traditional. The low or medium intensity ($I = 3.0$) is mainly due to high labour inputs with poor fertilization and a very low degree of mechanisation.

Poor soils (class IV and V predominate), unfavourable climatic conditions and rugged relief have also hampered the intensification of agriculture in this area. On the other hand, the early development of an important industrial and mining district, as well as the forestry have provieded an additional employment for the local population. Most of the farms, therefore, produce only to satisfy their owners needs, and are characterized by low differentiation of production orientations (rye, potatoes, livestock, milk).

Beside the types described above there remains a number of typograms combining the features of two or more types or subtypes. The analysis of their distribution convinced the author of their transitional character, especially evident in gromadas with highly internal differentiation of the natural conditions. These units were therefore classified as being of transitional character between two or more specified types.

The five types found in Ponidzie and twelve subtypes distributed in a mosaic-like way over the investigated area formed the basis for the division of the territory into agricultural regions, i.e. compact territorial units with defined boundaries, differing by their peculiar and never recurring patterns of agricultural types (5).

The generalization of the typological pattern on the basis of the domination or co-domination of separate agricultural types and subtypes served as a criterion for the distinguishing within Ponidzie of five agricultural regions (Fig. 2).

The first one is the Kazimierza-Vistula region (I), where type-one agriculture developed on most fertile soils, predominates and the prospects for the further increase of productivity and commercialisation, mainly through the increase of capital inputs that would replace present high inputs of labour, are good. It would require the elimination of high subdivision of land and the increase of average size of farms. The region is composed of three subregions, varying mainly in their commercial orientations.

The next one, the Jędrzejów region (II), is also characterized by most productive and commercial agriculture. Labour productivity is higher due to the lower population density and consequently lesser land subdivision. The lower level of commercialization and land productivity is the result of lower agricultural intensity and different production orientations. The cultivation of industrial plants (sugar-beet and tobacco) is not so widespread as in region I. Colza, potatoes or seed production are typical commercial specializations.

Busko region (III) is an area with predominant type-three agriculture and type-one or type-two enclaves, which — on the scale of gromadas — are represented by transitional forms. Their natural conditions are also of transitional character and fall between regions I and IV. This is reflected by great differentiation of production orientations as well as of other production features, that leads to a further division into three subregions.

Type-four agriculture, i.e. the least intensive form occurring in Ponidzie, predominates in the region of Małogoszcz — Chmielnik (IV), the borderland between the Nida Basin and the Holy Cross Mountains. In comparison with other regions the external features of agriculture, particularly the natural ones, are differentiated only slightly as for as their importance for agricultural purposes in concerned. The region is relatively hemogeneous.

In the region of the Holy Cross Mountains (V), situated in the northern part of Ponidzie, type five agriculture dominates. The productivity, and especially labour efficiency, and commercialization levels are low. Unlike the first four regions, extending over a typical agricultural area, this region has also developed the non-agricultural branches of economy, as it lies within the reach of the two important urban agglomerations (Kielce and that of the Kamienna River Valley). These circumstances are reflected in the employment pattern, as local population can combine work in agriculture with other occupations; they also affect the character of agriculture, its intensity and production orientations.

Within the region V two subregions can be differentiated. The first one is largely influenced by the industrial and urban agglomeration of Kielce; the other is characterized by agriculture of low commercialization, oriented mainly toward meeting the needs of farm population.

BIBLIOGRAPHY

[1] J. Ernst, Regiony geograficzno-rolnicze Polski. *Czasopismo Geograficzne*, 4, 1932.

[2] J. Fierich, Próba zastosowania metod taksonomicznych do rejonizacji systemów rolniczych w województwie krakowskim. *Myśl Gospodarcza* 1, 1957, pp. 73—100.

[3] J. Kostrowicki, Geographical Typology of Agriculture in Poland. Methods and Problems. *Geographia Polonica* 1, 1964, pp. 11—136.
[4] J. Kostrowicki, N. Helburn. *Agricultural Typology. Principles and Methods. Preliminary Conclusions.* Boulder, Colorado 1967, 37 p. + 12p. appendix.
[5] J. Kostrowicki, Agricultural Typology. Agricultural Regionalization. Agricultural Development. *Geographia Polonica*, 14, 1968, pp. 265—274.
[6] J. Kostrowicki, Some Methods of Determining Land Use and Agricultural Orientations, as Used, in the Polish Land Utilization and Typological Studies. *Geographia Polonica* 18 (in print).
[7] W. Mącznik-Stola, Kierunki użytkowania gruntów ornych w województwie białostockim. *Przegląd Geograficzny*, 36, 1964, pp. 143—155.
[8] W. Stola, Agricultural Typology of a Mesoregion as Exemplified by Ponidzie (Central Poland), *Geographia Polonica* 14, 1968, pp. 283—290.
[9] W. Stola, Próba typologii rolnictwa Ponidzia. *Prace Geograficzne* 81 (in print).
[10] R. Szczęsny, Próba określenia kierunków produkcji rolniczej w Polsce. *Przegląd Geograficzny* 37, 1966, pp. 41—59.
[11] R. Szczęsny, *Typologiczne mapy rolnicze. Problemy kartografii ekonomicznej* (in print).
[12] J. Szpaderski, Zastosowanie metody podobieństwa do rejonizacji ekonomiczno-rolniczej. *Ruch Prawniczy i Ekonomiczny* II, 1960, pp. 153—176.

GEOGRAPHIA POLONICA 19, 1970

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PRODUCTION PROPERTIES OF AGRICULTURE OF NORTH-EASTERN POLAND THE CASE OF BIAŁYSTOK VOIVODSHIP

First results of more extensive study on agricultural geography of the Białystok Voivodship, the least developed part of Poland, were already published in *Geographia Polonica*[1]. On the basis of selected indices and structures representing individual diagnostic criteria of agriculture for all gromadas of the voivodship an attempt has been made at an agricultural typology of the whole region.

The present paper is a more detailed account of the methods used in the study of production properties of agriculture only.

Production properties play a special role in agricultural typology, as they determine the effects such as volume, orientations and destination of agricultural production[2]. Agricultural production is, however, greatly differentiated, especially in small peasant farms, and therefore the researcher may run against certain methodological difficulties.

The following production properties (economic features): productivity, commercialization and orientation of agricultural production, were computed and presented by indices or formulas for each investigated unit (gromada).

The investigation of production properties started with the computation of agricultural productivity determined on the basis of gross production, i.e. total amount of crop and animal produce. First methodological problem was there of a common measure which would permit to compute the total gross production and at the same time to obtain comparability of results both in space and time. As monetary units, often employed in geographical literature for the computation of agricultural production, do not guarantee the comparability of results (oscillation of prices in time, local prices, various monetary

[1] W. Biegajło, Types of Agriculture in North-Eastern Poland (Białystok Voivodship), *Geographia Polonica*, 14, 1968, pp. 275-282.

[2] J. Kostrowicki, N. Helburn, *Agricultural Typology. Principles and Methods*, IGU Commission for Agricultural Typology, Boulder, Colorado 1967, 37 p. + 12 p. appendix (mimeographed).

systems), it was decided to use conventional grain units[3]. Gross agricultural production was then estimated in grain units for each gromada on the basis of standard statistical data collected by agricultural censuses.

Crop production was computed on the basis of acreages of individual cultivated plants and their average yields plus certain necessary estimates (the amount of cereal straw or sugar-beet leaves, output of pastures, fruit crops). This task was comparatively easy; to calculate, however, gross animal production was a long and laborious process, since Polish statistics are highly incomplete as regards animal production. Both meat production (beef, pork, mutton and poultry) in live weight and other products of animal origin (milk, wool, eggs), were finally estimated using the following procedure.

First and foremost, inadequate statistics relating to livestock made it necessary, in order to compute meat production, to use rotation indices. The rotation index indicates the percentage rate of slaughtered animals in certain period of time (usually a year) to total livestock population. With rotation indices available or estimated for each kind of animals, the number of heads in each kind is multiplied by its rotation index and by the average live weight. The result obtained is the approximate annual meat production in the given unit. It should, however, be remembered that the rotation indices of individual breeds differ from one another and change in space[4] often within short distances. This depends on the prevalent breed, production orientations, and also on breeding and feeding (fattening) methods employed in the given area.

It might be higher than one for cattle or pigs oriented toward lard production or less than one for pork pigs and particularly those oriented toward bacon production, as well as for lambs, poultry, etc.

Both crop production and animal production were then expressed in comparable measures, i.e. converted into grain units.

AGRICULTURAL PRODUCTIVITY

Two important indices of agricultural productivity, i.e. land productivity and labour productivity or efficiency, can be computed on the basis of gross production expressed in grain units and representing aggregate agricultural production.

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[3] The conventional grain unit is computed on the basis of the protein and starch content in individual agricultural products. For plants which are aimed neither for protein nor starch, input-output comparisons were used. Basic indices of grain units were taken from the work by G. Blohm, *Angewandte landwirtschaftliche Betriebslehre. Anleitung zur betriebsbeschaftlichen Einrichtung und Führung deutscher Bauernhöfe*, Stuttgart 1937, 3 rev. ed. 392 p.

[4] Rotation indices computed for separate breeds indicate the following percentages of total number of animals slaughtered each year in Białystok Voivodship: cattle 16—25 per cent, pigs 70—110 per cent, sheep 25—40 per cent and poultry 80—120 per cent.

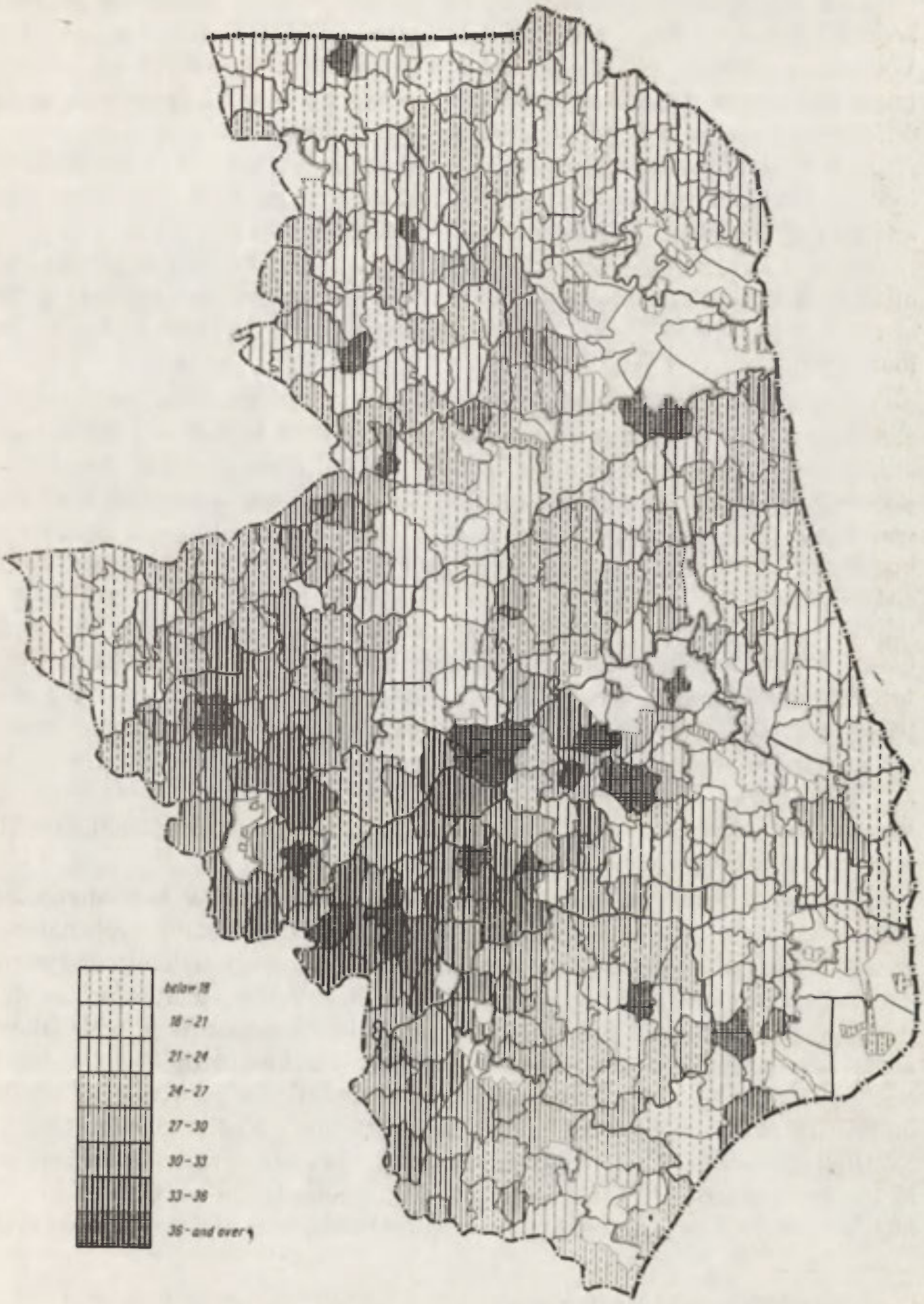

Fig. 1. Białystok Voivodship. Land Productivity.
Agricultural gross production in grain units per 1 ha of agricultural land

Land productivity determined by the volume of gross production per unit area of agricultural land is greatly differentiated. Land productivity in Białystok Voivodship oscillates between 15 and 40 grain units per hectare of agricultural land. The spatial pattern of agricultural productivity (Fig. 1) permits us to differentiate areas varying in the degree of land productivity.

Low land productivity, under 21 grain units per hectare of agricultural land, is characteristic of the northern and eastern parts of the voivodship, and also of the enclaves situated in the central and western parts.

Medium level of land productivity, from 21 to 30 grain units per hectare of agricultural land, characterizes the central, west-central and southern parts of the voivodship. Relatively high productivity, over 30 grain units, can be found in the western zone.

Investigations proved that spatial differences in agricultural productivity expressed by the index of land productivity correlated both with natural conditions and systems of agriculture. Low agricultural productivity in the proglacial valleys (*pradoliny*) (the enclave in the western and central parts of the voivodship, Fig. 1) is due to their unfavourable natural conditions. Sands and bogland with defective water systems, which dominate in the Kurpie Plain and the river Biebrza Valley, make low yields, in particular of grasslands, the prevailing form of agricultural land use (60—70 per cent). Hay-yields from boggy meadows amount to 8—15 quintals per hectare only, and this affects total agricultural productivity. Extensive system of utilization of meadows and pastures in this area makes it necessary to use two different reference bases for the computation of agricultural productivity. If productivity is referred to arable land, fairly intensively utilized, it appears that land productivity is medium and locally even high. If it is, however, computed in relation to total agricultural area the index is exceptionally low.

Low agricultural productivity characterizing the narrow belt along the eastern boundaries of the voivodship, is due, besides rather unfavourable natural conditions mainly unfertile sandy soils, to the antiquated agricultural system and the orientations that result from it. The three-field system[5], which is still practised in this part of the voivodship, often in its classic form, with fallow land, field compulsion and common pastures, together with mainly cereal orientations in the use of arable land, low intensity, in particular as inputs on floating assets are concerned, bring about extremely poor production results.

High productivity — over 30 grain units per hectare of agricultural land — in the western part of the voivodship is due, besides better soils, to relatively high intensity of agriculture. Longer crop rotations, with the rye-potato (with

[5] W. Biegajło, The Ways of Transition from the Three-field System to Modern Farming as Currently Observed in Poland's Underdeveloped Region of Białystok, *Geographia Polonica* 2, 1964, pp. 153—158.

considerable share of sugar-beet) — clover orientation is a common occurrence on arable land, which occupies 70 per cent of agricultural acreage. The rational system of crop rotations together with relatively high, for Białystok voivodship, outlays on floating assets (mineral fertilizers, selected seeds, concentrated feeds, etc.) and extensive cattle and pig breeding bring about high land productivity.

Labour productivity expressed in terms of gross production per head of population is even more differentiated than land productivity. Labour productivity oscillates in Białystok voivodship between such extremes as 60 and 240 grain units per head of population employed in agriculture. The indices obtained are, of course, only approximate; this is due to inadequate statistics. Actual employment figures for private farming were estimated on the basis of the ratio of working people to total agricultural population[6].

The spatial differences of labour productivity (Fig. 2) undoubtedly correlate with social and ownership properties of agriculture, density of agricultural population and the degree of mechanization of agricultural practices.

Consequently the highest labour productivity in the north-western part of the voivodship occurs in territories where state farms predominate. Large state farms employing few wage earners (7—10 persons per 100 hectares of agricultural land) are characterized by high indices of labour productivity (180—240 grain units per head of population employed in agriculture) due to high standards of mechanization of field and farm work.

In private farming a relatively high labour productivity (90—120 grain units) was found in powiats of the west-central part of the voivodship. These results are due to a favourable agrarian structure (the average size of farms amounts to 10 hectares, fields are integrated, plots range from 3 to 5 hectares), a relatively good equipment with tractors and agricultural machinery, not too high employment numbers (32—35 persons per 100 hectares of agricultural land), and also to high land productivity.

Low labour productivity (50—80 grain units) characterizes the south-eastern territories. This is mainly due to the defective agrarian structure and also to high density of agricultural population. Small-size farms are here a common occurrence (on the average they range from 5 to 7 hectares), characterized by great fragmentation of holdings (the average size of the plot is 0.3—0.5 hectare) and scattered fields (5—7 km from the village centre). The fragmentation of farms and fields limits the use of tractors and agricultural machines. The minimal mechanization of field work and partial utilization of man-power, mainly in winter seasons, lowers the value of labour productivity indices.

[6] In private farming the number of persons employed amounts to 55—60 per cent of total agricultural population; this percentege was computed on the basis of estimates in which the age structure of population, a proportion of working women, percentage of working young people aged from 14 to 18 and of people over 60 were taken into account.

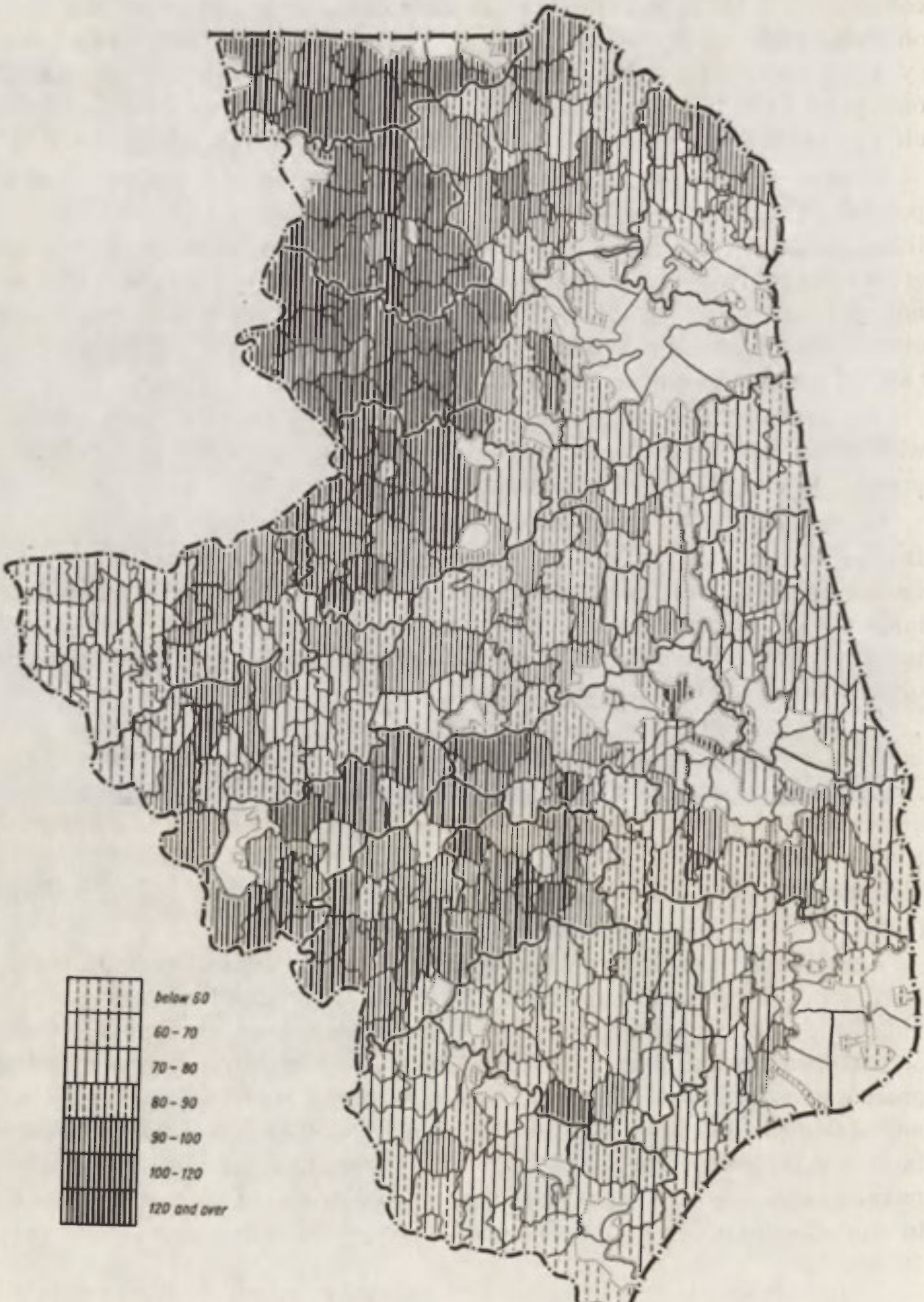

Fig. 2. Białystok Voivodship. Labour productivity.
Gross agricultural production in grain units per 1 person employed in agriculture

COMMERCIALIZATION OF AGRICULTURE

Commercialization of agriculture indicates the volume of agricultural production sold on the market, thus expressing the role of agriculture in the economy of the area under investigation. As long as peasant husbandry exists, it is not an easy task to investigate agricultural commercialization. Private farms produce goods largely for their own use, and only partially for marketing. The co-existence of various forms and ways of trading, e. g. the centralized (state or cooperative) system of purchases, free-market trade, etc. are further complications which trouble the researcher.

For lack of detailed data the computation of commercial agricultural production had to be based on estimates. In the case of the gromadas of Białystok voivodship commercial agricultural production was estimated on the basis of the following data: the output of industrial crops (sugar-beet, flax, hemp, colza, tobacco etc.) was fully included in commercial production, commodity surpluses of cereals, potatoes, vegetables, fruits, were calculated either on the basis of centralized purchases, increased by 10—15 per cent for free-market sales, or else on the basis of the mean consumption; contracted crops (seeds of leguminous plants, grasses etc.) were also included in total in commercial production.

As far as animal production is concerned, beef, pork, mutton and wool production was assessed on the basis of data provided by the socialized purchasing stations, plus certain percentage for free market sales; poultry sold mostly on the market, was entirely estimated. Milk and egg surpluses were calculated on the basis of the balances of consumption in the farm production minus reproduction needs and internal farm consumption.

Subsequently, the commercial production of vegetable and animal products, converted into comparable grain units, served as a basis for determining the indices of the level and the degree of agricultural commercialization.

The level of agricultural commercialization in Białystok Viovodship, in terms of commercial production per territorial unit is low and spatially differentiated (Fig. 3). A higher level (over 9 grain units per hectare of agricultural land) can be found only in the northern and west-central part of the voivodship, i.e. on a territory where state farms occupy vast areas and private farming is characterized by highly productive husbandry.

The degree of agricultural commercialization measured by the ratio of commercial production to gross production is also low (15—40 per cent). Its spatial presentation (Fig. 4) points to great differentiation. The spatial differentiation of agricultural commercialization determines also the areas of closer mutual bonds of agriculture with the market. In most of the Białystok Voividship these bonds are, however, still loose and agriculture is predominantly of self-sufficient character.

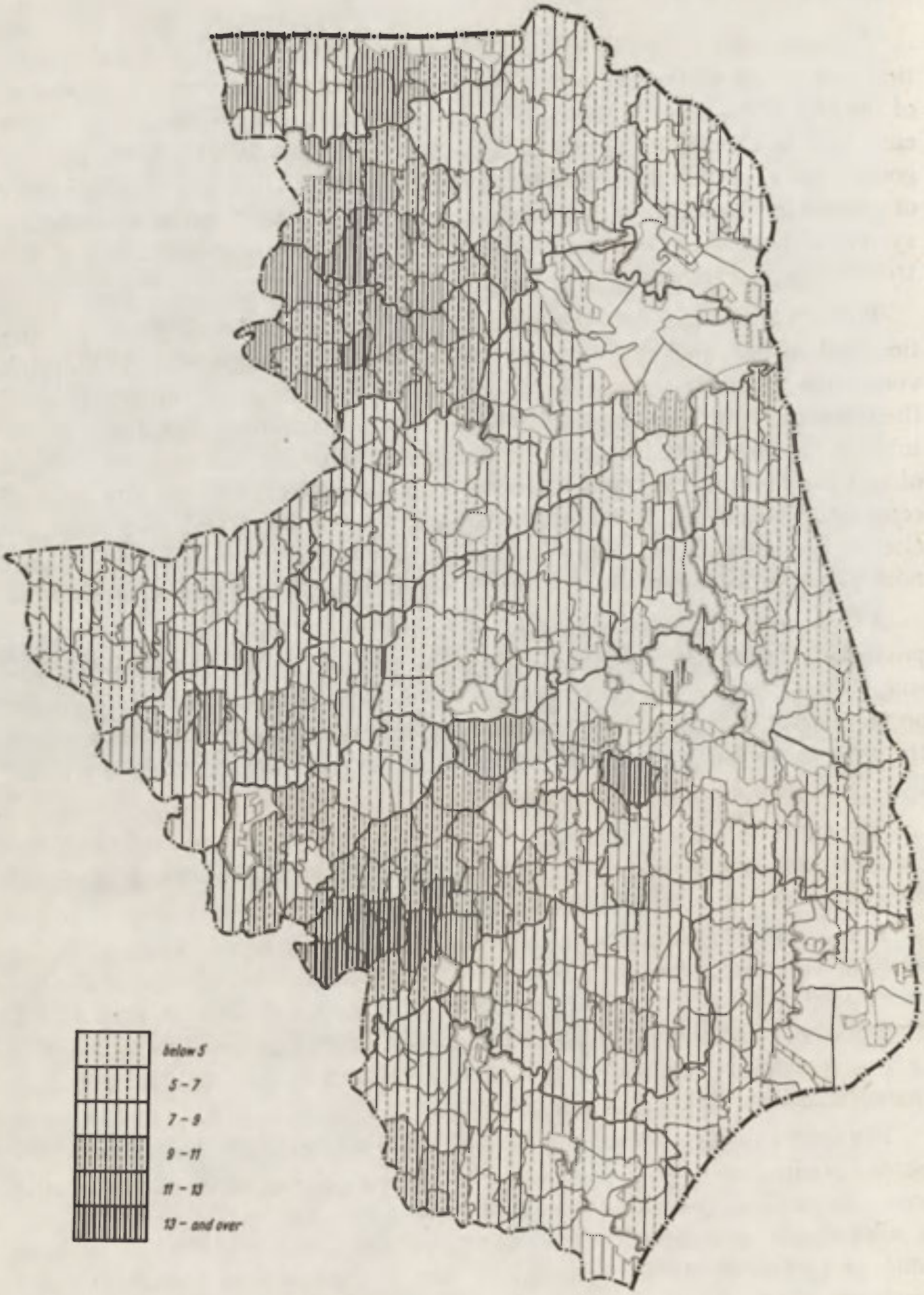

Fig. 3. Białystok Voivodship. Level of Commercialization.
Commercial agricultural production in grain units per 1 ha of agricultural land

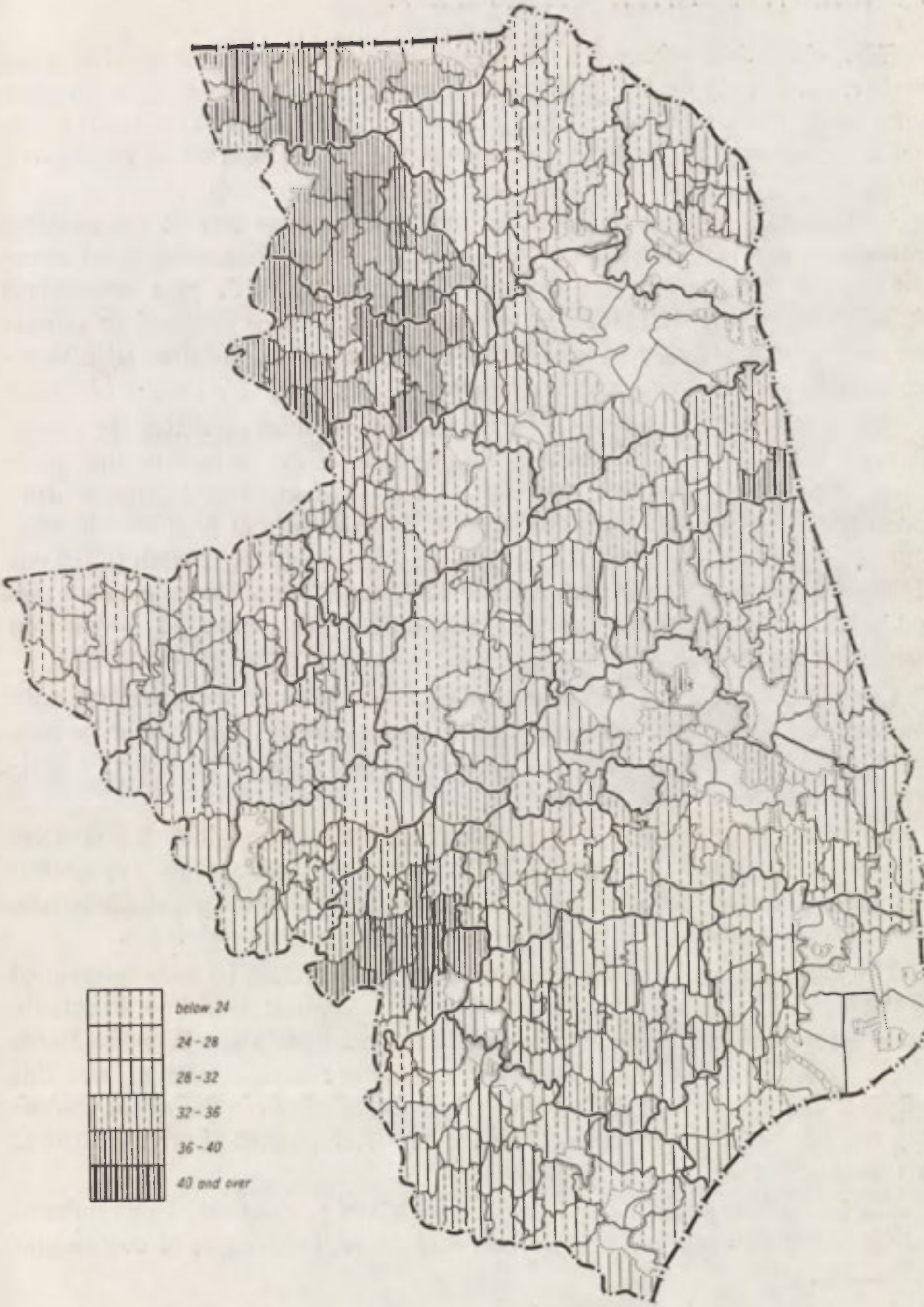

Fig. 4. Białystok Voivodship. Degree of Commercialization.
Commercial agricultural production in percentage of gross production

ORIENTATIONS IN AGRICULTURAL PRODUCTION

The orientations of agricultural production were determined based on gross production, namely on the proportion of crop and animal production in gross production. These ratios reveal that there are two procipal orientations: (1) crop, and (2) mixed crop-livestock. These can be further subdivided into 10 orientations determined by the composition of agricultural gross production.

In the group of crop orientations the most common one is: rye-potatoes with dairy cows and pigs $V_4\,(sc_2 + st_2) + A_2(bl_1 + ss_1)$ [7]. Among mixed orientations the rye - potato - meadow hay - dairy cattle with pigs orientation $V_3\,(sc_1 + st_1 + pt_1) + A_3\,(bl_2 + ss_1)$ dominates. In numerous suburban gromadas and towns the following orientation is most common: potatoes with vegetables and pigs with dairy cattle and poultry $V_3\,(st_2 + lg) + A_3\,(ss_2 + bl_1 + cc_1)$.

The analysis of the structure of commercial production permitted the researcher to differentiate 17 commercial orientations of agriculture in the whole voivodship, which indicates that agricultural production is becoming more specialized. Unlike production orientations, predominance of products obtained from livestock, mainly cattle-breeding (meat, milk), occur most often (in 15 out of 17 orientations) among the commercial orientations. Dominance of pigs and locally poultry determines the orientation of commercial production mainly in towns.

Cereals, potatoes, and locally suger-beet, flax, tobacco and colza are main commodities in vegetable production, which is equivalent to livestock production only in two orientations (mixed animal - vegetable) while in the others constitutes a supplementary element.

A comparative analysis was also made of the indices of production properties for separate gromadas; the cartographic method of star diagrams (typograms) was used to show the principal differences. Figure 5 presents characteristic arrangement of production properties for selected agricultural types.

The pattern of indices for production properties of state farms is determined by the high labour productivity and high degree of commercialization. In private farms the most regular shape of typograms can be found in the Wysokie Mazowieckie type [8]. All the respective indices are there at a maximum and this indicates that this type of agriculture is the most universal in the whole voivodship and can be accepted as a model for further developoment of private farming in conditions specific for this voivodship.

The low labour productivity index and high land productivity index influenced the shape of typograms in suburban agriculture. Low degree of commercia-

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[7] *V* — vegetable production, *A* — animal production, *sc* — rye, *st* — potatoes, *pt* — meadows, *lg* — vegetables, *bl* — dairy cattle, *ss* — pigs, *cc* — poultry (eggs).

[8] W. Biegajło, Types... *op. cit.*

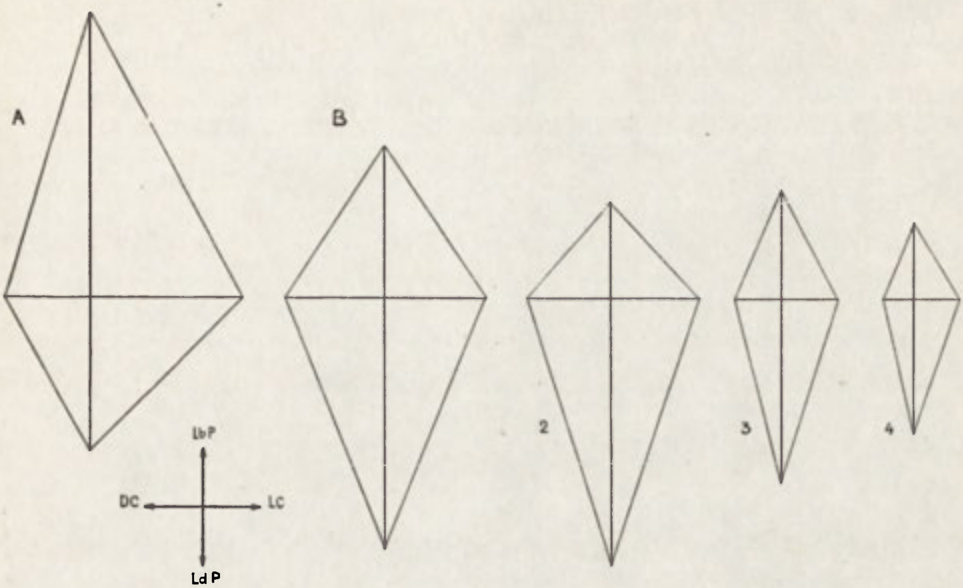

Fig. 5. Arrangement of production properties of the selected types of agriculture in the Białystok Voivodship

A. State farming

B. Individual private farming: 1 — Wysokie Mazowieckie subtype, 2 — Suburban subtype, 3 — Siemiatyczne subtype, 4 — Sokółka subtype

LbP — Labour productivity, LdP — Land productivity DC — Degree of commercialization, LC — Level of commercialization

lization and low land productivity determined the contours of typograms in the Siemiatycze and Sokółka types.

The analysis of the spatial differentiation of production properties of agriculture, together with social and ownership as well as organizational-cum-technical features, will serve as a basis to differentiate finally the agricultural types in Białystok Voivodship.

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THE CHARACTERISTICS OF AGRICULTURE IN JAPAN AND AN APPROACH TO AGRICULTURAL TYPOLOGY

AGRICULTURAL TYPOLOGY AND AGRICULTURAL GEOGRAPHY

Agricultural typology aims at classifying criteria or indicators after establishing terminology, in order to understand co-ordinately agriculture in the world, which present various aspects. There is no doubt that this aim has an important meaning for agricultural geography, the object of which formulates a system of scientific principles.

But the agriculture of every place in the world has been historically formed by different nations, and therefore it has many aspects which cannot be sufficiently measured by quantative indicators, which is the aim of agricultural typology. Even though the existing agricultural phenomena of a certain region could be measured mechanically by some quantitative indicators, it does not necessarily explain the factors or mechanism formed by those phenomena. Needless to say, a true perfect knowledge means the understanding of the mechanism causing phenomena and the process that is forming this mechanism in addition to phenomena themselves. In such a sense, it may be said that agricultural typology is limited, and the domain beyond the limit should be investigated by agricultural geography.

For all that, even though a certain region was grasped by agricultural geography, if that region is not fixed in relation to regions of a higher order and furthermore upon the whole world, the apprehension is unable to become a systematic knowledge including unified principles. Agricultural typology perhaps offers only some frames to establish certain systematic principles of agricultural geography.

Agricultural geography and typology should be unified in subsistence, but as an intermediate process of study, they should be tied together, holding each one's own sphere. It is an important problem to find some ways to tie up the both spheres. The problem is difficult for us to solve, for the typology has not been as yet established. In spite of it, I dare to try to approach this question by investigating the characterictics of agriculture in Japan.

THE CHARACTERISTICS OF AGRICULTURE IN JAPAN FROM THE MACRO-SCALE VIEW-POINT

The world is composed of many regions, and has a hierarchical structure of regions. Namely, some smaller regions make up a wider region, and these wider regions are making still wider regions. And the whole world is the largest region which comprises all these regions. Accordingly, as Kostrowicki pointed out[1], there must be many hierarchical orders of indicators by which the agricultural regions in the world are evaluated. Some of these correspond to regions of the smaller scale, and some others to regions of the wider or the widest scale. But, from the standpoint of typology which aims at classifying the types of various agricultural regions by uniform indicators, the numbers of the orders of indicators should be limited to the highest order, the lowest, and a few intermediate orders. What sort of an indicator is the highest? What sorts of indicators are intermediate or the lowest? In my opinion it is fundamental to find the highest indicator in order to know the proper meaning of agriculture.

Needless to say, agriculture is carried out by aiming at self-sufficiency of products entirely or almost all, in primitive societies, but in market societies producers practise agriculture with the object of supplying products to others as well as to themselves and their families. Under certain circumstances, the production for supplying others with products is the only aim. Although this matter is entirely self-evident, it is also the most fundamental for agricultural typology. Kostrowicki brought forward three categories concerning the criteria by which types of agriculture are classified as follows:

A. Who is a producer?
B. How produce is obtained?
C. How much, and for what purpose is it produced?

According to this classification, the first is Social category, the second Functional category, and the third Economic category. I think that the third must be the most important of these categories, and especially the problem of "for what purpose is it produced?" should be the nucleus. That is to say, it should be at first solved whether agriculture of a certain region is carried on self-sufficiency or commercial basis, and with what relative importance these two kinds of agriculture are combined with each other.

From this point of view, agricultural regions in the world are divided into the primitive societies, where agricultural production is fundamentally oriented to self-sufficiency and the other societies, where it is oriented to sale besides self-sufficiency. In the the latter, there are cases when the object of production is realized by the free will of producers themselves, and the other when this is

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[1] J. Kostrowicki, *Principles, Basic Notions and Criteria of Agricultural Typology*, Conclusions drawn from the answers to the Commission's Questionnaire 1, 1966, 36 p.

done by the social or national will. This latter example is typical of communist societies.

Hiroshi Ishida divided agriculture in the world into four types. His conceptional model is as follows[2]:

A. Tribal, subsistence agriculture
B. Peasant, semi-commercial agriculture
C. Individualistic, capitalistic agriculture
D. Co-operative agriculture
 D_1 Communist collective agriculture
 D_2 Capitalist co-operative agriculture.

From the view-point of orientation mentioned above, these types are to be re-classified as follows: 1. subsistence agriculture (A), 2. semi-commercial agriculture (B), 3. commercial agriculture (C, D). Probably he thought that agricultural production was really a phase of social phenomena, and that it should be fixed in the whole structure of society. Thus, he regarded, to be sure, the categories of social structure as tribal, capitalist and communist societies, and furthermore he combined these social categories with two categories of orientation in production, namely subsistence agriculture and commercial agriculture. If his interpretation is right, it may be said that he has shown the types of the most basic or the highest conception concerning the agriculture in the world.

If so, what category does the agriculture in Japan belong to? According to his opinion, Japan as an agricultural region belongs to the region of semi--commercial agriculture. Probably there are some scholars who do not share this opinion, considering that at present agriculture in Japan is tending strongly towards the commercial type. But the correctness of his opinion is perhaps confirmed by the fact that there are numerous classes of ultra-small farmers who hardly sell agricultural products at all. (cf. Table 1).

At any rate, the agriculture in Japan has thus been fixed according to Ishida's classification at the highest type level throughout the world. But, in order to make clear the characteristics of agriculture in Japan, some criteria of a lower level should also be established by means of a more detailed analysis.

THE TENTATIVE FRAMEWORK OF GEOGRAPHICAL STUDIES ON AGRICULTURE IN JAPAN

We may guess the characteristics of agriculture in Japan by examining the geographers' studies in this country.

Shōhei Birukawa arranged properly the results of geographical studies on

[2] H. Ishida, A Conceptual Model for Agricultural Geography. *Review of Historical Studies*, 1967 (in Japanese and English). See also his paper in the present volume pp. 71—80 (eds).

TABLE 1. The ratio of farm households classified according to the system of management in Japan

	Total	Self--sufficient type (A)	Semi-commercial type (B)			Commercial type (C)			
			self-sufficiently produce main cereals	produce semi-commercial products beside main cereals	do not produce main cereals	self-sufficiently produce main cereals	produce semi-commercial products beside main cereals	produce commercial products beside main cereals	do not produce main cereals
Number (1 000)	6 045	2 372	875	1 076	25	315	526	843	14
percent of total	100.0	39.3	14.5	17.8	0.4	5.2	8.7	13.9	0.2

Notes: (A) includes farm households which sold agricultural products less than twenty thousand *yen*. (B) between twenty thousand and one hundred thousand *yen*, and (C) over one hundred thousand *yen*.

Source: Ministry of Agriculture and Forestry (1955). *Report of Special Research on Agriculture*, No 9, which was quoted in *Agricultural Management in Japan*, compiled by H. Isobe.

agriculture in Japan, and pointed out that geographers in this country had been mostly concerned with the following issues [3]:

1. Development of land use
2. Competitive relations between urban land use in suburban zones of megalopolis in the Pacific Belts
3. Development of commercial farming resulting from horticulture, dairy farming and large-scale poultry farming
4. Connections between giant markets and horticultural regions and products
5. Areal succession or change caused by raising new crops and decline of sericulture
6. Combinations of agricultural and non-farming activities in rural villages
7. Development of productivity caused by the improvement of arable land and irrigation
8. Impact of mechanization on agriculture
9. Migration of agricultural labour
10. Changes in farm households and population caused by urbanization and industrialization
11. Spatial pattern of labour productivity and land productivity
12. Inclusive studies on the items and regions

Besides, he stated that the problem of the division of Japan into agricultural regions had interested geographers before and after World War II.

Fukuo Ueno classified the principal problems of agricultural geography in Japan as follows [4]:

1. Land-basement and farmland structure
   1) Studies on the development and regional characteristics of land improvement
   2) Studies on the modernization of irrigation facilities
2. Mechanization of agriculture
3. Structure of agricultural labour
4. Side-work or part-time work
5. Regional development, differences, and factors of modernizing rural organizations
6. Studies on regional specialization in agricultural production
   1) Studies aiming at understanding the rural status of regional specialization in agricultural production
   2) Studies concerning regional formation of specific agricultural crops

The items which they pointed out may be re-summarized as follows:

1. The essence of agricultural production, namely, products, forms of pro-

[3] S. Birukawa, Trends of Rural Geography in General, *Japanese Geography*, 1966, pp. 94—104 (in English).

[4] F. Ueno, Modern Changes of Japanese Rural Areas, *ditto* 1966, pp. 105—117 (in English).

duction, system of farm management, etc, especially the recent changes caused by urbanization and industrialization

2. The real status and development of productivity, and its factors
3. The areal pattern and its transition as given above.

As a matter of fact, however, the actual studies deal with various subjects or utilize different methods, and also the ways of understanding the real substance of agricultural geography do not necessarilly coincide with each other. We must find out the mutual relations between various studies and fix them upon the common scientific system, even if the diversity of the studies is to be considered significant, for the purpose of widening the base of this science. Though the classifications by Birukawa and Ueno are useful in such a sense, it is all the more important to try to find the whole framework including all possible studies on agricultural geography by combining their classifications.

A tentative scheme is shown in Figure 1. The indicators of the lower level or the intermediate ones which typify minutely the agricultural regions in the world, could not be obtained without comprehension of the structure of the regions concerned. This figure indicates what methods or ways have been applied to approach the characteristic structure of agricultural region in Japan. I should like to interprete briefly this figure, and inquire into some criteria applicable to agricultural regions in Japan.

It is generally admitted that there are methods of systematic and chorologic studies in any sphere of geography. Questions of progress, distribution, location, land use, landscape, and region can be treated as systematic studies. But from the standpoint of a search for unity of systematic and chorologic studies, it may be considered that the approach from the viewpoint of region plays an important role. The figure shown here is framed from this point of view, and it is to be applied to the whole Japan or to its partial regions.

"Agricultural region" is placed in the center of this figure in the line with the view mentioned above. Here we take such standpoint that agricultural geography accomplishes its basic task in elucidation of the characteristics or the whole structure of regions. The region is a structural whole, including various elements tied up with each other. Therefore the elements shown under the "region" ought to be investigated synthetically.

This region, needless to say, is an entity formed historically. The Japanese history has made a part of the history of monsoon Asia, and the Japanese agricultural region has fundamentally maintained the peasant system of family--labour type rooted in the production method of Asiatic monsoon-land. And yet it has not always been done by the same process as that of the other societies in Asia, but has been formed through a unique process and under the circumstances or an island-country consisting of a single nation. Especially the long duration of the isolated feudal society which this nation experienced was an important historical factor, by which an agricultural region differing

A GENERAL SCHEME OF AGRICULTURAL GEOGRAPHY CONCERNING JAPAN

An approach to the characteristics of Japanese agricultural regions — (a tentative model)

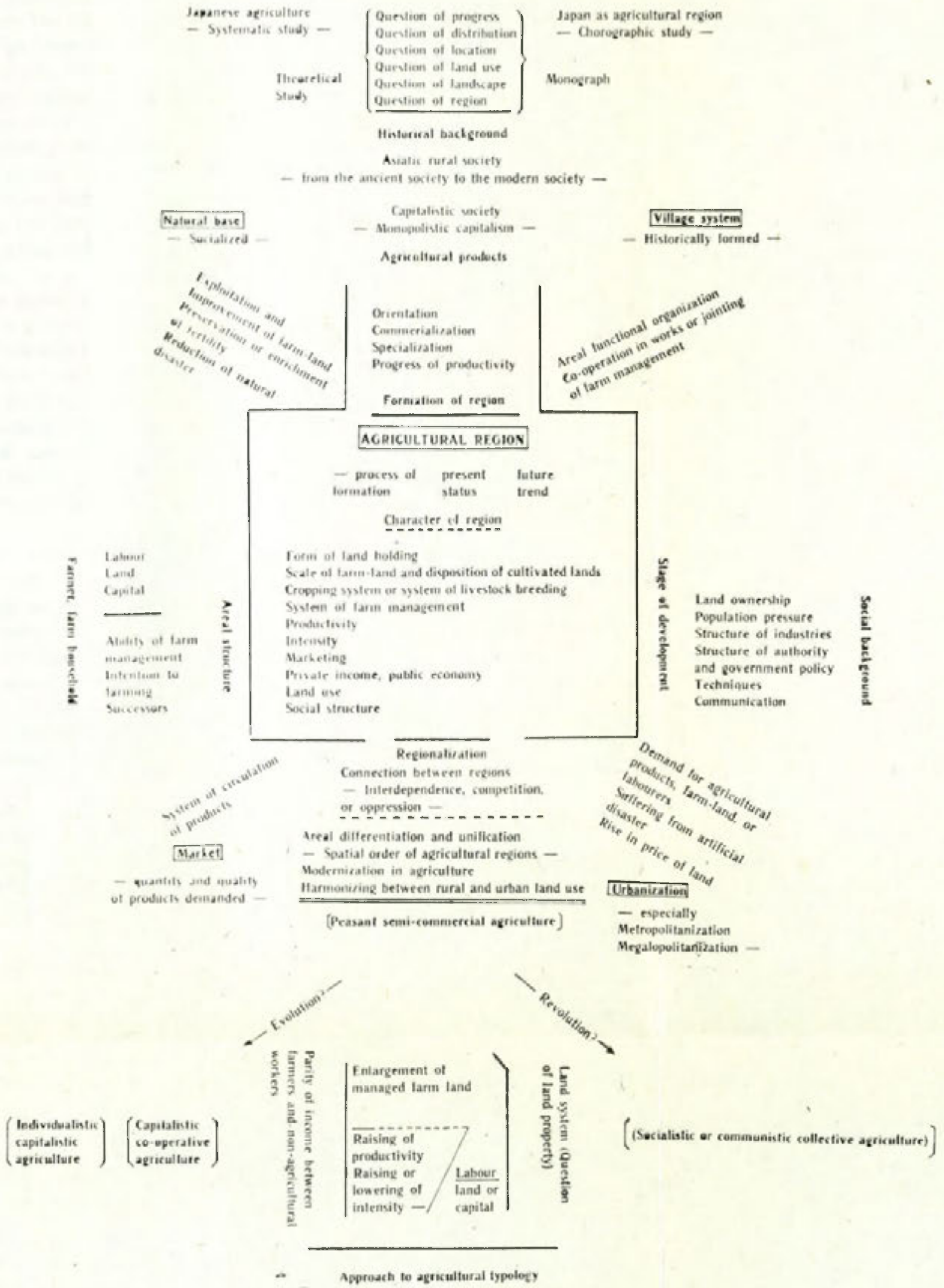

Fig. 1

Note: [ ] see theoretical model of agriculture by H. Ishida from other regions in Asia was formed. Agriculture in this country was not brought under the control of the imperialistic, colonial policies of the Western countries owing to the policy of isolation pursued by the political authority in recent times, but it was made in the form of serving that authority. This blockaded and isolated situation, however, was broken down in the mid-nineteenth century, and Japan has had close contacts with foreign countries thereafter. Since then, the agriculture in Japan has gradually changed under the impetus of foreign demand for its products and under the pressure of foreign agricultural products. Moreover, it has changed in the conditions of a strong rule of monopoly capital basing on commerce and industry which has grown through the process of the industrial revolution and the several wars Japan had fought. In such a process, the ways of combination or proportion between subsistence and commercial agriculture have changed, specialization of products or regions has made progress with the advance of development of commercial agriculture, and the productivity has raised as a whole. But the fundamental type of family-labour management in peasant system has not changed in spite of such changes.

Although the factors or external conditions which have affected the formation of agricultural regions are numerous and complicated, particular importance is given to the following four items: "Natural base", "Village system", "Market", and "Urbanization" which are cited in Figure 1. Some of the other factors or conditions may be found in the "Social background" which is opposed to "Farmers or farm holdings". "Social background" itself is also very complicated, but only several items are cited here. Obliquely written items are considered as functions of factors given above, which act on the "region" placed at the core. I should like to describe the real status of these four factors some other day.

These factors themselves change with time and so does their weight with the change of factors. As a result, the processes of formation of the region change. In other words, regions always involve powers of motion, i.e. trends towards the future. Accordingly, a certain region is to be understood at one period as a certain stage of development, and is to be fixed in the order of development. Agricultural regions include such moving phases or motion. In the moving process, the relation between the whole region and the partial regions or between the partial regions themselves changes, even if it may be a mutual relation, a competitive one, or a dominating-subordinating one. During such changes, differentiation and unification in regions are actualized. Such a motion towards these two opposite directions may dialectically interact, and thus may establish the spatial order of agricultural regions.

In my opinion, there was a similar style among agricultural regions in Japan at the stage before the Restoration of Meiji (AD. 1868) or even later in the period of Meiji. Namely the partial regions had nearly similar forms or, similar characteristics, and therefore the relations among them were loose. Such an areal structure has gradually been strengthened as commercial agriculture developed and as function of marketing of farming products enlarged actively. In other words, each partial region has been strongly fixed in the whole region at the moment of the strengthening of areal specialization in accordance with the development of commercial agriculture.

It is considered that such changes of areal order will be more and more rapid under the influence of progressing urbanization, in the future.

ON TYPOLOGICAL CRITERIA APPLICABLE TO AGRICULTURE IN JAPAN

As pointed out above the distribution of agricultural products or the disposition of agricultural regions in Japan has remarkably complicated and variegated patterns. As a result, it is very difficult to judge what phenomena are the most important or what factors are the most fundamental. Perhaps the judgement differs very markedly with scholars. I stated previously that the criteria of the most fundamental or the highest order should be those suggested by Ishida in fixing Japan's place in the world from the standpoint of agricultural typology. But I did not express my opinion as to what should be adopted as the next criteria. In Figure 1, I have not assessed either, which are the fundamental elements of an agricultural region or which factors affect the formation of regions. These points ought to be made clear by theoretical or specific studies by many scholars. But it is perhaps useful that some assumptions are proposed in order to stimulate those studies.

So I dare to investigate hypothetically the fundamental criteria to be adopted for the purpose of determining the type of Japanese agriculture. As stated before, the Japanese agriculture, which had developed by adding the production of commercial upland products to the basic rice production, has been influenced by violent urbanization since World War II. It has been fraught with collapse, while it has been faced with the status requiring radical reform and drastic advance.

Where does agriculture in Japan look for a way of advancement? To look for a way of advancement, in other words, to grasp how the evolution or the revolution is actualized, is nothing else but searching for the fundamental criteria mentioned above. Of course, this search ought to be done through investigation of the characteristics of Japanese agricultural structure.

As Sadao Ishiwata stated[5], there may be: (A) the route of revolution to the socialist or communist agriculture and (B) the route of evolution of the capitalist agriculture, as the ways of remarkable progress of the agriculture in this county. The former is the route by which collective agriculture is estab-

[5] S. Ishiwata, *The Questions of Japanese Agriculture, its Fundamental Isue*, 1964 (in Japanese).

lished on the basis of the national ownership of land. It will be actualized if political authority is gained by farmers and labourers. At the present development stage in Japan it seems that a large majority of people in this country are concerned about how the latter is actualized. If so, what is the level of agricultural development? And how can the present characteristics of Japanese agriculture be evaluated on the ground of agricultural development?

Needless to say, agriculture is practised as farm management on the basis of the organic combination of land, labour and capital. In case of Japan, it is fundamental and overwhelming that small producers manage their farms depending on family-labourers, with small capital which they store up themselves. Therefore, on an average, it may be said that a farm household produces agricultural products which only one household demands, besides products with which the farm household itself is supported. The management characterized with such a petty and low productivity is not an enterprise in the modern sense, but is, so to say, "islet-like existence in the capitalistic society" or "inferior industry" for a modern industry. This "islet" is dashed with the waves of capitalism on the axis of the monopoly capital, and is confronted with such a status as cannot be maintained unless it breaks up its constitution and strives positively through the waves. By what means can such an agriculture cast off the existing shell, adapt itself to the developing capitalistic society, and subsist in the future? The way of adapting and subsisting cannot be found in the traditional posture of farmers who are confident of self-sufficiency of foodstuff production and do not entertain ill feelings against excluding wages from the cost of production.

In order to break such postures, farmers ought to look ahead in the future urbanized society, realize their own social mission, and dash in the midst of monetary economy on the basis of specialized commercial agriculture. Rationalization of system of production and large growth of productivity are by all means necessary for this purpose. It is an urgent aim for farmers to raise productivity to gain the same incomes as that of urban workers at the least. In this case, it is a question what sort of income should be considered. Someone may regard it as the whole income including non-farm one, someone as the gross return from farming, or still someone else as the element-income on the basis that the self-reliant management is divided into three categories, viz., of profit, land rent and wages. The suggestion to adopt the element-income may be rejected as an impracticable idea, for the present state of agriculture in Japan belongs to the category of peasant farming. But, since the percentage of farmers in the whole industrial population is estimated to decrease remarkably in the near future, I think that agriculture has no chance to get out of the situation of "inferior industry in the modern industrial society", unless farmers aim at acquisition of element-income balanced with that of other industries, for self-reliance.

The effective way of gaining such a high productivity is to enlarge the farmland. This, however, is prevented by the wall of private ownership of land. It is a fact that even farmers who have abandoned farming, do not sell their farms. The main reason preventing the taking over of the farmland by self--reliant farmers is that the social security system for the remaining years has not been established satisfactorily, and that the sudden rise of land prices is expected especially within and around urban areas. The problem of how to overcome these obstacles cannot be solved only within the limits of agriculture.

By the way, the ratio of population engaged in farming to the whole industrial population which was 51% in 1920, 42% in 1940, and 45% in 1945, has decreased to 30% in 1965. And it is estimated that it will continue to decrease by 5 to 10 percent for the coming thirty years. In spite of this, it is postulated that farmers must supply at least 70% of foodstuff which the nation needs. But it is almost impossible to fulfill this demand at low productivity which characterizes the existing agriculture in this country. If the request is absolute, the agriculture must be reformed thoroughly. One way of the reform is to seek for vast farm lands beyond the limit of the existing agricultural areas, and an other is to establish a really new structure of farming within the present area.

Fortunately there is a considerably large amount of land beyond the farmed area. At present, the area of farm lands including grassland is 5,555 000 hectares, which is equivalent to only 15% of the whole area of the country. Out of the rest 61% is occupied by forests and waste land. The low share of farm land and the high proportion of forests and waste land are not only due to mountainous land configuration but also to the lack of grass-farming in this country.

Almost all of farmland were paddy fields and upland fields, and so the enlargement of farmland area has been considerably limited. Besides, as farming was individually practiced by peasants who were private land owners, it was very difficult to enlarge arable land by encompassing sloping areas. If there were no such obstades, vast lands would have been cleared and brought under farming. Indeed it has been estimated that about 1,500 000 hectares of land was to be cleared, soon after World War II. This estimation was made assuming the traditional paddy and upland field farming. Provided that it were done supposing grass-farming, the figure would largely increase. Ueno suggested this possibility in his recent paper[6]. According to him, about 3,000 000 hectares of grassland may be newly acquired beyond the limit of the existing agricultural areas, while about 600 000 hectares of farmland will be converted into urban area before 2.000 A.D. At that stage, the amount of land under cultivation would be from 3,900 000 to 4,500 000 hectares, and that of grasslands including

[6] F. Ueno, Land Use throughout the Country from the View Point of the Future Figure of Japanese Archipelago, *Report of Areal Development Center of Japan*, 1968, 94 p. (in Japanese).

grasslands converted from the present arable land would be between 4,000 000 and 4,500 000 ha. Namely, the total of these would be larger than the present arable lands. This status is very different from the present one, including ninety two percent of arable lands and eight percent of grasslands.

The new agriculture basing on such a structure of farmland would necessarily accede to the senior-type of Western agriculture. In this case, a great advance of grass-farming and fruit cultivation is expected. And moreover, if a little of the farming population (five or ten percent) should practice such agriculture, labour productivity ought to be raised remarkably by means of raising capital composition on the basis of renovated techniques. It is perhaps necessary that livestock breeding is developed on newly gained grasslands, and co-operative farming or agribusiness is promoted on the basic of large collected farm land in the existing agricultural areas. The majority of farmers who cannot attain high labour productivity will perhaps be unable to continue to exist as agricultural producers in the conditions of structural changes following the drastic centralization of population in the so-called Metropolitan Areas.

Under the present conditions, labour productivity in agriculture in this country is too low, as a whole, in comparison to that of Western countries. A little outdated Okawa's calculation [7] indicates that in Japan it was only ninety dollars, in Denmark, in the United States of America and in the Netherlands — five hundred and seventy dollars, in Switzerland, Germany, Norway and Austria from three hundred and eighty to three hundred and ten dollars, and in Finland, Poland from one hundred and eighty to one hundred and thirty dollars. Though it is certain that the labour productivity in agriculture is generally lower than in other industries in most of the countries, the tendency is especially conspicuous in Japan. The emphasis ought to be laid on this characteristic when comparing Japanese agriculture with that in other countries.

Thus it may be considered that labour productivity must be an important criterion either from the standpoint of grasping the present characteristic features of agriculture in Japan or from that of having as idea of its new reorganized status in the future.

DISPOSITION OF AGRICULTURAL REGIONS IN JAPAN

Although the labour productivity of Japanese agriculture is low, as a whole, and though it is a suitable criterion for comparison with foreign agriculture, areal differences must be found within the country, from a close point of view.

Generally speaking, high productivity may be attained in areas where agriculture is oriented towards commercial production, where new techniques are introduced on a large scale, where farmers have positive and direct connection

[7] I. Ōkawa, *Economic Analyses of Agriculture*, 1955, 284 p. (in Japanese).

with big markets, where there is a large-scale system of co-operation in production or circulation or, where these activities are combined. So it is our duty to point out these areas, on the basis of facts.

For all that, the characteristics of Japanese agriculture cannot be entirely comprehended only on the criterion of labour productivity. We must furthermore investigate other matters in order to understand the conditions or circumstances influencing changes in productivity. Not a few geographers have attempted some areal analyses of agriculture in this country. Although their interests have not been necessarily directed only to the problem of areal differences of productivity, most of their results were useful for solving this problem.

Soon after World War II Izeki, Watanabe and Nobui, Yokeno, Ogasawara, Birukawa, and Hattori analyzed the areal disposition of agricultural regions, and recently Yamamoto, Onuki, Saito and others drew some maps of agricultural regions in this country on the basis of certain indicators which were selected by them [8]. I should like to draw particular attention — because of the reason mentioned earlier — to Saito's study in which the patterns of Japanese agricultural regions were investigated on the basis of indicators of land scale of farm management, labour productivity and gross income per farm household. In this case, it was desirable to take net income, capital profit or returns of labour instead of gross income as an indicator. But, perhaps it is impossible to realize, because regional statistics concerning such indicators all over the country have not ben prepared. The maps A — C on Figure 2 und Figure 3 are made after Saito's original map.

According to these maps, the line which cuts diagonally the central parts of Honshu from southwest to northeast, and the one which passes through "the Pacific Belts of Southwestern Japan", from Tokyo and its vicinities to Fukuoka of Northern Kyushu, are clearly noticed. The northern section of the former line runs through the region which raises high return from the relatively large-scale rice production. The regions through which the latter line passes, are those of many

[8] H. Izeki, Geographical Regions in Japan, 1952, pp. 139—148 (in Japanese). M. Watanabe, and K. Nobui, Agricultural Regions, *New Series of Japanese Geography*, 1953, pp. 35—94 (in Japanese). N. Yokeno. *Areal Structure of World Economy*. 1949, 225 p. (in Japanese) Y. Ogasawara. Land use of Japan. *Bulletin of the Geographical Institute*. Vol. 2 1950, Part 1. (in Japanese). S. Birukawa. Agricultural Region of Japan - New System. *Bulletion of Otsuka Geographical Society*, 6, 1950, pp. 237—244 (in Japanese). N. Hattori Fixation of Agricultural Regions. *Course of Modern Geography* 1956, pp. 35—54 (in Japanese). T. Onuki and S. Yamamoto. Regional Specialization in Recent Japanese Agriculture. *The Science Reports of the Tokyo University of Education*, Section C. 96, 1968, pp. 131—144 (in Japanese). S. Yamamoto, T. Okuno, Y. Kinto and Y. Asano. Distribution Pattern of Agricultural Productivity in Japan and its Regression Analysis. *Tokyo Geography Papers*, X 1, 1967, pp. 113—128 (in Japanese). M. Saito. Japanese Agricultural Regions with Special Reference to Part-time Farm Households. *Japanese Journal of Geology and Geography*. Vol. XXX 11, 1961, 3—4, pp. 551—577 (in English).

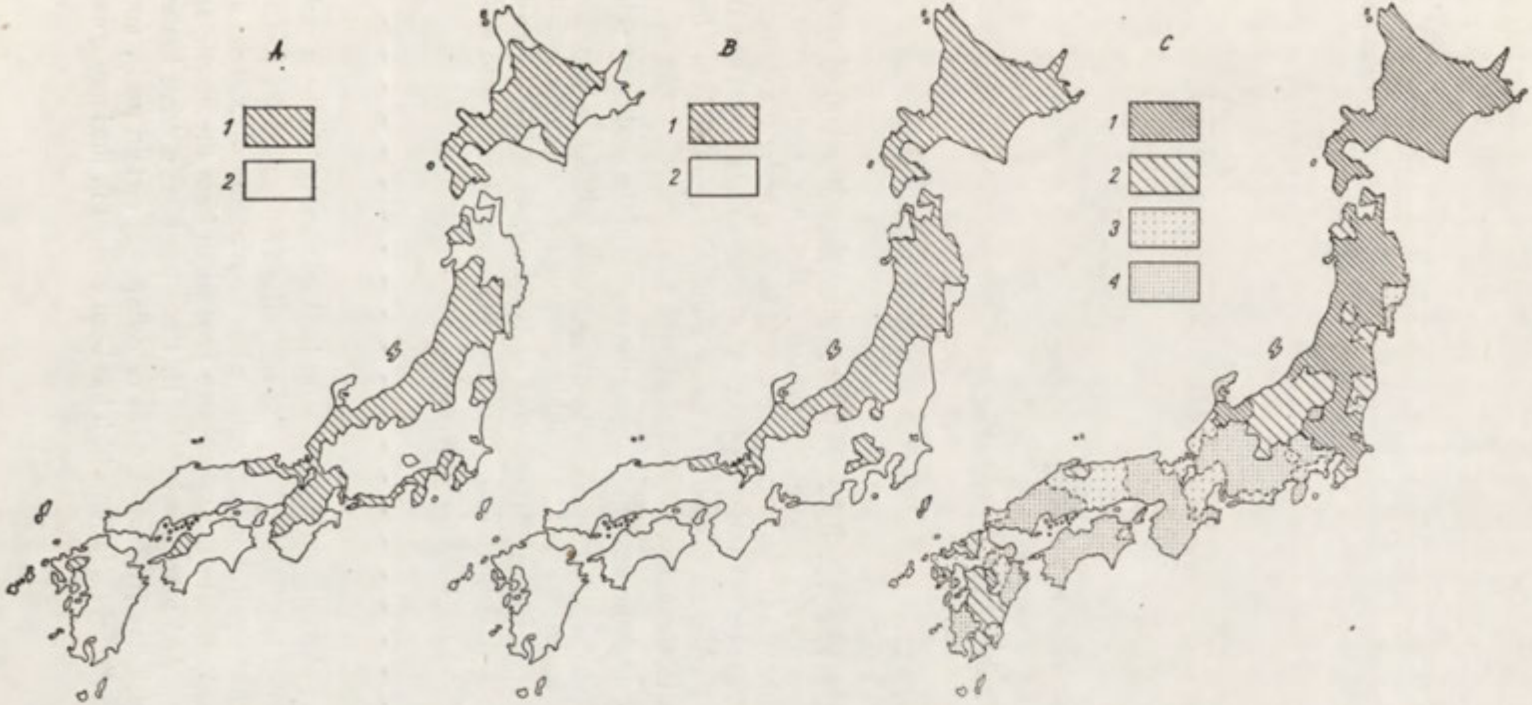

Fig. 2. Fundamental criteria of agricultural regions

A. Labour productivity
1 — high, 2 — low
B. Labour capacity
1 — small, 2 — large
C. Scale of managed arable land
1 — 1.00 ha and over, 2 — 0.80—0.99 ha, 3 — 0.60—0.79 ha, 4 — below 0.60 ha

Source: M. Saito (1961)

Fig. 3. Agricultural regions. A tentative scheme including the future prospects

I — Hokkaido, II — Region of rice farming, III — Region of upland field farming or grass farming, IV — Megalopolitan region

farm households which raise high return from small-scale cultivation of arable land, with high labour inputs. But, on the contrary, there are quite numerous part-time farmers or even farmers who have ceased farming under the influence of rapid urbanization, in the latter regions. The newly reclaimed Hokkaido during one hundred years from Meiji Era forms a unique region differing from the other ones in this country.

Figure 3 is drawn schematically by adding the results of the studies by scholars mentioned above to Saito's study. One may generally detect four regions on this map. I think this division may be useful in grasping the areal characteristics of agriculture in Japan from the standopint of typology, though it is only a schematic one. Perhaps these four regions are the smallest ones into which Japan may be divided on a world-wide scale.

SUMMARY

In Japan, a part of Southeast Asia, peasant land ownership has been maintained and subsistence family-labour type of agriculture fundamentally fostered for a long time of history. But the agriculture has been adding commercial and other than rice production to the subsistence production from the middle ages to the recent times. And after World War II, there has been a drive towards modernization, which has provoked a crisis or collapse in certain parts, under the influence of drastic urbanization which has been evident in the large growth

of economy. The stages of changes vary markedly by regions, and additionally, areal differences of natural environments are very conspicuous. As the result, the patterns of disposition of agricultural regions are considerably complicated. There are numerous factors which have had an effect upon the formation of such areal differences, and their ways are intricate. Therefore the types of agriculture in Japan cannot be easily defined. In spite of this, if the type should be defined by all means from the standpoint of agricultural typology, the following points are to be especially considered:

1. At first, Japan is defined as a semi-commercial agricultural region based on peasant land ownership, belonging to the capitalist countries, from the world--wide point of view. It is considered here that, from the standpoint of agricultural typology, the social establishment and the orientation in agricultural production should be the criteria of the highest order.

2. Next, in the case of Japanese agricultural region, labour productivity in commercial agriculture is to be seriously taken as a criterion. This suggestion comes from my opinion that the raising of labour productivity is an essential way of increasing farmers' incomes or net returns which ought to keep pace with those of other workers. Although labour productivity in agricultural production in Japan is quite low in comparison with that of Western capitalist commercial agriculture, fairly remarkable differences between various regions can be found within the country. But it is very difficult to point out exactly to the areal differences, for farmers' income or net returns are not indicated statistically all over the country. Therefore there is no other possibility than adopting gross returns as an indicator.

3. Not only labour productivity, but also land and capital are important criteria in case of subdivision of the Japanese agricultural region. It is necessary to investigiate, how land, labour or capital intensity is actualized in connection with such kinds of productivity.

4. In the process of study, some elements of commercial production are questionable in connection with productivity and intensity. Namely kinds of products, systems of farm management and scale of managed arable land per farm household are investigated here. And also, in order to clear up these items it is necessary to investigate such factors or conditions as shown in Figure 1. For example, the process of exploitation and improvement of land, preservation or enrichment of fertility, the ways of connecting agricultural regions with markets, aspects of introducing techniques and other matters which constitute the social background, are to be sought. But adopting so many criteria referring to such a wide range of matters would check typology which aims at fixing world's agricultural regions by uniform criteria. Therefore the detailed analyses and interpretations should be entrusted to agricultural geography. Eighteen criteria which Kostrowicki mentioned in his paper, *Principles, Basic Notions and Criteria of Agricultural Typology* are too many to define the type of Japanese

agriculture at a world scale, in such a sense. I took up tentatively only a few criteria among them. But the work of corroboration must be done in the future.

5. Kostrowicki indicated that the bases of classifying agricultural types are the inner and intrinsic characteristics of agriculture, and not the external ones, or conditions of agricultural development. It must be so, from the standpoint of typology which aims at classifying the types of agriculture. But, as I emphasized already, the classification cannot be really useful unless we know why certain types of agriculture have developed at a given place, and in what social establishment these types have been constructed. Agricultural geographers ought to clear such points beyond agricultural typology.

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A STUDY OF AGRICULTURAL REGIONS IN SOUTH KOREA

STATEMENT OF OBJECTIVES AND SOURCES

In South Korea today about 60 per cent of the total population are engaged in the agricultural economy. Agricultural development has always been a major problem in its economy. Many Korean farmers clearly live at subnutritional levels. The fact that the population of the country is growing rapidly and that more and more people will be forced to derive their living from the land gives cause for grave concern. It is true that agriculture has a broad base on which rests the economy of Korea. Its future is one of the most critical problems facing the next generation.

Among the basic 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 culture, is indeed the first step in Geography. Therefore, Geography ought to hold some of the keys to the solution of the agricultural problems. Geographers, in addition to investigating the special distribution of these phenomena, have also classified a number of them and mapped their resulting spatial distributions [1].

In order to shed clearer light on the regional differences of land-use reality, the peculiarity of each region and to promote scientific land-use in South Korea, it is imperative to study agricultural regions anew.

The paper reviews previous research on this subject in Korea, and discusses elements and criteria involved in the classification of agricultural regions. An attempt is made to set up new agricultural regions based upon the statistics from the first agricultural census taken in 1960.

The area of study involves 1,520 units comprising 9 "*Ku*" (ward), 26 cities, 85 "*Eup*" (town) and 1,400 "*Myeon*" (a division of county), the statistical sources are derived from the 1960 agricultural census of the South Korean Ministry of

[1] H. G. Kariel, A Proposed Classification of Diet, *Annals of the Association of American Geographers*, Vol. 56, 1966, pp. 68—79.

Agriculture and Forestry, the 1962 Statistical Year Book of Korea (Economic Planning Board Year Book of Korea), and yearly statistical reports of the Ministry of Agriculture and Forestry.

The new classification of agricultural regions is offered as an introductory guide to the long term project of Korea's Land-use Survey. It is hoped that its brief, generalized and mostly statistical statements, will form the basis for future studies of the classification of agricultural regions in South Korea.

THE ELEMENTS IN AND THE CRITERIA OF CLASSIFYING AGRICULTURAL REGIONS

In a classification of agricultural regions, the major problem involves the elements and choice of indices, from early Hahn[2] to Whittlesey[3]. Many scholars have attempted to set up these indices. The choice of suitable indices or criteria have in fact been the source of argument in classifying agricultural regions[4]. The term "agricultural regions", refers to an area of land characterized by homogenity in agricultural conditions, especially of the crop or crops grown, and of scientific dissimilarities from the conditions in adjacent areas which are clearly recognizable.

Agricultural regions are usually determined principally by climatic conditions[5]. This is because temperature and moisture are more permanent and pervasive; that is, less readily altered and less rigidly localized than the surface conditions of slope and soil. Furthermore, the general distribution of the forest, grass and waste land in any country, and the possibility of growing a particular crop on such land, are influenced primarily by climatic conditions.

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[2] E. Hahn, Die Wirtschaftsformen der Erde. *Petermanns Geographische Mitteilungen*, 33, 1892, pp. 8—12.

[3] D. Whittlesey, Major Agricultural Regions of the Earth, *Annals of the Association of American Geographers*, Vol. 26, pp. 199—240.

[4] See S. Birukawa, A Classification of Agricultural Region in Japan. *Chiri*, (Geography) 7, Tokyo 1962, 6; Cheng-Siang Chen. *A Geography of Taiwan*, Fu-Min Geographical Institute of Economic Development, Taipei, China, 1959, pp. 108—173; T. Fujimoto, A Classification and its Criteria of Agricultural Regions, *Problems of Industrial Geography*, H. Yamaguchi (ed.), Tokyo, 1963, pp. 17—26; N. Hattori, A Classification of Agricultural Regions, *Series of Modern Geography*, Vol. 7, Tokyo 1965, pp. 35—64; R. Hartshorne and S. N. Dicken, A Classification of the Agricultural Regions of Europe and North America on a Uniform Statistical Basis, *Annals of the Association of American Geographers*, Vol. 25, 1935, pp. 99—120; F. Ueno, *Land Utilization in Japan*, Agricultural Development Series, 1960, pp. 89—91; M. Watanabe and Y. Nobei, Agricultural Region, *Series of Japanese Geography*, Vol. 3, Tokyo, 1953, pp. 36—93; D. Whittlesey, *op. cit.*, pp. 208—209.

[5] Along this line see V. Koppen, Klassifikation der Klimate nach Temperature, Niederschlag und Jahreslauf, *Pettermanns Geographische Mitteilungen*, Vol. 64, 1918, pp. 193—203, 243—248; C. W. Thornthwaite. The Climates of North America, *Geographical Review*, Vol. 21, 1931, pp. 633—655.

Within an agricultural region differences in topography and soils may cause such variations in the proportion of land use for crops as to require recognition. The consequent division of an agricultural region into sub-regions on the basis of physical conditions in these sub-regions, especially soil, may in turn bring about differences in land use and in the system of farming, as to require the division of the sub-region into distircts. These districts, in turn, may be sub--divided into localities.

However, it must be noted that the boundaries of the agricultural regions are not determined solely by the physical conditions of temperature, moisture, topography and soil. They are often the result of population pressure on land, the pressure varying with the stage of cultural heritage, historical tradition and development of technology, that the particular people have attained[6]. This pressure of population on land demonstrates more or less clearly the socio--economic principles mentioned.

Although the physical conditions of temperature, moisture, topography, and soil are fundamental in determining the type of crop grown and the consequent devision of the world into agricultural regions, there are several economic factors which strengthen the influences of the physical factors. Consequently, the boundaries of agricultural regions influenced primarily by climatic conditions may not be static but will fluctuate, normally within narrow limits, as economic conditions change. The Study of changes in the boundaries, indeed, even of the developement or dissolution of an agricultural region, is likely to be one of the most rewarding in the fields of agricultural geography[7].

Eventually, land use in agricultural regions depends upon these two groups of factors: physical and economic. These show a constant flux and readjustment, according to the trend of population and consumption tastes, as well as national policies; in short, according to the varying demands for and fluctuating prices of particular crop or crops[8]. Agricultural products exert unequal pressure, in land-use, on the more or less elastic physical conditions of climate, topography and soil.

Underlying all the manifold problems of political coherence, social readjustments and economic stability, therefore lie the basic factors of Land and People.

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[6] D. W. Harvey, Theoretical Concepts and the Analysis of Agricultural Land-Use Patterns in Geography, *Annals of the Association of American Geographers*, Vol. 56, 1966, pp. 361—374.

[7] See O. E. Baker, Agricultural Regions of North America, *Economic Geography*, Vol. 2, 1926, pp. 459—493; J. L. Buck, *Land Utilization in China*, Shanghai, 1937, pp. 92—129; G. B. Cressey, Agricultural Regions of Asia, *Economic Geography*, Vol. 10, No. 2, 1934, pp. 109—142; O. Jonasson, Agricultural Regions of Europe, *Economic Geography*, Vol. 1, 1925, pp. 277—314 and Vol. 2, 1926, pp. 19—48; C. F. Jones, Agricultural Regions of South America, *Economic Geography*, Vol. 4, No. 1, 1928, pp. 1—30.

[8] Along this line see J. Kostrowicki, On the Study of Agricultural Typology, *Annals of the Association of Economic Geographers*, Tokyo 1966, pp. 70—78.

EVALUATION OF PREVIOUS STUDIES AND PROPOSED NEW CLASSIFICATION OF AGRICULTURAL REGIONS

Many studies have been made of agricultural regions in Korea. However, in the light of recent developments in the agricultural landscape and in techniques of study, it would perhaps be timely to re-examine the agricultural regions of South Korea. Before discussing a new system of classifying agricultural regions we shall briefly examine previous research on this subject.

Kato[9], early in 1922, attempted to classify agricultural regions, on a map which showed simply the major distribution patterns of crop types.

Nagai and Nakakawa[10], in 1924, established five paddy growing regions, using as index the distribution of the major species of rice. This was a valuable contribution.

Hall's survey on "Agricultural Regions in Korea" was the first attempted by a Westerner in 1935. However, he merely divided Korea into three districts: Northern, Middle and Southern, based upon physical conditions[11].

Ihn[12], a Korean economist, in 1932, discussed a classification of the agriculture regions of Korea based on management types.

Lee[13], in 1935, differed from the traditional goegrapher's approach (mainly moisture, temperature, topography and soils), and demarcated two major paddy growing regions, showing distribution pattern of the crop and type of cultivation. However, there are still room for an adequtae classification of agricultural regions.

These previous scholars suffered from lack of adequate statistical and field information as well as the general absence of satisfactory maps. Until recently, agricultural statistics were difficult to secure or evaluate. These statistics had to be treated with reserve. Few actual enumerations were ever undertaken and the figures available were often based on a generalized and unpublished estimates. There was, therefore, scope for an adequate classification of agricultural regions. The classification of agricultural regions, generally using provincial boundaries and making distinctions on the basis of predominance of rice or

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[9] He was an agriculturalist at Agricultural Experiment Station, he used statistics data in 1921.

[10] I. Nagai, Y. Nakakawa, Major Species and its Distribution, *Agricultural Experimental Station*, Report, Vol. 5, No. 1, 1924.

[11] R. B. Hall included Korea within the Japanese Empire in an early and pioneer study: Agricultural Regions of Asia, Part VII, The Japanese Empire, *Economic Geography*, Vol. 10, No. 4, October, 1934, pp. 321—374, Vol. 11, No. 1, January, 1935, pp. 33—52, and Vol. 11 No. 2, April, 1935, pp. 130—147. Korea was taken up in detail in Vol. 11, No. 1, January, 1935, pp. 44—52.

[12] Ihn Chung-Shick, *Agricultural Regions in Korea*, Seoul, 1937.

[13] Lee Hoon K, *Land Utilization and Rural Economy in Korea*, 1935, University of Chicago Press, XII, 289 p.

Fig. 1. Administrative districts of South Korea

double-cropping, are quite common in the literature on Korea. The agricultural statistics are often grouped into three divisions — North, Central, and South by the simple device of spacing the data[14].

After World War II, Hisama[15] in 1950 carried out research on this subject. In his work, he reviewed the various regional systems which have been presented in the past and adjusted as index, the regional characteristics. These comprised five major zones, each subdivided into regions. Some of these regions were in turn subdivided into districts so that 20 regions, and 11 districts, and 1 district locality (the Korean rice-growing locality) emerged. His final purpose was to, explain the characteristics each "agricultural management" region had, how each region was related to the other, and how these regions comprised one geographical entity for the whole of Korea.

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[14] A. J. Grajdanzev, *Modern Korea*, The John Day Company, New York, 330 p., 1944. He makes a critical evaluation using Japanese source materials; especially valuable is his appendix. II. *Reliability of Korean Agricultural Statistics*. pp. 296—299 (Rice Production in 1936).

[15] K. Hisama, *A Study of Agricultural Management in Korea*, Tokyo 1950, pp. 175—221.

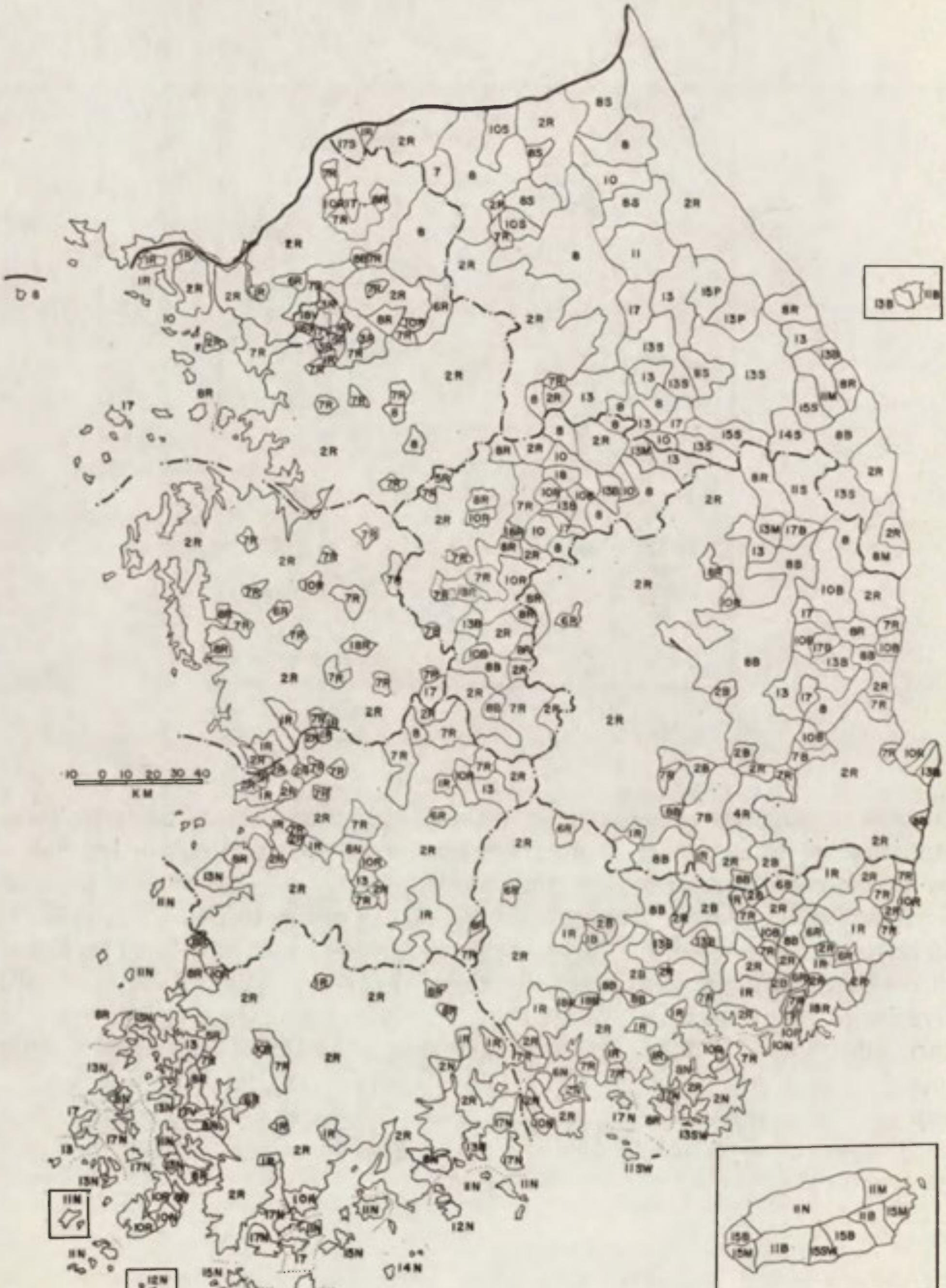

Fig. 2. Land use and farm management

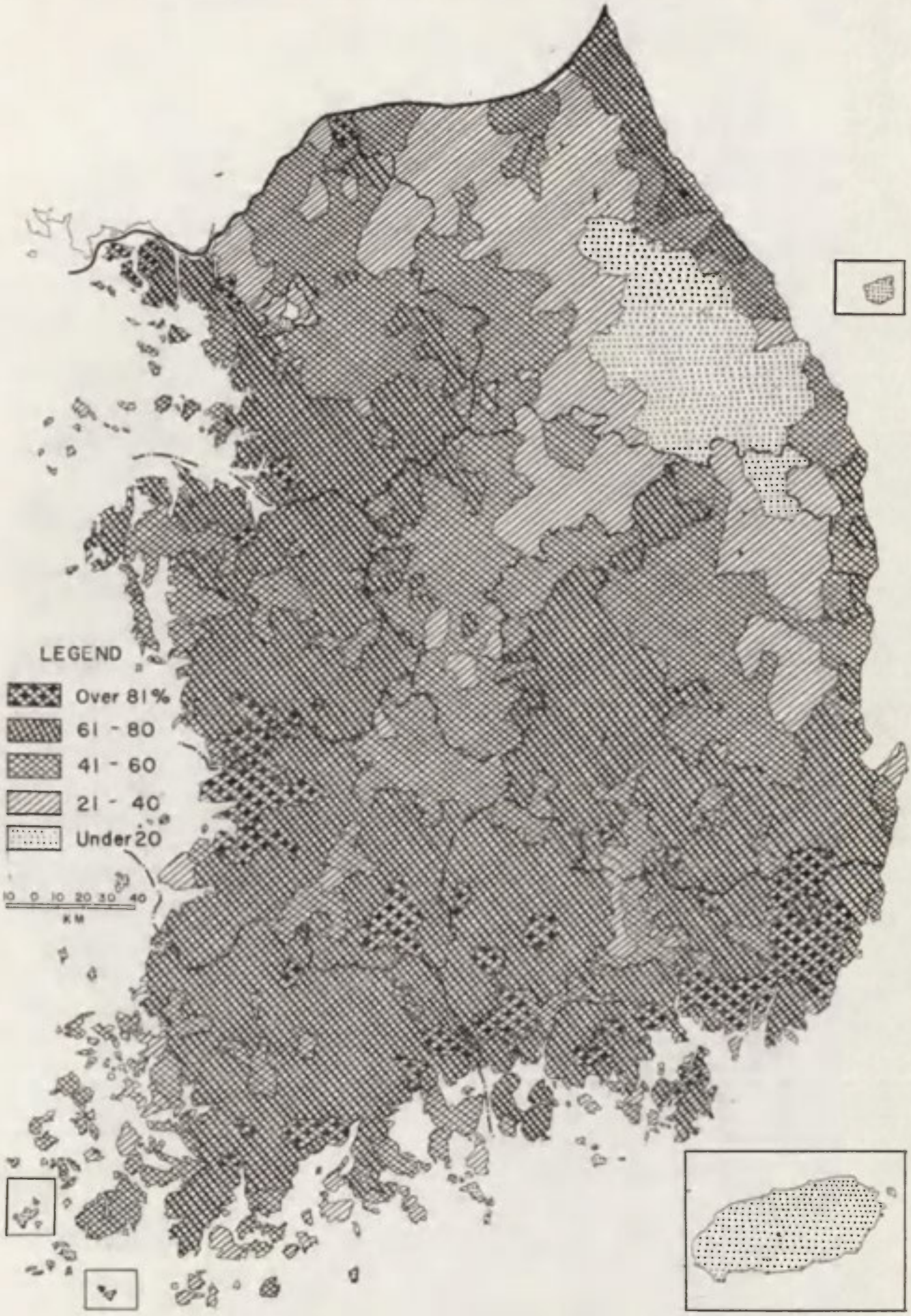

Fig. 3. Ratios of paddies against total cultivated acreage

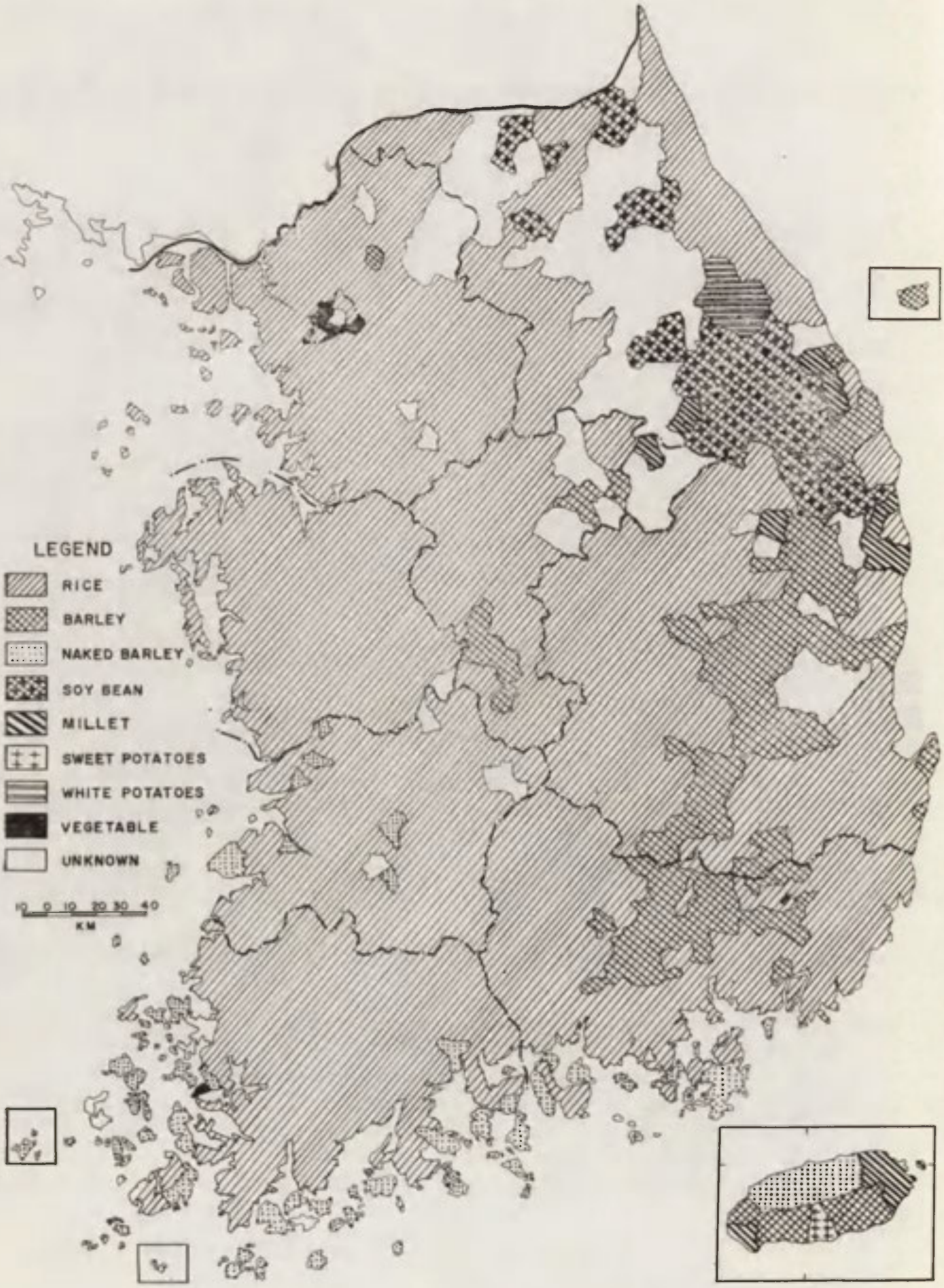

Fig. 4. Major crops

Seoh, one of later scholars, was able to classify agricultural regions using the index of agricultural management[16]. Lee, recently, concentrated on a feasibility study of agricultural land used in terms of efficiency of agriculture on existing farm-land[17].

A complex of human economic and physical factors is entailed in the classification of agricultural regions. Other agricultural phenomena, such as cultivation techniques, methods of drainage, fertilizers, crop yields and the frequency of harvest failures, which are important in production cost and economic viability, may be more closely related to technical differences in the agricultural land-use patterns. The influence of physical factors is usually subtle. They are inseparably interwoven with human and economic forces.

It is, therefore, impossible to isolate and to assess quantitatively the role of physical conditions and land-use types in the agricultural patterns. Apparently they were of more direct importance in the evolution of these patterns than in more recent moulding of the landscape. Many of the human and economic factors which are now so influential are indirectly related to these physical forces[18].

A careful consideration has been made in selecting indices for demarcating agricultural regions. These indices are selected from a functional viewpoint of farm management. They have been carefully adapted to delineate and generalize new agricultural regions[19].

The writer, in classifying the agricultural region of Korea, proposes to treat the problems as follows:

1) to deal with general problems relating to the selection of indices, standards and other functions used in studying agricultural regions in general, and South Korea in particular.

2) to adopt a statistical analysis of the agricultural census and to analyse, interpret and examine the problems of the new agricultural regions demarcated, based upon this material.

Physical factors were in the past used alone or in equal association with human factors as the indices for studying agricultural regions. However the

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[16] Seoh Change-Kee, A Classification of Agricultural Regions in Korea, *Kyungbuk University Thesis Collection*. Vol. 6, Taegue 1962, pp. 327—381.

[17] Chung-Myun Lee, *Land Use in Korea* (A report to the Ministry of Education whose grant of aid made the research possible, Seoh 1963—64, unpublished) p. 450.

[18] D. W. Harvey, *op. cit.*, pp. 362—363.

[19] Keel Yong-Hyun, *Study of Crop Combination Regions in South Korea*. Seoul, 1966 pp. 1—80, also see J. C. Weaver, Crop Combination in Middle West, *Geographical Review*, Vol. 44, 1954, pp. 175—200; Crop Combination Regions for 1919 and 1929 in the Middle West, *Geographical Review*, Vol. 44, 1954, pp. 560—572.

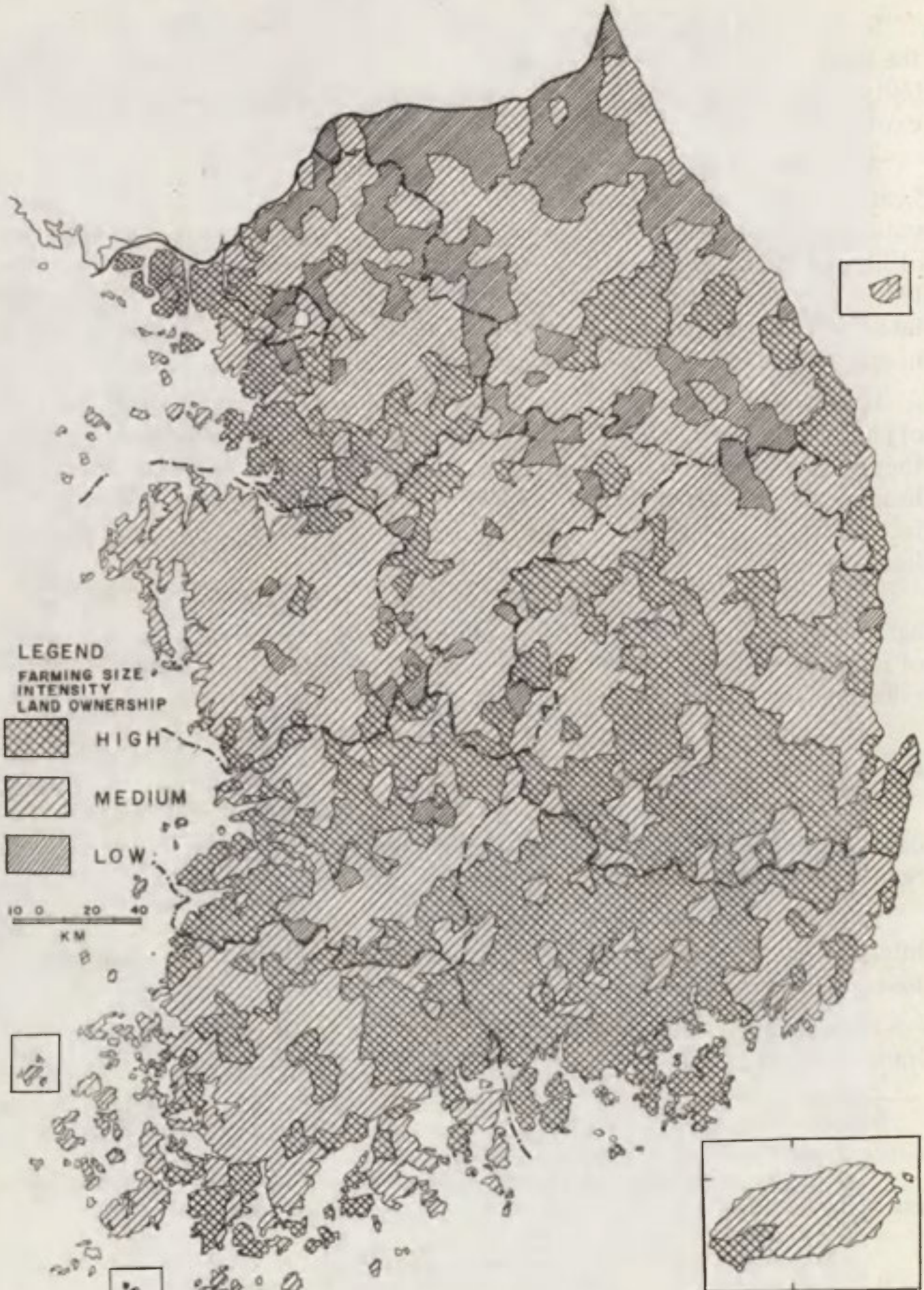

Fig. 5. Farm operation in South Korea

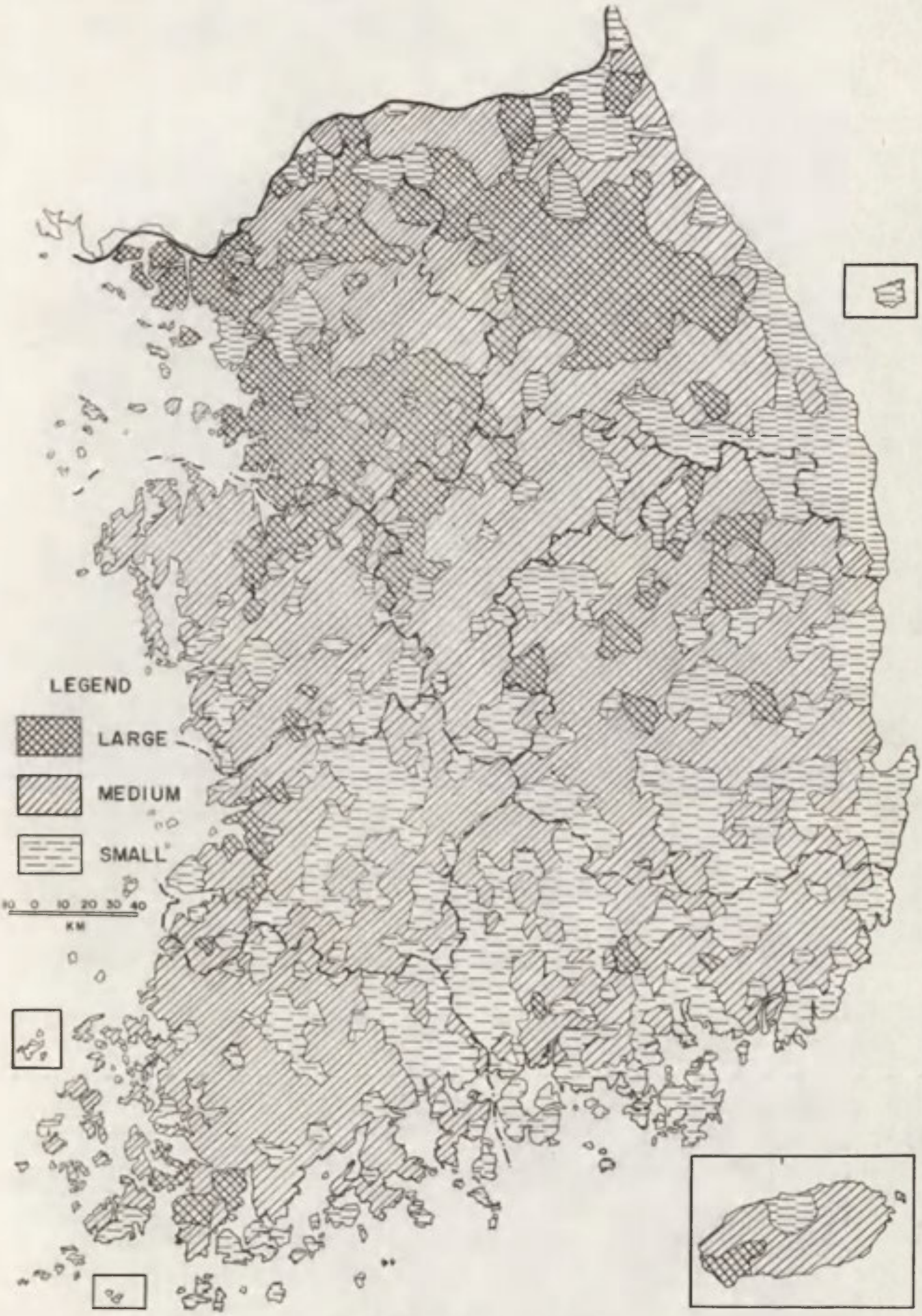

Fig. 6. Size of management

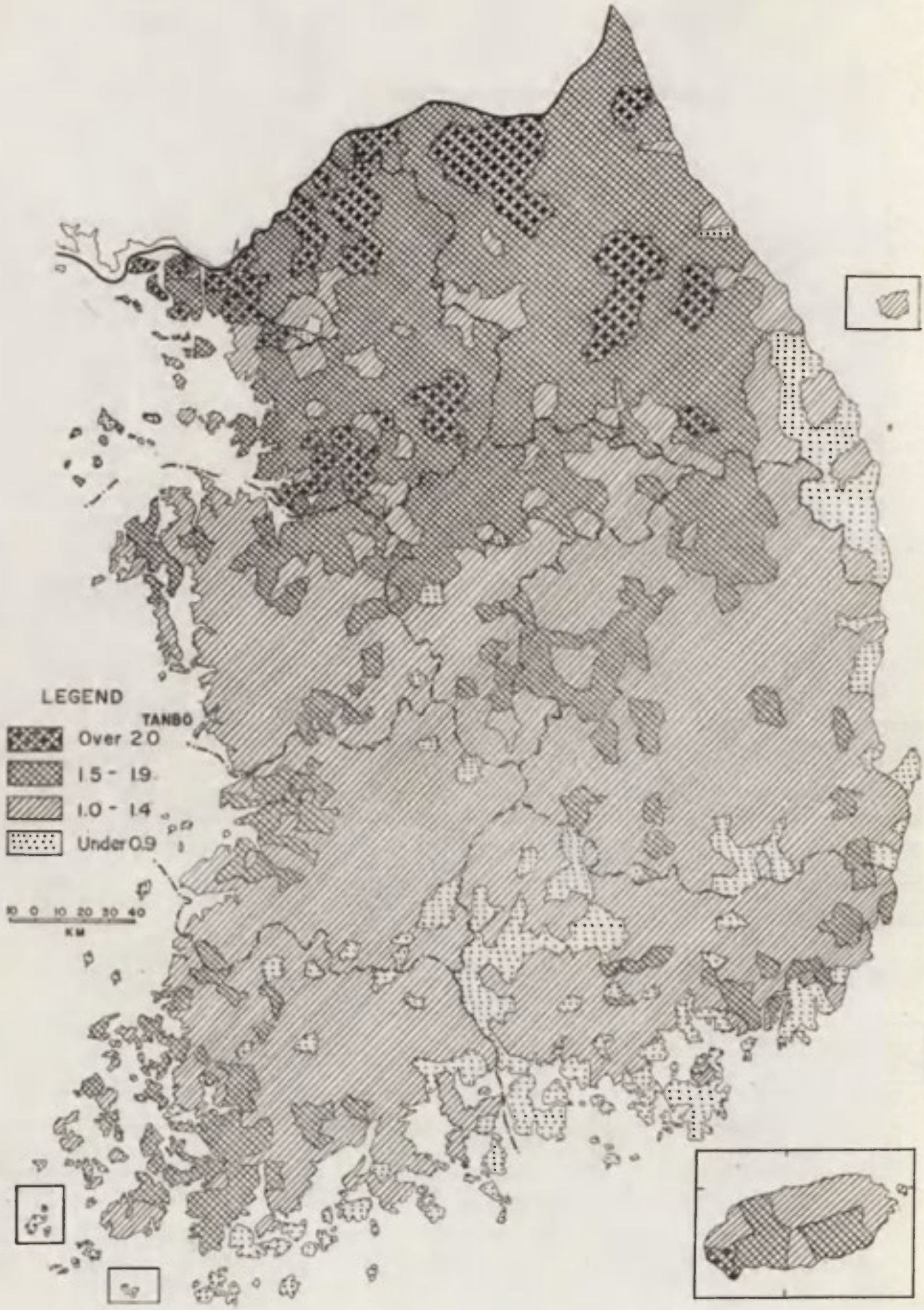

Fig. 7. Cultivated acreage per farm population

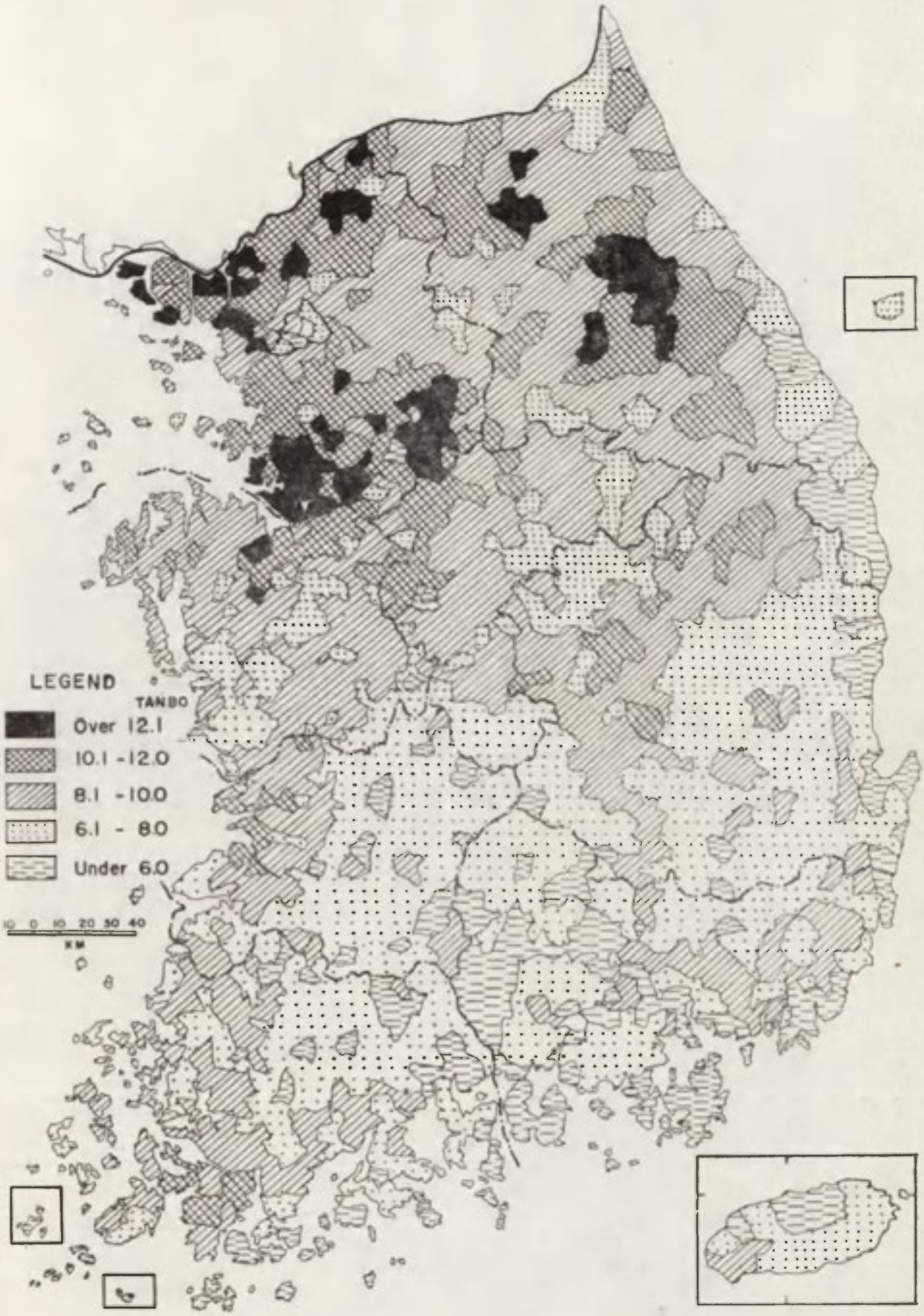

Fig. 8. Cultivated acreage per farming household

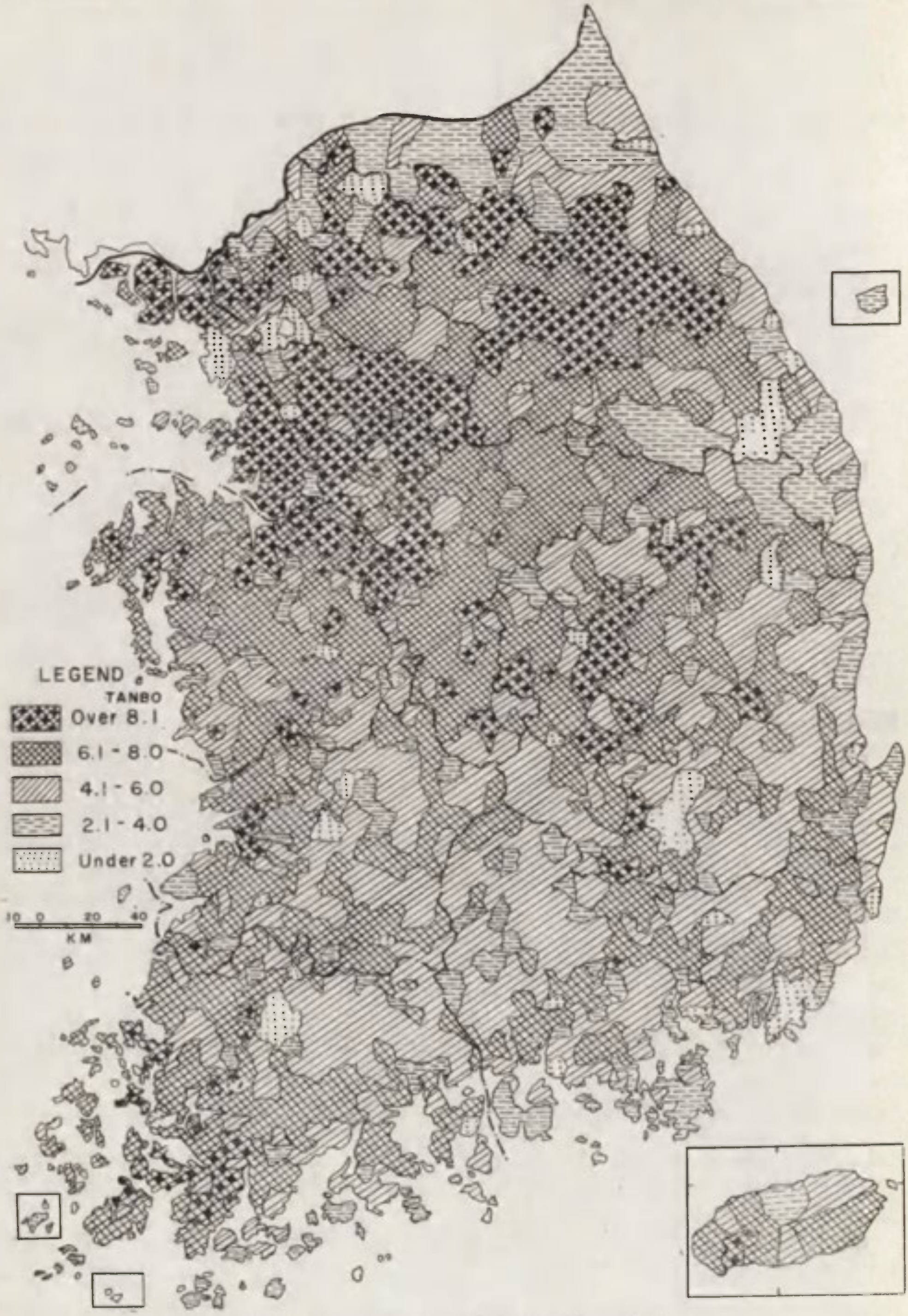

Fig. 9. Farming acreage for total household

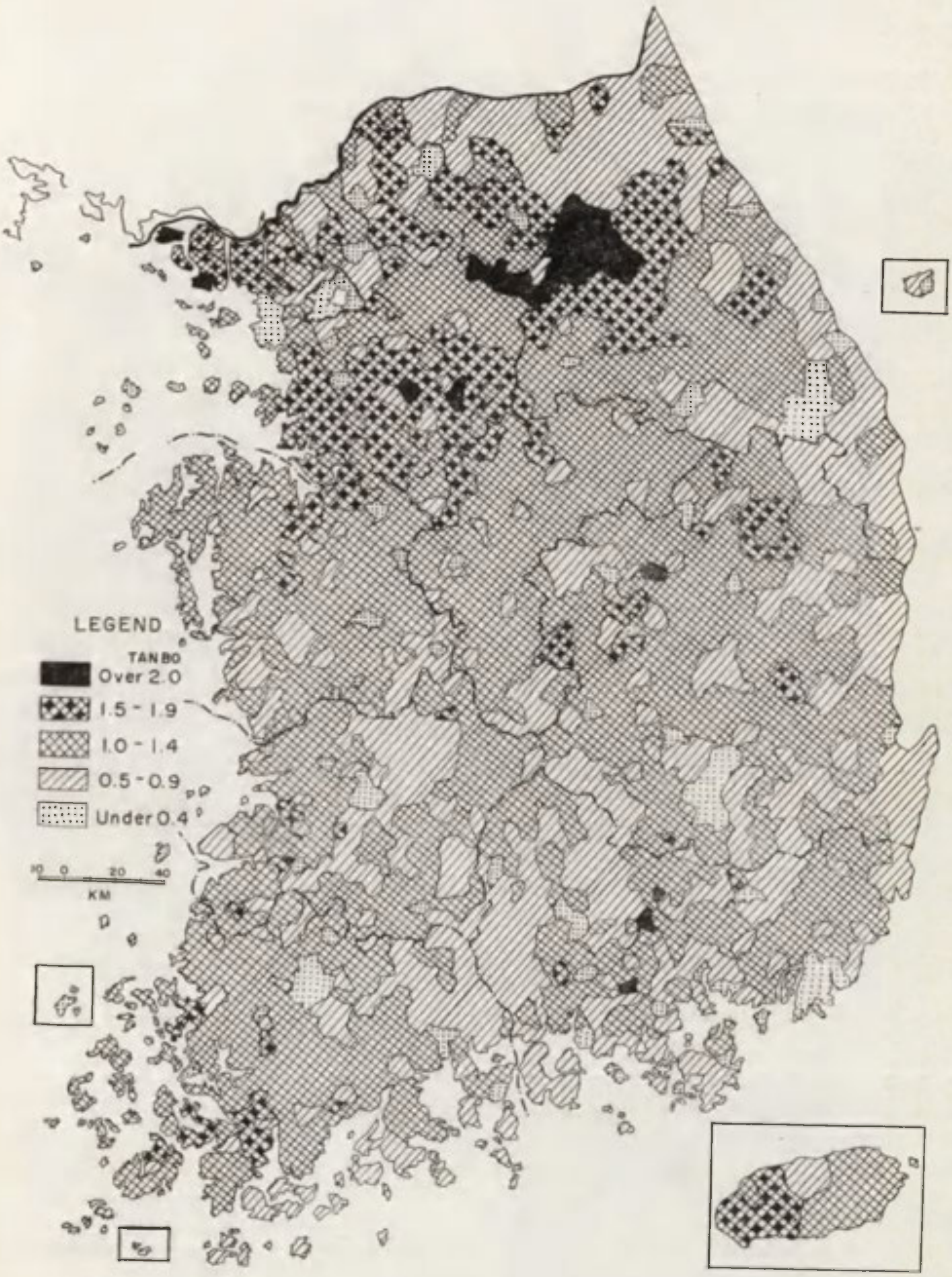

Fig. 10. Farming acreage for total population

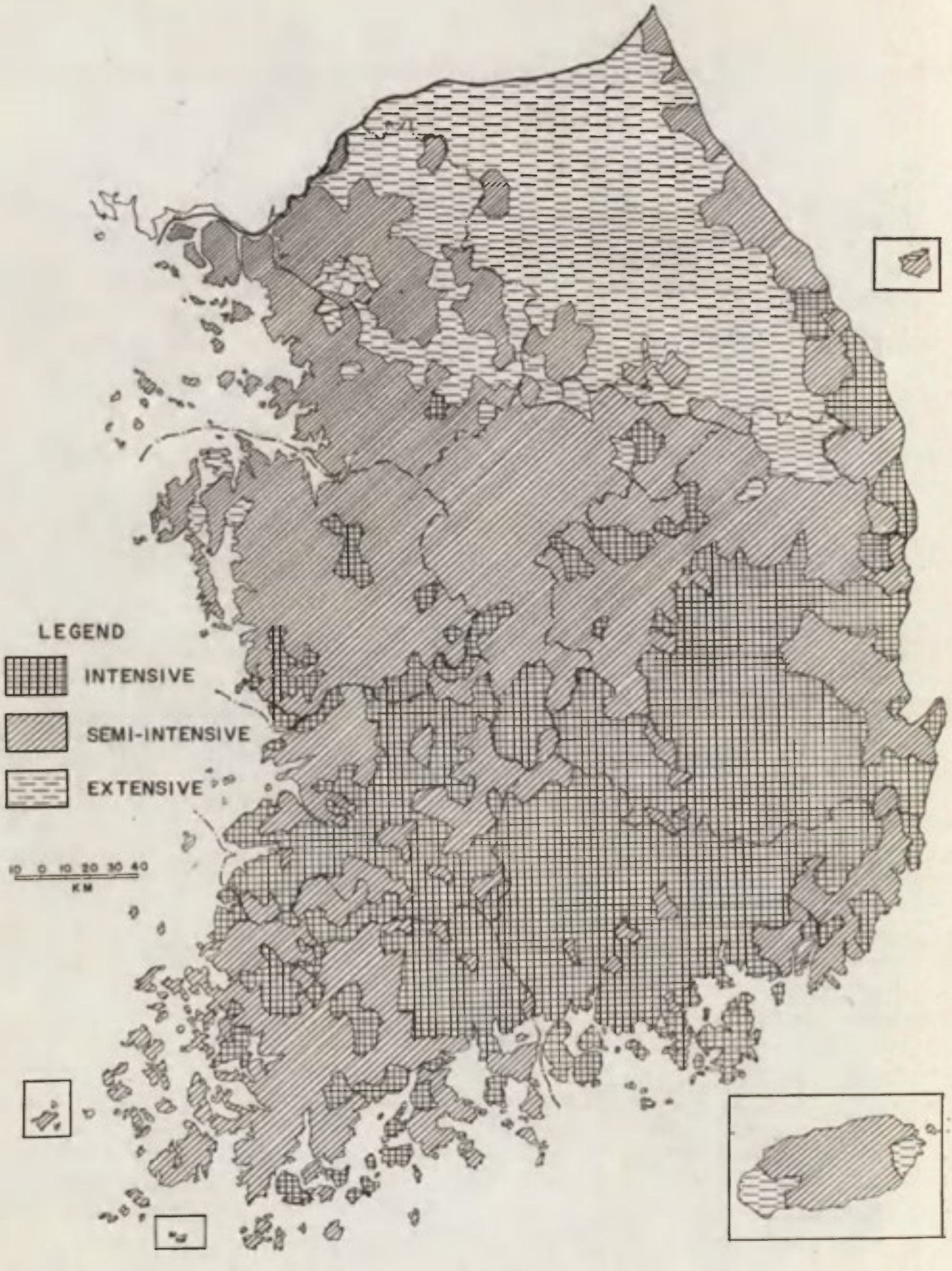

Fig. 11. Extent of intensive management

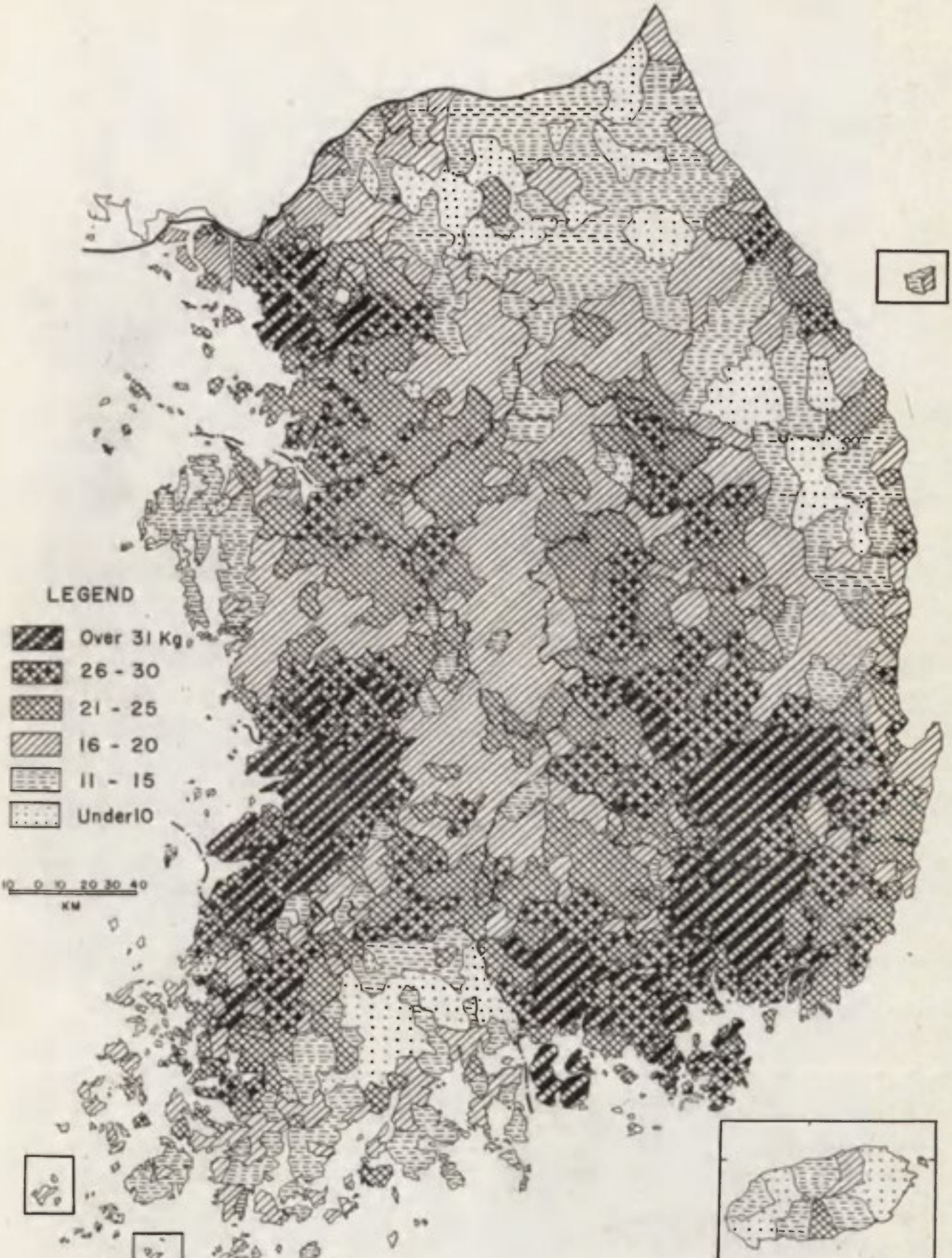

Fig. 12. Input of fertilizer per tanbo

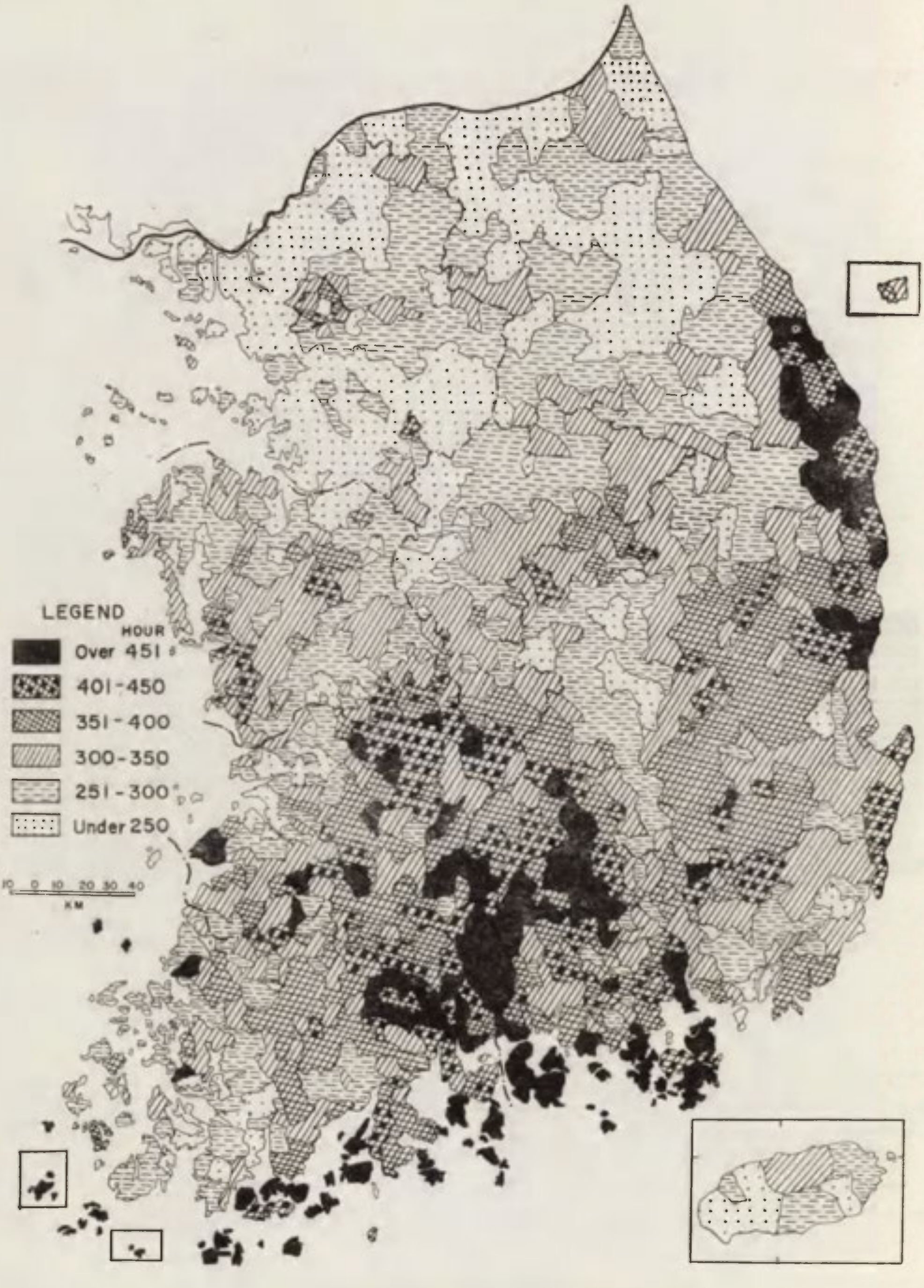

Fig. 13. Labour hours per tanbo

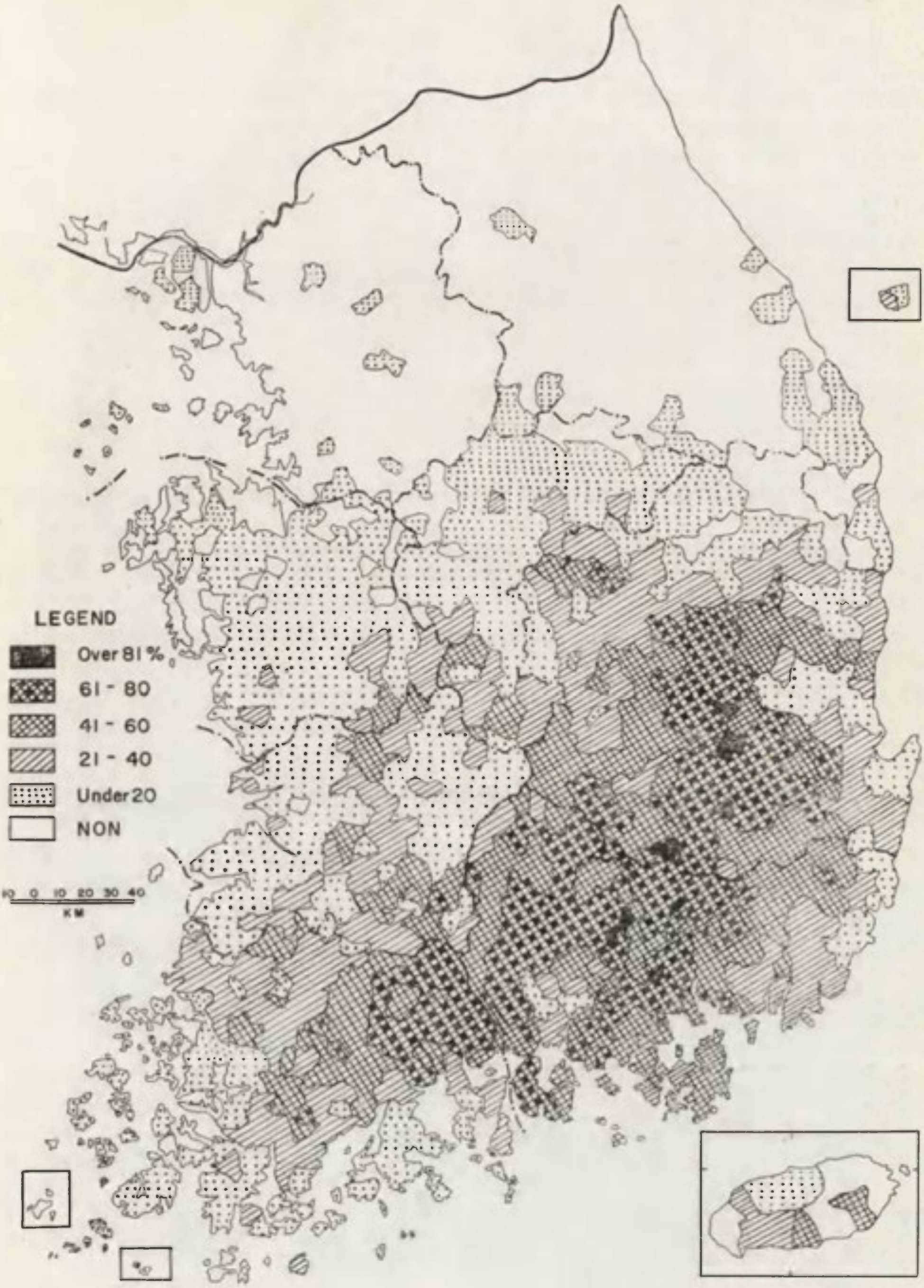

Fig. 14. Rates of double crops for paddies

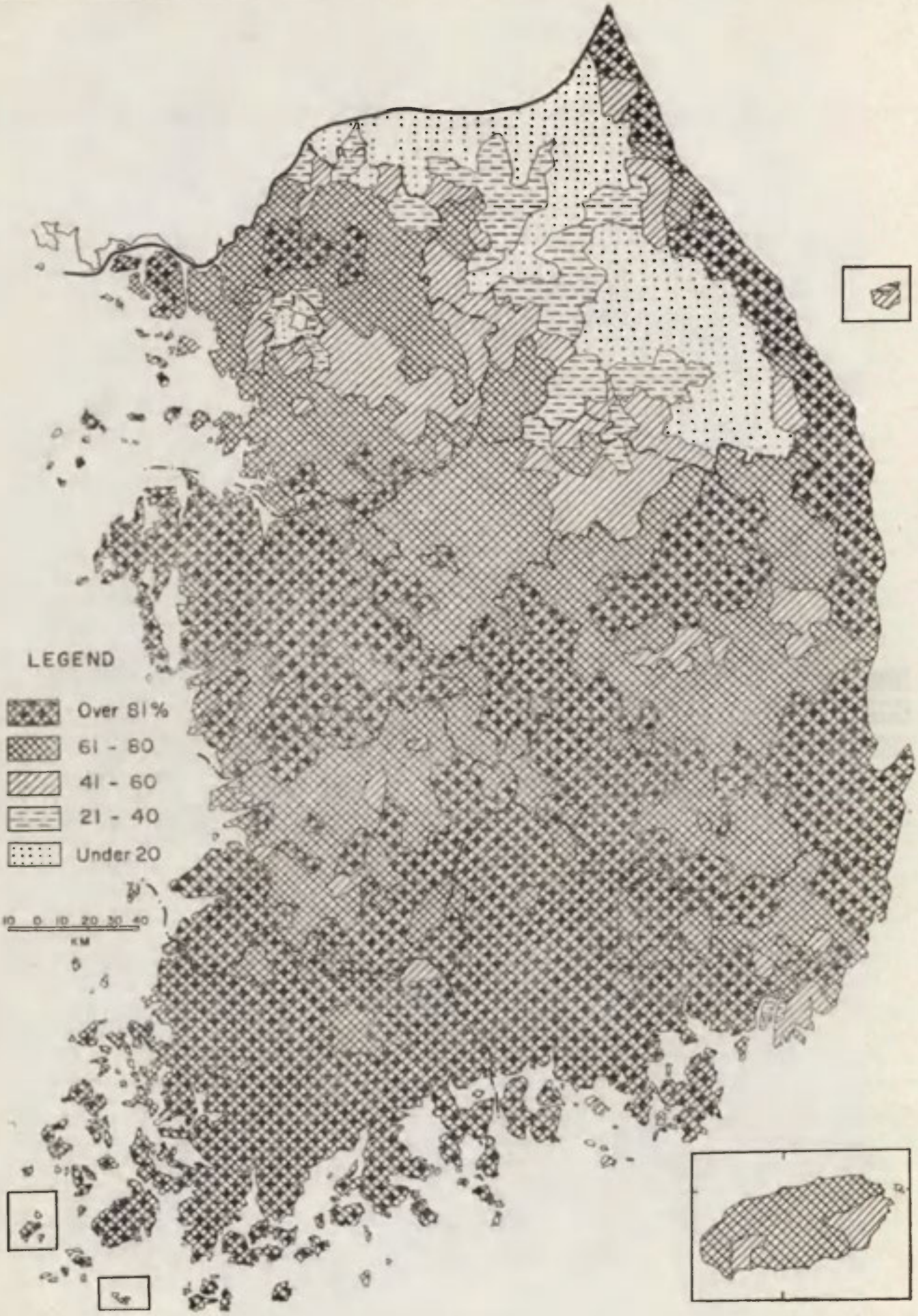

Fig. 15. Rates of double crops for fields

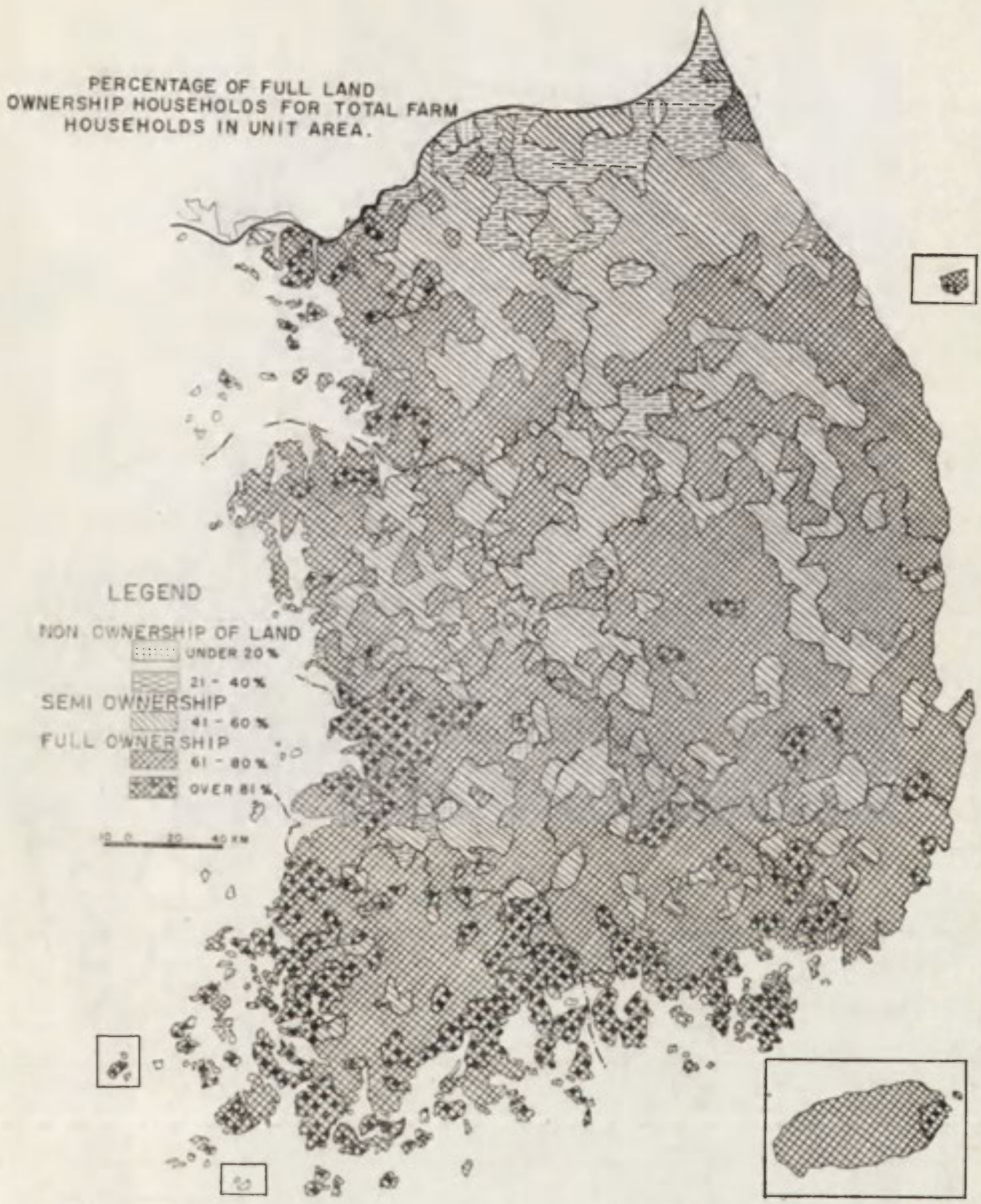

Fig. 16. Pattern of land ownership

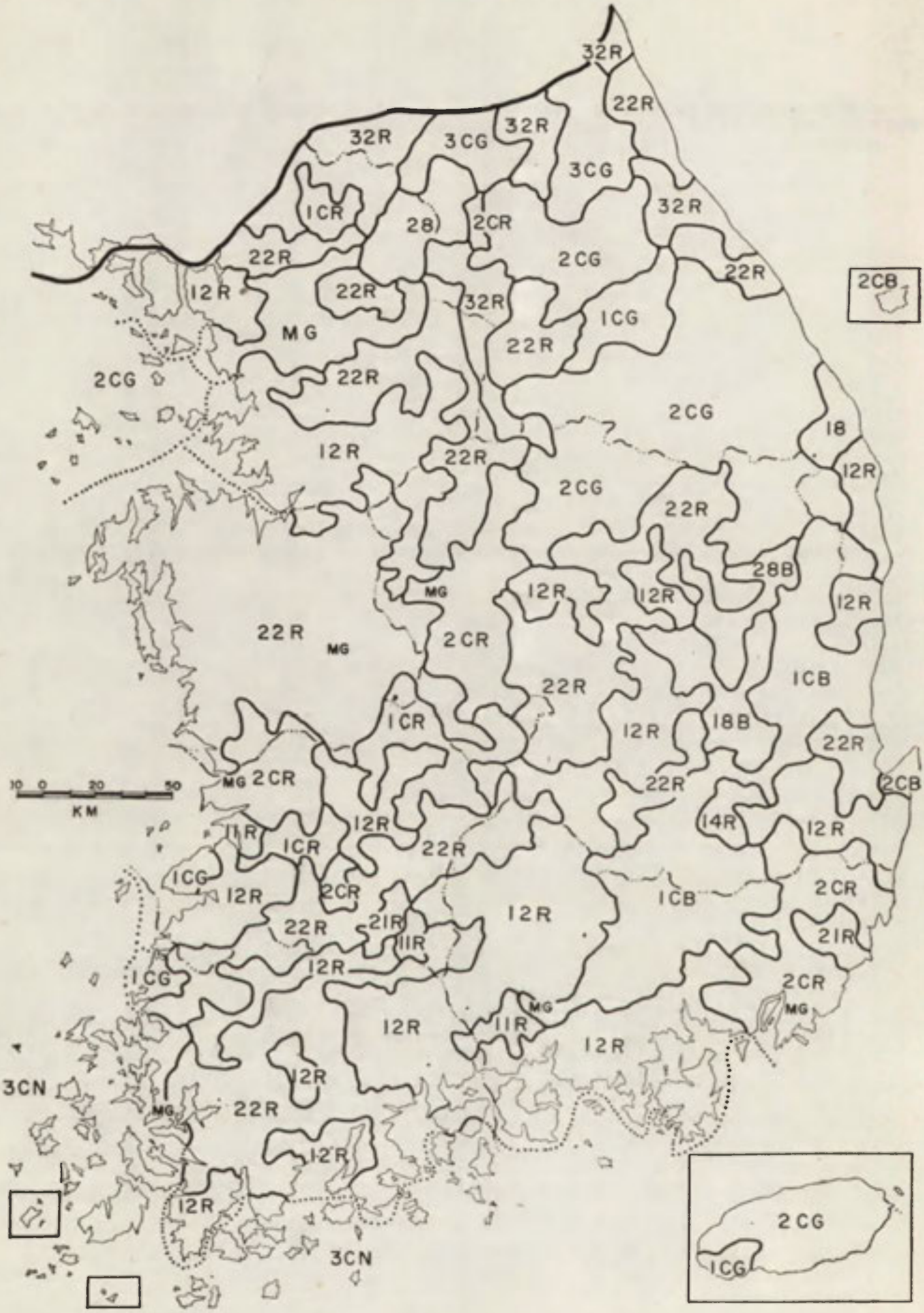

Fig. 18. Agricultural regions in South Korea

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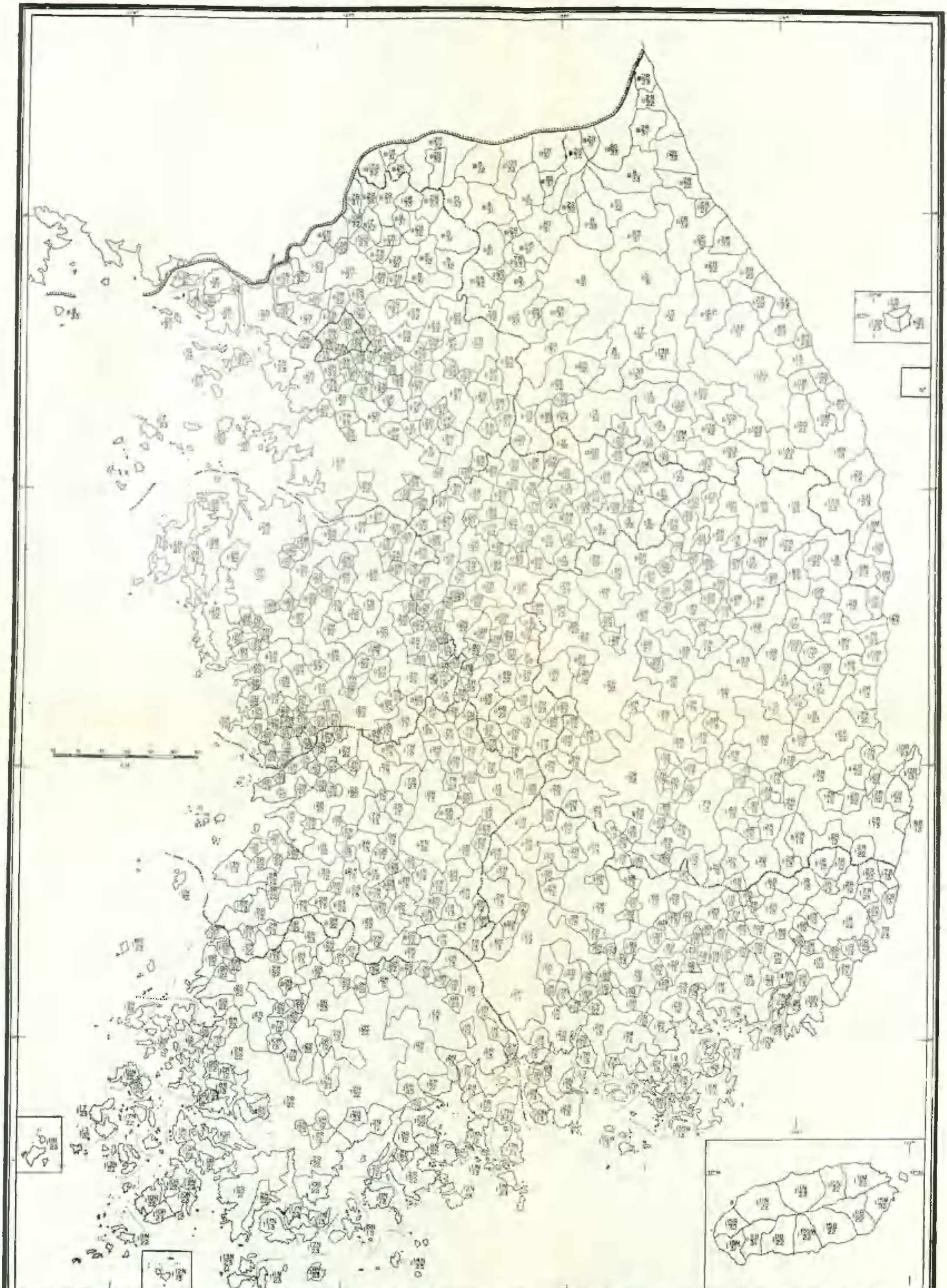

Fig. 17. The patterns of agriculture in South Korea

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association between the two is obscure. Therefore, functional factors have been injected in the study of this field in recent years [20].

Indices

Land use and farm management: (Fig. 2)
1) Ratios of paddies against total cultivated acreage (Fig. 3)
2) Major crops (Fig. 4)
3) Farming pattern (Fig. 5)
Size of management: (Fig. 6)
1) Cultivated acreage per farm population (Fig. 7)
2) Cultivated acreage per farming household (Fig. 8)
3) Farming acreage for total household (Fig. 9)
4) Farming acreage for total population (Fig. 10)
Intensity of management: (Fig. 11)
1) Input of fertilizers per "tanbo"[21] (Fig. 12)
2) Labour hours per tanbo per year (Fig. 13)
3) Rates of double cropping of paddies (Fig. 14)
4) Rates of double cropping for fields (Fig. 15)
Pattern of Land ownership: (Fig. 16)
1) Full ownership of land
2) Semi-ownership of land
3) Non-ownership of land.

By these indices, South Korea has been classified into 3 agricultural zones and 17 agricultural zones and 17 agricultural regions as follows:

Agricultural Zones (Fig. 17)
1) High Agricultural Management Zone
2) Medium Agricultural Management Zone
3) Low Agricultural Management Zone
Agricultural Regions (Fig. 18)

No.	Symbols on Map	Farming Size Intensity. Land Ownership	Notes for Regions
1	11R	High	Exclusive rice producing region.
2	12R	High	Grain producing region in which rice production is dominant.
3	14R	High	Orchard region in which rice production is dominant.
4	21R	Medium	Exlusive rice producing region.
5	22R	Medium	Grain producing region in which rice production is dominant.
6	32R	Low	Grain producing region in which rice production is dominant.
7	18B	High	Mixed region with paddies and dry farms (in which barley production is dominant).

[20] Chung-Myun Lee, A Study of Agricultural Regions in South Korea (Part I), *Geography*, No. 2, Seoul, 1966, pp. 1—13.
[21] One tanbo equals 0.245 acre.

8	28B	Medium	Mixed region with paddies and dry farms (in which barley production is dominant).
9	1CB	High	Mixed farming region (in which barley production is dominant).
10	1CG	High	Mixed farming region (in which miscellaneous crop production is dominant).
11	1CR	High	Mixed farming region (in which rice production is dominant).
12	2CB	Medium	Mixed farming region (in which barley production is dominant).
13	2CG	Medium	Mixed farming region (in which miscellaneous crop production is dominant).
14	2CR	Medium	Mixed farming region (in which rice production is dominant).
15	3CG	Low	Mixed farming region (in which miscellaneous crop production is dominant).
16	3CN	Low	Mixed farming region (in which naked barley production is dominant).
17	M.G.		Horticultural region (suburban areas).

These shall be examined from the attached map[22] (Fig. 17).

CONCLUSION

Through the 1,520 units analysed, the following results can be observed:

a) the agricultural structure and character of each unit,

b) differences in regional characteristics which can be compared.

However, the classification is rather detailed and complex. There is still scope for a more simplified quantitative approach.

Most of the research in this field have hitherto concentrated on qualitative classification. They suffer the weakness of subjectivity: there is little computible basis for establishing comparable agricultural regions by independent scholars. Some measurable, yet manageable, criteria should be prepared as objective standards to build on. Perhaps, further studies will employ a much needed quantative approach. This can help to establish, more finally, a more complete set of complex related physical, social and economic variables of Geography.

[22] $I\,\frac{2R}{13}$, $II\,\frac{8B}{12}$, $III\,\frac{7R}{23}$; I, II, III show pattern of land ownership: 2R, 8B, 7R show land use and farm management; 13, 12, 23 show size of management and intensity of management.

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THE CHANGING PATTERNS OF LAND USE AND THE AGRO-GEOGRAPHICAL DIVISION OF DENMARK

Agro-geographical researches from different countries have up to the present been very difficult to compare, each writer using his own methods, measures, indices etc. Agricultural geography however is, thanks to the IGU Commission for Agricultural Typology, moving towards the use of precise and measurable criteria.

This research into agricultural regionalization is at the same time a topical study in a method and technique of measuring agricultural intensity and a method of integrating agricultural statistics. It deals more with the effects of human activities as visible in the landscape than with economy. To some extent new methods have been elaborated for the delimitation of regions and for the regional concentration of branches of farming. Years ago I divided Denmark into 7 agro-geographical regions (Kampp 1959), (Fig. 1), principally on the basis of parish statistics of the total yield per hectare of a series of crops (expressed in isodones) for 1937—39, together with statistics of wheat-barley areas as a percentage of the rotation area (called isodenses) for 1939. The result was subsequently subjected to a critical revision based on corresponding material from 1837, 1907, and 1946.

It has now become possible to elucidate the stability of the basis for classification over an even greater span of years with the help of a map, which I have prepared on the basis of a dissertation by Hastrup 1964 (Fig. 2), in which the circle areas are proportional to the "hartkorn" figures about 1688, "hartkorn" being an old Danish unit of land valuation based on estimated productivity. All villages and single farms, which in 1688 had a certain amount of "hartkorn", are included on the map. The squares indicate villages whose "hartkorn" figures are missing from the statistics; the squares therefore merely indicate the density of the villages, and it can be taken that they are too large to the west and too small to the east in relation to the circles on the map, which are variable in proportion to the "hartkorn". As so often is the case on maps of this type the density appears less than it ought to be in the darkest areas, because some of the circles either partially or completely overlap each other.

Attempts have been made to trace the geographical differences in soil-quality even further back in time with the aid of agricultural population density, which,

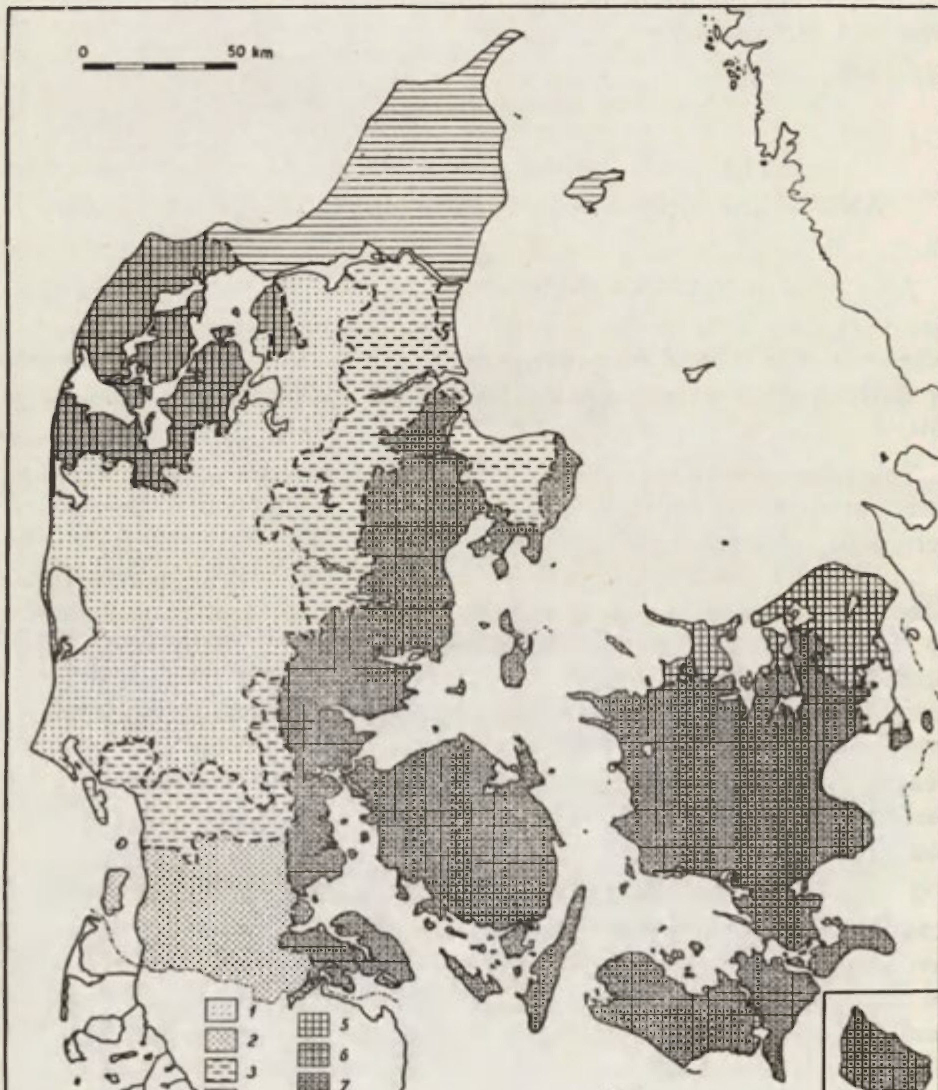

Fig. 1. The division of Denmark into 7 agricultural regions

1 — West Jutland, 2 — South Jutland, 3 — The transitional zones, 4 — Vendsyssel, 5 — Northern Zealand, 6 — North-West Jutland, 7 — Eastern Denmark

Fig. 2. Map showing the "hartkorn" figures at the time of the great land register
1 — 10, 2 — 25, 3 — 50, 4 — 75, 5 — 100, 6 — 150, 7 — 200, "toender hartkorn" 8 — Villages without hartkorn figures in the statistics from 1688

Fig. 3. „One dot for one parish" reflecting to some degree the distribution of primeval soil quality

needless to say, allows of no direct proof; but if one assumes that in earlier times it was directly proportional to the soil-quality, and thus probably inversely proportional to the size of the parish, then one can obtain an approximate measure for the agricultural population density, and thus presumably also for the soil-quality by simply placing a dot of uniform size in every single parish. Fig. 3 must, to some degree, reflect the geographical distribution of soil-quality in the unknown point far back in time, when the parish boundaries were drawn up.

The wheat-barley areas have made greater advances in recent years in Jutland than on the Islands. On the one hand, however, Jutland is divided into the agricultural regions 1, 2, 3, 4, 6 and 7 and the Islands into 5 and 7, and furthermore the shifts in the wheat-barley areas in favour of the low regional numbers are at any rate partly a logical consequence of the decline in agricultural areas to the east and the progress to the west.

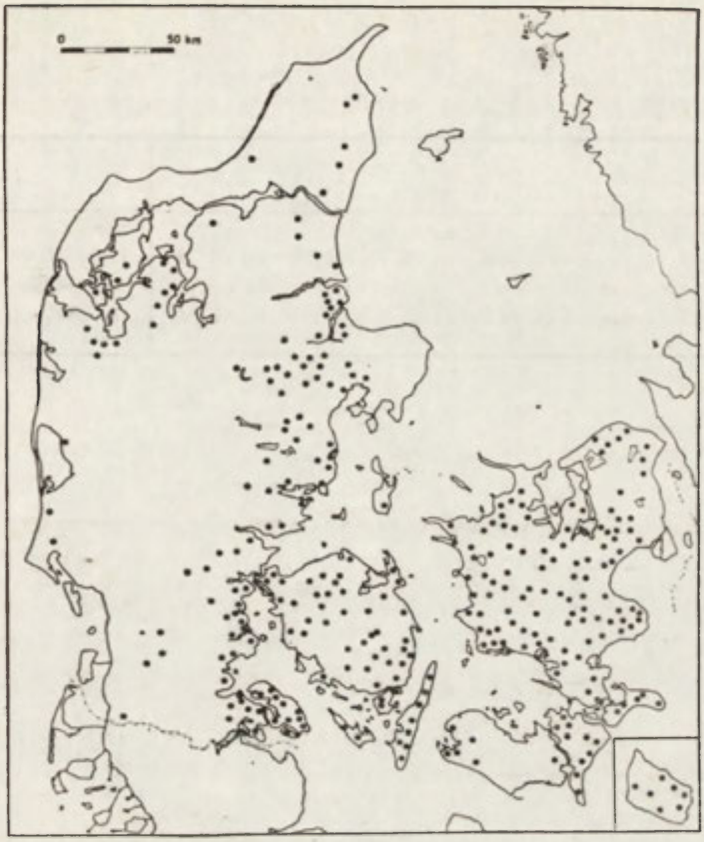

Fig. 4. Wheat area 1951. Each dot = 275 ha

Although there has been a considerable dynamism in the form of progress in wheat-barley areas to the west, the figures 5 and 6 would appear to indicate that the distribution pattern of these crops as an agro-geographical division need not alter the earlier established regions, and the isodense map (Fig. 10, 11) justifies a continued maintenance of my original division (Fig. 1).

In correspondence to the strong progress of the wheat-barley areas as a percentage of the total rotation area, the isodense signature column, which is determined by the distribution curve, covers far larger figures than in the previous years (table 1).

The regions themselves thus appear to be still unchanged, but their content varies, owing partly to the altered distribution of crops and livestock, yield per hectare, milk yield per cow, the quality of cultivated plants, fruit growing, etc.

TABLE 1

Isodense-signature-no.	1	2	3	4	5
1907	≦ 1,4%	1,5—5,9	6,0—11,9	12,0—16,4	≧ 16,5%
1939	≦ 9%	10—19%	20—27%	28—33%	≧ 34%
1962	≦ 24%	25—35%	36—42%	43—49%	≧ 50%

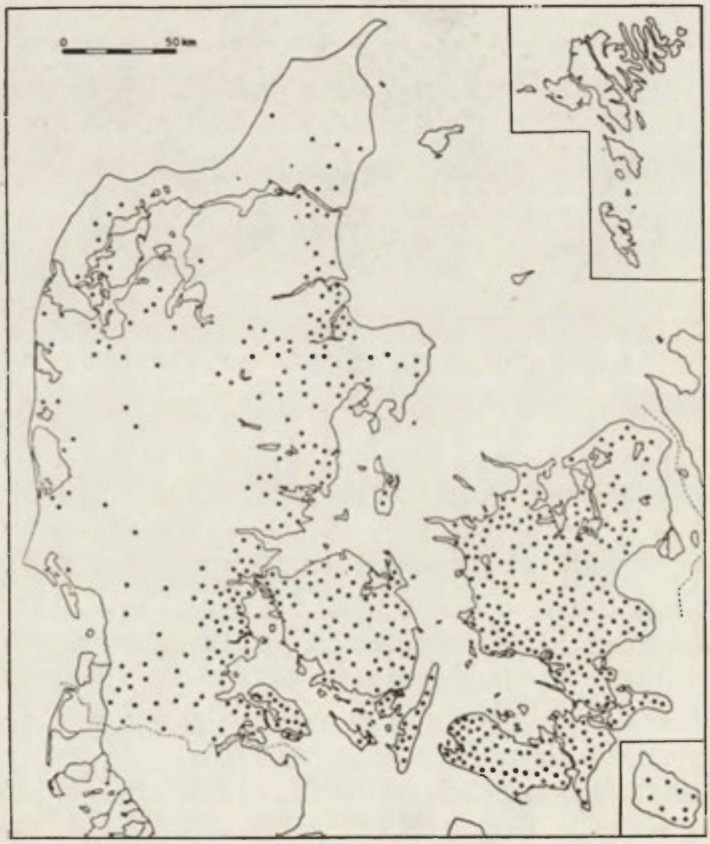

Fig. 5. Wheat area 1962. Dot = 275 ha

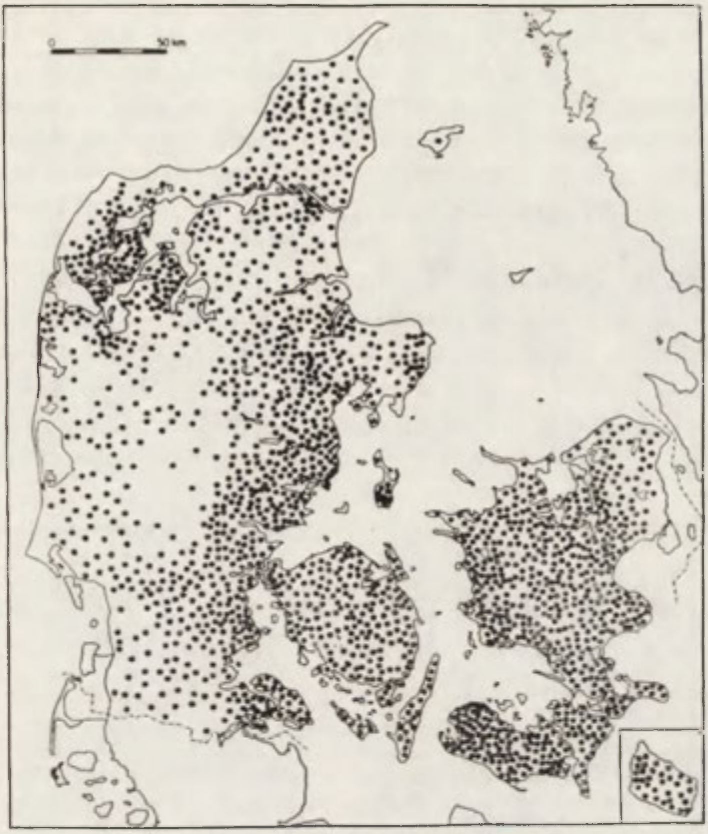

Fig. 6. Barley area 1951. Dot = 275 ha

The process of industrialization within agriculture after the end of the Second World War occupies a prominent place in the series of agrarian revolutions. It has resulted in a radical change in structure and drastic changes in the cultural landscape: through adaptation of the fields to the use of machines, changes in the use of fields and the tendency towards specialization.

While more and more farmers in East Denmark are moving away from a marked livestock production to a more plant-breeding production, interest in finding new crops is growing. Up to the present, this interest has shown itself in increased production of grain, seed and other commercial crops, especially rape and mustard. The decline of oats is connected partly with horse reduction.

Apart from districts from where Swedish sugar factories do not any more buy sugar beets, the reduction in areas with root crops is undoubtedly connected with the simultaneous decline in the number of dairy cows. In East-Denmark the number of dairy cows has been reduced from the mid-30's (but at the same time with an increase in the milk-yield per cow); in West-Denmark on the other hand, the number of dairy cows has increased, and although the number of dairy cows for the whole country now is only 86% of the number in 1938, there has been no change in the total milk production. The reduction in areas with root crops and in the number of dairy cows has been greatest in those parts of the country that were most affected by the drain of labour from agriculture to the towns. This reduction may in the long run have unfortunate consequences for the rotation of crops and thereby for the yield.

Contemporaneous with the farmers' increasing opportunities for supplementing their earnings in industry, an extensification is occuring in the use of agricultural areas, thus introducing a new phase in sheep-breeding.

The increase in the number of sheep is distributed fairly evenly over the whole country except in region 2, South-Jutland, where the number has been

Fig 7. Barley area 1962. Dot = 275 ha

very stable throughout the years, but which is still the part with most sheep per area unit. Many of the hilly fields, which it was quite possible to cultivate with horse-drawn implements, must lie unused today, because it is too dangerous to work on them with modern machines. In many cases it has proved practical to lay down areas with permanent grass for sheep-breeding, and in areas where grass-seed has a place in the rotation of crops, sheep have proved suited for exploiting after-growth and for cleaning off the fields. Sheep-farming makes at the same time small demands on buildings, which moreover are only used for a short time each year, and sheep-farming can be fitted into farming arrangements without any great adaptations and with favourable economic results.

Natural conditions make possible the growing of many cultivated plants; which ones are chosen depends on tradition and economic conditions. A regionally determined pattern of growing results from the fact that farmers in the district concerned make practically speaking the same decisions in response

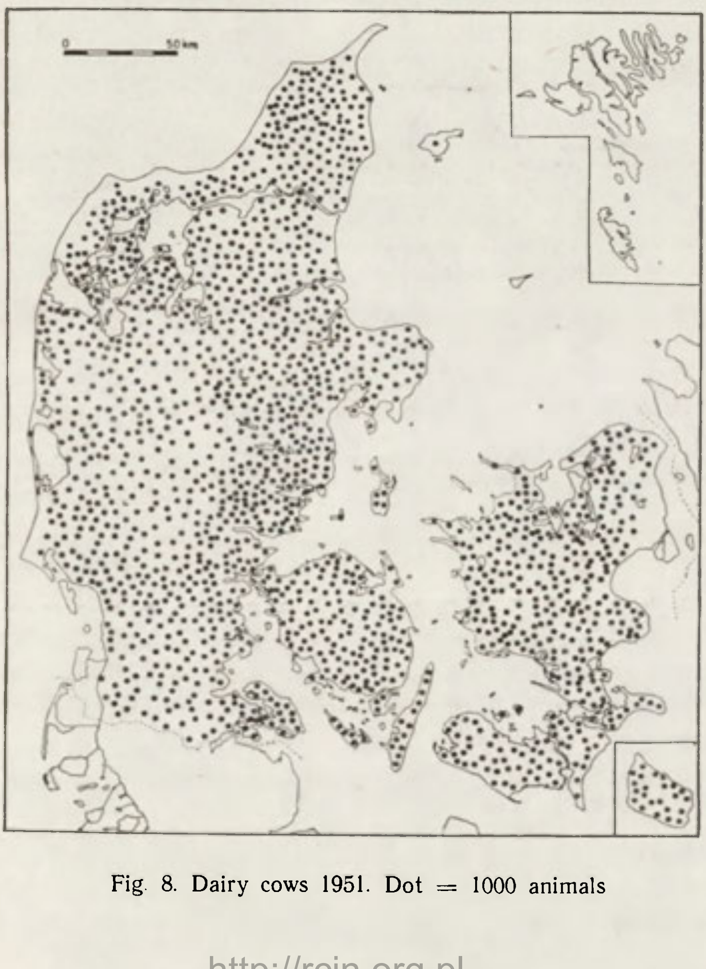

Fig. 8. Dairy cows 1951. Dot = 1000 animals

Fig. 9. Dairy cows 1962. Dot = 1000 animals

to fairly uniform conditions over larger areas. Maps of farming will always be mosaics.

The content of the regions is presumably altering more rapidly now than earlier. With the simplifying of administration, partly through an increase in the size of the administrative and thereby the statistical units, which is under way at present, the possibilities for future detailed mapping of the country as a whole deteriorate (until all elements necessary for registration of land use have been given co-ordinates, and computers are taken into use).

In order to show the probable changes in the content of the regions, one has gone over to examining limited, as far as possible representative parts of the single regions.

The number of dairy cows per km² agricultural area (Fig. 8—9) would appear to be almost unchanged in region 1, and to have increased greatly in 2 and 3;

in the other regions there has been a decline since 1946. The wheat-barley percentage is rising in the following order: 3, 1, 4, 2, 6, 5, 7; the percentage of corn wheat-barley is after the falling scale: 2, 1, 4, 3, 5, 6, 7.

Barley is today the most prevalent grain crop in all regions; only in region 2 does oat measure up to barley, in region 1 oat + mixed grain. Mixed grain moreover plays a considerable role in the transitional regions. Rye plays a declining role today with the exception of the following example from region 5.

Butter yield per cow has increased in all regions, but is still smallest in 1 and 2, greatest in 5, 6, and 7. Cattle breeds have become far more mixed, and Jerseys have become more numerous.

For pedagogic reasons the division has been simplified to 3 regions: "East Danish" and "West Danish" agriculture together with the transitional areas; while such a method naturally facilitates a broad understanding, it provides at the same time fewer possibilities for detailed investigations.

Fig. 10. Isodense map for 1946

Fig. 11. Isodense map 1962 for Denmark, Sconen and Schleswig-Holstein

In this division of the country into 7 resp. 3 regions a regionalization has been crystalizing thorugh the centuries; but within this regionalization a more far-reaching specialization is gradually developing.

In accordance with the simplification mentioned, the regions are grouped as follows:

While the agricultural area has progressed in West, and declined in East, the rotation area has progressed in all three regions, but greatest in West, particularly from a relative viewpoint. Parish statistics for grass within rotation are not available for 1962, but county statistics for the years 1951—62

TABLE 2

	West	Transitional	East
Total area in thous. hectares	1 130	920	2 110
Agric. area 1951, thous. hectares	743	692	1 618
— — 1962, — —	788	711	1 610
Rotation area 1951, — —	646	594	1 432
— — 1962, — —	683	609	1 457
Change in wheat-barley area 1951—62, thous. hectares	+ 102	+ 77	+ 214
Change in grass area outside rotation 1951—62, thous. hectares	+ 13	+ 4	— 37
Change in number of dairy cows, thousands	+ 32	+ 29	— 156

regions 1 + 2 = West
regions 3 + 4 = Transitional
regions 5 + 6 + 7 = East

show particularly progress for West Denmark; the total figures for the Islands and the county-totals for the purely East Jutland show a decline, while the middle of the country shows, as was expected, almost a standstill. Viewed statistically, both the number of dairy cows and grass regions have undergone a decline both outside rotation and as a whole, but the spontaneous dynamism of regionalization has made itself felt amongst other things in the westward-moving geographical shift in the distribution of grass areas, and of dairy cows.

Danish agriculture will only slowly be specialized in the absence of directives from a superior planning authority, which for the time being at any rate does not exist. But such an investigation as this one may be considered of importance for a continuation of the sprouting, spontaneous specialization, insofar as it has demonstrated such a specialization.

BIBLIOGRAPHY

[1] A. E. Christensen, Danmarks befolkning og bebyggelse i middelalderen. I A. Schück: *Nordisk kultur* II, 1938.

[2] K. E. Frandsen, Lidt om landbrugsgeografi og naturlandskab, 1969.

[3] F. Hastrup, *Danske landsbytyper*, Aarhus 1964.

[4] A. H. Kampp, *Landbrugsgeografiske Studier over Danmark*, København 1959.

[5] A. H. Kampp, Some types of farming in Denmark, *Oriental Geographer*. East Pakistan 1959.

[6] A. H. Kampp, Some changes in structure of Danish farming, *Geografisk Tidsskrift* 1963.

[7] A. H. Kampp, Hvad forstås ved bonitet?, *Biologi og Geografi* 1964.
[8] A. H. Kampp, *De levende råstoffers geografi*, København 1964.
[9] A. H. Kampp, Det rurale landskab, *Det Danske Kulturlandskab.* København 1965.
[10] A. H. Kampp, Den danske erhvervsfrugtavls geografi, *Erhvervsfrugtavleren*, 1966.
[11] A. H. Kampp, The agro-geographical division of Denmark and the time factor, *Geografisk Tidsskrift*, 1967.
[12] J. Kristensson, Indelning av Skåne i lantbruksergioner enl, A. Kamps metod, *Kulturgeografisk Trebetygsarb*, Lund 1963.
[13] C. Meldahl, Kaart over Hartkornets Fordeling i Kongeriget Danmark i Åå ret 1873, *Till. t. Statistik Tabelveark* 3, 32, København 1877.
[14] K. Nordborg, Landburgssgeografiske studier over Danamark (anm), *Svenska Geografisk Årsbok*, 1959.
[15] H.Pedersen, *De danske Landbrug. Fremstillet på Grundlag af Forarbejder til Chr. V's Matrikel 1688*, København 1928.

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THE HUZA STRIP FARMING SYSTEM OF THE KROBO OF GHANA

The Krobo who numbered about 163,000 in 1960 and form two separate traditional states — the Yilo and Manya Krobo — are part of the Ga-Adangbe ethnic group in Ghana (Fig. 1). They formerly lived on the Krobo hill for defensive reasons and cultivated the surrounding Akuse plains (Fig. 2). Millet which was their main staple crop thrived well on the dry plains but the frequent spells of drought resulted in meagre harvests. Krobo farmers were therefore compelled to seek for more suitable land for cultivation. Nearby, to the north of the plains were the well-watered Akwapim ranges owned by the Akan people. Yono, the mountain country as the coveteous Krobo called the area offered them an outlet fo· expanding their farming activities because a large part of it was virtually empty.

Their attempts to cultivate the adjacent hill slopes were however repulsed by the land-owning groups. Nene Sakite, *Konor* (Chief) of Manya Krobo ended the protracted strife between his people and the Akan groups by negotiating for the purchase of a tract of land in the middle of the last century. This agreement ushered in a period of Krobo migration into the mountain country. Towards the end of the *Konor*'s reign, the idea of acquiring land took a firm grip of his people, for land was then required not only for food crops but also for growing cash crops — first the oil palm and later cocoa.

Individual Krobo farmers did not buy land directly from the Akan chiefs. They organized themselves into small groups for this purpose, and thereby increased their bargaining power. At the head of each group or company as the organization came to be known was a *zugbanyadalor*, the negotiator of land; he was usually the person who discovered the tract of land to be purchased. There were, however, occasions when an important person in the social hierarchy of the tribe, such as an *Asafoatse*, captain of the *Konor* or his representative was invited by members of a company to take charge of the negotiations with the sellers. After the purchase, the "big man" was often rewarded with

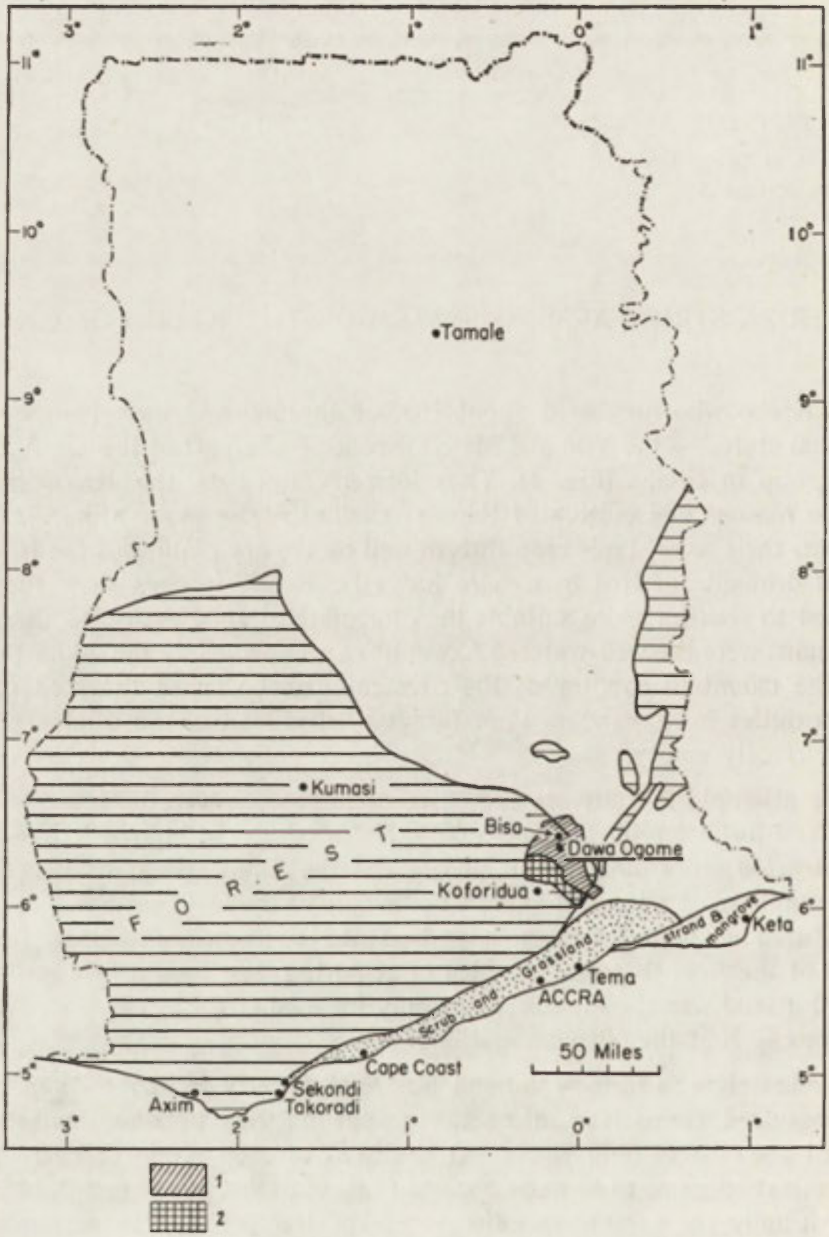

Fig. 1. Position of Dawa Ogome

1 — Manya Krobo traditional area, 2 — Yilo Krobo traditional area

a parcel of land by the company in return for his services; this offer ensured his continued interest in the purchased tract of land.

A company was usually composed of people from the same village. The names of the home — villages of the founding members of the Krobo farm settlements in the mountain country are included in the names of the *huzas*. A typical example is Dawa Ogome which is discussed below as a case study by the writer (Fig. 1).

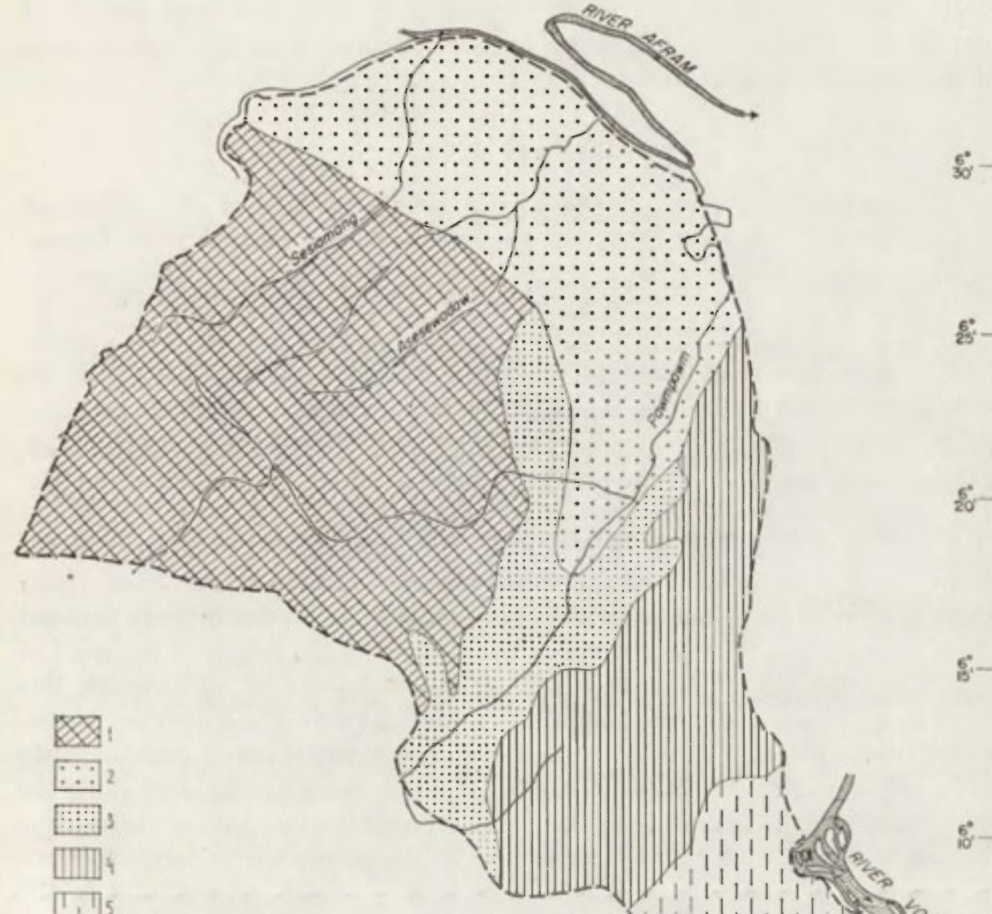

Fig. 2. Manya Krobo. Relief and drainage

1 — kwahu plateau, (500—1 700 ft.), 2 — afram plains (200—250 ft.), 3 — pawmpawm basin (below 500 ft.), 4 — akwapim-togo range (500—1400 ft.), 5 — akuse plains (below 150 ft.)

The *huza* system has already been studied from various angles. Dr. Field studied it from the anthropologist's point of view in 1943[1]. Dr. La Nyane, an agricultural economist, examined the economics of agricultural production at the Aweso *huza* in 1956[2] and Polly Hill gives an account of the migration of the Krobo into the forest region in her classic work on Migrant Cocoa Farmers in Ghana[3]. The aim of the present study is to examine in some detail the different aspects of this unique system of farming and to show to what extent it meets the demands of a rapidly growing population. The survey was carried out in 1962 with the assistance of surveyors and labourers from the cocoa division of the Ministry of Agriculture.

THE DAWA OGOME COMPANY AND LAND PURCHASE

There were 37 members in the company (Fig. 3). All but one came from Ogome, the only stranger being an Akwamu who had married from Ogome. Nineteen members were kinsmen of the *zugbanyadalor*, the father of the present *dademantse* (chief farmer) of the *huza*. The *zugbanyadalor* had lived among the Akim for a time and spoke their language fluently; he was, therefore, in a favourable position to negotiate for land with the Akim. He approached Okyere, the chief of Begoro in 1891 with a bottle of rum, cloth and an umbrella as tokens of good will. When these were accepted, the chief sent his representatives to delimit a tract of land for him, but the price was not fixed then, for the size of the land was not yet known.

There was no indigenous unit of area measurement and delimitation of the land was a simple process. The prominent landmarks in the area — river Ɗawa and Yoku hill — were first selected as two boundaries and the distance between the river bank and the brow of the hill was taken as the length of the tract of land. Since the price of the land was largely to be determined by its width, this was carefully measured. The unit of measurement was *kpa* (rope) or twelve *gugwe* (the armstretch of the tallest man among them). From a conspicuously rocky point in the river course, a baseline of $38^1/_2$ ropes was measured along the bank of the river. Boundary lines were then cut from the two ends of the baseline towards the foot of the hill, and large trees on these lines were selected to mark the boundaries. Although these lines were intended to be perpendicular to the baseline, they turned out to be far from that since no instruments were used to give direction.

After the tract of land had been delimited and the boundaries had been agreed upon, the *zugbanyadalor* returned to Begoro to pay the chief. The actual

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[1] M. J. Field, The Agricultural System of the Manya Krobo of the Gold Coast, *Africa*, vol. XIV, 1943, p. 54.

[2] S. La Anyane. *Aweso Huza*, Accra, 1956.

[3] Polly Hill. *The Migrant Cocoa Farmers of Southern Ghana.* London, 1963, pp. 265.

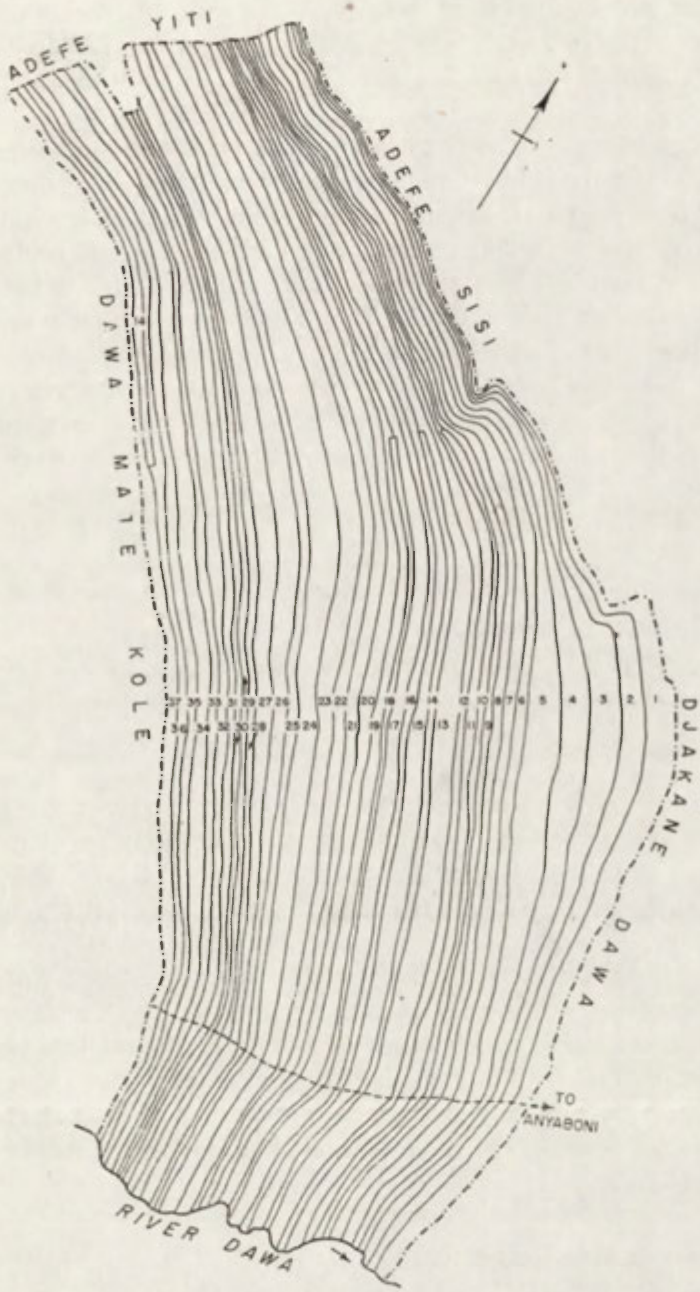

Fig. 3. Zugbas of original settlers

amount of money paid to the chief could not be remembered by informants, but the price paid by individual members of the company was quoted as twelve shillings per rope. This works out at £23 Is. 0d. for the 720 acres. Informants could not remember whether this included expenses on drinks and payment of the boundary cutters.

The final bargain — sealing ceremony took place one the banks of the river Dawa. A sheep provided by the buyers was slaughtered on a stone and libation was poured by a representative of the chief to the spirits of the ancestors informing them of the transaction and soliciting their succour and protection for the new owners of the land. The purchasers were then exhorted to keep the taboos of the land to ensure good harvests. They were never to till the soil on Fridays since that was the day of rest of the river Dawa whose spirit controlled plant growth. At the beginning of the main growing season every year, a sheep was to be offered to the river. These laws have been enforced ever since. At the end of the ceremony, the empty rum bottles were buried under trees standing on the four corners of the purchased land. The writer found only two of these bottles, and informants explained that those buried near the river had long been washed away.

THE PHYSICAL CONDITIONS

The *huza* slopes gently from the northern boundary which is about 900 feet above sea level to the valley of the river Dawa, and lies within the belt of forest ochrosols. Deep bouldery soils occupy the higher slopes, and sandy and heavy soils are found on the lower slopes near the river valley. The flood plain of the river is subject to waterlogging and is rarely cultivated.

There are no rainfall figures for the *huza* itself but judging by the known rainfall of surrounding stations it is assumed that the total annual rafinfall is between 50 and 55 inches.

Although the area lies within the semi-deciduous forest belt *Antiaris-Chlorophora* Association, the big trees such as *Ceiba pentandra* which are associated with this belt are sparsely distributed on the *huza*. The original vegetation has been replaced by regrowth of secondary vegetation of various ages interspersed with cultivated plots. The fallow vegetation consists of thicket and secondary forest, the latter fringing the river bank on the south-west corner of the huza (Fig. 7).

DIVISION OF THE PURCHASED LAND

The boundary along the river which had previously been measured was subdivided among the 37 members of the company according to the size of the contribution made by each member. After the share-out, *buna* trees, *Pycnona* *cornuta* were planted to mark the limits of each strip on the *kpa ka tso* (baseline), from which cultivation began. Each farmer was required to maintain the distance measured for him on the baseline as the width of his *zugba* (strip of land), as he developed with farming towards Yoku hill. In order to ensure that no strip increased in width at the expense of a neighbour's strip, each farmer was expected to keep pace with the advancing line of cultivation, *humi za.* The special name given to a *buna* marking the boundary between *zugbas* is *huzu nyabuna,* and no farmer could plant it without the knowledge and consent of the person with whom he shared a common boundary.

The width of the land was remeasured on a new baseline after the fourth season or so of cultivation. This was longer than the original baseline and in the subsequent redivision of the land, the length of the rope was increased to fifteen armstretches. *Buna* trees were planted on the new baseline known as *kpa tom buna,* and farmers were asked to keep the new distances marked out for them.

The co-ordinated advance of the cultivators towards the northern boundary was disrupted by pressure from members of the Adefe Sisi Company who started to encroach upon their land in the northern sector of the *huza.* The Begoro chief had mistakenly sold that part of the land to both companies. Many Dawa Ogome farmers jumped ahead of the line of cultivation and started to clear in the disputed area in order to establish their claims over the land before the Adefe Sisi farmers. The few who remained behind came out of the struggle with their *zugbas* cut short, and five Dawa Ogome farmers lost the northern sections of their *zugbas* to Adefe Sisi farmers. In the redistribution of land which took place after the pressure had been repulsed, some of the *zugbas* were greatly reduced in width and the owner of plot 14 was resettled between plots 36 and 37 (Fig. 3).

The acreage of individual strips of land which started from the first baseline with equal widths varied a great deal. The acreage of *zugbas* with a width of half rope varied from 9.1 to 20.7 while those with a width of one rope ranged between 11.6 and 28.4. There were instances when the width of a "one-half rope *zugba*" was found to be greater than that of a "one rope *zugba*" as one moved farther away from the *kpa ka tso.* According to informants, this occurred when industrious farmers took advantage of their lazy neighbours to increase the widths of their strips. Although one would normally expect a general redivision of the land in the northern sector after the advance of the Adefe farmers had been halted, this did not take place. The redistribution of land which followed affected only those whose strips of land were lying near to the boundary with Adefe Sisi. It is significant to note that none of the relatives of the *zugbanyadalor* was anywhere near the disputed area.

The company did not disintegrate after each individual had received his parcel of land but was transformed into a coherent social unit. The *zugbanyadalor* became the head of this social unit, and his title, "the negotiator of land" was replaced by *huzatse*, "the father of the *huza*". He had the responsibility of maintaining peace and harmony among members of the community, but a council of elders was chosen to assist him in discharging these duties. Boundary disputes between individuals were settled by the *huzatse* and his councillors. They were responsible for making the annual offering to the river and enforcing the taboos of the land. Since the *huzatse* knew the boundaries of the whole tract of land, he represented the community externally in all matters affecting the boundaries of the *huza*; nevertheless, every member of the company had absolute control over his parcel of land and could do whatever he liked with it without seeking approval from anyone. Thus, the owners of plots 28, 29 and 30 in Fig. 3, sold parts of their strips of land to a family in Adefe Yiti.

FRAGMENTATION OF ZUGBAS

A number of *zugbas* had undergone fragmentation (Fig. 4). This is the result of patrilineal inheritance system of the Krobos. All the *zugba* owners on the *huza* had inherited their strips from deceased kinsmen. Under the patrilineal inheritance system of the Krobo, land succession passes through all the members of one generation to members of the next one. Land inheritance from original owners, however, differs significantly from succession from the second and subsequent generations of holders.

The self-acquired *zugba* of a deceased father is inherited by all his sons. They all have equal claims over it but in order to prevent excessive fragmentation of the *zugba* it is divided between the wives by whom the deceased had issues. The sons of each wife receive collectively an equal share of the *zugba*, the number of children of a wife is not taken into consideration during the share out. The oldest son in each group inherits it on behalf of his junior brothers. The mother has no claim to the land, and a wife who had no issues by the deceased husband may be granted permission to use part of the uncultivated section of the *zugba* during a farming season. In the case of a wife with only female issues, the eldest daughter, if she is unmarried, inherits on behalf of her sisters, but her interests in the land abrogates upon marriage. A *yobi* (an illegitimate child of a sister) also had the right to inherit part of the *zugba* of his mother's brother. The children of the deceased receive the larger share from the subdivision of the land.

A few exceptions to the general principles described above were found on the *huza*. There was an example of a *zugba* which had not been divided between wives on the death of the owner but the eldest son of the deceased father had inherited it (number 2 in Fig. 5) on behalf of all his brothers. There were also two cases of fragmentation of *zugbas* among brotherso f the same mother.

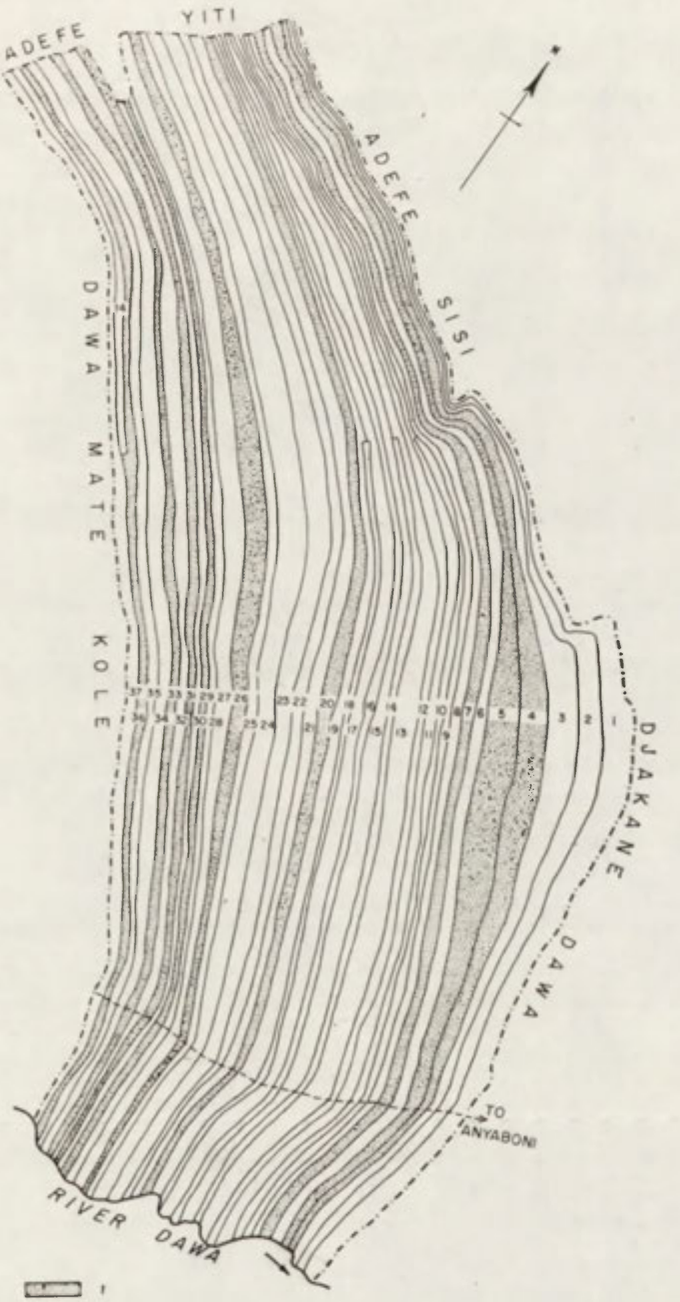

Fig. 4. Fragmentation of Zugbas

1 — fragmented Zugbas

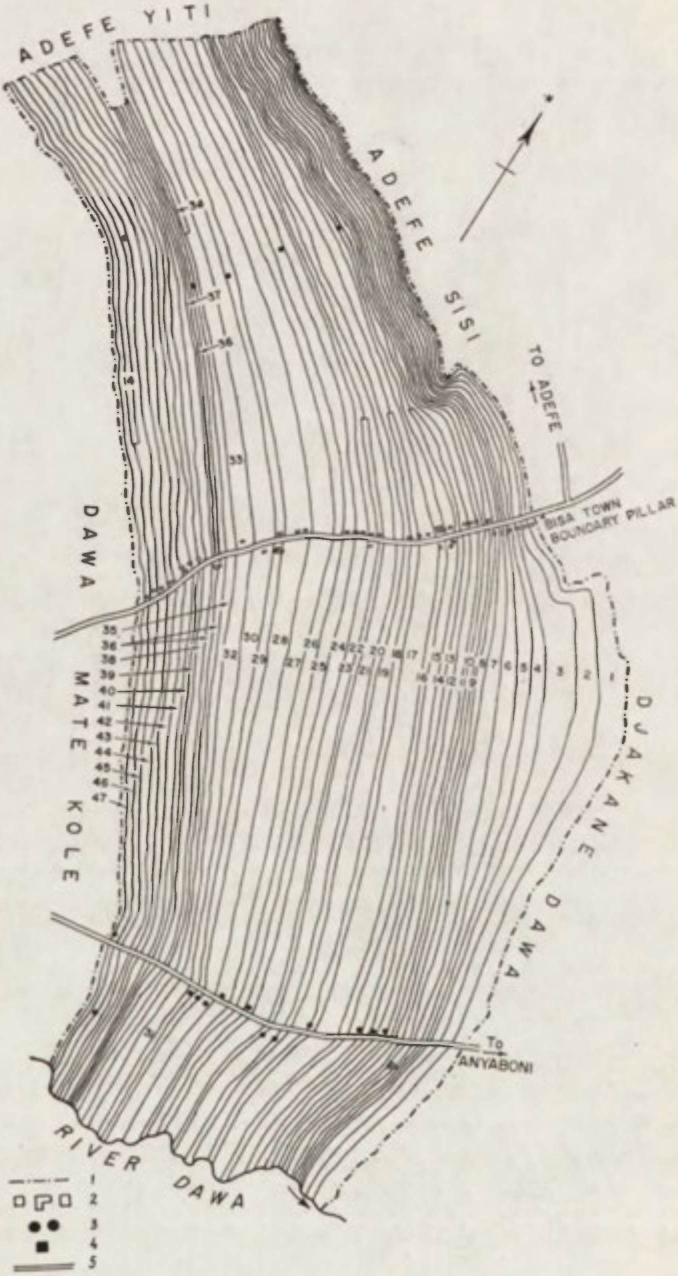

Fig. 5. Individual Zugbas, 1962

1 — boundary of Huza, 2 — occupied houses, 3 — abandoned houses, 4 — palm wine distillery
5 — roads

The extent to which self-acquired *zugba* may be partitioned depends on the number of wives, male issues and *yobis* of the deceased. A father could, however, save his *zugba* from excessive fragmentation by buying strips of land on the *huza* or elsewhere for some of his grown-up sons. Thus, the *zubganyadalor* bought land for four of his sons — all of different mothers — on the *huza*. On his death, the sons of his two junior wives inherited his strip of land.

Fig. 5 shows the individual strips of land on the *huza* at the time of the survey. The number of *zugbas* had increased from the original 37 to 47. Although *zugbas* are usually divided longitudinally to give everybody equal benefit from the variety of soils found within the area, three of the *zugbas* had been sub-divided transversely.

Twelve *zugbas* had been inherited from deceased second generation holders. None of these was partitioned at the time of succession, although four of them are fractions of *zugbas* which had been sub-divided in the preceding generation.

The salient aspects of the system of land inheritance on the *huza* are well illustrated by the case history of three *zugbas* bought by the same person. The *zugbas* are numbers 28, 29 and 30 in Fig. 3. The father (A) bought the three strips of land, each one rope wide. He gave one strip to each of his two sons of different mothers (B) and (C), and kept the remaining one. The elder son (B) died before him and (C) and on his death his *zugba* (29) was divided between his two wives. When the father (A) died, his only surviving son (C) inherited his strip, thereby acquiring control over two strips — 28 and 30. On the death of (C) his own *zugba* (28) was inherited by his unmarried daughter but that of the grandfather was inherited by the elder son of (B). On his death, his half brother will inherit it. The daughter of (C) comes after the two sons of (B) in the line of succession to the *zugba*.

After the first generation of successors the number of people who acquire an interest in a particular strip of land is increased, and it becomes a full-fledged family property. Succession to it is by generation and seniority. It is not partitioned because this would result in excessive sub-division; fragmentation of *zugbas* is therefore no longer a serious problem on the *huza*.

RENTING OF LAND

It was discovered at the time of the survey that not all families in the village were able to depend on the strips of land to feed themselves. In order to find out the man-land ratio on each *zugba* on the huza in 1962, data were collected on the sizes of the "*zugba*-families" for that year. A "*zugba*-family" is defined as the number of people who obtained their food supply from a *zugba*. Although, ideally, a "*zugba*-family" ought to have been estimated by allowing one unit for each person obtaining the whole of his or her food supply from a *zugba*,

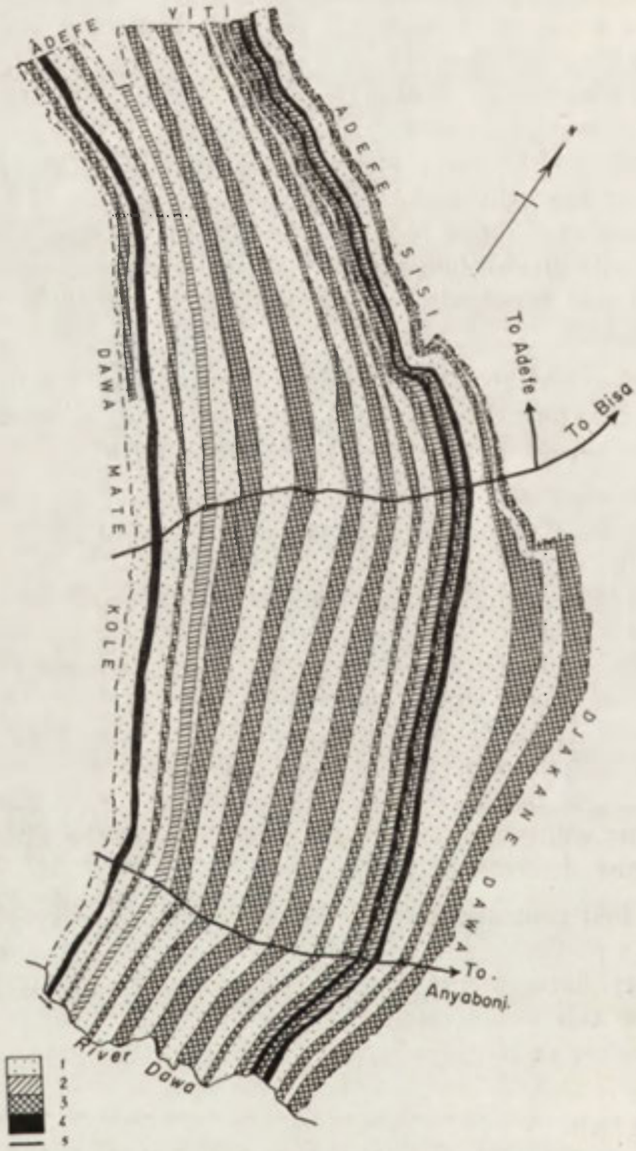

Fig. 6. Population density persons per acre
1 — 0—0.4, 2 — 0.4—0.8, 3 — 0.8—1.2, 4 — 1.2 and over, 5 — road

and an appropriate fraction for each person obtaining part of his or her supply in the course of that year, this method proved difficult to use. The writer was therefore forced to allow one unit for every person on the *huza* who had lived on food obtained from a *zugba* for six months or more. Thus occasional family guests were discounted.

The total number of units for the *huza* was 326 as against the total population of 289 recorded during the 1960 Census. Fig. 6 shows the density of population on the *huza* based on the collected data.

A density of more than one person per acre was recorded on five *zugbas* while ten plots carried a density of 0.2 or less persons per acre.

A close relationship existed between the population density and the extent to which land was being rented. Farmers with smaller families and large *zugbas* leased parts of their strips of land to those with larger families and smaller *zugbas*. Thus, the owners of *zugbas* which supported a density of less than 0.4 people per acre normally leased parts of their strips to the owners of *zugbas* with higher densities. The hiring of land has become an important outlet for the land-hungry and landless people of the *huza*.

Land may be hired for cultivating either maize, the chief cash crop, or other food crops, mainly cassava and cocoyam. In the case of maize land is hired for about three months, the life-span of the crop. In the latter cases it is leased for a period of three years. The agreement may be renewed with the approval of the owner. At the time of the survey, rents were thirty shillings for a "plot of one rope" to be used for growing maize and £2 10s. 0d. for that intended for cultivating cassava or cocoyam. The standard length of one rope was 302 feet, the distance between two selected telegraph posts in Asesewa, the main market centre in the area. According to the *dademantse*, this length had been agreed upon at a meeting attended by all the chief farmers of the district.

AGRICULTURAL LAND USE

At the time when the tract of land was purchased there was a flourishing trade in palm oil and palm kernels. Although cocoa had been introduced to some parts of the forest region, its impact as a cash crop had not yet been felt by the Krobo, and *zugba* owners planted oil palm on their newly-cleared plots. This was not the first time they were cultivating the crop, for most of them owned oil-palm plantations on the parcels of land which they had previously bought elsewhere.

As long as the trade in the oil-palm products boomed, the question of growing other cash crops did not arise, for the oil palm had come to be regarded as the symbol of security and prosperity. Indeed today, long after the heydays of the palm-oil trade, a farmer cannot fell a palm tree planted by a deceased kinsman without a justifiable cause and without first pouring libation to the spirit of the deceased. The trade in oil-palm products which had reached its peak level in 1884 soon declined, and cocoa increasingly became a more profitable cash crop. Krobo young men began to migrate to the established cocoa farms in Akim to work as seasonal labourers. This migration was strongly resented by Mate Kole I, *Konor* of Manya Krobo, and he encouraged his subjects to cultivate cocoa on their own lands towards the end of the first decade of the century.

THE COCOA ERA

According to an old informant, the first cocoa trees on the *huza* were planted round about 1908, and they were interspersed with oil-palm trees. The intermixture of the two cash crops proved remunerative but as the trade in oil-palm products slumped, cocoa was increasingly given pride of place on the newly--established farms. Oil-palm trees on old farms were not hewn down to give space to the new crop but their cultivation practically ceased.

By the late 1920s the *huza* was in the centre of the thriving Bisa cocoa--producing area. Moor estimated in 1930 that the Bisa area of 350 square miles accounted for about 10,000 tons, or 10 per cent of all the cocoa grown in the Eastern Province of the Colony and supported a population of 70,000 people nearly all of whom were engaged in cocoa farming[4]. The cocoa era was a time, of great prosperity in the area. The nearby villages of Bisa and Anyaboni became important cocoa buying centres. The population of the *huza* increased; informants put it as twice the size of the present population. This might, doubt be an exaggeration.

The cultivation of cocoa also gave rise to a profitable trade in foodstuffs, particularly plantains and cocoyams which were planted on newly-established cocoa farms to give shade to the young cocoa trees and were harvested and sold to the non-agricultural population of the two market centres, each of which had two market days per week. Maize and cassava, which were note cultivated on cocoa plots, were grown mainly for sale on land which had previously been used for other crops.

The boom in the trade in cocoa was not to last long on the *huza*. By the middle of the thirties the economic prosperity of the area was drawing to an end. The level of production on cocoa farms started to drop and individual cocoa trees began to shed their leaves and die, foreboding signs which had, however, been noticed earlier by agricultural officers. A report dated May

[4] H. W. Moor, Deforestation in the Bisa Cocoa Area, *Gold Coast Department of Agriculture Bulletin*, Vol. 20 1930, p. 135.

1928 on the Bisa area stated: "the cocoa is in a pathetic state of dieback... the Harmattan has had a very serious effect on these villages and the impression one gets is that the farmers have given up their cocoa in despair"[5].

The exact causes of the devastation of the cocoa trees are not known. Informants suggested drought, the capsid disease and swollen shoot. Agricultural officers in the thirties emphasized the effects of the Harmattan on the crop in an area which was marginal for cocoa cultivation. As Moor put it: "an area with delicately balanced soil and climatic conditions was subjected to wholesale deforestation, the soil exposed to the sun and the eroding and leaching effect of heavy rain and all lateral protection from the dessicating Harmattan winds removed... It is not surprising, therefore, that the cocoa which just managed to establish itself is dying back long before it has attained its alloted span"[6]. Whatever was the cause of the devastation, by 1948 cocoa production had almost ceased on the *huza*. Today, a few scattered cocoa trees stand on *zugbas* as poor relics of a prosperous past.

The devastation of cocoa had two important effects; on the one hand population on the *huza* dwindled as more and more people moved out to seek employment elsewhere, while on the other hand the cultivation of food crops, especially maize for the market, assumed greater significance. Between 1948 and 1960, the population of the *huza* had decreased by 40 per cent. While there may be other reasons for this remarkable drop in population, it appears that the greatest single factor has been the migration of farmers from the *huza* to newer cocoa areas, where some of them have bought land on which they have established cocoa farms in the last fifteen years. At the time of the survey, nineteen *zugba* owners possessed cocoa farms or worked on cocoa farms as labourers in other parts of the forest zone. Five of these had established cocoa farms in Techiman near Akim Oda, three had farms in Sefwi in the Western Region, four at Nyinasin, and three at Pechi. The *dademantse* was a cocoa tenant at Wenchi in Brong Ahafo.

There is now a seasonal oscillation of population between the *huza* and the areas where farmers have established new cocoa farms. At the beginning of the cocoa harvest in November, farmers, labourers and tenants leave the *huza* for the places listed above, together with some of the members of their families. Most of them return to the *huza* about February, just in time for the main growing season. During the time they are away, relatives look after their *zugbas*.

The land-use map (Fig. 7) shows the distribution of crops and fallow between August and October 1962 when the survey was carried out. The predominant

[5] A. S. Thomas, A Note on the Deterioration of Cocoa in the Bisa Area, *Department of Agriculture Year Book*, 1929, Paper XII.

[6] H. W. Moor, *Op. cit.* p. 128.

Fig. 7. Land use

1 — road, 2 — boundary of Huza, 3 — occupied houses, 4 — abandoned houses, 5 — palm wine distilleries, 6 — food farms, 7 — maize fields, 8 — pepper fields, 9 — oil palm plantation, 10— pine apples, 11 — derelict cocoa, 12 — bush fallow, 13 — secondary forest

crop cultivated during the period was maize; all the other crops except pepper, had been planted during earlier farming seasons. No attempt was made to measure the size of each farmer's maize or cocoyam-cassava plot. This would have necessitated fuller co-operation between the farmers and the survey teams than was possible during the first weeks of the survey. Moreover, *buna* plants marking the boundaries of *zugbas* would not have been of much help because farmers were known to disregard the boundaries of their *zugbas* when clearing for cultivation. There is often a tacit understanding between owners of adjacent strips, particularly if they are relatives, which makes it possible for one to cultivate the fallow land of the other on a reciprocal basis. Again, hired plots sometimes covered parts of adjacent *zugbas*. Thus, *buna* plants were often found standing in the centre of a person's cultivated plot.

The distinction between fallow land and food farms of one to three years old in an area where cocoyams grow wild and cassava plants often compete with uncleared weeds was not easily perceptible to the untutored eye. The determination of the age of fallow land also proved a tricky exercise, since the regrowth vegetation was not always a true guide to its age. The assistance of two farmers who worked with the survey teams therefore proved invaluable in the land-use survey.

There were 63.3 acres under maize; this was 38 per cent of the total area of the cultivated land. Another 100.2 acres were under other food crops — mainly cassava and cocoyams. These two crops were intermixed on cultivated plots. No attempt was made to estimate by eye the acreage of each of the two crops. The cocoyam-cassava combination occupied 60 per cent of the total area of cultivated land. A mere 1.3 acres supported derelict cocoa, 2 acres carried pepper, and pineapples occupied 0.6 acres. The total area of cultivated land was 167.4 acres, 23 per cent of the total *huza* area of 720 acres.

Although the oil palm was not cultivated, it was fairly well distributed on the *huza*. The only large stand was on the plantation which was established on *zugba* 28 (Fig. 7) some fifteen years ago by the Agriculture Department as a demonstration plot, in an attempt to revive the interest of the farmers in the crop. The felling of palm trees for palm wine was greatly reducing the numbers of palms, and although the tree grows wild and the young seedlings which appear on cropland are protected and preserved, it is likely that if the present rate of felling continues, there will be very few left in the near future. There was a noticeable absence of old palm trees on many *zugbas*.

THE CYCLE OF FARMING ACTIVITIES

There are two farming seasons based on the wet and dry seasons of the year. The main season starts in December — the beginning of the main dry season — with the clearing of fallow for cultivation. This activity may continue up to late March, depending on the lenght and severity of the dry season. Clearing is carried out by men, and the cutlass is the main implement used; there is now hardly a tree left which would require an axe to fell it. Where oil palms occur within the cleared plot, their main branches are lopped but they are left standing. Small trees are coppiced to stumps of two or three feet high.

Although formerly no hired labour was used for clearing, many farmers now employ hired labour on their *zugbas* for this purpose. In August 1962, there were five resident stranger-labourers on the *huza* engaged in clearing land. These labourers charged £2 10s. 0d. for clearing a "plot of one rope".

At the same time a number of local farmers were employed on *Dibimaminnibi* (literally — eat and let me eat) basis. Under this arrangement the owner of the *zugba* shares the cleared plot equally with the labourer for a farming season.

The litter on the cleared plot is left for a period of one to two weeks or sometimes even more, for the leaves and twigs to dry, and is then burned. The sticks and trunks lying in the charred debris are collected for firewood or piled up in small heaps and burned again. This latter activity is usually done by women. A farmer normally prepares two separate plots for cultivation during this season. One of these is used for growing maize, while the other is put under cocoyam, cassava and plantain. The plot which is to be used for the latter crops, is selected from at least a four-year old fallow land. The age of the fallow is not, however, the sole criterion for selection; there must be adequate tree growth on the plot.

When the first few showers in March or April have washed the ashes on the plot into the soil, planting begins. The cutlass is again the main implement. Maize seeds are dibbled into the ground, usually three or four to a hole and about three feet apart. On the second plot, wild cocoyams which sprout after the first rains are left standing. The farmer plants this crop in the open spaces and pulls out some of the shoots from areas where they are in large stands. Cassava is then planted at stake in between cocoyam seedlings, and plantains and bananas are occasionally planted on the same plot, although a few food plots supported these latter crops during the survey. The seedlings of tomatoes and pepper raised on nursery plots behind farmhouses are transplanted on the food farms. Thus, by the end of the growing season in April a food farm, with all the different crops jumbled together, presents a confused picture to the casual visitor.

Weeding is carried out in June on cultivated plots. This is done by all the grown-up members of the farmer's family. It is usually a slow process, since great pains must be taken not to slash down the seedlings of the different crops entangled in weeds. Many farmers appeared to have reservations about the use of hired labour for this activity since labourers, in their opinion, were not careful enough when weeding. The charge for weeding "one rope plot" was £2 10s. 0d.

Harvesting of maize is done in July; only a small proportion of the crop is reaped green, the bulk of it is left to dry on the stalks before the cobs are harvested. Maize is stored on the cob in shelters erected on the farm, and on sheltered platforms raised above kitchen floors in the farmhouse. Tomatoes, pepper and beans are harvested when required from July onwards.

In August, the regenerating weeds on the old maize plots are cleared and burned with the dead maize stalks. New plots selected from fallow land two or more years old may also be prepared in the same way for cultivation. At the beginning of the September rains, the second crop of maize is sown. Cassava which was planted in March is by this time ready for harvesting. Maize is harvested in November and the plot is abandoned for the soil to recuperate for a period of two to six years. There was, however, an instance where a hired piece of land was being used for growing maize for the third successive time during the survey. The farmer explained that he renewed his agreement with the owner to use the plot for the third maize crop when he failed to make a profit from the sale of the last crop because of poor yields. He hoped the yields would be better than those of previous seasons.

The cocoyam and plantain crops are harvested when required in the course of the second year. Palm fruit is harvested during two periods — December to April and July to September, the former being the busier period. The felling of oil-palm trees for producing palm wine has greatly reduced the importance of this activity. There has thus been a decline in the production of palm oil and palm kernels on the *huza*. Although in former times, two kinds of oil were prepared on the *huza*, namely hard and soft oil[7], now only the latter is prepared. Few people prepared it for the market. Indeed, apart from the owner of the oil-palm plantations and three other farmers who had produced ten or more kerosene tinfuls in the 1962 peak season (February to April), most people produced less than two kerosene tinfuls.

Almost every housewife of a *zugba* owner on the *huza* is engaged in the selling of foodcrops. On Fridays and Mondays throughout the year, women take harvested crops — maize, cocoyam, cassava and vegetables — to Asesewa market to sell. Some carry the produce on their heads while others travel by lorry. Attendance at markets is an important feature of the life of the people on the *huza*.

THE SETTLEMENT PATTERN

The original site of the settlement was on the Asesewa — Anyaboni road, and the foundations of some of the farmhouses built there were located and plotted during the survey (Fig. 3). The old site enjoyed certain advantages

[7] Soft oil is used for cooking and hard oil for making soap.

in the early years of occupation. It was not far removed from the first cultivated plots and it was near the river which was then the main source of drinking water. It was, moreover, situated on a stretch of land which was free from water-logging and floods during the rainy seasons.

These initial advantages became less significant as farmers started to cultivate cocoa in the northern sector of the *huza*, for their farms were then far from the settlement. The daily journeys between the farms and the settlement were time-consuming, and the headloading of fermented cocoa beans to the settlement was tiring. Consequently, a number of farmers built farmsteads on their *zugbas* in the northern sector. These were only occupied during the harvesting season, and when the cocoa trees were devastated the farmsteads were abandoned.

The present site of the settlement dates back to 1928, a few years after the motorable road from Koforidua to Bisa was opened, and the only farmhouse on the old site which is still occupied is that of a family of lepers. The present site has also the advantage of being in the centre of the *huza*; the nearby Bisa stream is the source of drinking water.

Like all *huza* settlements in Manya Krobo (Fig. 8) the Dawa Ogome settlement is typically linear in pattern, with all the houses strung along the motorable road. This settlement pattern emerged as a result of the desire of the early farmers to live near each other in order to present a common defence against the enemy — usually wild beasts. Since there was no communally-owned plot of land on which a nucleated settlement (like their home village in Dorm) could be established, every farmer built his farmhouse on his own *zugba*, near and almost in line with that of his neighbour. Relatives sometimes lived under one roof, although each of them owned a *zugba* independently. Thus, not all *zugbas* had farmhouses on them.

PROBLEMS OF AND PROSPECTS FOR THE HUZA SYSTEM

The *huza* system is, perhaps, the most advanced traditional system of farming in the country, and was well suited to the needs of the pioneer migrant farmers operating within a cash-crop economy. The method of purchasing land within the system made it possible for the individual farmer to buy land more cheaply than he could otherwise have done on his own, and by acquiring an absolute title to his *zugba* the farmer had the incentive to improve it. The Krobo farmer is reputed to be the most efficient farmer in the forest region of Ghana.

The continual efficiency of the *huza* system depends on low population density. Since the only indigenous way of restoring the fertility of the soil on a cultivated plot is by allowing it to rest for a number of years a large "*zugba* family" making heavy demands on a small strip of land would inevitably lead

Fig. 8. Manya Krobo. Huza settlements
1 — huza settlement, 2 — nucleated settlement 3 — roads

to a reduction of the length of the fallow period. In the past, farmers solved the problem of population pressure on their *zugbas* by buying more land; there was thus always some land in reserve. Indeed, it was the wish of every father to buy land for each of his grown-up sons in his life time. The acquisition of additional *zugbas* also saved a father's *zugba* from excessive fragmentation upon his death.

Unfortunately, with the depletion of virgin forest land in Ghana as a result of the rapid expansion of cocoa cultivation it has become difficult for farmers to acquire more land for their children. Much more, the collapse of the cocoa industry of the *huza* has considerably reduced the purchasing power of farmers and a number of them have been forced to seek work as caretakers on cocoa farms in other parts of the forest region. Renting of land for cultivation on the *huza* is also becoming a common practice.

But despite the shortness of the fallow period, most of the crops seen during the survey appeared to be in remarkably good condition. This is probably due to the fact that the cultivation-fallow cycle has only been repeated three or four times since cocoa died out. With the present intensity of cropping, yields will inevitably fall unless present methods of cultivation are modified and new techniques are introduced. An attempt by the State Farms Corporation to take over a nearby *huza* — Mensa Dawa — for development during the time of the survey raised a storm of protest from the farmers. Since the system is so inextricably bound up with the customs and traditions of the people, any attempt to replace it with a new farming system would raise many social and economic problems. And yet because of its unique organization the *huza* offers better prospects than any other farming system in Ghana for improving the traditional methods of cultivation through co-operative farming.

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POST-INDEPENDENCE AGRICULTURAL CHANGES IN THE KENYA HIGHLANDS[1]

GENERAL CHARACTERISTICS

The Kenya Highlands area formerly known as the "White Highlands" was by colonial legislation an area reserved for European farming in Kenya (Figure 1). By a series of covenants[2] the area had from the beginning of the century been reserved for white farming only. The total area involved covers approximately 7.5 million acres (3 million hectares) or 11,600 square miles, and falls within some of the most important high altitude farming areas of Kenya which also contain the main national forest reserves (Figure 1). European Agricultural Settlement in the area had started in 1902, gathered strength in 1908—14 so that by the end of the First World War there were already 1,122 owner occupiers farming the area. Many new settlers came in the interwar period but despite greater efforts to encourage even further settlement in the post-war period, the numbers coming forward remained small. Thus even as late as 1960, there were less than 4,000 owner occupiers in the Highlands. The small numbers forced such agricultural developments as took place to be large-scale, or extensive rather than small scale or intensive. However, ecological and economic considerations encouraged specialization in land use, with the tendency towards the reduction in farm size in the favoured localities, although most of the Highlands remained under large scale operation. The specializations came at the end of many failures and much experimentation with the environment. Unfortunately, after 1960, political events came in to disrupt these developments and even to reverse the process. It is the purpose of this paper to summarise briefly the different types of land use which had

[1] For a detailed information on the agricultural geography of the Kenya Highlands — R. S. Odingo: *The Kenya Highlands; Land Use and Agricultural Change* (in the press; to be published by the East African Publishing House, Nairobi).

Kenya Laws — Revised Edition, 1948 Cap. 155.

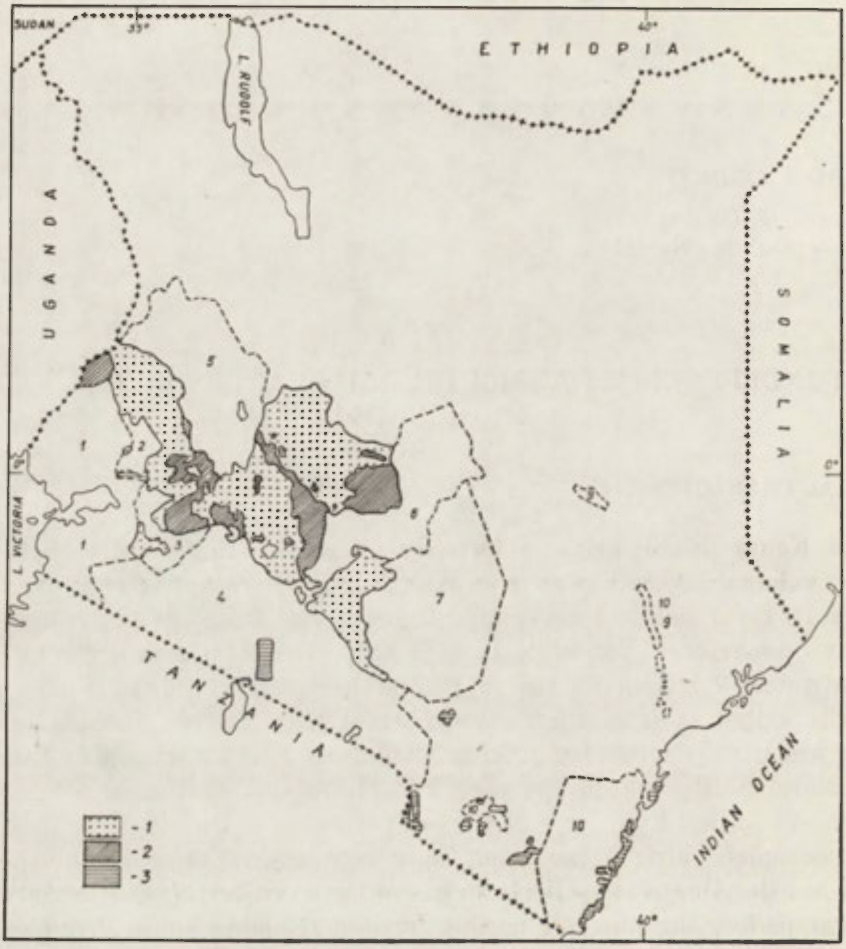

Fig. 1. Location of the Kenya Highlands (Main area of large scale farming)
1 — the highlands', 2 — forest reserves, 3 — other alienated land, Numbers refer to African Land Units

developed by 1960—1962, the end of the period of "Europeans only" farming in the Highlands, and then to concentrate on the changes which took place with the arrival of independence in 1963. Since many of the changes were political, a lot of interest is focused not so much on the patterns of farming, but on the general agricultural upheaval, with the opening-up of the Highlands for farming by all races.

Under the Highlands Order in Council 1938/39[3], all non-Europeans had effectively been excluded from owning land or farming in the Kenya Highlands

[3] *Kenya Laws* — Revised Edition, 1948. *Op. cit.*

Fig. 2. Kenya Highlands
1 — railways

by a series of restrictive covenants. The significance of this prohibitive legislation may be seen from summarizing the progress of European settlement and farming in the area. There had been some clear advantages to the European agricultural population, of this exclusive policy, the most important of which in the eyes of the European farmers, was security of tenure. Developments on the land and hence the pattern of land use as seen around 1959/60 tended to show adjustments to economic and ecological parameters rather than short--term quick return arrangements, a feature which became so evident in the Highlands just before, and soon after independence.

The main lines of farming in the Kenya Highlands' development had taken three forms: 1) the establishment of plantation enterprises which were largely company-owned and operated, and which in all essentials could be compared with plantation farming in other tropical areas of the world;[4,5] 2) the development of mixed farming, the wide activity for the majority of the European

[4] V. D. Wickizer, Plantation Crops in Tropical Agriculture, *Tropical Agriculture*, Vol. 35, No. 3, 1958, pp. 171—80.

[5] P. P. Courtenay, *Plantation Agriculture*, London, Bell and Sons Ltd., 1965.

Fig. 3. The selection of new settlers for the Nyshururu re-settlement scheme in Thompson's Falls in the Highlands

farmers in the Highlands; and 3) the development of ranching both for dairy and for beef in some of the drier areas of the Highland environment.

Figure 9 contains a summary of the major characteristics of land use in the Highlands in 1960 and so forms a convenient point from which to start looking at the post-independence changes which have subsequently affected the area. This map has been based on a detailed analysis of the major distributional characteristics of the main crops and livestock to be found in the Highlands, in the pre-independence period, and will now be summarised.

THE MIXED FARMING AREAS

Within the mixed farming areas a distinction is made between the mainly arable districts where dairy animals were important, but where there was a clear tendency to emphasise crops rather than livestock, and those in which beef cattle were kept in large numbers and fattened from the limited cereals grown, chiefly maize. A further distinction can be made between those mixed farming districts which had maize as the main cash crop to supplement the livestock economy and those which had wheat. These distinctions were largely based on ecological considerations: The relatively low (5,000 ft. c. 1500 m) to medium altitude (6,500 ft. c. 2,000 m) areas had favoured maize as dominant cash crop. The low altitude mixed farming areas included much of Trans Nzoia district, the lower parts of Uasin Gishu district; the Lumbwa/Songhor and Sotik areas, and the lower parts of northern Nakuru district in the Rift Valley (see Figs. 4, 5). Within these areas the only other significant cash crops included sunflower (*Helianthus annuus*) and in a few suitable areas arabica coffee (*Coffea arabica*). Cattle were kept in large numbers, beef cattle being more predominant in the lower altitude areas below 6,000 ft. (1,800 m) and dairy cattle in the higher areas. The tendency towards dairy specialization was already noticeable in limited parts of the Trans Nzoia, Uasin Gishu, and the maize areas of the Nakuru District. The mixed farming areas based on maize were also some of

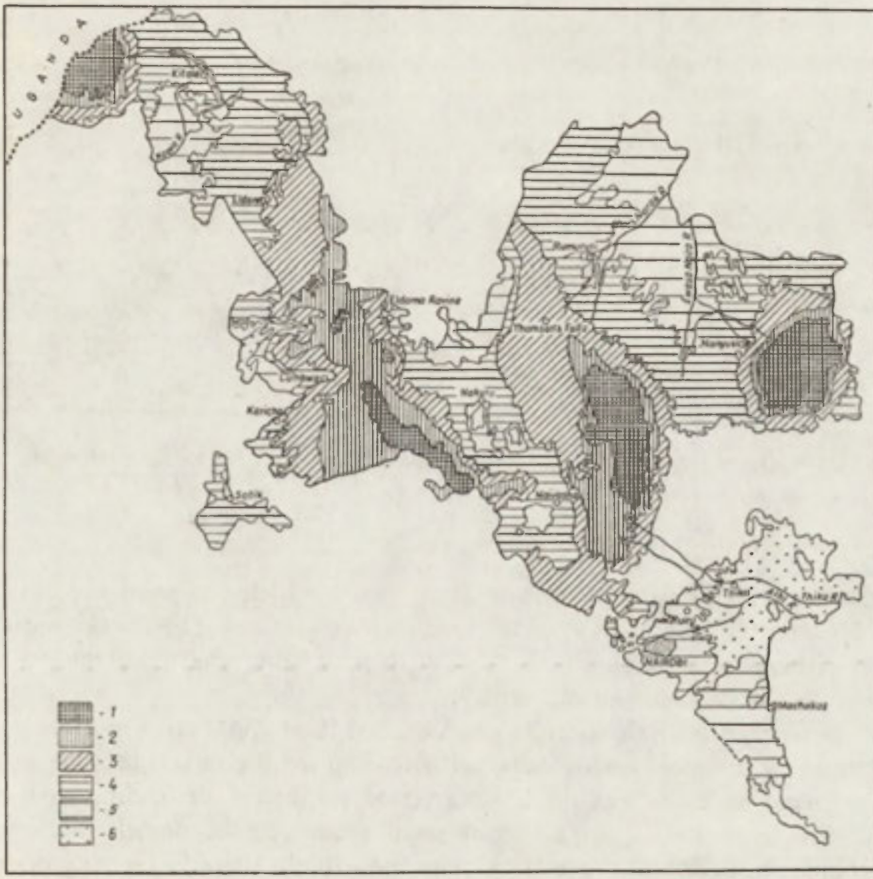

Fig. 4. Kenya Highlands relief

Metres: 1 — land above 2,743, 2 — 2,439—2,743, 3 — 2,134—2,439, 4 — 1,829—2,134, 5 — 1,524—1,829, 5 — under 1,524

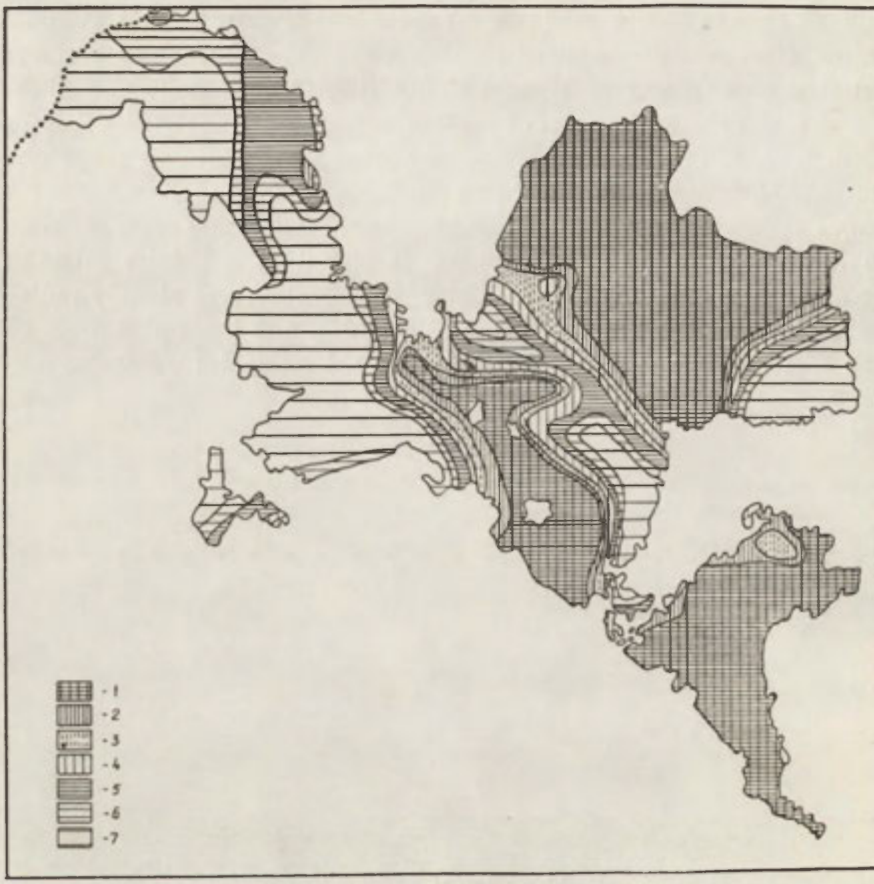

Fig. 5. Kenya Highlands annual rainfall : 30 inch prospect percentage probability
1 — 30 and over (less than 30″ for at least 6 years in 20), 2 — 25—30, 3 — 20—25, 4 — 15—20, 5 — 10—15, 6 — 5—10, 7 — 5 or less (rainfall reliable 30″+)

the most successful with indigenous ley[6] grasses which indicated the development towards the stabilization of the land use systems in the districts concerned. Towards the altitudinal limit of this sub-type wheat was found mixed with maize as two of the leading cash crops.

In the higher altitude districts (above 6,500 ft. or 2,000 m) wheat took over from maize as the most ecologically suitable crop for the mixed farming system and in almost all cases was the leading cereal and often the leading cash crop. In addition to wheat, the traditional small grain cereals, namely barley and oats could be successfully grown within these high altitude farming districts but rarely did they figure significantly in the cash economy of the farms to

[6] E.g. Rhodes Grass (*Chloris gayana*) and Nandi (*Setaria sphacelata*).

be found in the regions. Barley was grown partly for malting and mainly for feed and there was a limited acreage of oats also for feed. In some of the localities, wheat monoculture was still fairly common, and grass ley farming such as was to be found in the maize districts was hardly developed. In addition to wheat and the small-grain cereals, the high altitude farming regions above 6,500 ft. (2,000 m) had another important and economically valuable crop, namely pyrethrum (*Chrysanthemum cinerariaefolium*) to vary their arable economy. The main locations for pyrethrum included the Molo-Mau Narok areas of Nakuru district, the Kinangop plateau and the adjacent area of Dundori (Naivasha and Nakuru districts) and the southern-most parts of Uasin Gishu districts. The best pyrethrum lands were found between 2,130 m. and 2,740 m. In all these mixed farming districts dairying played a most important part. In the remoter districts as the Kinangop plateau, such dairying was geared to the production of butterfat, and in the more accessible areas, to the production of whole milk. Finally, some of these high altitude mixed farming lands, in particular Molo-Mau Narok (Nakuru district) and the Kinangop (Naivasha) had in addition to dairy cattle, wool sheep (see Fig. 9). The systems of farming which had been developed were thus already tending towards greater stability both in ecological and economic terms.

Fig. 6. A pyrethrum field belonging to a woman settler on the Lesirko settlement scheme. This area, well above 7500 feet (2300 m) is well known for dairying and pyrethrum

THE PLANTATION FARMING AREAS

The specialized plantation farming regions were on the whole restricted but they could easily be identified with the particular plantation crops. In the western districts the most clearly defined plantation farming areas were the high rainfall tea lands of Kericho, Nandi and Sotik (Figs. 5 and 9). But by far the most important concentration of plantation farming was to be found in the neighbourhood of Nairobi in the Nairobi-Thika and Nyeri districts. Within these areas arabica coffee (*Coffea arabica*) was the most important plantation crop on medium rainfall (760 mm) farms varying in altitude from about 5,000 ft. (1,500 m) to 6,500 ft. (2,000 m). Below 5,000 ft. (1,500 m) sisal (*Agave sisalana*) was by far the leading plantation crop often being grown in the more marginal districts (c. 760 mm rainfall).

Fig. 7. A co-operative coffee farm in the Machakos area of the Highlands. This farm formerly operated on a plantation basis

THE RANCHING AND DAIRY RANCHING AREAS

This represented a specialized form of land use largely dictated by ecological conditions but also to some extent, by economic considerations. The ranching areas were mainly restricted to the low rainfall regions of Naivasha, Laikipia Mount Kenya, Machakos and Nairobi-Thika districts. Near the main whole

Fig. 8. A fine example of improved beef cattle on the Lukenya co-operative ranch in the Machakos area of the Kenya Highlands. The ranch measuring some 41,257 acres (16,709 ha) is one of the many formerly operated by European farmers

milk consuming centres a form of extensive dairying (dairy ranching) developed. Elsewhere it was mainly beef cattle or wool sheep, both reared on a ranching basis. Nearly 50 percent of the total land area in the Highlands was occupied by ranching (Fig. 9).

It is important to emphasize that these systems of farming and types of land use developed in the Highlands during the sixty years of European occupation, as a result of much experimentation and many costly failures.

CHANGES IN LAND OWNERSHIP IN THE HIGHLANDS

As a result of political events, chiefly the approach of and finally the attainment of independence, the actual land ownership in the Kenya Highlands has been forced to change drastically thus destroying the patterns of land use which had been established by 1960. Only a summary of these changes can be given in this short paper and these are summarized below:

As a result of political decisions, parts of the former "White Highlands" were portioned out for re-settlement by largely African peasant farmers in

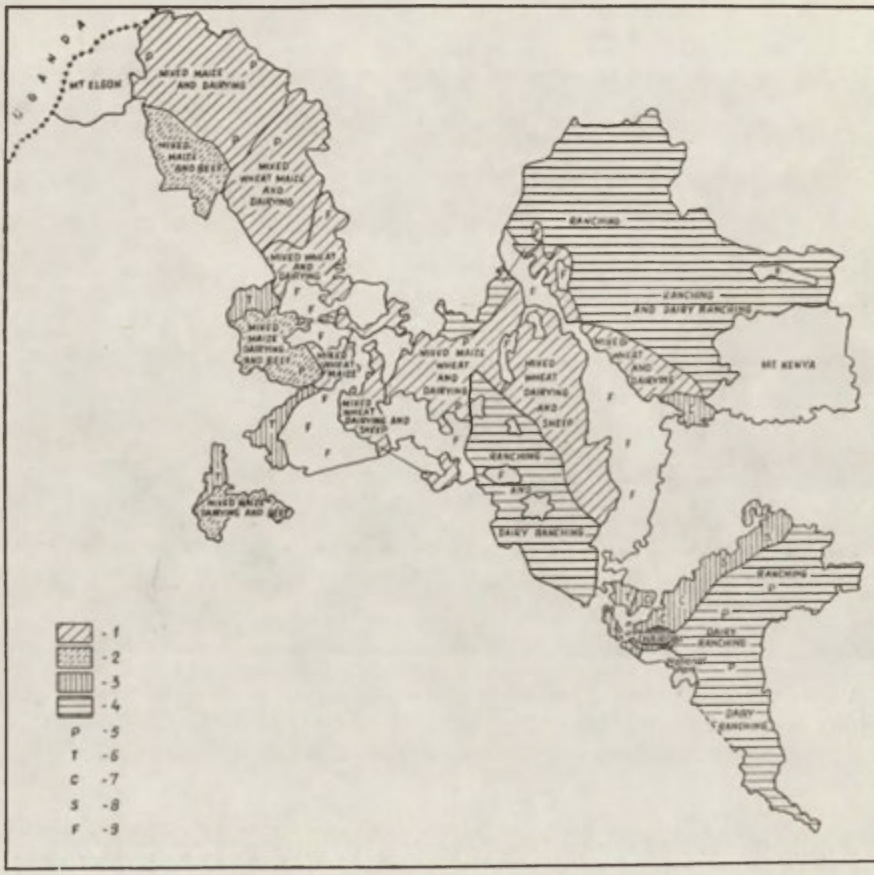

Fig. 9. Kenya Highlands agricultural regions

1 — mainly arable mixed, 2 — mainly pastoral mixed, 3 — plantation crops, 4 — ranching and dairy ranching, 5 — plantation crops (not-dominant), 6 — tea, 7 — coffee, 8 — sisal, 9 — forest

what were referred to a Settlement Schemes (Fig. 12). The decision for this large-scale land transfer was made in 1962 and it was intended to cover an area of approximately 1,300,000 acres (526 500 hectares). The main regions selected for this re-settlement were those in which mixed farming had been developed based on maize and livestock in the low to medium altitude areas (1300—1900 m.) and on wheat and livestock in the high altitude farming districts (above 2,000 m.). This is what came to be known as the "Million Acre Settlement Scheme"[7]. From then on different patterns of land use were bound to emerge in those

[7] C. P. R. Nottidge and J. R. Goldsack, *The Million Acres Settlement Scheme*. Nairobi Govt. Printer, 1966.

areas that in future were to be largely farmed on a small-scale (small-holding) basis by the new African settlers.

In addition to the important changes in ownership in the former White Highlands arising from the decision to settle parts of the area with peasant farmers, a new and important area of change was to be found within the remaining large farms in the region. As former European owners left so came in a new category of large-scale African and to some extent Asian farmers. The areas involved were more haphazardly spread and are shown in Fig. 10. It is estimated that by 1966, at least 405,000 hectares of land formerly in European hands in the Kenya Highlands had changed hands in this way. Like in the case of the re-settlement schemes most of these new purchases have been located

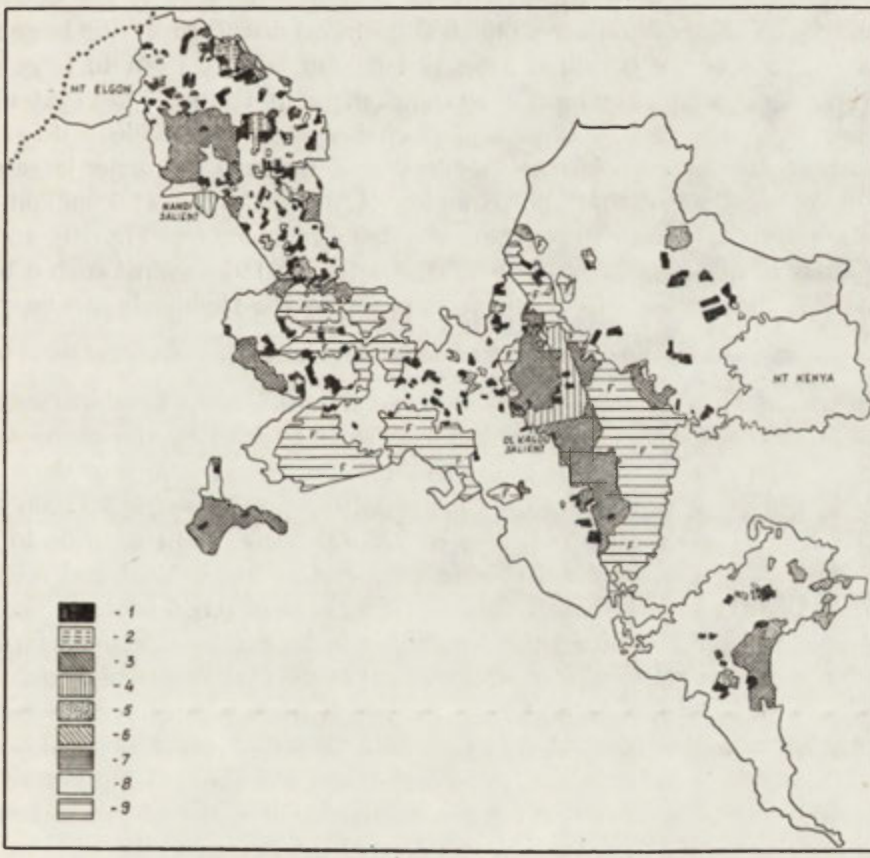

Fig. 10. Kenya Highlands the state of land ownership, 1967

1 — African owned Farms, 2 — Asian owned Farms, 3 — Settlement Schemes (African), 4 — Ol Kalou Nandi Salient (African), 5 — Mismanaged Farms (European), 6 — Unalienated Government Farms, 7 — Completion of Million Acre Settlement Scheme (African), 8 — Areas still largely owned by Europeans, 9 — National Forest Reserves

in the former mixed farming areas, with special concentration in the Trans Nzoia, Uasin Gishu and Nakuru districts. The locations which in 1960 had specialized in plantation farming and in ranching, whether for milk or for beef, appear to have been avoided by these changes. Wherever they have gone, however, this new class of African and to some extent Asian farmers have bought the farms intact and are presumed to be carrying on farming on large scale, allthough they have initially preferred short-term crops like wheat. The disturbances to the patterns of farming which had been established by European farmers by 1960 would therefore be much less than in the case of those areas affected by the settlement or re-settlement schemes.

The total area originally farmed by Europeans in the Highlands was approximately 7.5 million acres (3 million hectares). Of this nearly 1.5 million acres (600,000 ha.) were transferred to peasant management and operation and nearly another million acres (405,000 hectares) disturbed by the large scale transfers. Thus of the 6 million acres (2.4 million hectares) left to large scale operation there will have been internal changes in the land use systems as compared with the rest of the area, which has been sub-divided into nearly 40,000 plots for the new African "settlers". Of the land left under large-scale farming, it is estimated that approximately 4 million acres, (1.6 million hectares) are devoted mainly to ranching and dairy ranching (see Fig. 10), and the plantations ocupy 400,000 acres (162,000 hectares). It is against such a background that an analysis of changes in land use in the Highlands can be made.

THE MIXED FARMING AREAS

The mixed farming areas of Trans Nzoia, Uasin Gishu, Lumbwa/Songhor, Sotik, Nakuru and Naivasha were the ones most affected by the changes. For example in both the Trans Nzoia and Uasin Gishu, large portions of the former arable farming land have been used for re-settlement, involving 250,000 acres (101,250 hectares) out of a total area of 729,000 hectares. In addition to this, 6,885 hectares of this former arable farming region was excised and returned to Nandi District as the "Nandi Salient". This area of 6,885 hectares had originally been taken away from the Nandi people for use by European farmers. With the approach of independence, it was one of the first "bones of contention" to be dropped! Furthermore, these are the two districts which have experienced the greatest amounts of land transfers as a result of purchases. However, in spite of all these disturbances, the Trans-Nzoia and Uasin Gishu still remain the leading large scale farming regions containing the core of mixed farming in the Highlands with significant proportions of the maize and the wheat acreages, and a large portion of the dairy and beef herds.

In contrast to the Trans Nzoia and Uasin Gishu, the former European farming areas of Lumbwa/Songhor, and Sotik virtually disappeared to settlement. In the Rift Valley (Nakuru and Naivasha districts) only 101,250 hectares of the former core wheat farming area of the Kinangop is now the "Ol Kalou Salient", an extensive area now being farmed on large scale semi-co-operative lines. The changes involving areas still thus devoted to large-scale farming are shown in Tables 1 and 2.

TABLE 1. Comparison of Crop Acreages in the Highlands: 1960 and 1966

Crop	(All Farms) Acreage 1960 ('000)	(Large Farms) Acreage 1966 ('000)
Wheat	247.9	298.8
Maize	142.4	141.7
Barley	31.3	23.7
Oats	28.0	13.2
Pyrethrum	39.7	11.6 (1965)
Sunflower	13.1	4.4 (1965)
Fodder Crops	34.4	18.6
Grass Leys	11.0	196.2
Sisal	165.7	190.6
Tea	37.0	51.1
Coffee	85.7	36.2
Wattle	85.7	36.2

Source: *Kenya European and Asian Agricultural Census* and *1961 Agricultural Census 1966* (*Large Farms Areas*).

Table 1 shows a comparison of crop acreages in the Highlands between 1960 and 1966. From this table it can be seen that of the cereals, wheat has been the least affected by the changes as there was significant increase in acreage in the period. This overall increase is partly explained by the fact that some of the leading wheat growing districts, namely Uasin Gishu and Nakuru did not pass into peasant hands with re-settlement, and partly by the point already mentioned, of the tendency for many of the new large-scale farmers to go for short-term farming with special preference for the highly priced wheat. However, one of the former leading wheat districts, namely the Kinangop plateau (Naivasha) simply disappeared from the wheat map because of settlement.

Unlike wheat, the acreage of maize must be assumed to have expanded because large portions of former mixed farming areas based on maize as the leading cash crop are known to have gone over to settlement especially in the Trans Nzoia district. There was evidence of increased growing of maize since the acreage grown in the much reduced area was almost as much as that grown in the Highlands as a whole in 1960. The drop in acreage was more marked in barley and oats because some of the best lands for these two cereals went over to settlement. In general many of the crops associated with the mixed farming areas suffered a drop in acreage which could partly be explained by the disturbance due to settlement schemes but possibly also due to changes in the farming outlook within the large-scale farming areas of the Highlands. One of the crops most hit by the changes were pyrethrum with a drop from 39,700 acres (16,079 ha) in 1960 to 11,600 acres (4,700 ha.) in 1965. This drastic drop in average was due to the fact that the choicest pyrethrum lands of the Kinangop plateau and Dundori both within the Rift Valley were taken for settlement. The settlement areas had over 20,000 acres of pyrethrum in 1966. (See Table 3). The crop was regarded by the planners as one of the most desirable crops for settlement schemes because of its high value and because it is easily adoptable for peasant farming purposes, consequently, many pyrethrum areas were taken for peasant settlement.

In summary it may be said that although there have been clear changes in land use, as seen from the crops, it is difficult to observe clear trends because of the confusion brought about by the settlement schemes. However, the picture of change is further strongly shown by comparing livestock statistics for 1960 and 1966 (Table 2).

TABLE 2. Comparison of Livestock Numbers in the Highlands: 1960 and 1966

Livestock	Total 1960 ('000 head) All Farms	Total 1966 ('000 head) Large Farms
Dairy Cows	241.7	158.5
Other Dairy Cattle	180.3	100.0
Total Dairy Cattle	412.0	248.5
Beef Cattle	566.9	469.8
Sheep	582.6	409.8
Pigs	50.5	36.0

Source: *Kenya European and Asian Agricultural Census 1960*, and *Agricultural Census (Large Farms) 1966*.

In almost all cases, there was a clear drop in the total numbers for the various types of livestock for the period, although in actual fact the. numbers within the old boundaries of the Highlands may have arisen. For example, there was a 40 percent drop in the total number of dairy cattle during the period considered. Not only had large portions of the former mixed farming areas where dairying had been important been taken for settlement, but in almost all cases, the settlement schemes were planned to use as many dairy animals as could be found. Each peasant plot was budgeted to have from 1 to 5 dairy cows [8]. Thus, although there was a big decreases in the total number of dairy cattle for the large-scale farming areas, there will have been an overall increase in the number of dairy animals within the old boundaries of the Kenya Highlands. There was a smaller drop in the numbers of beef cattle because only a few of the core beef farming areas had been disturbed by settlement. This was partly true of the ranching districts.

As far as sheep numbers were concerned, there was only a small drop, and possibly an increase in some of the large-scale farming areas because almost half of the former sheep farming areas had in fact gone to settlement. One of the areas which had been leading in sheep rearing was the Kinangop area of Naivasha district. This is now one of the leading settlement areas where sheep farming has been preserved on the settlement schemes. But in spite of this the large-scale farming sheep areas were still able to keep over 400,000 heads of sheep in 1966. Finally, the pig population appears to have suffered a reduction corresponding to that noticed for the dairy cattle. In general it can be said that mixed farming is still being pursued in the large farm areas, although there has been a clear tendency towards increased cereal monoculture, from the limited information available on crop acreages.

PLANTATION FARMING AREAS

The plantation farming areas were not disturbed by settlement, and throughout the whole period of the upheaveal in the farming areas of the Kenya Highlands, the plantation farming districts have been expanding their activities. This is borne out by Table 1, which suggests significant increase in the acreages of sisal, tea and to some extent, of coffee. The coffee acreage appears to have remained stationary but in actual fact certain limited acreages were transferred to settlement co-operatives. Secondly, coffee was recently badly hit by world overproduction and consequently there has been a recent attempt to discourage any acreage expansion. Finally the drastic drop in the acreage under wattle could not be blamed on settlement schemes so much as on the change in conditions leading to the replacement of wattle by more profitable crops.

In conclusion, it is fair to say that whereas with the break-up of the Kenya Highlands, the farming systems may not have changed drastically, there has been inevitable change of emphasis. The main difficulty that is noted is the fact that whereas in the early days the whole area had been considered as a unit and the one main region in Kenya where large-scale farming was being practised, in the post-independence period this is no longer true. To discuss the new systems of farming within the new re-settlement schemes would be to

[8] Nottidge and Goldsack, 1962, *op. cit.*

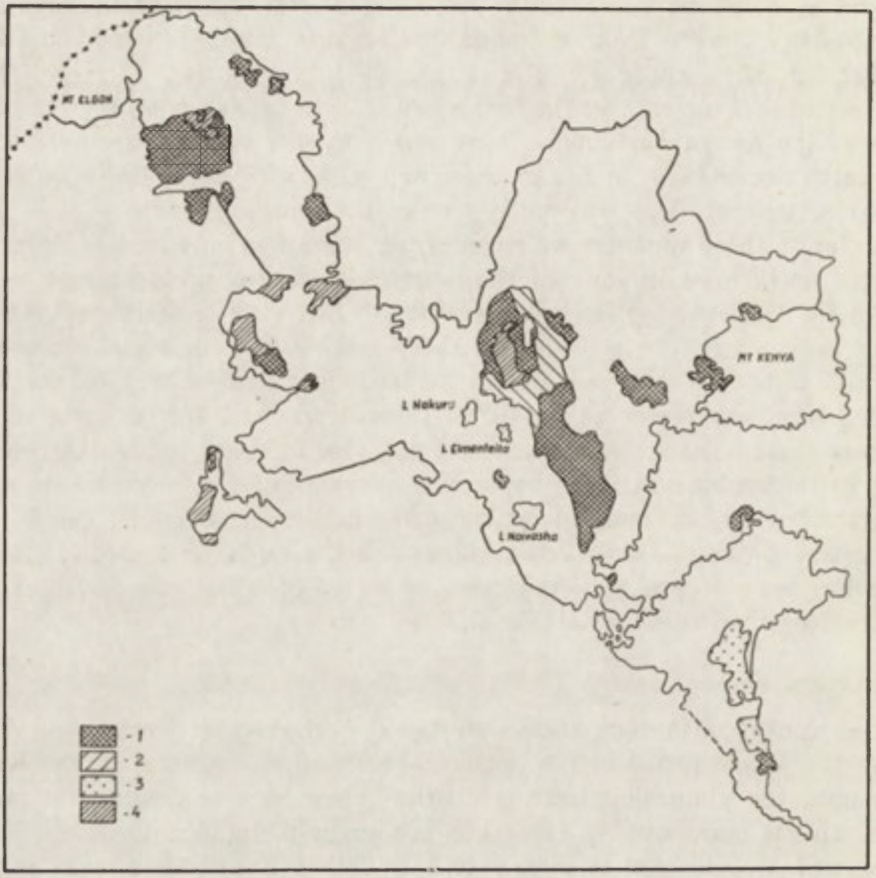

Fig. 11. Kenya Highlands types of settlement schemes 1966

1 — high density schemes (H.M.G./W.G.), 2 — Ol Kalou Salient Area, 3 — co-operatives, 4 — low density schemes (I.B.R.D./C.D.)

introduce a completely new theme, perhaps requiring different methodology of treatment. It is however important to mention the fact that as a result of government policy, further areas of this former large-scale farming regions will be transferred to small-scale operation in new settlement schemes. With the completion of the first set of settlement schemes, nearly 1.5 million acres (600,000 hectares) has been thus transferred. The areas affected are shown in Figs 11 and 12. Then in 1968 more money was made available under the Stamp Commission arrangements[9] to enable the new land purchases for re-settlement purposes to be carried out although this would be on a much more reduced scale.

[9] *Kenya Weekly News*, September 27th, 1968, p. 5.

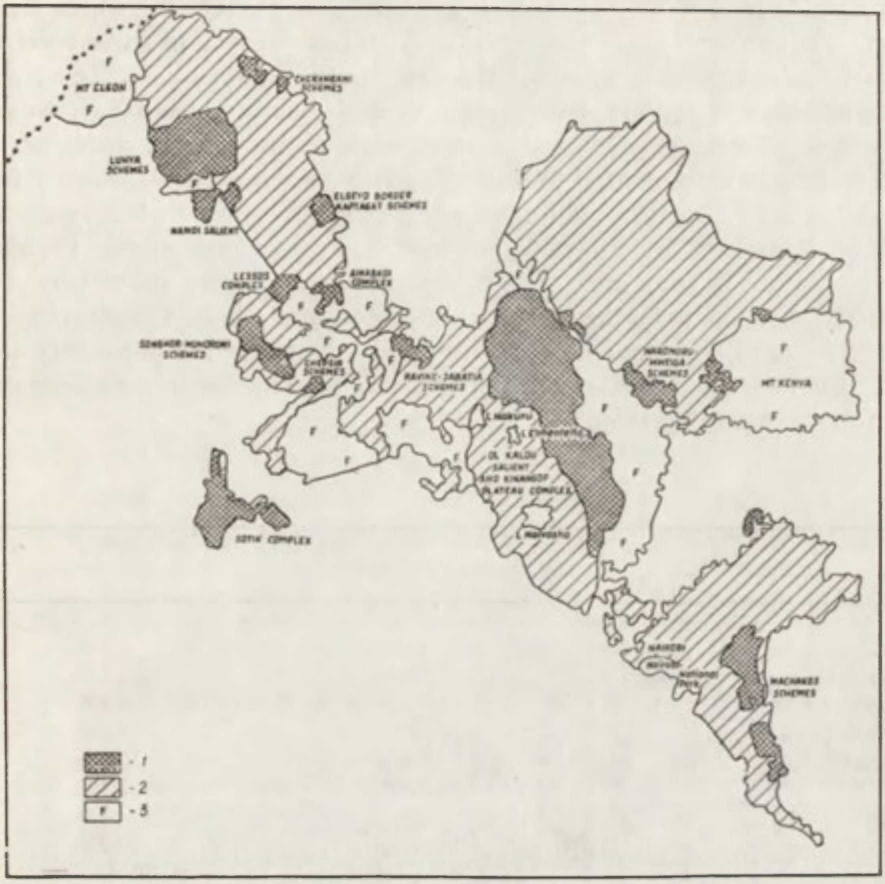

Fig. 12. Kenya Highlands settlement areas — 1966

1 — land occupied by settlement schemes — 1966, 2 — land predominantly farmed on large scale basis, 3 — forest reserves

The completion of this latest scheme would add another 400,000 acres (142,000 hectares) of mixed farming land to the areas which have permanently been transferred to settlement. The most visible changes will therefore be those concerned with land transfer and thus the conversion of the area from large--scale highly mechanised agriculture to small-scale often poorly mechanised farming. There will also have been a drastic increase in the number of farms from the 3,480 holdings in 1960 to over 40,000 in 1968. Fig. 11 and 12 help to emphasise the change in the face of the Highlands from the point of view of land use, and by implication the whole outlook in farming.

An attempt has been made as far as possible to preserve the pattern of farming which was being practised prior to the transfer of the land from the

European farms but this has not always been possible. On the whole the full effect of re-settlement has been to intensify mixed farming in these what were formerly mixed farming areas of the Highlands. Perhaps dairy farming has benefited most from the introduction of settlement schemes following the deliberate policy of expanding it in most settlement areas. On the other hand systems of land use requiring the use of expensive machinery have been avoided. Thus for example most of the former wheat growing districts which were taken over for settlement have disappeared from the wheat map of the Highlands. The plantation farming areas, it has been emphasised, were avoided by settlement schemes; so were the ranching areas on the whole. Certain crops like pyrethrum have obtained a boost as a result of settlement. The popularity of this crop with the peasant settlers in the appropriate areas led to some overproduction as the following table (Table 3) shows:

TABLE 3. Acreages of pyrethrum in Settlement Schemes, 1966

Settlement Area	Budgeted Acreage	Actual Acreage
Sotik	229	114
Nakuru	2,109	1,159
Thomson's Falls	4,242	2,604
Dundori	3,838	3,860
Kinangop	5,613	10,918
Nyeri	1,764	1,463
Nairobi	126	117
Total	17,921	20,235
	(7,258 hectares)	(8,195 hectares)

Source: Department of Settlement, *Annual Report*, 1965/66, pp. 57—8. The main pyrethrum growing areas e.g. Dundori and Kinangop combine this crop with potatoes and some vegetables, both aimed at the Nairobi Market.

Another popular crop, namely maize has expanded in acreage whilst at the same time experiments have been made with new crops like Passion fruit (*Passiflora edulis*), and even sisal (*Agave sisalana*) at an early stage when the market price of this crop was promising. A summary of the changes in farming brought about by settlement is given in Table 4.

Whereas these may be regarded as purely projected ideas, it is quite clear that when the information is available in a form more suitable for analysis it will be interesting to note the changes which have taken place in the agriculture of the area since independence. From what can be seen greater use is being made of the land, new crops are being introduced, within the settlement scheme

TABLE 4. A Summary of Changes in Farming Types in the Settled Districts

District/Area	Former Farming Type	New Settlement Farming type (proposed)
Trans Nzoia — SW Trans Nzoia — NW	Mixed Maize and Beef Mixed Maize and Dairying	Maize, Dairying and Sisal Tea, Coffee and Dairying
Uasin Gishu — NE SE	Mixed Wheat and Dairying	Pyrethrum, Tea, Maize and Dairy Produce Pyrethrum and Dairy
Lumbwa/Songhor	Mixed Maize, Dairying and Beef	Sugar and Dairy Produce
Sotik (Most of the former district affected)	Mixed Maize Dairying and Beef and Tea	Maize, Coffee, Tea, Passion Fruit and Dairy Produce
Nakuru — NE	Mixed Wheat, Dairying and Sheep	Pyrethrum, Potatoes, Dairy Produce and Sheep
Naivasha/Laikipia (Kinangop Plateau)	Mixed Wheat, Dairying and Sheep	Pyrethrum, Potatoes, Dairy Produce and Sheep
Nveri area (Mount Kenya)	Mixeed Wheat and Dairying	Pyrethrum, Maize, Wheat and Dairy Produce
Machakos (N and E)	Dairy Ranching	Dairy Ranching

Source: 1. *Farming Types Map for 1960*
2. Settlement Department, *Annual Report, 1966.*

area, but on the whole the broad patterns of farming established before independence appear to be persisting. Part of the explanation for this may be found in the decision by the planners to use the proved systems of land use in terms of both crop and animal husbandry rather than to indulge in new experimentation.

SUMMARY AND CONCLUSIONS

To summarize the position, the most outstanding changes affecting the Kenya Highlands must be regarded as those arising from the decision to carve important portions of the area for small-scale settlement. Considering the whole area still as an entity, a new concept of land use has been introduced and now there are to be found large-scale farmers in 80 percent of the total area and predominantly small-scale farmers in the remaining part. Large-scale agriculture in the original concept of the Highlands is still operated by a small minority of individuals or companies, managing and occupying approximately 3,000 holdings. At the other end of the scale is to be found the small-scale or small--holding type of agriculture being practised by nearly 40,000 peasants on 20 percent of the former Highlands area.

In termes of actual farming types, it should still be possible to distinguish the broad zones which had been outlined for the pre-independence period, namely:

a) The mixed farming areas, where crop and animal husbandry is the most dominant form of land use. These areas are classified according to altitude, and hence according to crop possibilities. But since independence, they are also the ones which have been most affected by new settlements or re-settlements. The actual form of land use will therefore have changed in order to accommodate in the particular localities affected, peasant farmers with less machinery and less experience in farming in the particular environments. However, within the overall mixed farming areas, are still to be found large scale farmers operating along the same lines as noted for the period before independence.

b) The ranching and plantation farming districts which have on the whole been least affected by the political upheavals and in which the farming systems are still being operated will have remained essentially the same as before independence.

The dichotomy which has thus been brought into the agriculture of the Highlands, will clearly change the outlook on farming in the area. The large-scale section of farming in the area is still well-documented, and the annual agricultural censuses have been preserved. This has proved neither practical nor possible for the small-scale sector of agriculture. The problem of making useful comparisons with the period before independence has therefore been increased. It is, however, possible to note the inevitable intensification in land use following the establishment of settlement schemes. The economic success or failure of such an effort cannot, however, be discussed here. The main result of the breakdown of the former large-scale farming area has been the drastic increase in the number of people owning land in the area. In the early stages of the exercise, there were suggestions that the whole programme would end in a failure. But this has not been the case after more than five years of the changeover in the areas affected.

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DYNAMIC APPROACH TO THE ANALYSIS OF CHANGE: A CASE STUDY OF CROPLAND USE IN UTTAR PRADESH, INDIA [1]

The main objective of the research program on which this paper is a preliminary report has been to study changes in agricultural geography that have taken place during the last decade in a fairly large part of the Ganges Plain in India. Though the substantive aim has been to obtain a better understanding of the factors and processes of change in agricultural patterns, an additional, but inseparable, objective of technique developed in the course of pursuing the former, and it seems to have wider implications than the context of the present study.

In developing countries where planning programs are oriented toward inducing change in the traditional forms of agriculture, it is of considerable interest to know whether the agricultural patterns are undergoing any change under the impact of inputs and incentives that are being introduced at various levels of the economy. Increase in agricultural production is indeed one manifestation of change that is readily observed. However, the interaction between socio-economic and technical-organizational factors brings about changes that are reflected in the patterns of cropland use. Such changes are the result of continuing processes that vary from year to year. Hence, there is need to study change as a continuing process. For a proper understanding of change, not only it is essential to know what change has taken place over a period of time, but it is also necessary to determine the pace at which change has been taking place during the period under study. An idea of the pace, or rate, of change provides a dynamic dimension to the understanding of change in contrast to the static percentages which describe a characteristic at given points of time.

In this paper, the methodology concerned with spatial aspects of the dynamic dimensions of change is presented. As an illustration of the approach sugge-

[1] Research reported in this paper was supported by a Faculty Research Grant from the Board of Regents of the Wisconsin State University

sted here, recent changes in cropland use in Uttar Pradesh, India, have been measured, mapped, and discussed.

APPROACHES TO THE STUDY OF CHANGE

Changes in cropland use may be expressed in two ways: a) qualitatively, and b) quantitatively. Qualitative expression of change may relate to the spatial arrangement of land classified as cropland at two given points of time. For instance, Coppock compared the distribution of land used for raising crops for the years 1931 and 1951 to show *qualitatively* the nature of change involved in the land use pattern in the Chilterns[2]. The qualitative aspects of change can also be concerned with the kind of crops that dominate in an area. For example, Weaver compared the distribution of dominant crops (according to acreage under different crops) at two points of time for a general idea of the spatial changes in the kind of crops that compete for a share of the cropland[3]. The quantitative expression of change generally relates to the *quantum of change* in the relative strength of crops in the total cropland over a period of time. The quantum of change is determined by taking the percentage point difference between the ratios of crop acreages to total cropland for the two selected points of time. Such a procedure, according to Coppock, appears to be "particulary useful where changes are small, but there is a danger that it may show changes which are only apparent, resulting from differences in the land returned under each administrative unit at the two dates; this risk is reduced where ratios are compared..."[4]

THE DYNAMIC APPROACH

The determination of change based on a comparison of ratios, however, gives only a partial picture because 1) the strength of crops in the total cropland is subject to variations from one year to another, and 2) the variations

[2] J. T. Coppock, Land Use Changes in the Chilterns, 1931—1951, *Transactions and Papers, Institute of British Geographers*, 1954, Publication No. 20, pp. 113—40.

[3] John C. Weaver, Changing Patterns of Cropland Use in the Middle West, *Economic Geography*, Vol. 30, 1954, pp. 1—47. See Figures 4—9 showing the distribution of first, second and third ranking crops for 1939 and 1949. Also see, P. Sen Gupta, *The Indian Jute Belt*, Orient Longmans, Calcutta, 1959, pp. 133—44, which shows the distribution of first to fifth ranking crops in eastern India for years ending 1941 and 1951; and M. Shafi, Patterns of Cropland Use in the Ganga-Yamuna Doab, *The Geographer*, Aligarh, India, Vol. XII, 1965, pp. 13—20, which shows the pattern of ranking crops in a portion of Uttar Pradesh, India.

[4] J. T. Coppock, Crop and Livestock Changes in the Chilterns, 1931—1951, *Transactions and Papers. The Institute of British Geographers*, 1960, Publication No. 28, pp. 179—198, Reference on p. 180, and Weaver. *op. cit.*, p. 2. For other measures of change between initial and terminal dates of a time period, see O. D. Duncan, R. P. Cuzzort, and B. Duncan, *Statistical Geography*, Glencoe, Illinois, 1961, pp. 162—3.

are the manifestation of processes that bring about change. The socio-economic or technological processes generate forces that induce changes in cropland use. The forces of change seem to act through competition between crops for a share of the cropland. This competition is invariably slow and extends over a period of several years during which the forces of acceleration and deceleration act and interact, thereby affecting the patterns of cropland use gradually. The forward "pushes" and backward "pulls" of an individual crop vary from one year to another. The gain of an individual crop in its share of cropland affects the strength of other crops because this gain is at the expense of some less competitive crops. Likewise, decline in the proportion of cropland devoted to a crop indicates lack of competitiveness of the crop in relation to other more dynamic crops. The gain or loss in the strength of a crop varies from year to year and a generalization based on these variations can provide a new angle to the study of changes in cropland use.

The annual variations in the strength of individual crops may be generalized by determining the *rate of change* through regression analysis. The rates at which different crops have changed during a given period of time provide a dynamic view of changes in cropland use. By contrast, the ratios describing the crop pattern at a given point of time are static in nature and a comparison of ratios obtained at two points of time does not alter their static character.

MEASUREMENT OF THE RATE OF CHANGE

Many methods are available for determining the rate of change based on year to year variations in the strength of different crops. These methods assume the concept of secular change[5] and involve the fitting of linear or curvilinear trends. However, there is no objective rule by which the most appropriate curve can be selected. Generally, for time series which is not too long, a straight line or a simple non-linear function gives a reasonably good fit.

For determining the rate of change in the strength of crops in a short time series, say a decade, the use of a straigth line function is considered appropriate[6]. The fitting of such a function involves at least two assumptions: first, that change has been taking place regularly and continuously, and second, that the rate of change has been uniform during the entire period under con-

[5] "The concept of secular change entails notions of regularity, of essential continuity. Frequent and sudden changes either in absolute amounts or in rates of increase or decrease are inconsistent with the idea of secular trend." Frederick C. Mills, *Introduction to Statistics*, New York, 1956, p. 284.

[6] See Margaret J. Hagood and D. O. Price, *Statistics for Sociologists*, New York, 1952, pp. 443—4, for reasons for the assumption of linearity in practical work.

sideration[7]. A straight line function is obtained by fitting a linear equation of the type $Y = a + bX$ through the method of least squares[8] to the yearly values of the strength of cropland devoted to individual crops in an areal unit. In this equation, Y represents the historical variable, i.e., the proportion of cropland under a given crop for each year, and X is time representing the years as consecutive numbers, while constant a denotes the position of the straight line (or trend line) on the Y-axis and constant b, commonly spoken of as the regression coefficient, indicates how many units of Y increase or decrease as X increases by one unit. In other words, constant b gives a measure of change in the Y-variable with each increase in the X-variable which is time. Or, constant b gives a measure of the linear *rate of change* per year. The sign of the regression coefficient gives an indication of the direction of change[9].

As an illustration of the technique discussed above, consider an areal unit Z in which the proportion of rice acreage to total cropland during the decade 1953—63 was: 30.46, 29.15, 28.84, 31.21, 29.45, 31.41, 31.35, 32.05, 33.39, and 35.29 per cent respectively. Taking rice percentages as Y-variable and time represented by consecutive numbers 1 to 10 as X-variable, the fitting of a straight line function gives the equation $Y = 28.47 + 0.52X$. The value and sign of the regression coefficient in this equation indicates that the proportion of rice in areal unit Z has been *increasing* at the rate of 0.52 per cent per year[10]. In the same areal unit Z, the proportion of wheat to total cropland during the corresponding ten-year period was: 23.66, 22.68, 23.88, 21.38, 23.76, 22.65, 21.61, 20.95, 21.44, and 20.04 per cent respectively. The fitting of a straight line function to the wheat series, gives the equation $Y = 24.08 - 0.34X$. The value and sign of the b coefficient here indicates that the proportion of wheat in areal unit Z has been *decreasing* at the rate of 0.34 per cent per year.

The linear rate of change obtained as above can be used for making comparisons between different areal units for a given crop and also between various crops within an areal unit. For instance, the linear rate of change for wheat can be computed for all the areal units in a study area and mapped to distinguish areas where the proportion of wheat in the cropland has increased, decreased, or remained unchanged. Likewise, a comparison of various crops within an areal unit can indicate which crops are dynamic and are increasing their

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[7] Ibid., pp. 170—1 and S. Gregory, *Statistical Methods and the Geographer*. London, 1963, p. 195

[8] The equation $Y = a + bX$ algebraically describes a line so that the sum of the vertical distances from this line to the observed points is minimum. For a discussion on the method of least squares, see Mills, *op. cit.*, pp. 217—22 and Hagood and Price, *op. cit.*, pp. 172—80.

[9] Peter Haggett, *Locational Analysis in Human Geography*, New York, 1966, pp. 293—4.

[10] Since the regression coefficient indicates change in Y-variable with each increase in X-variable, the b coefficient is always in the same units as the orginal Y-variable. In this example, constant b expresses change in percentage of cropland devoted to rice..

share in the cropland. Maps prepared from these kinds of comparisons can bring out the spatial patterns of change and help explain the dynamic character of changes in cropland use.

A CASE STUDY OF UTTAR PRADESH, INDIA

The new approach presented above was developed during an investigation of changes in agricultural geography of the western part of the Gangetic Plain which forms the State of Uttar Pradesh in the Indian Union. As an illustration of this approach, the dynamic dimensions of change in the patterns of cropland use in Uttar Pradesh during the ten-year period from 1953—54 to 1962—63, have been measured with a view to identifying the structural elements involved in change. The State of Uttar Pradesh is now divided into 54 administrative units known as districts[11]. Comparable yearwise cropland use data are available for only 47 districts which have been taken to constitute the study area for the purpose of this paper.

The study area, lying between the Himalayas in the north and the Peninsular Foreland in the south, is a vast alluvial plain, sloping gently toward the east and drained by three great rivers: Yamuna, Ganga, and Ghaghra. Here, the annual rainfall ranges from about 50 inches in the northeast and east, to about 25 inches in the west and southwest[12]. In this area of 60.8 million acres, over two-thirds is under cultivation, and nearly a quarter is double cropped, thus making it one of the most highly cultivated tracts of India. Its cropping pattern is highly diversified and a variety of crops, such as cereals, pulses, oilseeds, sugar cane and cotton are grown[13]. For the purpose of the present study, however, nine major highly competitive crops, namely, rice, wheat, barley, gram (chick pea), bajra (a millet), maize, jowar (sorghum), sugar cane and arhar (a pulse), were selected. Each of the selected crops occupies at least two per cent of the total cropland in the study area and together these nine

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[11] In 1953—54, the State was divided into 51 districts but in 1960, three northern districts were subdivided into two administrative units each, thus making a total of 54 districts.

[12] For general characteristics of the study area, see India (Republic). Office of the Registrar General, Census of India, 1961, Vol. XV, Pt IX: *Census Atlas of Uttar Pradesh.* Manager of Publications, Delhi, 1966. Also, O. H. K. Spate and A. T. A. Learmonth, *India and Pakistan*, third edition London, 1967, pp. 545—69. For an excellent treatment of land tenure and the impact of reform upon agrarian structure in this area, see Walter C. Neale, *Economic Change in Rural India: Land Tenure and Reform in Uttar Pradesh, 1800—1955.* New Haven, 1962, Yale Studies in Economics, 12.

[13] For a survey of agriculture, see India (Republic), National Council of Applied Economic Research, *Techno-Economic Survey of Uttar Pradesh*, New Delhi, 1965, pp. 20—44. For a discussion on the spatial pattern of different crops for 1960—61, and their contribution to agricultural efficiency, see the author's article, A New Measure of Agricultural Efficiency in Uttar Pradesh, India, *Economic Geography*, Vol. 43, 1967, pp. 244—60.

crops occupy more than 80 per cent of the cropped area[14]. The choice of base year in a study of this kind is highly important since an unusually favorable or adverse base year can give misleading results. The year 1953—54 was taken as the base year for a ten-year series ending with the year 1962—63. The base year was a normal year for almost all of the study area except a small portion in the southwest[15]. Another factor in the selection of the base year was the fact that for the preceding year, 1952—53, no data were collected or published[16]. The choice of a base year prior to the one selected here would not have given a continuous time series data for a recent period.

Data for nine crops and for total cropland for each year of the decade for all the areal units were collected from official sources[17]. Each crop acreage was expressed as a percentage of the total cropland in the respective district for each year. The linear rates of change were then obtained for each crop for each areal unit according to the method discussed earlier. This alone involved the fitting of 48 × 9, or 432, linear equations. The quantum of change for each crop in each district was also determined by taking percentage point difference in the proportion of cropland under a crop between the base year and the terminal year. The spatial patterns of the base and terminal years, the quantum of change, and the linear rates of change, for the selected crops have been identified and their regional distribution is given. Further, the dynamic nature of competing crops is brought out by comparing the linear rates of change for different crops within each district to identify the inducers of change, that is, the leading crops that show the highest positive and highest negative rates of change. The regional characteristics of the leading crops so defined have been analyzed. Lastly, the total volume of cropland involved in change is determined by separately adding the quantum of positive and negative changes for different crops in each district, and regionalized to distinguish the relatively dynamic and relatively stable areas[18].

[14] Since the purpose here is to illustrate the dynamic approach, the minor crops which occupy 1 to 2 per cent of the total cropland in the study area are not included.

[15] Uttar Pradesh, India, Land Reforms Commissioner, *Season and Crop Report of Uttar Pradesh*, 1953—54, Allahabad, Superintendent, Government Printing and Stationary, Uttar Pradesh, 1956, pp. 1—3.

[16] The mass resignation of several hundred *lekhpals* (village accountants) resulted in irreparable loss of valuable data for 1952— 53 for the entire State of Uttar Pradesh.

[17] Data for nine years from 1953—54 to 1961—62, were obtained from the annual season and crop reports, see Footnote 15 above. Data for 1962—63 were obtained from the Directorate of Economics and Statistics, Ministry of Food and Agriculture, Government of India, New Delhi.

[18] For mechanics of computing the total volume of change, see Weaver, *op. cit.*, pp. 34—35. Footnote 2 above.

CHANGE PATTERNS OF SELECTED CROPS

During the decade under consideration, total area of the nine selected crops showed a fair degree of stability both in respect of the quantum of change as well as the linear rate of change per year (see Table I). Likewise, a number of individual crops also showed stability in the cropping pattern in the study area in general. The almost negligible change in wheat, maize, arhar and jowar establishes their firmness and stability in the overall picture. The change in rice, sugar cane, barley and gram indicates the relative dynamism of these four crops in comparison to the other crops. It also indicates possibilities of crop substitution in a rather slow and gradual manner. The positive rates of change for rice and sugar cane are almost balanced by the negative rates of change for barley and gram. These four crops seem to be the harbingers of change and that change is marked by the areal extensiveness of their impact upon the cropping pattern in the study area (see Fig. 6 A and B). It will be shown later that not only has there been an areal redistribution in the strength of individual crops, but there seem to be definite indications of crop substitution in certain areas.

TABLE 1. Crop pattern changes in the study area, 1953—63

Crop	Percent of Total Cropland		Percentage Point Difference 1953—63	Linear Rate of Change Per Year
	1953—54	1962—63		
Rice	17.6	19.5	1.9	0.23
Wheat	17.9	18.1	0.2	—0.02
Jowar	4.7	4.2	—0.5	0.04
Bajra	5.8	4.9	—0.9	—0.11
Barley	10.0	7.8	—2.2	—0.19
Maize	5.1	5.0	—0.1	—0.002
Sugar cane	4.0	5.9	1.9	0.15
Gram	13.5	11.6	—1.9	—0.17
Arhar	3.0	3.0	Nil.	0.006
All 9 crops	81.6	80.0	—1.6	—0.17

RICE

The distribution of rice in 1953—54 shows that the crop is dominant in the eastern half of the study area and its density declines toward west and extreme southwest where the districts of Mathura and Agra show an absence of rice that year (see Fig. 1, top left). The core area of rice lies in the northeastern part comprising the districts of Gorakhpur, Basti, Gonda, Azamgarh, Faizabad and Sultanpur. The highest density within the core area occurs in Basti district where 38.1 per cent of the cropland is under rice. A small area of high density formed by Pilibhit district lies to the northwest of the core area.

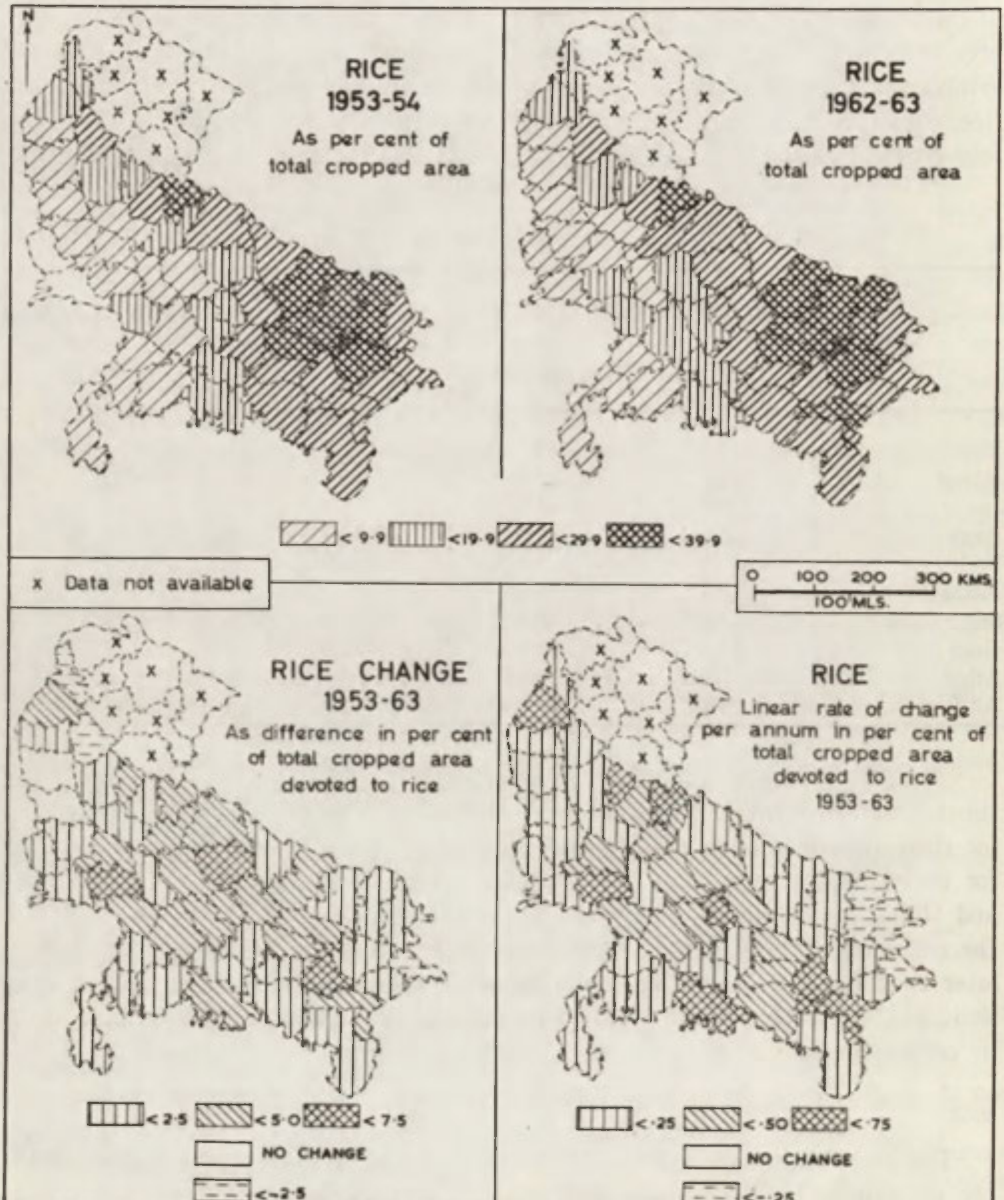

Fig. 1. Rice

A comparison of the distribution of rice in the initial and terminal years of the decade shows a close areal similarity between the two. (See Fig. 1, top). However, the regional pattern seems to be bettrr organized around the core and high density areas in the terminal year. Also, the core appears to be pushing into the adjoining territory toward the south and the west. This fact is indicated by the emergence of an area of high density in Varanasi district and confirmed by the areal extent of increase in the density of cropland devoted to rice.

Everywhere in the study area, rice seems to have gained at the expense of other crops. (See Fig. 1, bottom left). The exceptions occur in small pockets where rice has either remained constant or slightly declined. The regional variations in the quantum of change show that rice density has particularly increased in mid-central parts of the study area. The maximum gains seem to have occurred outside the core area, the highest positive change being in Sitapur district to the west of the core area.

The spatial pattern of the linear rate of change for rice (Fig. 1, bottom right) shows some interesting facets of the nature of change that is taking place here. Firstly, the rate of change has generally been positive and particularly pronounced in the central districts along an arc from Varanasi district in the southeast to Pilibhit and Rampur districts in the north central area. There are offshoots from the arc toward Banda district in the south and Mainpuri district in the southwest. Secondly, the core area in the northeast (with the exception of Sultanpur district) seems to show negligible positive or negative rates of change. Thirdly, the block of three northeastern districts comprising Deoria, Gorakhpur and Ballia show extremely small negative rates of change[19] and the same is true of the entire belt of western districts from Muzaffarnagar in the north to Agra in the south. Fourthly, areal units with a high rate of change are indicative of the increasing importance of rice in the competition between different crops and point to the fact that, in these areas, certain other crops are likely to feel the squeeze of substitution by rice.

WHEAT

The western Gangetic Plain is one of the most important wheat areas of India. The state of Uttar Pradesh has the largest wheat acreage among states and accounts for over one-third of the total wheat production of the country [20]. The distribution of wheat density in the study area shows that wheat is dominant in the western half and its proportion in the cropland declines toward the east. (See Fig. 2). In this respect, the areal distribution of wheat stands in marked contrast to that of rice, and yet the two seem to complement each other. The

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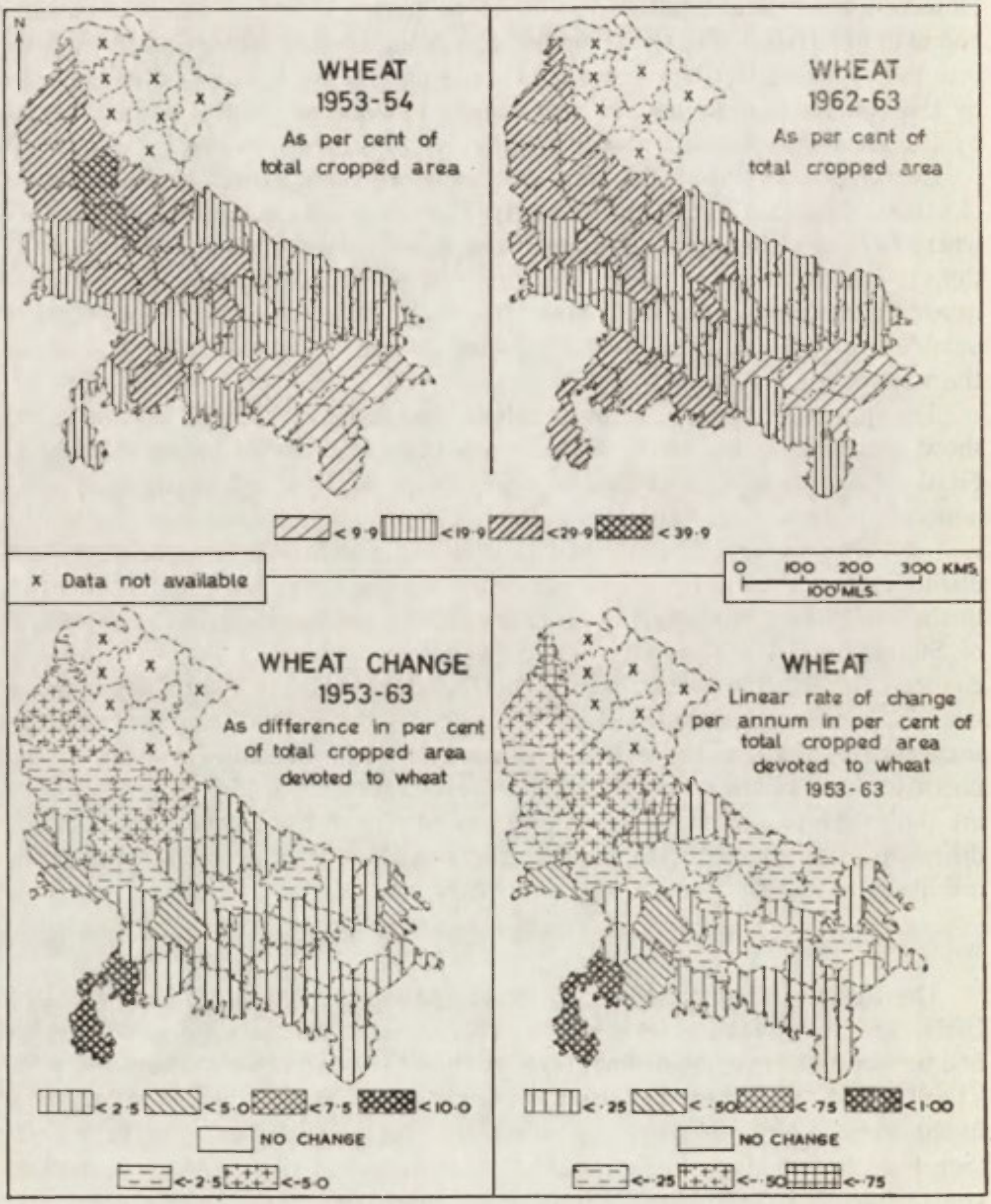
[19] Generalization involved in cartographic representation, however, necessitates the assigning of a separate category on the map.

[20] *Census Atlas of Uttar Pradesh*, op. cit., p. 110. Footnote 12 above.



N
WHEAT
1953-54
As per cent of
total cropped area
WHEAT
1962-63
As per cent of
total cropped area
< 9·9
< 19·9
< 29·9
< 39·9
x Data not available
0 100 200 300 KMS
100 MLS
WHEAT CHANGE
1953-63
As difference in per cent
of total cropped area
devoted to wheat
< 2·5
< 5·0
< 7·5
< 10·0
NO CHANGE
< -2·5
< -5·0
WHEAT
Linear rate of change
per annum in per cent of
total cropped area
devoted to wheat
1953-63
< ·25
< ·50
< ·75
< 1·00
NO CHANGE
< -·25
< -·50
< -·75

Fig. 2. Wheat

western Gangetic Plain seems to form a zone of transition with wet rice dominating in the eastern half and the dry wheat dominating in the western half[21].

In the initial year, 1953—54, high densities occur in Moradabad and Budaun districts where wheat occupies 31.7 per cent of the cropland respectively. In the three western districts of Saharanpur, Meerut and Bulandshahr, the density of wheat ranges from 26.9 to 28.9 per cent. Lowest densities of wheat occur in the east in Azamgarh and Ghazipur districts, where less than five per cent of the cropland is devoted to wheat. A comparison of the distribution of wheat in the initial and terminal years (Fig. 2, top) shows three points of contrast: a) the shrinkage of the lowest density area in the east, b) emergence of a distinct wheat zone in the southwest, and c) the disappearance of a small core formed by Moradbad and Budaun districts in the terminal distribution.

The regional pattern of the quantum of change in wheat (Fig. 2, bottom left), clearly brings out the fact that the proportion of wheat in the cropland has considerably declined in the dominant wheat area in the west. Wheat has generally gained in strength in the eastern half, although the areas of significant improvement in the position of wheat lie in the south, southwest and extreme northeast. While the intensity of decline in the strength of wheat is marked by its areal extensiveness in the western districts, the corresponding intensity of increase in rather localized. Maximum decline occurred in the three contiguous districts of Etah, Budaun, and Shahjahanpur. On the other hand, Jhansi district showed an increase of 8.3 per cent.

The spatial distribution of the linear rate of change shows that while the western districts have distinct negative rates of change in the strength of wheat, the eastern districts show very low positive or negative rates. In Deoria district in the northeast, and in the southwestern districts, wheat appears to be very dynamic and Jhansi district stands out with a very high linear rate of increase. On the other hand, Shahjahanpur and Dehra Dun districts are marked by a high rate of decline. These high rates of decrease or increase are not reflected in the overall rate of change in the strength of wheat in the study area (cf. Table 1).

BARLEY

Uttar Pradesh is the leading state for barley in the Indian Union and accounts for more than half the barley area of the country[22]. Within the study area, about ten per cent of the total cropland is devoted to barley (cf. Table 1). Here

[21] *Ibid.*, see Map No. 49 for a very vivid portrayal of this fact in a dot map showing rice in blue, wheat in red, and millets in black color.

[22] Of the 3 million hectares under barley in India during 1962—63, Uttar Pradesh had over 1.6 million hectares. See Central Statistical Organization, Cabinet Secretariat, Government of India, *Statistical Abstract of the Indian Union*, 1963 and 1964, New Series, No. 12, Delhi, 1965, p. 50.

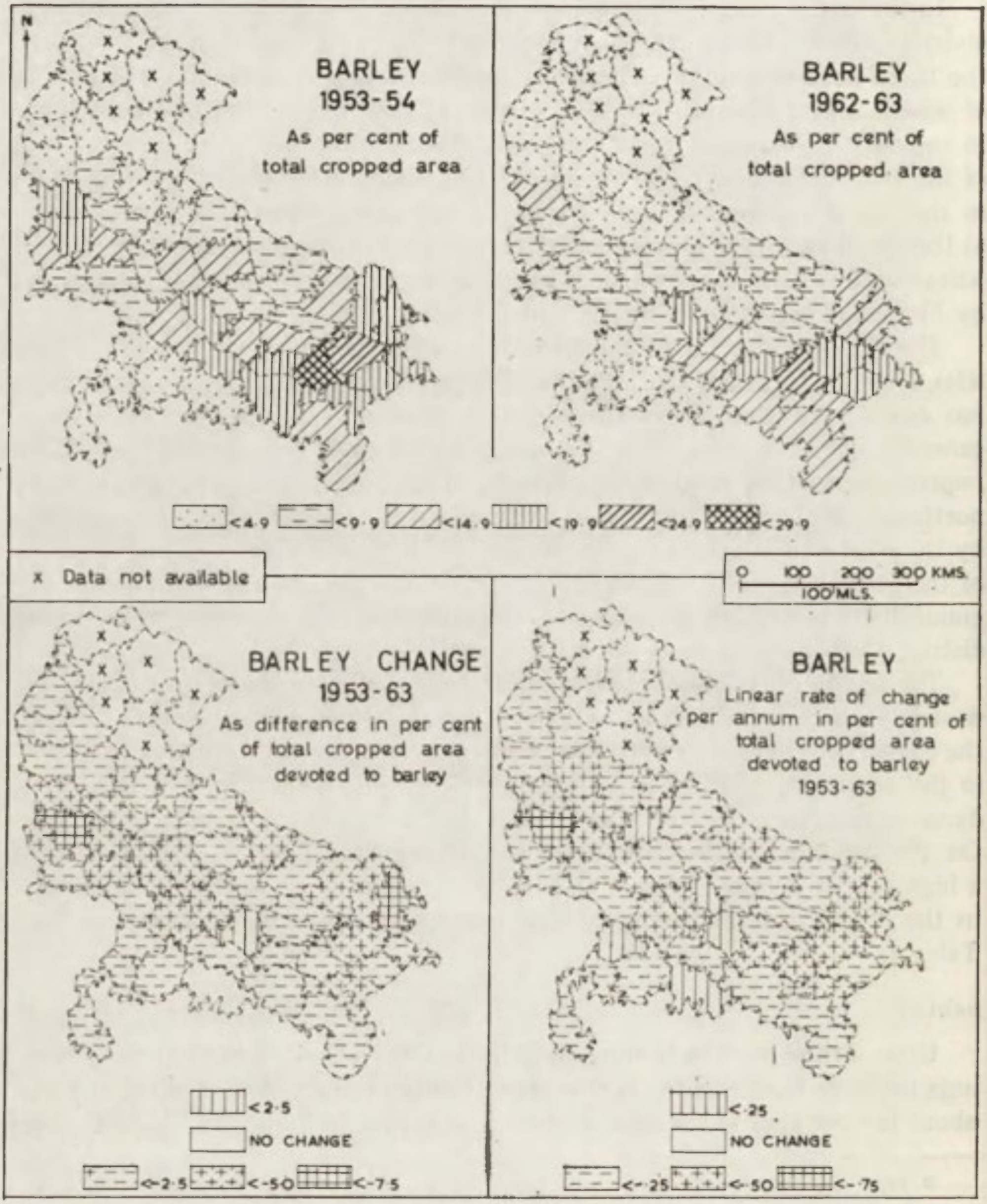

BARLEY
1953-54
As per cent of
total cropped area
BARLEY
1962-63
As per cent of
total cropped area
<4·9 <9·9 <14·9 <19·9 <24·9 <29·9
x Data not available
0 100 200 300 KMS.
100 MLS.
BARLEY CHANGE
1953-63
As difference in per cent
of total cropped area
devoted to barley
<2·5
NO CHANGE
<-2·5 <-5·0 <-7·5
BARLEY
Linear rate of change
per annum in per cent of
total cropped area
devoted to barley
1953-63
<·25
NO CHANGE
<-·25 <-·50 <-·75

Fig 3. Barley

barley is mainly grown in the eastern section, and its density declines in general toward the west and southwest. In 1953—54, the chief area of barley concentration occurs in the east central districts. The highest density is found in Jaunpur district where more than 25 per cent of the cropland is under barley. An exception to the low density area in the west is provided by a block of four districts comprising Bulandshahr, Aligarh, Mathura and Etah.

An interesting aspect of the areal accordance and discordance of crops in the study area is brought out by the pattern of distribution of barley in relation to wheat and rice. Barley distribution shows some degree of accord with rice, but the core area of barley lies to the south and east of the core area of rice. The areal distributions of wheat and barley show a high degree of discordance and appear to be mutually exclusive of one another (cf. Figs. 1, 2 and 3, top left).

During the terminal year, 1962—63, barley occupied only 7.8 per cent of the total cropland in the study area, thus showing a decline of 2.2 per cent in comparison to its share of the cropland a decade earlier. The regional pattern for barley in the terminal year shows not only a shrinkage of high and medium density areas, but also a general decline in barley density (see Fig. 3, top right). The block of medium density, which was conspicuous in the western districts in the initial year, has almost disappeared after a decade.

The distribution of the quantum of change in barley shows that the crop has experienced a negative change throughtout the study area. There are, however, two exceptions: Rae Bareli district which shows a slight positive change and Banda district which shows no change (Fig. 3, lower left). The main areas of negative change are located in the northeastern, mid-central, and western parts. This pattern of change is confirmed by the spatial distribution of the linear rate of change (Fig. 3, lower right). The crop seems to be generally on the decline in the study area and the rate of decline is particularly marked in those areas where its density was more than ten per cent in the initial year. Barley faces competition from rice in the eastern districts and from wheat and sugarcane in the western districts.

GRAM

Uttar Pradesh ranks first among the states of India in terms of acreage under gram [23]. Within the study area, gram is next to rice and wheat in importance (cf. Table 1). The regional distribution of gram in 1953—54 shows that high density occurs in the south central and mid-central parts of the study area (Fig. 4, top left). In the districts of Jalaun and Hamirpur, gram occupies 41 and 40 per cent of the cropland respectively. In contrast, low density is found in the northeast and the west. The lowest density occurs in Basti, Go-

[23] *Ibid.*, p. 51.

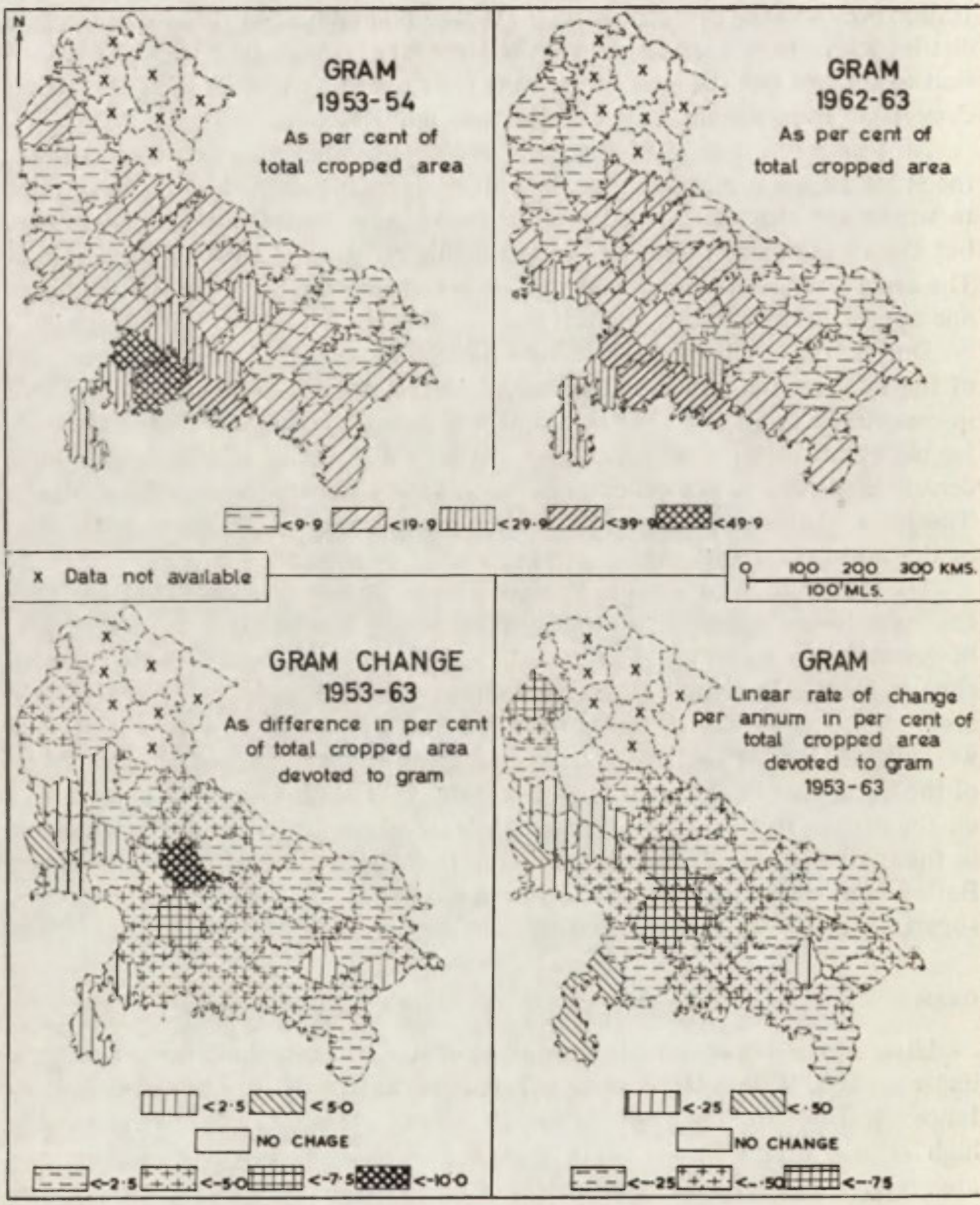

N
GRAM
1953-54
As per cent of
total cropped area
GRAM
1962-63
As per cent of
total cropped area
<9·9 <19·9 <29·9 <39·9 <49·9
x Data not available
0 100 200 300 KMS.
100 MLS.
GRAM CHANGE
1953-63
As difference in per cent
of total cropped area
devoted to gram
<2·5 <5·0
NO CHAGE
<-2·5 <-5·0 <-7·5 <-10·0
GRAM
Linear rate of change
per annum in per cent of
total cropped area
devoted to gram
1953-63
<·25 <·50
NO CHANGE
<-·25 <-·50 <-·75

Fig. 4. Gram

rakhpur and Deoria districts in the northeast. In each of these three districts, gram has a density of less than 5 per cent.

A comparison of the pattern of gram distribution in the terminal and initial years brings out two salient points: a) shrinkage of the high density area, particularly in the mid-central parts, and b) a general decline in the density of gram throughout the study area. As many as 38 areal units out of a total of 47 show a decline in the density of gram. However, it is the mid-central and south central districts that are conspicuous in this respect. The highest decline in density has occurred in Hardoi and Kanpur districts (Fig. 4, bottom left). In contrast, a small block of southwestern districts shows a gain in the density of gram. Here, the highest gain occurs in Mathura district.

The spatial distribution of the linear rate of change per year in the density of gram indicates that during the decade under study, gram has been declining slowly but surely in its share of the cropland (Fig. 4, bottom right). The area of highest linear rate of decline occurs in the mid-central parts comprising Kanpur, Hardoi and Unao districts. The very high density districts of Jalaun and Hamirpur show relatively small linear rates of decline, thus indicating that even in the core area, the crop is losing in the competition for a share of the cropland.

SUGAR CANE

Uttar Pradesh accounts for more than one-half of the entire sugar cane acreage of India, and the importance of sugar cane has gradually been increasing in this area during the last three decades. It is, however, during the decade under study that sugar cane has seen phenomenal expansion of area in Uttar Pradesh. Its acreage in the study area increased from 1.95 million (4 per cent of the cropland) in 1953—54, to 3.05 million (5.9 per cent of the cropland) in 1962—63, representing an acreage expansion of about 56 per cent in a decade.

The regional distribution of sugar cane in the initial year, 1953—54, shows three areas where its density is more than 5 per cent: a) the western districts comprising Saharanpur, Muzaffarnagar, Meerut, Bulandshahr, Bijnor and Moradabad, b) the north central districts comprising Kheri, Sitapur, Bareilly and Pilibhit, and c) the northeastern districts comprising Jaunpur, Azamgarh and Deoria (Fig. 5, top left). The block of six western districts, of course, forms the most important sugar cane area. The highest density occurs in Muzaffarnagar district where 15.2 per cent of the cropland is devoted to sugar cane. A comparison of the distributional pattern for the initial and terminal years clearly brings out the phenomenal expansion of sugar cane referred to above. In 1962—63, the northeastern area has expanded and the western area has merged with the north central area to form a large block from Sitapur in the east to Muzaffarnagar in the west and from Dehra Dun in the north

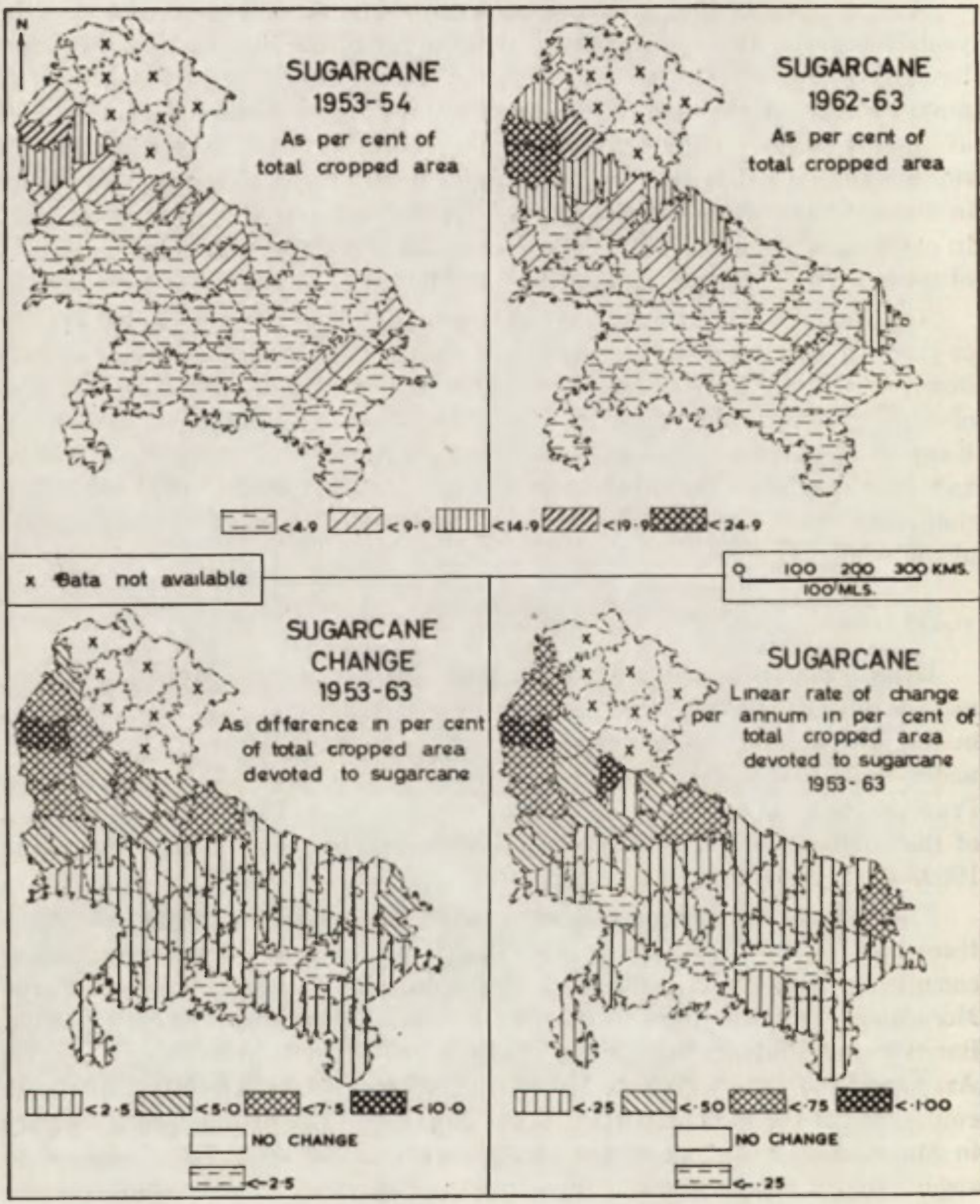


Fig. 5. Sugar cane

to Mathura in the south (Fig. 5, top right). In addition, the density of sugar cane has increased to 11.9 per cent in Deoria district in the northeast, and to 23.1 per cent in Muzaffarnagar district in the west.

The spatial pattern of the quantum of change (Fig. 5, bottom left) shows that the proportion of sugar cane in the cropland has increased almost everywhere in the study area. Phenomenal increases have, however, occurred in the western districts, although the north central and north-eastern districts also show major increases. In Kheri district (north central area), sugar cane density changed from 7.7 per cent to 14.5 per cent, while in Rampur district, it changed from 4.4 per cent to 10.9 per cent. Likewise, among the western districts, Bulandshahr shows a change from 5.8 to 11.6 per cent, Meerut from 14.4 to 20.0 per cent, Muzaffarnagar from 15.2 to 23.1 per cent, and Saharanpur from 8.4 to 14.1 per cent. The areal distribution of the linear rate of change seems to be in accord with the quantum of change (cf. Fig. 5, bottom left and right), and clearly shows the areas where sugar cane has been undergoing phenomenal change. In a north-south belt from Dehra Dun to Bulandshahr, and in the districts of Rampur, Kheri and Deoria, sugar cane has been increasing at the average rate of 0.5 to 1.0 per cent per year. The districts of Muzaffarnagar and Rampur show a positive linear rate of change of 0.84 and 0.75 per cent per year respectively.

The phenomenal change in sugar cane and its impact upon the cropping pattern during the last few years has attracted the attention of a number of investigators[24]. Though the factors and processes involved in such a change are not fully understood at the present, there seems to be some consensus that the higher net return per acre of sugar cane in comparison to other crops is an important element in inducing change. In the western districts, net return per acre of sugar cane is seven to eight times as large as the net return from wheat, and about four times as large as the net return from rice[25]. Likewise, in the northeastern district of Deoria, the net return per acre of sugar cane is four times as large as that of paddy[26]. In view of the much higher net return per acre of sugar cane, it is to be expected that more and more area would be devoted to sugar cane. Other factors favouring sugar cane extension appear

[24] Shyam S. Bhatia, Changes in Cropping Pattern: Sugar Cane Supplants Cotton in the Ganges Valley, *Commerce*, Bombay, Vol. CXI, No. 2849, December 4, 1965; N. A. Mujumdar, Crop Pattern, Production Targets and Strategic Intervention, *Indian Journal of Agricultural Economics*, Vol. 18 (1), 1963, pp. 44—53; P. V. John, Responsiveness of Relative Area-output of Sugar Cane and Rice to Changes in Their Relative Prices in Uttar Pradesh: 1954—63, *Indian Journal of Agricultural Economics*, Vol. 20(1), 1965, pp. 40—47; and S. C. Gupta and A. Majid, *Producers Response to Changes in Prices and Marketing Policies: A Case Study of Sugar Cane and Paddy in Eastern Uttar Pradesh*, Bombay, 1965.

[25] India (Republic). Ministry of Food and Agriculture, *Studies in the Economics of Farm Management in Utter Pradesh: Report for the year 1954—55*, Delhi, 1957, pp. 66—85.

[26] S. C. Gupta and A. Majid, *op. cit.*, p. 26. Footnote 23 above.

to be "The provision of credit, and of developmental and cooperative marketing facilities, by the government specifically for sugar cane cultivation"[27].

The patterns of change for jowar, bajra, maize and arhar were mapped and studied, but are not presented here. For the discussion that follows, all the nine crops were considered.

INDUCERS OF CHANGE: LEADING CROPS ACCORDING TO POSITIVE AND NEGATIVE RATES OF CHANGE

The dynamics of crop pattern change in any areal unit depends upon the competitiveness of the different crops. The most obvious manifestation of the competitive nature of a crop is the rate at which the crop gains or loses in its share of the cropland over a period of time. A comparison of the rates of change of different crops in an areal unit can help identify the inducers of change, i.e., the crops that initiate changes in cropland use either through their vigorousness generated by technological and economic forces, or through their absolute inertia, which acts as a catalyst for other crops. With a view to identifying the crops that may be inducing changes in cropland use, the linear rates of change for the nine selected crops for each areal unit were arranged in an array in a descending order. In such an array, the crop with the highest positive rate of change would be at the top while the crop with the highest negative rate of change would be at the bottom. The crops at the two ends of the array represent the inducers of change. The crops so identified for each areal unit in the study area were regionalized to obtain their distributional pattern (see Fig. 6, A and B).

According to the positive rate of change, four crops, namely, rice, sugar cane, maize and wheat, seem to be increasing their share in the cropland at a higher rate than the other crops. However, rice and sugar cane dominate by their areal extensiveness as shown by the spatial distribution of the leading crop based on positive rate of change (see Fig. 6, A). Rice forms the leading increase crop over the eastern two-thirds of the study area. In contrast, sugar cane leads among the increase crops in the western one-third, as well as in the northeastern districts of Basti, Deoria and Ghazipur. Wheat as a leading increase crop occurs in three isolated areas: Agra district in the southwest, Jhansi and Hamirpur districts in the south, and Gorakhpur district in the northeast. Maize stands out in the increase crops in two mid-central districts of Hardoi and Farrukhabad as well as Ballia district in the east.

The spatial distribution of the leading crop, according to the negative rate of change, shows that five crops, namely, gram, barley, jowar, bajra and wheat, are experiencing more decline in their share of the cropland than other crops.

[27] *Ibid.*, p. 52.

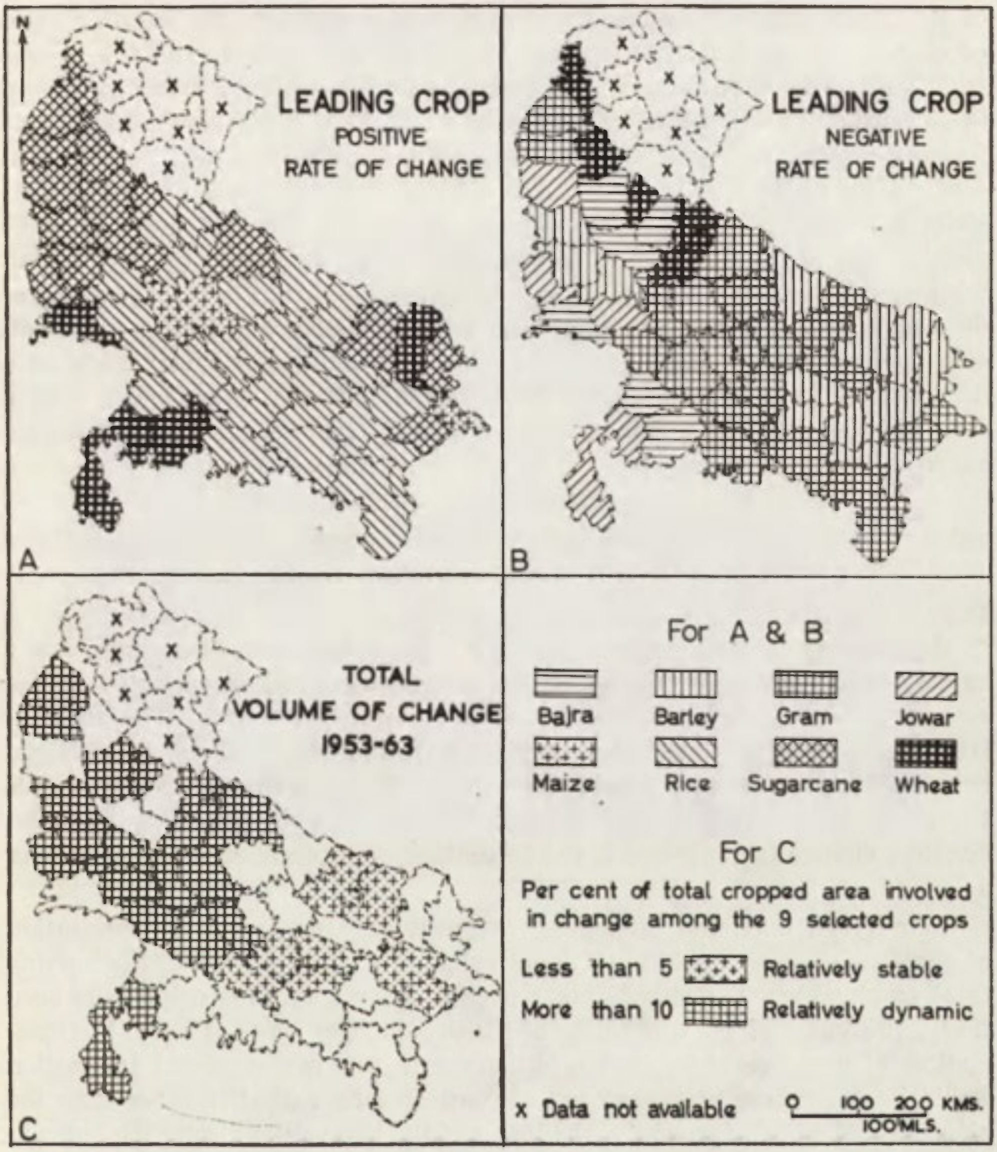


Fig. 6. Inducers, and total volume, of change

Among these five decline crops, gram and barley seem to be the most wide-spread. A significant point to be observed in this connection is that wheat is the only crop that appears both among leading increase and leading decrease crops, and in both cases, it has a limited distribution. Obviously, the leading increase crops are mutually exclusive of the leading decrease crops. Comparison of the distribution of leading crops, according to positive and negative rates of change, brings out some interesting features and patterns of crop substitution. (Cf. Fig. 6, A and B). Rice seems to be the leading increase rate crop in 25 districts in which the leading decrease rate crops are: gram (in 13 districts forming a large contiguous block), barley (in 7 districts of which five lie in contiguity), wheat (in 2 districts), bajra (in 2 districts), and jowar (in one districts). Likewise, sugar cane appears as the leading increase rate crop in 15 districts, in which the leading decrease rate crops are: gram (in 4 districts), wheat (in 3 districts), barley (in 4 districts), bajra (in 2 districts), and jowar (in 2 districts). Looked at another way, gram is the leading decline crop in 20 districts in which the leading increase crops are rice (in 13 districts), sugar cane (in 4 districts) and maize (in 3 districts). Similarly, barley is the leading decline crop in 12 districts, in which the leading increase crops are rice (in 7 districts), sugar cane (in 4 districts), and wheat (in one district).

TOTAL VOLUME OF CHANGE: A MEASURE OF AGRICULTURAL DYNAMISM

The change patterns of various crops have been examined individually as well as in relation to each other. An assessment of the accumulated change among the nine selected crops as a group may now be made. The accumulated change may be determined by a separate summation of the positive and negative changes shown by the different crops. Positive change for any crop is the percentage-point increase in cropland over a period of time. Likewise, negative change for any crop is the percentage-point decrease in cropland over a period of time.

In a given unit, the summation of positive changes and the summation of negative changes would have equal value, provided all the crops occupying total cropland are considered. Since in this study only nine crops have been taken, the value of the summation of positive changes may not equal the summation of negative changes. The difference in the two values of summation would be due to changes in crops not considered here (that is, other than the nine selected crops). Obviously, the larger of the two values among the summations of positive and negative changes is indicative of the total volume of change that has occurred in the cropland[28].

The magnitude of change in the cropland was computed for each areal unit as well as for the entire study area. The proportion of cropland involved in change in the study is amounted to 5.6 per cent. Using the volume of change in the study area as a guide, it was decided to distinguish the districts

[28] For an illustration of the method used, see Weaver, *op. cit.*, p. 35.

with less than 5 per cent change as relatively stable, and the districts with more than 10 per cent change as relatively dynamic.

The spatial distribution of the relatively stable and relatively dynamic areas (Fig. 6, C) clearly brings out the contrast between the eastern and western regions. The relative stability and stagnation of the eastern region has been a cause for concern and a survey of the region was conducted jointly by the Government of India's Planning Commission and the State of Uttar Pradesh. The Joint Study Team reported that the "problem of agricultural development in these districts is the problem of introducing improved crop patterns and techniques and maximising inputs of resources in agriculture"[29]. Among other things, the Study Team recommended that the "area under paddy and maize ... be increased" and that the "increase... be brought about by diversion of some area from inferior millets ..."[30] It would be interesting to watch the impact of the implementation of such proposals on the cropping pattern of the eastern region.

The relative dynamism of the western region may be attributed to a number of physical and technological factors. The western part of the study area has a lower annual rainfall than the eastern region, a general absence of floods, and extensive supplemental irrigation facilities which make possible an increased emphasis on commercial crops, particularly sugar cane.

CONCLUSION

The dynamic approach presented above seems to offer a useful tool for understanding the patterns of change especially where the phenomena being investigated are subject to great variations from one year to another. The technique used here provides a means for analyzing spatially the variations through time and allows the integration of temporal dimension with that of the spatial dimension. It is particularly in the latter context that the technique seems to have potentialities of wide application. The approach presented here can perhaps also be used for predicting spatial patterns, of say 5 or 10 years hence, on the assumption that the current rates of change will continue. However, the validity and effectiveness of this approach need to be tested in other areas of geographical research.

Acknowledgement The author would like to thank Krishan Kumar, B. S. Shekhawat, Barbara Truszynski, and Barbara Dumke for assistance at various stages of the research project.

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[29] Planning Commission, Government of India, *Report of Joint Study Team: Utter Pradesh (Eastern Districts)*, Ghazipur, Azamgarh, Deoria, Jaunpur, Published by Manager of Publications, Delhi, 1964, p. 52.

[30] *Ibid.*, p. 57.

GEOGRAPHIA POLONICA 19, 1970

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SUB-TYPES OF AGRICULTURE IN THE AREA OF BRATISLAVA

The map of land-use of the nearest hinterland of Bratislava, in a scale of 1 : 25 000 has been drawn by the author on the basis of field mapping and indoor processing of material collected in conformity with the international key of symbols and recommendations of the regional subcommission for East Central Europe of the IGU Commission on World Land Survey. After the redrawing and diminution the final version of the map has been made in the scale 1 : 50 000.

In this map we can immediately distinguish the following subregions of land-use: Zahorská lowland, Malé Karpaty (the Little Carpathians), the loess upland of Trnava, and Zitný Ostrov (Wheat Island). The natural conditions characterizing these units greatly influence agricultural production as well as its structure and specializations.

Zahorská lowland is a part of Vienna Basin; in the west it is demarcated by the Morava river and in the east by the Little Carpathians. ·In the Tertiary period it was effected by sea transgression which influenced essentially its geological composition. Large quantities of sandy and gravelly material remained after the regression of the sea; in the Quaternary period the most minute particles were carried away by prevailing west winds and transposed in the form of sandy dunes in the eastern part of Zahorská lowland, on the places where the wind power was weakened by the bursts on the mountain barriers of the Little Carpathians, or by air streams induced by the Little Carpathians. The pine woods, the most rational economic use of these sandy dunes appear over extensive area on the map very clearly. The wood resources exerted an influence on the economic structures of several rural settlements as well as on the location of the timber industry in Zahorie. Other soils, non-covered by woods have also sandy structure and make the orientation including: among the extractive crops-rye, in the group of intensifying crops —

potatoes, and clover in the group of structure forming plants. In many places there is marsh land produced either by wind erosion of soils down to the ground-water table, or by neo-tectonic subsidences, or as a consequence of the role played by the sandy dunes which force the streams running down from the Little Carpathians to bend, and eventually inundate the area during the rainy periods. Meadows and vegetables, mainly cabbages are cultivated in this area. Horticulture has developed there already in the period of the Austro-Hungarian monarchy, and was influenced at that time by great demand caused by the proximity of Vienna, and nowadays by the vicinity of Bratislava. Cabbages are exported also to other regions of Slovakia. Market-gardening had a favourable influence on the location of canneries in Stupava, Záhorská Ves and Malacky. These factories have also influenced the development of market-gardening. Their main specialization are canned cucumbers, and sour cabbage. An analysis of the statistics of the most commonly grown vegetables in Záhorie is also very interesting. In the whole surface used for market-gardening cucumbers occupy 22.4 per cent, cabbages 20.2, peas 11.1, carrots 10.2, onions 7.9, tomatoes 3.2 per cent. Yield in quintals per ha is as follows: cabbages 251, cucumbers 197, tomatoes 165, carrots 129, and onion 92. Vegetables are cultivated on fields and in gardens. Field vegetables (cabbages, cucumbers, carrots, onions) are grown on extensive areas and the criterion of their choice is to save on labour. Vegetables in gardens are cultivated in hot-beds and green-houses. The cultivation of early vegetables necessitates highly qualified staffs, which after the World War II are very scarce. In general horticulture is practised in areas suitable for irrigation. The specialized production of early vegetables is connected with the market of Bratislava. Large green-houses are in Záhorská Bystrica, Zahor, Láb and Malacky; extensive hot-beds in Zahor and Záhorská Bystrica.

A further development of market-gardening is closely connected with the following problems: a) solution of the problem of qualified man-power; today's average age of workers is very high (50—60 years), b) further improvement of purchase and price policies; a certain improvement is noticeable in the last years as the result of the opportunity for direct sale of vegetables by the producers to the consumers; c) the construction of new green-houses and hot-beds.

The Little Carpathians seem to be another land-use sub-region. They are crystalline mountains with mesozoic sediments covering their middle altitudes, overgrown in the central part mainly by beech forests, often mixed with pine, and in the lower, marginal parts by belts of oak trees. This sub-region is rich in woods and simultaneously is also a zone of recreation where fresh air, clean water and numerous weekend facilities can be enjoyed by the inhabitants of Bratislava. These recreational functions grow unceasingly and increase the importance of the Little Carpathians.

GEOGRAPHIA POLONICA 19, 1970

K. Ivanicka — *Sub-Types of Agriculture in the Area of Bratislava* pp. 250—251

Fig. 1. Land use map of the area of Bratislava, 1963

1 — district boundaries, 2 — state boundaries, 3 — roads, 4 — railroads, 5 — settlements, 6 — waters, 7 — deciduous forests, 8 — coniferous forests 9 — river flat forests, 10 — vineyards, 11 — meadows, 12 — wheat, maize, green maize, 13 — rye, maize, green maize, 14 — rye, potatoes, lucerne, 15 — barley, maize, green l maize, 16 — barley, maize lucerne, 17 — barley, maize, sugar beet, lucerne

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A special attention must be paid to the belt of most intensive agriculture on the eastern slopes of the Little Carpathians and adjacent ridges of the hilly country of Trnava. It is a region of viticulture, stretching from the Danube in the south to Smolenice in the north. This viticulture is of old origin and in the surroundings of Bratislava had originated from the historical contacts with the Roman Empire, the northern boundaries of which were on the Danube. The cultural influence of the Roman Empire penetrated into the territory of Slovakia. In the Middle Ages, the viticulture brought about the prosperity of several little towns, e.g. Pezinok, Modra, Jur, and played also an important part in medieval Bratislava. Nowadays Bratislava as a center of consumption has become a stimulus for the further development of viticulture. In the area of great concentration of vineyards many industrial-viticultural enterprises have been started. The following vines are cultivated: Riesling, Veltlin, Mueller--Thurgau, Muscat, Vine of Girls, Frankovka, etc. The yields per hectare oscillate between 60—80 q in old vineyards, up to 160—180 q in new ones. The natural and economic conditions of viticulture are very good. The area of vineyards is about 4000 ha, and there are plans to extend this area further by an addition of 1000 ha. In the subregion around the district of Bratislava there are 22 specialized viticultural agricultural enterprises, 15 of which are agricultural cooperatives. Vineyards are being modernized because in the past the rows of grape--vines were planted in a narrow distance one from another, in a system obstructing modern agrotechnics. The reconstruction will be accompanied also by the construction of anti-erosion devices and of a new type of road network.

In the subregion we can distinguish the southern area from Bratislava to Modra, of the IA quality of soils and the best quality of the grape-vines (7 viticulture areas), and the nothern area, from Dubova till Suchá nad Parnou, which has the 1st quality of soil. Besides a number of traditional small grape--processing establishments, three large-scale bottling factories are also localized in the subregion: Pezinok, on the basis of raw materials, Bratislava and Rača on the consumer's as well as on the raw material basis paralelly. The position of the subregion is high, this can be illustrated by the proportion of its area under vineyards to the Czechoslovak total (4000 ha : 24 000 ha).

A further subregion is the Danube lowland, which is the most important agricultural area of Czechoslovakia. In the area of Bratislava we can distinguish on the map the loess plateau of Trnava and Žitný Ostrov (Wheat Island). Wheat and barley are the most important extractive crops, in the group of intensifying crops the first place should be reserved for maize, and among structure forming plants for clover. In Žitný Ostrov we find some market--gardens which, because of their size, do not appear on the map, but from the standpoint of differentiation and income of agricultural establishments are very important. On the loess plateau of Trnava sugar-beet occupies in some commu-

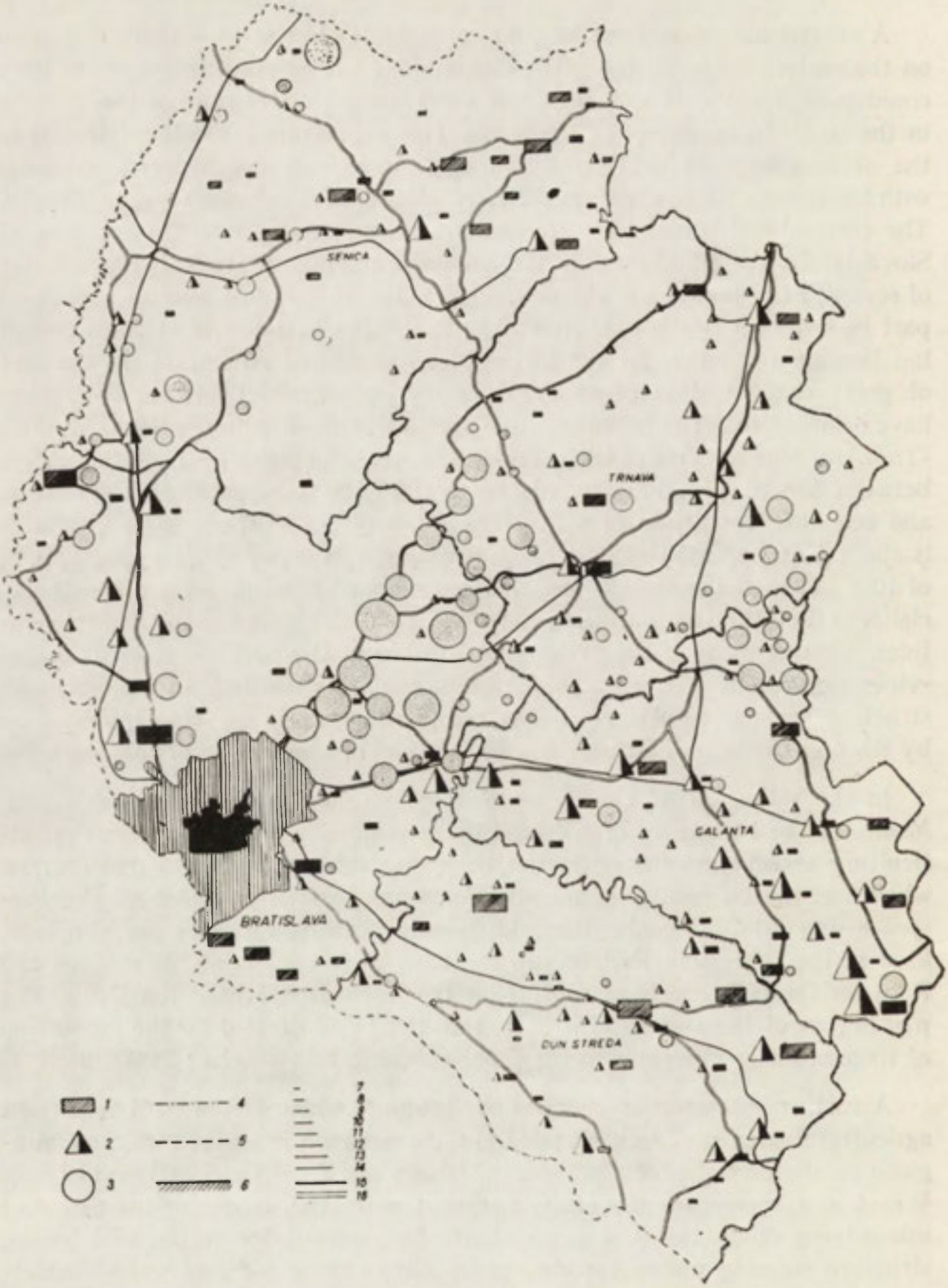

Fig. 2. The cultivation of vegetables, fruits and grapes in the hinterland of Bratislava

1 — fruits, 2 — vegetables, 3 — grape, 4 — state boundaries of CSSR, 5 — boundaries of the Slovak Socialist Republic, 6 — district boundaries, 7—14 size categories, 15 — railroads, 16 — roads

nities about 5% of arable land, although this area is not particularly the centre of such cultivations.

South-Slovakia, mainly the area eastward from the territory under investigation is the center and the most important sugar-beet area, with several big sugar factories (Trnava, Sládkovočovo, Nitra, Šurany, Pohronský Ruskov).

The map of vegetable, fruit and grape cultivations reveals an interesting fact (Fig. 1). It indicates that the villages situated very near to Bratislava, localized eastward and southeastward in the Danube lowland, cultivate vegetables on a smaller area, but with the growing distance the vegetable areas increase. On Žitný Ostrov this inverted order is clearly visible. Vegetable areas appear only on the eastern border of the Dunajská Streda district. In the district of Galanta, situated north of Žitný Ostrov, the cultivation of vegetables forms a continuous belt from Senes until Neded. These villages have good connections with Bratislava. Inverted intensity of the spatial distribution of market-gardening has a close negative correlation with the commuting to Bratislava. It seems that the inhabitants of nearest villages, situated close to Bratislava, prefer to commute to work in the city and the market-gardening is deprived of sufficient man-power. The vegetable zone of Záhorie is differently formed. Here market-gardening regardless of the proximity of Bratislava, is well represented. This is connected with the old tradition of market-gardening. We can also see on Fig. 2 an area of viticulture on the slopes of the Little Carpathians, and a certain concentration of fruit-growing in the surroundings of Myjava and in the immediate proximity of Bratislava.

The above described division into regions and subregions shows certain dynamics. Some subtypes shift considerably the center of gravity of their production. It is true with viticulture on the slopes of the Little Carpathians, or with vegetable production in Záhorie; rye and potatoes have been replacing wheat and maize. Generally, hovewer, the social regularities of agricultural development are similar.

A special attention must be paid to Bratislava and its suburbs. It is a nucleus of the metropolitan area of west Slovakia and is noted for its tremendous building activity, particularly the construction of residential houses and factories, transport facilities, and storehouses. The land utilization in the place where the Little Carpathians get near to the Danube and create good transportation possibilities for the contact and exchange of several macro-regions, appears clearly on the map.

GEOGRAPHIA POLONICA 19, 1970

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THE LAND OF HUNGARY AND THE UTILIZATION TYPES OF ITS AGRICULTURE

Land is the most important factor of agricultural production, it is the site of productive activity at the same time. The area of cultivated land determines the scale of agricultural production. Besides the physical properties of soils, the quality of land depends upon climate, water balance and other physical conditions. In studies of land connected with agriculture, all the physical factors are usually included.

In most cases people are not satisfied with yields given by natural productivity. They increase them by manuring, irrigation, or other technical operations. Accordingly, besides physical factors, land bears marks of human transformation activities.

The area under cultivation and quality of agricultural land is of special significance in a country like Hungary, with a small territory and great density of population. Its territory totals up to 16 million hectares, out of which cultivated area (i.e. arable land vineyards and orchards) occupies 6 million hectares. Under such circumstances not more than 0.6 ha of cultivated land and a little more than 1 ha of the utilized area falls to one inhabitant.

Great population density is a general feature in Europe; Hungary shows medium density of population in comparison with European standards. However, contrary to the West European countries, Hungary has to produce not only enough food to supply its own population, but also relatively considerable, for a small territory, export surpluses. Under such conditions there an imperative need for reasonable and intensive land utilization is evident. It is this necessity that determines agricultural land utilization in Hungary, where 92 per cent of the total territory, including woodland, is used for agricultural purposes (the character of Hungarian forestry justifies its inclusion among agricultural activities). Arable land plays the most important role in the land utilization of Hungary, for the relief features, where plains predominate are favourable. Each area with proper physical conditions is utilized as arable land. All the other forms of utilization are confined to areas where soil properties and relief conditions are unsuitable for crop production. Meadows and pastures occupy 15 per cent, forests 15 per cent, vineyards and orchards about 4—5 per cent of the total territory. Non-agricultural area totals to 8 per cent.

Naturally, the rapid pace of industrialization and urbanization affects the area devoted to agricultural uses. In certain parts competition between industrial-urban and agricultural utilizations has become intense, and it is always agriculture that comes off defeated. In the past 30 years cultivated area decreased by 11 per cent which is indeed a high proportion.

New industrial plants purchased their land on good terms or even obtained it free of charge from the state; however, they treated it wastefully (this practice was stopped by the introduction of economic reform in 1968). Agricultural land has also been decreased through afforestation, often without much consideration of the quality of land. The afforestation of eroded slopes and blown sands seems to be a reasonable procedure, but utilization of first class soils as forests cannot be justified.

The area lost for agriculture in the past 30 years would produce an output of 4—5 thousand million forints per year at the present level of production. In order to illustrate how important this loss was, we must consider that the new agricultural investments total 8 thousand million forints annually.

The economic reform of 1968 will regulate the relations between price and rent. This regulation will stimulate increased economies in the non-agricultural use of land; the change of the land tax system will stop extensive utilization of first class soils. Nevertheless, the fact that Hungarian agriculture has to fulfil a task of providing for growing needs on a diminishing area can hardly be changed in the future.

The properties of Hungarian soils in general may be regarded as favourable to agriculture. Productive chernozem soils occupy 60 per cent of the territory, while sandy, meadow and marshy soils occupy 17 per cent respectively. Alkali (szik) soils, difficult to utilize, spread over about 8 per cent of the territory. Soil conditions are characterized by relatively great extremities. Besides favourable chernozem soils, we find a good deal of acid and eroded soils requiring improvement. In the past 20 years 15 per cent of cultivated land were put under improvement. Although in certain regions soil conditions exert an unfavourable influence on land utilization, the quality of land shows an ability for intensive utilization.

In our interpretation the quality of agricultural land means productive capacity; the more it yields, the greater is its value. The natural productive capacity of Hungarian land was estimated in the course of detailed investigations. Yields to be expected by natural productive capacity were estimated for every type of soil in individual villages. Additional yields can be obtained by manuring or by the use of chemical fertilizers. In this manner either regional planning, or individual farms can find out to what extent could they rise productive capacity in order to obtain scheduled yields. Investigations have also pointed out to what measure the geographical differences in yields can be attributed to the quality of land or to the level of supply of productive capacity

THE ECONOMIC SIGNIFICANCE OF LAND IN HUNGARY

Agriculture plays a considerable role in the national economy of Hungary and in all probability this situation will remain the same in the future. Some 25 per cent of the national gross production derives from agriculture; 22 per cent of the export value consists of agricultural products; about 30 per cent of the active population are occupied in agriculture. Accordingly, the outputs from agricultural land utilization make a heavy impact on the national economy, including foreign trade and employment as well.

The quality of land affects considerably the level of agricultural production, and in spite of any expectations, this will not disappear under technical progress either.

The degree of influence exerted by the quality of land on the level of agricultural production has often been investigated. One of these investigations was concerned with establishing whether such influence is diminishing or increasing. A comparison was made of the intensity of these effects on production levels in the 1930s and in the 1960s ("production level" denotes the value of agricultural production per hectare, calculated on the basis of constant prices for both periods). Respective correlation calculations reveal that the quality of land more strongly affects the regional differentiation of production levels at present (average of 1962/66: $r = +0.743$) than it was true in the 1930s (average of 1934/38: $r = +0.437$). Technical progress in the period under investigation did not eliminate regional differences caused by the influence of land quality; in fact, it emphasized them. Namely, with up-to-date technology available, soil capacity can be utilized to a greater extent than before. Consequently, higher yields are obtained on better soils. Moroever, while the transportation of agricultural products and freezing procedures became easier and more widespread, the proximity to city markets lost its importance. Up to the recent past a uniform price system prevailed in Hungary, which was more advantageous to farms with good soils, producing therefore cheaper. All this contributed to the fact that the quality of land has grown in importance.

Another investigation, undertaken in 1967, analysed the impact of the quality of land on the expenditures and incomes of cooperative farms. It revealed that the following values are higher in cooperative farms with predominantly chernozem soils: production value per hectare, net income per hectare, production value per one person employed in agriculture (labour productivity), income per one person employed, return rate from investments (income per value of fixed assets and production value). Expenditures, should they refer to production inputs, or to one agricultural product, are the lowest in the cooperative farms mentioned above.

Summing up the economic significance of land, we can state that it is the complex effect of all factors listed before that forms the trend, structure and level of land utilization. Trend in land utilization is determined by the density of population, as it can meet its consumption demands. That is why the leading branch of land utilization is production of arable crops in which breadgrains and fodder crops are the most significant.

Another essential economic factor is a high density of labour force. The number of currently employed agricultural workers is approximately one and a half million, i.e. somewhat more than 6 hectares of the total agricultural area and only 4 hectares of the cultivated area falls to one person employed in agriculture. The demand of agriculture for labour force puts a check on the development of agrotechnics (e.g. maize and sugar beet harvesting is partly done by hand), and gives a relative significance to utilization forms employing a great amount of labour force, as viticulture, fruit and vegetable production. The third economic factor is the role of agriculture in foreign trade. Some 40 per cent of the national income of Hungary is realized in foreign markets. Thus, the trend in land utilization is influenced by the demands of foreign agricultural markets, too. This is conspicuous in the vegetable, fruit and meat production exceeding by far internal needs. Of course, the influence of economic factors on the trend of land utilization is limited the possibilities offered by the quality of land.

THE TYPES OF AGRICULTURAL LAND UTILIZATION

Under the type of agricultural land utilization we understand a socio-economic organization of utilization which bears the characteristics of historical development, accommodates itself to the physical conditions of the utilized land and fulfils a definite purpose of production. Accordingly, the socio-economic organization of land utilization is determined basically by two factors: the physical quality of land and the production trend of its utilization. We have mentioned already the character and influence of economic conditions. The purpose of production may differ by regions of distinct social development, that affect the organization of land utilization. The organization of land utilization tends to the optimum realization of economic activity (as human decisions are of sub-optimum character, in practice we cannot find an optimum organization, a trend is however obvious). Thus, the trend, structure and level of land utilization are subordinate to the requirements of the most economical realization of the basic purpose of production. An example for this is the maximalization of the food production characteristic, in general, for underdeveloped agricultural areas, where the basic purpose of production is food supply for local population. This purpose indicates self-sufficiency, i.e. a relatively low level of market production of the area which is characteristic of the agriculture of the developing countries. The purpose of land utilization can also be the making a maximum profit. In this case land utilization tends to the production that can ensure a maximum profit, and the quality of land, the local population and the market are considered as factors influencing the costs of production. This example is characteristic of the major part of the United States, where modern, capitalistic large-scale farming is typical. Land utilization displays several trends in Hungary. Production is performed mostly by large-scale commercialized farms, with an effort to obtain a maximum profit. Maximum profit is limited by two factors, however, — supplying population with agricultural products at a national level, and the employment needs of labour force available at the farm level. Consequently, the types of land utilization express:

— the natural capacity of land of the area in question;
— agricultural history of the area (production traditions, settlement network, etc.);
— social purpose of production, or rather:
  a) increase of enterprise income,
  b) participation of the area in the national supply of agricultural produces,
  c) consumers' density,
  d) labour force density.

We may presume that land utilization fulfils, more or less, the social purpose of production in every area. The above-mentioned conditions of land utilization are accompanied by a regionally varying structure of land utilization. This structure is made up of the outputs of land utilization, i.e. of the distribution of agricultural gross production among the individual branches of production.

The agricultural types of Hungary were determined on the basis of the gross production of 3200 villages, on an average of the years between 1962 and 1966. The structure of production was investigated according to the following branches:

1) Cattle-breeding
2) Pork- and poultry-breeding
3) Perennial crops
4) Potato and vegetable production
5) Fruit and vegetable production, viticulture (i.e. horticulture).

These are the main branches, rendering 90 per cent of the gross production, as most of fodder is consumed on the spot.

The regional specialization of production (i.e. the proportion of leading branch to gross production) cannot be regarded as considerable. It is only viticulture and fruit production that show higher specialization.

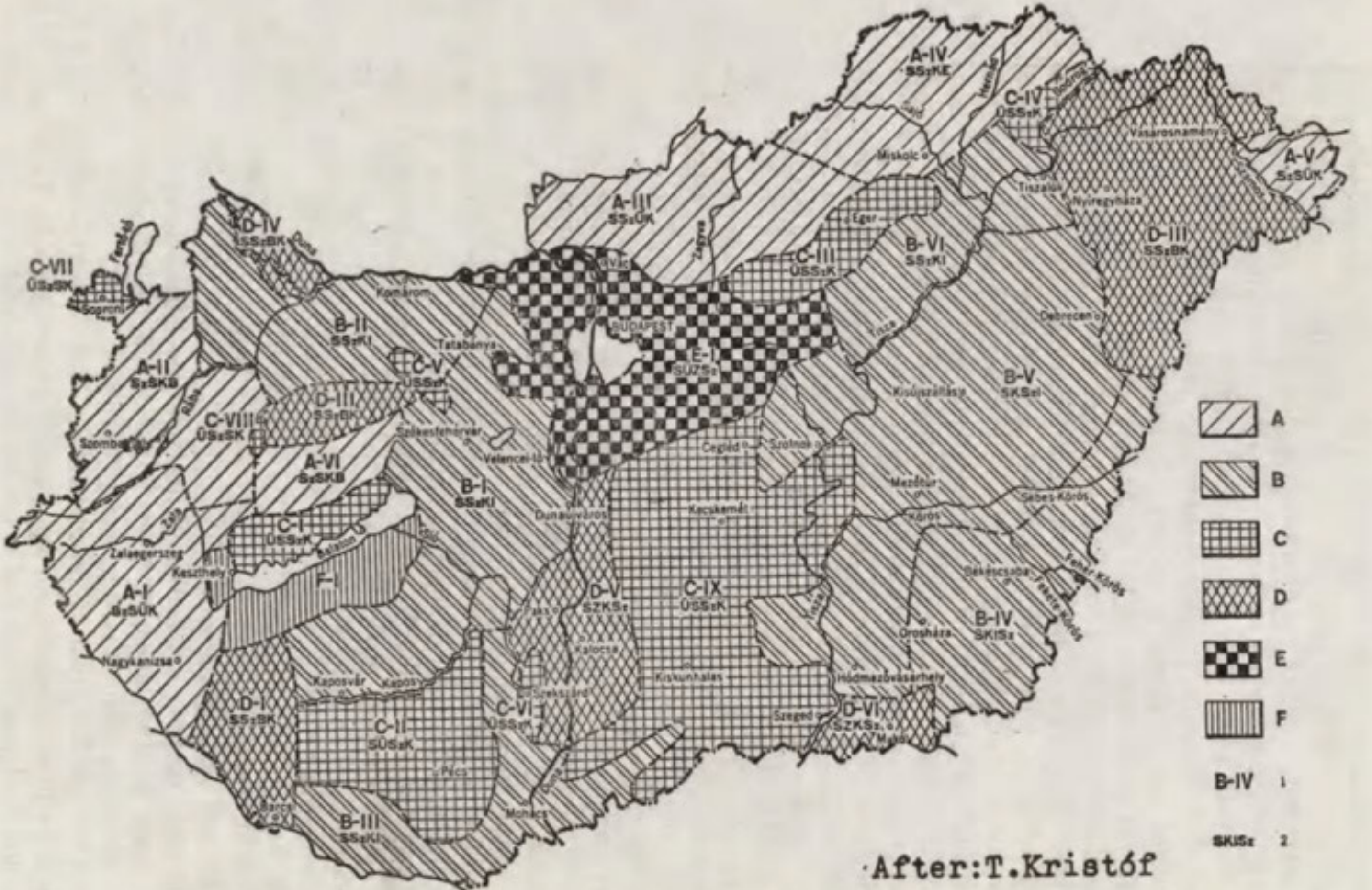

Fig. 1. Agricultural types

A — Cattle-breeding, B — Pig and poultry breeding, C — Viticulture and fruit growing, D — Potato and vegetable growing, E — Fruit, vegetable flower and viticulture, F — Mixed farming

1. Subregions (A-II, B-IV etc.) 2. Farm — combinations

S — Pig-breeding + rearing of poultry + fodder grain production, Sz — Cattle + sheep-breeding + fodder production, K — Bread crops cultivation, I — Industrial crops cultivation, B or Z — Potato production + growing of vegetables (together), Ü — Viticulture + fruit-growing, E — other plants (seed growing)

Each type may occur in separate regions of the country. These are called micro-regions of land utilization which are the divergencies within the individual types.

A) T h e t y p e o f c a t t l e-b r e e d i n g is found in six micro-regions. Its share of gross production amounts to 30—35 per cent approximately. The share of pork-breeding does not lag considerably behind this proportion. Grasslands in land utilization and rough forages in arable lands come to the fore.

B) T h e t y p e o f p o r k e r a n d p o u l t r y-b r e e d i n g characterizes six micro-regions, above all the maize production region of the Great Plain, some 55 per cent of the total country's utilized area. The share of the leading branch of gross production is between 40 and 50 per cent.

C) T h e t y p e o f v i t i c u l t u r e a n d f r u i t p r o d u c t i o n occurs in nine micro-regions. Among these eight are the so-called historical (centuries old) wine-districts. The ninth one is the viticultural and fruit producing region of the sandridge of the Danube-Tisza Interstream Area. The leading branch amounts to 40—80 per cent of gross production.

D) T h e t y p e o f p o t a t o a n d v e g e t a b l e p r o d u c t i o n characterizes six micro-regions. Potato predominates in three regions, while vegetables in the other three. The percentage of the leading branch is varying: the share of potato in gross production amounts only to 20 per cent in a micro-region of potato type. In another micro-region onion alone shows a proportion of 30 per cent.

E) T h e t y p e o f f r u i t, v e g e t a b l e, f l o w e r p r o d u c t i o n a n d v i t i c u l t u r e, i.e. horticulture, can be found in the suburban zone of Budapest with a high specialization index of 60 per cent.

BIBLIOGRAPHY

[1] L. D. Armand, The role of Soviet geographers in land recording and appraisal, *Land utilization in Eastern Europe*, *Studies in Geography in Hungary*, 1967, pp. 19—27.

[2] W. Biegajło, Polish land utilization survey in the years 1960—64, *Land utilization in Eastern Europe*, *Studies in Geography in Hungary*, 4, 1967, pp. 28—34.

[3] I. Enyedi, The "Kossuth" Collective Farm of Békéscsaba in the southern part of the Great Hungarian Plain, *Geographia Polonica*, 5 1963, pp. 407—420.

[4] G. Enyedi, *La cartographie de l'utilisation du sol de la Hongrie.* Etudes sur les Sciences Géographiques Hongroises, Budapest 1960, pp. 65—70.

[5] G. Enyedi, A brief characterization of the agricultural land utilization in Hungary, *Land utilization in Eastern Europe*, *Studies in Geography in Hungary*, 4, 1967, pp. 74—88.

[6] G. Enyedi, Die landwirtschaftliche Bodennutzung in Ungarn. *Petermanns geographische Mitteilungen*, 112. Jahrg. 2, Quartelsheft 1968, pp. 81—91.

[7] G. Enyedi, Probleme der Bodennutzung in den Gebirgs-und Hügellandschaften Ungarns, Wiss. Z. Univ. Halle, 17, 1968, M, H. 2, S. 343—351, *Mitteilungen für Agrargeographie, Landwirtschaftliche Regionalplanung und ausländische Landwirtschaft*, N. 31.

[8] J. Kostrowicki, Land utilization. Case studies: origins, aims, methods, techniques, *Geographia Polonica*, 5, 1965, pp. 7—28.

[9] J. Kostrowicki, Methods applied in elaborating the material of land utilization survey, *Land utilization in Eastern Europe, Studies in Geography in Hungary*, 4, 1967, pp. 9—18.

[10] W. Roubitschek, The regional pattern of livestock farming in the German Democratic Republic, *Land utilization in Eastern Europe. Studies in Geography in Hungary* 4, 1967, pp. 45—53.

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LAND USE STUDIES AS A BASIS OF AGRICULTURAL TYPOLOGY OF EAST-CENTRAL EUROPE

Although some land use studies in individual countries of East-Central Europe have been attempted much earlier[1], their development on a larger scale follows the 1st Land Use Conference of East-European Geographers held in Poland in 1960, during which the foundations of future collaboration were laid down[2]. One of its results was the exchange of both individual scholars and teams of research workers to carry on field work together, which has been kept going on since. The 2nd Land Use Conference in Budapest[3] strenghtened furthermore this cooperation, and the Regional Subcommission for East-Central European countries of the IGU Commission on World Land Use Survey was established there. Altogether, between 1960 and 1968 — 24 expeditions were organized[4] and over 80 units (villages, state or collective farms) in most of the countries concerned, were investigated (see Fig. 1) by the mixed teams of research workers which used the same methods and techniques of research, developed by the Polish geographers[5] on the basis of the recommendations of the IGU Commission on World Land Use Survey[6].

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[1] J. Kostrowicki, W. Tyszkiewicz, Land Use Studies in East-Central Europe, The Report of the Regional Subcommission, *Dokumentacja Geograficzna*, 1968, 3, 89 p.

[2] J. Kostrowicki (ed), *Land Utilization. Methods and Problems of Research*, Proceedings of the International Seminar. Poland 30. V. 1960. Warsaw 1962, 250 p.

[3] B. Sarfalvi (ed), *Land Utilization in Eastern Europe*, *Studies in Geography in Hungary*, 4. Budapest 1967, 88 p.

[4] See the report by J. Kostrowicki and W. Tyszkiewicz, *op. cit.*

[5] K. Dziewoński, Detailed Survey of Land Utilization in Poland, *Przegląd Geograficzny*, *28*, 1956. Suppl. pp. 26—31. J. Kostrowicki, Polish Land Utilization Survey (in): *Problems of Applied Geography*, Proceedings of the 1st Anglo-Polish Seminar. Warsaw 1961, pp. 45—56. J. Kostrowicki, The Polish Detailed Survey of Land Utilization. Methods and Techniques of Research, *Dokumentacja Geograficzna* 1964, 2, 72 p. W. Biegajło, Polish Land Utilization Survey in the Years 1960—1964 (in) B. Sarfalvi (ed), *op. cit.*, pp. 28—34.

[6] *Report of the Commission on Inventory of World Land Use.* International Geographical Union. 1956/7. N. York 1956, 67 p.

Fig. 1. Distribution of the land utilization case studies

1 — detailed survey, 2 — simplified survey

Note: in Poland only the studies made by foreign geographers are indicated

In the course of these investigations rich material was collected; a new problem aroused therefore how to use it apart of merely mapping and describing individual units. The problem was discussed in Budapest in 1964[7]. The use of the material from land use survey, as the basis for agricultural typology was suggested by the present author in his paper offered to the 19th International Geographical Congress, 1960[8]. A number of studies based on land use investigations that have been published since present the whole evolution of approach and methods, from a simple description to more and more synthetic methods of investigation[9] recommended by another IGU Commission for Agricultural Typology, and tested in these studies.

Already in 1965 a large volume appeared[10] as the first product of cooperation between the countries concerned. Some 17 case studies of 44 units (villages, collective and state farms) were published there together with two methodological articles. The last one was a preliminary attempt at a typological classification of agriculture of East-Central Europe[11].

The present paper is based largely on that article, supplemented by the results of more recent studies.

As the criteria, methods and techniques of agricultural typology have already been discussed[12], and as some results of these studies will be published elsewhere[13], the present paper is limited to discussing the differences in agricultural characteristics that could be drawn from land use sample studies, and to the resulting preliminary division of the area under study into agricultural types and regions.

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[7] J. Kostrowicki, Methods Applied in Elaborating the Material of Land Utilization Survey (in). B. Sarfalvi (ed) *op. cit.* pp. 9—18.

[8] J. Kostrowicki, Land Utilization Survey as a Basis for Geographical Typology of Agriculture, *Przegląd Geograficzny*, 32, 1960, Suppl. pp. 169—182.

[9] W. Biegajło, Gospodarka rolna na Żuławach Gdańskich. Wieś Radunica (Sum: Farming in Gdańsk Żuławy. Village Radunica). *Przegląd Geograficzny*, 31, 1959, 3—4, pp. 345—369. W. Biegajło, D. Kowalczyk, H. Piskorz, Land Utilization in Nieborów, (in) *Problems of Applied Geography* (*op. cit.* pp. 56—68). W. Biegajło, Recherches sur l'utilisation du sol dans la region de Forcalquier, commune de Banon (Basses Alpes), *Cahiers du Centre d'Etudes Mediterrannénnes.* Aix-en-Provence 1966, 1, pp. 131—171. See also individual volumes of *Dokumentacja Geograficzna*, 1959, v. 1; 1960, v. 1:, 1962, v. 6:, 1965, v. 5; 1967; v. 2/3; 1967, v. 1; and many other studies in Polish listed in J. Kostrowicki, W. Tyszkiewicz, *op. cit.*

[10] J. Kostrowicki (ed), Land Utilization in East-Central Europe. Case Studies. *Geographia Polonica*, 5, 1965, 500 p.

[11] J. Kostrowicki, An Attempt to Determine the Geographical Types of Agriculture in East-Central Europe on the Basis of Case Studies on Land Utilization (in) Land Utilization in East-Central Europe. *op. cit.* pp. 453—458.

[12] J. Kostrowicki, *Agricultural Typology. Summary of the Activities of the IGU Commission for the Years 1964—1968*, in the present volume.

[13] J. Kostrowicki, *Agricultural Types and Regions in East-Cenral Europe.* Ali Memorial Volume. Aligarh, India (in print).

Any regional geographic study will disclose that both natural conditions of the area situated between the Baltic, Black and Adriatic Seas and those of its historical past are very varied.

There is no space here to discuss those matters: it should be stated, however on the basis of investigations made to date, that differences in natural conditions in the macro-scale are reflected more by the diversification of crops cultivated than by other agricultural characteristics, which seem to depend to a greater extent on general political, social, economic, and cultural conditions in which agriculture of the area under study developed in the past and is developing now. Thus, the present pattern of agricultural characteristics seems to have been influenced more by old cultural traditions, past long-lasting division of the area concerned between various powers that occupied it, and above all by recent developments and differences in general and agricultural policies of individual countries, and to a smaller extent by peculiarities of natural conditions, which in most of cases distort only the differences caused by human factors. These problems will be elaborated further on, when individual agricultural characteristics, are discussed.

Present social characteristics of agriculture on the area under study, as compared with the prewar status are largely the results of the socio-economic system that was introduced there after the liberation from the Nazi or Fascist occupation. First of all, land reform of various extent was carried on in all of them, in result of which big landed estates; which had played an important role in some of these countries, were abolished and their land was subdivided among peasants or converted into state farms. Within a few years after the World War War II all those countries began to organize, at a different time and pace, collective farming. Consequently, in Bulgaria, Czechoslovakia, the German Democratic Republic, Rumania, and Hungary, agriculture was entirely or almost entirely collectivized, while Yugoslavia and Poland, after some unsuccessful attempts, turned back to the individual, small-scale farming. Therefore while in the first four countries agriculture is planned more or less centrally or ridgidly, but always directly, in Yugoslavia and Poland in planning agricultural production various indirect methods, such as price regulations, contract purchases etc. have been used.

These differences in the social characteristics of agriculture are one of the principal foundations of the typological differentiation in the countries concerned.

While in most of the countries of East-Central Europe large-scale, collective or state farming dominates, in Poland and Yugoslavia, these social forms of farming account for no more than 13—14 per cent of the total agricultural acreage. At the same time there are considerable differences in the size of both private and socialized land holdings in East-Central Europe, and therefore in the scale of operation, which are due less to varied natural conditions than to the past economic, social and cultural conditions.

As a result mainly of the size of villages and former landed estates in Poland, the German Democratic Republic and most of Czechoslovakia, both collective and state farms are relativaly small (200 — 1000 ha). In the Danubian countries, on the other hand, where with the exception of mountain areas, the villages have always been much larger, it was possible from the very beginning, to organize, much larger collective farms. The size of the investigated units ranges there from 1500 to 10 000 ha in Hungary and Rumania, while in Bulgaria after further consolidation they average between 4000 and 10 000 ha. At the same time the mountain areas of Rumania, where mechanization of agriculture is hardly posible, were left uncollectivized, while in Bulgaria big forestry enterprises were organized in the mountains and the former private holdings were incorporated into them as members' personal lots.

Private farms both in Poland and Yugoslavia as well as in the Czechoslovak and Rumanian mountains are small. They are larger in Northern and Western Poland (7—20 ha), smaller in Central Poland (5—10 ha), still smaller in the Carpathians (2—5 ha). In Yugoslavia larger private farms occur only in Slovenia (10—30 ha), while in the other parts of the country they are smaller, and on the Adriatic Sea Coast very small (usually below 2 ha). Mountain farms are larger but only a small percentage of their land is cultivated, most being used as rough pastures. The situation often deteriorates as a result of the fragmentation of village fields and their dispersion. In north-eastern Poland a farm of 5—10 ha has sometimes its land in 40—80 or more lots scattered throughout the whole of the village territory. Such situation contributes largely to the conservation of antiquated farming methods and techniques[14].

The differences in social characteristics of agriculture contribute much to the differentiation of both organizational-cum-technical and production characteristics.

Two major crop rotation systems developed in the past on the area under study. In the area north of the Carpathians the original three-field system that has survived only in some remote, underdeveloped areas, was gradually replaced in the 19th century by more advanced continuous four-year and longer crop rotations. The same happened in the most of Slovenia, Western Hungary and a part of Transilvania. At present, in most of the peasant farms a short three or four-year crop rotation, without fallow, is practised there, while state and collective farms usually apply longer, five-to-nine-year crop rotations envisaged by the management plans.

South of the Carpathians two-field system was originally applied in which the maize field gradually replaced the fallow land. This system is still practised

[14] W. Biegajło, *Sposoby gospodarowania w rolnictwie województwa białostockiego* (Sum.: *Ways of Farming in the Voivodship of Bialystok*), *Prace Geograficzne*, 35, Warsaw 1962, 187 p.

not only by private small-scale farms, but also by large-scale socialized farming; only some of them substitute it by that with longer rotations.

Along the Adriatic Sea Coast two-year crop rotations together with a garden-like system of crop cultivation without any rotation, are widespread. The same is true of many suburban zones of great cities specializing in market-gardening.

Despite the growing use of machinery and chemical fertilizers, horse-drawn (or oxen — in the South) implements and organic manuring still dominate in private farming on most land under investigation. On the other hand, both mechanization and chemical fertilization are much advanced in state and collective farms. Higher labour inputs and more livestock make private farming usually more intensive, which is also reflected in the higher percentage of intensive crops. The highest intensity of farming was recorded on the Adriatic Sea Coast where both annual and perennial, intensive crops occupy as much as 50—75 per cent of the total cultivated area. The differences in the labour inputs are also evidenced by the density of population actively employed in agriculture, which ranges from 10 to 20 persons per 100 hectares in the Polish state farms and socialized farming of the GDR and Czechoslovakia, 20—40 persons in collective farms of Hungary, to 40—60 persons in Rumanian and Bulgarian collectives. It varies also from 40—80[15] persons in private farming of Western and Central Poland, to over 100 persons in the Polish Carpathians and 80—120 persons on the Adriatic Sea-Coast, where the Mediterreanean system of mixed intercalary cultivation (*coltura promiscua*) of various perennial and annual crops is widespread.

The general level of agricultural development and intensity of farming as well as natural properties of land are reflected in land productivity. The highest land productivity (over 40 or even 50 grain units per hectare of agricultural land) was recorded in some of the suburban zones, where the inputs of both labour and capital are the highest. Fairly high productivity is obtained also by some well managed state or collective farms and private villages in western Poland, western Hungary, and Slovenia, where general level of agriculture is higher. In most of the units under study land productivity ranges between 20—25 GU/1 ha with the lowest figures found in the least developed north-eastern parts of Poland and in the Yugoslav mountains where considerable areas are used as little productive rough pastures.

Labour productivity reflects more closely the degree of mechanization and in a negative sense the inputs of labour. The top labour productivity is displayed by some state and collective farms of Poland, Czechoslovakia, West Hungary and Dobrogea (E. Rumania), (over 200 GU per 1 person employed),

[15] J. Kostrowicki, *Agricultural Types...*, *op. cit.*

then by collective farms in east and central Bulgaria (over 100 GU), as well as other Bulgarian and Rumanian collective farms (40—100 GU).

In individual farming the indices are usually lower and oscillate between 20—100 GU per person employed, with the highest figures to be found in the villages of Western Poland, Slovenia, and the suburban zones, and the lowest in the minute peasant farms of the Adriatic Sea-Coast and in the Polish Carpathians.

The data collected as yet are not adequate for calculation accurately the degree and level of commercialization. It is, however, obvious that in general commercialization is much higher in the large-scale, state and collective farms, where it usually is over 40 or 50 per cent of gross agricultural production, than in still largely semi-subsistence peasant farming, where it varies between 1/3 or 1/5 of gross production. Of course, in both these groups and particularly within individual farming, the degree of commercialization differs greatly, being the highest in the suburban zones and other higher level agricultures of western Poland and Slovenia, and the lowest in the underdeveloped North-Eastern corner of Poland, in the Yugoslav mountains as well as in the small farms of the densely populated Carpathian regions.

In the overwhelming majority of units under investigation crop production prevails over animal production if gross output is taken as a basis. Most frequently, crops make some 50—70 per cent of gross production, with higher values in grain farming of Moldavia and Dobrogea, as well as in some specialized market-gardening or fruit growing areas. Animal products prevail over crops only in the Yugoslav mountains and the proportion between these groups is about 50 : 50 in Slovenian, Carpathian and north eastern Polish villages. It is obvious that these proportions would have been different if final production had been taken into account. It is estimated that in that case the share of animal production would exceed crop production in about a half of examined units.

The orientation of agricultural production was defined for all investigated units by means of special techniques. The most common are the following orientations presented in the formalized way.

$V_4\,(a_2 ar + f_1 st/pt) + A_1 btl$ — food-fodder crop, apple with potatoes (and meadow hay) and similar orientation-crop with livestock; apple with potatoes and dairy cattle — in the private farms of Warsaw suburban zone.

$V_4\,(a_{2/3}\ ar,\ vv + f_{1/2}\ zm)$ — food crop, apricot-grapes, maize-in the private farms of the Belgrade suburban zone.

$V_4\,(a_{3/4}\ vv,\ vr,\ lg)$ — food crop, grape-fruit-vegetables in Izola of Istria.

$V_3\,(a_{1/2}\ lg,\ vv + p_{1/2}\ ms) + A_1\,(btl + ss)$ — crop with livestock, food-fodder-vegetable-grapes-lucerne with dairy cattle and pigs in Novi Bar on the Mediterranean Coast of Yugoslavia.

$V_3 (a_{1/2}\ tv, sc) + (p_1 st, cv, ms) + A_1 btl$ — crop with livestock, food-fodder, wheat or rye with potatoes (and clover or lucerne) and dairy cattle in state and private farms of western Poland and Slovenia.

$V_3 (a_{1/2}\ tv + p_1\ zm) + A_1 ss$ — crop with livestock, food-fodder, wheat--maize pigs breeding in the collective farms of the Danubian plains.

$V_3 (i_3 oe) + A_1 (ov)$ — crop with livestock, food-industrial crop, olive with sheep — on the slopes of the Yugoslav Adriatic Sea Coast.

$V_3 (i_3 nt) + A_1 (ov, tml)$ — crop with livestock, industrial crop, tobacco with multipurpose sheep breeding in the foothills of the Rhodope Mts, Bulgaria.

$V_2 (a_1 st + p_1 tp/pt) + A_2 btl$ — crop-livestock, food-fodder, potato-clover (meadow hay) — dairy cattle in the small farms of the Polish Carpathians.

$V_1 (p, ps) + A_3 (btm, ovt)$ — livestock with crop, beef cattle — wool sheep with pastures in Yugoslav mountains.

As neither the final set of typifying agricultural characteristics and representing them measures, nor a method of putting them together have as yet been generally accepted, the present typology is based on the following measures.

Size of farms	Land productivity
Density of man-power	Labour productivity
Crop rotation system	Degree of commercialization (not always)
Manuring	Crop combinations
Chemical fertilization	Orientation of agricultural production
Irrigation	
Principal draught power	
Degree of mechanization	

These measures were used to establish the model types with which each of the cases (units) was compared. The enclosed table (No 1) presents the account of characteristics of each of the eight types of agriculture that were distinguished in the area under investigation.

As the description of the individual types of agriculture of East-Central Europe was published elsewhere[16], only the following summary and some methodological remarks are included in the present paper.

In most of the East-Central European countries two social forms of farming, varying in many features, exist side by side in various proportions: i.e. large--scale, highly mechanized and more commercial state or collective farming, and small-scale, little or not mechanized, usually less commercial, often semi-subsistence private farming. As it has already been said, in some countries small-

[16] J. Kostrowicki, *Agricultural Types...*, *op. cit.*

-scale farming is a prevalent form (Poland and Yugoslavia) and shows a high degree of vitality, in the others it looks rather as something temporary, lagging behind the main stream of economic development (Czechoslovakia, Rumania). Small private farming represents everywhere the continuation of the types of agriculture that had been developing in the respective countries for many years and that in the last 25 years was affected by certain changes caused more or less by the absorbtion into the system of planned economy. State and collective farming on the other hand, constitutes a new element, that while adopting some local characteristics of the former large scale private farming, it has developed many properties of its own.

Since private and socialized farming, interconnected by various links, inevitably influence one another, since both types are in turn influenced by the socialist state policy in the form of direct or undirect planning, and are tied up with the socialized sector of economy which supplies them with virtually all means of production and purchases most of their output, the question arises whether we are dealing here with two distinct social systems and types of farming, or with only one of dual, symbiotic character, of the kind known from elsewhere, such as feudal, manor-peasant system of Medieval Europe, or hacienda-tenant system of Latin America. The answer to this question seems to depend also on the level of study, whether we are studying the world types of agriculture on the basis of aggregate units or types of farms with an individual land holding as basic unit as well as on the opinion as to the durability of the present system.

The author has no intention to give the final answer to this question. As the present typology is based on the study of individual cases, small-scale private farming is treated separately from the large-scale, socialized farming. The first one was divided into five types and the second into three types of agriculture.

Central European Small Scale Individual Farming in its more or less peripheral form is characteristics for most of Poland and some uncollectivized farming of East Germany and Czechoslovakia. It is characterized by small, and in the Carpathians very small, farms operated by their owners living in small, mostly nucleated settlements (villages). The mechanization of labour is low, increasing to the west. Despite the recent growth in chemical fertilization, organic manuring together with a short 3—4 year crop rotation still play a dominant role in maintaining soil fertility. In crop combination there is fairly high proportion of cereals among which, depending on soil conditions, either rye or wheat and less frequently oats and barley prevail.

Among the intensive crops, the proportion of which varies greatly, potatoes on poorer and sugar beets on better soils dominate. The share of structure-forming crops is fairly high, with clover on heavier soils and serradella or lupine on sandy soils dominating. Because of high population pressure per-

TABLE 1. CHARACTERISTIC MEASURES OF AGRICULTURAL TYPES OF EAST-CENTRAL EUROPE

Characteristics	Small Scale Private					Large-Scale, Socialized		
	Central European	Danubian	Dinaric	Mediterranean	Suburban	Central European	Danubian	Thracian
	2 2 3	2	1/3	1 1 2	1 2 2	5	5	5
Size of farms in hectares	2—15 ha	2—10 ha	small cultivated large pastures	0.5—3 ha	small	200—1000	1500—10.000	2000—6000
	3,4,5	4,5		5	4	2	2 2 3	3
Density of man-power per 100 ha agricultural land	20—100	50—100	.	100—150	40—80	10—20	20—60	25—35
Crop rotation	short 3—4 year	2 year	2 year or none	2 year or none	none or special	long	2 year or longer	2 year or longer
Manuring. Big animal units/100 ha	60—100	70—90	30	80—120	40—60	40—80	50—80	.
	3,4	3,4	2	4	3	3	3	
Chemical fertilization	low to medium	low	absent to low	absent to low	medium to high	high	medium	.
Irrigation	no	sporadic	no	common	sporadic	no	sporadic	over 30 per cent of land
Draught power	horse	oxen	oxen, cows	oxen, cows	vary	tractor	tractor	tractor
Mechanization	absent to low	absent to low	absent	absent to low	low	high	medium to high	medium to high
Arable land per cent of agricultural land	70—90	70—90	less than 30	around 30	50—90	60—80	70—90	50—80
Perennial crops as above	negligible	about 10	negligible	20—60	low to high	negligible	5—15	5—25
Permanent grassland as above	10—30	less than 10	over 60	intercultivated around 30	low	20—40	less than 15	15—25
Extractive crops in per cent of cropland	40—70	30—50	30—40	5—20	10—30	30—50	30—50	.

Intensifying crops as above	10—50	30—50	30—40	50—80	50—60	15—30	30—50	.
Structure - forming crops as above	10—25	5—15	0—10	20—50	10—30	15—30	10—30	.
Land productivity in grain units per 1 ha of agricultural land	25—50 223	25—40 2	5—15 1	30—50 23	30—55 23	20—50 223	25—50 223	20—40 2
Labour productivity in grain units per 1 employed	20—100 1,22	20—100 122	20—50 1	25—50 1	medium	200—500 344	40—400 234	100—150 3
Degree of commerciali-zation per cent of gross produciton	low to medium	low to medium	low	medium to high	high	40—60 per cent	over 40 per cent	60—85 per cent
Crop production per cent of gross production	50—80	60—80	40—60	50—90	50—85	60—80	60—90	60—80
food crops per cent of crop production	20—40	30—60	20—40	around 30	40—80	20—40	30—60	40—60
fodder crops as above	30—60	40—70	50—70	25—40	10—20	20—60	40—60	30—60
industrial crops as above	0—20	0—10	negligible	around 30	negligible	5—30	5—20	15—30
Animal production per cent of gross production	20—50 223	20—40 2	40—60 3	10—50 123	15—50 1223	20—40 2	10—40 122	20—40 2
milk per cent of animal production	40—60	20—40	30—50	25—60	vary	20—50	20—40	20—40
meat as above	30—60	40—80	30—50	40—60	vary	30—60	50—80	40—60
wool as above	negligible	negligible	10—30	10—20	none	up to 10	up to 15	10—20

Fig. 2. Types of agriculture of East-Central Europe

A. Private farming

1 — Central European: a — Western subtype, b — Eastern subtype, c — Mountain subtype, 2 — Danubian, 3 — Dynaric, 4 — Mediterranean, 5 — Suburban

B. Socialized farming

1 — Central European, 2 — Danubian, 3 — Thracian

manent grassland is limited to land which, for various reasons, is not fit for cultivation, mainly to river valleys. In livestock production milk is more important than meat, the first highly dominating in the mountains. Most of meat is provided by pigs fed on potatoes. Land productivity is low or medium, increasing to the west, labour productivity — low, the degree of commercialization low or medium.

At least three subtypes can be distinguished within this type of agriculture: 1) more productive, more efficient and commercial West Polish lowland subtype, with a tendency of expansion towards the east, 2) the East Polish lowland subtype, gradually shrinking, differing from the first subtype mostly in the stage or degree of development, 3) mountain subtype differing in many respects from both lowland subtypes, characteristic not only of the Polish Carpathians, but perhaps also of non-collectivized mountain farms of Czechoslovakia as well as of the subalpine Slovenian farms which, astonishingly enough, reveal most of typifying properties closely corresponding with those of the Carpathians. It is assumed that also non-collectivized farms of Transilvania and Southern Bukovina could be included in this type. High intensity of labour and prevalence of livestock production over crop production, very low labour productivity and low commercialization are characteristic features of this sub--type of agriculture.

P a n n o n i a n or D a n u b i a n agriculture in its unaltered form has survived only in northern Yugoslavia. Small family farms assembled in large villages are characteristic examples of this type.. Two year crop rotation is dominant, the mechanization of farming is very low or absent. Among draught animals oxen rather than horses play an important role. Soil fertilization both with organic manure and chemicals is low but in view of high natural fertility of soils—often sufficient. Arable land highly dominates, permanent grassland being limited mainly to hills. The share of extractive crops is lower than in the north, with a marked prevalence of wheat; the share of intensive crops is higher, with dominant maize, often intercultivated with beans and pumpkins. Sun-flowers and gourds play an important role. The share of structure-forming crops is very low with, lucerne dominating. On the other hand, perennial crops are more important and in some specialized areas of fruit or vine growing very important — the typological position of the latter being still unclear.

Crop production exceeds livestock production; in the latter; meat provided mostly by pigs breeding (with maize as the main feed) is a dominant element. Land productivity is medium, labour productivity low, the degree of commercialization low to medium. Insufficient material does not allow the researcher to draw any conculusions as to the sub-types within this type of agriculture.

D i n a r i c A g r i c u l t u r e. Due to a much larger extension of grazing land and also to other reasons, farming in the Yugoslav mountains seems to differ more from that of the surrounding lowlands, that differs, from lowland agriculture of the Carpathian or Sudeten mountain farming, concentrated mainly in the basins or river vallyes, while mountains are heavily forested. The farms are very small, as arable land is concerned, assembled in small or medium-size villages, surrounded by large areas of common rough pastures. Summer pastures belonging to the villages are often situated far away from the village itself and are grazed in the way derived from the old transhumance system. Oxen or cows constitute the main draught power, while mules and asses are used for transportion. For lack of mechanization and "machinization" and, high inputs of labour, labour intensity in the use of cultivated land is very high, while pastures are used very extensively. Consequently land productivity of cultivated land is medium to high, labour productivity low to very low, the degree of commercialization low. Livestock production with meat (beef and mutton), and wool dominates over crop production (wheat, barley, rye, potatoes, vegetables), which is usually obtained with similar crop rotation systems as those of Danubian agriculture. Due to climatic conditions the role of permanent crops is much reduced. As only few case studies were made of this type of agriculture formerly classified as a subtype of Danubian agriculture[17], these characteristics should be treated as provisional ones.

Mediterranean Agriculture is limited to the narrow strip of the Yugoslav Adriatic Sea Coast. It is characterized by the extreme subdivision of land. The proportion between arables, perennial crops and permanent grassland is almost equal. Arables and perennial crops are very intensively cultivated, with a high input of labour and little, if any, mechanization, which in small farms and with the prevailing system of intercultivation of perennial and annual crops would hardly be possible. As in the previous type certain animals are used as draught power (oxen, cows) and other for transportation (horses, mules, asses). A large number of livestock grazed in summer on neighbouring hilly or mountain pastures allows for abundant manuring, making crop rotation irrelevant, often substitued by some kind of a garden-like system. There is a pronounced prevalence of intensive crops with maize, vegetables and gourds; structure-forming crops, mostly lucerne, used for feeding animals in winter time, play an important role, the role of extractive crops with wheat dominating is lesser. The share of perennial crops is fairly high or high; they are cultivated either in a system of intercropping or as uniform (olive, citrus trees) groves or vineyards. In such a situation crop production clearly dominates over livestock production. Meat constitutes its bulk, with milk and wool lagging behind. Land productivity is either medium or high, labour productivity medium to low, the degree of commercialization medium to high.

What remains open is a position of suburban agriculture characterized by high labour and capital intensity, high fertlization and moderate

[17] J. Kostrowicki, *Agricultural Types...*, *op. cit.*

Fig. 3. Agricultural regions of East-Central Europe

mechanization, the garden-like system of cultivation with litte care paid to the crop rotation, with a high land and labour productivity, a high degree of commercialization and specialization, with the dominant role of crop production in general and market gardening and/or fruit growing in particular. This suburban agriculture often differs less between some distant areas, such as for instance Warsaw and Belgrade suburban zones, than from their neighbouring areas. Some specialized areas of market gardening or fruit growing, not connected with any single urban market, show much correspondence with this type of agriculture.

The differences between socialized large-scale agricultures are far less and more depending on policies of individual governments than on local conditions.

At least three distinct types of socialized farming could be singled out here. The first one, which has developed from landed estates or villages of the eastern part of Central Europe, is characterized by a relatively small scale (200—1000 ha), higher level of mechanization and chemical fertilization, and varying but longer crop rotations than in the case of both the other types of socialized farming and neighbouring private farms. It differs also from the latter by a higher degree of specialization, more emphasis placed on less labour absorbing crops (both cereals and leguminous), but higher proportion of industrial crops. Livestock production is more meat oriented with cattle rather than pig breeding prevailing. Land productivity is usually lower or the same, labour productivity and commercialization is much higher than in neighbouring private farms.

The second type, developed from the Danubian agriculture, is characterized by much larger farms, a lower level of mechanization and fertilization, and two-year crop rotations still dominating over more advanced longer rotations. Arable land highly dominates with new, big, uniform orchards and vineyards often planted there. Apart from prevailing wheat and maize, the importance of both industrial crops such as sunflower, oil-flax, as well as lucerne is increasing. While dairy and beef cattle is bred everywhere, pig breeding prevails over cattle, with sheep grazed on dry pastures in the third place. Generally, crop production highly dominates over livestock production. Land productivity is more or less the same as in the north, labour productivity is lower and the degree of commercialization is more or less the same.

The third type which has been investigated only recently, and because of that not all the characterizing figures could be quoted here is occurring in the Thracian Basin of Bulgaria. This is a more intensive, mostly irrigated agriculture, with higher productivity on cultivated land, lower labour productivity, and a high degree of commercialization. Large collective farms of that area specialize in various vegetables and gourds, such as tomatoes, melons, sweet and hot paprika, fruits, and even peanuts or rice grown on irrigated land, with a number of additional cash crops such as grape-vines, cotton, tobacco, but also lavender, anise, etc. grown on non-irrigated land. Livestock breeding plays a secondary role.

Some state and collective farms specializing in similar products, but located elsewhere might also be included in this type.

Through the generalization of this more complicated typological pattern we may easily proceed to a simpler image of the regional pattern.

Going from the north to the south the seven following agricultural regions were distinguished in East-Central Europe.

1. The North Eastern Region, covering primarily Poland, is characterized by dominant small-scale individual farming of the Central European type with some socialized farms.

2. The North Western Region, consisting of East Germany. Bohemia, Moravia and most of Slovakia plus western margins of Hungary, is characterized by the dominance of socialized agriculture derived also from the Central European type.

3. The largest, South Eastern region contains most of Hungary, Rumania and Northern Bulgaria, as well as southern Slovakia, with dominating socialized agriculture derived from the Danubian agriculture.

4. The Thracian Region, with highly intensive and specialized irrigated agriculture.

5. The North Eastern Yugoslavia region (Northern Serbia, Northern Croatia and Eastern Slovenia), of a mixed private-socialized farming of the Danubian type.

6. The Yugoslav mountain region with the dominance of individual farming of the Dinaric type.

7. The Adriatic Sea Coast Region, with Mediterranean agriculture.

Of course, in the present state of our work, neither the order of these types of agriculture in relation of the world types could be defined, nor their limits precisely drawn. This would call for establishing the typology of world's agriculture, more accurate methods and techniques adopted, and more material collected.

These are precisely our goals for the nearest future.

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LAND UTILIZATION AND TYPES OF FARMING

An article by I. P. Gerasimov[1] published in 1958, pointed out that studies on land utilization may have two distinct objects: the first one is to describe the situation as it is at a certain moment; the second one is to find out the areas available for future utilization.

The study of the situation as it is presents certain problems. It is necessary to determine the meaning of the stipulation "as it is", as it would be rather useless to survey such situation if agricultural methods applied at present or these which may presumably be applied in future are left aside. The cartography of the future possibilities of land use depends on too many unknown factors; it is not possible therefore to carry out such work having no certainty of it proving useful. In general, even on the smallest plots of land agriculture can be practised provided that there is sufficient rainfall or irrigation is available. Glass houses and hydroponic cultivations may be quoted as the furthermost limits of these possibilities. Even non-agricultural land, which is rare, can often be improved by proper techniques; only when salts are present in such quantities as to annihilate every effort at improvement, or when the area is covered with rocks or when altitude or geographical latitude make useful vegetation unobtainable, land is practically useless. However, it cannot be excluded that technology, pedology, chemistry and genetics may reduce the number of such cases even more in the near future.

Therefore, if at present certain land cannot be reclaimed because of the costs, this may change in the future. Desalinization is becoming cheaper and cheaper, and it probably will not be long before sea water is economically utilized for land irrigation. When this goal is reached, it will be easy to carry water on long distances by means of pipelines in order to prevent evaporation,

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[1] I. P. Gerasimov, The Geographical Study of Agricultural Land Use, *The Geographical Journal*, 124, 1958, pp. 452—463

and to make it economical to utilize land which now, to the most elementary common sense would remain unusable.

It is obvious that when the prospects for utilization, that is the productive potential of land, change rapidly, it is very useful to know the areas which can be utilized at certain moment according to the techniques then employed.

But the character of potential utilization from the agricultural viewpoint makes it necessary to solve certain difficult and complex problems. Often it is not enough to know whether soil, rainfall and temperature favour land utilization, and a detailed analysis must be made how to find water and materials for land improvement. It is also necessary to carry out land reclamation and irrigation works at a cost which can be borne by agricultural production and which is reasonable in relation to the prices of individual products. In other words, plans are needed which can actually be realized, and not abstract and general ones, which detailed studies would prove unrealistic. Plans available at present cover areas very small in proportion to vast spaces still unexploited.

In spite of these reservations, maps on a small scale and therefore generalized, may be valuable, as they show, in a general way, the possibilities of land use in the future and cover areas where some elements are sufficiently known.

Such are the maps of some countries of Central America[2] recently drawn by the F.A.O. These maps are not to be taken literally because a more detailed analysis could show a different situation in comparison with broad generalizations. If, however, a detailed representation is required, instead of a generic one on a small scale, it is necessary to carry out properly planned projects with an integrated series of pedologic, climatic, agronomic, economic and environmental studies. These studies require generally the co-operation of several experts, but agronomists and hydraulic engineers play the major part.

As the field of the study on future land utilization is limited in the ways indicated above, the analysis of the present situation is the object of such a study which allows for looking at the elements common to a great number of research studies carried out, mostly in individual countries and in selected areas.

The study of "land utilization" is concerned with the type of use which man carries out over a certain area at a certain time or nonutilization of an area on account of its particular nature or the presence of unfavourable environmental conditions. The so-called land utilization may involve the gathering of natural products, or livestock breeding on rough grazing land, or proper agriculture. In other cases utilization may consist of the extraction of useful

[2] Food and Agricultural Organization, *Uso potencial de la tierra*, Informe a los Gobiernos de Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama — Roma, 1967—1968.

minerals, construction of buildings for various uses, provision of services and roads, and recreation for tourist purposes. Other areas, such as deserts, rocks, gravelly soils, gravel-beds, water streams are not utilized at all because of their nature, or because man has not yet thought it necessary to utilize them otherwise than in their natural state. This happens with virgin forests, jungles, savannas, steppes and areas covered by more or less aboundant natural vegetation.

Land utilization is a fundamental element for the knowledge of a region; it supplies its main features and gives a synoptic view of the technical and economic aspects. However, it has been said that utilization must cover a certain area and include an environmental study at a certain time, so that it would be possible to represent what is seen on the soil at that period of study. The ideal condition therefore, though it would be difficult to realize it, is to portray the situation at a certain moment without enlarging it as a more comprehensive research study would demand.

A census would be an almost ideal procedure because it is made in a well--defined and rather short period of time. However, this procedure is still not ideal because it is necessary to know not only that a specific crop is grown at a certain time; in fact, the crop may grow in a period of the year when vegetation cycles are short, but what interests us more is crop rotation, that is the series of utilizations which belong to the same cultivation cycle. When arable land is mentioned it implies that on this area various crops, pastures and fallows may alternate in a more or less regular rotations which, however exist and are practised according to some more or less developed and rational agricultural rules. These rules generally aim at a use of different soil layers one after another, or at utilizing existent fertility or at restoring it, though modern techniques make it less urgent. In fact, at present it is possible to restore depleted soil through abundant and frequent application of fertilizers.

When the technical knowledge is widespread it is possible to apply no strict rules of rotations, but a certain crop rotation must always take place, though not so strictly as in the past. If the technique of applying fertilizers may in certain cases make it unnecessary to follow the rotation system, other factors of an economic character often lead to the alternation of crops in order to reduce the risk of monoculture and to pay due regard to the markets.

When we speak of arable land, we generally mean that the land utilization implies a crop rotation of root or industrial crops followed by cereals or temporary pastures; or less intensive and complex rotations like cereals-fallow; or the rotation applied in primitive countries such as the alternation of the forest and crop. In this case primitiveness is not an economic factor but it rather concerns the technical procedures which can be applied in countries sparsely inhabited, with little infrastructure.

Rice is a particular case; it should be considered as a cereal in rotation if it is alternated with other crops. It has to be considered as rice fields if one rice crop is always followed by another. For rice fields we often need tremendous works such as canal construction, diking, storage and draining of water which may, however remain unutilized on the fields for some years till rice is grown again. This does not eliminate growing of other crops after rice for longer periods of time, such as three years out of four, or two years out of three.

Apart from these investments, which are partially unused, in that case it would not be possible to call land a rice field if the crop is grown only for one-fourth or one third of the time; it is only arable land on which rice can be grown. On the contrary, the rice field which is permanent, and in certain countries rice is grown on the same land more than once a year, can be considered as a separate category of land utilization, not only because of this feature but also because the investments are fully utilized for rice cultivation, and rice is undoubtedly one of those crops which gives the highest yield of calories per hectare.

It is not absolutely essential to distinguish a permanent rice field, but every analysis should aim at giving the highest number of details within the classification based on logical foundations and concepts, which can be generalized, and from this point of view to classify the permanent rice field separately seems quite right.

Crops with a long life cycle may also be included in the category of arable land, as well as various kinds of pastures, which in certain environments may last for two or three years and on fertile deep land particularly suitable to the grown species often much longer, even seven or eight years.

This also happens in case of certain leguminous crops such as lucerne, where symbiotic bacteriae find particularly favourable conditions of life. This does not eliminate the growing of other crops after the pasture, and it would be wrong to ignore the fact that this is a part of a rotation and that crops could not be grown on the same land indefinitely.

Rotation pastures may be constituted by crops which remain on the land for few months only, or by crops which remain for years, but their distinctive feature is their participation in rotation; it is therefore not only possible but necessary to include them in the arable land category.

There are also permanent meadows and grassland which should be differentiated from temporary pastures because the latter are meant to be rotation crops, at least in the farmers' opinion. As in other cases which will be examined later on, a problem arises as to the meaning of the word "permanent", because meadows and permanent grassland may have a limited life, even if it is generally a long or very long period of time.

The following criteria seem to be the most appropriate for their differentiation. They are either created by man or are fertilized and improved by him, and in certain countries they are mown in order to get hay, and above all, the most important feature is that the areas are permanently devoted to this way of production which may last for years and even centuries.

Of course, it is hardly possible to know what will happen in the future; therefore uninterrupted utilization is purely hypothetical and could be altered by the farmers, by economic and social situation in the given environment. In spite of this the nature of land, its position, its exposure, the character of local agriculture may lead us to consider it reasonable to expect that this utilization will be continued.

This form of utilization is called "meadows and permanent grassland" by the English, *pres* by the French, *prati* and *prati-pascoli* by the Italians and *praderas* by the Spaniards.

Another category, although not so important for production but undoubtedly of a much greater range and exceptional importance, is rough grazing land. It is natural in origin and often utilized as such by man because soil characteristics, the altitude, the climate and other conditions of the environment do not permit it to be utilized in any other way. It cannot be excluded that in some cases rough grazing land has been created by human activity; this, however, happens always in poor regions with low production, and we can generally exclude any possibility of hay being mown there. Land in this category may provide mosses and lichens, which allow the reindeer to live. The upper slopes of mountains are also included here; the unending Asiatic and African grasslands where nomadic populations live, and the grazing land of America and Australia, which is often more productive, even if only on a modest scale. What is important is that such land is considered permanent grazing even if notion of permanence is the same as when referring to meadows and could be summed up in the phrase "maintaining the *status quo*". We often have at our disposal, a map which makes no distinction between pastures in rotation, meadows and grazing land. This creates such confusion that we cannot perceive the situation in a precise way. There appears to be no collaboration among geographers, economists, and agronomists in this respect. It is therefore to be hoped that mutual discussion among these groups can take place whenever problems of this type have to be faced. Common rules must be adopted if we want to speak a common language and understand each other without any ambiguity.

The World Atlas of Agriculture, now in print, has been dedicated to the purpose of cataloguing and distinguishing the various types of land utilization with complete awareness of not insignificant difficulties created by traditional technical nomenclature, completely different and even contradictory from country to country.

Another point deserving particular consideration is that of fruit trees, bushes, trees producing fibre and spices, and similar. All of them are characterized by long life cycles and by being grown on areas excluded from crop rotation. There is no doubt that such trees must be included in one or other category and that is the same problem as with meadows. Can these cultivations be considered permanent? Their cycle can last from about 10—12 years to several decades or even hundreds of years, as in the case of the olive tree. But it is not possible to make subtle detailed distinctions: the problem consists in the decision whether to treat such cultivations as permanent; the only possible solution can be the one that has already been adopted for meadows, that is, we must make an assumption that these cultivations will be replaced inside the farm as they are at present, in view of the length of their biological cycle.

It remains to be seen whether such plants may not in fact be renewed or cut down prematurely. At present we can classify as permanent only such cultivations, even if this depends on decisions of man, influenced by continually changing technical procedures and by consumers' demand.

Mixed cultivation of trees and bushes which occurs in certain countries, seem to present a particular problem. For example, the vine and other crops mixed with arable land in Italy, or the oil palm mixed with herbaceous crops or with natural vegetation in many African countries. In my opinion, the classification of such areas as the cultivation of trees can only depend on economic criteria, because it is the density of the plants and their yield compared with that of the *undergrowth* which can furnish adequate criteria of differentiation.

Then, for every category of soil utilization, there arise a problem concerning the cartographical presentation of areas smaller than the accepted limit, what makes impossible to see them on maps. This fact would be of little importance if it concerned limited or marginal cases. Often however, it concerns myriads of cases which cumulatively represent an appreciable percentage of the total area. In such cases these are probably only three possible solutions. The first one is to eliminate those units of area which are less than a certain size and to accept the inconvenience of presenting a situation which is different from the real one, as the total sum of these units can make an important percentage of the total. The second solution is to create some well-defined mixed categories which would represent these cases. The more uniform these mixed categories are in their composition, the more closely their representation will correspond with reality.

The third solution is group the units which cannot be represented through different procedures. I think that the first solution is too far from reality, and that we can use the other two solutions, according to the circumstances. In fact, when we have to represent non-agricultural land such as roads, built — up areas, water courses, to present them some characteristic symbols seems to be particularly convenient; similarly we can adopt the same procedure when we have to represent small areas which change continually their patterns at short intervals of time, as it happens with shifting cultivation.

Some prefer the method of alternating strips which constitute precise but rarely aesthetic representation in cartography. If we have to take into consideration the wishes of the observer it can be said that the method of the strips does not meet these requirements. In this case, it is better to represent the universe according to its geographical configuration; the sum of a certain percentage of phenomena will be represented by geometric symbols (squares, bars, or circles) and in the interior of such figures their distribution can be marked with clearly visible methods. Such are the sectors of a circle when percentage representations are required; or "organ pipes" to represent other types of phenomena. But in this case we can no longer speak of maps but only of statistical cartograms.

Finally, I should add that in the representation of land use it is necessary to reduce the number of signs as much as possible, because complexity hinders visibility and makes it difficult or impossible to see closely the situation.

At this point the problem of colours to mark the different categories of land use should be raised. Attempts have been made to unify the colouring in the hope of producing easily comparable maps, but the comparison can be possible only by examining the methods of representation and all those agronomic and geographic *particularities*, if we may call them so, which mark the limits and meaning of the representations. The colour is of little importance, and I am of the opinion that it must be adapted, at each particular case, to the necessities of the inquiry and representation. Everything depends on the number of simple and mixed categories, which have to be represented, and on the size of the smaller units which have to be shown.

The map of land use aims at a clear representation of phenomena, and those who prepare the map have to be instructed accordingly.

It does not seem necessary to assign to each category of land utilization a defined, invariable colour; as far as possible, the map must be a faithful representation of reality, but it must also satisfy aesthetic requirements to be read more easily, and therefore become more useful. The rules of representation generally applied seem to be not very useful: on the contrary, the way of collecting and analyzing statistical and geographical elements, fundamental for such inquiries, should be studied more carefully and standardized. Of course, these methods cannot be imposed but the research supervisors have to realize that it is necessary to conform to certain patterns which have proved to be most useful for the purposes that are being pursued. And, at the same time they make it possible for such data to be more extensively used, even for comparisons which are beyond the boundaries of a single country.

A few more remarks related to the so called "types of farming" can be added to those on land utilization and its representation. This concept of types of farming is well known by agricultural economists and agronomists, and it is very important for understanding of the agricultural situation. The "types of farming", according to the English, means the type of farm organization as indicated by its results, that is, on the base of the production obtained.

Obviously land utilization and types of farming are connected problems, but we can here hardly speak of the correlation in a statistical sense. In fact land utilization refers to the area while the types of farming concern the economic importance of products obtained, that is the final result of land and agricultural structures and of the characteristics of the ownership[3].

The United States is a country where the research concerning the types of farming has been pursued most actively and where the widest experience has been gained. In fact for fifty years, statistical research has been directed in such a way as to elucidate the elements necessary to satisfy the requirement of knowledge. The purposes of this research are many, if we remember that the organization of production is carried out on the farm which is the elementary organism, where agriculture develops and where the farm family lives. A type of farming classification, as Bonuzzi notices, takes into account the plans of farm production, the regional localization of the types of production, the characteristics of the agricultural products, important and fundamental aspects of the structure, and its connection with the physical and social environment. In fact, relations can be found even with types of farms which, together with land utilization, represent the most important aspect of the agricultural economy, conditioned by them often in a decisive way.

Knowledge of the types of farming is as important and useful as that of land utilization, but unfortunately, in most cases this aspect has not been analyzed, though in some countries where censuses have been taken recently, remarkable progress has been made in order to broaden the scope of research in question, using the most recent census data. Thus if statistical elements concerning farms specifically are not available, the representation of the types of farming cannot be made. Nevertheless, statistics at a regional level can be sufficient to estimate production, which allows for fairly precise economic classification. The possibility exists if adequate statistical data for production per administrative unit are availabe, but this unit must be sufficiently limited in size.

According to his experience, gained in the course of the compilation of the *World Atlas of Agriculture,* Bonuzzi points out that it is necessary to make a preliminary choice between two different methods: either to represent the prevailing type of farm organization in certain area, and to neglect all others, or to adopt such a representation form which besides this predominant type points to the existence of others according to well defined rules.

The classification of these types is never an easy task but the less variety

[3] Vittorio Bonuzzi La rappresentazioni dei tipi di agricultura (The Represention of the Types of Farming), *Rivista di agricultura subtropicale e tropicale*, II. 7—9, Luglio-Settembre 967.

the easier it is. We must not forget, however, that a simple and intelligible cartography is always to be preferred, even if limited in its representation, to a detailed one which is made too complicated by the use of more elements.

It is therefore necessary to make classifications as simple as possible: following this principle, in the United States in 1959, the types of farming were reduced to only 14 categories, giving a striking example of a very restricted synthesis.

We have to ask ourselves whether in the estimation of the value of production, which is the result of the operation of the farm, we should not take into account the destination of production distinguishing subsistence agriculture from commercial agriculture. Other activities of farms "sui generis" must be added also, such as harvesting natural products or using rough grazing land, even if temporarily.

It seems that there are no serious objections to introducing these activities in the classification of the types of farming whenever they present themselves in reality in such a proportion as to be accepted in the rule of representation.

The difficulty does not lie only in solving the problem for a certain environment or country, but in finding schemes which can be applied to a large number of situations and which allow us to make comparisons on a large scale between different economies. The variety of farm situations is immense. It ranges from the typical farm under fruit-trees and herbaceous crops to the precarious holding operated by nomadic shepherds; from the collector of caoutchouc of the Amazonian hylea, to the extensive Australian livestock farm, to the poultry farm of Manhattan, New York, to the farm under hydroponic crops.

We have to find a common denominator and to make a synthesis which allows us to notice the major features, eliminating what is not essential and reducing the categories of the types of farming as greatly as possible. The concrete examples of such a synthesis do not go beyond a few cases. Even in the countries in which research of this kind are made, we find that they follow completely different ways.

Such investigations often enter into vague details which is obstructive to an all-embracing view indispensable in order to obtain first, elementary, concrete results from these enquiries. This must be a descriptive result.

The World Atlas of Agriculture has allowed us to gain broad experience, because the types of farming have been studied in every country and we have tried, as much as possible, to standardize the methods used by different authors. However, synthesis and standardization on a world scale have not yet been achieved. This will need more time, co-operation of many experts, and agreement on the part of the statistical organizations of individual states. While waiting for these notions to be put together and for the research to be carried out in a standardized way it may be helpful to repeat that the purpose of a types of farming classification is to represent the productive organization of the farms, taking account of the composition of the value of their production and the destination of that production. If this concept is accepted, the work of synthesis might be realized and numerous discussions might also begin on the types of farming.

The types of enterprise, that is the system of land tenure is another subject which deserves a careful consideration of the cartographer. But there is such a variety of types that simple representations are not possible. In this sector the example of Italy remains unique[4].

This refers to facts which should deserve greater attention from statisticians because they are the consequence of land utilization, types of farming and other historical and social circumstances. It is further known that these types of enterprise are so often mixed and spread out over such a limited area that cartographic representation is useless or extremely complex. Nevertheless efforts must be made even in this field. If it were possible to standardize methods when the agricultural censuses are taken, it would be possible to contemplate the representation of even the types of enterprise. This, of course, would necessitate the solution of many methodological problems.

The subject is perhaps not yet mature, in contrast with land use and the types of farming, which can already be represented successfully. A greater coordination of the method of surveying and interpretation of the data which are fundamental to the research is all that is necessary. All this can be achieved only through an active co-operation of the experts in different sectors. In this field, as elsewhere, one can only hope for greater scientific co-operation at all levels, for meeting of specialists, exchanges of cartographic material, publications on the subject, and research in common. Why not to ask for free exchange of scientific publications among different countries without custom barriers which make it slow and often expensive?

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[4] Istituto Nazionale di Economia Agraria, *Carta dei tipi di impresa nell' agricoltura italiana* (Map of types of enterprise in Italian Agriculture), Rome, 1958.

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