THE CHANGING FACE OF THE GREAT HUNGARIAN PLAIN

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AKADÉMIAI KIADÓ, BUDAPEST

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OF THE GREAT
HUNGARIAN PLAIN

Studies in Geography in Hungary, 9

Representing No. 9 of the series "Studies in Geography in Hungary", this book differs somewhat thematically from the previous ones in so far as it has been confined to the geographical survey of the eastern part of the country which — owing to diverse natural endowments and a different history — has been lagging behind the western part as regards economic standards.

The papers included have been meant to contribute to the foundation of a long-term program of nivellization. Therefore particular emphasis has been laid on the utilization aspects of the traditional energy sources, as well as of the newly exposed hydrocarbon deposits. Parallel importance has been attributed to such key-questions of rural development as are connected with the changing structure of land-utilization, the improvement of the forage basis, the allocation of new food-industrial plants, etc. The process of transformation of the typical Great-Plain towns, the so-called *tanya*-towns, has also been discussed in the volume. Far from providing an overall approach to the developmental problems, the studies here published reveal with a vivid approach the new role played by the Great Hungarian Plain in the regional division of labour in the country.

1828

AKADÉMIAI KIADÓ

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STUDIES IN GEOGRAPHY IN HUNGARY, 9

Geographical Research Institute, Hungarian Academy of Sciences, Budapest

THE CHANGING FACE OF THE GREAT HUNGARIAN PLAIN

Edited by
BÉLA SÁRFALVI

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FOREWORD

Compared with other landscapes of Hungary, the Great Plain is an underdeveloped area. Its relative backwardness is due partly to physical conditions and partly to various historical, economic and social factors.

In the period of the Great Conquest the Hungarians were attracted in greater numbers to the Transdanubian areas, the one-time Roman province of Pannonia with its agricultural traditions than to the Great Plain where vast sandy regions and grasslands, afflicted by droughts in summer, and flood areas that became sea-like swamps in spring, could support only a very small number of pastoral nomads. The disparity between the two areas was somewhat reduced in the fifteenth and sixteenth centuries; but during the Turkish occupation, the Great Plain turned again into a scarcely populated area, while the western part of Transdanubia, then in the economic sphere of the Habsburg empire, began to develop, though at a slow pace. At the same time industrialization was restricted to some of the larger towns of the Great Plain, and agriculture continued in its earlier course with a structure and at an intensity characteristic of the extensive type. The settlement network was slow to develop up to the most recent times.

During the past ten years, however, things have changed in the Great Plain. First agriculture fell into line with Transdanubia, and indeed the intensity of production is some regions surpassed that of Transdanubia. Industrialization and the development of infrastructure in the settlement network now look promising, since the newly discovered energy sources have largely relieved the formerly painful lack of crude oil and natural gas supply.

A more even distribution of the forces of production is one of several factors eliminating differences between economic levels in the various regions. In certain areas of the Great Plain economic growth cannot be expected unless the surplus of manpower is diverted to other parts of the country.

The studies collected in this volume endeavour to grapple with the main trends, or the more important phases, of this slow but radical change. The questions studied are in the nature of things varied in weight and in importance, and the methods applied follow now traditional, now modern trends. This diversity falls well within the framework of the general theme of this volume, the aim of which is to present a geographical interpretation of some of the characteristic changes in the Great Plain. Physical properties and economic endowment are here evaluated by geographers wishing to offer points of departure to those concerned with the planning of production.

The Editor

ECONOMIC GEOGRAPHICAL PROBLEMS OF THE GREAT HUNGARIAN PLAIN

by

GYÖRGY ENYEDI

THE GREAT PLAIN — AN UNDERDEVELOPED TERRITORY

THE DELIMITATION OF THE GREAT HUNGARIAN PLAIN

The Great Hungarian Plain is the largest flat surface in South-East Europe, and occupies a considerable part of the Carpathian Basin. Although foreign public opinion often identifies the whole of Hungary with the territory of the "Alföld", in reality only about one half the country's territory belongs to this area. This present study-volume does not consider the Great Plain as a natural geographical region, but as a particular unit of social-economic life, the borders of which do not follow strictly those of the natural regions.

The aim of this paper, as well as of the rest in this volume, is not only to acquaint the geographers of foreign countries with the present-day situation and economic problems of the Great Plain, but also to give a comprehensive picture of the manner in which a traditional agrarian area becomes an under-developed territory within a country where industry is developing fast. In addition it aims to describe the attempts that are being made by territorial organization and territorial development to overcome this situation. Our investigations therefore encompass only that part of the Great Plain, which deserves to be considered an underdeveloped economic area. Incidentally there is little difference between the natural geographical border of the Great Plain and the limit of the underdeveloped economic region. The most significant difference is that the agglomeration of Budapest is situated at the north-western margin of the Great Plain and has naturally been omitted from our investigation.

The northern borders of the Great Plain which form a transition to the piedmont of the Northern Middle Mountains, have also been eliminated in our present investigations. This area is the hinterland of an industrial district which is only surpassed in importance by the Budapest agglomeration, and consequently does not possess the characteristic economic indications of underdeveloped areas (Fig. 1).

In making the delimitation of the Great Plain we have also deviated from the natural geographical borders to the extent that we have taken into consideration the borders of the administrative regions, because the statistical information necessary for the following analyses is available only according to these areas. Additionally the results of the investigations, that incidentally may be useful in practice, can only be applied when adjusted for administrative areas.

So the Great Plain considered from the viewpoint of economic geography is somewhat smaller than the natural region, although all the characteristic features of the natural region are incorporated: i.e. the flat surface, a climate

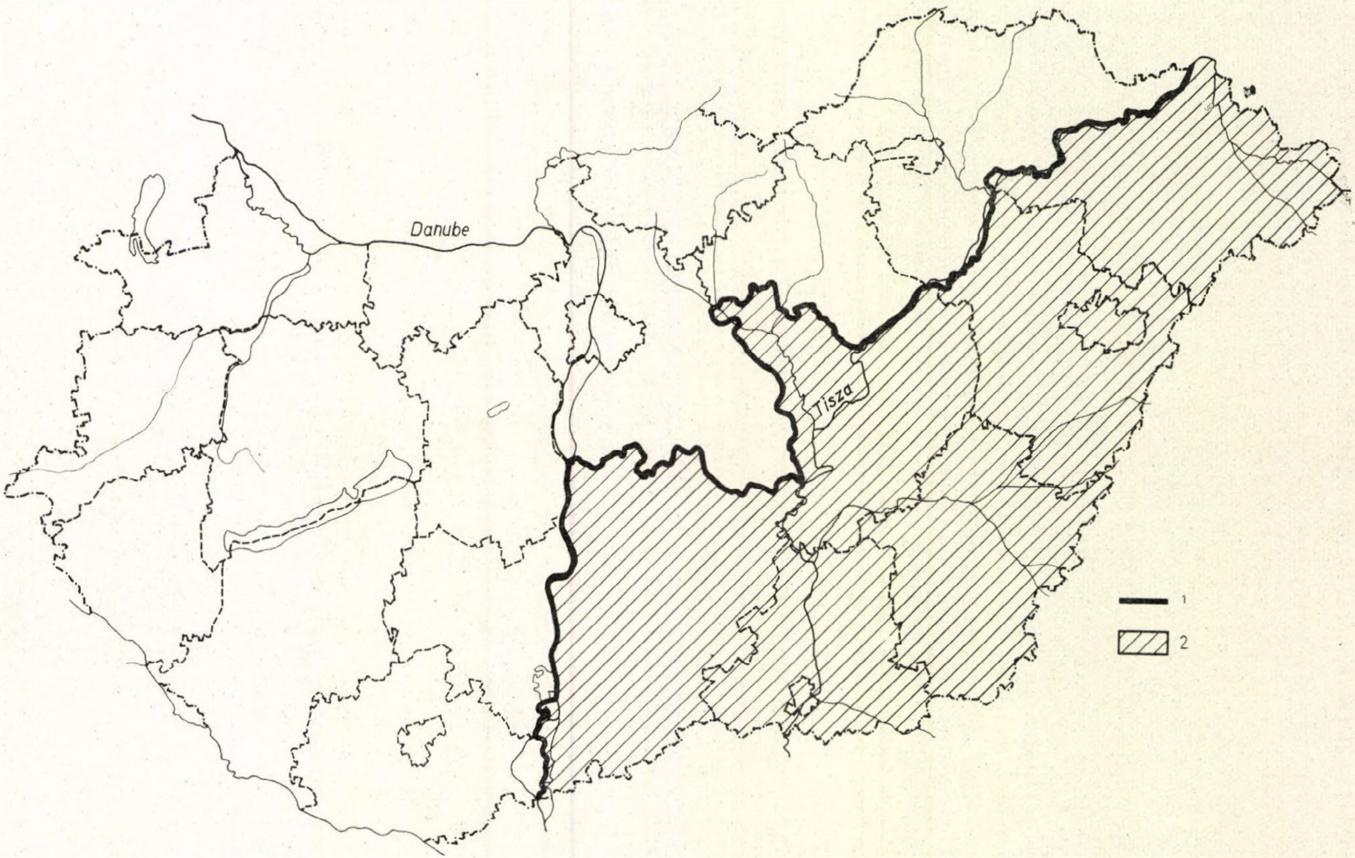

Fig. 1. Delimitation of the Great Plain

1 = boundaries of the Great Plain as economic region; 2 = the territory of the counties investigated

tending to aridity and rich in sunshine, the scarcity of a surface water, and variations from the extraordinary rich chernozems to the barren alkaline (szik) and sandy soils.

THE PROBLEMS OF REGIONAL UNDERDEVELOPMENT

The problem of underdeveloped areas is an acute care of planning, not only within the world economy but also at the level of national economies. In the literature the criteria defining underdevelopment are not uniform, indeed it is not possible to establish features and indices that might be of international validity in this respect. It must certainly be emphasized that *underdevelopment is a relative concept* having no absolute measure. It always *implies a negative deviation from the general economic level and the living conditions of a country*. We therefore cannot accept an absolute standard such as per capita national income, the proportion of industrial or agrarian population, the degree of urbanization, etc., because, for instance, an area characterized by a certain income level may belong, depending on the country, to either the underdeveloped or to the highly developed category. Frequently, when the population of an underdeveloped area decides to migrate, it does so on a relative basis. It does not measure its own position by some absolute standard, but in relation to the situation of other areas within or outside the country.

The criteria and concepts of underdevelopment change according to the actual situation within the national economy, and as the national economy develops the underdeveloped areas are also able to attain a higher level. So the state of underdevelopment does not exclude development, it only states the relative position of territories of various economic levels.

The state of underdevelopment becomes apparent in many ways, although it is not possible to determine the deviation from the national average with the help of a single factor. Fundamentally, *economic level and a population's living conditions* are conclusive.

Neither of these concepts expresses a completely uniform meaning. The most comprehensive indication of the economic level can be determined by the national per capita income. Economic development cannot be identified simply with industrial development, although in an overwhelming number of cases industrial development is of decisive significance. We are, however, of the opinion that in developing the underdeveloped areas, agriculture and the tertiary sector can play a dynamic role. When determining a population's living conditions, we consider both their income level and other factors such as the extent to which the population is provided with an adequate infrastructure, cultural and health facilities, etc. Both are worth investigating separately and in combination. For instance, the material conditions of living can be turned to good account only when a certain income level is reached, while the accumulation of money cannot substantially improve the level of living if the area lacks the necessary conditions and equipment.

Strictly speaking the economic structure associated with the low level of economy and income also belongs to the causes of underdevelopment, although here we only use it for the sake of characterization. One of the standards from which to judge the modernness of the economic structure is the ratio of industry to agriculture; within industry and agriculture the ratio of up-to-date branches, especially those involved in exporting (the so-called dynamic branches) and the numerous non-productive sectors that play an important role in the activity rate of an area, e.g. tourism, are important standards.

In accordance with the schema outlined above the following features characterize the underdevelopment of the Great Plain:

— an economic level below the average (i.e. per capita income derived from industrial and agricultural production below the national average);
— the ratio of industry to agriculture and within these two branches the ratio of the principal sectors, to each other;
— the average annual per capita or family income;
— infrastructure level, cultural and hygienic facilities compared with the average.

THE EVOLUTION OF UNDERDEVELOPMENT

The underdeveloped state of the Great Plain is the result of its historical evolution during the course of several centuries. A short-term solution to this problem does not exist therefore. Every major economic period of the country's modern history has for various reasons always placed the Great Plain in an unfavourable position within the country. During the period of intensive development of agriculture the western areas, neighbouring on Austria, were in a more favourable situation, while the development of agriculture in the Great Plain was restrained by partitioned landed property, considerable agricultural overpopulation and by unfavourable climatic conditions. At each stage in the industrialization of Hungary, the Great Plain was left out of consideration, or at best only the border areas benefited. As a consequence of this slow economic development the strengthening of the town network and the urbanization of the population were delayed.

The underdeveloped condition of the Great Plain was perhaps most conspicuous during the two world wars. In this period the agglomeration of Budapest had already taken shape and had become strong, while the provincial industrial districts were making good progress. Additionally a significant difference existed between the level of agriculture of western Hungary and that of the Great Plain. The majority of the urban centres of the Great Plain deserved the name of town only for their administrative status as they were but agricultural market towns left over from the Middle Ages, with poorly developed central functions and with few exceptions an almost complete absence of industry.

After the Second World War the elimination of the underdeveloped condition of the Great Plain was always mentioned among the objectives of economic planning. However, the economic development in the Great Plain could not keep pace with other areas during certain periods, and so, despite absolute growth, the relative underdeveloped position of the Great Plain was but little cared. Only during the last decade has a conscious regional policy resulted in the speeding up of the pace of development in the Great Plain. Thus although the region as a whole may still be qualified as an underdeveloped area, this status is being reduced as centres of rapid growth emerge within its territory.

Underdevelopment has affected the population movement of the Great Plain as well. The population of this extensive area has been steadily shrinking for over a quarter of a century and natural population increase is unable to compensate for the losses caused by migration. Between 1949 and 1965, the population of the Great Plain diminished by approximately half a million, and the agricultural towns have not been exempt from this process. Today, the number of inhabitants in many of the towns is smaller than at the turn of the century, and their demographic behaviour is identical with that of the villages.

THE ECONOMIC LEVEL AND STRUCTURE OF THE GREAT PLAIN

THE ECONOMIC LEVEL OF THE GREAT PLAIN

In order to determine the economic level of the Great Plain we have made use of per capita national income. The official data for national income are compiled only on a country-wide basis, and are not available by territorial division. For the investigation of the economic level of the Great Plain we have employed the regional analyses of national income as prepared for industry (Bartke, 1967) and agriculture (Kulcsár, 1969).

The main conclusions of the examination are as follows:

(a) The per capita national income (derived from industry and agriculture) was well below average for the whole area of the Great Plain. From among the twenty administrative units of the country (nineteen counties and Budapest) the *highest-ranking* lowland county occupied tenth place (Fig. 2), lagging behind the industrialized counties of the north and north-west by fifty per cent.

(b) The territorial variations in per capita national income within the area of the Great Plain are in general not great. The lowest values characterize the sandy territories situated in the Danube—Tisza Interfluve and the Nyírség Region in the north-east. In the latter areas the agricultural level also is low and it is not possible to lessen the disadvantages that industrial underdevelopment would bring about.

(c) The territorial inequalities in economic level relate first of all to the distribution of industry. A marked positive correlation exists between the economic and the industrial levels ($r = 0{\cdot}99$). The state of industrialization therefore can explain the underdeveloped economic condition of the Great Plain.

THE INDUSTRIALIZATION OF THE GREAT PLAIN

The Great Plain was in an unfavourable position during the important stages of the country's industrialization. The first wave of industrialization of major importance occurred in Hungary between the years 1860 to 1870.

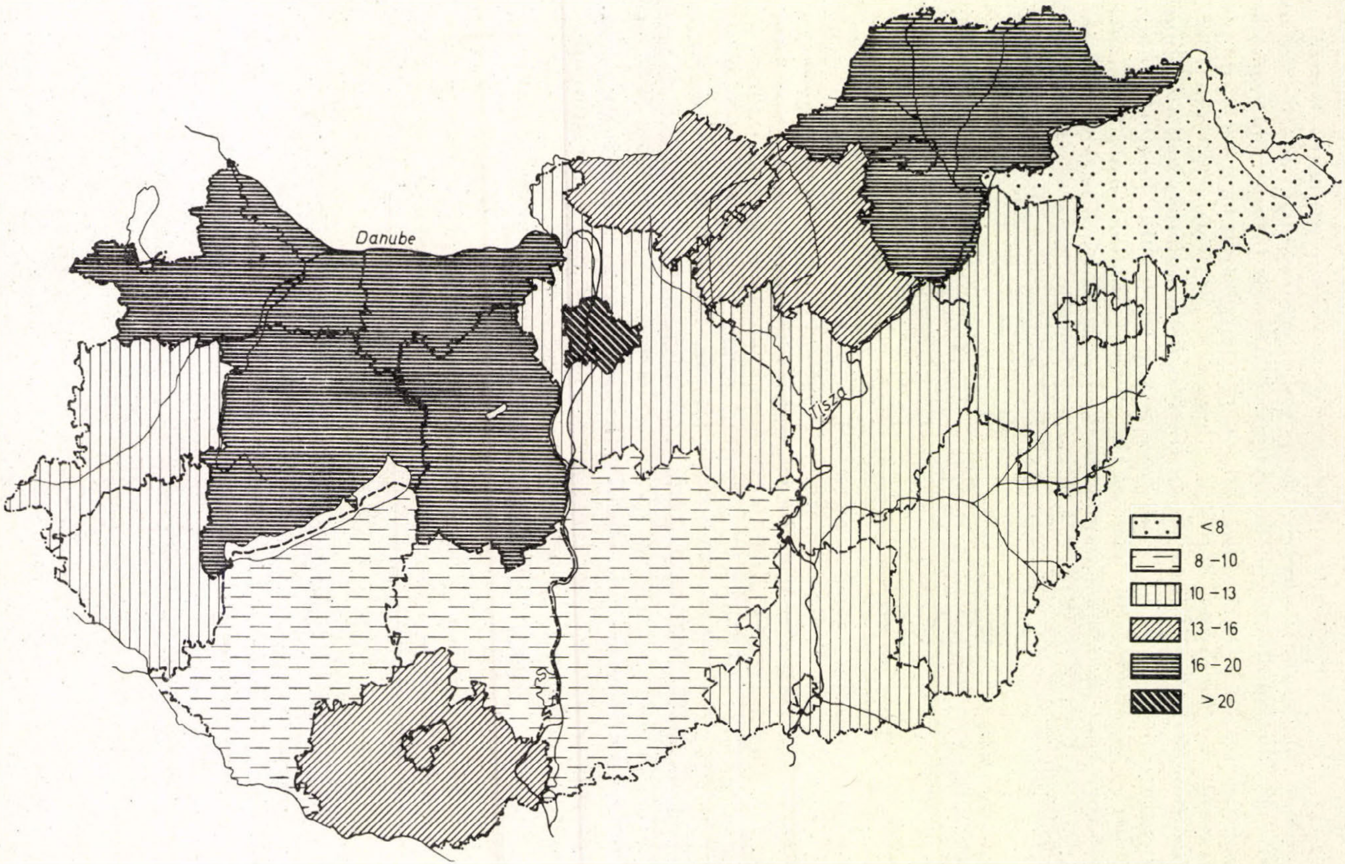

Fig. 2. Regional variations in the economic level in Hungary. Per capita GNP (1000 Fts)

Mining, the first enterprises of heavy industry, and later the processing of foodstuffs for export purposes (flour-milling and sugar refining) provided the hard-core of industrialization. Mining and heavy industry were of course closely linked with deposit of coal and ore, and consequently became closely connected with the area of the Hungarian Northern Middle Mountains. The processing of foodstuffs could have been settled quite advantageously in the Great Plain, but as this industry was intended mainly to boost the export trade, transport considerations became prominent. Consequently Budapest became the largest centre of flour-milling industry in Europe at the turn of the century.

After the First World War the new frontiers that were established drastically reduced the internal market of the country. Heavy industry was separated from the majority of the sources of raw materials. The industrialization that subsequently took place concentrated mainly on the export trade, in the first place exploiting the availability of the plentiful and cheap labour supply. The textile industry therefore attained prominence, being established principally in old industrial centres and where, after the First World War, an excess of labour became conspicuous.

In practice up to the outbreak of the Second World War a situation developed in which manufacturing industry of note was located in a few settlements only of the Great Plain such as Szeged, Debrecen. And even there, it was light industry, particularly the food industry.

In the years immediately after the Second World War up to 1949, the main task consisted in making good for the damage and destruction caused by the war, and at that time there was no possibility of restructuring the industry of the country. In the First Five-Year Plan, beginning from 1949, the industrial development of the Great Plain was already envisaged and certain noteworthy results were achieved. Substantial changes however could not be accomplished in this respect, because the main objective of industrialization was to increase the production of basic materials and energy, and to expand heavy industry. Poor in energy, the Great Plain could not be closely associated with this process of development, but, compared with the past, it was possible to register some positive changes. Thus among the new industries of the Great Plain were established not only units belonging to the light and food industries, but also to the machine and chemical industries.

For some years after 1957, emphasis was laid on the reconstruction of industry and on technical renovation. Consequently only the industrial establishments that were already in existence, were expanded and therefore, in contrast with the idea of territorial development, the predominance of the Budapest agglomeration and the relative underdevelopment of the Great Plain were again increased.

Since the beginning of the 1960s, the dynamic branches of industry such as the chemical, the machine engineering, and the instrument and telecommunications industries have become firmly established. Greater possibilities have therefore appeared for expansion of these branches in the underdeveloped areas, for they were not based on raw materials or energy. Thanks to a ten-year policy of territorial development, the whole of the Great Plain grew much closer to the average of the country as a whole. It is especially significant that within the Plain such industrial centres as Debrecen, Szeged, and Szolnok emerged which by attracting other industrial branches, can grow into industrial agglomerations, and thus transform their more distant surroundings. One of the characteristics of the regional development policy of the past decade has been the so-called 'counter-pole' conception whereby it was intended to create competitive centres such as Szeged and Debrecen in opposition to Budapest. The county seats of Nyíregyháza, Békéscsaba and Kecskemét also benefited from such encouraged economic development. This short decade, however, has done but little to ease the industrial underdevelopment of the Great Plain and today the number gainfully employed in industry per 10,000 inhabitants amounts to 58 per cent of the national average (Fig. 3).

Possibilities and factors of industrialization in the Great Plain

At present the new economic mechanism whereby the economy is planned on the basis of decisions made locally by individual enterprises, in contrast to over-centralized decision making has made it possible to reconsider the industrialization of the Great Plain. With the help of the new economic regulators, certain settlements in the Great Plain are given preference in the establishment of new industrial settlements through such measures as the granting of greater credit facilities, by subsidies for the foundation of establishments, by the construction of public utilities and by the allocating sites free of charge. At the same time it must also be noted that the investment decisions of enterprises will take into consideration, first of all, economic efficiency, so that industrial development in the Great Plain can only be undertaken in such a way that its efficiency is not impaired relative to other parts of the country. It is clear of course that this cannot apply to every branch of industry. Still, we have to suppose that certain industrial enterprises will be sufficiently interested in the Great Plain to settle there.

In the context of medium and long-term development, what are the determinants for industrial investment in the Great Plain?

Until the Second World War two basic determinants prevailed in the territorial development of Hungarian industry: namely the sources of energy and the communication network. The location of the Great Plain was unfortunate from both points of view. It must ascribed to the irony of fate that at the present time these two factors are beginning to shape themselves in a favourable manner precisely in the Great Plain, yet, it is unlikely that we can count on these factors to any large extent to assist in the process of industrialization. In the past decade, owing to the exploitation of hydrocarbon resources, the Great Plain, so far always considered as being poor in this respect, has suddenly become rich in energy and is the possessor of an energy source more up-to-date and more sought after than coal. When in earlier times industry was developed, coal, the main energy source of that time, attracted large industrial areas. Hydrocarbons, however, that can be transported easily and at low cost, will hardly do the same. The oil pipe-line system already leading from the source areas will be further amplified to carry crude oil and natural gas to the industrial centres situated on the coal fields, where the natural gas

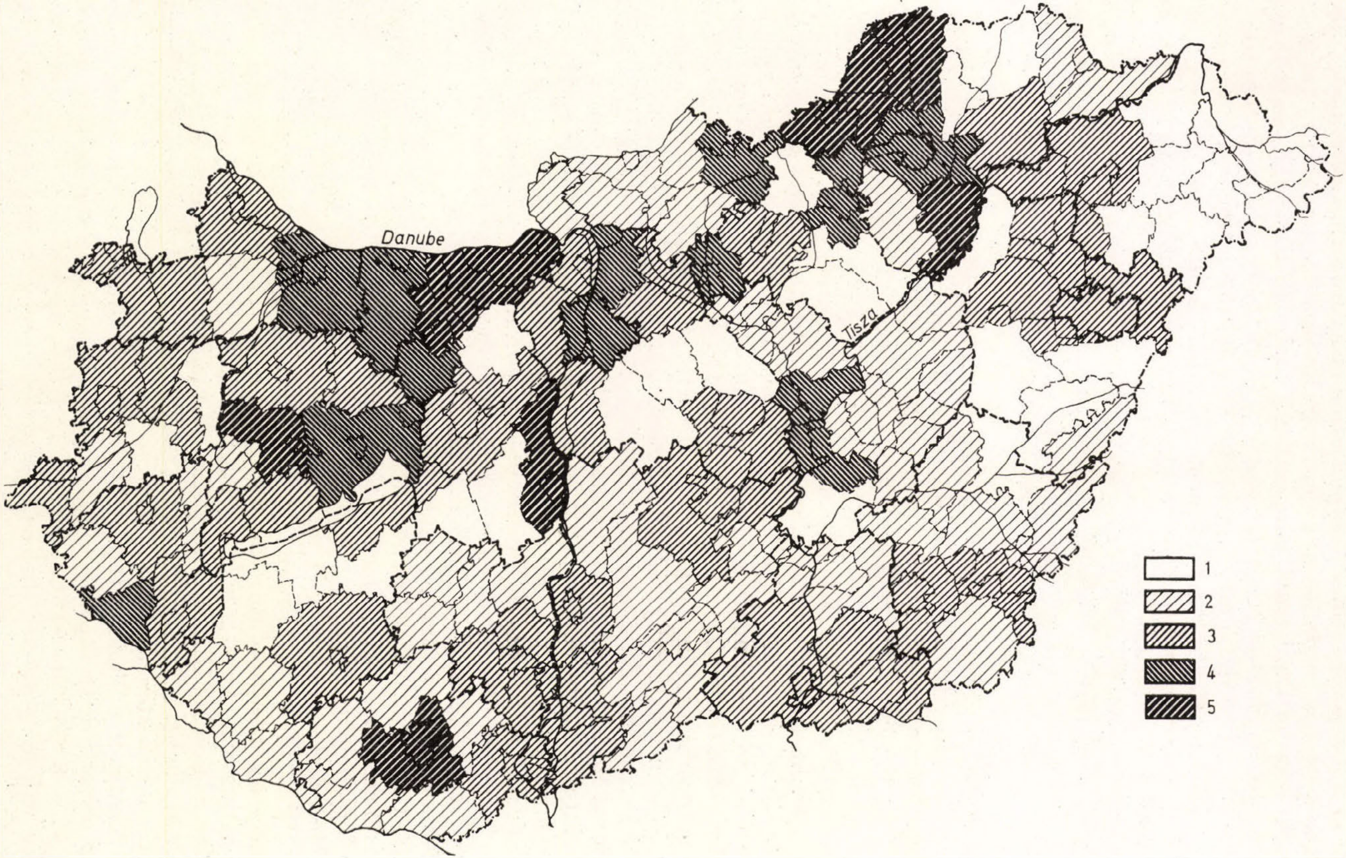

Fig. 3. Regional variations in the level of industrial development in Hungary

1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high

or fuel oil will replace coal. The exploitation of hydrocarbons certainly influences the economic situation as regards the level of employment in the various settlements of the Great Plain, but in relation to the extracted calories, the employment created is much smaller than in the case of coal. It is likely that the refining of oil and natural gas will be shifted to those centres of the chemical industry already in existence, and it may be assumed that the refining and further processing of natural gas and crude oil will take place only in the region of Szeged.

Up to the Second World War the economic connections of the country were mainly with Central and Western Europe. Owing to its favourable position with regard to communications, the Little Plain in northwestern Hungary was developed into an industrial district, although the deficiency in energy and raw material supply was just as great as in the Great Plain. During the past twenty-five years however the export trade has increased most significantly, the East, the Soviet Union now being the most important trading partner. The enormous amounts of raw material pouring in from the Soviet Union and the large quantities of products exported to the Soviet Union, mainly by the engineering industry, pass along the communication network of the Great Plain. This fact, however, has little importance with regard to the industrialization of the area. Imported ore is utilized by the metallurgical districts already in existence, mineral materials are forwarded to the established chemical industrial districts in other regions of the country, and only part of the imported timber is processed in the northeastern part of the Great Plain. The wood-working industry can still be extended, nevertheless it is evident that this branch is hardly likely to make substantial changes in the whole industrial structure of the region.

We must thus conclude that the industrial development of the Great Plain has run into difficulties owing to a loss of momentum. Although the unfavourable features which it possessed earlier such as poverty in energy and poor communications have been overcome—indeed, its condition has become extremely favourable—the Great Plain is not in the position to take advantage of these factors, because of the changing viewpoints with regard to the location of industrial investment.

In the Great Plain a substantial excess of labour has been accumulated, which is being compensated for by study out-migration. The existence of this labour force might constitute an adequate attraction for industrial development. More and more labour-intensive industries are making their appearance in the settlements of the Great Plain and in some small townships the changes they have already produced are relatively great. Yet, industries that are labour rather than capital intensive, e.g. the textile industry, represent precisely those branches which develop slowly or indeed tend to regress; and their location in the Great Plain cannot therefore bring about substantial changes in the territorial structure of industry.

Admittedly, the whole of the Great Plain is lacking in surface water, but the Tisza river might attract some industry, although its ample and suitable supply of water is harnessed at present to but a small extent. The chemical industry which demands large supplies of water is already established at Szolnok and Tiszaszederkény (now: Leninváros) and the planned integrated petro-chemical plant at Tiszaszederkény means a further development of this industry.

At present and in the forseeable future the most dynamic branches of the Hungarian national economy will tend, to a great extent, to form agglomerations. They will be attracted to cooperative sectors in the already existing industrial regions. For their development highly skilled labour is essential, as well as the existence of research and planning institutions. It is hardly worth risking, for instance, the manufacture of television studios and equipment in an agricultural market town, where, within a reasonable time, it is possible to create neither a pool of skilled labour, nor the capacity for research work. Thus, taking all these factors into account, the likelihood of industrializing the Great Plain does not seem very promising. In the first place, we can expect industrial development to occur in the six aforementioned towns and in a few smaller centres at an increasing pace. These towns are suitable for accommodating the more pretentious branches of industry which have a tendency to agglomerate. Szolnok and Szeged are able to attract industries demanding large water supplies. Thus the surroundings of the above towns are considered suitable for industrial development and can form the hard-core for economic expansion in the Great Plain.

In summary, it would appear that there is little likelihood of any major industrialization in the vast open expanses of the Great Plain in the foreseeable future either. (It goes without saying that the development of service enterprises catering for local needs is desirable everywhere.) The scale and complexity of a modern industrial economy do not allow new industrial enterprises to be spread throughout the large territory of the Great Plain. Effective developments will be concentrated in certain localities only. The future of the vast expanses of the Great Plain will continue to be in agriculture and in the food industry. When considering the possibilities of industrialization, I did not mention the food industry on purpose, because that tpye of the agriculture is developing which more and more effectively integrated the supply, processing and distribution of agriculture and industrial products into a uniform process. The integrated food economy differs substantially from the traditional agriculture of the Great Plain, comprising the repair of agricultural machines, cold-storage plants, and factories working for the food industry.

Therefore the conception, which has been expounded here concerning the possible expansion of industry, means that the task of overcoming the underdeveloped state of substantial parts of the Great Plain must be left to agriculture. It remains to be seen whether agriculture can fulfil this task.

THE DEVELOPMENT OF AGRICULTURE

The underdevelopment of the Great Plain of many decades' standing was caused not only by insufficient industry, but also by a below average level of agricultural development. It has already been mentioned that before the Second World War there were many out-of-date small farmsteads and extensively cultivated large estates. At the same time a considerable surplus of agricultural manpower accumulated. The technical level of agriculture in the

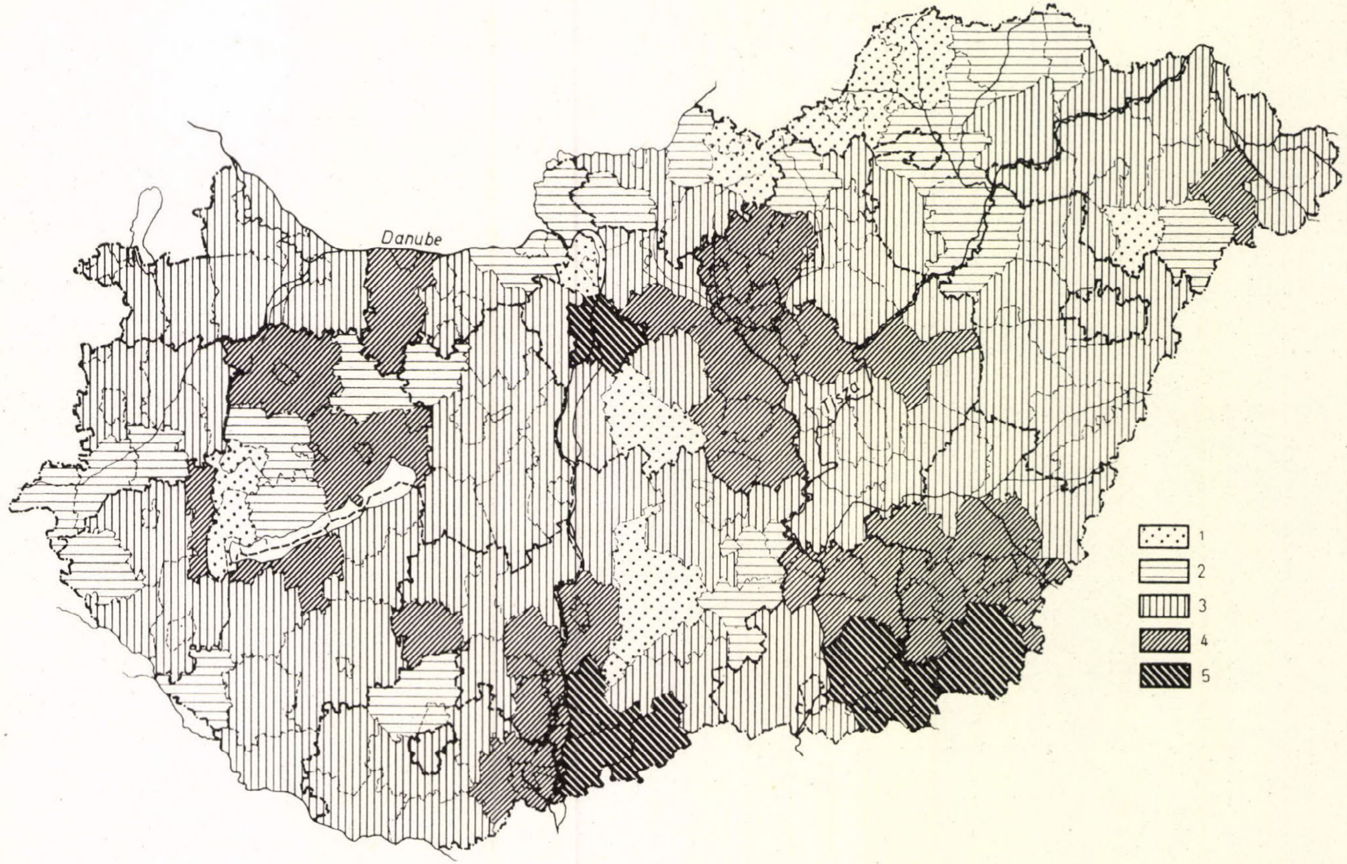

Fig. 4. Regional variations in the level of agriculture in Hungary

1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high

Great Plain—e.g. the use of machinery and fertilizer—lagged well behind that in western Hungary. Owing to the low technical level and a climate susceptible to droughts, the crop yields were low and fluctuated considerably from year to year. The low level of agricultural development was even more pronounced by the unfavourable structure of production, namely the predominance of grain cultivation as against livestock breeding. The extensive character of the farming was in striking contrast to the high density of agricultural population.

The development of agriculture in the Great Plain

In the course of the last twenty-five years the backwardness of agriculture in the Great Plain has been greatly alleviated, and, indeed, is now ahead of that in western Hungary in many ways (Fig. 4). This change gathered momentum after collectivization, because the Great Plain—for instance, the large unbroken expenses of flat ploughland—offered considerable advantages to large-scale farming. The spread of the use of fertilizers and irrigation compensated for the climatic disadvantages, and made it possible to exploit more thoroughly the excellent qualities of the soil.

Extensive migration, as already mentioned, has eased the problem of agrarian overpopulation and the more intensive structure of production has permitted a more efficient utilization of the existing labour force. The cultivation of fodder and industrial plants is coming into prominence and the results achieved in the growing of grapes, fruit and vegetables are considerable.

Livestock breeding in the Great Plain has also improved considerably compared with earlier conditions. Pig-breeding especially has gained in importance, and in many respects cattle-breeding has also made good progress.

These changes turned the Great Plain into a most dynamic agricultural area and have practically eliminated underdevelopment in agriculture. We must add however that from the point of view of the national economy these changes are not positive in every respect, for eliminating the underdeveloped status of the Great Plain has meant relatively slow progress in the west Hungarian counties (Fig. 5).

In addition to the favourable natural and technical potential already mentioned, favourable conditions have also been created within the sphere of livestock breeding for meat production, which has consequently risen in importance. Within the range of plant cultivation, grain long ago attained, owing to its subsidized position, an exclusive profitability. As the country cannot expect any grain deliveries from the Soviet Union, and as purchases from the West are restricted for various reasons, it has been economic policy to make the country self-sufficient in grain supplies. Natural endowments are favourable for this, since it is well known that up to the Second World War Hungary was a significant exporter of wheat.

From the early 1960s wheat-growing to assure self-sufficiency was made extremely attractive economically. Significant technical developments in this field led to rapid increases in crop-yields, and co-operative farms now attain an average net profit of 60 to 65 per cent in wheat-growing. None of the other branches show such advantageous characteristics. The excellent profitability of wheat-growing, however, has placed the Great Plain, the most prominent

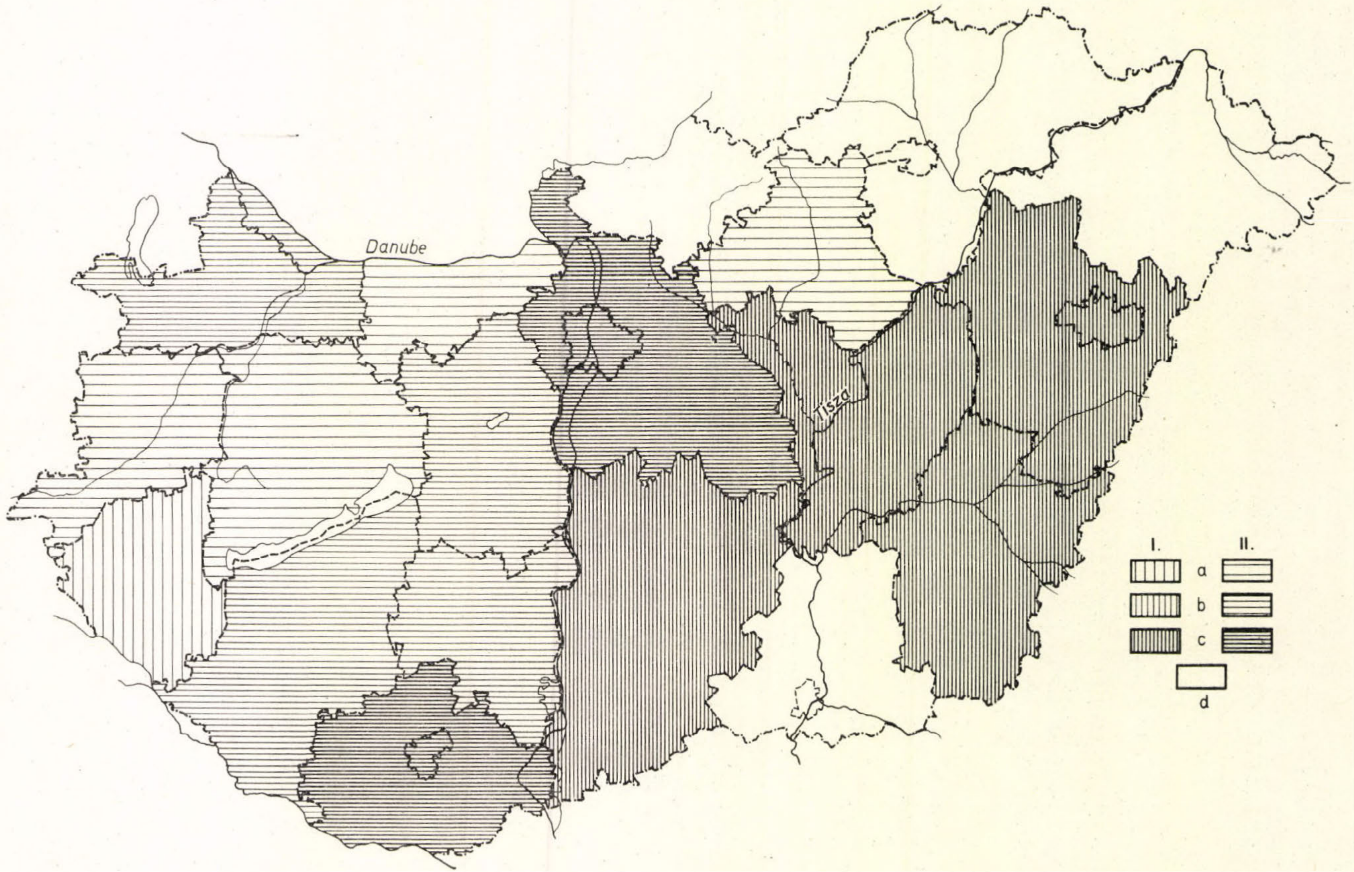

Fig. 5. Regional variations in the development of agriculture (1934/38—1962/66)

I = growth; II = decline; a = low; b = medium; c = important; d = stagnation production centre, in a permanently superior position. This has resulted in considerable capital accumulation, which has given further stimulus for investment, and, in general, has encouraged a more intensive agriculture. At the same time, because of the limited extent of the country's agricultural area, it is not altogether possible to satisfy the demands for grain and fodder at the same time, thus the solution to the grain problem was found at the expense of fodder-growing.

This large-scale development in spite of some negative aspects, has increased the role of the Great Plain to a position never before attained in the country's agricultural production—50 to 60 per cent of the main agricultural produces coming from the Great Plain. The above average development in agriculture has raised the whole economic level of the Great Plain and, to some extent, has even been able to counterbalance its modest industrial growth. Thus with respect to per capita national income the Great Plain counties are significantly less far behind the highly developed industrial counties than is the case when the industrial levels are compared only. Those areas of the Great Plain which are endowed with favourable natural and economic potential, first of all in the regions where the chernozem soil is underlain by loess, the development of agriculture is fast, and the increase in productivity and net income surpasses that derived from industrial activity. In such areas the per capita personal income of those employed in agriculture is as high as that of those who are not employed in other sectors although this has been done with more labour input. This fact also would appear to justify our supposition that economic underdevelopment in certain minor areas can be eliminated without notable industrialization.

In order to complete the picture, it must be mentioned that in certain parts of the Great Plain there also exist areas that are extremely underdeveloped, especially in the north-eastern part of the country which comprises a large sandy area, where agricultural overpopulation is considerable. Here, demographic pressure has led to intensive cultures, such as the growing of tobacco, fruit and certain vegetables. The value of these agricultural branches is high as compared to the extent of the land, but these cultures being highly labour intensive, yield low personal incomes. However, apart from agriculture, there are no other possibilities of employment, either locally, or in the immediate surroundings. From this region therefore tens of thousands of commuters travel considerable distances to find work and consequently can only return to their families at fortnightly or monthly intervals. (From the whole territory of the Great Plain, some hundred thousand people commute to various other parts of the country, mainly to Budapest.) The problem is thus perhaps less serious than in the sand-ridge of the Danube–Tisza Interfluve and in large areas of the Körös valley which comprise alkaline soil, and where poverty is great. In these poor agricultural regions it will be difficult to raise the economic standard by means of agriculture alone. If the possibilities for employment within agriculture are enhanced, this could well hinder the technical developments. As a result of this prolonged state of underdevelopment, a great part of investment in agriculture has been aimed at ensuring possibly full employment (by plantation of orchards and vineyards). Insufficient finance, however, frustrated the construction of the necessary cold storage and processing works. In the underdeveloped agricultural areas, even simple reproduction requires state subventions, and it is quite out of the question to think that sufficient accumulation and investment will be available for modernization on a large scale. Thus within the general development of the Great Plain a contradiction exists between the rapidly advancing grain producing areas and the sandy areas, where the labour-intensive forms prevail.

In these underdeveloped agricultural districts the outflow of population is unavoidable. Industrial establishments which are labour intensive should be located in these areas, although even then migration will have to be the solution to the excess labour in the long run.

What are the future prospects for agrarian development in the Great Plain? Increased specialization, which for a time has been restrained by the lack of capital and the demand for employment, is unlikely to bring about a substantial change in the geographical distribution of production. The present regional specialization well expresses the interaction of market demands and natural endowments. Besides general technical standards, an upsurge in the agriculture of the Great Plain can be expected from a further two factors. The first which has already played an important role is irrigation. In the Great Plain with its dry and unstable summers irrigation assures larger yields, more safety and the introduction of new cultures. Irrigation farming on a large scale has been gradually introduced during the course of the last fifteen years. The great hydraulic construction of the 1950s provided the physical means and the introduction of large-scale farming the economic frame. Before 1945 an area of some 15 to 20,000 hectares, mostly pastureland and market-gardens, was irrigated. At present systematic irrigation has been extended over an area of approximately half a million hectares, not only along the Tisza river, but also in the valley of the three Körös rivers. Moreover thanks to the reconstruction of canals the interior of the Great Plain has also benefited. Because of irrigation, fodder crops have become more widespread and contributed to the intensification of cattle-breeding in the whole region. Rice is now standing crop in the irrigated areas of the Great Plain. The second Tisza barrage which is at present under construction will make it possible to irrigate further areas, and so increase the safety of production in the Great Plain.

The second source of improvement has been the integrated food economy. In the Great Plain vast quantities of agricultural goods are produced. Local storage, sorting and marketing or alternatively processing, might increase significantly the possibilities of employment, and at the same time secure advantages for agriculture. It is likely that in the future the chemical and machine industries will pay more attention to agriculture, as a consumer of industrial products. The Hungarian agricultural machine industry has been rather neglected and the majority of necessary implements are imported. The manufacture and repair of certain agricultural equipment belong also to an integrated food economy and will certainly make headway on the Great Plain. Since today agriculture requires a significant educational-research network, a developed infrastructure, improved transport facilities, an up-to-date agricultural landscape will certainly unfold itself in which agrarian production, while lying central will unite a whole range of non-agricultural occupations.

A direct consequence of economic underdevelopment is the low level of living on the Great Plain. This situation is largely responsible for the process of out-migration. The loss in population has been greater than justified by the demand for manpower in the industrial centres.

The measurement and precise assessment of living conditions are not simple. Personal income is only one factor, the degree to which the population is supplied with services, sanitary and cultural facilities (assured by state subventions) also being important.

The statistical analyses carried out recently (Klonkai, 1969) to determine the level of living used the following indices expressed in monetary units (forint/one thousand inhabitants):

1. Annual income
   1.1 Value of food consumption,
   1.2 Value of durable consumer goods consumption, corrected by the following natural indices (per 1,000 inhabitants):
      1.2.1. Television subscribers,
      1.2.2. Radio subscribers,
      1.2.3. Owners of motorcars, and
      1.2.4. Number of telephones.
2. Value of communal allotments, corrected by the following natural indices:
   2.1 Proportion of dwellings provided with running water,
   2.2 Proportion of dwellings connected with the sewage system,
   2.3 Electricity consumers per 100 dwellings,
   2.4 Gas consumers per 100 dwellings,
   2.5 Number of state dwellings per 10,000 inhabitants.
3. Value of sanitary allotments, corrected by the following natural indices:
   3.1 Number of doctors per 10,000 inhabitants,
   3.2 Number of hospital beds per 10,000 inhabitants,
   3.3 Accommodation in day-nurseries per 10,000 inhabitants.
4. Value of cultural-educational allotments, corrected by the following natural indices:
   4.1 Infant-school places per 1,000 inhabitants,
   4.2 Classrooms in primary schools per 1,000 inhabitants,
   4.3 Primary school-teachers per 1,000 inhabitants,
   4.4 Secondary school classrooms per 1,000 inhabitants,
   4.5 Secondary school-teachers per 1,000 inhabitants,
   4.6 Theatre-visits per 1,000 inhabitants,
   4.7 Library books per 1,000 inhabitants.

Corrections with the help of natural indices are necessary, because, for instance, identical cultural allotments may be used in a different manner in places where there is a theatre, and where there is not, or communal allotments of the same amount may influence the circumstances of life differently if the locality possesses a gas distributing system, a sewage system, etc. or not.

The above described method yielded the following results:

(a) With respect to the living conditions the Great Plain is an underdeveloped region, but—excluding Budapest—compared with the economically developed areas, the extent of underdevelopment is less than when per capita national income is used as the yardstick. This is the result of the conscious territorial redistribution of national income. The highest-ranked county in the Great Plain, County Csongrád, ranks sixth, the shortfall behind the best developed county (County Komárom) being only 15 per cent (Fig. 6).

(b) Within the area of the Great Plain living conditions are more differentiated than economic level. The underdeveloped state of the north-eastern region forms a striking example.

(c) The regional shaping of the living conditions is strongly and positively correlated with the spatial characteristics of economic and industrial development. The supply of cultural needs does not follow this pattern, because the general trend is to provide all parts of the country with approximately similar facilities.

The correlation matrix of economic development and living conditions is as follows:

	Level of		Economic development	Income level	Communal	Sanitary	Cultural	Living conditions
	industry	agriculture			allotments			
Level of industry	1·00	—0·88	0·99	0·90	0·90	0·84	0·12	0·90
Level of agriculture		1·00	—0·81	—0·96	—0·97	—0·94	—0·10	—0·96
Economic development			1·00	0·84	0·85	0·77	0·13	0·84
Income level				1·00	0·98	0·97	0·21	0·99
Communal allotments					1·00	0·97	0·27	0·98
Sanitary allotments						1·00	0·36	0·98
Cultural allotments							1·00	0·22
Living conditions								1·00

We have mentioned that the effect of financial allotments on living conditions depends to a great extent on the already established facilities in the various areas. An additional but significant element in this context is the character and quality of the settlement network, and the state of underdevelopment in the Great Plain manifests itself in this regard also.

PROBLEMS OF SETTLEMENT NETWORK DEVELOPMENT

One of the consequences of economic underdevelopment is the inadequacy of the urban network of the Great Plain, more specifically the distorted character of the settlement hierarchy. This also affects in an unfavourable manner the living conditions of the population, because the services necessary to provide a locality with an urban character are lacking not only in a majority of the rural settlements of the Great Plain, but partly even in its towns.

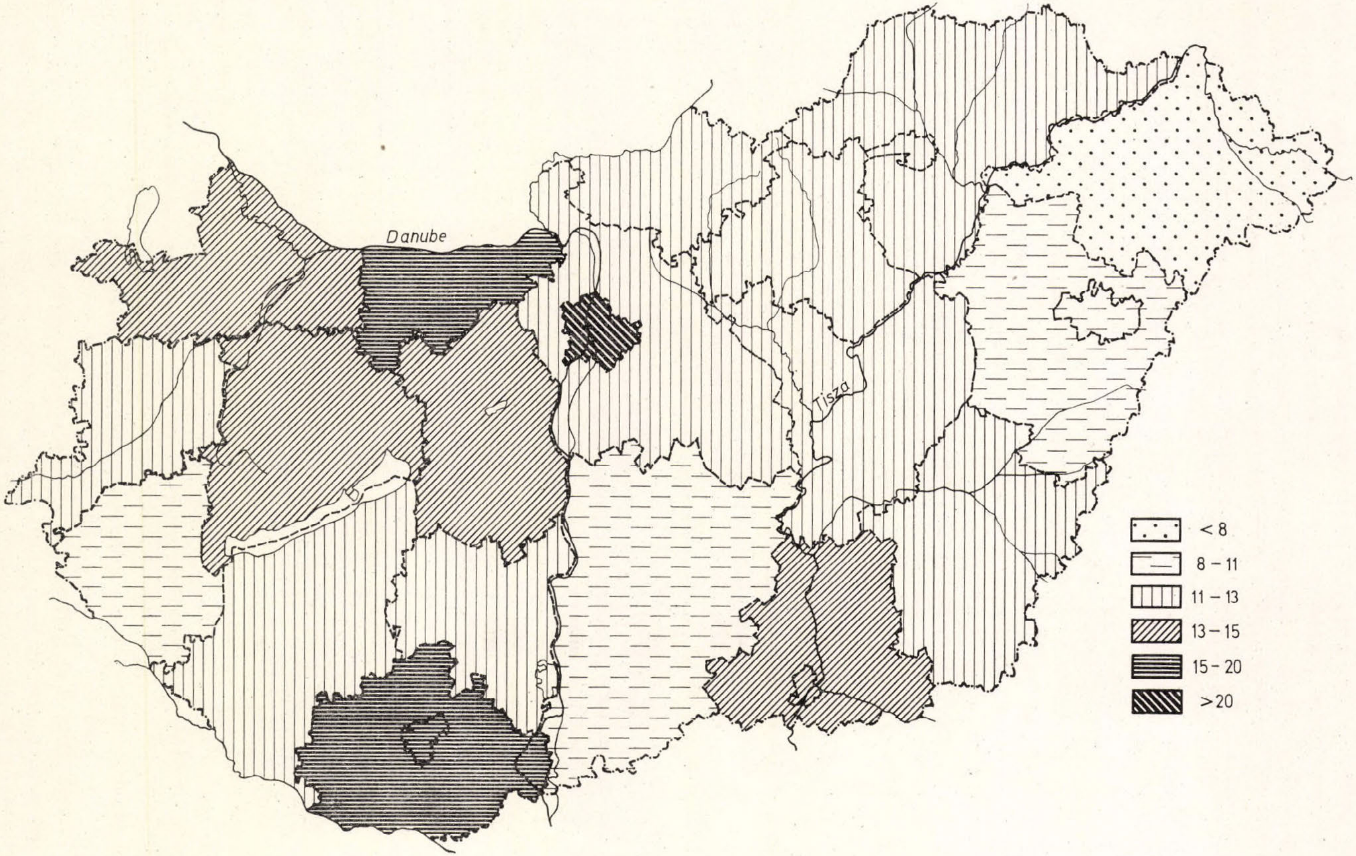

Fig. 6. Regional variations in the level of living in Hungary. The value of the per capita consumption (1000 Fts)

A particular problem is that the majority of rural settlements are scattered, being isolated from roads and services. Among the towns many agricultural market centres exist, which obtained their urban rights during the Middle Ages. Today, however, their urban functions have vanished, and only the administrative title of town distinguishes these settlements from villages.

(a) The structure of the rural settlements in the Great Plain possesses unique features. In general it is characterized by large villages—both in terms of population and cultivated area. Villages of similar proportions are to be seen in Europe only in those areas of the Great Plain stretching beyond the borders of Hungary and in southern Italy. Giant villages possess both advantages and disadvantages. One advantageous feature is that owing to the large number of inhabitants, central place functions are already developed to some extent, and this helps in eliminating the backward conditions of living. The extensive agricultural area of the giant villages brought about a mass of scattered farmsteads (*tanya*) as the outlying tracts of land were far away from the village centre. Consequently these scattered farmsteads constitute one of the most peculiar problems of the Great Plain.

Scattered settlement is encountered in many parts of Europe, e.g. in Great Britain, and northern France—where it is the chief form of settlement of the agricultural population. It is, however, peculiar of the Great Plain that the scattered settlement is closely connected with the giant villages and agricultural market towns. It frequently occurs that the owner of a farmstead also has a residence in the group settlement. The formation of these scattered settlements is fundamentally different from that in Northern and Western Europe.

After collectivization, the creation of large-scale farms within the boundaries of the giant villages generated commuting similar to that stimulated by industry. But here the moves were in the opposite direction, namely from the place of residence in the village to the place of work on the outer edge of the rural agglomeration. After collectivization the land around the farmsteads became incorporated into the property of the common farm, and the farmsteads apparently lost their economic sense. Therefore, after the collectivization we supposed that the scattered farmsteads, having lost their social basis, would soon be liquidated. It did not happen that way. During the approximately one decade that had passed since the collectivization, the network of scattered settlements has lost about 15 to 17 per cent of its population, but the decrease in population was not much faster than it was in the other forms of rural settlements. An explanation of the relative stability of the scattered settlements is that Hungary recognized the importance of household plot farming during collectivization, especially that of stockbreeding, and even today about 40 per cent of the peasant families' income derives from this. The farmstead yields advantageous conditions to private farming on the household plot. An additional condition for the farmstead population migrating into group settlements would have been a sufficient capital to build new houses with. These cash reserves, however, were not at their disposal.

The liquidation of the scattered farm settlements is urged by many, because the living conditions of the population there are very poor. Part of the farmsteads have no satisfactory roads, the majority of them are still without electricity, water or gas or sewage systems. On account of the bad road conditions the inhabitants of the scattered farmsteads who live several kilometres from the service, sanitary and educational institutions of the group settlement, can only make use of them with great difficulty and under restricted circumstances. In our opinion, when we discuss the future of the numerous scattered farmsteads, we must separate those that are regularly distributed along the road, or comprise smaller concentrations. Such farmsteads are not at particular disadvantage, and modernization of communications and the spreading of the motorcar will enable them to reach the service institutions of the next village. A more economic solution may be found in increased rural road construction—which is required for the transportation of the steadily increasing volume of produce from the large-scale farms. For some time it will not be possible to dispense with the production of the household plots. What one may first expect is that the population living in highly irregularly scattered farms will migrate to group settlement. It is not possible to conceive such a breakdown of infrastructure investments that would solve the problems of these irregularly scattered farms, too.

(b) Another characteristic element of the settlement network is the problem of the market towns which we have already mentioned. Many arguments have been raised with regard to their problems, similar to those which arise everywhere in Europe in connection with the improvement of old provincial townships. The development of the market towns has slowed considerably. They contain little industry apart from local services and their urban-like attractiveness in most cases does not extend beyond the scattered settlements situated within their administrative borders. The crisis of the market towns is not a phenomenon of the present day, because the tendency of population decrease started in many of them 60 to 80 years ago.

It is apparent that certain activities connected with trade and processing, prompted by an integrated agriculture, can be expected to find place in these market towns. Moreover, other small, labour-intensive industrial establishments may also be so located, but an infrastructure of urban quality can of course be realized without major industrialization. Official policy is to save these market towns, by stopping further population decline and by reinforcing their urban functions. In the opinion of the author, however, this is a rather hopeless proposition. Most of the Great Plain market centres are situated too close to one another, and thus do not even possess a field of attraction. If we disperse the allotments by letting each town have its share, the result would be that none of them would be in the position to grow, all being doomed to stagnate. If the funds available centrally for the development of the market towns are concentrated on a few, sufficient economic stimulus would be created to enable these settlements to develop independently.

The industrialization policy of the last twenty-five years has already raised the level of quite a number of earlier market towns (such as Szolnok, Debrecen) to be suitable for independent development. Others such as Békéscsaba and Kecskemét, have made such significant strides that future development will not require any central preference. The proportionate growth of the urban network of the Great Plain, however, means that some of the giant villages must grow into towns, as is already occurring. We must face the fact that between one-third and one half of the 20 to 24 existing market towns will sink to the level of giant villages, from which they will no longer be distinguished socio-economically, but only administratively.

FUTURE PROSPECTS IN THE GREAT PLAIN

To conclude our study, we wish to summarize the most important means for eliminating the underdeveloped state of the Great Plain and the objectives to be set for the near future.

The foremost aim must be to bring the living conditions of its population closer to the level of the more advanced areas. It is essential that in the near future (say in the next Five-Year Plan) all settlements in the Great Plain be provided with first-rate public utilities (water, electricity and household gas supply), educational and trade facilities. The population of no parts of the country should be kept permanently disadvantaged.

Another reasonable objective is to bring the private income of the population considerably closer to the national average. It is evident that a complete territorial equalization of income cannot be a realistic aim, because those industries, and research and commercial activities demanding higher qualifications, and thus yielding larger incomes, will always tend to be concentrated spatially. There are, however, instances especially in the Great Plain where agriculture itself is capable of assuring an average income.

A more difficult task for longer term is the elimination of the distorted state of the settlement network and the raising of the general economic level. It is very likely that the formation of a sound settlement hierarchy will be a task covering several decades. At the same time, it should not be left out of consideration that a geographically more rational settlement network will not preclude the decline of certain areas.

Industrial growth in the Great Plain has been over the average for some years and should so remain. It is expedient, however, to concentrate further projects on those industrial districts already firmly established, and possibly on the line of the Tisza. The need for economic efficiency speaks out against any extensive territorial dispersion of industry. Therefore, the majority of the Great Plain has little chance of eliminating its backward state through industrialization. Some rapidly advancing areas will emerge, but other regions will not be in a position to avoid the widening of the gap in consequence of underdevelopment.

Growth in poor agrarian areas is a special problem, because here the modernization of agriculture, hampered by many problems anyway, cannot counterbalance the lack of industrialization. Even in the case of these areas we adhere to the concept of concentrated development, for there are many poor districts in the country, and not all of them are located in the Great Plain. A high proportion of agrarian population, bad occupational conditions, and low educational and income levels occur in some six to eight counties of the country. These are considered underdeveloped. On the level of microregion, even in the environs of the capital, underdeveloped areas occur. In the author's opinion economic underdevelopment should be remedied in the first place where it affects a large population, and where it provokes migration on a large scale which affects the territorial structure of the whole national economy. It follows that the means of development, which are strongly limited in every moderately advanced country, must be used to solve the problem of the north-eastern Great Plain—the Nyírség region. In the medium term (five to eight years) we cannot achieve significant upswing in all the area concerned. We must begin to remedy the problem where it is most serious and where its effects are likely to spread most vigorously.

In the introduction to this short study, the relative nature of the concept of underdevelopment was emphasized. In itself it does not mean poverty, as the attribute "highly developed" does not mean wealth when considered in international relation. It must be assumed that the probabilities are against the forces of production ever being able to achieve a complete spatial equalization of the socio-economic level in any country. There will always be underdeveloped and above average areas. An area need not constantly remain in one of these categories, because, for instance, subsidized development, or the exploitation of new raw material resources, may radically change its circumstances. Our supposition is that the Great Plain, which today is an underdeveloped territory, already possesses features that will lead to dynamic growth in some of its regions. In fifteen to twenty years the attribute "underdeveloped" is not likely to refer to the whole of the Great Plain. Moreover, it is probable that some areas, for instance the Szeged region, may form a part of the best advanced areas of the country. The Great Plain yields the major part of Hungarian agricultural produce, which gives the area a special importance in supplying the population and the foreign markets. It is assumed that the underdeveloped regions of the Great Plain will remain the agrarian ones in the future, but that this relative underdevelopment will mean a considerably higher economic level than at present, together with a more developed standard of life.

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NATURAL ENDOWMENTS OF THE GREAT HUNGARIAN PLAIN

by

SÁNDOR SOMOGYI

The Great Hungarian Plain with an area of 52,000 sq.km, occupies 5/9ths of the country. The other five large regions are not so extensive even when taken together. It has been of paramount importance in the past as the principal area of corn-growing and animal husbandry, today also of certain industrial plants, fruit and wine-growing. Recently hydrocarbon deposits favourably influencing the national energy balance have been developed there.

In this article we shall introduce the factors constituting the natural conditions of the largest Hungarian region according to how they control economic life both from the positive and negative points of view. Since complex regional ecological investigations are still in the initial stage with us we are unable to provide a synthesis of the whole spectrum. As a first attempt, therefore, we have to be satisfied with a qualitative and possibly quantitative presentation of the extreme and average occurrence of the most conspicuous regional factors. However, we cannot strive for homogeneity even in this respect because the regional efficiency of each factor cannot be expressed numerically, and we do not possess information covering the whole area.

THE SURFACE REFLECTIONS OF THE GEOLOGICAL, STRUCTURAL AND PHYLOGENETIC CONDITIONS OF THE GREAT PLAIN

The Great Hungarian Plain is a quaternary basin of Neogene age with a ruptured marginal zone, divided into cauldron subsidences. In the western half of the basin, approximately as far as the line of the Tisza, the basement consists of banded Mesozoic–Paleozoic block mountain ridges, of Carpathian type cretaceous-orogenic folding, and of an old crystalline Paleozoic core surrounded by folds. In the southern half of the latter tract, Mesozoic sediments of undetermined structures also occur. Portions of the basement, as shown in Figure 1, are covered with a several thousand metres of Neogene and younger sedimentary aggregates.

The large-scale mobility and instability of the basin structure is due to its early formation and varied composition. Portions of the crust built up from different rock aggregates became heavily divided in the course of their varied phylogenesis. The orogenic and epeirogenetic movements recurring in succession induced considerable vertical and—presumably—horizontal displacements also. For this reason, the crust facets do not form a large contiguous mass. Our first inference with human implications is connected with this fact. The fragmented basement of the basin is unsuitable for the accumulation of

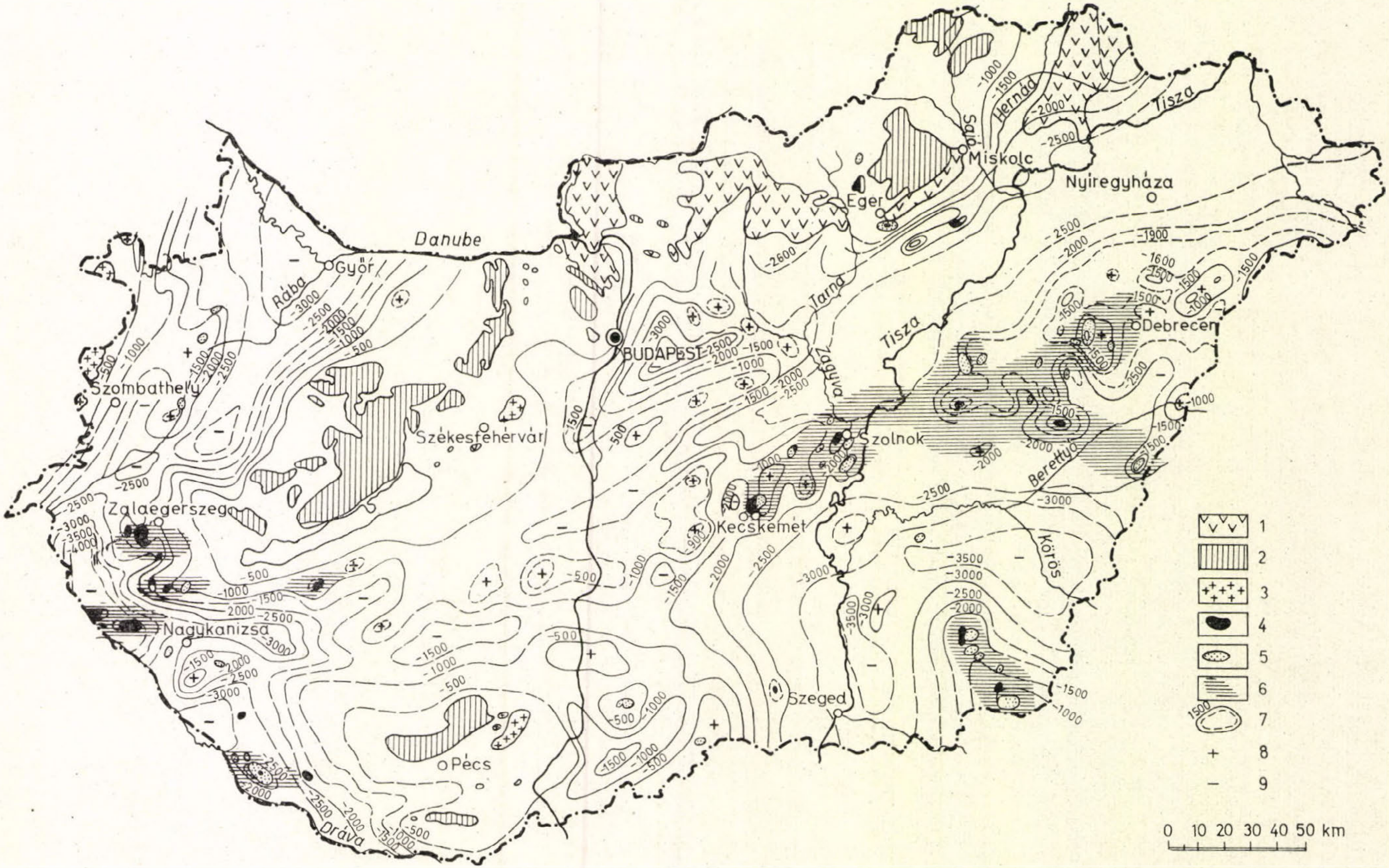

Fig. 1. Regional zones of crude oil and natural gas occurrence in Hungary (after L. Kőrössy)

1 = surface, Tertiary volcanic formation; 2 = surface, early Paleozoic—Mesozoic (Pz_2—Mz) formation; 3 = surface, crystalline formation; 4 = crude oil zone; 5 = natural gas zone; 6 = hydrocarbon; 7 = Tertiary, upper level of the basin basement (under sea level); 8 = upper level of the basin basement; 9 = lower level of the basin basement

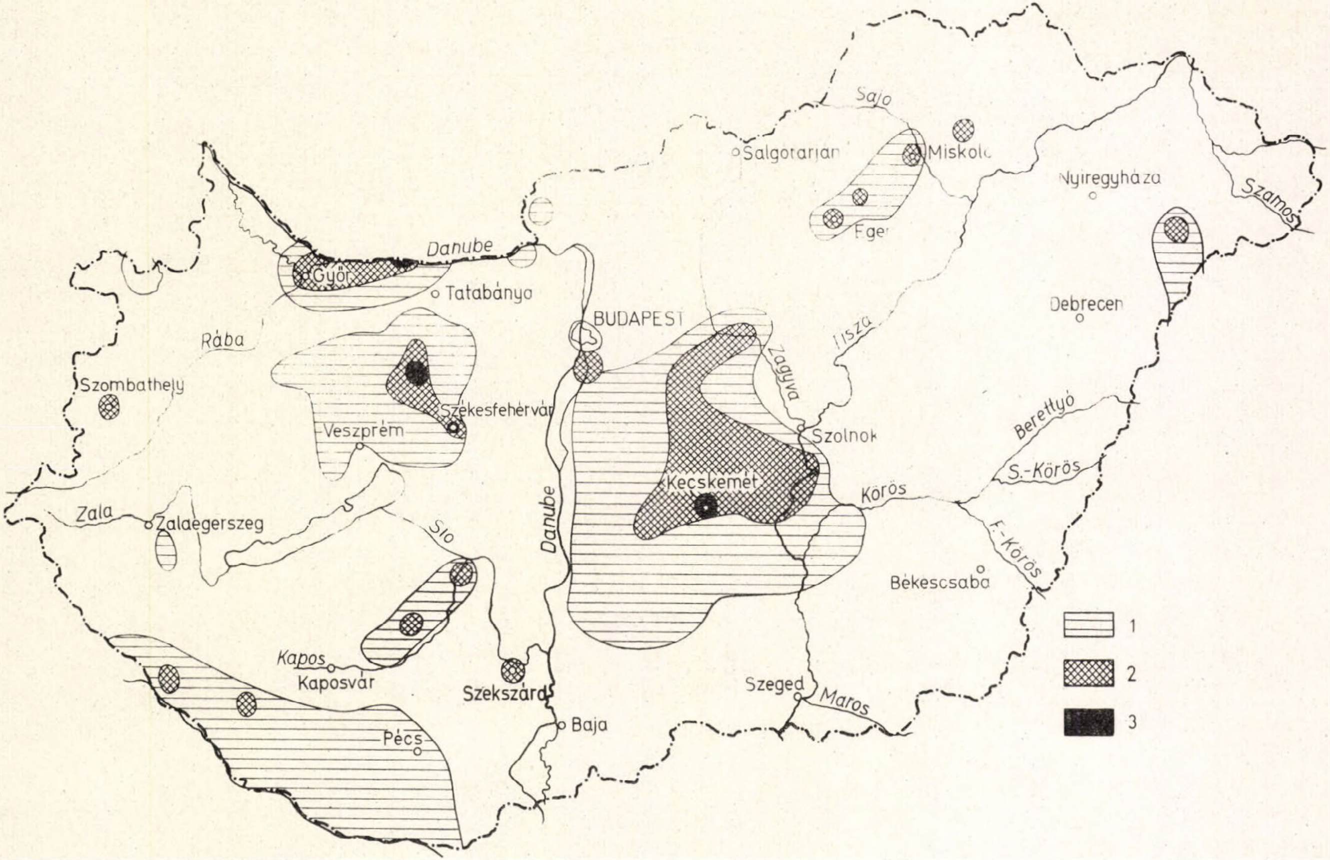

Fig. 2. Seismic map of Hungary (after B. Simon)

1 = 6—7 S—M degree; 2 = 8 S—M degree; 3 = 9 S—M degree

considerable crustal stresses which, if exceeding the load-bearing capacity of the rocks, could cause devastating earthquakes when transformed into kinetic energy. Tectonic stress, at least since the beginning of written history, has caused only minor earthquakes. The seismic focuses of registered earthquakes in the Great Hungarian Plain indicate the lines connecting the main structural directions as those along which more frequent tremors of lower or higher intensity can be expected (Map 1 attached).

The seismic map of the Carpathian Basin clearly shows a contiguous aseismic zone on the east side of the Tisza, extending from Záhony to the confluence with the Körös, the continuation of which can be seen on the west side of the Tisza, south-west of the Maros confluence (Fig. 2). Between the two, in the Tiszakécske—Fülöpszállás—Jászberény triangle is situated a zone of frequent seismic activity. Similar zones exist along the margins of other large structural units. This "seismic" situation can be explained in general terms on the basis of recent structural and geophysical investigations. Deep drilling has shown flysch-like and Miocene volcanic material as forming the basement of the aseismic area of the central part of the Great Plain. According to recent assumptions, the Lower-Tisza Rift-Valley, which separates the two seismic zones and is the maximum point of Neogene and subsequent subsidence (Fig. 3), forms the continuation of the Vardar—Morava Rift-Valley, one of the seismic centres of the Balkans. This ancient structural rift-valley marks the boundary between the block structure of the basement of the western part of the Great Plain ends, and the north-eastern flexures in the north-east. The transitional zone between the two is marked by the area of common seismic activity on the Great Plain, namely, the Kecskemét, Gomba, Jászberény region. Here, however, is also found the minimum geothermal gradient which at Tiszakécske is a 1 °C increase in temperature for every 7 m.

Concerning the further influence of the deep-seated structure on the present surface, we have to point out that the outline of the river system, and the marginal subsidences which extended into the Holocene period, are all surface reflections of the structure and movements of the basement. The relative position of the quaternary strata is shown by J. Urbancsek's block section (Fig. 2) (M. Pécsi, 1959).

An important practical question is whether the working capacity of the rivers is retarded by the present rate of subsidence. Relying on data measurements on the Tisza, which bear evidence of the continuously increasing quantities of materials carried by the river, it is presumed that the Tisza overcomes the effect of subsidence, even though it also fills in the flood-plain in some places (Bogárdi, 1951, Z. Károlyi, 1960). It seems that it will also be necessary to pay close attention to the relationship between structure and the life of the rivers in the future.

Other effects of the structure such as the migrations of brine at depth escaping gas, geothermal anomalies and the temperature variation of artesian water, will be referred to in subsequent sections (E. Szádeczky-Kardoss, 1944, T. Boldizsár, 1962, L. Bélteky, 1964).

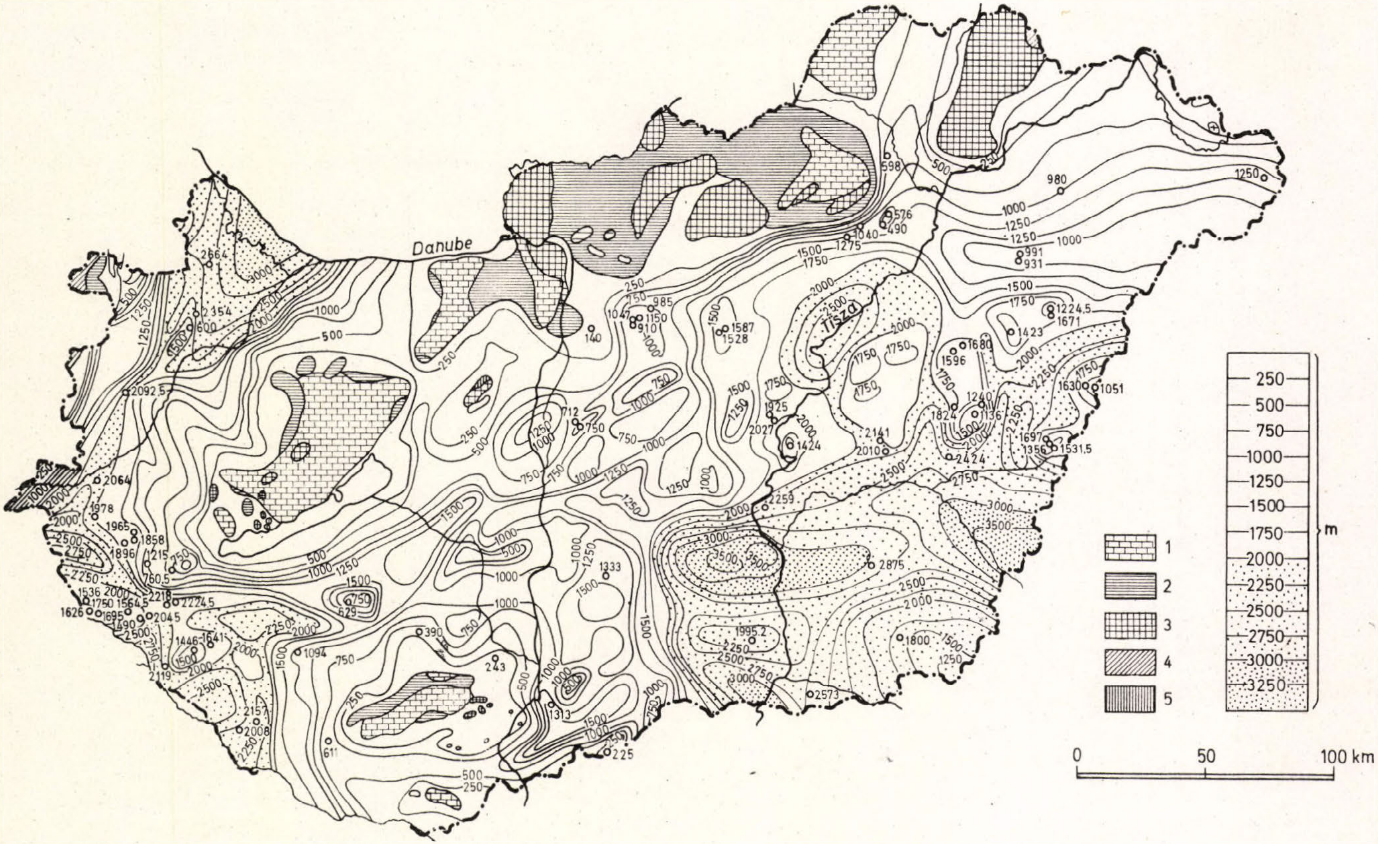

Fig. 3. Thickness of sediment younger than Sarmatian in Hungary (after Gy. Kertai). Older rocks on the surface

1 = Paleozoic and Mesozoic; 2 = Tertiary sediments; 3 = magmatic rocks; 4 = metamorphic rocks; 5 = rocks of magmatic origin and metamorphic rocks; Scale= thickness of the sediment younger than Sarmatian (mostly Pliocene and Pleistocene from 0 to 3500 m)

THE RESOURCE BASE OF THE GREAT PLAIN

It follows from the geological characteristics of the Great Plain that utilizable industrial raw materials are not abundant. A thick blanket of recent deposits of shallow-sea, fluvial and loess like material fills the depression of the Great Plain and buries the basement built in the periods of old mountain formation and magmatic intrusion. Deposits close to the surface were not affected by volcanic mineralization either. Consequently, because of the deposition history, the more valuable sedimentary ores—according to the prospecting that has been performed until now—are also absent at depth in the Great Plain. The hydrocarbon formations that are present, on the other hand, are most important for the national economy. Preliminary estimations issued on the basis of developments now in progress have modified favourably the energy balance of both the Great Plain, and of the country. It was partly during the deep drilling aimed at the development of hydrocarbon reserves and partly during the establishment of artesian wells that knowledge of the thermal-water resources of the deeper strata was obtained whose utilization for multiple purposes is becoming more and more general. Finally, the individual sectors of the national economy utilize in considerable quantity some of the young superfinal sediments as building material and as industrial raw materials as well although to a more limited extent.

Thus, on the basis of our brief survey, the utilizable raw materials of the Great Plain can be grouped as follows: sources of energy, thermal water, minerals and building materials.

SOURCES OF ENERGY

Since the basin of the Great Plain was only formed in the Neogene period, the older and more valuable varieties of coal cannot be found near the surface anywhere. However, in the forehills of the Northern Mountain Range, under the Mátra and the Bükk, substantial accumulations of organic matter led to the formation of young brown coals and lignites of low calorific value. The lignite beds are mostly ligneous earths in character produced predominantly from fenwoods, in particular from remnants of the marsh cypress (*Taxodium distichum*). Their seams are free from major disturbances, are laminated, and are in contact with the structurally varying basal layer of the margin of the basin. The calorific value of the lignites is only 2100 in the original state. It can, however, be raised to 3300 by drying.

The reserves of lignite exceed 2 thousand million tons. Most of this, however, is located below the general stratum and groundwater levels and exploitation therefore with the present methods is not economical everywhere. The lignite produced is used primarily in the local thermal power-station. Present production exceeds 2 million tons annually.

The *peats of the Great Plain* are of younger origin than even the lignite, and are of lower caloric value. They are formed of materials accumulated from marsh vegetation in basins and marginal depressions between alluvial sheets formed during the transition of the Pleistocene–Holocene periods. In such locations the plant residues sealed from air underwent a dry distillation process, thereby forming methane and carbon dioxide. Before the regulation of drainage, the Great Plain abounded in marshes and swamps, but because of their young age, the accumulation of individual plants and peat formation was not advanced. In several places (e.g. in the marsh-land of Ecsed) the dry peat appearing at the surface was destroyed owing to carelessness. In other places, the layer, deprived of its protecting cover of water and aquatic plants, for instance, in the case of the Nagy and Kis Sárrét, was destroyed by wind action. In the Bodrogköz there is too much interstratified river sediment. For this reason, peat material remained only in few places, where working began from the deposits either on the surface or under a thin protecting cover.

The most significant peat deposits occur in an old dammed bed of the Danube running from Kiskőrös to the Sárrét region of County Fejér. The reserves of peat are difficult to evaluate but more than half of the total, estimated to be 140 million tons, is mainly to be found in the Great Plain. In connection with the variable exploitation of the reserves, the question arises whether it is correct to utilize the available peat as fuel, for, due to its low caloric value, its use to ameliorate poor soils can be more productive.

As an energy source, the recently developed *hydrocarbon* occurrences of the Plain are of great significance for the national level. According to earlier views, only the anticlinal ridges of folded structures are suited for the storage of hydrocarbons and, consequently, prospecting for mineral oil and natural gas in the structurally complex depression of the Great Plain seemed hopeless. However, more recent ideas and especially the discovery of oil and natural gas confirm the opinion that traps arising from layer compression and even layer traps brought about by the alternation of rock strata of variable porosity are suited for storage.

However, while the diverse composition of the substrate of the Great Plain means the existence of many potential parent rocks, conditions for the storage and undisturbed accumulation of mineral oil and natural gas are less favourable. During the periods of epeirogenic uplift which divided the cycles of sedimentary formation, much of the strata forced close to the surface were preserved, together with accumulated hydrocarbons. On the other hand, orogenic movements probably destroyed a great number of strata and structures containing stored hydrocarbons.

Concerning the age of the hydrocarbon reserves, the most important rock reservoirs are largely found immediately under Lower Pannonian clayey marls, and consequently hydrocarbon accumulation must have followed the formation of this barrier layer. We do not know, however, to what extent the present locations of mineral oil and natural gas occurrences are representative of primary migration or of later Neogene structural movements. The latter is likely because of the presence of mixed gas beds.

It is already possible to recognize distinct and more or less delimited zones at the Great Plain containing hydrocarbons. In these zones, not only are there structural, phylogenetic and sedimentary accumulation similarities but geochemical conditions also are nearly identical. Consequently, the migration and accumulation possibilities for hydrocarbons were favourably developed on a regional scale. The delimitable hydrocarbon zones of the Great Plain are

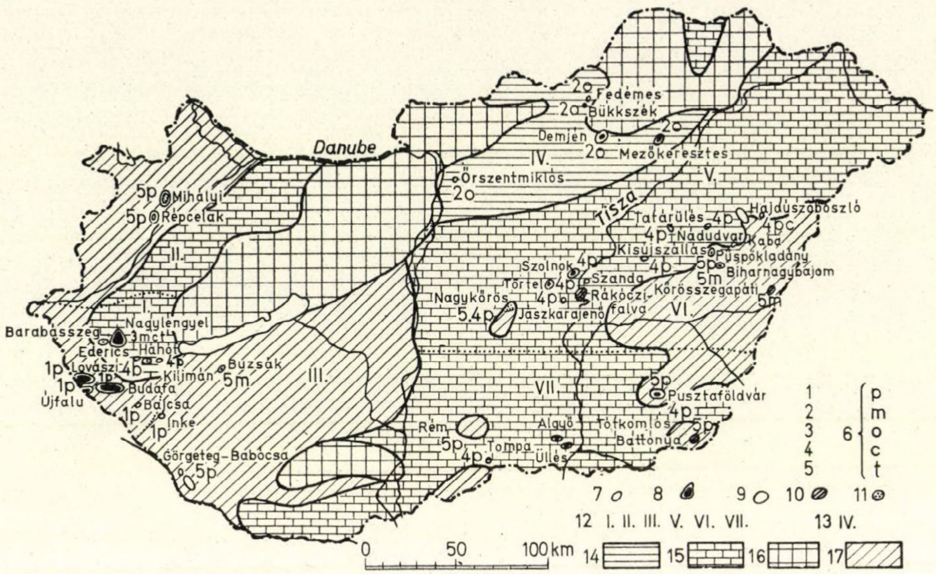

Fig. 4. Bedrocks containing crude oil and natural gas deposits in Hungary (after Gy. Kertai)

1 = folded, Neogene; 2 = faulted, Paleogene; 3 = faulted, Mesozoic; 4 = over Mesozoic block, curved, Tertiary; 5 = over Paleozoic block, curved Tertiary; 6 = age of storing rock; p = Pliocene; m = Miocene; o = Oligocene; c = Cretaceous; t = Trias; 7 = oil deposit under prospecting; 8 = active oil deposit; 9 = mostly mixed gas deposit; 10 = predominantly mixed gas deposit; 11 = mostly CO_2 gas deposit; 12 = Neogene basins delimited for exploration; 13 = early Tertiary, Paleogene basin delimited for exploration; 14 = Paleogene basin delimited for exploration; 15 = supposed basement of Tertiary basin, Mesozoic, 16 = not suitable for exploration according to present knowledge; 17 = hypothetical basement of Tertiary Paleozoic basin

the following: 1. the north zone; 2. the central zone; 3. the south-east zone, which is the second most important natural gas-field area in Hungary; 4. the fourth zone is located in North Bácska and County Csongrád. Whether this field is connected with zones 2 and 3, only further prospecting can answer.

Although output is still higher in Transdanubia, the exploitation of the oil fields of the Great Plain is constantly increasing, and on the basis of current prospecting there is every hope for further development. Moreover, the natural gas fields of the Plain have already considerably influenced the potential for the economic industrialization of the region. A problem is presented, however, as to the proper utilization of the abundant non-combustible carbon dioxide occurrences (Fig. 4).

A potential energy source with which the Great Plain is abundantly provided in the form of rivers, is water. Though the intense fluctuation in volume must be stressed, the main obstacle to the generation of hydraulic power is the low relief energy, because of the lack of gradient. This produces slow flowing and meandering rivers in wide flood plains. Obtainable hydraulic power is given by the relationship $E = QI$, and in the Great Plain the value of I (gradient) is always and that of Q (quantity) periodically small. For this reason and also because the primary aim of the construction of dams at Tiszalök and at Kisköre now being built has been to ensure irrigation water

TABLE I

Planned hydroelectric stations on the Danube, Tisza and on their tributaries

Stream	Hydroelectric station	Built-in capacity, MW	Average annual energy production, 10^6 kWh	Note
A. Danube	Upper Danubian	350·0	1314·0	Share of Hungary
	Nagymaros	93·5	510·0	(50%)
	Adony	120·0	835·0	
	Fajsz	95·0	710·0	
	Kvassay dam	1·6	6·0	
	Tas	1·6	6·9	
Lajta	Márialiget	0·2	2·0	
	Mosonmagyaróvár	0·4	3·0	
Rába	Rába I.	7·5	30·0	
	Rába II.	5·3	34·0	
	Ikervár	0·5	3·0	Augmentation
	Rába III.	6·8	43·0	
Sió	I—VI.	4·8	15·3	6 barrages
Mura	Murarátka	7·2	47·9	Share of Hungary
Dráva	I.	10·0	67·8	Share of Hungary
	II.	11·1	76·1	Share of Hungary
	III.	8·6	58·1	Share of Hungary
	IV.	6·8	46·8	Share of Hungary
	Total	730·9	3808·9	
B. Tisza	Vásárosnamény	14·7	85·0	
	Záhony	15·1	90·0	
	Tiszabura	17·5	70·0	
	Csongrád	12·6	65·0	
Szamos	Rápolt	4·4	27·0	
Hernád	Hernád I.	12·9	34·0	
	Hernád II.	2·7	15·0	
	Hernád III.	2·2	12·0	
	Kesznyéten	2·1	10·0	Augmentation
Sajó	I—VI.	6·9	50·0	6 barrages
Sebeskörös	Kőrösladány	0·4	1·6	
Maros	Makó	3·9	23·0	
	Total	95·4	482·6	

during the summer season, relatively small amounts of electric power are produced.

There is thus the possibility of producing hydraulic power in the Great Plain despite the fact that natural endowments are not altogether favourable economically. This is a justifiable policy because, even with 50 per cent probability, only 1 per cent of the estimated hydraulic power resource is utilized by the present production. Information is given in Fig. 5, and Table I about the existing and planned power stations of the Great Plain and about the available hydraulic power.

A problem to be solved in the long term is the *utilization of wind power* in the Great Plain. Perhaps, permanent electric power production cannot be

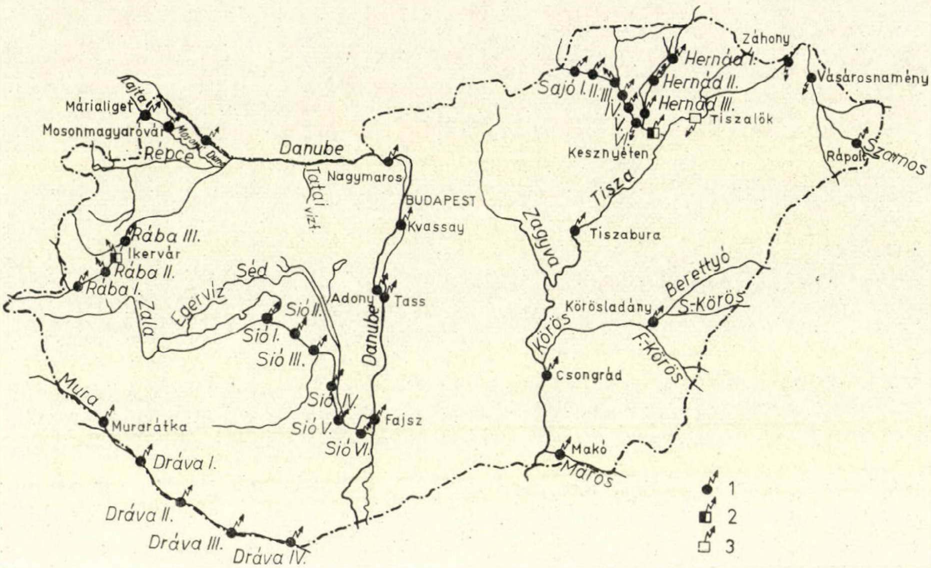

Fig. 5. Working and planned hydroelectric stations of Hungary (after M. Breinich)
1 = planned; 2 = expanding; 3 = working

considered because one of the climatic characteristics of the region is windlessness, sheltered as the basin is by its mountainous rim. However, several minor local power requirements could be so satisfied using the extinct windmills as the model. It will also be a task of the future to utilize the thermal water resources of the Great Plain for power generation. Concerning this question, preliminary studies are still in progress. The true potential of this resource is demonstrated by the fact that the geothermal gradient of the Plain is half (18—20 m/1 °C) of the world average. According to Boldizsár (1962), the thermal water stock is equivalent to 1200 million tons of coal. Exploitation so far utilizes only 28 per cent of the heat supply flowing to the surface (Szebényi 1962). The situation, however, is different if the heat flux is examined on the basis of detailed location. Szebényi has shown that there are great differences in the degree of utilization of natural heat supply within individual geohydrological regions (Fig. 6). The utilization of the thermal water of the Great Plain is surpassed only by the production in the Lower Tisza region and in the foreland of the Bükk. Here, production already shows the heat stock stored in the waterbearing soil. For the time being, however, there is no reason for anxiety because nationally, according to Szebényi, the stored heat in the rocks to a depth of 2000 m is equivalent to more than 700 million tons of coal of 5000 calorie per ton. The only question is at what rate should this resource be used to ensure optimal exploitation. Pertinent research will answer this question in the near future.

However, not only the temperature, but also the *quantity of water* is an important factor of the economic utilization of thermal waters, and in this

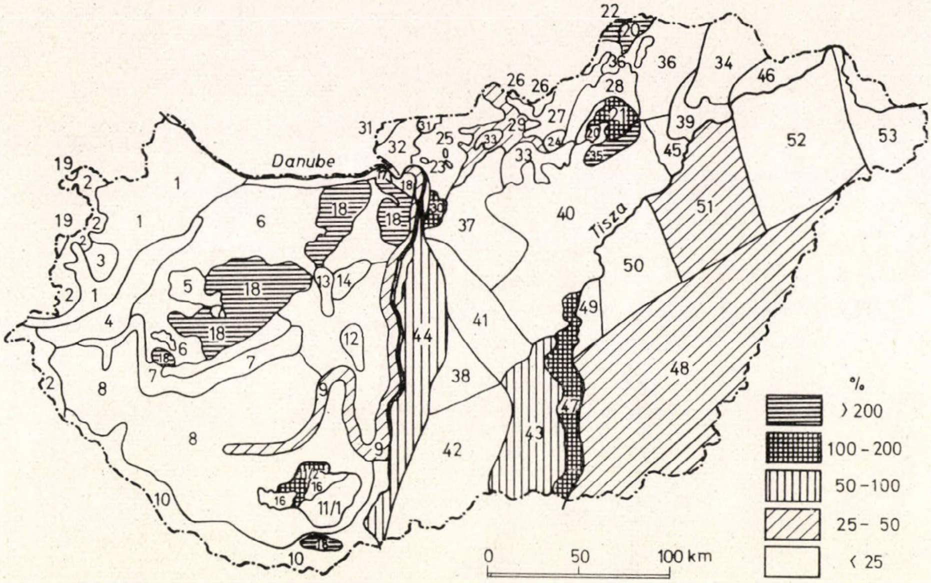

Fig. 6. Heat quantity of deep waters compared to heatflux in hydrographical regions 1—53

context only the deep seated upper Pannonian strata can be taken into consideration. L. Bélteky's map shows the areas where it is certainly possible to produce a thermal water output higher than 200 liter per minute at 50 °C and 80 °C (Fig. 7).

Two-thirds of the 33,500 sq.km suitable for the development of thermal water above 50 °C and three-quarters of the 8300 sq.km area providing thermal water above 80 °C are located in the Great Plain. If these data are compared with T. Boldizsár's calculations, the available exploitable thermal water resource must be considered of very considerable value. Consequently, using Iceland and Italy as models, an attempt can be made to establish thermal generating stations operating with geothermal power. However, more favourable methods of utilization than the ones offered at present should be developed for the economic utilization of thermal water below 100 °C which is of such diverse potential (cf. Boldizsár 1962, Bélteky 1964, Szebényi 1962).

MINERAL AND BUILDING MATERIALS

For phylogenetic reasons, raw materials of mineral origin are to be expected only on the margins of the Great Plain, where Lower and Upper Pannonian strata of marine and lacustrian origin wedge out onto or near to the surface. Elsewhere, because of the character of the quaternary sediment aggregate covering most of the surface, this is not found.

Among the small number of mineral occurrences, the Pannonian white sand seams which occur at the surface are suitable for glass-making. Another

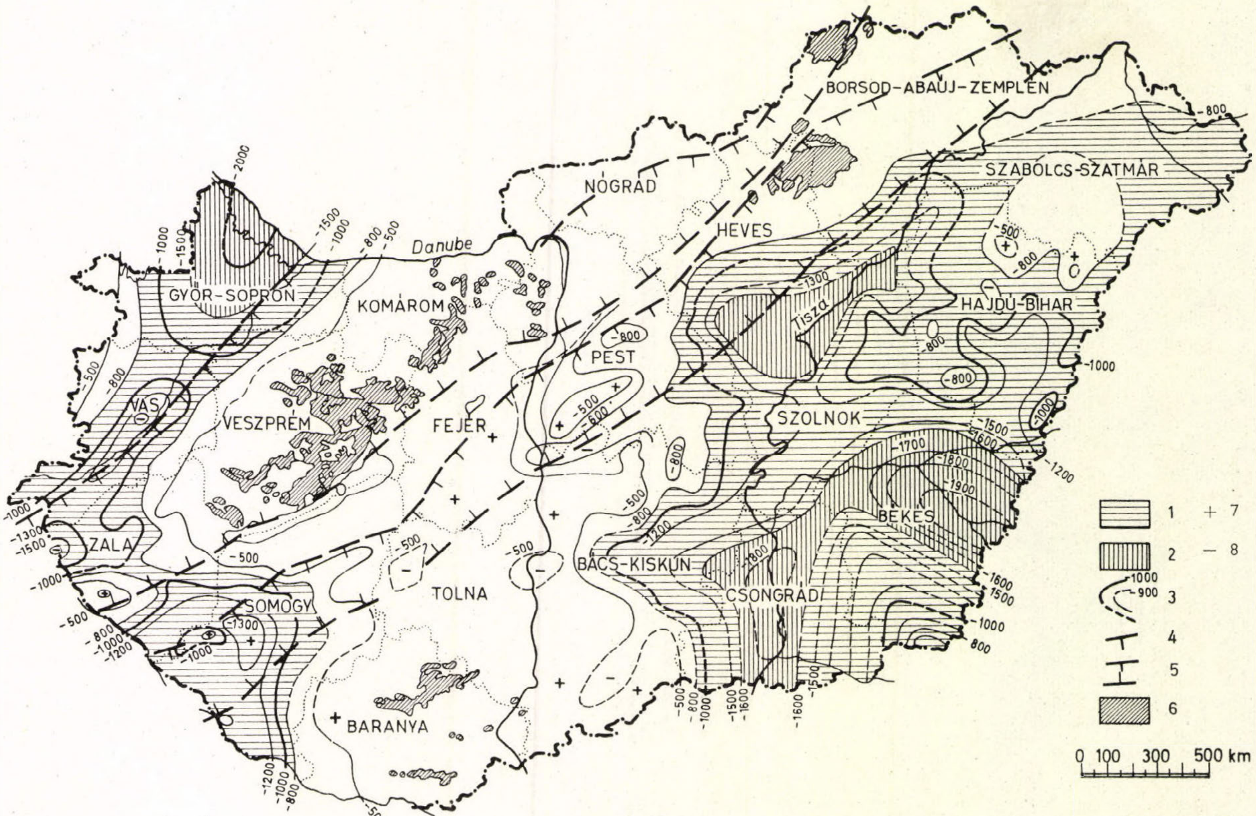

Fig. 7. Sites of thermal water prospecting in Hungary (after L. Bélteky)

1 = 50—80 °C; 2 = above 80 °C; 3 = Upper Pannonian bedrock compared to sea level; 4 = tectonic line dividing the large structural units; 5 = Mesozoic ranges covered with sediment; 6 = Mesozoic surface formations; 7 = upper level of the basin basement; 8 = lower level of the basin basement

marginal occurrence of Pannonian sand is the Mezőföld which has for a long time been utilized as moulding sand because of its favourable composition.

Building stone is also quarried in the marginal region of the Great Plain, where subsurface granite intrusions are near the surface. Such are the quarries near Székesfehérvár based on the continuation of the Velence batholith and the granite blocks near Polgárdi north-east of Lake Balaton. The andesite and rhyolite lavas and ashes are quarried in some places for building stone as are the hydroquartzite outcrops of the Bükk foreland and Mátra.

Quaternary sands and clays which, of course, outcrop extensively in the Great Plain, are of great importance for the building industry. However, mixed and contaminated nature of the sediments makes utilization for homogenous materials difficult. The sand and clay sediments can be separated into two main groups according to whether they occur in the sedimentation area of the Tisza or of the Danube. The latter are generally lime rich, and the former, with the exception of sediments associated with the Maros, are poor in lime.

The *clays* have been the most important materials for adobe and brick making in the Great Plain since ancient times. All the clay varieties of the region are now suitable for the production of burnt brick which will probably remain the most widely used building material because of the lack of other types which includes sediments of 0·02—0·002 mm grain size. Sharp distinctions can be drawn between the adaptability of individual clay varieties according to quality. The clays consisting largely of clay minerals are recognizable by their plasticity. Best quality homogeneous clay is required by the production of roofing tiles to prevent shrinking during drying. The sediments of the Tisza derived from the varied drift materials of its several tributaries are more favourable from the point of view of adaptability than those of the Danube. Another characteristic of the clays of the Tisza region is acidity, i.e., hydrogen ion concentration, in contrast to the limy, basic character of the clays of the Danube lowlands, which has an unfavourable effect on brickmaking. The clayey Upper Pannonian sediments where they emerge from below the Quaternary cover, form the most excellent raw material for brick manufacture and are the bases of the brick industries of Budapest and the Bükk region. The Great Plain supplies 47 per cent of the brickworks of the country with raw material. Seventeen per cent of the plants are located on the northern fringe of the Plain. Another 19 per cent are situated in the Tisza catchment area, most of them (10 per cent) being in the region between the Körös and Maros, and fewest (1 per cent) in the Nyírség. That part of the Danube catchment which comprises the Great Plain contains only 8 per cent of the brickworks. This does not, however, include the Mezőföld where in some places large quantities of brick, although of poorer quality, are made, for instance, at Paks.

The utilization of the many *sand varieties* is even more diverse. The Great Plain is rich in sand sediments of 0·02—2 mm grain size. However, angular sands, primarily suitable for building purposes, should be separated from blown-sand which consists for the most part of rounded grains and this immediately largely restricts adaptability to river sands. The second condition is the least possible clay and sludge content, which means that the sediments

TABLE II

Raw-material production in the Great Plain, 1968 (1 000 m³)

Region	Peat		Building stone		Coarse gravel	
	a	b	a	b	a	b
Danube Plain	48·0	15·0	—	—	4 091·3	534·6
Danube—Tisza Interfluve	394·8	64·0	2·4	0·3	1·0	—
Bácska	—	—	—	—	—	—
Mezőföld	—	—	—	—	54·3	14·6
Dráva Plain	—	—	—	—	—	—
N-Great Plain alluvial cone	—	—	—	—	9 942·6	439·3
Bereg-Szatmár Plain	—	—	1178·0	29·5	293·6	—
Bodrogköz	—	—	—	—	—	46·5
Central Tisza	—	—	—	—	—	—
Jászság	—	—	—	—	—	—
Lower Tisza	—	—	—	—	—	—
Nyírség	—	—	—	—	—	—
Hajdúság	—	—	—	—	—	—
Körös	—	—	—	—	0·1	0·8
Maros—Körös Interfluve	—	—	—	—	2 389·0	1·2
Total	442·8	79·0	1180·4	29·8	16 771·9	1 037·0

a = existing stock; b = production

of the faster flowing rivers are more suitable than those of slower moving waters such as the middle reaches of rivers which are the most frequent in the Plain. The chemical composition is not unequivocal. For instance, the limy sand of the Danube is excellent for plastering, but limefree sand necessary for special purposes should be sought rather in the region of the tributaries of the Tisza.

The Danube sands are used for the production of lime-sand brick, of which there were 4 works in 1960. The formation of meadow limestone in the fenny areas of the table-land, which satisfied the building stone requirement of the local population, is also connected with high lime content and permeability.

The utilization of river gravel formerly of local significance only has become of national importance as the use of concrete has spread. Gravels suitable for concrete are free of sludge and clay, and consist mainly of quartz of between 1 and 3 cm grain size mixed with a certain amount of sand. Gravel aggregates having a composition meeting these requirements are to be found only on the margins of the Great Plain, where the talus of rivers flowing from the frame mountain rim is still on or near to the surface. The material of the gravel terraces of Pleistocene age are also of great importance, and extensively quarried. The gravel material of the large Pleistocene fan of the Danube in the region of Budapest, which only extends on the surface as far south as the line from Délegyháza to Vecsés because of subsidence, is quarried at several points. In the Great Plain reach of the Danube gravelly sand is only deposited as far as Uszód, and farther south only fine sand and sludge can be obtained (Bogárdi 1951).

Region	Building sand		Brick-clay		Ceramic-clay	
	a	b	a	b	a	b
Danube Plain	83·8	43·2	7·9	3·4	—	—
Danube—Tisza Interfluve	120·7	16·4	—	—	—	—
Bácska	—	—	—	—	—	—
Mezőföld	125·7	20·5	—	—	—	—
Dráva Plain	175·0	1·1	—	—	—	—
N-Great Plain alluvial cone	1 146·5	47·2	—	—	—	—
Bereg-Szatmár Plain	42·7	—	—	—	—	—
Bodrogköz	—	20·3	—	—	—	—
Central Tisza	1 864·0	216·4	6 008·9	4·7	—	—
Jászság	94·0	16·0	42·2	4·5	—	—
Lower Tisza	558·3	92·1	59·3	17·0	8·6	3·6
Nyírség	—	—	—	—	—	—
Hajdúság	139·2	12·9	77·6	8·1	—	—
Körös	188·5	7·2	—	—	—	—
Maros—Körös Interfluve	937·5	223·0	520·6	92·8	—	—
Total	5 475·9	716·3	6 716·5	130·5	8·6	3·6

Gravel with a high sand content along the Tisza is to be found only above its confluence with the Borsa. The gravel aggregates of the plain of Szatmár-Bereg which occur near the surface, as well as those of the Szamos at Csenger are of the same character. Cleaner gravel layers are situated only below the surface here and in every case below the groundwater level, which hinders production.

The situation is more favourable at the large fan of the Sajó, extending from the Bükk to the Tisza. The gravel filling of the Hernád Valley which joins this from the north is covered with a young sandy-limy superficial deposit. The gravel drift of the Sajó is extensively produced especially between Ónod, Miskolc and Nyékládháza, mainly by deep working. It can also be noted that considerable quantities of gravel are still brought down by the Sajó even today.

The bulk of the coarse drift of the tributaries of the Körös and of the Maros does not extend as far as the eastern frontier of Hungary, and the greater part of their talus fans are also buried soon after they leave the country. In some places, however, sandy gravels are sporadically worked. More detailed information concerning the location of the Pleistocene taluses below the surface is given in the Hydrogeological Atlas of Hungary (E. R. Schmidt 1962).

For the sake of completeness, the formerly wide-spread nitrate and soda production must be mentioned. The former became impossible because of flood control, the latter, however, would be still possible in the areas of solonchak soils were it not made uneconomical by industrial production (Table II).

PRACTICAL ASPECTS OF THE RELIEF OF THE GREAT PLAIN. THE RELIEF FROM THE VIEWPOINT OF NATIONAL ECONOMY

The flat surface of the Great Plain which has an area of 52,000 sq.km, generally lies at an altitude of between 78 and 178 m above sea level. Thus the relief is not such a powerful influence on the national economy as it is within a single hilly region even. The situation is different if small relief variations are accentuated by other natural geographical factors such as climatic, hydrographic or soil conditions, or if the microrelief itself is diversifying otherwise uniform physical conditions.

According to the *Láng—Vass* relief energy map, the boundary zone of the Great Plain displays a relative relief of 100—150 m. As one moves into the interior of the plain, however, the relative relief rapidly decreases and the surface approximates a perfect plane with height differences ranging from 0 to 5 m in the extensive flood areas of the Tisza and the Danube and Dráva (Map 2 attached).

As the relief energy differences clearly indicate the local erosion bases, we can distinguish individual regional units on the basis of their groundwater characteristics, trends in soil development and type of the natural vegetation. The character and diversity of local microclimates can be also studied. We shall, however, review here only the morphological regions of the Great Plain. These correspond in many respects to the natural geographical regions because relief produced by phylogenetic factors is frequently one of the most powerful landscape-forming features.

The lowest lying morphological region of the Great Plain is the youngest alluvial level which even today is still being constructed in certain parts. Its former active area has been greatly restricted by river and flood controls. Some 150 years ago two-fifths of the Great Plain belonged to this level, but nowadays the flooded area is restricted to 6 per cent of the ancient flooded area.

There is a great difference between the flood plains of the Danube and the Tisza in terms of the amount of water within the flood plain level. The loose sediments along the Danube and Dráva contain groundwater in large quantities, which tends to be absent from the fine-grained sediments of the Tisza and of its various Körös tributaries. Floods produced by a rise in the level of the groundwater during wet years in the latter area are consequently dangerous phenomena. The different groundwater conditions influence soil development within the two flood plains as well.

Generally the loessic surfaces of the Great Plain belong to the morphological stage immediately above the flood plain level, even though their phylogenetic character is rather different. In many places the parent material of the soil cover was formed from sludge transported by rivers rather than from falling dust. This region includes those terrains where the relief energy is generally in excess of 25 m but characteristic of the flood plains. The former restriction is necessary because the greater part of the area between the Körös and Maros rivers are also characterized by relief energy values below 5 m, and similar values are to be found on the loessic table-land of Szolnok and along the northern and western peripheries of the Hajdúság.

Yet, these regions are distinct from the real flood plains because they are situated above the base level of erosion. As these regions are at least 10 m high above the local base levels of erosion, they are characterized by good runoff and—because they lack impermeable subsoils—by a favourable water economy. Agricultural activity has been long pursued on their surface. The mass of soft vegetation and associated saturated humus facilitated the formation of deep black soils and as a consequence the most fertile soil varieties of Hungary are to be found at this morphological level. Their fertility is enhanced by the fact that their groundwater is located at a depth within the reach of agricultural plants.

The small features to be found on the loess surfaces are for the most part the products of fluvial erosion. These are negative forms. Positive features are represented by *tumuli* mainly of anthropogenic origin (Cumanian mounds).

The relief energy of the third and at the same time highest morphological level of the Great Plain is represented by alluvial fans exceeding 25 m. Four subzones can be distinguished. In the sand-covered parts of the table-land in the Danube—Tisza Interfluve, in the Nyírség and in much of the eastern part of the Mezőföld relief energy exceeds 50 m only in a few places. However, in the foreland of the Mátra and Bükk Mountains, and on the periphery of the Mezőföld it exceeds 100 m at some points. From the point of view of origin, the Nyírség and the table-land between the Danube and Tisza rivers are fossil taluses, while in the area of the Mátra and Bükk Mountains fossil and recent taluses exist side by side. The Mezőföld is a plain dissected into blocks by deep valleys. Evidence of recent subsidence and taluses are to be found along its margins. These surface units are generally characterized by denudation, although accumulation is to be found in the minor basin-like features. Regarding the character and extent of erosion considerable differences occur between the regional units mentioned according to the type of surface deposit. In the table-land of the Danube—Tisza Interfluve and Nyírség, eolian denudation is characteristic owing to the high degree of permeability of the sand surface and to drought. On the other hand, the surface erosion of the drift slopes of the northern part of the Great Plain and of the Mezőföld is destroyed by linear erosion. The heavy slope denudation involves the destruction of the soil cover in some places which demands the introduction of anti-erosion measures.

A common characteristic of the various hills within sandy regions is that their slope gradients exceed the 12° maximum limit for agricultural cultivation—indeed, some may be as high as 32°. Even steeper slopes are to be found in the foreland of the Mátra and Bükk Mountains and along the valleys of the Mezőföld. They are, however, generally more stable than the small features of the sandy areas. For this reason, agricultural utilization is preceded by the levelling of the terrain, an indispensable precondition for the formation of large fields and the introduction of mechanical and advanced cultivation techniques.

Although the taluses of the northern part of the Great Plain cannot be levelled which means that they cannot be irrigated by gravitation, they are in an advantageous position from the point of view of exposure to sunlight. Indeed, during the summer months slopes of 10° with southern exposition receive irradiated light heat approximating that of mediterranean regions.

This is enhanced by the protection against excessive winds and precipitation afforded by the mountains, as well as by the foehn character of the air currents. The latter factors are not all advantageous in that the foreland of the Mátra and Bükk Mountains is considerably drier than surrounding areas. In precipitation, in sunshine and in drought the western, southern and eastern slopes respectively are "favoured". The water supply of these regions is no longer advantageous just because of their privileged natural position. The situation on the drift slopes of the northern part of the Great Plain and to some extent on those of the Mezőföld is alleviated through drainage from other areas, as well as by underground water in the case of the former. However, the sandy regions are poor in both surface and groundwater. The Hátság table-land is better placed in respect of underground water, and even certain parts of the Nyírség are in a more advantageous position than the Mezőföld. On the other hand, soil conditions are best in the Mezőföld, although, in dry years vegetation may suffer drought damage because of the groundwater being so far below the surface.

THE CLIMATE OF THE GREAT PLAIN

By summarizing the climatic picture of the individual regions of the Great Plain, several inferences of practical value can be drawn from the available data in Climatic Atlas of Hungary.* Three extreme climatic types can be distinguished in the Plain, which are represented by the environments of Szeged, Barcs and Kisvárda. Travelling from any one of these places to either of the other two, the climatic elements change in proportion to the distance covered (Fig. 8).

The annual sunshine minimum of 1906 hours as shown by 50 years of records is to be found at Barcs in the south-west. The annual fluctuations in monthly temperature are likewise at a minimum (21·8 °C) here as is the average water deficit (50 mm !) and the occurrence of early and late frosts (11 and 10 days, respectively). On the other hand, air humidity (78 per cent), average annual (774 mm) and daily precipitation and number of rainy days are at a maximum at Barcs.

In the south-east, around Szeged the highest values occur regarding: mean annual hours of sunshine (2102 hours), annual and vegetation mean temperatures (11·5 and 18·5 °C), average maximum temperature (36 °C), number of summer days (94), hot days (31) and extremely hot days (3), total annual heat (4344 °C), total heat during the vegetation period (3407 hours), July mean temperature (22·7 °C), number of 10 °C daily means (200 !), duration of potential evaporation and frost-free period (213 days). As a consequence, the duration of the frost period (152 days) is at a minimum, while the first (22nd December) and last (22nd February) days of snow occur respectively later and earlier than elsewhere in the Great Plain.

The third type region comprises the north-eastern part of the Great Plain. Here the following minima occur: annual mean temperature (9·3 °C), tempera-

* For details see: A dunai Alföld, 91—164, Tables 12, 13.

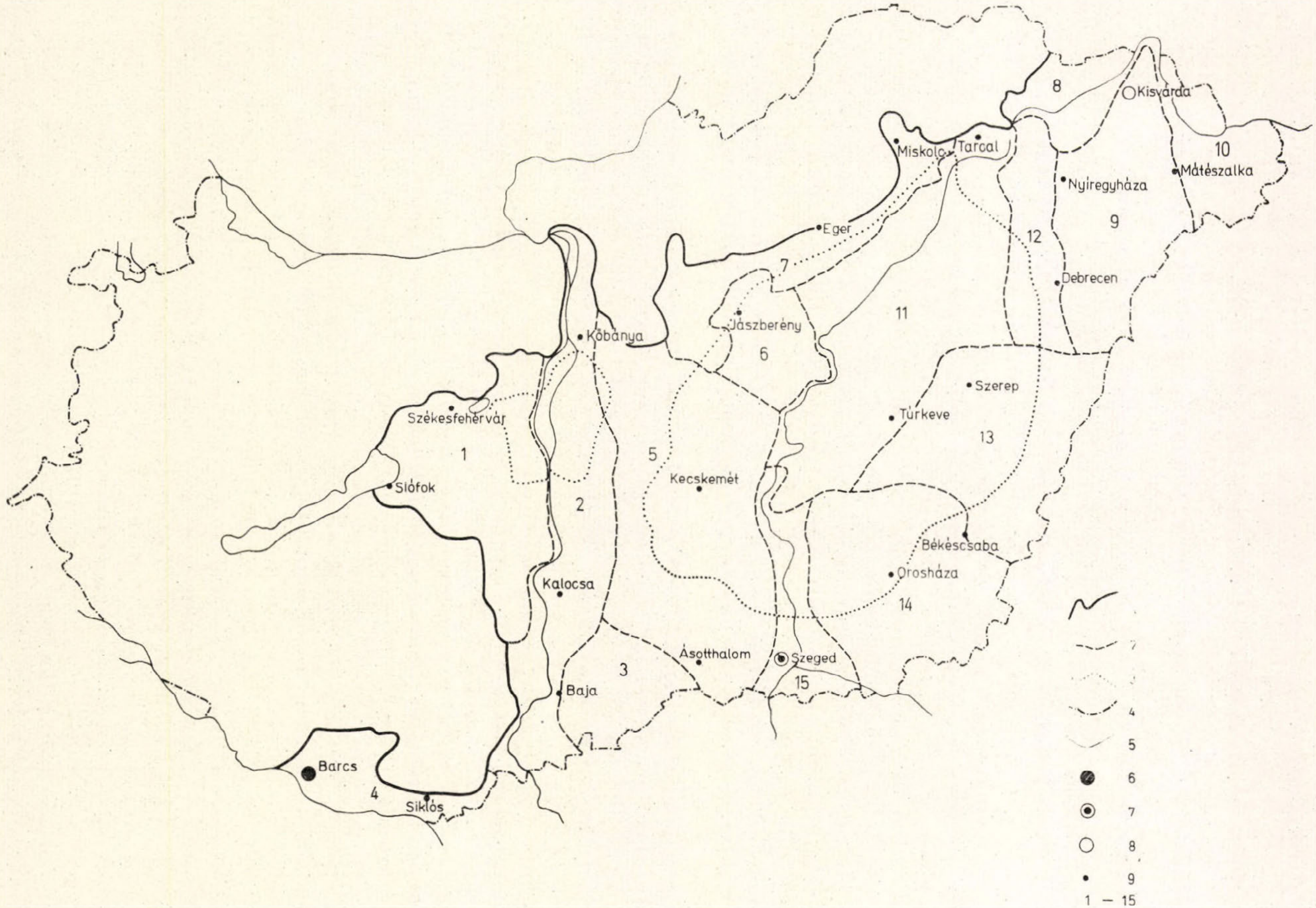

Fig. 8. Climatic regions and basic stations in the Great Plain

1 = borderline of the Great Plain; 2 = borderlines of the regions; 3 = the driest areas; 4 = frontiers; 5 = rivers; 6 = station of highest precipitation; 7 = the warmest basic station; 8 = the coldest basic station; 9 = basic stations; 1—15 = regions

ture of the vegetation period (16·3 °C), average maximum temperature (34 °C), July mean temperature (20·5 °C), extremely hot days (1), total annual heat (3748 °C) and total heat during the vegetation period (3051 °C). At the same time, the frequency of foggy days (50), the number of days with frost (118), the number of winter days (38), the number of severe days (22), the duration of the snow cover (5th December—5th March), and the number of days with snow (26) are at a maximum here. Frosts begin early (8th October) and can occur as late as the 22nd April. The duration of the frost period exceeds 190 days, and the occurrence of early (20 days) and late (22 days) frosts is high.

Thus, of the climatic extremes the south-western part of the Plain represents maximum humidity and the south-eastern and north-eastern parts maximum and minimum temperatures respectively. Consequently, while in the territorial distribution of temperature the counterpoint to the south-east is the north-east, in the distribution of moisture the south-west has no corresponding counterpole on the periphery of the Plain. In this area, average precipitation is everywhere below 550 mm, and indeed, there are places where it hardly reaches 500 mm. Summers are hot—the 50-year July average being above 22 °C—and winters fairly cold. Consequently, the maximum range of temperature—above 24 °C—is also to be found in this zone. The number of summer and extremely hot days, as well as the number of frosty, winter and severe days closely approximates the maximum values of the neighbouring areas as well.

Thus, among the regions of the Great Plain, the Dráva area leads in moisture supply, the Lower Tisza and the area between the Körös and Maros in summer heat input and the Bodrogköz, the Nyírség and the plain of Counties Bereg and Szatmár in winter heat deficit. With regard to the lack of precipitation and climatic extremes, however, the Jászság and the Central Tisza Region may be considered the area having the most adverse climate.

The territorial distribution of climatic elements reviewed in the foregoing is governed by the action centres and the fact that Hungary is located in a basin situation. It is the Dráva region of the Great Plain which is situated closest to the wind directions carrying moist air-masses from the Atlantic Ocean. Its location is also the most favourable from this point of view in that there is no hill country sheltering the region from the prevailing wind directions. The south-eastern part of the Great Plain is nearest to the Mediterranean climatic region and is frequently subjected to the effect of air currents bringing in Mediterranean air-masses from the south, the south-west and the south-east (Bacsó 1959). On the other hand, the north-eastern part of the Plain is influenced longest by the East-European cold anticyclone during the winter. The Central Tisza Region is farthest from each type centre and consequently there is nothing which prevents this area experiencing the temperature trends of the north-east in winter and of the south-east in summer. Drought is also characteristic of this area owing to the rain shadow effect of the nearby hills.

Several valuable features of the climatic character of individual regions can be obtained by tabulating their climatic elements. Average values, however, are not suitable for the concrete characterization of the climate of an individual region. However, the frequency values are much more closely connected with production. Although the data are still insufficient to give frequency values of every climatic element, the most important ones, namely temperature and precipitation, have already been computed for several stations.

If the frequency of the values of the most important climatic elements is determined in percentages, one obtains the occurrence of certain weather types. In other words, the weather types associated with different climate systems are all connected with the frequency of the occurrence of the limiting values of a certain number of climatic elements. However, as with average values individual weather types determined by the extreme values of the climatic elements do not express the fitfulness and changeability of the local climate. If, however, they are systematized on the basis of properly selected criteria, they are suitable to characterize briefly individual areas—in the present case regions. If, additionally, the occurrence of the properly determined weather types is expressed for individual places as relative frequencies, from which the probabilities of the recurrence of certain climatic types can be determined, more is revealed about the climate of those places than by the most detailed analysis of individual climatic elements. So that occurrence frequencies could be evaluated, we resorted to a newer method of characterizing regional climates. Its basis lies in the trend of the two main climatic elements of temperature and precipitation. It is well known that the climate of the Great Plain varies between the extremes of temperature and precipitation according to the alternating effects of the governing factors. This provides a basis for distinguishing variations in the four weather types of the Great Plain by an analysis of annual temperature and precipitation data (Table III). These weather types are: warm-dry submediterranean, mild-humid subatlantic, cool-humid subpolar and cool-dry subcontinental. Their different characteristics are determined by the origin of the associated air-masses, as well as by the air circulation deciding their movements and by the repetitive frequency of the various weather situations (Bacsó 1959).

TABLE III

Climate types of the Great Plain

M	Temperature:	higher than average
	Precipitation:	average or lesss
A	Temperature:	average or higher
	Precipitation:	more than average
P	Temperature:	less than average
	Precipitation:	average or more
C	Temperature:	less than average
	Precipitation:	less than average

M = Submediterranean (continental subtropical)
A = Subatlantic (maritime subtropical)
P = Subpolar (maritime polar)
C = Subcontinental (continental polar)

The occurrence frequency of the weather types shown in Table III can be calculated in two different ways. First, the 50-year temperature and precipitation averages of individual stations are taken, and the annual data of the

TABLE IV

Climatic fiuctuation of the Great Plain between 1901 and 1950

Region	Station	50 years' average						Climate types as average
		Temperature, °C			Precipitation mm**			
		min.	av.	max.	min.	av.	max.	
1	2	3			4			5
Danube Plain	Bp. Kőbánya*	8·2	10·8	11·7	325	560	900	M
	Kalocsa	8·4	11·0	12·2	391	586	860	M
Danube—Tisza Interfluve	Kecskemét	8·1	10·5	12·0	360	517	827	M
	Ásotthalom	8·1	11·1	12·0	381	594	847	M
Bácska	Baja	8·4	10·9	12·1	387	599	868	M
Mezőföld	Székesfehérvár	8·0	10·8	11·9	367	565	818	M
	Siófok*	8·8	10·6	11·8	418	623	862	A
Dráva Plain	Siklós*	8·7	10·9	12·2	451	676	915	A
	Barcs*	8·4	10·5	12·0	397	799	1252	A
N-Great Plain alluvial cone	Eger	7·7	10·1	11·5	341	542	834	M
	Miskolc	7·1	9·7	11·5	369	584	836	P
Bereg-Szatmár Plain	Mátészalka*	7·3	9·8	11·1	337	555	1047	C
Bodrogköz	Kisvárda	7·0	9·3	11·6	324	600	888	P
Central Tisza	Tarcal	8·0	10·3	11·8	329	574	862	M
	Túrkeve	7·8	10·5	11·9	343	545	821	M
Jászság	Jászberény	7·9	10·3	12·3	263	517	789	M
Lower Tisza	Szeged	9·0	11·4	12·5	348	565	867	M
Nyírség	Nyíregyháza	7·4	9·8	11·7	359	593	822	P
Hajdúság	Debrecen	7·9	10·0	11·5	342	585	874	P
Körös	Szerep*	8·4	10·6	12·2	324	560	873	M
Körös—Maros Interfluve	Békéscsaba	8·3	11·1	12·2	341	560	857	M
	Orosháza	8·3	10·9	12·2	380	542	816	M
			10·45			589		

* data calculated by the author

** data from M. Kéri and I. Kulin (1953)

(A) Frequency of the climate types as compared with station average				(B) Frequency of the climate types as compared with Great Plain average			
M	A	P	C	M	A	P	C
6				7			
12	12	9	7	22	12	7	9
44%	24%	18%	14%	44%	24%	14%	18%
26	8	8	8	32	9	6	3
52%	16%	16%	16%	64%	18%	12%	6%
22	13	7	8	27	10	6	7
44%	26%	14%	16%	54%	20%	12%	14%
20	13	11	6	24	14	9	3
40%	26%	22%	12%	48%	28%	18%	6%
18	12	13	7	22	18	6	4
36%	24%	26%	14%	44%	36%	12%	8%
16	10	14	10	16	18	12	4
32%	20%	28%	20%	32%	36%	24%	8%
16	14	11	9	19	11	10	10
32%	28%	22%	18%	38%	22%	20%	20%
25	12	8	5	13	29	7	1
50%	24%	16%	10%	26%	58%	14%	2%
14	19	16	1	5	30	14	1
28%	38%	32%	2%	10%	60%	28%	2%
16	14	16	4	18	10	15	7
32%	28%	32%	8%	36%	20%	30%	14%
21	10	11	8	11	9	13	17
42%	20%	22%	16%	22%	18%	26%	34%
13	18	11	8	9	9	17	15
26%	36%	22%	16%	18%	18%	34%	30%
21	14	8	7	9	9	17	15
42%	28%	16%	14%	18%	18%	34%	30%
21	13	8	8	21	13	8	8
42%	26%	16%	16%	42%	26%	16%	16%
20	11	8	11	26	11	6	7
40%	22%	16%	22%	52%	22%	12%	14%
20	12	8	10	23	8	6	13
40%	24%	16%	20%	46%	16%	12%	26%
26	9	10	5	36	12	2	—
52%	18%	20%	10%	72%	24%	4%	—
20	13	8	9	17	8	14	11
40%	26%	16%	18%	34%	16%	28%	22%
22	13	8	7	15	14	12	9
44%	26%	16%	14%	30%	28%	24%	18%
22	12	8	8	27	11	6	6
44%	24%	16%	16%	54%	22%	12%	12%
26	8	9	7	30	11	5	4
52%	16%	18%	14%	60%	22%	10%	8%
23	11	7	9	32	8	5	5
46%	22%	14%	18%	64%	16%	10%	10%
450	270	219	161 = 1100	454	283	293	160 = 1100
41%	24·5%	20%	14·5%=100%	41·3%	45·7%	18·5%	14·5% =100%

TABLE V

Frequency and distribution of the various compound types of years

According to head (A) of Table IV

Types					Number of				Year in per cent	Production character
					M	A	P	C		
No.	Symbol				types of year by station					
Clear types										
5	M				110				10	—
1		A				22			2	+
2			P				44		4	0
Mixed types										
14	M	A			163	145			28	+
2	M			C	20			24	4	—
3		A	P			53	13		6	+
9			P	C			112	86	18	0
4	M	A	P		52	30	6		8	+
3	M	A		C	54	6		6	6	—
4	M		P	C	14		34	40	8	—
3	M	A	P	C	37	14	10	5	6	0
Number of years × number of stations (50×22)					450	270	219	161	100	

	A		B	
Number of years favourable for production (+)	22	44%	19	38%
Number of years indifferent for production (0)	14	28%	13	26%
Number of years unfavourable for production (—)	14	28%	18	36%
Total	50	100%	50	100%

concerned station compared with them. Secondly, the average temperature and precipitation of the Great Plain are calculated, and the respective annual data of all stations compared with the average value thus obtained. (The average temperature of the Great Plain as calculated from the records of 22 stations over the period 1901 to 1950 is 10·45 °C; the precipitation average is 584 mm.)

A comparison of the relative frequencies of different climate types (Table IV) indicates that great differences are rarely shown for a given station by the two methods. In those regions where extreme average values of individual climatic elements were found, the relative frequency of the weather type associated with the given extreme is more significantly compared with the average for the Great Plain than with the average for the region itself. For instance, the subatlantic type is shown as occurring at Barcs 38 per cent of the time by the first method, and 60 per cent by the second. The respective values for submediterranean type at Szeged are 52 and 72 per cent, for the subpolar type at Kisvárda 16 per cent and 34 per cent, and the subcontinental

According to head (B) of Table IV

Types No.	Symbol				Number of types of year by station M	A	P	C	Year in per cent	Production character	Serial No. of climatic character
Clear types											
2	M				44				4	—	1
1		A				22			2	+	2
Mixed types											
10	M	A			120	100			20	+	2
2	M			C	27			17	4	—	4
3		A	P			36	30		6	+	2
2			P	C			38	6	4	0	3
5	M	A	P		29	44	37		10	+	2
9	M	A		C	139	32		27	18	—	1
5	M		P	C	7		40	63	10	—	4
1		A	P	C		2	14	6	2	0	3
10	M	A	P	C	88	47	44	41	20	0	5
Number of years × number of stations (50×22)					454	283	203	160	100		

Distribution of climatic character:

		A		B	
1. Number of warm, dry years		8	16%	11	22%
2. Number of mild, humid years		22	44%	19	38%
3. Number of cool, humid years		11	22%	3	6%
4. Number of cold, dry years		6	12%	7	14%
5. Number of indifferent years		3	6%	10	20%
	Total	50	100%	50	100%

type at Miskolc 16 per cent and 34 per cent. Apart from these, however, the relative frequencies of the individual weather types are approximately equal when analysed with both methods (totals for columns 6 and 7 of Table IV).

The average climate type of individual stations was determined from the 50-year records and compared with the Great Plain (column 5, Table IV). It is apparent that the submediterranean type dominates, it being present in 63 per cent of the time at the main stations analysed. Fifty per cent of the stations are warmer than the Great Plain average and 63 per cent are drier. The distribution of temperature is consequently much more uniform than that of precipitation.

Table V demonstrates the situation in greater detail by indicating the distribution and relative frequency of occurrence of individual climate types during the 50 years investigated. Here too, among the unambiguous climates the submediterranean type is dominant. Among those of mixed type, the submediterranean–subatlantic combination occurs most frequently. In addition to this, however, submediterranean elements are well represented in almost every type relationship. It is interesting to observe in the context of type relationships the association between contrasting and non-contrasting climatic types. It is obvious that types M and A, as well as P and C may occur much more frequently beside each other than types M–C and A–P, while types M–P and A–C never occurred beside each other. In the Great Hungarian Plain a situation when the atmosphere is cool-humid in one place and warm-dry in another is inconceivable while theoretically the warm-humid—warm-dry and cool-humid—cool-dry weather types may occur beside each other.

In Table V, from the point of view of agricultural production mild-humid years were assumed to be favourable (+ *sign*), warm-dry and cold-dry years unfavourable (— *sign*) and cool-humid and characterless years indifferent (0 *sign*). However, these broad generalizations would be true only if annual average precipitation and temperature were distributed evenly, and did not contain large seasonal and monthly extremes. Yet, agricultural production usually depends upon a favourable temperature and precipitation distribution during a short period within a year, and for this reason there is not such a close correlation between output and the above climatic types as might be presumed at first sight.

One might object to the designation of the weather types. Our starting point does not, of course, depend on the terms used, but on the correct selection and delimitation of real weather types. It should be mentioned here that according to Alisov's climatic system Hungary may be included either in the polar zone (No. 5) in winter or in the subtropical zone (No. 4) in summer. In the selection and designation of our types, we relied on the main properties of air-masses coming *from the action centres*. It is admitted that better methods have already been elaborated by meteorological research. However, these can be applied to small areas such as the regions of the Great Plain only with difficulty. We wish to emphasize the fact that we have not striven for some new climate classification, but have endeavoured only to analyse the frequency of the main types of the climate of the Great Plain which is well known for its moderately warm and dry character.

WATER RESERVES IN THE GREAT PLAIN. SURFACE WATER

In the context of utilizable water, the regional distribution of surface water is taken into account. Local requirements are also estimated in order to judge the level of supply and possible shortfall of water within the regions.*

The average annual precipitation over the 52,000 sq.km of the Great Plain is 584 mm which is equivalent to a 963 cu.m/sec continuous jet of water. These data show that it is only groundwater, cavern water, and other water that can be derived from this total amount. The sum of these three sources is 86 498 cu.m of water per sec, which is not quite 9 per cent of the total precipitation received. This would be equal to the coefficient of runoff, i.e., the water surplus of the Great Plain, if much of the groundwater did not fall victim to evaporation. A runoff coefficient of 6·5 per cent is thus more real-

* For details see: A dunai Alföld, 91—164, Table 18.

istic, which corresponds to an average of 1·2 litres per sec per sq.km of surface. Thus, as already mentioned the water requirements of the Great Plain are satisfied for the most part by the rivers flowing through it from neighbouring regions which are better supplied with precipitation. This feature of the supply situation will become even more pronounced in the future.

Because of their peripheral nature, the Danube and Dráva cannot be utilized to the same extent as the Tisza. This problem will not be completely solved even by the planned Danube—Tisza canal which will only supply the southern part of the Tisza region below Szolnok. One finds that at present although the total water stock of the Great Plain (1038,836 cu.m per sec) still far exceeds the 160,445 cu.m per sec of water required as shown by the 1963 survey, the water balance of the individual regions is by no means as favourable.

The regions closest to the Danube and the Dráva possess the most significant utilizable water reserves. The water available in the northern part of the Great Plain as a whole is almost sufficient to meet the demand although significant deficits exist in some places, for instance at Miskolc. The situation in the Körös region is the same. In the Central Tisza Region and on the Hajdúhát, by contrast, present demands already exceed total reserves.

The picture becomes even less favourable when future requirements are taken into consideration. Thus by 1980 it is expected that demand will be five times larger than it was in 1963, which means that with the exception of the regions bordering the Danube and the Dráva, the Bodrogköz and the Upper Tisza Region, requirements will exceed supply in all regions of the Great Plain.

These factors will be of prime importance in determining the location of establishments such as industrial plants which have high water requirements and the extension of irrigation. It is easy to understand, however, that it is not always possible to extract water in those places most favourable from the point of view of water reserves. This is prevented by the fact that rivers with low water output in the Tisza region fall very much short of the indicated 80 per cent frequency in August of larger rivers. Water extraction from the Tisza and its tributaries should also take this into account.

Besides this, several factors affecting water quality hinder the utilization of available water. For instance, some groundwater reserves are unsuitable for industrial and irrigation purposes owing to hardness and total salt content (Fig. 9). Shore-filtered water which has the most favourable composition for utilization comprises hardly one quarter of total subsurface water. It is available in significant quantities only in the vicinity of the Danube and to a lesser extent, beside the Dráva, Szamos, Bodrog and Sajó rivers. The industrial suitability of river-water depends primarily on its hardness: for irrigation it relates to total salt content and for drinking water to the degree of contamination. From these points of view, the Danube, Dráva, Tisza, Szamos, Bodrog, Sajó, the Köröses and the Maros may be considered suitable for irrigation and for industrial water (Map 3 attached).

The situation is even more unfavourable from the point of view of public health. Nowadays, only certain reaches of the Tisza, together with the Túr, Fekete-Körös and Maros may be considered to have perfectly clean water, the

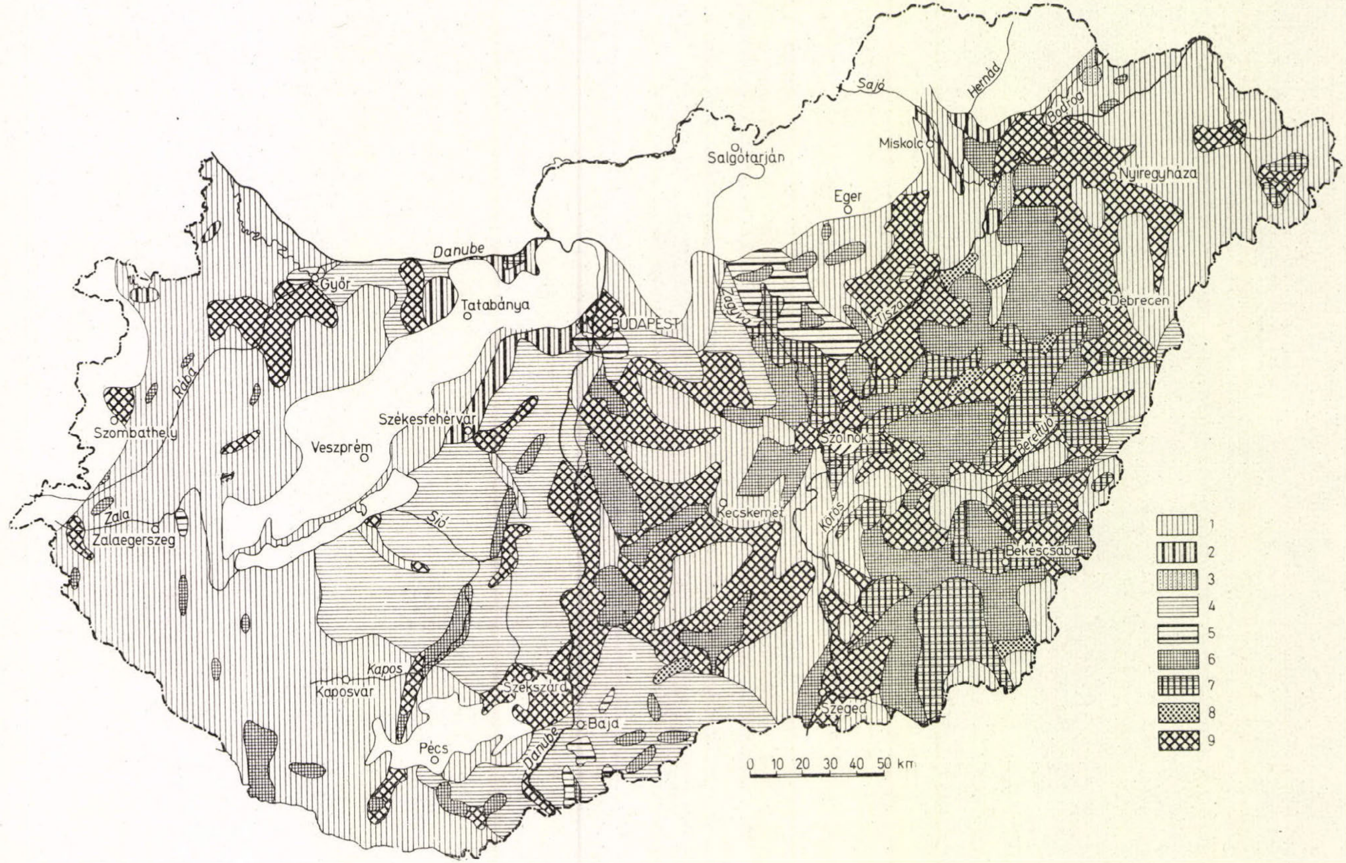

Fig. 9. Chemical characteristics of groundwater samples (after A. Rónai)

1 = calcium-hydrocarbonate; 2 = gypsum; 3 = calcium chloride; 4 = magnesium-hydrocarbonate; 5 = magnesium-sulphate (epsom salt); 6 = sodium-hydrocarbonate (alkaline, sodium); 7 = sodium chloride (glaubersalt); 8 = sodium chloride (salt); 9 = mixed

overwhelming majority of rivers being slightly contaminated. However, the Danube below Budapest, the Sió above its confluence with the Kapos, the Eger, the Sajó below Miskolc, the entire Hungarian reach of the Bodrog have already reached the highly contaminated state. This is why the maintenance of water purity is such an important task (Map 4 attached).

Another problem is that the population is becoming increasingly concentrated into towns and settlements of urban character. Because of this, water requirements are also rising as the daily 30 litre average water consumption of the rural population is replaced by the 200 litre per day average requirement of the urban population.

The large-scale extension of the irrigated areas which are envisaged will take place for the most part in the very regions where even today the available water sources are reaching their limit. Meeting all these tasks and requirements at an adequate level imposes the need to economize increasingly in the use of water as well as to protect the reserves available.

Even with the most stringent economy, the only way to meet the long-term water requirements of the Great Plain is the construction of a mountain reservoir system through the cooperation of all countries sharing the catchment area of the Tisza. Its construction will mean the material sacrifices, and presupposes international cooperation and mutual assistance closer than has previously been achieved. However, the long-term water requirements of the Great Plain cannot be satisfied otherwise.

SUBSURFACE WATER SOURCES

Certain types of subsurface water, such as groundwater, strata water, thermal water, cavern water, cannot be strictly separated because the geological structure and evolution of the Great Plain have made possible their continuous and constant mixing both vertically and horizontally. The same can be said for the origin of the individual subsurface water types as well. Thus, water from precipitation, vadose or freatic water, fossil water, water from dehydration or compaction, and water of crystal and juvenile origin, are all intermixed, although to a differing extent depending upon location and geological layer. Naturally, groundwater situated nearest to the surface contains a smaller proportion of water of juvenile origin compared with artesian water from deeper strata while the proportion derived from precipitations is correspondingly higher. Former precipitation also comprises a high proportion of water welling up in regions covered with young basin sediments adjacent to karstic mountains. Water derived from the clays of the Lower Pannonian, on the other hand, are mostly fossil in origin or result from dehydration.

It is not the location and origin of the subsurface water which is of importance to us here but rather its quantity and supply. Conservative calculations made on the basis of different considerations indicate a total subsurface water volume of 2500—3000 cu.km under the Great Plain (Rónai 1960, Kocsis and Koltay 1959), and indeed, estimates of up to 20,000 cu.km may be considered realistic. The only question is what proportion of this water—which is equal to a 40-year average output from the Danube—can be exploited. Rónai (1960) assumes hardly 10 per cent, i.e., 300 cu.km, of the total quantity is theoretically exploitable. However, the greater part of this still very significant water reserve is fossile or static. Consequently, the water stored in the deeper subsurface layers is not being renewed. Geological research has as yet given no unequivocal answer concerning the extent to which subsurface water is being replenished (Sümeghy 1954, Rónai 1960, Ubell 1963). According to K. Ubell's recent calculations, the replenishable cavern and stratum water reserves amount to 91 cu.m per sec, of which the share of the Great Plain is approximately 50 cu.m per sec. In other words, this is the amount of water that can be extracted without significantly lowering the level. Besides this, he estimates the shore-filtered and other groundwater reserves within the whole country to be 117 cu.m per sec which is also replenishable. Of this, the share of the Great Plain is 45—50 cu.m per sec.

About two thirds of the exploitable groundwater reserve close to the surface are found within a maximum 2 km wide zone along the rivers, thus it relies on the so-called shore-filtered supply. The position concerning the remaining one third is not yet completely clarified. One view derives it entirely from local precipitation, and the other from strata waters through the process of lateral and vertical infiltration. On the loose, sandy, uplifted surfaces such as the Nyírség groundwater probably derives from precipitation. In the case of groundwaters under pressure and associated with clays, on the other hand, such as in areas with low geotherm gradient along the Tisza, which suggests intensive migration along structural lines, lateral and vertical infiltration from below is more likely.

The replenishing of the deeper strata from local surface precipitation cannot be accepted because total potential evaporation almost everywhere exceeds total actual evaporation and run-off combined in the Great Plain.

Every supposition leads to the conclusion that groundwater of compaction, crystal and juvenile origin forms a very small proportion of deep-seated water, and other possibilities for replenishment must be taken into account. This was already indicated by J. Sümeghy's first synthesis (1954) concerning subsurface water, when he pointed out the hydrogeological links between the mountain catchment area outside Hungary and the loose water-bearing sediments within the Carpathian Basin proper. Although this concept acquired many opponents, it is the most plausible explanation of how the water content of the deeper strata is replenished from the point of view of physical geography as well (Kocsis—Koltay 1959).

Assume a 35 per cent runoff coefficient and 990 mm of precipitation for the 251,000 sq.km Danube–Dráva catchment area, and 709 mm of precipitation and a 25 per cent runoff coefficient for the 138,400 sq.km catchment area of the Tisza as far as Szeged. If the total catchment area of 390,000 sq.km is then compared with the 93,000 sq.km area of Hungary, for which 620 mm of precipitation and a runoff coefficient of 15 per cent are assumed, it is easy to understand how the deeper strata are replenished with groundwater. It is by precipitation which falls primarily outside of Hungary and which moves towards the centre of the Carpathian Basin. Indeed, it has been estimated that only one per cent of total precipitation need keep under the surface in this way to maintain the groundwater level.

In Map 5 (attached) the hydrogeological divisions of the Great Plain based on J. Urbancsek's recent research are shown.

In order to complete our summary of subsurface water, we should mention the recent calculations concerning the groundwater reserve of the Great Plain. The first survey was published by the VITUKI in 1954. Since 1962 the findings of recent research activity have been published in the Annals of Water Economics.

If one looks at Table VIII which is based on the 1963 Water Management yearbook of the VITUKI, the areas of the Great Plain can be ranked according to abundance of subsurface water (calculated in litre per sec per sq.km) as follows: 1. The Danube plain (6·5), 2. The Dráva plain (5) and the plain of Szatmár-Bereg (5·4), 3. The Bodrogköz (2·7) and the northern part of the Great Plain (2·1). The areas with least subsurface water are: 1. the Nyírség (0·85), 2. the Mezőföld (1) and the Körös region (1). It is doubtful whether the Körös—Maros and the Lower Tisza regions, which have approximately the same subsurface water reserves, should be grouped together, as the former is a region provided with both ground and stratum water, and the latter with stratum water only. Besides, the data in the table indicate succinctly the variations produced through time and because of different climatic and surface types (Map 6 attached).

THE NATURAL VEGETATION OF THE GREAT PLAIN

The former natural vegetation consisting of park-land and moors has for the most part disappeared, and has been replaced by the "puszta". Indeed, certain botanists would consider the present phytogeographical picture of the Great Plain as being the natural one, defining its geobotanical character as climatic steppe. The concensus, however, which has been mainly formed by the investigations of R. Soó and B. Zólyomi is that under the transitional climate of Hungary, forests, moors and the "puszta" may all be considered zonal, just as Scherf proved the natural juxtaposition of chernozem and brown forest soils.

Table VI provides much comprehensive information in this respect. First of all, it is conspicuous that forest occupies barely 6·7 per cent of the total area of the Plain. Its areal distribution is also very uneven. The territorial extent of meadow and pasture, which can still be regarded as a type of natural vegetation in contrast to the forest cover, is significantly more even, ranging from 2·1 to 6 per cent and from 8 to 14 per cent, respectively. Excluding the very much reduced area of marshland, the regional distribution of uncultivated territory, occupied mostly by settlements, is also reasonably well balanced. The small spatial fluctuations in this parameter partly reflect an even population density, and partly a fairly uniform distribution of settlements and fallow areas. Variations in the percentage of cultivated land are a reflection of soil conditions and the distribution of land use types already mentioned. The direct association with variability in the proportion of chernozem soils is particularly conspicuous, however (Table VI).

TABLE VI

Regional distribution of the vegetal cover in the Great Plain, 1964 (ha and per cent)

Region	Total area	Forest	Cultivated area	Meadow	Pasture	Reeds	Not cultivated
Danube Plain	440 000	31 998	273 000	27 000	53 000	4 000	51 000
	100	7·5	62	6	12	1	11·5
Danube—Tisza	740 000	85 647	481 000	33 000	60 000	—	80 000
Interfluve	100	11·5	65	4·5	8	—	11
Bácska	190 000	9 228	129 000	10 000	25 000	—	17 000
	100	5	68	5	13	—	9
Mezőföld	440 000	21 970	306 000	24 500	40 000	3 000	44 500
	100	5	69·5	5·5	9	1	10
Dráva Plain	150 000	16 241	97 500	9 000	13 500	500	13 000
	100	10·8	65	6	9	0·2	9
N-Great Plain	300 000	7 317	219 000	13 500	34 500	1 000	25 000
alluvial fan	100	2·4	73	4·5	11·5	0·3	8
Szatmár-Bereg	150 000	10 206	108 000	6 000	13 500	400	12 000
Plain	100	6·8	72	4	9	0·3	8
Bodrogköz	130 000	5 022	89 500	7 200	18 500	100	10 000
	100	4	69	5·5	13·4	0·1	8
Central Tisza	680 000	24 771	476 000	25 840	92 480	3 000	57 800
	100	3·6	70	3·8	13·6	0·5	8·5
Jászság	210 000	5 734	155 000	4 400	23 000	1 000	21 000
	100	2·7	74·0	2·1	11	0·2	10
Lower Tisza	200 000	13 598	138 400	6 000	20 000	2 000	20 000
	100	6·8	69·2	3	10	1	10
Nyírség	450 000	69 070	282 600	18 000	39 600	200	40 500
	100	15·3	62·8	4	8·8	0·1	9
Hajdúság	150 000	2 827	107 200	5 300	21 000	—	13 500
	100	1·9	71·6	3·5	14	—	9
Körös	480 000	18 160	338 400	12 000	67 000	1 000	43 000
	100	3·8	70·5	2·5	14	0·2	9
Körös—Maros	500 000	4 667	385 000	12 500	50 000	—	48 000
Interfluve	100	1	77	2·5	10	—	9·5
Total: ha	5210 000	326 456	3 585 600	214 240	571 080	16 200	496 300
%	100	6·7	69	4·1	11	0·3	9·5

If the proportion of forested areas within the individual regions is expressed in terms of the forest associations characteristic of the Great Plain, it appears that the areas of natural forest communities nowhere approximate the total extent of the forest area. This reflects the high degree of conscious afforestation by man, and the fact that part of the area consists of scrubland which at best may be regarded as degraded forest. In addition, fruit and associated trees are included as part of the forest. The exact definition of the forest communities of the Great Plain is also made difficult by the fact that in part they are brush-wood by origin being produced by mowing and overgrazing. Thus, it is possible definitely to determine the community of only 60 per cent of the total forest area. The original forest communities and their areal extent were reconstructed by B. Zólyomi (1957).

The park-land of the wooded steppes of the Great Plain belongs to the climatic zone of oak-forests. According to their community system and topographic situation, they belong to two main associations, namely the elm–ash–oak grove forests which have developed from a riverine–still-water succession and the oak-forests of the higher and drier areas. Based on variations in edaphic factors the latter are divided into saline loessic, sandy and, in the Mezőföld, turkey oak forests; elm–ash–oak grove-forests including hornbeam-oak stands are termed robur-forests. What remains is a relic of a much more extensive robur forest in the past. The most natural habitat of this forest type is to be found close to rivers. Today they mostly occur in places liable to flooding in flat wet and waterlogged areas, and abandoned river channels. They are most widespread in those regions with a moisture-intensive habitat such as the plain of Szatmár-Bereg, the Central Tisza Region, and along the Dráva (Table VII).

Among the drought resistant oak associations, those occurring on the Tartar-maple loess and on sandy soils are the most significant. The area of sandy oak-forests includes both convallaria oak-forests of moister habitat and drier heath oak-forests.

The fact that these various forest types not only occur but grow well in their present habitats is again good evidence of the natural forest steppe character of the Great Plain.

The other forest types of the Great Plain are either additional elements of the grove forest type, for instance, elms and ashes, or members of a transitional succession series such as soft-wood grove forests comprising willows, poplars, alder forest, fenwood and junipers. The area of partly natural and completely artificial forest is also significant, for instance, pine-forests, poplars, as well as the ubiquitous acacia groves.

The hard-wood stands still occupy considerable areas in the Danube and Dráva plains, in Counties Szabolcs-Szatmár and Bereg, as well as in the region of the Köröses. Soft-wood stands are also characteristic mainly of the areas along the Danube and Dráva liable to be flooded. Few fenwoods remain now that the former marshes of the Great Plain have been drained. The richest are still the fenwoods of the swamp region along the Danube and of the Nyírség. The poplar-juniper stands that occur in the Danube—Tisza Interfluve are most frequently deteriorated, secondary associations of the former sandy forests. The Scotch fir and black pine forests are planted without exception and are most widespread on the dry sandy surface of the Danube—Tisza Interfluve, on the Nyírség and in the southern part of the Mezőföld. The planted maple stands have nothing in common with the willow-maple woodland, even though they often have common habitats. Recently, the former have become a popular and spreading tree type. Their territorial proportion is highest in the areas between the moister dunes of the table-land of the Danube—Tisza Interfluve, in the Bácska, in the Nyírség, in the Central Tisza Region and along the Lower Tisza.

The most extensive forest type comprises acacia stands which occupy 23 per cent of the total forest area or more than 75,000 ha. This relative newcomer has rapidly acclimatized to the changed and drier local climate of the Great Plain. Regionally, the drier regions such as the Nyírség, the Danube—Tisza Interfluve and the Bácska are the leading acacia areas.

TABLE VII

The actual and the planned proportions of tree species in the total forest area (ha and per cent)

Region	Robur oak		Acacia		Noble poplar	
	1964	Plan	1964	Plan	1964	Plan
Danube Plain	2 425	1 610	1 647	1 103	3 470	5 780
	7·7	—	5·1	—	10·8	—
Danube—Tisza Interfluve	3 793	4 514	35 952	29 637	3 829	5 024
	4·5	—	42·0	—	4·5	—
Bácska loess ridge	410	1 800	7 200	4 400	630	1 900
	4·2	—	78·0	—	7·0	—
Mezőföld	2 329	2 904	4 604	3 150	309	610
	10·5	—	21·0	—	1·4	—
Dráva Plain	6 418	4 131	938	842	571	3 000
	40·0	—	5·8	—	4·5	—
N-Great Plain alluvial	676	890	661	395	144	338
fan	9·3	—	9·1	—	2·0	—
Bereg-Szatmár Plain	3 284	3 662	—	—	205	400
	62·0	72·0	—	—	5·0	8·0
Bodrogköz	—	—	—	—	—	—
Central Tisza	—	—	—	—	—	—
	1 823	2 125	1 091	629	1 507	1 585
	7·5	—	4·5	—	6·0	—
Jászság	167	137	217	146	62	71
	3·0	—	4·0	—	1·0	—
Lower Tisza	1 425	1 450	100	100	1 700	3 255
	10·5	—	0·8	—	12·5	—
Nyírség	7 389	4 061	27 302	23 556	1 455	6 906
	19·0	10·0	66·0	58·0	5·0	19·0
Hajdúság	1 223	924	481	321	—	—
	4·4	—	1·7	—	—	—
Körös	5 405	5 940	1 214	660	551	394
	30·0	—	7·0	—	3·0	—
Körös—Maros Interfluve	418	470	287	215	102	183
	9·0	—	6·0	—	2·2	—
Total	37 185	34 618	81 694	65 154	14 535	29 446
	11·4	—	25·0	—	4·4	—

It is apparent from the data concerning the various forest communities and forest types that edaphic and climatic conditions are nowhere obstacles to tree growth, with the exception of the calcareous shifting sand and barren saline soil types. This offers the opportunity of increasing the afforestation of the Great Plain. Apart from the recreational and physical aspects of large forested areas, for instance, their effect on local water economy and microclimate, we must stress their economic significance. According to P. Magyar (1960), in order to satisfy the timber requirement of Hungary without imports, 26 per cent of the surface of the country should comprise forests. At present, the national average is barely one half, namely, 14 per cent, and in the Great Plain hardly one quarter of that value. The relative lack of afforestation means that the country is obliged to import the greater part of its timber requirements from abroad. Indeed, according to Magyar the cost of timber imports

Pine		Ash		Other hard wood		Other soft wood	
1964	Plan	1964	Plan	1964	Plan	1964	Plan
50	80	—	—	5 095	5 405	6 861	4 468
0·1	—	—	—	15·9	—	21·5	—
8 409	32 380	1 200	700	2 721	1 770	10 525	14 263
10·0	—	1·5	—	3·2	—	12·4	—
230	950	—	—	280	260	450	270
2·4	—	—	—	3·2	—	4·9	—
1 033	1 983	—	—	3 252	3 153	610	1 270
4·7	—	—	—	14·5	—	2·8	—
—	—	1 773	901	3 245	3 152	1 059	2 132
—	—	11·0	—	20·0	—	6·5	—
132	114	—	—	677	592	201	162
1·8	—	—	—	9·3	—	2·8	—
—	—	677	508	893	356	—	—
—	—	14·0	10·0	16·0	7·0	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
174	163	67	67	2 010	1 678	908	935
0·6	—	0·2	—	8·0	—	3·5	—
17	53	—	—	65	122	—	—
0	—	—	—	1·0	—	—	—
—	—	1 000	500	1 277	737	1 019	882
—	—	7·5	—	9·5	—	7·6	—
2 218	4 061	—	—	1 375	812	728	1 624
5·0	10·0	—	—	3·0	2·0	1·0	1·0
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
32	—	—	—	2 645	2 507	102	390
0·02	—	—	—	14·5	—	0·5	—
—	—	—	—	212	128	100	114
—	—	—	—	2·2	—	2·0	—
12 295	39 784	4 717	2 676	23 747	20 672	22 563	26 510
3·9	—	1·5	—	7·3	—	6·9	—

between the two world wars considerably outweighed the value of corn exports. Increased afforestation would thus benefit the national economy as well.

It is impossible, of course, to restore the woodland of the Great Plain to its former natural level. Additionally, the idea of using mainly those tree species for the afforestation of the Great Plain which were the components of the onetime natural forest communities must be abandoned. Under the changed local climatic and soil conditions, this policy would not succeed everywhere. Moreover, we now possess tree species which grow faster and are better suited to meet the requirements for wood-board and paper production. The first step in accomplishing this task is to plant trees in the woodland deficient areas of the Great Plain to bring them at least up to the level of the region as a whole.

Besides a 20 per cent and 7 per cent decrease in the area of acacias and of noble poplars, respectively, the afforestation plan intends to increase the area of pine-forests by 300 per cent. The aim is to plant individual tree species in the most suitable environments and thus achieve the most economic method of afforestation from the point of view of the national economy. Intensive exploration and mapping of habitats is taking place to this end in areas of potential tree planting.

Apart from the built up areas of local communities and along roads and channels, three areas have potential from the point of view of afforestation. These are: 1. sand surfaces unsuitable for cultivation but which provide habitats primarily for pines and domestic poplars; 2. areas liable to flood which are suitable for noble poplars, domestic poplars, ash, black nut, oak, pine and acacia; 3. class I—III saline meadows, pastures and plough-lands providing habitats for the robur oak, silverbirch, tamarisk, possibly elm, white poplar, wild pear and acacia. Pioneering work has been carried out in this respect by the experimental forestry station at Püspökladány since 1929 (Magyar, 1960).

Besides the economic importance stressed here, increased afforestation has several other positive aspects which cannot be overemphasized. There are views according to which a purposefully planted forest taking up 20 per cent of the country and consisting of selected species would be of considerable conservation value.

The territorial extent of the dominant plants of the moor-marsh association has also greatly decreased, and today hardly 0·3 per cent of the surface of the Great Plain is covered with reeds. The major expanses are to be found at Lake Velence in the Mezőföld, along the Danube and in the abandoned channels of the Tisza. Even though they are no longer used as a building material, there are several commodities made out of them while a small quantity is even exported (Ruttkay, Tilesch and Veszprémi 1964). As relics of the ancient landscape, and as refuges for the fauna, however, the reedy marshes deserve more appreciation.

It is not always usual to mention meadows and pastures in connection with natural vegetation. However, in extent, they comprise more than double the area of forest in the Great Plain. It is also true that their vegetation consists mainly of semi-domesticated communities, resulting from the transformation of microclimates and soils, as well as from constant mowing and grazing. Despite this, the sandy, saline and loessic heath fields and meadows are the refuges of the natural steppe vegetation, their communities in part consisting of species inherited from the hazel climatic steppe phase. Locally, meadows in the Great Plain are to be found on the sites of one-time fens and marshes which even today have higher groundwater levels and are moister. Pastures, on the other hand, have been forced back onto highly calcareous water-logged sand surfaces, and onto saline heaths which are scorched in summer. The former rich meadows on loessic heath have already been completely replaced by plough-lands. Regarding the spatial distribution of meadows, the Dráva plain is the most and the Jászság the least significant. The proportions of meadows in these two areas are 6 and 2·1 per cent, respectively. The percentage of pasture land is highest, everywhere above 13 per cent, in the solonetz areas where the surface soil is acid, in the Hajdúhát and in the Central Tisza Region. The proportion is lowest on sand surfaces.

Although it has been long urged, the mapping of the most significant meadow and pasture plant communities of the county has not yet been completed. For this reason, we can say little about the territorial range of individual associations. In general, the principal task of meadow and pasture management is to accelerate the establishment of plant communities on barren surfaces by such means as grass-sowing and irrigation in order to ensure a more developed and closed association with a higher yield and nutrient content. Thus, the main task is the development and protection of the *astralgo-festucetum sulcatae* on sandy soil, the *salvia-festucetum sulcatae* on loess, the *agrosti-alopecuterum pretensis* on the extensive saline meadows and the *agrostidion albae* on the marsh meadows. Even in 3rd class saline areas the spread *Beckmannietum* and *puccinellietum limosae* can be similarly encouraged in 4th class regions. Compared with the present condition, the fodder surplus thus obtained would amply compensate for the cost of improving the meadows and pastures of the Great Plain which today are generally neglected and left fallow.

TABLE VIII

Nature conservation areas of the Great Plain

Ócsa, Nagyerdő and Mádéncia forest	191
Kunbaracs, hornbeam-oak	13
Kunadacs, oak	7
Csaroda, Nyírestó and Bábtava peat-moss-moor	35
Aporliget, Fényi forest	285
Aporliget, Bátorliget	52
Kállósemjén, Mohostó	25
Debrecen, Nagyerdő	43
Egyek, Ohati forest	26
Ujszentmargita, alkaline-oak	61
Sándorfalva, Tisza Sasér	87
Lad	28
Martonvásár	69
Tengelic	37
Vácrátót, arboretum	28
Erdőtelek, arboretum	3
Cégénydányád	16
Szarvas, arboretum	42
Gyula, park	17
Szeged, Fehértó	250
Total	1 315 hectares

Finally, Table VIII shows the nature conservancy areas, as of 1961, in which former natural vegetation of the Great Plain can still be studied.

THE SOILS OF THE GREAT PLAIN

The soil conditions of the Great Plain are shown by the genetic soil map (Fig. 10). As shown by the map, blown-sands and river alluvium comprise the skeletal soils of the Great Plain. Together they cover more than 6000 sq. km, i.e. 11·6 per cent of the whole region. Unfortunately, however, the alluvium rich in inorganic mineral salts, and highly productive when drained,

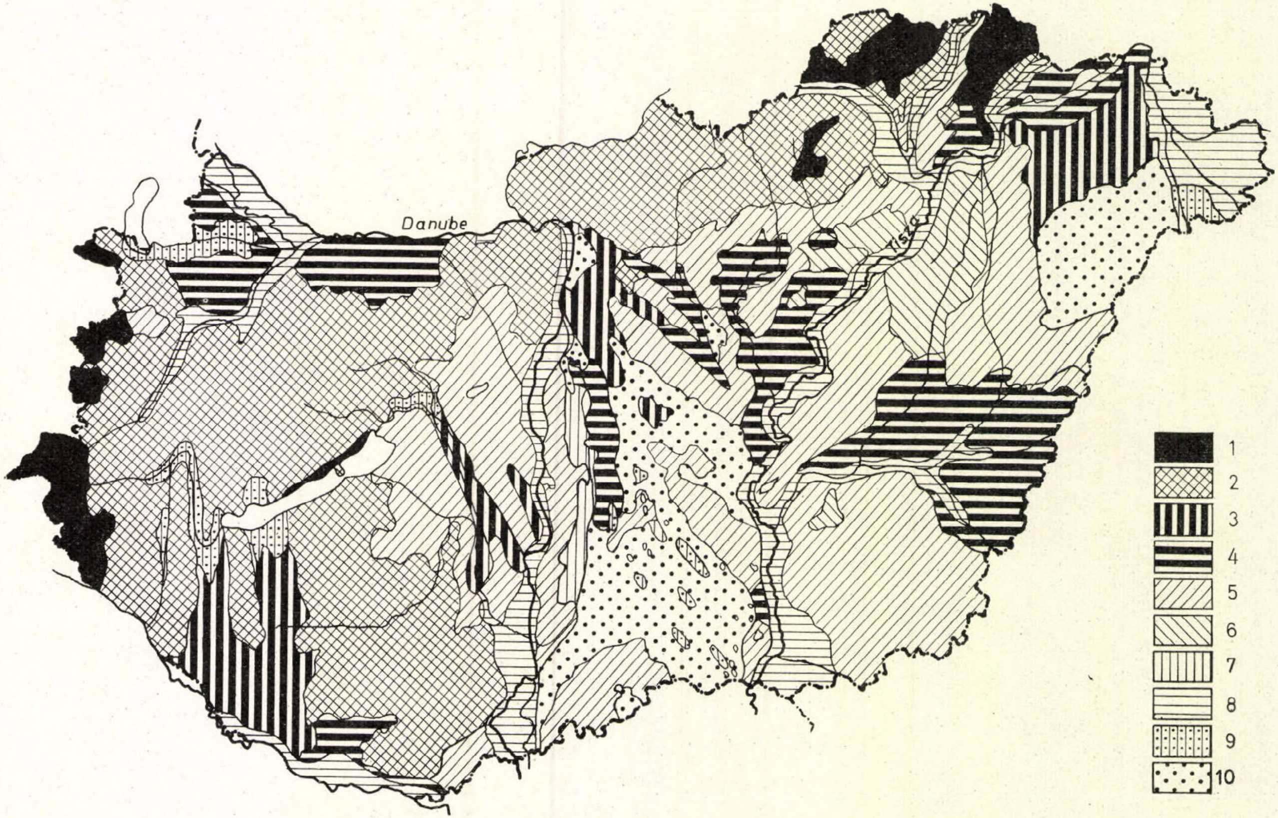

Fig. 10. Genetic soil map of Hungary (after P. Stefanovits and L. Szücs)

1 = grey-brown podsolic soils; 2 = brown forest soils; 3 = rust-brown forest soils; 4 = meadow soils; 5 = steppe soils; 6 = limeless alkali soils; 7 = limy sodium soils; 8 = alluvial soils; 9 = swamp soils; 10 = blown-sand soils

makes up only one third of this area, the remaining two-thirds consist of the less valuable blown-sands.

In places where the sandy regions have only recently lost their natural vegetation, various varieties of forest soil are to be found. Where, however, they have long been cultivated, as in the southern half of the Plain, sandy chernozems are dominant. Where it is possible to reclaim blown-sand by irrigation, afforestation, and the application of fertilizers, the formation of sandy chernozems is in all probability to be expected.

Under favourable conditions for development, the following succession of soil types evolves on alluvial soils: alluvial soil, meadow alluvial soil, meadow soil, alluvial chernozem. Even though this sequence seldom evolves rapidly and in strict succession, it is necessary through modern soil management techniques to use the rich alluvial soils as intensively as possible.

The zonal forest soils which develop in the moister regions of Hungary occur infrequently in the Great Plain. Where they are found they are representative of past natural conditions in areas marginal to the Plain. They have either been protected in such places by woody vegetation, or are transitional varieties. The latter probably applies to two small areas of brown soil with clay inwash, characteristic of explicitly moist terrains, which occur in the foreland of the Bükk Mountain and along the Dráva.

The different chernozem varieties were zonal soil types on the former, natural woody steppes as well as on the drier loess and sand surfaces of the Great Plain. Today, however, chernozems are dominant. Although numerous varieties of this major soil type cover more than 40 per cent of the surface of the Great Plain, the typical chernozem does not occur. The reason for this is to be found in the fact that the climate is more humid and milder than in the Ukraine (Szücs 1963).

The most common chernozem is the so-called lime-coated type which together with its subvarieties covers nearly 16 per cent of the Great Plain. Approximately one tenth of it is characterized by saline lower horizons, which must be taken into account with deep rooted plants. This principal chernozem type covers 55 per cent of the area of the Mezőföld, 58 per cent of the Bácska and 65 per cent of the Hajdúság. It also occurs in the eastern and central part of the area between the Danube and Tisza, in the Jászság, in the Central Tisza Region and in the area between the Körös and Maros.

Sandy chernozems occupy 31 per cent of the table-land of the Danube—Tisza Interfluve. Additionally they cover considerably lower proportions of the Danube plain south of Budapest, the Bácska, the Mezőföld and the southwestern part of the Nyírség near Debrecen. They are the most productive soils of the sandy areas.

Other varieties, such as brown forest and meadow chernozems with saline lower horizon varieties are transitional in that they have not yet been transformed into zonal types. By regulating the groundwater level, by deep cultivation and by the application of lime, these already fairly productive soils can be further improved. The maintenance of proper groundwater levels and constant drainage are especially important when these chernozem varieties possess saline lower horizons in order to prevent over-enrichment of sodium in the upper levels.

Territorially, forest steppe soils cover 40 per cent of the well-exposed surfaces of the drift-slopes of the northern part of the Great Plain and 18·7 per cent of the Dráva plain. They are also scattered throughout the Mezőföld, the table-land of the Danube—Tisza Interfluve, and along the Sajó. The main zone of meadow chernozems lies between the Körös and Maros, where they cover nearly 64 per cent of the region. One third of them, however, possesses saline lower horizons.

The intra- or extrazonal alkali soils are the result of the unique physical conditions of the Great Plain, for instance, relief, hydrology, climate and parent materials. Their different varieties occupy approximately 7000 sq.km or 13 per cent of the total area of the Plain. Their nutrient content is satisfactory, and indeed in certain cases they are very rich in inorganic minerals, although their water economy is very poor. Owing to their heaviness, they are very difficult to cultivate and the high concentration of sodium salts often hinders the growth of agricultural plants. Several types are distinguished according to quality, concentration of the sodium salts and depth below the surface of the salt-bearing layer.

The least useful are the limy, sodic solonchaks of which there are few. They occur mainly in regions belonging to the Danube catchment area such as the Bácska, the Danube plain and the table-land of the Danube—Tisza Interfluve, as well as in small patches on the Nyírség. If these soils cannot be improved economically, they can be utilized as *puccinellietum limosae* pasture, provided sufficient water is available.

The production characteristics of solonchak-solonetz soils are not much better. However, if positive leaching can be observed—as against the more unfavourable process of salinization—the soil can be influenced to develop in a favourable direction by agrotechnical intervention. Water of good quality for a thorough washing of the surface must, however, be available and subdrill cultivation practiced. Otherwise, these areas may be utilizable only after irrigated rice cultivation or after planting *Melissa officinalis*. Their most frequent occurrence can be observed along the Danube and in the Danube—Tisza Interfluve.

The solonetzes comprise saline soils somewhat less rich in sodium. Because their salt concentration is below the surface, they qualify as productive areas. Their cultivation, however, is rather difficult, as the irrigation, soil loosening and liming necessary to ensure favourable conditions require much labour. The extensive pastures of the region east of the Tisza becoming scorched as early as June are to be found on these areas, where rice growing is also general because of their highly impermeable nature. However, groundwater brought to the surface has often involved secondary alkalization and the formation of moors on the solonetzes. They cover 47 per cent of the Hortobágy and are also widespread in the Körös region (32 per cent), in the Jászság (nearly 17 per cent) and in the Lower Tisza Region (8 per cent).

Meadow soils are a transitional type and the high associated groundwater level may conserve this state for a long time. They were considerably more extensive than at present prior to the flood control measures and river regulation. Even so they still cover 24 per cent (12,000 sq.km) of the Great Plain. The formation of the steppes so characteristic of the Plain took place on these soils, following the lowering of the groundwater due to drainage. During this process, many such soils took on chernozem features, although, for lack of continuing good drainage some become saline due to the high sodium content of the groundwater. All soils of this type can be made fully productive by ensuring saltfree water supply, by liming and by subdrill cultivation (Fekete 1958, Stefanovits 1956—1961).

Marshy meadow soils are found among the blown-sand dunes in the tableland of the Danube—Tisza Interfluve where they occupy former flooded areas, for which proper runoff has still not been ensured. To a limited extent drained and cultivated marshland and moor soils are also to be found in these regions.

By surveying the regional distribution of soil types in the Great Plain and evaluating their productivity in totality, inferences can be drawn concerning the favourable or otherwise pedological composition of the individual regions. Applying this spatially, the region between the Körös and Maros is in the first place with 87·4 per cent of the soils being of above average quality. It is followed by the Hajdúság with 83·6 per cent highly productive soils, the Bácska with 75·5 per cent, the drift-slope of the northern part of the Plain with 76 per cent and the Mezőföld with 78 per cent. High quality soil also covers 50 per cent of the Danube—Tisza Interfluve. Regions richest in meadow and alluvial soils are the Bodrogköz (92 per cent) and the plain of Counties Bereg and Szatmár (100 per cent). They also cover more than 50 per cent of the Lower Tisza area and more than 40 per cent of the Danube and Dráva plains, the Jászság and the Körös region.

The Nyírség leads in area occupied by saline and blown-sand soils, 40 per cent of its territory being so occupied. They also comprise 32 per cent of the Central Tisza Region and, contrary to general belief, less than 30 per cent of the Danube—Tisza Interfluve.

The role of the regions of the Great Plain in agricultural production can be broadly demonstrated in terms of the composition of their various soil types. This picture can be made more precise by the territorial distribution of the humus and nutrient content of the soils, and the expected effect of the application of fertilizers. Studies of cultivability and the possibilities of soil improvement also provide relevant information. For the time being, however, the results of such investigations are not sufficiently detailed to allow regional evaluations. We can, however, discuss the findings concerning soil losses through erosion. According to a compilation published by Stefanovits, soil erosion so prevalent in the mountainous and hilly regions of the country also afflicts the peripheral regions of the Great Plain. In the Mezőföld, the drift-slope of the northern part of the Great Plain, the Danube—Tisza Interfluve, the Dráva plain and the Plain of Pest approximately 70,000 ha is characterized by heavy erosion. In addition 165,000 ha and 540,000 ha experience medium and slight soil losses respectively.

On the basis of the foregoing, it will be perfectly clear that the conditions of heat and water economy which determine soil fertility vary within a wide range. They do not always correspond to the pattern that can be inferred from the distribution of soil types.

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For detailed bibliography see: *A dunai Alföld.*

THE POWER ECONOMY OF THE GREAT HUNGARIAN PLAIN

by

ÁKOS BORAI

THE DEVELOPMENTAL CHARACTERISTICS OF THE POWER ECONOMY

The relatively small demand for energy in the Great Plain can be explained in terms of the special historical development of its economy and social conditions. In the second half of the 19th century, with the expansion of capitalism the role of the Great Plain in agricultural raw-material production intensified. Due to a lack of local energy-sources, the small-scale production of food stuffs, textiles, and building materials grew up mainly to satisfy local demands, but, owing to the eccentric lines of communication the great majority of agricultural produce has to be processed in Budapest. Consequently, the market towns of the Great Plain have become above all centres supplying services for and processing the produce of the scattered "tanya" farmsteads. As a result of the process outlined above, the demand for energy was insignificant. The larger centres such as Nagyvárad, Arad and Temesvár which developed at the trade-generating zone of contact between the Great Plain and the mountainous areas, are situated outside Hungary. The strengthening of the market orientation of the regional centres hindered the development of large industrial agglomerations requiring much energy in the central part of the Great Plain.

After World War I, the influence of Budapest in the socio-economic development of the Great Plain intensified because the capital's imperial role came to an end with the Trianon Settlement. Owing to the large-scale development of industry in Budapest, a growing percentage of agricultural raw-materials could be supplied only from the Great Plain. This increasingly intensive economic attraction of the capital further hindered the growth of local industry, and as a consequence the energy-demand of the Great Plain showed a moderate increase only between the two world wars.

After World War II the socialist industrialization concentrated mainly on the extension and development of the already existing industrial districts. Consequently, the new socialist towns were also built in industrial centres. During the period of heavy-industrialization, industry within the Great Plain expanded only slowly. For reasons easily accounted for, it was the location of those industrial branches whose energy- and raw-material demands were small such as machine-building, metal-working and instrument-making, that was furthered. Under such circumstances it is evident that the majority of the energy-demand was generated by the communities of the Great Plain, particularly for domestic purposes. Besides the purchase of low value coal from other regions the utilization of local agricultural waste was still considerable amongst the population.

During the second Five-Year Plan (1960—1965) power demands within the Great Plain were enlarged, owing to the realization of industrial development based on the exploitation of local resources, and the re-location of some factories from Budapest. The exploitation of the significant oil and natural gas fields in the Great Plain greatly contributed to the acceleration of this process. Despite this, however, only some of the high energy-demand factories were switched over to natural gas firing, because it did not prove profitable to supply the low demand consumers dispersed in scattered farms.

The actual demand for energy in agriculture is still smaller than it should be and the utilization of natural gas and geothermal energy is insignificant. Any increase in energy requirements will be in connection with motive power.

Concerning the power consumption of the population, the role of local natural gas is smaller than expected. The power demands for heating, cooking and hot water are still in the main satisfied by the purchase of coal.

The areal changes in the power economy between 1960 and 1968, using 1960 = 100 per cent as the base year are shown in Map 1 (attached). The data reflect changes in the gross value of fixed assets together with total population number gainfully employed in industry.

THE RELATIVE UNDERDEVELOPED NATURE OF THE POWER ECONOMY OF THE GREAT PLAIN

While energy consumption within the Great Plain is insignificant, its role in the production of energy is becoming more important. According to the survey of 1965, the total utilization of energy was only 11·6 per cent of the national total. Lacking consumers, the power utilization of this area of relatively low population density is $9{\cdot}2\times10^6$ kcal per capita, which falls greatly behind the national average of $22{\cdot}8\times10^6$ kcal per capita. It is evident that the demand for energy per unit area is not great either, which is especially conspicuous when compared with that of the capital (Table I).

TABLE I

The structure of the power economy in the regions of Hungary in 1965

Regions	Industry	Communication	Agriculture	Domestic	Total	Specific heat consumption	
	per cent					10^6 kcal per capita	10^6 kcal per km^2
Budapest	66·9	5·4	—	27·7	100	21·8	8106
Central (without Budapest)	65·3	4·3	2·9	27·5	100	14·9	1971
Northeast Hungary	81·8	3·0	1·7	13·5	100	31·4	3144
Great Plain	37·0	15·6	9·5	37·9	100	9·2	753
Northern Transdanubia	86·6	4·3	1·5	7·6	100	47·4	4377
Southern Transdanubia	66·5	11·9	4·9	16·7	100	18·8	1388
Hungary	73·1	6·4	2·6	17·9	100	22·8	2500

The relatively small energy demand within the Great Plain can be best elucidated on basis of the sectoral structure of energy utilization. The major part (37·9 per cent) of the total heat demand of the region was supplied to domestic and communal consumers. By contrast with other regions, the industrial energy demand within the Great Plain in 1965 ranked only in second place.

In Northern Transdanubia and Northeast Hungary where energy demand is high, that required by industry is 86·6 and 81·8 per cent, respectively, of total energy consumption, and despite the comparatively high densities of population domestic and other types of consumption are far smaller. Consequently, a greater demand for power within the Great Plain can be achieved only by means of a large-scale industrialization.

A change-over to natural gas within the Plain is greatly hindered by the unfavourable technical condition of the furnace-stock. The *number* of the registered *furnaces* corresponds to the spatial demands for energy. But although the Great Plain contains 23·1 per cent of the national total stock, the methods of firing them and their nominal capacity make it unfavourable to increase the volume of natural gas consumption (Table II).

TABLE II

The distribution of furnaces according to system of firing

Regions	Basic fuels								
	Manual	Stoker fired boilers	Mixed coal fired boilers	Pulverized coal fired boilers	Kerosene fired boilers	Gas fired boilers	Waste heat fired boilers	Industrial and agricultural waste heat	Total
	heating								
	per cent								
Budapest	47·5	31·7	0·6	1·3	13·4	4·1	0·9	0·5	100
Central (without Budapest)	52·1	31·1	0·6	—	16·2	—	—	—	100
Northeast Hungary	48·7	17·9	—	5·5	7·0	12·3	8·2	0·4	100
Great Plain	70·6	16·8	—	0·1	4·8	5·2	1·2	1·3	100
Northern Transdanubia	46·2	27·4	4·6	7·9	8·9	0·9	1·9	2·2	100
Southern Transdanubia	63·7	10·6	0·4	2·8	9·5	10·6	0·6	1·8	100
Hungary	55·1	23·0	0·9	2·7	9·5	5·7	2·0	1·1	100

Basic fuels. It is mainly traditional energy sources that are utilized in the furnaces of the Great Plain. Despite the local sources of ore and natural gas, 87·5 per cent of furnace installations are fuelled by different kinds of coal which are brought in from other areas. They far outnumber furnaces using ore—9·5 per cent, natural gas—5·7 per cent, and waste products—3·1 per cent.

The nominal capacity of the furnaces of the Great Plain is revealed by the small annual energy demand that is generated. Thus 48·2 per cent of all furnaces have a capacity of less than 1 t/h: 43·2 per cent a capacity of 1—6 t/h and 5·7 per cent of 6—10 t/h. High energy boilers with a capacity of 10—40 t/h comprise only 2·9 per cent of the total. Due to the relatively small power demands of the boilers of 0—6 t/h capacity, which are scattered throughout the region, their conversion to natural gas fuelling does not seem economic.

TABLE III

The distribution of furnaces according to construction date

	1871—1880	1881—1890	1891—1900	1901—1910	1911—1920	1921—1930	1931—1940	1941—1950	1951—1960	1961—1970	Total
	per cent										
Budapest	0·1	0·8	4·5	17·5	21·3	15·7	6·7	6·2	14·5	12·7	100
Central (without Budapest)	—	1·2	5·8	16·2	22·5	11·0	0·5	5·8	15·6	21·4	100
Northeast Hungary	0·4	0·8	8·0	19·0	16·9	12·4	3·6	5·5	16·7	16·7	100
Great Plain	—	0·5	7·9	18·5	22·9	20·9	4·0	4·1	9·5	11·7	100
Northern Transdanubia	—	0·2	2·9	12·8	19·7	17·1	6·6	7·8	19·9	15·0	100
Southern Transdanubia	0·6	0·6	5·8	14·2	20·5	19·1	5·4	7·6	14·0	12·2	100
Hungary	0·1	0·7	5·8	16·7·	20·8	16·9	5·2	6·0	14·1	13·7	100

The age of the furnaces does not encourage the spread of natural gas firing either in that the cost of conversion could be amortized only in case of modern plant. The replacement of the small capacity coal-fired furnaces of the Great Plain in the not too distant future would, however, appear to create favourable conditions for the utilization of local natural gas. Yet the adaptation of this new equipment to natural gas firing will be greatly limited by the geographical dispersion of their occurrence and the relatively small volume of their individual heat demand. It seems natural that most of newly purchased furnaces should use traditional fuels.

The bulk of the heat energy of the Great Plain is used by domestic and communal consumers. If we analyse the sources of energy, it turns out that the level of natural gas utilization out of total domestic consumption is still insignificant. From the point of view of the Mineral Oil and Gas Industrial Trust it is uneconomic to link the loose-structure settlements of the Great Plain into the natural gas grid, because their heat demand is rather low and the relatively large-scale investments carried out without government aid amortize only slowly. At the same time the indifference and continued dependence of the population on the traditional heating, cooking and water-boiling methods also play a significant role, which however is easy to understand since the expense of connecting a dwelling to the street gas main is too high.

THE SPATIAL CHARACTERISTICS OF THE POWER ECONOMY OF THE GREAT PLAIN

The Great Plain, a region for so long poor in sources of energy, became almost overnight one of the most significant areas in the production of this commodity. In 1960 the volume of energy produced was 5·2 Tkcal and grew to 31·8 Tkcal by 1968, an increase of 609·6 per cent. [Tkcal (Terracaloria) = 10^{12} kcal caloric value.]

TABLE IV

The structual distribution of energy production in the Great Plain (in Gkcal*)

Energy type**	1960	1963	1965	1968
Coke	102·7	105·3	105·2	105·4
Total solids	102·7	105·3	105·2	105·4
Petroleum	408·3	2 470·8	2 535·8	7 904·9
Petrol	328·0	333·8	496·5	501·3
Gas-oil and kerosene	737·0	729·6	890·9	915·2
Fuel oil	1049·0	1 893·6	2 358·3	2 511·4
Total fluids	2522·3	5 427·8	6 281·5	11 832·8
Natural gas	2495·8	5 229·5	7 795·2	18 974·4
Town gas	74·4	76·7	87·0	88·1
Propane-butane gas	—	2·5	3·8	783·6
Total volatiles	2570·2	5 308·7	7 886·0	19 846·1
Total	5195·2	10 841·8	14 272·7	31 784·3

* Gkcal = gigacaloria = 10^9 kcal caloric value.
** Without loss

According to the survey of 1968, 62·4 per cent of production was gas, and 37·3 per cent liquid hydrocarbons. The proportion of traditional solid fuel production (0·3 per cent) is insignificant. Depending upon the capacities of the gasworks at Debrecen and Szeged the total production of industrial and household coke varies between 102 and 105 Gkcal per year. The use of wood as fuel still fails to reach 30 Gkcal per annum.

During the last decade the Great Plain has become the most important hydrocarbon producing region of Hungary. The high rate of development is characterized by the fact that the 2,904·1 Gkcal output of 1960 had increased to 26,879·3 Gkcal by 1968.

Intensive prospecting for oil and natural gas started in 1958, when the fields at Battonya, Pusztaföldvár and Pusztaszöllős in county Békés, in the south-east part of the Great Plain, were exploited. This was followed by the dis-

TABLE V

The efficiency of hydrocarbon research in the Great Plain

Date of exploitation	Geological structures examined	Productive wells	Rate per cent
1960	7	7	100·0
1961	5	2	40·0
1962	11	5	45·5
1963	15	2	13·3
1964	10	7	70·0
1965	7	3	42·8
1966	10	4	40·0
Total	65	30	46·2

covery of a significant natural gas reservoir at Hajdúszoboszló in 1959. These results stimulated further exploration and between 1960 and 1967 the examination of 65 seismic structures yielded 30 productive wells (Map 2 attached).

As a result of geological prospecting, the exploitable industrial natural gas reserve in Hungary increased to 95·8 milliard m^3 in 1967, 93·2 per cent of which is to be found in the Great Plain, 6·6 per cent in Transdanubia and 0·2 per cent in the southern part of the Northern Middle Mountain range.

Of the total area of Hungary 74,100 km^2 is suitable for oil and natural gas prospecting; 20,300 km^2 cover basin formations filled with thick deposits which are qualified as "first class" exploration areas. Of these 89·7 per cent are found in the Great Plain, and 10·3 per cent in Transdanubia.

According to the survey of 1968, 58 per cent of the energy sources being exploited were in the northern part of the Trans-Tisza Region, namely in counties Hajdú, Szabolcs-Szatmár and Szolnok, 35 per cent in the southern Trans-Tisza counties of Békés and Csongrád, and 7 per cent in county Bács-Kiskun of the Danube—Tisza Interfluve. Map 3 (attached) represents the proportion of primary to secondary energy curves in 1968. The decisive role of natural gas and crude oil production in every county, with the exception of Szabolcs-Szatmár representing the output of the oil-refinery at Nyírbogdány, is conspicuous. Counties Hajdú, Szolnok and Békés yield mainly natural gas, while county Csongrád supplies crude oil for the Hungarian national economy. Natural gas and oil production has a roughly equal distribution in county Bács-Kiskun, although total output is smaller.

The volume of heat energy consumption in the Great Plain increased by 120·5 per cent from 22·9 Tkcal in 1960 to 27·6 Tkcal in 1968.

Comparing output and consumption, the energy balance of the Great Plain reveals a positive difference of 4·1 Tkcal. Naturally, intercounty differences are apparent in the utilization of the various sources of energy depending upon the extent to which the oil and natural gas programme has been realized (Map 4 attached). In counties where solid-fuel firing prevails outside sources of fuel are predominant, while in those areas where oil and gas firing are common, local sources of supply are more important.

In 1968, 99·4 per cent of solid fuel used was supplied from sources outside the Great Plain, the remainder being derived from local coke-production. The bulk of it was imported from north-east Hungary and Northern Transdanubia, although a small proportion was delivered from the Komló area of Southern Transdanubia. Of the solid fuels coal is the most important, and despite the growing consumption of oil and natural gas, coal-fired furnaces are still considerable in number.

TABLE VI

The structure of energy consumption in the Great Plain (in Gkcal)

Energy type*	1963	1965	1968
Coal	13 304·6	13 205·1	12 826·5
Briquets	1 389·1	1 599·9	1 693·0
Coke	396·2	397·0	414·4
Total solids	15 089·9	15 202·0	14 933·9
Petroleum	3 288·8	3 882·1	3 778·0
Petrol	655·0	836·9	1 245·6
Gas-oil and kerosene	2 768·9	3 226·2	3 997·3
Fuel-oil	750·4	958·0	736·5
Total fluids	7 463·1	8 903·2	9 757·4
Natural gas	1 300·7	1 818·9	2 332·4
Town gas	76·7	87·0	75·5
Propane-butane	91·1	118·0	454·7
Total volatiles	1 468·5	2 023·9	2 862·6
Total	24 021·5	26 129·1	27·553·9

* Without loss

An intricate system exists to enable the transport of coal to overcome the locational differences between the source and place of consumption. The structure of the source of supply in 1965 reveals the variations in the delivery distances from the coal fields and in coal demand for the different counties. On the basis of gravity examinations we can point out that 62·6 per cent of coal received by the northern part of the Trans-Tisza Region derived from the nearby coal mines of Borsod, Ózd and Nógrád. Only 16·9 per cent of coal delivered arrived from Transdanubia, while 20·5 per cent was imported from outside the country. The sources of coal used by the more distant southern counties of Bács, Csongrád and Békés are more balanced geographically. For instance, in 1965, 43·9 per cent of the coal used came from Northeast Hungary, 38 per cent from Transdanubia and 18 per cent was imported.

The present structure of the sources of coal supply developed after World War II, during the period of economic autarky between 1950 and 1955.

Recently, however, due to the introduction of the new economic reforms, the mechanical nature of the distribution of energy supply has changed, and transport questions are determined more and more by the qualitative requirements of furnace installations. Despite the more economical distribution of coal, the results are still not satisfactory. This is shown in Map 5 (attached) where the quantity of coal supplied and transport costs according to distance are given for individual counties. It is conspicuous that in counties Borsod and Heves which possess their own local coal fields, 80—100 per cent of the coal was transported over distances of between 0 and 100 km. By contrast, in the southern Great Plain counties of Csongrád and Békés 80—85 per cent of coal delivered was transported over 200 to 300 km because of the large distances from the regions of supply.

The relationship between coal supply and transport costs needs supervising in the case of each county in the Great Plain.

As regards the supply of *briquets* in the Great Plain, the survey of 1965 shows that 55·0 per cent of briquets used there were transported from the South-Transdanubia plants at Nagymányok, Hidas and Pécs, 30·5 per cent by those of Dorog, Tatabánya in Northern Transdanubia and 3·5 per cent by plants in the capital. The remaining 11·0 per cent were imported.

The distribution of briquets in the Great Plain according to transport zones is disproportionate (Map 6 attached). Supplies to counties Szabolcs, Hajdú and Békés in the eastern part of the Great Plain carry relatively high specific transport costs and it would appear more reasonable to provide the consumers of this region with briquets of Soviet origin.

The factors concerned with the transport of household and industrial *coke* in the Great Plain are somewhat more favourable than those of briquets. According to the 1965 survey, 20·7 per cent of the consumption was covered by the local gas-works at Baja, Debrecen and Szeged. That almost 80 per cent of the supply should be derived from other regions is, however, not satisfactory.

Among solid fuels the transport conditions of fuel wood are the least advantageous, since output within the Great Plain is insignificant. It is not by chance that in the diagrams referring to the structure of transport zones, the majority of the supply within the 0—100 km zone is of imported origin.

In 1968, 93·1 per cent of the petrol, gas-oil, kerosene and fuel oil used in the Great Plain was obtained from extra-regional sources and only 6·9 per cent was of local origin. The one and only oil refinery in the Great Plain at Nyírbogdány, has of late, however, been increasingly supplied with local crude oil. According to the latest information for 1968, however, the use of local crude oil at Nyírbogdány seems to have decreased, because a greater part of the output of the Great Plain in that year was from the more remote wells at Szank, Algyő, Decsk and Üllős. It proved more economic from the point of view of transport costs to pipe this oil to the Transdanubian refineries at Százhalombatta, Szőny and Pét and to rely more on Soviet crude oil at Nyírbogdány.

In 1968 the refinery at Nyírbogdány played only a secondary role in supplying petrol, gas-oil, kerosene and fuel oil to the Great Plain, being surpassed in importance by the refineries at Százhalombatta, Szőny and Almásfüzitő (Maps 7 and 8 attached).

As the 1968 survey shows, 96·9 per cent of natural gas consumption was derived from local sources. Local conditions for natural gas consumption seem most favourable, but despite this demand in the Great Plain was only 6·9 per cent of the total output of 1968. The remainder was piped to the industrially more developed regions of county Borsod, Budapest and Százhalombatta (Map 9 attached).

According to a governmental decision of 1960, natural gas was to be used to satisfy the demands of the chemical and metallurgy industries, and domestic consumers. In the industrially underdeveloped Great Plain supplying the latter became the centre of the natural gas programme but as yet this task has not been completely realized.

FRUIT AND VEGETABLE CANNING IN THE GREAT HUNGARIAN PLAIN

by

IMRE BENCZE

HISTORICAL CHANGES

Hungary, particularly the Great Plain is extremely suitable for the manifold development of agriculture, and for the industrial processing of agricultural products. This is largely due to the favourable geographical, climatic and soil conditions of the country and to the relatively plentiful supply of labour. Despite these factors, the industrialized fruit- and vegetable canning is a comparatively young branch of industry in Hungary. The nutrition traditions, the habits of people and the prejudice against canned fruit and vegetables have possibly been responsible for this. The main reason, however, was that the population could not afford the luxury of the expensive canned products, while the small volume of sales did not allow the reduction of the prices of such products. Thus, before 1945 fruit and vegetable used to be home-preserved throughout the country. The majority of smaller canneries established after the turn of the century handled a limited number of products, and only operated seasonally, i.e., during two or three months in the summer. The few larger preserving factories either exported their products or worked to military contracts. During the two world wars the capacity of the factories provisioning the army was expanded.

Since World War II, more exactly since the 1948 nationalizations, the role and conditions of the canning industry have changed fundamentally. In the interest of more effective production, the smaller factories were amalgamated, while the existing larger ones were later expanded and modernized. After exploring the so-called inner reserves, the main concern of the canning industry was to establish large capacity new plants. As a result of this triple process, while the number of workers per factory in 1968 was five times higher than in 1938, output rose tenfold over the same period.

Despite this considerable expansion, Hungary's per capita consumption of canned food is still rather small, being on average barely one-third of that of the more developed countries. This still, however, represents a considerable increase compared with the interwar period, i.e., per capita consumption rose from 1 kg in 1940 to 8 kg in 1954, 15 kg by 1965, and 21 kg by 1970. The export of canned food by comparison has increased at an even greater speed than home consumption and as a consequence, only one-third of total output was expected to be sold in the home market in 1970. Since 1964, 50 per cent of exports have been to the Soviet Union, and about one quarter to Czechoslovakia and the German Democratic Republic. The rest has been exported to capitalist countries.

CHANGES IN AREAL DISTRIBUTION

The special development of the Hungarian canning industry determined the geographical location of the preserving factories. Before 1945, plants were established mainly by commercial firms exporting raw products. The majority of both small and large plants, which operated unsystematically, were located in Budapest and at Kecskemét and Nagykőrös in the Danube—Tisza Interfluve, and further at Hatvan and Szeged. The former were attracted by the exporting role of the capital, the latter by the proximity of raw-produce and the cheapness of labour, especially female labour.

In choosing the location of the plants in the Great Plain, raw vegetables were more significant than fruit, in contrast to Budapest, where the preserving factories processed fruit, which had either been left unsold in the local markets or was surplus to export requirements. The preserving factories of the Great Plain turned to the handling of fruit later and did so only to prolong the period during which production was possible. Vegetables, however, are still the dominant product from the canneries of the Great Plain, although fruit canning is gaining in significance. Consequently, the area of raw-produce supply has to be chosen and analyzed on the basis of the vegetable demands of individual plants. Fruit generally arrives from greater distances than is considered optimal from the transport point of view. In the case of perishable vegetables, geographical proximity and continuous processing are essential because of damage caused by transport over long distances or by storage for a long time. Not only the favourable physical conditions and abundant raw produce, but also the skill of the peasants in cultivating and irrigating plants for canning, have attracted the preserving factories to the sandy areas of the Great Plain. Yet nowadays, as modern technology is becoming more widespread and professional skill of a high degree more general, this last factor is of less importance in determining the location of plants.

The preserving factories were rather concentrated in location before 1945. There were no plants in the eastern part of the Great Plain, i.e., in the Trans-Tisza Region, which occupies one-third of Hungary's territory. In Transdanubia, which represents half the area of the country, there were only 3 to 4 canneries each of small capacity. In the above-mentioned parts of the country, vegetable processing could not develop due to the lack of large-scale plants, although the physical conditions were suited to vegetable growing.

PRESENT AREAL DISTRIBUTION OF PRESERVING FACTORIES

After 1945, the higher standard of living, which also implied a more reasonable level of nutrition, increased the demand for canned fruit and vegetables. The raw produce required was supplied by the high quality horticulture of the country. In the second half of the nineteen-sixties, the preserving factories already handled a range of different fruits and vegetables and produced various juices, soft drinks and a growing number of canned foods. The majority of the products are made of tomato purée, a considerable part of which is exported.

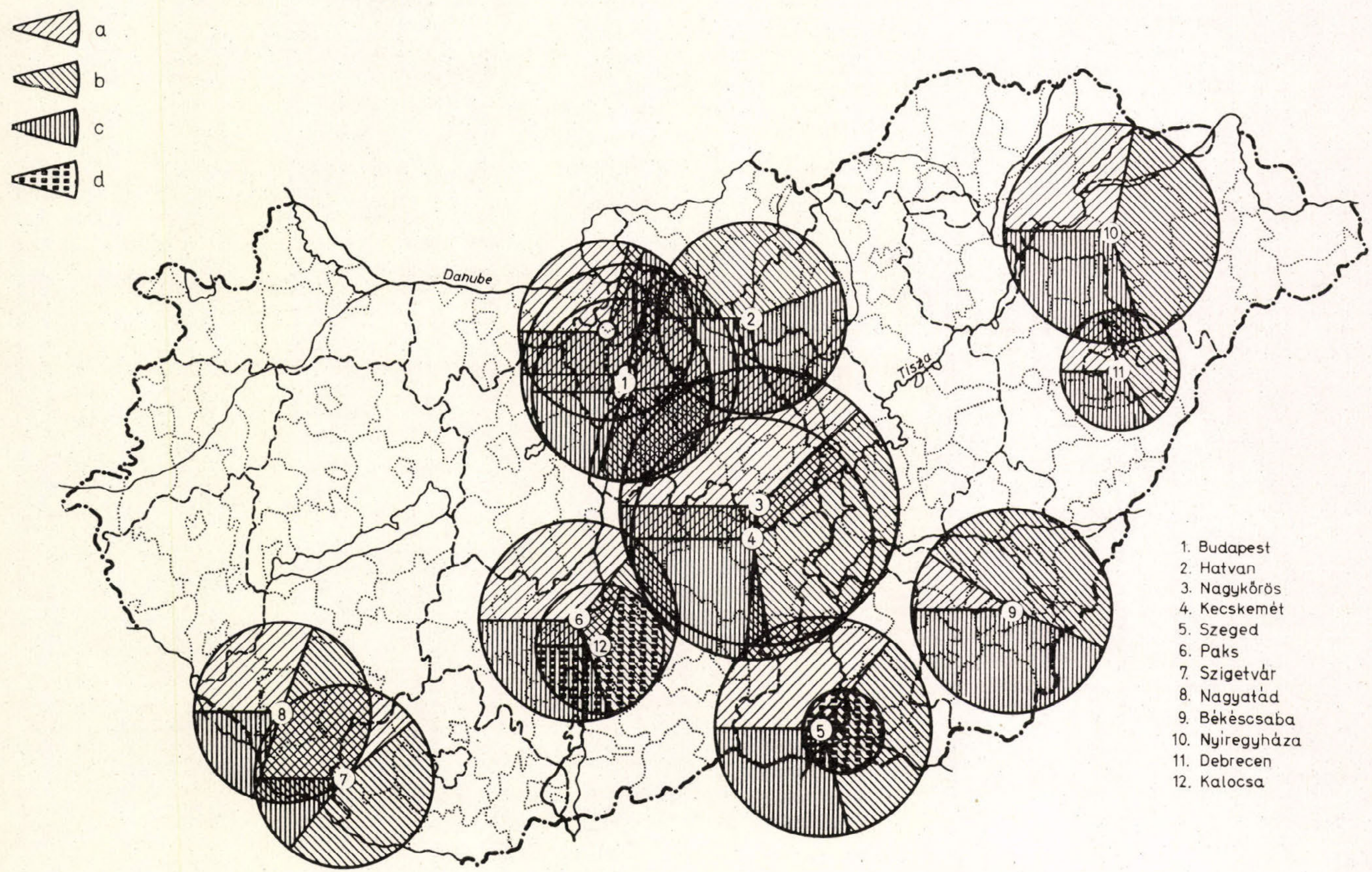

Fig. 1. Capacity of the preserving factories, 1969

a = fruit; b = vegetables; c = other; d = red pepper

Many of the Hungarian preserving factories are concentrated in the main fruit- and vegetable-growing area in the middle of the country, i.e. at Nagykőrös, Kecskemét, Szeged, Kalocsa, Budapest and Dunakeszi. There is also a factory on the northern fringe of the Great Plain, at Hatvan, and three in Transdanubia: at Paks, Szigetvár and Nagyatád. Three new canneries were built at Nyíregyháza, Békéscsaba and Debrecen in the Trans-Tisza Region at the beginning of the sixties. The centres of red pepper processing are Kalocsa and Szeged.

Despite the bringing into production of the new Trans-Tisza preserving factories 60 per cent of the total capacity of canning industry is still concentrated in the region between the Danube and Tisza rivers (Fig. 1). Between 1960 and 1980 the capacity of the canning industry is, however, expected to increase eightfold, which will totally change the areal distribution of the factories. According to preliminary plans, 40 per cent of canning capacity will be concentrated in the Trans-Tisza Region, while the total capacity of plants in Transdanubia will exceed that of the Danube—Tisza Interfluve (Table I).

TABLE I

Expected changes in the areal distribution of the capacity of the canning industry in Hungary between 1960 and 1980

Region	1960 in per cent	1970 in per cent	1980 in per cent
Transdanubia	17	12	35
Danube—Tisza Interfluve	83	60	25
Trans-Tisza Region	—	28	40
Total Hungary	100	100	100
Capacity (thousand tons)	164	710	1270
Index	100	433	774

Of the 14 preserving factories of the country, eleven are to be found in the Great Plain. They comprise the following centres of the canning industry: (a) The Danube—Tisza Interfluve with plants at Kecskemét, Nagykőrös and Kalocsa, (b) the southern region of the Great Plain with plants at Szeged and Békéscsaba, (c) the northern part of the Trans-Tisza Region with factories at Debrecen and Nyíregyháza, and (d) the factory at Hatvan. The remaining three plants are located in the Budapest region, two being in the capital (e) itself and one at Dunakeszi.

FEATURES OF THE NATURAL ENVIRONMENT INFLUENCING THE CANNING INDUSTRY

Beside the analysis of economic factors (i.e., raw-materials, transport conditions and energy, and labour supply), it is essential to examine the physical conditions and the particular demands of the spatial coincidence of raw-produce production and processing capacity. For these reasons a short survey of the geographical conditions at the major locations of the canning industry of the Great Plain is given below.

(a) THE DANUBE—TISZA INTERFLUVE

This is the leading region of Hungarian canning industry and the major fruit-growing area. Of all the regions of Hungary, the counties of Pest and Bács-Kiskun have the greatest number of fruit trees, amounting to one quarter of the total. On average there are 2050 hours of sunshine throughout the year while the total quantity of heat is 3,200 to 3,300 °C. A less favourable feature is the frequent occurrence of ground frost during late spring. Fruit canning is restricted to apricots, cherries and morello cherries, while the tomato is the vegetable most generally canned.

Between 25 and 40 per cent of the surface of the supply area consists of dune ranges, covered by sandy calcareous soils, which are still mobile in certain places. Much of the area of sandy calcareous soils which warm rapidly, has a poor, meadow- and pasture-like topsoil. Though it can be easily cultivated, its yield is below average due to inadequate moisture.

The climate of this area is very dry, annual precipitation averaging between 500 and 550 mm; of this 200 to 275 mm falls during the growing season. Yields are higher than might be expected on the basis of the low rainfall, owing to the ground water level being but 1 to 3 m below the surface. To compensate for the deficiency of water, however, tube well irrigation has been started.

On the Danube-riverine, near Kalocsa, where the soil is well watered, the groundwater level being but 1 to 1·5 m below the surface the highest yields of red pepper are produced. The red pepper is processed in the preserving factory at Kalocsa, which also can fruit during the summer season.

(b) THE SOUTHERN AREAS OF THE GREAT PLAIN

Its climatic conditions are favourable to fruits and vegetables requiring a great deal of sunshine, though its soil conditions are rather various. Along the banks of the Maros, acid alluvial soils are predominant. Groundwater level is between 2 and 5 m below the surface and 250 to 275 mm of rainfall can be expected during the growing season. This region delivers vegetables to the preserving factory at Szeged in particular.

Even more favourable are the soil and climatic conditions of the area which serves the recently completed preserving plant at Békéscsaba. Its chernozem soil is of excellent fertility and of medium-bound, although it seeds small amounts of lime. The groundwater level varies from 2 to 4 m below the surface in the southern part of the area, 4 to 8 m in the northern parts. Although the 200 to 275 mm of precipitation during the growing season is rather sparse, proper land-utilization, adequate fertilization and above all the expansion of irrigation from the river Körös and the Berettyó-canal may result in reasonable and mainly balanced yields from plants demanding considerable quantities of water as well. The increase in tomato yields especially has been considerable.

(c) THE NORTHERN PART OF THE TRANS-TISZA REGION

In the north-east part of the area the surface is made up of undulating dune ranges. The local sandy soil is loose, acid and easy to be cultivated although yields are of only average due to a poor water regime. Groundwater level shows great variations being between 1 and 7 m below the surface, while precipitation during the growing season is 275 to 300 mm. These unfavourable water conditions can be ameliorated by means of irrigation and organic fertilizers.

The loess platform of Debrecen and the Hajdúság is covered by medium-bound adobe-soils. Annual average temperature is 9—10 °C, the number of hours of sunshine 1,800—2,000, and the total amount of heat during the growing season 2,900—3,200 °C. In the north-east fringe of the area, i.e. in the Nyírség, the annual average of precipitation is somewhat higher, between 600 and 700 mm. The Hortobágy, on the other hand, is the driest region in Hungary. But the Eastern Main Canal which traverses the area, is also used for the irrigation of conserve-vegetables.

(d) THE HATVAN REGION

The supply area is made up of gentle hills and meadows. Its forest-type soil is rich in nutrients, is non-calcareous and meadow-like and has been bonded by cultivation. Yields are excellent. South of Hatvan bonded calcareous adobes predominate while to the north-west of the town slightly acid adobe-soils of medium-bond are found. The latter alternate with sandy soils, that warm up rapidly, east of Hatvan. At some places the soil is brown, and is of typical forest variety. The average humus content is 3 to 4 per cent, while the depth of the topsoil varies between 40 and 80 cm. The alluvial soils along the rivers Körös, Tápió and Galga are of a high fertility. Annual average precipitation is between 500 and 550 mm, although rainfall during the growing season is rather scarce, 200—275 mm. The water balance of the deep humus soil can be improved by liming, deep-ploughing, etc.

The main vegetable canned is tomato, while a large amount of green paprika is also processed.

(e) BUDAPEST AND ITS SURROUNDINGS

The south-eastern portion of the supply area is composed of part of the Danube—Tisza Interfluve and here sandy soils are predominant, while on the western side of the Danube, in Mezőföld, medium-bond adobe can be found. In the southern part of county Nógrád on the other hand, the soil is calcareous and slightly acid. Alluvial deposits are found along both banks of the river Danube. The sand is covered by red-brown forest soil, while chernozem soils occur in other places.

The main feature of the supply district is that vegetable growing is non-specialized because of the varied demands of Budapest. Road conditions within the supply district are good.

Fruit and vegetable production is continually adjusting itself to the physical conditions of the Great Plain, although many anomalies are still apparent. In the case of fruit, physical conditions are of a decisive importance even today, particularly in determining the quality of certain fruits, for instance, the apricots of Kecskemét, the plums of Szatmár, and the apples of Szabolcs. Vegetable growing on the other hand, with its large-scale intensive cultures such as hothouse plants, plants raised under foil-tents, and irrigated plants in air-conditioned hothouses, is becoming more and more independent of climatic, and water and soil conditions, with the exception of a few species of vegetables requiring plenty of heat. Favourable economic conditions, for instance, proximity to a preserving factory, and the availability of export and internal markets and other features beneficial to cultivation such as hot wells, waste heat and the possibilities of irrigation are becoming increasingly important. Consequently, vegetable growing and canning are in symbiotic relationship while large-scale fruit growing will also adjust itself more to natural conditions in the future.

The canning industry is dependent on the seasons. For this reason it is of special importance that the period of processing should be prolonged and crop fluctuations due to uncertain climatic conditions eliminated. An efficient way to achieve this in the case of vegetables is to grow crops of different ripening times. Another method is to extend vegetable culture into regions where it has not yet been developed. This refers particularly to the northern counties, where vegetables ripen later. It is true that the distance of raw-material transport is lengthened in this way, which increases the costs of delivery, but the losses involved are easily amortized during the longer period, in which processing can be undertaken economically.

The seasonal character of fruit and vegetable canning hinders efforts at specialization in the canneries. The limitation on the range of products, i.e., the degree to which a factory handles one or a limited number of products, has an effect different from that expected in that it hinders the optimal utilization of existing productive capacity, by engendering a shorter processing period.

OPTIMAL FACTORY SIZE

The large-scale development of the canning industry and the realization of the necessity for a more balanced areal distribution raise the question of the optimal size of preserving factories in the context of the physical and economic conditions of Hungary. The experts of various countries have different views on this question while international experiences also vary. In the German Federal Republic, 450 preserving factories operated with an average of 50 workers at the beginning of the nineteen-sixties. In France there are roughly 1,000 canneries, mostly of small capacity. In the socialist countries, particularly in the GDR, Czechoslovakia and Poland, the majority of the preserving factories are also small plants, though the concentration of the canning industry has been started in all three countries. The Hungarian canning industry with its 14 large factories, each with an average capacity in 1969 of 42,000 tons, and a labour force of 1,500, seems overconcentrated at first sight. These figures in fact represent an almost doubling in size since 1964.

The two preserving factories completed in the first half of the nineteen-sixties at Békéscsaba and Nyíregyháza have a capacity of 35 thousand tons each, while the preserving factory at Debrecen, completed in 1969, operates at a full capacity of 50 thousand tons per year from 1970 on. These developments indicate that Hungarian specialists have decided upon factories of large capacity. According to them, the saving in costs by economics of scale more than compensates for any additional expenses incurred because of size. In their opinion the ideal capacity of future factories is between 40 and 100 thousand tons a year, plants of smaller capacity being considered uneconomic. Moreover, in case of a factory specializing in fruit and vegetable canning only the optimum is considered to be 80 thousand tons in a year.

The development of the canning industry raises several difficult problems. As internal and export demands rapidly increase, the mechanization and automatization of production become more and more urgent. Experience shows that as in the case of many other branches of industry, other things being equal, the larger the factory, the more profitable it is to instal automatic or semiautomatic machines and equipment. Larger factories, on the other hand, increase the average distance of raw-material transport which may in addition cause interruptions in the supply of raw produce through damage in transit, delivery delays or stockpiling. One should consider that the labour demand of a preserving factory with a capacity of 60—80 thousand tons per year is 3—4 thousand workers, consequently it does not appear economic to maintain an area for growing raw produce close to the processing plant, since the latter absorbs necessary manpower from the intensive farms of the area. The factory, on the other hand, has to enrol workers from distant regions or else has to increase the average distance of the raw-produce transport (Fig. 2).

Hungarian specialists in the canning industry thus try to find possibilities of reducing primary costs by increasing plant capacity. A similar, though slower concentration is taking place in Bulgaria, whose canning industry is of the same size as that of Hungary. The only important difference is that in their plans raw-produce cannot be delivered from a distance greater than 30 km from the plant. In Hungary, on the other hand, the average transport distance is about 50 km. Due to the limitation placed on the radius of the supply area, the capacity of the new Bulgarian factories is 10 to 20 thousand tons, and only exceptionally are larger units built.

In the last 2 to 3 years experts in the canning industry in Hungary have tried to combine the significant advantages of large capacity with geographical proximity to the areas of raw-produce supply. For this reason so-called preparatory stations are being established in and around the growing areas which

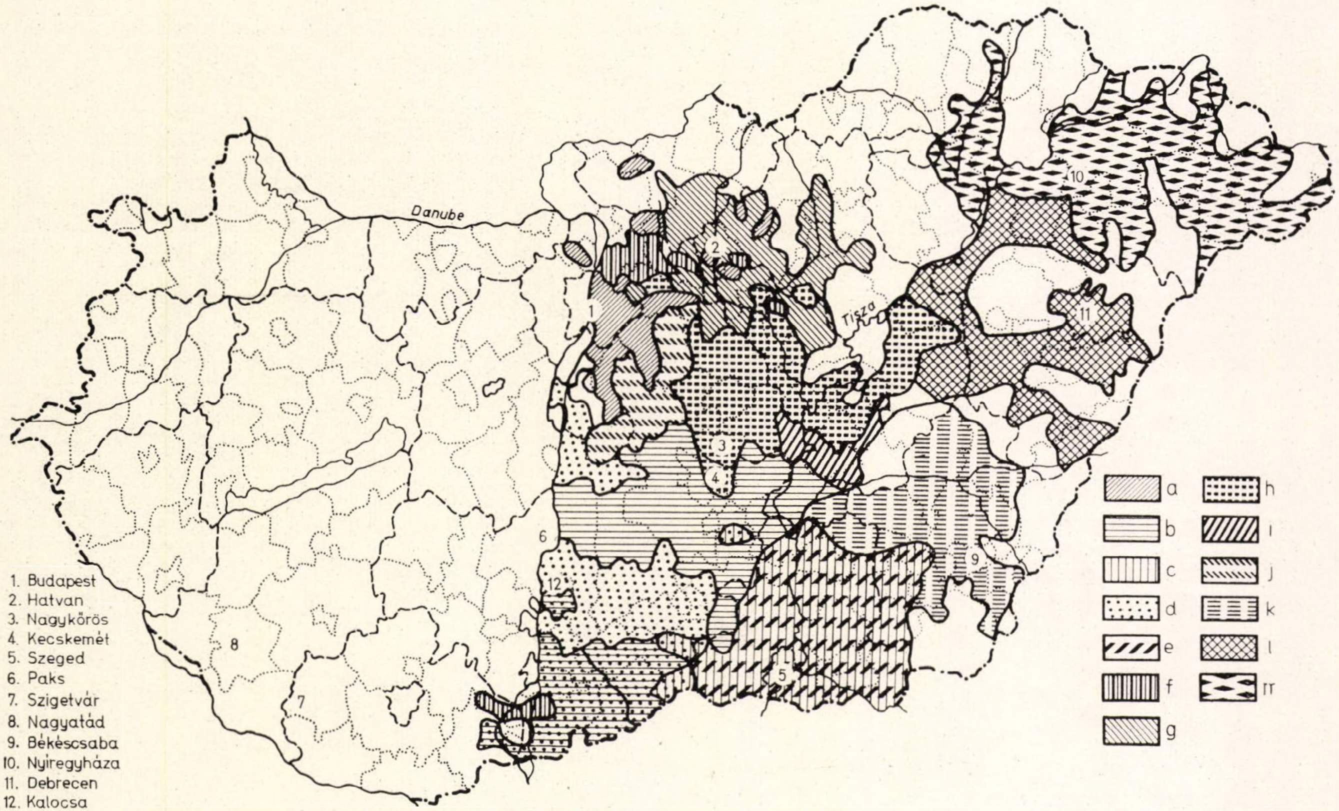

Fig. 2. Supply areas of the preserving factories, 1969

a = Budapest; b = Kecskemét; c = Szeged (red pepper); d = Kalocsa (red pepper); e = Szeged; f = Budapest (Dunakeszi); g = Hatvan; h = Nagykőrös; i = Szeged; j = Budapest; k = Békéscsaba; l = Debrecen; m = Nyíregyháza

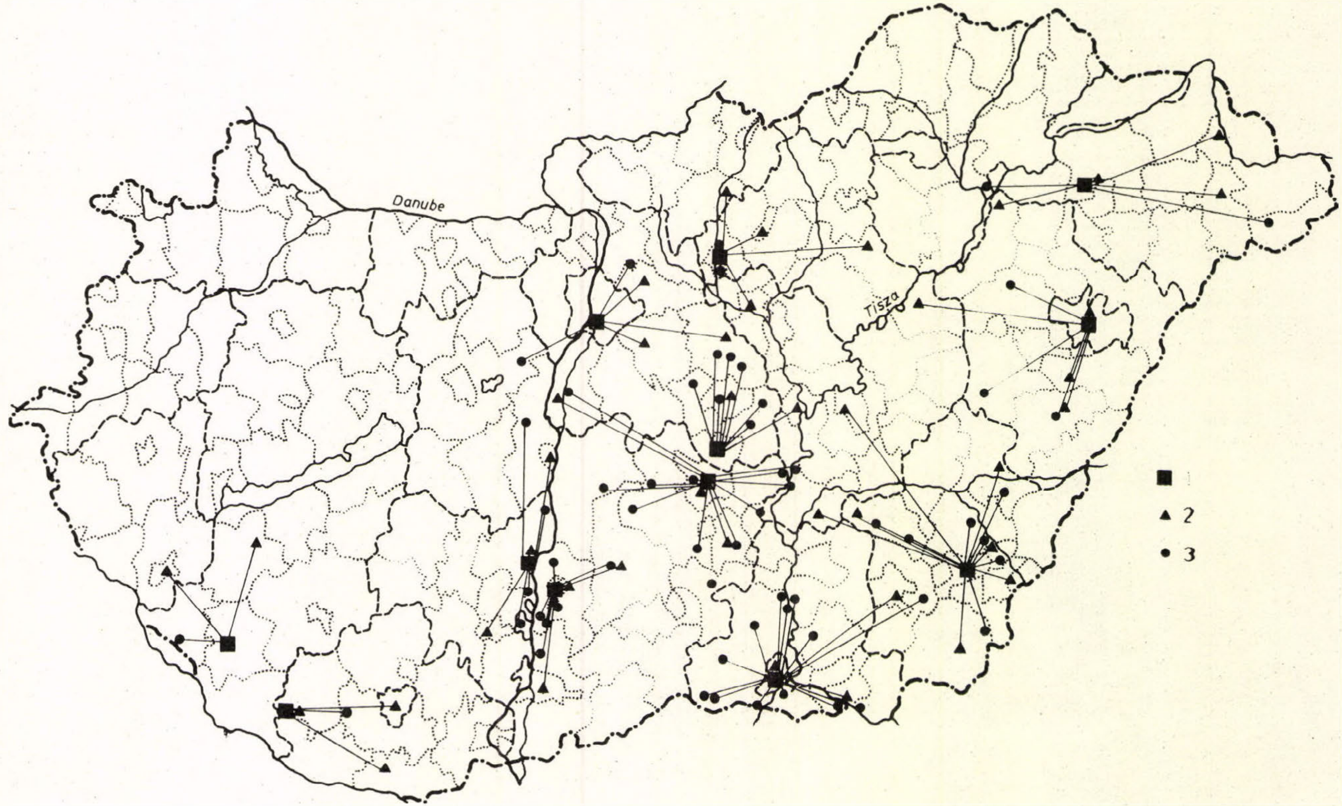

Fig. 3. Semi-processing plants of the preserving factories, 1969

1 = factory; 2 = existing semiproduct-processing plant; 3 = prospective semiproduct-processing plant

lie far from the preserving factories. By 1969 fifty-four plants of this type were already in operation over the country (Fig. 3), and were used for the preliminary processing of tomatoes, green peas and green paprika. At present 30 per cent of all raw-produce arrives at the cannery in a semi-processed state, and in this way production capacity is considerably increased. In most cases only 20 per cent of the original weight of the raw produce has to be transported. Further advantages are that energy costs, water consumption and water disposal are made easier.

THE CANNING INDUSTRY OF THE GREAT PLAIN IN THE NINETEEN-SEVENTIES

After 1945, one can distinguish three separate growth stages in the development of the canning industry. At the end of the nineteen-forties, with the nationalization, the smaller preserving factories were closed down; in the nineteen-fifties the plants still operating in Budapest and in the Danube—Tisza Interfluve were modernized, while in the nineteen-sixties the establishment of new plants of large capacity in the Trans-Tisza Region was the characteristic feature of the development of the canning industry. In the nineteen-seventies the preserving factories of Transdanubia will in all probability be developed.

Between 1960 and 1970 the capacity of the Hungarian canning industry was increased by almost 450 per cent from 196,000 tons in 1960, to 710,000 in 1970. Sixty per cent of this large expansion in capacity was due to the renewal of existing factories, chiefly those of the Danube—Tisza Interfluve, while 40 per cent of it resulted from the completion of new plants, at Békéscsaba, Nyíregyháza and Debrecen in the Trans-Tisza Region (Fig. 4). By the end of the nineteen-seventies, the total capacity of the preserving factories will have been increased by an additional 80 per cent. As the possibilities of reconstruction and the consequent saving of costs become less and less, the capacity of the canning industry can be expanded only by the construction of new preserving factories as has been the case during the last ten years (Fig. 5).

To make a clear view possible, it is desirable to analyze both the planned expansion of existing plants and the establishment of new factories. The criterion for an increase in production is different in the two cases. In the expansion of existing plants, the possible radius, direction and conditions of the optimal supply of raw-produce are particularly taken into account (Fig. 6). Increasing their capacity is justified by the existence of favourable natural and economic conditions in the district in question that further the expansion of fruit and vegetable growing for canning. Other arguments in favour of the expansion of small-line factories are that the training of experts, and labour, the organization of contractual production, and the establishment and development of the necessary conditions for production are easier in an already existing factory. A new factory is burdened in most cases by heavy additional costs such as the construction of approach roads and industrial rail-tracks, and the establishment of water and sewage system.

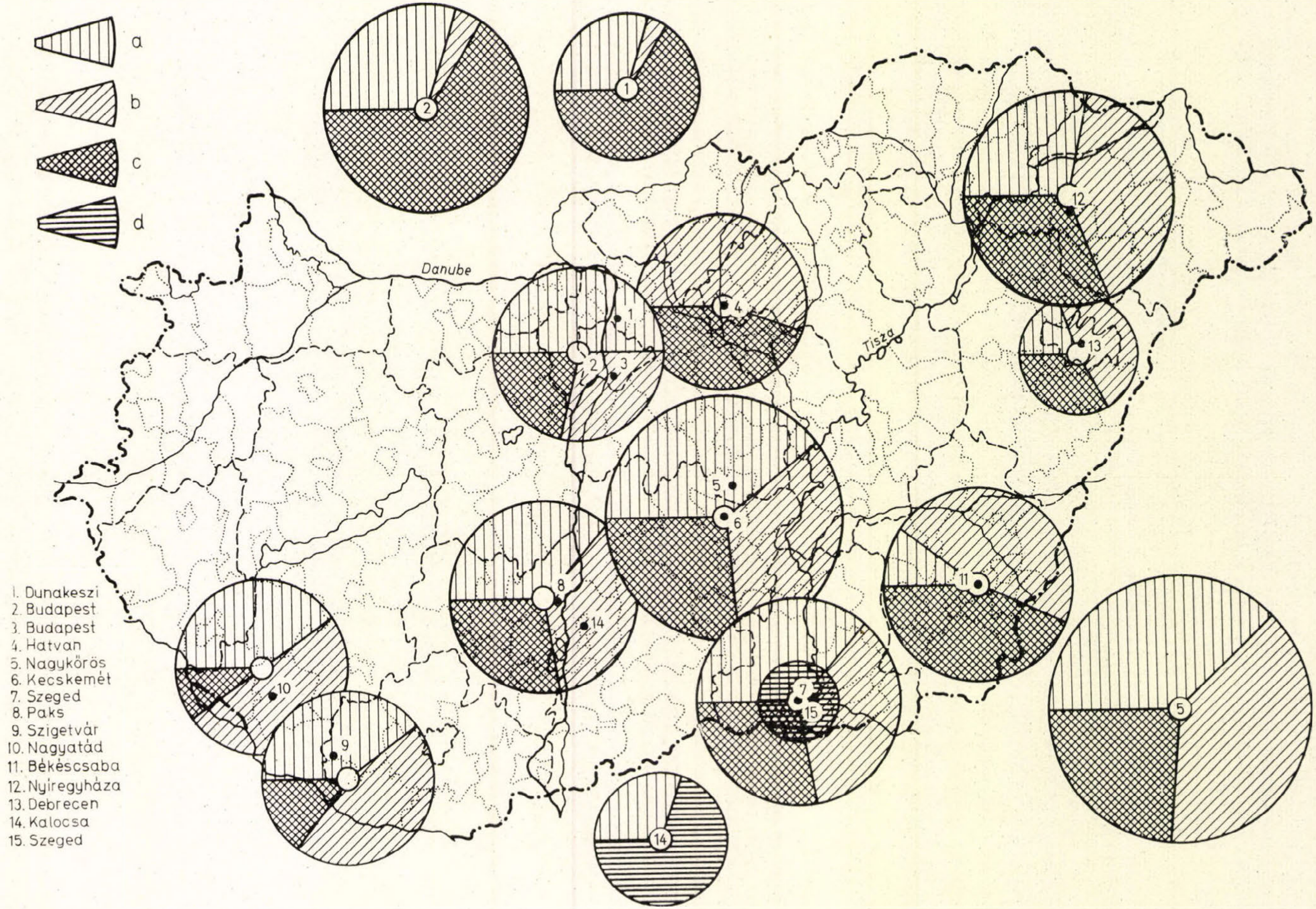

Fig. 4. Composition of processed products, 1969

a = fruit; b = vegetables; c = other; d = red pepper

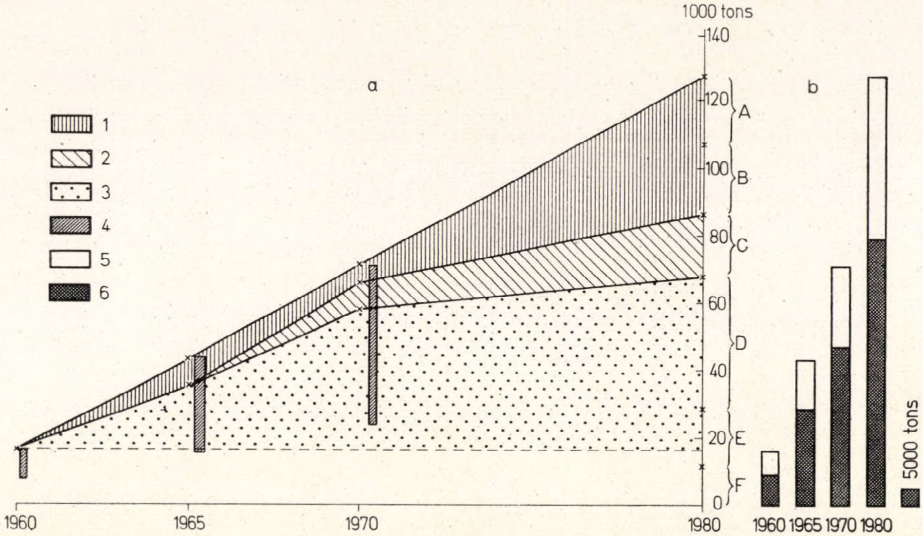

Fig. 5. a = growth of processing capacity, 1960—1980

1 = new plants; 2 = enlargement of plants built in the 1960s; 3 = enlargement of plants built before 1960; 4 = participation of the Great Plain; 5 = capacity of the plants outside of the Great Plain; 6 = capacity of the Great Plain plants. Plants envisaged: A = Transdanubia; B = Great Plain. Plants to be enlarged; C = Trans-Tisza Region; D = Danube—Tisza Interfluve; E = Transdanubia; F = Budapest

b = the share of the Great Plain in the national processing capacity

The three preserving factories completed in the Trans-Tisza Region in the nineteen-sixties can also be considered as expanded plants, as in these cases the machinery had been planned earlier. Some of the expansion shown in Table II belongs to this category.

The figures in the table indicate that even if we consider only the existing plants, the size of preserving factories will be totally changed during the next decades. In 1960 only one factory exceeded an annual capacity of 50,000 tons.

TABLE II

Actual and expected changes in the capacity of preserving factories between 1960 and 1980

Region	1960			1970			1980		
	50	50—100	100	50	50—100	100	50	50—100	100
	thousand tons			thousand tons			thousand tons		
Transdanubia	3	—	—	3	—	—	1	3	—
Danube—Tisza Interfluve	6	—	—	2	3	1	1	3	2
Trans-Tisza Region	—	—	—	1	2	—	1	2	—
Budapest	1	1	—	1	—	1	1	—	1
Total	10	1	—	7	5	2	4	8	3

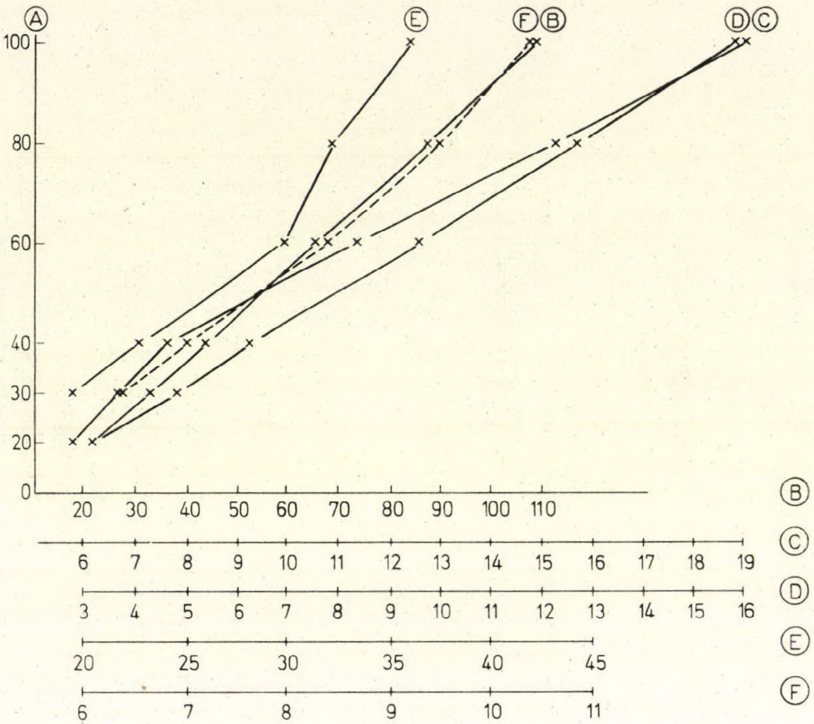

Fig. 6. Comparison of the factors of raw-material supply for the processing plants of differing capacity

A = processing capacity ('000 tons); B = raw-material requirement ('000 tons); C = required sowing area ('000 cad. hold*); D = area supplied by the plant ('00,000 cad. hold); E = average length of raw-material transport (km); F = cost of raw-material transport (Ft/q)

In 1980 there will be 11 such plants and three of them in Kecskemét, Nagykőrös and Budapest, will even exceed an annual capacity of 100,000 tons. Within ten years there will be only 4 preserving factories in the country whose annual capacity will not surpass 50 thousand tons.

On the basis of a thorough analysis of the already operating preserving factories of the Great Plain and those to be developed in the future, we may state that:

(a) In the traditional areas of the canning industry, in the Danube—Tisza Interfluve, the average annual capacity of each factory will exceed 80 thousand tons, while the corresponding value for the Trans-Tisza Region will be 60 thousand tons.

(b) The average supply areas per plant in the Danube—Tisza Interfluve will be 12 thousand, and in the Trans-Tisza Region 8·5 thousand cadastral hold.

(c) The average distance of transporting raw produce will be reduced from 50 to 40 km and to 25 km for the factory at Nyíregyháza.

* 1 hold epualling c. 0·6 hectare

(d) Parallel with the above, the production of fruit and vegetables will be intensified, particularly in the Nagykőrös and Kecskemét area where the proportion of arable land devoted to vegetable produce will be almost 5 per cent (Table III).

To ease the grave situation due to insufficient capacity, the sugarworks in the Great Plain at Szolnok, Mezőhegyes and Sarkad will also produce tomato-purée. The processing of sugar-beet is generally commenced at around the 20th of September which means that the factories can be utilized for

TABLE III

The planned development of existing preserving factories in the Great Plain up to 1980

Preserving factory	Capacity of preserving factory (in '000 tons)	Extension of supply area (in '000 cad. hold)	Average distance of raw-produce transport (in km)	Proportion of arable land producing vegetables (in per cent)
Nagykőrös	100	15·9	33·4	3·9
Kecskemét	100	14·4	32·2	4·9
Hatvan	85	12·3	39·9	3·2
Szeged	70	10·1	26·9	3·9
Kalocsa	50	7·2	25·2	4·0
Békéscsaba	70	10·1	29·0	2·9
Debrecen	60	8·7	31·5	2·7
Nyíregyháza	45	6·5	24·6	3·1

other processes during the two months previous to that date. According to preliminary plans all three factories will produce 1·5 thousand tons of tomato-purée annually.

By means of such measures to increase capacity the construction of 3 new factories, each with a capacity of 60,000 tons, can be saved during the nineteen-seventies. Even with such increases, however, capacity will still not be sufficient to meet the planned production of 1·3 million tons of canned products, and the construction of new factories with a total capacity of 380 thousand tons will thus be a necessity during the next ten years, i.e. 6—8 new plants in all. Each will have the optimal capacity of 50—60 thousand tons.

Preserving factories are usually located close to the source of produce to be canned, but in Hungary there are also significant secondary factors to be considered, such as manpower requirements, as well as water (steam) supply. As regards manpower, there is still surplus labour in agriculture in the Great Plain despite considerable outmigration. It is, of course, more and more expensive each year. In the Trans-Tisza Region and in the industrialized market towns of the Danube—Tisza Interfluve the rate of commuting from the surrounding districts does not exceed 10 per cent of their population. By enlarging this proportion and by the drawing more heavily on the still largely unutilized supply of female labour, the manpower problems of future preserving factories may be solved successfully. Plants of 60 thousand tons' capacity should be located in towns whose population exceeds 43 thousand, while those producing 80 thousand tons annually need to be located in settlements with at least 56 thousand inhabitants, if we allow for 20 per cent commuters among the work force. Otherwise difficulties in labour procurement can be expected.

TABLE IV

Settlement size, water demand and capacity of factory to be established

Capacity of the future plant ('000 tons)	Daily water demand ('000 m³)	Settlement size to support factory location (in '000)
40	6·8	34
60	10·0	50
80	13·4	67

The considerable water requirements indispensable to the production process are another factor that direct preserving factories to the more populous towns, such as those along the Tisza river (Table IV).

If water were available only from artesian wells, the upper limit of productive capacity would be 30 thousand tons, since 5 thousand m^3 is the maximum daily output from an artesian well. Owing to their considerable demands for steam, it is economic to locate preserving factories close to generating stations, sugar factories and the centralized hot water supply plant of housing estates.

An important generating station in the Great Plain which produces surplus steam is sited at Tiszapalkonya, sugar factories are to be found at Szolnok, Sarkad and Mezőhegyes, and on the margins of the Plain at Szerencs and Hatvan, while centralized hot water supply plants for housing estates are planned for towns with populations exceeding 50 thousand.

In the next few decades solutions have to be found to the following questions in view of the fact that under prevailing conditions in Hungary the optimal annual capacity of a preserving factory from a technological point of view is 60 thousand tons. First, due to labour and water supply requirements it is desirable to locate factories with these dimensions close to the rivers Danube and Tisza, and in towns where the population is at least 40—50 thousand. The majority of the small- and middle-size towns of the Great Plain at present industrializing, on the other hand, do not reach this size, though the canning industry with its relatively simple technology, labour intensiveness and sources of raw-produce in the Great Plain, is the very branch of industry to establish in a poorly industrialized region. The principles of national territorial planning also aim at concentrating the food industry in settlements with 5—10 thousand inhabitants which are developing economically. Those centres of the Great Plain which fall into this category encourage the location of preserving factories of 10 to 20 thousand tons annual capacity (i.e. the economic optimum). The Bulgarian canning industry, as we have seen already, follows this objective, which is in contrast to the Hungarian approach of establishing plants reflecting the technological optimum size. Beside the above, there are additional factors which urge the deconcentration of the canning industry. At present, despite considerable investments in the Trans-Tisza Region in the nineteen-sixties, the bulk of the Hungarian canning industry is still concentrated in the central part of Hungary, where similar physical conditions prevail. A weather unusually rainy, cold, dry or hot has unfavourable effects on the whole canning industry. Both shortages and overabundance of raw produce can cause stoppages in the supply. Preserving factories established in regions of diverse climatic conditions, on the other hand, may be able to balance the differences caused by uneven yields. It is evident that centrally located preserving factories close to main roads possess great advantages from this point of view. The selection of optimal plant capacity requires careful study and influences moderating its dimensions such as restricted water supply and eventual shortages of labour, have to be taken into account also.

AN ACTUAL ATTEMPT TO LOCATE PLANTS

Some 6—8 preserving factories are to be established in the nineteen-seventies, 3 or 4 of them should be located west of the Danube at such places as Zalaegerszeg, Sárvár, Győr, Székesfehérvár or Tamási. The remainder would be best situated east of the Tisza, at for instance Szentes, Szerencs, Mátészalka, Sárospatak or Berettyóújfalu. The population number of most of the similar settlements is below that required for optimal plant size from the technological viewpoint. This plan of preliminary locations undoubtedly assumes that it will be possible to decrease easily manpower demands, by means of the latest canning techniques. The precise location of the factories has not been determined yet, and no final decisions have been made as regards their construction and operational order. The highly responsible decision of final locations will be left to economic-geographers.

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STRUCTURAL CHANGES IN THE STOCK-FARMING OF THE GREAT HUNGARIAN PLAIN

by

ISTVÁN ASZTALOS

THE SIGNIFICANCE OF THE GREAT PLAIN IN THE STOCK-FARMING OF HUNGARY

Stock-farming whose development has been influenced by physical, social as well as economic factors, has a very long tradition in the Great Plain, as it has been the main branch of agriculture for many centuries. Physical conditions were predominant in the middle and second half of the last century, when due to drainage works and the regulation of the Tisza, stock-breeding particularly cattle-breeding, was deprived of its natural rationale and new directions of development were established for the next hundred years.

The soils of the originally humid grasslands have become saline, supporting nothing else but dry pasture of low quality, while the former grasslands on the better soils have long been converted to arable cultivation. The ploughing up of parts of the natural fodder growing areas, and the deterioration of the quality of those remaining have pushed into the background the ranching type of stock-farming and have given rise to intensive (stabled) stock-breeding coupled with the growth of fodder production.

During the course of adjusting to the new physical conditions, radical changes in the structure of agriculture particularly in that of animal-breeding occurred, the effects of which are felt even to-day.

The Great Plain is an extensive flat area made up of young sediments. Its landscapes, however, display diverse physical characteristics which produce an unevenness in the possibilities of fodder production. There are wide sandy areas in the Danube—Tisza Interfluve, areas of saline soils in the central parts of the Trans-Tisza Region and the flood plains along the Danube and Tisza, which do not provide favourable conditions for crop production. By contrast, there are regions of considerable extent, having more favourable pedological conditions, such as the meadow-soils of the loess platform along the middle course of the Tisza and of the southern part of the Trans-Tisza Region, which are of a very good quality. Fodder production is, however, even more influenced by climatic conditions than by the quality of soils. The Great Plain has the most extreme climate in the country. Its summers are warmer and its winters colder than in other regions and consequently its monthly and annual ranges of temperature are greater than elsewhere. Hours of sunshine and the strength of solar radiation are also greatest in the Great Plain. Except the north-eastern and eastern marginal zones, the number of sunshine hours varies between 1950 and 2100 per annum. These conditions exert a favourable influence on vine- and fruit-growing and on wheat production.

The climate of the Great Plain is continental. Average annual precipitation varies from 500 to 600 mm in the centre of the Great Plain and reaches 600 to 700 mm only in the marginal areas. Moreover, even this small amount of precipitation fluctuates from year to year and droughts lasting for several weeks are not rare. The dry climate is due to the hemmed in nature of the Great Plain, and to its basin-like character. The scarcity of precipitation, the excessive evaporation, the high temperatures and the poor water economy of many of its soils have further negative effects on the production of fodder crops, particularly on roughages. Fodder production from meadows and pastures is especially affected because of the lack of irrigation.

The given physical conditions were responsible for the formation of a specific structure of production, which has been slow to change despite considerable social efforts. The large-scale soil improvements and irrigation programmes undertaken since World War II have greatly altered the landscape and have made conditions more and more suitable for the production of roughages. The effect of these measures can be seen in changes in the structure of fodder production as well as in stock-farming.

For several decades the structure of fodder production did not change considerably due to the given physical, social and economic conditions. Maize played a predominant role in fodder production while crops for roughage remained rather underdeveloped. Consequently, cattle-breeding shifted steadily towards other parts of the country, particularly to Transdanubia. The shift in the areal distribution of cattle-breeding was due not only to a shrinking in the fodder basis of the Great Plain, but also to the fact that the trend to produce meat (single-line stock-farming) had to give way to the more balanced mixed production of meat and milk (mixed type of animal husbandry), the conditions for which are more favourable in Transdanubia. This region has a higher rainfall and was nearer to the more industrial parts of the country, with their greater demands for milk, milk products and meat.

With the demise of the cattle industry, pig-breeding began to develop intensively on the Great Plain, being supported by large-scale maize production. The division of landed property with a higher than average proportion of small estates and medium-sized farms, played an important role in this as well.

Beside pig-breeding the upswing in poultry-farming is worthy of mention. It was supported not only by the large-scale production of grain crops, but also by the great number of farms scattered all over the region, which provided a favourable basis for extensive poultry farming. Pig and poultry production were favoured as being the most profitable branches of stock-breeding for small farms, which lacked capital. Only small investments were needed for rapid returns, while the necessary abundant labour supply was available.

The Great Plain was also the most important region for sheep farming, the fodder basis of which was supplied by the extensive saline pastures of low quality, which were unsatisfactory for the rearing of cattle.

Before World War II stock-breeding fluctuated. Its development was affected by several factors, such as an insufficient fodder basis, economic crises, and variable market conditions which influenced both the composition of livestock and the utilization of particular varieties.

Before World War II, fodder production on the Great Plain was restricted chiefly to the production of fodder crops, and this was reflected in the com-

TABLE I

The spatial distribution of fodder production (in per cent)

Fodder crops	Great Plain			Hungary		
	1931—40	1951—60	1968	1931—40	1951—60	1968
Grain crops	46·9	47·2	47·4	43·2	44·3	43·9
Rough and soft fodder crops	46·2	19·2	23·5	18·9	20·9	23·5
Meadow-pasture	36·9	33·6	29·1	37·9	34·8	32·5
Total	100·0	100·0	100·0	100·0	100·0	100·0
Maize	33·4	35·0	31·1	27·1	29·4	31·2
Barley	9·5	9·4	10·0	10·8	11·0	11·3
Legumes	6·5	8·5	10·7	8·4	9·4	10·6
Pasture	24·7	25·5	22·4	22·8	21·9	22·1

position of the livestock. This relationship which is demonstrated in Tables I and II was to some extent different from the national trends.

TABLE II

Distribution of livestock types (in per cent)

Livestock type	Great Plain			Hungary		
	1935	1960	1968	1935	1960	1968
Cattle	46·6	48·1	52·1	53·3	55·1	58·1
Pigs	20·0	25·1	28·7	18·5	21·4	26·1
Horses	29·4	19·9	8·8	24·6	17·6	7·6
Sheep	4·0	6·9	10·4	4·6	5·9	8·2
Total livestock in animal units	100·0	100·0	100·0	100·0	100·0	100·0

(One animal unit is equal to 500 kg live weight. In this scheme cattle rate 0·8 units each, pigs 0·114, horses 0·8 and sheep 0·0714 units.)

Thus, in the nineteen-thirties, fodder crop production occupied 49 per cent of the total crop area of the Great Plain, and this proportion has not changed considerably since then, although the minimal changes that have taken place have favoured the spread of fodder crops. The same tendency can be observed at the national scale as well. Maize is predominant amongst the grain fodder crops, although in contrast to the general trend its acreage has decreased. The result of this is that the proportion of maize now grown on the Great Plain is equal to the national average and the specific features of stock-farming peculiar to the Great Plain are thus less predominant. This equalizing tendency can also be observed in the changes in the production of roughage. In the nineteen-thirties, their production in the Great Plain fell behind the national average, but by 1968 the respective values were identical, largely as a result of the rapid spread of legume production throughout the Plain. A similar trend can be observed in the proportion of pasture land, but owing to its lower nutritive value in the Great Plain, it is only suitable for sheep-farming there. The changes in fodder production have diminished the possibilities of areal specialization in stock-farming, and the trends in the structure of livestock farming are consequently similar throughout the country. Sheep-breeding alone is becoming increasingly concentrated in the Great Plain.

World War II produced heavy losses in stock-farming. The post-war upsurge, however, was fairly rapid to which the changes in the structure of agriculture in 1945 greatly contributed. As a result of the land reform, the number of independent farms increased which greatly furthered the numerical rise in livestock. The socialist reform of agriculture created the basis for the steady evolution towards high quality intensive stock-farming. During the period of the reforms difficulties may have arisen, but the advantages they have bestowed are beyond doubt, since up-to-date fodder production and suitable livestock husbandry can be realized only within the scope of large-scale farming. The more favourable economic conditions resulted not only in the further development of the traditional branches of stock-farming, but also in the expansion of cattle-breeding. However, although stock-farming on the Great Plain is becoming more intensive, the rudimentary specialization that did exist is declining at the same time (Table III).

The trends in stock-farming on the Great Plain correspond to those occurring in the rest of the country, although differences in terms of magnitude do exist. The stock of each animal type has increased numerically, with the exception of horse, which has declined by two thirds since the nineteen-thirties. The latter is, however, a positive factor since the large-scale mechanization of agriculture has reduced the need for horses. The decrease in the horse-stock has also meant an increase in the fodder available for other animals, particularly for cattle. Regional differences in the development of stock-

TABLE III

Changes in the number of livestock

Livestock type	1000			per cent		
	1935	1960	1968	1935	1960	1968
Great Plain						
Cattle	702·8	819·2	912·5	100	116·6	129·8
Pigs	2 215·5	2 999·3	3 479·1	100	135·4	157·0
Horses	456·7	338·8	152·5	100	74·2	33·4
Sheep	655·5	1 334·8	2 033·3	100	203·6	310·2
Total livestock in animal units	1 226·7	1 363·1	1 383·0	100	111·1	112·7
Hungary						
Cattle	1 911	1 971	2 096	100	102·8	109·7
Pigs	4 674	5 356	6 609	100	114·6	141·4
Horses	886	628	274	100	70·9	30·9
Sheep	1 460	2 381	3 311	100	163·1	226·9
Total livestock in animal units	2 880	2 858	2 885	100	99·2	100·2

farming have given rise to considerable changes in the composition as well as in the areal distribution of livestock. As a result, compared with the nineteen-thirties, a higher proportion of the total livestock of the country is now concentrated in the Great Plain (Table IV).

TABLE IV

The livestock of the Great Plain as a percentage of the total livestock of Hungary

Livestock type	1935	1960	1964	1968
Cattle	36·7	41·6	42·9	43·5
Pigs	47·4	56·0	52·0	52·7
Horses	51·5	54·0	54·7	55·6
Sheep	45·0	56·1	59·0	61·4
Total livestock in animal units	42·6	47·7	47·9	48·0

The changes in the structure of the fodder-growing area were followed by both a numerical and spatial expansion of cattle-breeding. The cattle-stock has increased by 30 per cent since 1935 and as a result the proportion of cattle on the Great Plain in 1968 was almost identical to that in Transdanubia. Pig-farming has also developed rapidly and more than half of the total number of the country are now bred in the Great Plain. Animal husbandry on the Plain is characterized by a faster than average rate of development for while total livestock in animal units in 1968 hardly exceeded that of the nineteen-thirties in the country as a whole, that of the Great Plain was greater by 12·7 per cent. A less favourable phenomenon is, however, that the traditional pig-farming of the Plain failed to follow the trend of specialization and having expanded at a rate less than the national average, it is becoming less concentrated spatially. In sheep-breeding alone can we observe a more definite regional concentration.

The regional changes in the structure of production are in the majority of instances virtually the same and it is almost always the same sphere of fodder production and animal breeding that expands or contracts. This characteristic has undoubtedly a negative influence on the development of regional specialization in production. "The trends against specialization can be most conspicuously observed in the regional shifts in maize production. Maize production has increased relatively speaking in each county but in the traditional growing areas, maize production has actually fallen behind the average" (Bernát, T. and Enyedi, Gy. 1968a). Consequently, pig-farming is becoming more evenly balanced spatially, since development is slow in the traditional breeding areas of the Great Plain, but faster elsewhere. Cattle-breeding reveals the same areal trends, although in this case the regional shifts are reversed in that the rate of expansion on the Great Plain is faster than in Transdanubia. There is no balancing tendency in sheep-breeding.

THE STRUCTURE OF FODDER PRODUCTION AND ITS AREAL DISTRIBUTION

Stock-farming on the Great Plain was greatly furthered by the socialist reforms of agriculture. Although between 1960 and 1967 the main fodder growing area declined by almost 10 per cent, and the acreage devoted to stock-farming was 3 per cent less than in the nineteen-thirties, the number of livestock in 1967 was almost 13 per cent higher than in 1935 and 1·5 per cent greater than in 1960. These trends are contradictory to the extent that the supply of fodder does not seem to have improved. Nevertheless, the changes in the structure of fodder production and particularly the increase in total nutrients produced, provide a more secure fodder basis for livestock. Even the smaller area devoted to fodder yields starch values 30—40 per cent higher than the average for the nineteen-thirties. The reasons for higher yields are twofold: first, the growing area itself has been extended by nearly 10 per cent, and secondly more crops are grown than previously—the cultivation of grains being particularly noticeable. The better protein supply has been provided by roughages grown on arable land, particularly leguminous crops.

The regional shifts and changes in the structure of stock-farming have paralleled the changes in the areal distribution and structure of fodder production. A favourable trend concerning the latter is that, disregarding the 22 per cent decrease in the natural fodder-growing area, the roughage supply to livestock has not worsened, because its production on arable land has increased by more than 40 per cent. By contrast, a small decrease has occurred in total cropland fodder made up of a 10 per cent decline in maize production and small expansions in barley and wheat production for fodder. These changes relate to the spread of slaughter pigs, the demands for a more up-to-date fodder supply, the need to increase the protein basis, and an insufficient labour force. Although fodder production has developed rapidly, the demands for modern feedstuffs cannot as yet be considered satisfied. The still existing shortage of nutrients, particularly of protein, hinders a uniform expansion in the number of the livestock, and productivity increases. Since maize is the predominant fodder crop, the overall protein content of fodder is rather low, at about 9·5 or 10 per cent, which is far below the requirement of 15—16 per cent. The task must thus be to grow barley, fodder peas, soyabeans and sunflowers, to increase the protein supply of the livestock and industry. The spread of roughages, especially of the legumes is a favourable phenomenon. In 1968 the growing area of rough and soft fodder crops and of legumes exceeded the average of the nineteen-thirties by 41 and 61 per cent, respectively. From the point of view of the protein supply for livestock, it is of special importance that the area of legume production has almost doubled, which means that the protein content of roughage is now satisfactory. The introduction of large-scale stock-farming has produced significant changes in the structure of fodder production, particularly the spread of silage, i.e. green maize and silo maize. By contrast, the production of sugar-beet which is labour intensive and was characteristically used on small peasant farms as soft winter feed, is rapidly decreasing in significance. The national increase in the areas devoted to both rough and soft fodder crops clearly indicates the

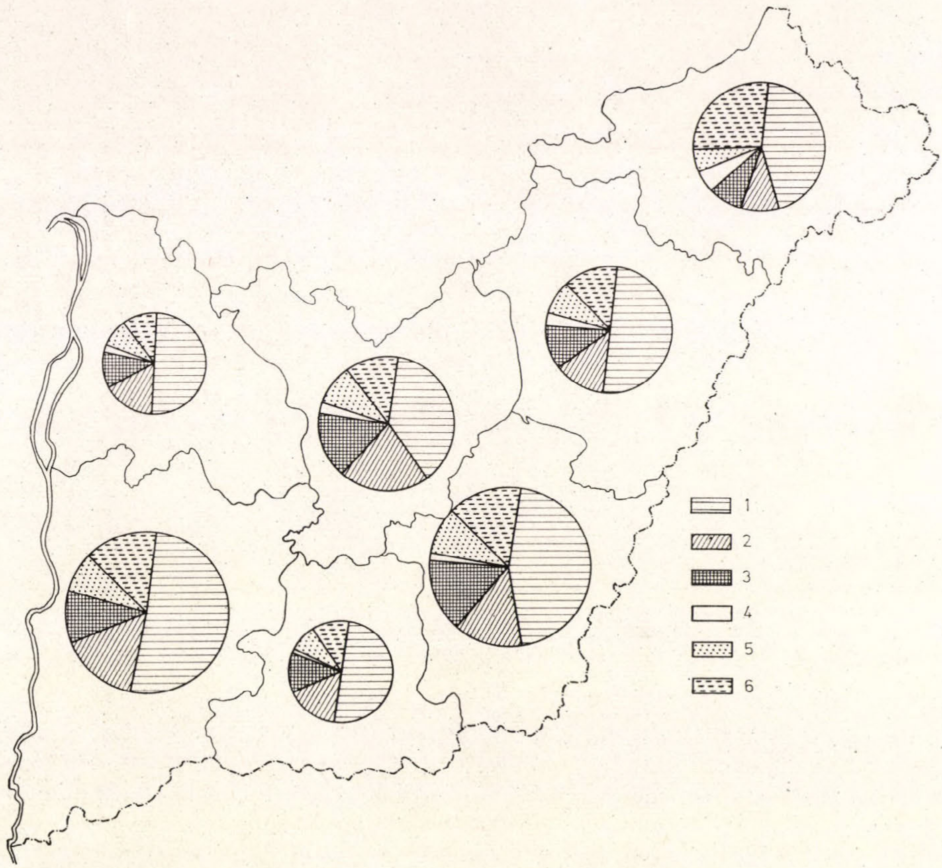

Fig. 1. The land use of the arable fodder-growing areas of the Great Plain in 1968 per cent (the circles are proportional to areal extent)

1 = maize; 2 = barley; 3 = lucerne; 4 = red clover; 5 = silo-maize and green maize; 6 = other roughages

efforts made in the various regions to produce the crops best suited to the prevailing physical conditions (Table V, Fig. 1).

However, when describing the trends in fodder production, we cannot content ourselves merely with an examination of the changes in the structure of sowing and of regional shifts in the growing areas of certain fodder crops. This does not convey an adequate picture—as crop production averages and changes in the bulk of feedstuffs should also be taken into account. The production of maize, barley, lucerne and red clover, the four most important fodder crops, provide us with a good overall example, since together they occupy nearly three quarters of the total crop area. Maize and barley comprise nearly 60 per cent of the arable fodder area, and nearly 90 per cent of the grain fodder growing area. Lucerne and red clover are raised on 15 per cent of the crop area, and on 44 per cent of the roughage-producing area. These

TABLE V

Changes in the composition of the fodder growing area of the Great Plain

Fodder crops	1000 ha			per cent		
	1931—40	1951—60	1968	1931—40	1951—60	1968
Maize	689·8	699·1	623·6	100	101·4	90·5
Barley	197·1	186·9	199·6	100	94·9	101·3
Oats	80·2	53·9	16·7	100	67·2	20·9
Total coarse grains	967·1	939·9	950·3	100	97·3	98·3
Lucerne	103·5	133·2	179·7	100	128·7	173·6
Red clover	23·1	34·4	30·3	100	149·3	131·4
Total legumes	133·2	170·4	214·5	100	127·9	160·9
Mixed oats and vetches	47·8	28·3	12·5	100	59·3	26·2
Silo-maize, green-maize	32·7	40·3	121·6	100	123·3	372·4
Other roughages and soft fodder crops	48·1	98·4	105·6	100	204·7	220·0
Sugar-beet	71·9	45·5	16·3	100	63·1	22·6
Total roughages and soft fodder crops	333·7	382·9	470·5	100	114·8	141·0
Meadow	252·7	167·0	136·3	100	66·1	53·9
Pasture	510·8	508·2	449·4	100	99·5	87·9
Total meadow and pasture	763·5	675·2	585·7	100	88·1	76·7
Roughages raised on arable land and meadow-pasture	1 097·2	1 058·1	1 056·2	100	96·4	96·3
Total fodder production area	2 064·3	1 998·0	2 006·5	100	96·7	97·2

four important feedstuffs furnish about 80 per cent of the total starch and protein produced by the main fodder crops raised on arable land.

Nevertheless, a considerable difference can be observed in the development of grain crops and leguminous feedstuffs. Though in the final analysis, the amount of feedstuffs produced has increased in both cases, the preconditions are different. Thus while the crop area of maize has decreased, maize output has considerably increased. In the case of barley both its growing area and output have increased, the latter, however, to a much greater extent. Due to the increase in average yields, the number of livestock dependent on both crops in 1968 exceeded the corresponding figure of the nineteen-thirties by 45 per cent. Average yields from legumes, however, were no higher than in the nineteen-thirties. In 1968, although fodder harvested exceeded the volume for the nineteen-thirties, this is not so reassuring when it is considered that at the same time the crop area had also increased by 66 per cent (Table VI).

Despite considerable developments, however, the shortage of fodder is still general and grave. Considering grain fodder crops, a 16 per cent deficiency exists in fodder starch, and a while there is a shortfall of 25 per cent in starch and 30 per cent in protein, in rough and soft fodder. To compensate for this, beside the enlargement of the fodder growing area, average yields must be increased, and modern agricultural techniques and principles, such as up-to-date methods of harvesting, and the introduction of a second sowing season must be envisaged. Owing to the dry and extreme climate of the Great Plain, however, second sowing can only be introduced successfully by means of

TABLE VI

Production changes in the most important fodder crops

Fodder crops	Average yield (quintal/ha)			Total yield ('000 tons)		
	1931—40	1951—60	1968	1931—40	1951—60	1968
Maize	17·9	21·0	28 2	1 237·1	1 474·1	1 751·9
Barley	13·4	17·6	21·2	265·0	327·3	422·7
Lucerne	41·2	36·7	41·7	472·2	487·7	748·5
Red clover	32·0	32·7	27·8	73·7	112·9	83·7

irrigation. It is particularly essential to increase the irrigation of pasture land since this provides the most effective and cheapest way of raising the fodder basis.

The effects of irrigation can already be seen on the structure of fodder production and livestock farming. The regional spread of irrigation has been favourable in that the majority of irrigation equipment and nearly three quarters of the total land irrigated are concentrated in the low rainfall areas of the Great Plain, particularly in the region east of the Tisza river. The spatial coverage, however, has not been even and approximately one half of the irrigated area of the Great Plain and more than one third of the total land irrigated is situated in the central part of the Trans-Tisza and Central Tisza Regions.

The significance of irrigation on fodder crop production should not be underestimated, since about 40 per cent of the total irrigated area is occupied by roughages and fodder crops raised on arable land and 15 per cent by meadow and pasture lands. The latter, however, comprises only 3 per cent of the total area of meadows and pasture. Besides, the effectiveness of irrigation is decreased by the fact that it is not accompanied by the application of fertilizers.

The majority of fodder for the livestock is produced on arable land, with grain crops playing a leading role. Their production exceeds that of roughages in acreage of cropland as well as in yield and starch value. Coarse grain production in the Great Plain still claims 36·7 per cent of pasture land and occupies 67 per cent of the total fodder-growing area leaving only one third for the production of roughages. The importance of grain crops naturally varies from region to region in the Great Plain. The Danube—Tisza Interfluve and the south-east part of the Great Plain account for a higher proportion of fodder crop production on arable land than in the Nyírség and Central Tisza Region where it tends to be neglected. The production of rough and soft fodder crops occupies an area half the size of that devoted to grain crops, i.e., 18·2 per cent of total arable land. They form important components of the agriculture of the Nyírség, the Central Tisza Region and the south-east part of the Great Plain. The combined production of fodder crops and roughages occupies 55 per cent of the total arable land, but even this is insufficient to satisfy the feedstuff needs of the animal stock, since average yields are still low. Stock-farming consequently is rather expensive. The unsatisfactory

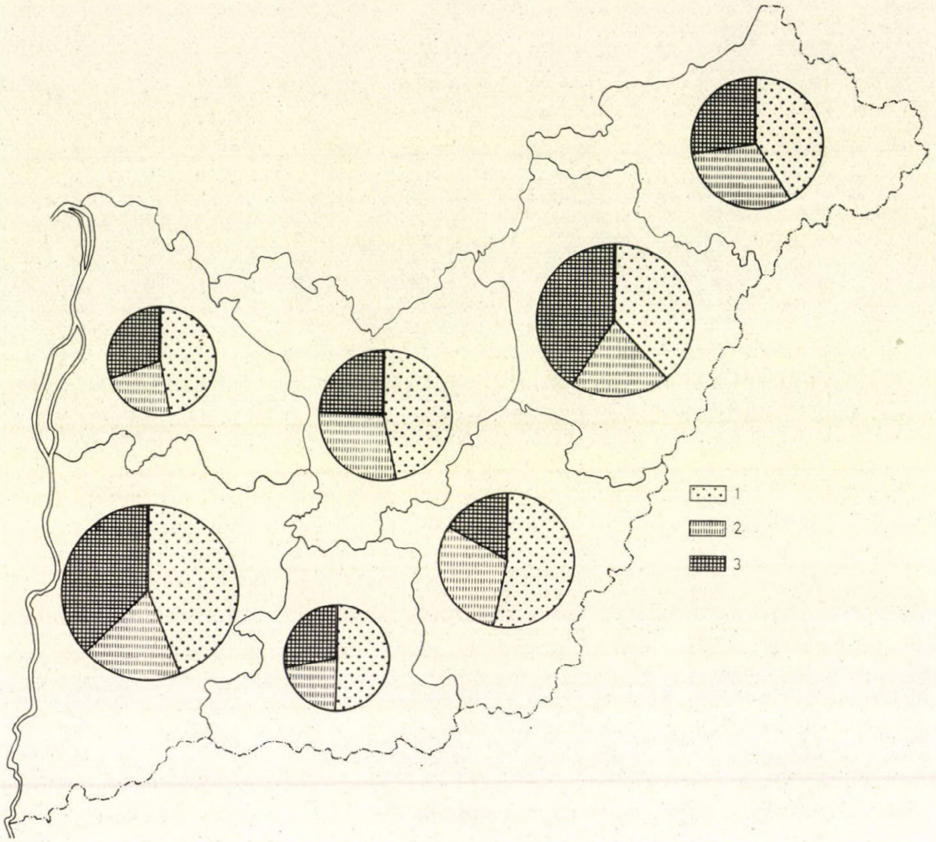

Fig. 2. The distribution of cropland in the Great Plain in 1968 (the circles are proportional to areal extent)

1 = grain crops; 2 = roughages raised on arable land; 3 = meadow-pasture

supply of fodder hinders animal productivity. It is responsible for the disproportions, characteristic not only of the Great Plain, but of the whole country as well, that while more than half the arable land is in the service of stock-farming, the proportion that stock-farming contributes to the total gross production value of agriculture is only 38 to 40 per cent.

Stock-farming is based mainly on the production of fodder on arable land, but the natural fodder growing areas are of equal importance. By increasing their productivity they certainly can play an important role in stock-farming, owing to their large territorial extent. The area of roughages grown on arable land plus that produced from meadows and pastures tends to be concentrated in the central part of the Trans-Tisza Region, in the Nyírség and in the southern half of the Danube—Tisza Interfluve. Fodder crops, on the other hand, predominate in the south-east part of the Great Plain (Fig. 2).

CHANGES IN THE STRUCTURE OF STOCK-FARMING

The development of stock-farming has more or less paralleled the trends in fodder production. The changes in the structure of the former have been due to the modernization and mechanization of agricultural production, whereby a large horse-stock is no longer required. This process has raised the proportions of both cattle and pigs, the two most important livestock animals. The areal distribution of livestock shows that the Great Plain has strengthened its role in the stock-farming of the country. Its traditional position as the leading area of pig-farming has been preserved while the stock of cattle has expanded considerably, although not yet attaining the national average. The spread of roughages is truly reflected by the changes in the structure of stock-farming. Sheep-breeding, which has also grown, is due to the existence of the extensive pasture rather than to roughages raised on arable land. The areal modification of the structure of stock-breeding can also be observed through changes in the density of the various animal groups. Whereas nationally there are 30·2 cattle per 100 hectares, the corresponding value for the Great Plain is 27·3. For pigs the respective values are 95·7 and 99·9, for sheep 48·0 and 58·3, and in terms of standard animal units 41·8 nationally and 39·7 in the Great Plain. Naturally, the areal distribution of animal types within the Great Plain is highly differentiated. Pig-breeding is significant in every part, but particularly in the south-east and in the Central Tisza Region. Although below the national average, nearly one quarter of the livestock, when measured in standard animal units, in the northern part of the Danube—Tisza Interfluve comprises pigs. The density of cattle in the Nyírség exceeds the national average, and considerable numbers are to be found near the capital and in the Central Tisza Region. The Danube—Tisza Interfluve still contains a good stock of horses. The poor quality pastures of the central parts of the Trans-Tisza Region support sheep rather than cattle farming, more than one sixth of the total livestock being sheep. This value is more than double of the national average and is one and a half times greater than the Great Plain average (Fig. 3).

With the introduction of large-scale farming, between 1963 and 1968, changes in the composition and numbers of livestock have contrasted with the evolution of the fodder-producing areas. Fodder-growing has decreased in all areas, with the exception of the south-eastern and north-eastern parts of the Great Plain, while pig-breeding has increased everywhere. It is characteristic that this increase has been smallest in the Nyírség, where, by contrast with the general tendency in the Great Plain, the production of fodder crops has been most widespread. The number of pigs has also risen considerably in the Danube—Tisza Interfluve and in the Central Tisza Region. The production of roughages as against fodder crops has become more widespread in all parts, with the exception of the Nyírség, where its growing area has not essentially changed, and the area round Budapest where its average has diminished. The density of cattle-stock as related to the fodder-growing area reveals certain differences in that the number of livestock has decreased in the Nyírség and increased near the capital although the fodder-growing area has remained constant. In the central part of the Trans-Tisza Region, although the

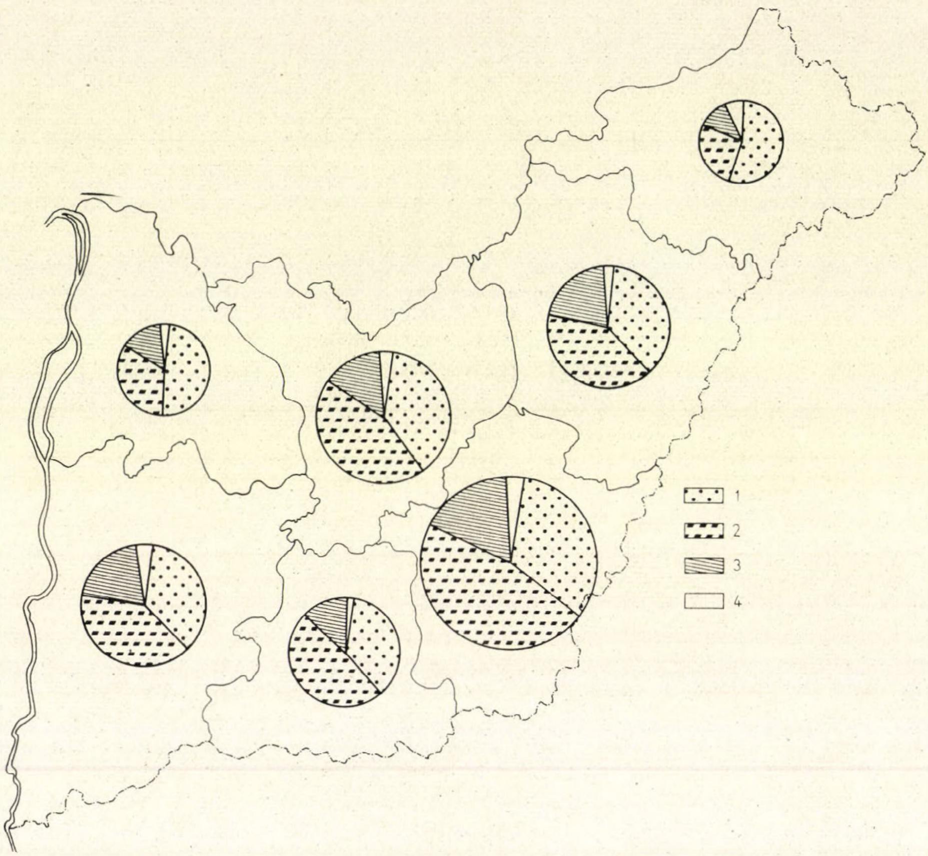

Fig. 3. The structure of livestock in the Great Plain in 1968 (the circles are proportional to the number of livestock)

1 = cattle; 2 = pigs; 3 = horses; 4 = sheep

roughage crop has expanded, the number of livestock has stagnated. In some parts of the Great Plain livestock has increased numerically, but in the main cattle-breeding areas of the central and northern parts of the Trans-Tisza Region the stock has stagnated, and even decreased. Thus a trend towards an evening out of the spatial disparities in the stock-farming can be observed throughout the Great Plain, an over-all upsurge characterizes sheep-breeding, mainly in the great natural fodder-growing areas, of the southern part of the Danube—Tisza Interfluve and the central parts of the Trans-Tisza Region.

Meat production has always been the main rationale for stock-breeding in the Great Plain. This feature has been preserved so far, but appears less important at the national scale than formerly as many other regions are also specializing in meat production.

Pork, the dominant meat product in the country, is also predominating in the Great Plain. Pork comprises 49·7 per cent, slaughtered poultry 24·3 per cent and beef 22·9 per cent of total meat production. Mutton production is small at 2·5 per cent. The significance of poultry is conspicuous in that it exceeds the volume of beef production. The majority of the pig and poultry stock are reared on fodder crops, which reveals the significance of the latter.

Although the trends are the same throughout the country, differences do exist in the rate of development which tends to weaken specialization. Between 1960 and 1968 beef production for the market expanded by 16·7 per cent in the Great Plain as against the national average of 10·2 per cent; the corresponding figures for slaughter pigs were 6 per cent and 29·5 per cent respectively. In the production of slaughter poultry which is a traditional business in the Great Plain, the increase was more modest (144 per cent) against the national average of 216 per cent. Similar trends are apparent in mutton production for the market. The growing significance of cattle-breeding in the Great Plain is revealed not only by the fact that meat output exceeds the average, but by the rapid upswing in milk-production as well.

Owing to the differences in the rate of development, the role of the Great Plain in the production of different animal products has greatly altered. The production of slaughter cattle and milk exceeds the national average, but the output of other products has decreased. The unfavourable aspects of the slow expansion of pig and poultry production for the market can be felt especially from the point of view of specialization, and the share of the Great Plain in the national production of meat, an area in which it formerly dominated, has diminished (Table VII).

TABLE VII

The commodity production of stock-farming on the Great Plain*

Product	Changes in purchases 1960–1968				Proportion of the national average (in per cent)	
	in '000 tons	per cent	in '000 tons	per cent	1960	1968
Slaughter cattle	104·6	41·3	122·1	38·9	41·4	43·8
Slaughter pigs	122·2	48·2	129·6	41·3	51·8	42·4
Slaughter sheep	5·3	2·1	10·4	3·3	50·5	49·5
Poultry	21·2	8·4	51·7	16·5	76·0	58·7
Total meat	253·3	100·0	313·8	100·0	48·1	45·2
Milk (in million liters)	301·0	—	468·6	—	40·7	42·2
Eggs (in millions)	199·8	—	445·4	—	48·2	46·3

* Commodity production is equated with state purchases.

Beside the regional differences, Table VII shows that the composition of animal product purchases has changed. Between 1960 and 1968 the percentage of cattle and pigs for slaughter out of total meat production decreased. By comparison, the proportion of sheep for slaughter showed a slight increase, while the significance of poultry almost doubled. The structure of commodity production has not changed identically throughout the Great Plain, and also significant structural divergencies from the national average exist. A certain balance can be observed in the output of meat. The purchase of slaughter cattle from the southern part of the Great Plain has increased considerably—an area which formerly was mainly devoted to pig-breeding. The increase in purchases, however, is partial and derives mainly from the south-eastern part of the Trans-Tisza Region. The fact that there has been stagnation in the volume of purchases from the main beef-producing areas such as the central and northern parts of the Trans-Tisza Region, and the central areas of the Tisza Region, is further proof of the tendency towards the establishment of a regional balance in commodity production. Nevertheless, these regions still continue to supply the majority of cattle for slaughter, although the purchase of slaughter pig has decreased. The upsurge in the production of poultry for sale is characteristic throughout the Great Plain, particularly in the northern sectors where the modest increase up to 1960 has since accelerated leading to a tripling of output or better in eight years. The rise in poultry production has also induced significant changes in the structure of meat-purchase.

The main trends between 1960 and 1968 are as follows: the proportion of slaughter pigs purchased decreased everywhere, but particularly in the southern half of the Great Plain and in the central parts of the Trans-Tisza Region. In the former area, however, the proportion of cattle for slaughter increased, although decreases were observed in other parts of the Plain. The increases in the proportion of slaughter sheep and poultry form a general tendency. Poultry has gained significance in the structure of purchases, and now represents one fifth of the total purchase of slaughter animals in the southern part of the Danube—Tisza Interfluve and in the central sections of the Trans-Tisza Region. In accordance with the special features and structure of stock-farming in the Great Plain, pigs comprise the most important animals for slaughter, with the exception of two regions—the area surrounding the capital and the Nyírség where cattle are more significant. Yet the disparities between the purchase of pigs and cattle for slaughter diminished between 1960 and 1968. While in 1960, of all animals for slaughter, pigs comprised 48·2 per cent, cattle 41·3 per cent, sheep 2·8 per cent and poultry 8·4 per cent, the respective figures for 1968 were: 41·3 per cent, 38·9 per cent, 3·3 per cent and 16·5 per cent. Some regions of the Great Plain may depart from the average picture presented but this does not contradict the general tendency (Fig. 4).

Thus, in the structure of fodder production, the composition of livestock and changes in commodity production an equalization process can be observed. Each branch of animal husbandry has developed, and the result has been an increase in the gross value of production from the stock-farming greatly in excess of the average for agriculture. The production value per 100 hectares was greater in the nineteen-sixties than thirty years earlier, fodder production increasing by between 36 and 60 per cent, and stock-farming by between 58 and 100 per cent. The process of balancing has both advantageous and disadvantageous consequences. On the credit side is the fact that both the volume and standard of agricultural production on the Great Plain exceed the national average. A negative feature, however, is the weakening of areal

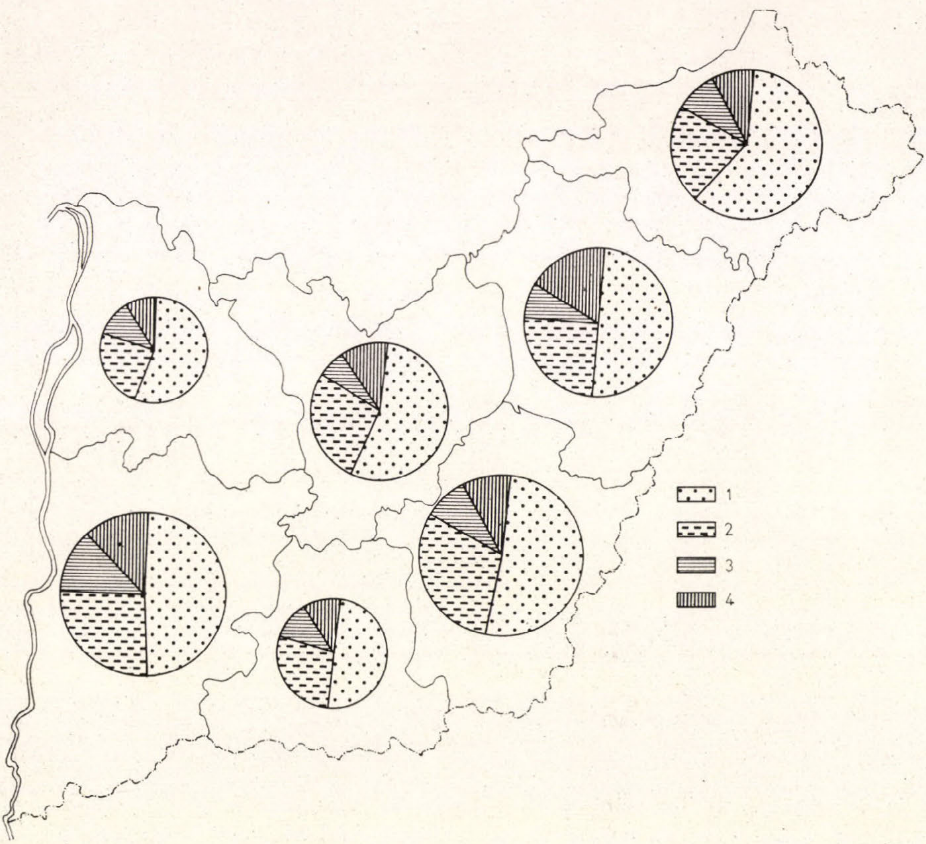

Fig. 4. The structure of slaughter animal sales in the Great Plain in 1968 (circles are proportional to the volume of sales)

1 = slaughter cattle; 2 = slaughter pigs; 3 = poultry; 4 = slaughter sheep

specialization, even though it was rather rudimentary. Multi-purpose production and breeding cannot be the path of further development, and must be eliminated because it hinders the growth of large-scale modern farming. Since Hungary has only just taken the first steps towards specialization, unnecessary buildings and investments are not a rare occurrence. It is characteristic that cow-sheds are utilized only 70 to 80 per cent of the time and with further specialization they often turn out to be superfluous. At present the traditional unspecialized structure of production still prevails in the Great Plain and throughout the country as a whole. As agricultural expansion demands the spread of specialization the result may lead to changes in the structure of livestock different from those to be expected on the basis of present tendencies.

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DEVELOPMENT OF THE AGRICULTURAL STRUCTURE AROUND KISKŐRÖS

by

ISTVÁN BERÉNYI

The Danube—Tisza Interfluve represents a special agricultural area with a profile that differs from the other agrarian regions of the Great Plain.

To show the changes experienced in cultivation during the last 250 years, we have selected as a representative area the environs of Kiskőrös.

To analyse the successive land utilization, we have chosen to compare and interpret the land-use maps at a scale of 1 : 28,800 prepared from the military map surveys of I/1770 and III/1880, and the maps at 1 : 25,000 prepared from the military survey of 1950. To these we have added the 1965 land-use photographs prepared by ground survey. In describing changes in cultivation, we have made use of the statistical data of 1897, 1935, 1960, and 1965.

PHYSICAL-GEOGRAPHIC FACTORS INFLUENCING THE SPATIAL STRUCTURE OF CULTIVATION

The surface morphology of the study area, which is basically of lowland character, developed as the alluvial fan of the Danube. The sand was blown out of the alluvial deposits and piled into dunes, forming the characteristic surface. Despite its small size, the region around Kiskőrös exhibits a varied morphology since it is situated on the western periphery of the Soroksár—Baja dune line. Consequently, part of the area occupies the sandy upland of the Danube—Tisza Interfluve, and part of it the depression of Kalocsa. The variety shows itself in the surface height above sea level.

(a) The western part of the region, the depression of Kalocsa, is 90 m a.s.l. It is an area of hard soils suitable for the cultivation of field plants. The same low height characterizes also the flats between the sand-dunes. These poorly drained lands are water-logged even in late spring and are occupied by meadows and reeds.

(b) The lands 90 to 100 m a.s.l. form a transition zone between the above-mentioned surface and the dune-covered territories. The soil is sandy but richer in humus and the cultivation of field plants is the dominant land-use.

(c) The highest sections (more than 100 m a.s.l.) are represented by a partially anchored sandy surface, utilized for viticulture and fruit growing. The small differences in elevation, therefore, become significant in delineating land-use.

The region enjoys 1250—2100 hours of sunshine annually, 100—130 hours more than the national average—a fact highly significant for cultivation.

Even the beginning of October receives much sun, an advantageous situation for the ripening of grapes.

The mean annual temperature of 9·5 °C is 1 °C above the national average. The total heat intake during the growing season reaches 3000 °C, which makes the cultivation of highly heat-intensive plants possible. The spatial distribution of cultivation is particularly influenced by the microclimate. Owing to the physical peculiarities of the sandy surface, the amplitude of temperature change is great. The highest and lowest values are extreme, for in summer the temperature may reach 35 °C and in winter, —18 °C. In summer, the sand possesses a strong reflective capacity, which increases surface radiation.

Grapes are able to utilize this radiation, although if too strong it may singe their leaves. Interplanted fruit-trees can weaken this radiation. The wind is also an important climatic factor which can often become damaging on sandy uplands through the production of sandstorms. Especially dangerous are winds in early spring and also in mid-summer when the summer is dry. Only proper soil cultivation and the correct spatial arrangement of plants can mitigate the destructive power of the wind.

An especially important climatic factor, directly affecting the harvest and the spatial structure of cultivation, is precipitation. The yearly average is 500—550 mm. This quantity more or less satisfies the moisture demand of the grape-vine but not that of the hoed cultures grown on the sandy soils, and the yield of the latter is greatly affected by the distribution of precipitation during the year. The greater part of rainfall comes during the vegetative period. An average of 25—35 stormy days falls below the national mean, but hail is very frequent. The quantity of annual precipitation decisively influences the height of the water-table, which in turn has special significance for the agriculture of the area. The water-table is generally high, i.e. 100—200 cm below the surface. In one way this is beneficial because it makes viticulture possible on the sandy territories even in drought years. In another way, it is harmful because the flat areas interspersed amongst the sand dunes are water-logged even in late spring.

Owing to variations in the height of the water-table, not only the meadows but part of the arable land may often be covered with water, resulting in a loss of harvest. To insure the more intensive utilization of the area a broad programme of water management is necessary. For instance, in past years, some attempt has been made to utilize the high water-table for irrigation from pipe wells. This may assume increasing importance in the future.

Soil conditions also influence the spatial distribution of cultivation. In miniature, the environs of Kiskőrös show the same pedological variety as the entire Danube—Tisza Interfluve. By and large, three well-distinguished soil types dominate. The largest territory is occupied by *sandy soils*, the clay content of which ranges from 3 to 13 per cent, and humus content to 0·5—1 per cent. Their nutrient content is low, and water-retaining and nutrient-fixing capacity poor. Their ventilation, on the other hand, is excellent. Shifting sand has no clearly distinguishable humus layer. However, in some places a loamy humus-containing subsoil can be found at depths of 1—2 meters, whose nutrient content the grape-vine is able to utilize. This soil type is thus the most important for viticulture. The poor quality sand, however, requires great quantities of organic fertilizers, without which the vine stock deteriorates and its productivity declines.

The soils found on the areas between the dunes are brown, grey or black with a humic thickness of 30—60 cm, and are mainly covered by damp meadows. These soils harden during the summer droughts.

The soils of the Kalocsa depression are recent and late alluvial and meadow clays. In general, they are utilized for the growing of field plants.

SPATIAL CHANGES IN THE METHODS OF LAND UTILIZATION

(a) The Hungarian feudal system of land cultivation prevailing in the 15th century disappeared during the 150 years of Turkish occupation in the 16th and 17th centuries.

A large part of the population escaped to the Felvidék (Slovakia) and Transylvania. A smaller portion settled in the so-called *khas* towns, e.g. Kecskemét and Kiskunhalas, since these were the property of the sultan, and protected from the raids of roaming Turkish military bands. The specified tax levies, collected at definite intervals, permitted tolerable living conditions.

However, the sultans gave the larger part of the territory to the pashas for given periods in payment for military service. To escape taxation and constant looting, the small remaining population scattered over the *puszta* and changed to extensive stock-raising. The resulting mobility meant a certain protection against raids. The change to extensive stock-raising, however, demanded more meadow- and pastureland, and instituted the rapid clearing of woodland. The 20 years of war which finally liberated Hungary from the Turks was also unfavourable for the settling of the population.

The resettlement of the people was initiated at the beginning of the 18th century by returning landowners to secure the necessary manpower. The resettlement was initially quite unorganized but was followed from the middle of the century on by the planned colonization programme of the Court. However, the programme was primarily aimed at bringing in and settling population of German origin.

The "puszta" in the environment of Kiskőrös belonged to the Wattay family, the first colonists coming to it from what is now Slovakia in 1718. The settlement of population brought about a further clearing of the woodland and an enlargement of the pasture area which was demanded by some of the new settlers who had previously been engaged in stock-raising.

From the middle of the 18th century, the growing opportunities for labour made it possible to expand the manorial system on the latifundia. The increase in grain-growing meant the extention of arable land and the bringing of much pastureland under the plough.

By the end of the 18th century, the large-scale deforestation, the stock-raising, mainly for sheep, and the ploughing up of pastureland gave free reign to wind erosion on the sandy surface. Within a few years, blown-sands covered much valuable agricultural land. The "sand-plague" reached such proportions that it was discussed by the Parliament of 1791, and resulted in Joseph II forbidding the ploughing up of pasturelands and proposing reforestation and the establishment of vineyards and orchards.

Although the agrarian system of the 18th century bore the stamp of feudal restrictions, in our area it also contained different features. The duties and restrictions were less onerous, since the landowners were interested in attracting new settlers and gaining new labour power. They even made some concessions to the colonists. According to the 1720 census, 69 per cent of the families in Kiskőrös owned plots. This portion increased during the century, for the parcelling up of the sandy surface enabled more serfs to acquire property.

By contrast, in the densely populated regions of the country the endless division of property multiplied the numbers of landless serfs.

The agrarian system which had become established by the 18th century is represented in the first military survey. The three main categories of land use are: stock-raising on meadow and pastureland, the growing of field crops, and, a smaller scale, vine and fruit culture (Map 1 attached).

(b) The parcelling of free sandy lands continued into the 19th century, leading to the settlement of further population groups and to a gradual extension of viticulture. In 1828, half the 928 families of Kiskőrös owned vineyards.

The Napoleonic wars of the early 19th century affected grain production favourably, since Hungarian grain was assured a secure market in the countries in conflict. The increased demand led to the expansion of arable land at the expense of meadows and pastures. Arable land now occupied 60 per cent of the agriculturally usable area, and the relative importance of stock-raising declined somewhat. The particular natural conditions, however, prevented the unrestricted expansion of arable land, and therefore grain growing did not approach the extent that is found, for instance, in the Trans-Tisza Region. Thus the slackened demand following the Napoleonic wars resulted in a less severe economic recession.

The peculiar system of ownership in the territory did not change after the 1848 liberation of the serfs, and certain tithes to the seigneur (for example, a tithe on grapes) remained in effect and were abolished only in 1868.

The influx of foreign capital that followed the Compromise in 1867, and the concomitant establishment of the Austro-Hungarian Monarchy, stimulated the capitalist development of Hungarian agriculture. However, only the great estates were favourably affected by this process, accelerating the development of the agricultural regions of Transdanubia first of all where the great estates occupied 70 to 80 per cent of the total area.

The ownership conditions that characterized the environment of Kiskőrös were such that the process of capitalistic transformation hardly touched agricultural production there in the middle of the 19th century. The small peasant properties were unable to secure credit, a fact that had much to do with the agricultural structure becoming fossilized in the state it had been established by the beginning of the century. In the study area, therefore, during the 19th century (until 1880) the growing of field crops came to the fore (Table I).

Only in years of good harvest did the wine reach markets outside the territory.

TABLE I

The land use of the Kiskőrös region

	1897		1935		1960		1965	
	cadastral hold	per cent	cadastral hold	per cent	cadastral hold	per cent	cadastral hold	per cent
Arable land	6 424	49·9	7 365	41·0	5 168	32·9	4 659	29·7
Meadow	2 433	18·1	3 311	18·4	2 874	18·3	2 358	15·0
Garden	129	1·0	146	0·8	124	0·7	289	1·7
Orchards	—	—	—	—	—	—	340	2·1
Vineyards	784	6·5	3 283	18·3	4 014	25·6	4 571	29·1
Pasture	1 505	11·7	1 509	8·5	986	6·2	852	5·4
Forest	115	0·9	96	0·5	97	0·6	196	1·2
Reeds	715	5·8	771	4·3	665	4·2	502	3·2
Non-agricultural area	747	6·1	1 475	8·2	1 743	11·5	1 874	12·6
Total territory	12 852	100·0	17 956	100·0	15 671	100·0	15 641	100·0

Since stock-raising remained significant, the peasants rented meadow and pastureland. Viticulture was also playing an increasing role in land use (Map 2 attached) which in its broad features retained its separate character.

(c) The agricultural structure of the country established during the 19th century once again began to change following the ravages of filoxera (*Phylloxera vitifolii*). Between 1875 and 1885, 200,000 cadastral hold of vineyards were destroyed within the pre-World War I boundaries of Hungary.

By contrast, the vineyards planted on sandy soils survived. The attention of grape-growers was therefore focussed on the more intensive utilization of sandy territories, and, in these regions which so far had been hardly utilized property values increased tenfold within a few years. The planting of vineyards was also encouraged by such government measures as, for instance, the 6-year tax exemption on new grape plantations, the guaranteeing of free grafts from the United States, and various advantageous credit arrangements. Influenced by these measures, vineyards in the region of Kiskőrös tripled in extent in 10 years. Parallel with the growth of small holdings, industrial capital, too, made significant investment.

From 1900 to 1940, the area of vineyards continued to expand, encroaching on former arable lands. In this way a new agricultural region dotted with small vineyards appeared outside the compact area of grape plantations that had become established by the beginning of the century (Map 3 attached).*

The system of grape production on the sandy regions, however, differed in many respects from that found on the so-called traditional wine areas of, for example, Tokaj, Eger and Badacsony. One characteristic feature was that the vines were interplanted with fruit trees resulting in a two-storey plant culture.

* The map represented was prepared on the basis of the 1950 survey. However, it mirrors the agricultural structure that emerged after 1900, since the land reform of 1945 did not alter the spatial arrangement of cultivation which in broad features remained intact up to 1960.

Although the intercropping of fruit trees appeared also in the traditional wine regions, it was not general. In the sandy regions, on the other hand, more than 90 per cent of the vineyards were intercalated with fruit trees which meant protection against wind erosion and diminished the extremes of soil temperature. (Notably, in summer the exposed sandy surface can rise to 60—70 °C and singe the leaves of the grape, vine, but in early spring, owing to strong surface radiation, soil-level frost can be frequent.)

The constant population increase (Table II) also aided the development of characteristic cultivation of the area and resulted in the rapid division of property in the period 1920 to 1930 (Table III). In 1935, 72·6 per cent of the families in Kiskőrös owned only 22·4 per cent of the land area usable agriculturally. Thus it became necessary to use the land at maximum intensity.

TABLE II

The population of Kiskőrös between 1869 and 1966

1869	1880	1890	1900	1910	1920	1930	1941	1949	1960	1966
6 490	6 902	8 138	9 715	11 235	11 865	12 671	12 405	12 420	13 137	13 028

TABLE III

The distribution of property in Kiskőrös in 1935

Size of property (cadastral hold)	Families (in per cent)	Total area (in per cent)
Less than 1	29·3	2·6
1—5	43·3	19·8
5—20	23·4	39·8
20—200	3·8	21·8
over 200	0·2	16·0

Another feature of the region is that, owing to its lowland character, it could not develop as high a standard in the use of wine cellars as could the highland regions. In the hilly areas, natural cellars dug in loess or in ryolithic tufa guarantee an even temperature and favourable microclimatic conditions for the fermentation of wines. In these caves, the wine could be stored for several years with actual improvement in quality. Therefore the vineyard owners could wait for favourable market conditions. By contrast, the wine cellars dug in the sand, with their clay walls and reed roofs, suffered temperature fluctuations and the wine could not mature properly. Although the *kadarka*, the wine-grape most suitable for the natural conditions of the region, became general, the poor cellars prevented the proper maturing and long-term storage of the wines, whose quality therefore did not reach those produced in the hill areas. The vine-growers were forced to market their wines before the onset of summer because the warming of the cellars frequently ruined their quality. Naturally the merchants exploited the situation and bought up the wines at low prices. Thus the periodical difficulties appearing in wine production in the past 50 years were felt most acutely by the wine-producers in the sandy areas. From the beginning of the century, therefore, small-scale wine production became characteristic, remaining unchanged until large-scale factory production was created during the 1960s.

A decrease in the arable average has paralleled the expansion of the vineyards. The structure of cultivation has also changed in that fodder crops have received priority over grain. Although the extent of meadows remained unchanged from 1897 to 1960 and the area of pasture lands declined by only a half, the animal stock rapidly diminished. For instance, in 1897, the number of cattle stood at 2068, falling to 1205 in 1935, and 80 in 1965.

(d) Following World War II, new social conditions were created for the utilization of land. We have already mentioned that the land reform of 1945 did not upset the previous structure of land use in the study area; nor were there basic changes in property relationships. Although great land holdings occupied 37·8 per cent of the total usable agricultural area, the vineyards that lent themselves to large-scale wine production were not distributed but were turned into state farms. The pasture, meadows and arable lands of the former latifundia were, however, distributed among 4·6 per cent of the population of Kiskőrös, against a national average of 6 per cent. The land reform therefore affected only a small part of the population of the region, since the number of landless peasants and indentured agricultural labourers was smaller than in Transdanubia and Trans-Tisza Region. The majority of the population had become property owners as a result of the parcelling of formerly uncultivated sandy territory at the beginning of the century, and the property divisions, resulting from population increase, were not of such extent as to make a large portion of the population landless. The tiny but intensively cultivated vineyards permitted tolerable living conditions for the small property owners.

The restratification of population accompanying the rapid industrialization and the growing demands of the urban population for foodstuffs justified the nation-wide collectivization movement that began in 1950. The organization of agricultural production on a large scale became a necessity. During the socialist transformation of agriculture, however, insufficient attention was given to historical traditions, well-established agricultural structures and specialization, and the diverse physiographic endowments of areas. The situation was aggravated by the fact that newly created cooperative farms did not receive sufficient financial backing, because in many places the new method of production was equated with a simple cooperative of small producers. Moreover, the economic system then based on forcible plan directives of the central state administration did not pay sufficient attention to the differing types of the various cooperatives, for instance, all were given a uniform crop structure, and owing to the priority once again accorded to grain production, regional specialization that had been established earlier began to decline.

As a consequence, the vineyards of the Kiskőrös region entered a depressed phase which was further aggravated by the low purchase price of wine. Thus the grapestock continued to deteriorate, although even before World War II it had already needed replanting. The vineyards situated in the least favourable areas, for example, those above 200 meters or those planted on blown-sand which thus required large quantities of organic fertilizer, were completely destroyed. Within five years, vineyards in Hungary as a whole decreased in extent by 10 per cent.

From 1957 on, the system of economic management underwent considerable change. Compulsory deliveries were abolished, and grape-growing was stimulated by more advantageous purchase prices. The transformation of the small-holder sector was also more prudent from 1960 on. A new type of cooperative was created, more suitable for viticulture and corresponding more to the interests of the peasantry. Members of these new types of specialized cooperative cultivate their own vineyards with their own means of production. They relinquish 10 per cent of their net income to the collective fund, and in return, the cooperative purchases pesticides, insecticides, and fertilizers at advantageous prices and undertakes to market the produce. The construction of new buildings and purchase of machinery are also defrayed from the collective fund, and the foundation is thus being laid for a more efficient type of large-scale viticulture. This type of cooperative, primitive as it was, has created the conditions for the renewal of aged vine stocks. The developments aimed at separating the planting of grapevines from fruit trees, a practice suited only to small-scale unmechanized agriculture, are thus creating the preconditions for large-scale, mechanized cultivation. The realization of these projects has gradually altered the spatial structure of agriculture so that between 1960 and 1967, these cooperatives planted 1607 hectares of vineyards and 340 hectares of orchards producing for market.

In 1965, after detailed fieldwork, a landuse map was prepared on a scale of 1 : 25,000 of the environs of Kiskőrös in order to gauge the extent of the spatial changes. During this work, the qualitative assessment of the prevailing form of land utilization (viticulture) and the establishing on the trend of spatial change have been aimed at. When this land utilization map (Map 4 attached) is compared with the previous one (Map 3), the following conclusions can be drawn.

1. Viticulture remained the main form of agricultural specialization.
   (a) The types of vineyard designated 1 and 3 are planted by the cooperatives and are capable of large-scale cultivation. On 70 per cent of these newly planted vineyards, the distance between rows are 240 cm by 60 cm. The cultivated surface was formed from sandy pastures and in some cases from arable land. The latter is less satisfactory.
   (b) The types of vineyard designated 2 and 4 are new plantations on individual holdings and correspond to traditional methods of cultivation. The effect of these, however, is insignificant.
   (c) The types designated 5 and 7 occupy 70 per cent of the total area planted to vineyards. Cultivated by traditional methods, they are the individual holdings of cooperative members. On average, the vine stock is over 50 years old and 95 to 97 per cent of the plots is interplanted with fruit trees. Their reconstruction will require several years, or even decades, of work.
   (d) The interior of the sandy upland is occupied by declining and even ruined vineyards designated as types 8 and 9. The reconstruction of

these has begun, though it is quite expensive, for prior to replanting the surface has to be smoothed by levelling the sand hills.

2. Orchards producing for market as a form of land use appeared only with the reconstruction of the vineyards. It is unfortunate that a large part of these orchards has been planted on humic soils that were formerly used as arable land, since, for stoney fruits, e.g. sour and sweet cherries and apricots, sandy soils provide the best ecological conditions. Today a large part of the fruit production is still derived from 280,268 fruit trees (1960 data) interplanted with grapevines. The concentration of these into separate orchards is a task for the future.
   (a) Between 1960 and 1965, owing to the planting of grapevines and orchards, the arable acreage declined by 10 per cent. Although this means a more intensive utilization of the soil, it cannot unconditionally be approved, because extensive and otherwise unusable sand soils are available in old ruined vineyards and should be used for the planting of grapevines and orchards. Of the arable land 70 per cent is occupied by maize which is used as fodder on the individual holdings.
   (b) The meadow- and pasturelands have not declined appreciably as compared to 1935 (see Table I). This is due to the fact that the problem of drainage remained unsolved and the arable land could not expand at the expense of meadows. Regrettably, the basically unchanged area of meadows and pastures plays an insignificant role in stock-raising today.

In the opinion of the author, one of the most important tasks of the future is the development of stock-raising based on the intensive utilization of arables, meadows and pasturelands. This is also justified because of the heavy fertilizer demand of grape and fruit production on sandy areas and the need to utilize the labour force more evenly.

MODIFICATION OF THE SPATIAL STRUCTURE OF LAND UTILIZATION

The growing importance of intensive cultures clearly represents the most significant trend in the spatial development of the agricultural system. In the author's opinion, a yet closer adjustment to natural endowments and a still more intensive form of land utilization mean a process that will continue in the forthcoming years.

One may suppose on the basis of the present trends that:

(a) The reconstruction of the vine-growing area will continue, and, since this will be accompanied by an increase in average yield, the areal extent of viticulture will not grow substantially. In fact, once the new plantations come into production and dying vineyards are liquidated, some contraction of the vine-growing area may be predicted, although it must be taken into account that the new large-scale plantations are more demanding of space due to greater distance between rows. If the vineyard areas are fully reconstructed, the replanting of 300,000 fruit trees should also be considered. If the planned reconstruction of 3·5 to 4 thousand hectares of vineyard materializes, the combined extent of vineyards and orchards will exceed

40 per cent of the usable agricultural area. The reconstruction should further the areal concentration of production as well.

(b) The development of stock-raising requires greater emphasis to be laid on the growing of field crops and the more intensive utilization of meadow- and pastureland. To realize this, a better water management programme and the utilization of soil water, i.e. irrigation by pipe wells, should be carried out.

(c) Today the vegetable supply of the population is mainly guaranteed from household plots. Since 35 per cent of the population of Kiskőrös (13,028 in 1966) lives on outlying 'tanya' farmsteads, one may suppose that migration into the town will accelerate—a movement which will intensify the fragmentation of property and thus diminish the extent of household gardens. Since a horizontal expansion of the settlement would make no reason a more intensive use of the already built-in area is likely to ensue. Therefore it becomes necessary to form a new vegetable growing area outside the town limit.

(d) Already agricultural firms are striving for the full utilization of manpower. This need will grow in the future. Therefore, it becomes essential to expand the storage, processing, and packaging capacity associated with fruit growing. In fact the establishment of other industrial branches related to this specialization could be justified. The combined result of this could mean a continued decrease of the land utilized for agriculture.

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INDUSTRIALIZATION AND POPULATION CHANGES ON THE GREAT HUNGARIAN PLAIN

by

ERZSÉBET TAJTI

If we examine the effect of industrialization on the population of a given area, we must consider the industrialization process both within and outside the limits of this territory. The process of industrial development influencing the restructuring of population in space, appears as either an external or internal factor, and in certain cases as *both*. This is related to the fact that, although industrial development always takes place in a delimitable geographic area, it spreads manufacturing employment beyond the boundaries of this region. Employment in manufacturing spreads also to the population of neighbouring and even to more distant regions, from which people are willing to commute or migrate for want of suitable jobs.

The spread of manufacturing employment among the population at an industrial place is possible until the manpower reserves for both industry and the related tertiary sectors (retail, supply, services) are exhausted. In other words, up to the point when the quality and quantity of labour reserves and labour needs at a location is in balance. If, owing to low population density, low skill levels, etc., the manpower demand cannot be satisfied locally, then the force of attraction by industry is felt not only within the region of manufacturing growth but outside as well. In this way, even when the industrial process originally appeared as a force internal to a region, if manpower needs as to quantity or quality exhaust the available local reserves, the commuting and immigration of labour begins.

Whether industrialization appears as an internal or external factor may determine the territorial extent of the effect of the process. The larger a given area, the less likely it is to experience only one type of attracting force on labour as a consequence of industrial growth. In general, different types of manpower attraction are found together, though one type normally dominates. The Great Plain is not among Hungary's best industrializing regions, although parts are developing industrially. Therefore, population movement on the Great Plain induced by the industrial progress of the country is mainly the result of industrial development outside the region. However, since it also possesses a few industrial growth centers of its own, the Great Plain is not a homogeneous territory as regards the recent changes induced by industrialization.

The spread of manufacturing employment is the *direct* but not the exclusive effect of industrial progress on the regional redistribution of the population. The *indirect* effect of industrialization is felt, among other things, through the resulting improvement of regional infrastructure which increases the attraction to manpower.

THE POSITION OF THE GREAT PLAIN IN THE INDUSTRIALIZATION OF HUNGARY

Compared with the countries of Western Europe, Hungary was late in starting her industrialization. With the development of the transport network during the second half of the 19th century, industrial progress became more vigorous. Already, the outlines of industrial areas were beginning to emerge in the regions of raw materials and energy sources, in the area of the Middle Mountains and in the centrally located capital, Budapest. Development continued within this territorial framework. Following the boundary changes of World War I, the profile and territorial shape of Hungarian industry was basically altered insofar as Budapest and its immediate environs remained the only region with advanced manufacturing. The few centres possessing industry aside from the capital were one-sided and unbalanced in structure.

Between the two world wars, Hungary's industry as a whole achieved greater structural balance, but its spatial distribution became even more lopsided. The new branches became concentrated mostly in Budapest, while in the Transdanubian and Northern Mountains the one-sided nature of industry, dominated by primary branches, was further accentuated.

The great social transformation following World War II favourably affected industrial development in the country. Economic planning aimed at not only the acceleration of industrial growth but the improvement of the territorial distribution of manufacturing as well. The fact that the disproportions in the spatial distribution of industry notwithstanding the establishment of new enterprises in backward areas actually solidified, can be explained by the fast expansion of heavy and primary branches. The rapid growth of such industries could be best achieved by the continued development of already industrialized territories. In this way, the expansion of manufacturing in backward areas was not sufficient to overcome the century-old lag.

It is also true that only after a given level of development has been achieved do the territorial and structural disproportions demand interference which would deliberately aim at equating the level of industrial and other economically productive factors with the size of the population of a region. The location of industry in areas of labour surplus, thus improving the employment structure, is the way towards achieving this end. However, it is not the Great Plain but areas with unbalanced industrial structures which even today are given priority for such corrective measures. This is all the more true since industry in such areas is heavily weighted towards such depressed and declining branches as coal-mining, where the available labour supply is much more concentrated. Therefore, the rapid industrialization of the Great Plain is still a task for the future.

The Great Plain is traditionally Hungary's agricultural region, and its natural endowments make it highly suitable for this role. Throughout the centuries, industry was represented by the craftsmen of agricultural towns. The development of the railway network, however, destroyed the closed market areas of the handicraft industries of the agricultural market-towns before they had time to transform themselves into manufacturing centres.

The produce suitable for processing was "exported" to other regions: i.e. the agricultural processing industry of Budapest, for example milling, grew up on the basis of raw materials from the Great Plain. For long years, the railway repair shops established at major transport nodes (Szolnok, Debrecen, etc.) alone represented the kernel of large-scale manufacturing.

A backward agriculture and scanty industry characterized the Great Plain even at the turn of the century. By 1900, the number of industrial employees per 1,000 persons in Hungary as a whole reached 81; yet in the counties of the Great Plain the values were much lower, i.e. Szabolcs-Szatmár 39, Szolnok 49, Békés 54, Hajdú-Bihar 66, Csongrád 71.

During World War II, despite the war-time boom, industrial development of the Great Plain lagged behind that of the country as a whole and was restricted to a few cities. Rare were the factories with a permanent labour force reaching 500.

After 1949, the rate of industrial growth accelerated everywhere, and the industrial labour force employed within the Great Plain doubled. New manufacturing enterprises were established and the number of industrial employees per 1,000 inhabitants changed as follows:

Counties	In 1950	In 1960
Szabolcs-Szatmár	48	71
Bács-Kiskun	53	88
Hajdú-Bihar	61	93
Békés	67	94
Szolnok	69	114
Csongrád	88	134

One of the most important problems of the national economy, which came to the fore in the 1960s, is the more rapid industrial development of backward regions, among them the Great Plain. This is explained not only by the fact that surplus manpower, still manifest in certain places within the agricultural areas, is largely immobile, but also by the discovery of mineral resources in parts of these territories—in the Great Plain, notably hydrocarbons. Besides, the further development of agriculture has also demanded industrial progress. However, the policies concerning the further location of industry have had to be amended. Instead of dispersed manufacturing establishments, the stress is laid more and more on concentrated investment in industrial nodes. Since 1960, the industrialization of the Great Plain has been primarily characterized by investment in larger towns, a policy which more effectively works towards the development of industrial bases with self-generating growth.

In 1968, the Great Plain's industry (aside from small-scale private establishments) employed 281,655 persons. The areal dispersion of the so-called "local industry", employing only local manpower and serving local needs, is quite significant, one hundred and fifty villages containing enterprises with more than 10 employees.

Three-quarters of the population employed in industry work in town factories. Of these, one-third is concentrated in two large cities, Debrecen and Szeged, another third in the five dynamic middle-sized towns of Kecskemét, Szolnok, Békéscsaba, Nyíregyháza, and Hódmezővásárhely with between 50 to 100 thousand inhabitants and the remainder in 19 other towns of various sizes, but in such a way that in none of them does industrial employment reach 10,000.

Regarding the number of workers, the leading manufacturing branches on the Great Plain are the light and food industries, but in counties Szolnok, Hajdú-Bihar and Bács-Kiskun the numbers engaged in heavy industry are also significant.

The opportunities for industrial development are far from being exhausted on the Great Plain. This is true even more so today since the region is able to provide not only labour and materials for food processing but also energy, thanks to the discovery of hydrocarbon resources and industrial raw materials as well. Besides the industrial bases established in the last decade, the Great Plain still has plenty of suitable areas for industrial development.

INDUSTRIALIZATION AND POPULATION IN THE GREAT PLAIN

The density of population always depends on the territorial structure of production. In agricultural regions an increase in population density is always restricted. At a given level of technology, an agricultural area cannot increase its population without proportionally expanding its cultivated land. Indeed, agricultural population cannot accumulate in one place beyond a certain point, determined by the level of technology. Population growth must stop, or the increment must either migrate or change occupation.

While the possibility of expanding the cultivated area existed on the Great Plain, for instance, the regulation of the rivers saved about 3 million hectares from periodic inundation, the anchoring of blown-sand in the Danube—Tisza Interfluve also created much new arable land, while the colonization of the "puszta" absorbed the surplus population of many settlements, e.g. of the Jászság, and Great and Little Cumania, following the turn of the century, there was little opportunity for any more expansion of the arable area. The backwardness of agriculture could provide neither employment nor an acceptable life for the population increment. Nor did the adoption of a few labour-intensive crops and the slow spread of more advanced techniques of cultivation solve the population problems. It only delayed them.

Due to the backwardness of the economy and the lack of employment opportunities, several hundred thousand workers remained within the agricultural sector which could at best only utilize their labour potential during peak periods such as at harvest. This open and hidden labour surplus was constantly increasing.

Only in the 1950s did the industrialization process in Hungary accelerate sufficiently to absorb the manpower reserve in agriculture. However, since industry has not been expanding primarily in the agricultural regions where the manpower surplus has accumulated, the restructuring of employment among economic sectors is being accompanied by a territorial shift in population as well.

At the national scale, population growth has been almost entirely due to natural increase, emigration and immigration playing a negligible role. This does not, however, hold for different parts of the country. Between 1949 and 1970, the country's population grew from 9,204,800 to 10,314,152, i.e. by some 12 per cent. That of the Great Plain, however, declined from 2,994,100 to 2,760,000, i.e. by about 8 per cent. The Great Plain's share of the population of Hungary is also gradually decreasing. Two decades ago, more than one-third of the total population of the country lived on the Great Plain: in 1970 barely one-quarter. While over 40 per cent of the country's inhabitants are urban dwellers, hardly one-third of the population of the Great Plain live in towns. Additionally, besides the villagers, many still live in isolated farmsteads.

Outmigration from agricultural areas is not a new phenomenon, but until the 1950s the Great Plain did not experience an absolute decline of population. Even in the 1949—1960 period only certain settlements suffered a population loss, but the high overall rate of natural increase compensated for the outmigration. Only since 1960 has the population change on the Great Plain started to fall in. The restructuring of agriculture released manpower faster than it was possible for it to be absorbed locally in other sectors, e.g. primarily industry. The surplus labour was attracted to other, more industrialized, regions. Since the majority of outmigrants are from among the younger age-groups, a gradual aging characterizes the population of agrarian territories, which, in time, will affect the rate of natural increase.

Population growth is caused by natural increase and inmigration (that is, a positive migration balance); population loss by natural decrease and outmigration (that is, a negative migration balance). If natural increase is combined with a higher rate of inmigration, or natural decrease coincides with more substantial outmigration, population change is highly dynamic. More commonly, however, the change is moderate. A moderate population increase is experienced in those regions where natural increase exceeds inmigration or where natural increase not merely compensates but more than compensates for outmigration. A moderate population decline is found where natural increase cannot fully compensate for outmigration, nor inmigration for natural decrease, and here we distinguish two sub-groups of negative population change according to the intensity of decline:

(a) natural increase is equal to at least half of the outmigration,

(b) natural increase is equal to less than half of the outmigration. In the first group belong the regions with less dynamic, in the second, those with more dynamic population change.

In 1968 (but also in all previous years during the decade) natural increase could only partially compensate for outmigration through much of the Great Plain. Those areas which lost population owing to *both* natural decrease and outmigration are not large in extent, although among the settlements one even finds a town (Fig. 1). Very numerous are the settlements in which natural growth could make up for less than half the people who moved away. This is a frequent occurrence even in the north-eastern part of the Great

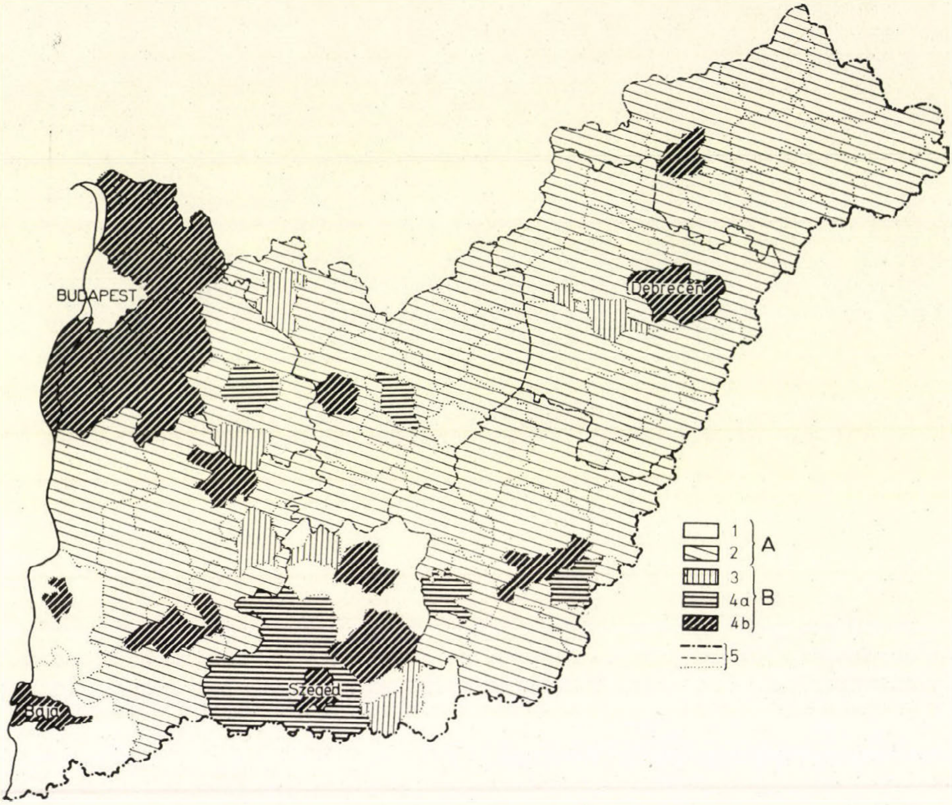

Fig. 1. Population changes in the Great Plain in 1968

A = decrease: 1 = natural decrease associated with outmigrations; 2 = natural decrease exceeds inmigration or outmigration exceeds natural growth. B = increase: 3 = natural growth exceeds outmigration or inmigration exceeds natural decrease; 4 = natural growth associated with inmigration; a = natural growth exceeds inmigration; b = inmigration exceeds natural growth; 5 = administrative boundaries

Plain, for although these parts experience the highest rate of natural increase, they also represent the least industrialized segments of the country. It is characteristic of a few towns and a number of villages along the Danube in the southern part of the Great Plain that moderate inmigration compensates for the natural decrease. The environment of Budapest and the towns and villages which are being industrialized are distinguished by inmigration exceeding natural increase. A few towns, as well as the villages near Szeged, grew primarily through natural increase. There are also those towns in which industrialization, though begun, is proceeding very slowly. These have suffered outmigration which, however, is compensated for by their natural increase. (This demographic phenomenon, by the way, characterized the majority of Great Plain settlements from 1949 to 1960.)

More drastic is the population decline in the villages. Between 1961 and 1965, a mere 16 of them experienced an over 5 per cent growth of population. Among these one finds two significant industrial centers (Martfű in Szolnok County and Téglás in Hajdú County). In the majority (68 per cent) of villages which account for 62 per cent of the village population the population diminished by more than 5 per cent (Table I).

TABLE I

The distribution of the Great Plain population in 1966

Population change in per cent between 1961 and 1965	Villages		Population		Industrial wage-earners (excl. privately owned handicrafts)		Employment in industry per 1000 population
	number	per cent	number	per cent	number	per cent	
Rate of growth							
> 25	3	0·5	10 707	0·6	4 848	9·6	451·9
15·1—25	—	—	—	—	—	—	—
5·1—15	13	2·1	36 316	1·9	3 543	7·0	97·5
Rate of decrease							
5·1—15·1	392	62·6	1 138 712	59·1	17 448	34·7	15·3
15·1—25	32	5·1	52 189	2·7	470	0·9	9·2
> 25	3	0·5	2 479	0·1	—	—	—
Rate of change							
+ 5·0 and —5·0	183	29·2	685 260	35·6	24 003	47·8	35·0
Total	626	100·0	1 925 663	100·0	50 312	100·0	26·1
Towns	26	—	1 027 000	—	193 700	—	189·5

The demographic experience of the 26 towns differs greatly. The two large towns in which a quarter of the urban population is concentrated and the five industrializing middle-size towns, accounting for over a further third of the urban population are characterized by inmigration. Such is the experience of some of the other towns, although in 11 of them the population declines from time to time, as their industrial progress is not satisfactory.

THE SIZE AND COMPOSITION OF THE GAINFULLY OCCUPIED POPULATION

Between 1949 and 1966, the growth rate of employment exceeded that of the general population (23 per cent as against 10 per cent), which primarily resulted from the entry of large numbers of women into the labour force who previously had not held jobs. Nationally, the active male labour force increased by 200,000 (7 per cent), and the female labour force by 730,000 (62 per cent).

On the Great Plain, the changes in the number and sex of the gainfully occupied population were different. Despite a decline in the number of actively employed males, the occupied population increased (by some 30,000 persons) because rise in the number of working women exceeded the loss in that of working men. Even so the growth rate of female employment—only some 30 per cent—lagged behind the national average. At the same time, the share of the Great Plain in the active working population of the country diminished from 32·5 per cent in 1949 to 27 per cent in 1966.

The agricultural labour force in Hungary as a whole diminished by nearly 700,000, and on the Great Plain by about 300,000. Of the country's agricultural labour force, the Great Plain accounted for 43 per cent in both 1949 and 1966. Non-agricultural employment grew by 319,000, of which the increment in industry was 123,000, that is nearly double the number in manufacturing employment in 1949. Although industrial employment increased greatly, the Great Plain's relative share of the country's industrial workers declined (from 16·6 per cent to 16 per cent).

Industrial occupations spread only slowly among Hungary's population. At the turn of the century, 60 per cent of the active labour force worked in agriculture, and only 15 per cent in industry. By 1910 these shares stood at 52·2 and 17. Even in 1930, however, agriculture accounted for 50·8 per cent of all employment, and industry 17·9 per cent. The capital concentrated over half of all the industrial labour force. On the Great Plain, agriculture remained the mainstay occupying 70 to 90 per cent of the population.

According to the 1949 national census 49·1 per cent of the population gained its livelihood from agriculture, which employed 49·8 per cent of the active labour force. From 1949 to 1966 the number of agricultural workers diminished by 31 per cent and their share in total employment today is around 35 per cent. Mining, manufacturing, and construction now employ more people than agriculture.

Owing to the slow progress in the early stages of industrialization, only in the immediate areas of manufacturing growth did a noticeable restructuring of employment take place. On the Great Plain between 1900 and 1930, growth in employment mostly meant an increase in the number of agricultural workers and only to a small extent the expansion of non-agricultural labour force. The exception was Budapest and its environment, together with a few other industrial nodes, where the number of non-agrarian workers also swelled on account of inmigration and the shift out of agriculture.

The industrialization of the country accelerated the restructuring of occupations and its spatial distribution. In contrast to agriculture, industrial employment is areally concentrated, and leads to the agglomeration of population.

In the industrialized towns and centres attractive to labour in the industrial regions, as well as in the Budapest agglomeration and surrounding hinterland, the number of non-agricultural employees is primarily increasing on account of inmigration. In these localities one also finds a shift of labour out of agriculture, but this is not the main source of growth in non-agricultural employment.

A change in the distribution of occupations among the economic sectors is mostly characteristic of the early stages of industrialization and of settlements making slow industrial progress. In the settlements with declining populations, the fall in agricultural employment exceeds the overall loss in employment, because even in these the number of workers in non-agrarian occupations is increasing (Map 1 attached). The shift in occupations accelerated between 1949 and 1960 and created different settlement types with respect to this process. After 1960, the exodus from agriculture became especially noticeable and the local restructuring of employment continued in full force.

Map 2 (attached) represents a cross-section of settlement types in the Great Plain with respect to the structural changes in employment. From the environs of Budapest to the eastern boundary of the country all such types can be found: the magnetic center of the Budapest agglomeration, the dynamic industrial node of Szolnok and surroundings, the sluggishly developing agricultural market-towns and the different kinds of villages with declining populations.

Following 1949, the share of women in the labour force greatly increased, from 29 per cent, in that year to 39 per cent in 1966. Always, it was in Budapest that the proportion of female employees was highest, but their share and number also grew significantly on the Great Plain (Table II). During this period, the number of working males on the Great Plain decreased by nearly 80,000, while the increase in working women exceeded 100,000. The share of female employees in the total employment of the Great Plain stood at 28·8 per cent in 1949 and 36·3 per cent in 1966.

TABLE II

The distribution by sex of the wage-earners on the Great Plain

	Total (in '000)			Agricultural (in '000)		
	1949	1966	Change between 1949 and 1966	1949	1966	Change between 1949 and 1966
Men	931·5	852·3	—79·2	677·4	425·5	—251·9
Women	377·0	485·0	108·0	277·4	238·5	—38·9
Total	1308·5	1337·3	28·8	954·8	664·0	—290·8

	Non-agricultural (in '000)			Of which industrial (in '000)		
	1949	1966	Change between 1949 and 1966	1949	1966	Change between 1949 and 1966
Men	254·9	426·8	172·7	105·8	146·6	40·8
Women	99·6	246·5	146·9	24·4	107·2	82·8
Total	353·7	673·3	319·6	130·2	253·8	123·6

The growth in total employment was accompanied by a decline in the agricultural labour force. On the Great Plain in 1949, 73 per cent of all workers earned their living in agriculture, but in 1966 less than 50 per cent. The share of industrial employees grew from 10 to 19 per cent. Thus, owing to the shift out of agriculture, the relative importance of industrial occupations increased.

As with males, the number of females engaged in agriculture also diminished, but less rapidly. The number of women working in manufacturing, however, quadrupled between 1949 and 1966. In Csongrád, Bács-Kiskun, and Szolnok counties, the rise in the industrial labour force, mostly females, exceeded 20,000. In other words, the expansion of the female labour force was especially significant in those counties where one finds industrializing urban centers and where light industry has a prominent role.

However, the number of working women increased in almost all settlements, even in those with little manufacturing. The retail, supply, and other service sectors employ many women, and in the agrarian settlements the female labour force mostly grew due to these industries.

There are limits to the drawing of women into active employment especially where population is not concentrated. Commuting takes time from housework and family affairs. The service establishments which could ease the burden of house- and family-work are scanty on the Great Plain. Therefore, in many parts of the region the cottage industry is fairly widespread. In the cities, the supporting infrastructure is much better developed, and more and more women take jobs in industry.

THE DISTRIBUTION OF OCCUPIED POPULATION ACCORDING TO PLACE OF EMPLOYMENT AND RESIDENCE

Although the Great Plain belongs to the industrially underdeveloped regions of the country, manufacturing made more progress there in the past 20 years than during the previous half century. Industrialization did not simply mean a relative growth, i.e., a decrease in the share of agriculture, but rather an absolute expansion of employment and the number of establishments.

In the majority of villages, the share of industry in total employment did not attain 10 per cent in 1960. In the two villages of Martfű and Nagylak only, both important for light manufacturing, did industry employ over half the active labour force. The majority of industrializing towns had 25 to 33 per cent of their working population in manufacturing, with only Szeged and neighbouring Kiskunhalas registering higher shares.

In the beginning of the last decade, the industrial enterprises in the settlements of the Great Plain drew their labour force mostly from local sources. Many settlements with manufacturing establishments, however, could employ only a fraction of the manpower available locally (Map 2). Since that time, the seven industrializing towns have more or less exhausted their local labour supply and, in addition to receiving inmigrants, increasingly attract commuters from nearby villages.

A significant and growing number of people have their place of work separate from their residence. On a national scale, in 1960, 612,900 persons worked away from their residence, and by 1966 their number had increased to 900,000. In 1960, of the workers employed in the six Great Plain counties, 1,262,900 lived in the same settlement as their place of work, which by 1966 had fallen to 1,194,900. About 45 per cent of the 200,000 commuters in that latter year were long-distance commuters with temporary residences at their place of work. They return to their families only after quite long intervals of time. The number of long-distance commuters, more than 30,000, is greatest in Szabolcs-Szatmár County with half of them working in Budapest. However, from Szolnok, Békés, and Hajdú counties some 25,000 persons also commute to the capital. More than 10,000 people from Hajdú and Szabolcs counties also work in the Northern Industrial Region.

In several Great Plain settlements —mostly in the above-mentioned seven towns—the expansion of housing lags behind the growth in employment and the labour force cannot be entirely settled there. Many new employees commute daily from nearby villages to their town jobs. In 1960, Szolnok, Szeged, Debrecen, and Békéscsaba employed the largest number of commuters. But relative to total employment, the share of commuters was greatest in Martfű.

In 1966, within the settlements of the Great Plain, 132,700 commuters found employment. Of these 113,400 lived and worked in the same county; 11,800 commuted from other neighbouring counties, and 7,500 came from outside the Great Plain. The latter group had jobs primarily in Szolnok and Bács-Kiskun counties, commuting mostly from the eastern peripheries of County Pest. Budapest employs the largest number of commuters (140,000 in 1960 and 160,000 in 1968), the majority of which are daily commuters from the Great Plain districts of Pest County. The attraction of Budapest, however, extends throughout the whole Great Plain, and besides the long-distance commuters mentioned above, there are large numbers of daily commuters to the capital from Bács-Kiskun and Szolnok counties. The majority from the latter region work in transportation rather than in industry.

The number of commuters continued to increase after 1960, with more and more women among them, although even in 1966, men still accounted for two-thirds of all commuters. Moreover the depletion of male labour reserves means that commuting increasingly involves working women. In both 1966 and 1968, the majority of commuters to Budapest were still men, although during those two years the growth in the number of female commuters was more rapid. A similar situation exists in the case of the industrializing cities on the Great Plain, e. g., almost one quarter of the 45,000 employees in Szolnok are daily commuters, a substantial number of them women. One finds many women among the commuters to the shoe-factory at Martfű, some having to travel over an hour to reach their place of work.

Additionally, the seasonally operating food processing enterprises play a significant role in the industrial structure of the Great Plain towns. At peak periods they attract a temporary labour force from large areas in quantities far exceeding their permanent staff.

CONCLUSION

The industrialization of the economy of Hungary affects the population of the Great Plain in a complex fashion. The most obvious negative effect, appearing as an *external* force, is expressed in the migration of people out of the region. To a smaller extent, the *internal* manifestation of industrial growth is also present, leading to a *concentration* of population in certain nodes on the Great Plain itself, since a substantial proportion of those who migrate do not leave the Great Plain. They move from dispersed farmsteads and villages to cities, drawn by employment opportunities in the non-agricultural sector. Regarding the Great Plain as a whole, this is an internal process. The isolated industrial nodes of the Great Plain, however, are surrounded by settlements with declining populations. From the vantage point of these settlements, industrial development, and its effect on the population distribution, appears as an external factor.

The progress achieved through industrialization goes beyond industry itself and begins to transform the whole of the economic way of life. Having attracted the excess manpower from agriculture, industrial growth makes possible the mechanization and structural transformation of agriculture, releasing more labour for other sectors. If, however, the manpower completely or seasonally released from the agriculture of the Great Plain cannot be employed in or near its place of residence, outmigration will continue and soon a seasonal labour shortage may become an obstacle to further development.

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KECSKEMÉT, A TYPICAL TOWN OF THE GREAT HUNGARIAN PLAIN

by

EDIT LETTRICH

THE CHARACTERISTICS OF THE TOWNS OF THE GREAT PLAIN

Divergent views are to be found concerning the towns of the Great Plain both in the domestic and foreign specialist literature. They are often called market towns, or giant villages, and are believed to differ only in population size.

Even though the towns of the Great Plain differ in character from those of other regions, these are not differences affecting their urban nature. They are central places in like manner to towns elsewhere being linked with hinterlands of varying size due to their central functions. However, since the structure of the settlement network of the Great Plain differs from the network of small and medium sized villages, characteristic of the other regions of the country, it follows that the relationship between town and village in the Great Plain is also unique to some extent.

The network of closed settlements on the Great Plain of large population size interspersed with scattered farmsteads (tanya) constitutes the largest contiguous region of scattered settlement in Europe. However, ignoring the most recent changes, the scattered parts do not form independent administrative units, but, in accordance with their historical formation, are linked with the closed settlements. To the villages and towns are also attached extensive regions of scattered farms with populations as high as 10,000 in some cases. This is one of the reasons why the majority of the towns in the Great Plain are called tanya-towns. *Thus, the administrative area of a tanya-town comprises, apart from the city, also a part of its agrarian hinterland of scattered farmsteads.* The towns of the Great Plain are comparatively young. With the exception of the two ancient towns of Szeged and Debrecen, they developed *from giant villages into towns* possessing market functions in the 18th century. Only a few of them have had an uninterrupted development, and these now represent, backed by their vast hinterlands, the most rapidly expanding urban centres in the Great Plain. The urban development of the majority, however, was weaker, these function as urban centres for their more or less restricted agrarian attraction zones. Indeed, approximately one-fifth of these are urban only with regard to their administrative rank, and since they do not possess an urban hinterland, are in reality giant villages (Stadtdörfer).

One morphological feature of the Great Plain towns, namely *the characteristic belt structure*, is connected with their former agrarian past. The settlement spreading unimpeded over the flat terrain of the Plain became too extensive. The *town core* with its closed residential area is urban in character and is surrounded by a more loosely built-in *rural zone*. The latter merges almost imperceptibly into a belt of *scattered dwellings*, which developed from the belt of orchards (vineyards) and which, in turn, passes into the zone of scattered farms belonging to the urban field of the town. At first, urban functions were concentrated at the centre of the giant village, the predecessor of the present town, and in the course of development, the expanding core practically encompassed the whole of the giant village. Depending on the intensity of development, these former central areas which are still distinctive in the present town, assumed different proportions and dimensions. In the more developed towns the rapid, dynamic expansion of the urban core almost completely replaced the former rural zone, the remnants of which no longer form a contiguous zone. In other places, however, because the rebuilding of the town took place only at a slow pace, the rural zone survived, with little decrease in its dimensions.

It should be noted that the "administrative inner area" included in statistical publications can be roughly identified as the town of the Great Plain, while the "outskirts" refers to the area of isolated farmsteads which administratively form part of the town, but which in reality are part of its urban field. Since the "entire administrative area" comprises both, the demographic features of what might be called urban character cannot be determined from it.

These characteristics of the towns of the Great Plain, as well as their evolution through time are well represented in the largest Hungarian farm town of Kecskemét.

THE CIVIC TOWN OF KECSKEMÉT

Kecskemét, a village of bondsmen situated along the busy road leading from Szeged to Buda through the Danube—Tisza Interfluve was a prominent market place as early as the 14th century. The last accretions to the settlement, which was highly unstable at that time, were represented by the abodes of the semi-nomad Cumanians who had settled there hardly half a century before. The numerous small hamlets and more isolated Cumanian abodes in the general area did not, however, last for long and were in part destroyed during the desolation which took place in the sixteenth century. In the middle of the sixteenth century, some six villages were destroyed in the vicinity of Kecskemét. The areas of these villages were joined to that of Kecskemét and were used for extensive cattle-breeding.

The Turkish occupation from the middle of the 16th century had a considerable effect on the economic and social life, and on the settlement conditions of those regions of the Great Plain which came under effective Turkish rule. The frequent fighting caused large-scale desolation throughout the second half of the 16th and the whole of the 17th centuries and in consequence a great part of the mediaeval settlements of the Plain was destroyed. Only a few major settlements survived the period of Turkish occupation. The population of the hamlets fled to the larger settlements which promised safety. Kecskemét with a population of about 4,000 at the end of the 16th century and which stood as an "island" in the depopulated countryside in this way became the collecting place of the population of the region.

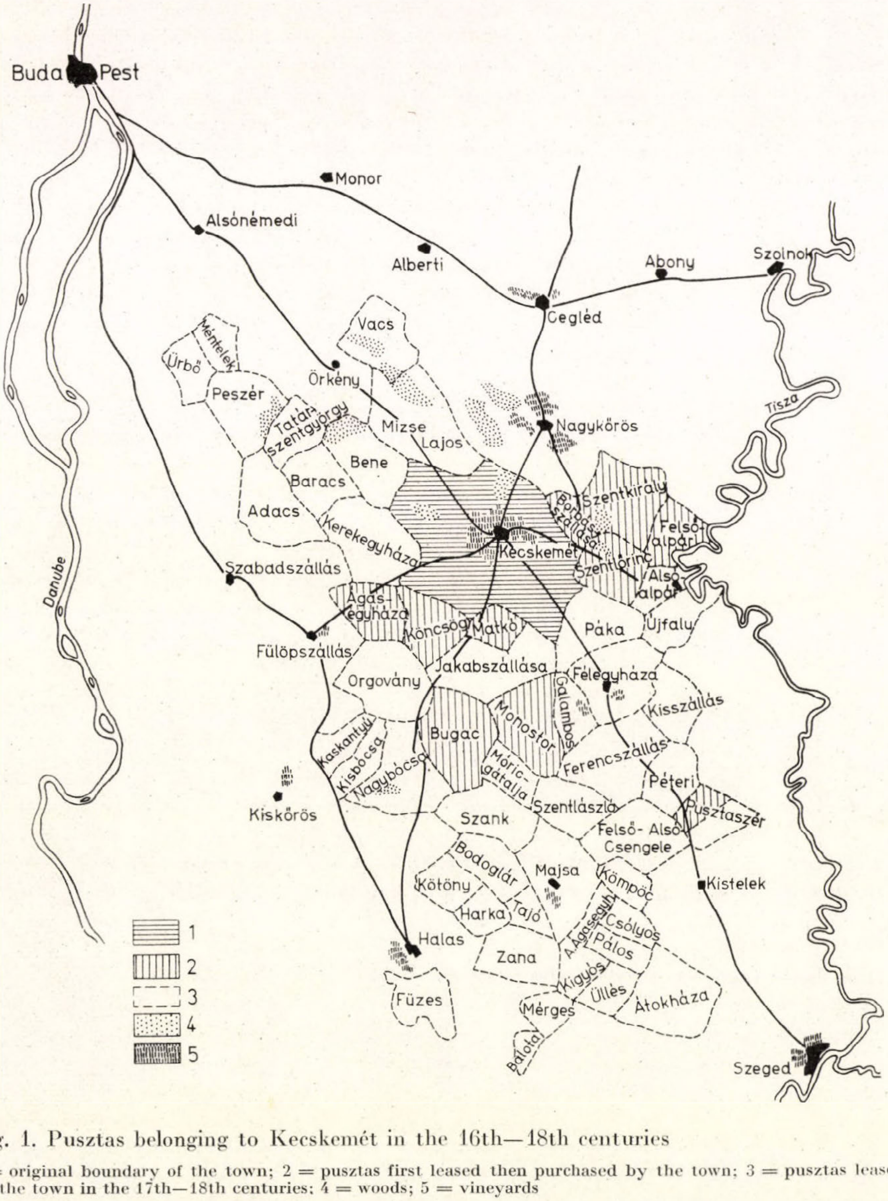


Fig. 1. Pusztas belonging to Kecskemét in the 16th—18th centuries

1 = original boundary of the town; 2 = pusztas first leased then purchased by the town; 3 = pusztas leased by the town in the 17th—18th centuries; 4 = woods; 5 = vineyards

The earlier development of Kecskemét based on cattle-breeding on the extensive pastures of the plain and associated cattle-trade continued to grow during the Turkish occupation, accommodating itself to the new conditions. By incorporating neighbouring depopulated villages, the area of Kecskemét became very large by the middle of the 17th century (Fig. 1). On the 10,000 hectares mainly utilized as pasture for extensive animal husbandry, farming played only a subordinate role, being pursued in the immediate surroundings of the settlement. Later on, in the 17th century, the so-called "field gardens", which came into being beside the wintering quarters of the animals on the plains, were developed into plots of plough-lands. These were scattered like small spots over the huge pasture areas of the plain.

Accommodating itself to the peculiar conditions of the occupation and utilizing to its benefit the social and economic advantages resulting from it, the organization of the "civic town" came into being during the period of Turkish rule. The characteristics of its coming into existence are based on the peculiar conditions of the "dual power" existing in the area of the occupation at that time. The representatives of Hungarian feudal power fled, although their legal continuity did not cease in the Great Plain. On the other hand, the conquering Turkish power only took possession of the occupied areas within the limits of its peculiar military feudalism. Thus, the population of the occupied areas paid tax both to the absent landlord, if he was able to collect it, and to the Turks. Concerning the internal affairs of the settlement, the inhabitants had to decide for themselves the form of administration under which they would live.

Thus the absence of Hungarian feudal power made possible the development of greater social freedom, and the civic towns making use of this, evolved considerable self-government. Although most of them in fact remained feudal settlements in the legal sense until the 19th century, they were in reality self-governing as they were able to organize their administration during the occupation.

In the society of Kecskemét in the 16th—17th centuries, only people possessing civic rights—particularly the wealthy stock-keepers—played a leading role. In contrast to this relatively narrow stratum were the rapidly increasing mass of people with no civic rights, i.e. the mass of landless cotters (*subinquilinus*). The population of the civic town was overwhelmingly agrarian, primarily engaged in ranching and in plant husbandry on the plough-lands around the town. There were few handicraftsmen and merchants among them. The basis of property stratification was live-stock.

The life and structure of the settlement accommodated itself to the particular conditions of the age. Although we have no certain knowledge concerning the settlement conditions of Kecskemét in the Turkish period, as no contemporary map or picture has been preserved, information can be inferred from references in charters that the main lines of its present road system date back to the 16th and 17th centuries. The nearly circular settlement was surrounded by a trench and palisade, through which it was possible to pass only at the town gates. The Turks forbade any new construction, which seriously hampered the population and paralysed the development of the settlement. Within Kecskemét, the immediate presence of the Turks was limited to short periods, but the inhabitants often suffered from marauding soldiers moving through the Danube—Tisza Interfluve when parts of the town could be destroyed by fire. The thatched houses built of adobe were reconstructed from time to time out of the building material provided by the surrounding region.

It was also characteristic of the age that Kecskemét, which had trade relations in animal products with several distant towns such as Vienna, Venice, Augsburg and Nürnberg, did not possess mercantile connections with other places in Hungary while under Turkish rule. It was a node in an uninhabited plain which obviously prevented the establishment of normal rural–urban relationships.

However, with the creation of the civic town, several features of the later tanya-town came into existence.

KECSKEMÉT AS A TANYA-TOWN

With the passing of Turkish rule the feudal power of the landlords was rapidly restored who then endeavoured to accelerate the re-peopling of the desolate areas of the Great Plain. It is true that this process evolved more slowly in the sandy regions of the Danube—Tisza Interfluve, but even by the beginning of the 18th century several new settlements were to be found in this area. The plains within a 15—20 km radius of Kecskemét constituted the confines of the town. In the north, the old civic town of Nagykőrös was the adjacent settlement, while in the south-east Kiskunfélegyháza, which had been destroyed by the Turks, began to revive. Apart from Izsák, an ancient village of bondsmen, which had about 2,500 inhabitants in the middle of the 18th century, there were only the small cotters' villages of Lajos, Mizse, Kerekegyháza, and Újkécske with 50—200 inhabitants at a distance of 25—50 km from Kecskemét. As opposed to them, Kecskemét with about 10,000 inhabitants represented an enormous concentration of continuously increasing population. By the time of the 1871 census, the municipal area of the town had reached 21,318 inhabitants, while 1308 residents lived in the plains around the town.

In the second half of the 18th century, a more intensive utilization of land than formerly was adopted on the Great Plain. Extensive animal husbandry was gradually pushed into the background by corn-growing. In the areas of good soil southeast of Kecskemét, arable land gained ground rapidly at the expense of pasture. Several of the farmers of Kecskemét had had "field gardens" within the confines of the town since the 17th century which they now turned into arable land. Now, in these areas far from the municipal area, they constructed sheds and barns for their draught animals, and for the storage of crops and during working periods they themselves also lived there for considerable periods. These *farm-yards* established in the former "field gardens" were *the first of the scattered farms*.

Ranching was gradually forced on to the poor sandy pastures of the western confines of the town, but the formation of considerable blown-sand, a consequence of over-grazing, brought it to a final end in the 1750s. The lands which became covered with blown-sand were distributed by the town to new settlers and to its own older inhabitants for the planting of vineyards, forests, orchards to overcome the sand hazard. The appearance of the landscape changed considerably from that time on as its transformation into a cultivated region began.

The concentration of the agrarian population in the municipal area became increasing excessively, and by the middle of the 19th century a mass exodus to scattered farmsteads began. From that time on, the scattered farms became permanently inhabited and after the abolition of serfdom, sprang up in masses as everywhere on the Great Plain.

Thus, the areas of villages and towns developed in unbroken rows were surrounded by an increasingly dense network of isolated farms. *The extensive vine-growing and gardening on the sandy soils in the Danube—Tisza Interfluve, after the end of the 19th century, created thousands of such settlements, which absorbed the population made redundant in other agrarian regions of the country.* To the latter is attributable the fact that the existing nucleated centres showed no tendency to disperse during the formation of these scattered settlements. The density of the population around Kecskemét increased from 15—25 persons/sq.km. to 35—70 persons/sq.km. between 1900 and 1930.

The transformation of Kecskemét into a tanya-town went through its early stages in the 16th, 17th and 18th centuries, with, for example, such things as freehold land tenure and the parcelling of land. *However, the factors bringing about the large-scale formation of scattered farmsteads manifested themselves only in the last third of the 19th century.* The lack of industrial development in the town led to an excessive increase in redundant agrarian population in the municipal area. As a response a large-scale division of land into plots for the purpose of creating small peasants' gardens occurred. Additionally small farmers were helped by credits, exemption from taxes and expert advice on production. This process of the geographical expansion of population within the confines of Kecskemét is shown in Table I. The location of the zones in Table I is depicted in Fig. 2 where the *inner zone of isolated*

TABLE I

The distribution of population within Greater Kecskemét* between 1869 and 1960

Year	In municipal area	In garden area	In inner zone of scattered farmsteads	In present administrative area	In outer zone of scattered farmsteads	In all zones of scattered farmsteads 4 + 6	Total Greater Kecskemét
1.	2.	3.	4.	5.	6.	7.	8.
1869	—	—	—	31·000	—	—	—
1890	29·193	3·086	3·768	36·047	13·646	17·414	49·693
1900	31·304	3·300	8·636	43·240	15·985	23·594	58·198
1910	34·133	3·570	11·884	49·587	17·670	29·603	67·306
1920	35·577	3·721	12·875	52·173	20·936	33·811	73·109
1930	34·788	5·958	13·910	54·656	24·811	38·721	79·467
1941	35·740	9·500	14·308	59·548	27·721	42·029	87·269
1949	33·330	10·458	13·539	57·327	31·042	44·581	88·369
1960	46·351	8·364	12·127	66·842	32·148	44·275	98·990
Area (in 1960)	2·093 ha	4·093 ha	22·199 ha	26·385 ha	67·569 ha	89·768 ha	93·954 ha

* Greater Kecskemét = the administrative boundary of Kecskemét in 1930, from which the farm villages, made independent, became detached in 1948—1950.

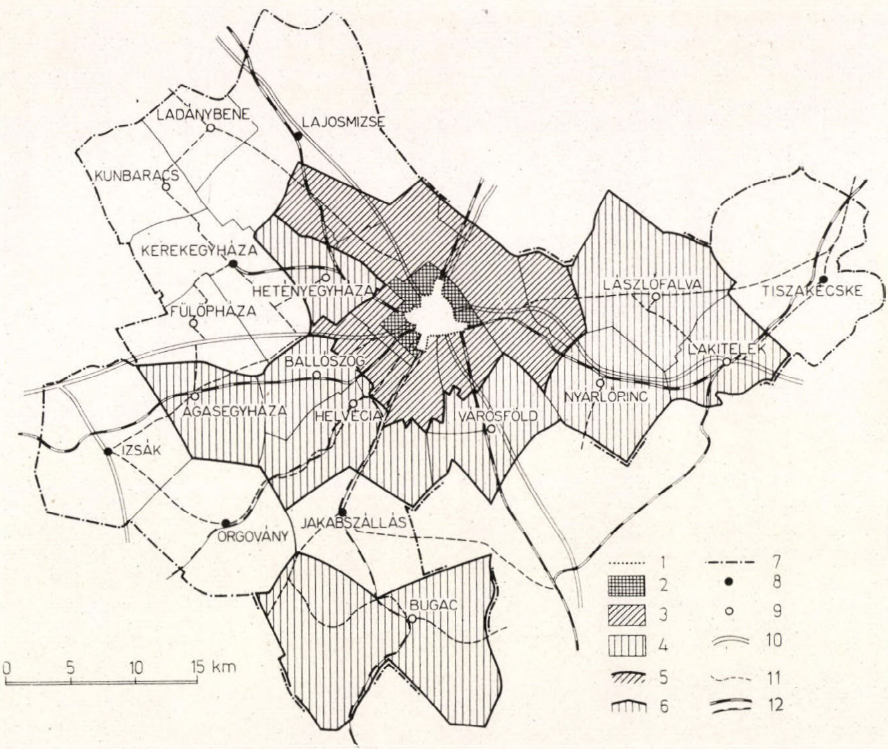


Fig. 2. Settlement network around Kecskemét

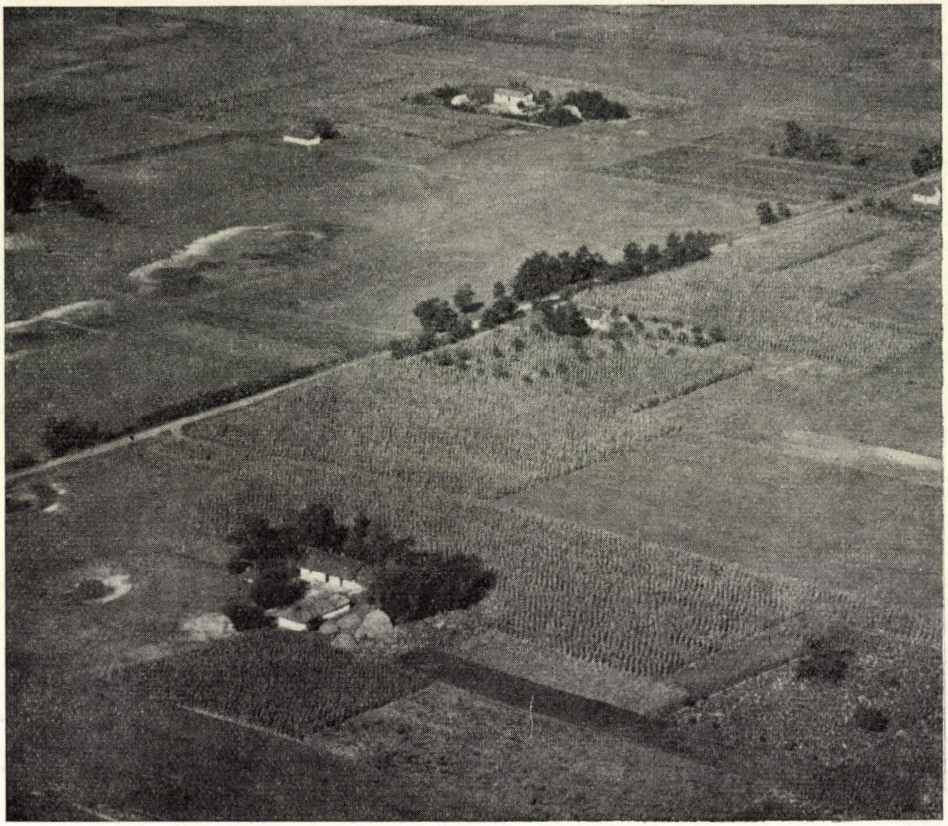
1 = inner area; 2 = garden belt (orchards with weekend houses and cottages; 3 = inner tanya belt; 4 = outer tanya belt; 5 = actual administrative boundary of Kecskemét; 6 = the boundaries of Greater Kecskemét (including the areas that belonged to Kecskemét prior to 1948); 7 = actual boundaries of Kecskemét administrative district; 8 = tanya community with closed nucleus; 9 = tanya community of scattered farmsteads without nucleus; 10 = main trunk roads; 11 = road; 12 = railway

farms is situated within the present administrative boundary of the town. The *outer zone* was separated from Kecskemét in 1948 (Fig. 2).

While the settlement network around the town was being formed, *the urban functions of Kecskemét developed significantly at the same time*, and the town became a central place offering many services. Its ever widening zone of attraction stretched out in all directions for about 50 km, embracing the rural areas of Kecskemét and two neighbouring market-towns as well.

Within this hinterland, special "town–countryside" relationships evolved with the areas of scattered farmsteads. Close family associations existed between the population of newly formed scattered farms who had recently left Kecskemét and the inhabitants of the municipal area, which manifested themselves both in way of life and in popular customs. These bonds and relationships which were closer than is usual indicated but a slow disintegration of the "extended family" (Picture 1).

The increasing number of urban institutions within Kecskemét, its increasing role as a commercial centre and the considerable expansion of its



Picture 1. Tanya landscape around Kecskemét

transport system ensured the livelihood of an ever increasing non-agrarian population even with the comparatively poor industrial development. By contrast, owing to the considerable outflow of redundant agrarian population into the belt of scattered farmsteads, the proportion of the urban agrarian population became smaller. Due to this outflow, the population stagnated and the number of wage-earners actually fell from 17,731 to 17,122 in the municipal area between 1900 and 1930, and the agrarian proportion in 1930 was 22 per cent. During the formation of the scattered farmsteads, the urban and agrarian population became increasingly separated spatially. Despite this, however, the town retained several features from its agrarian past, which made its environment and the way of life of its inhabitants individual.

The characteristic features of Kecskemét were determined by the fact that *it developed into a town from a village spreading freely over a flat terrain.* Our knowledge concerning its road system, its settlement structure and grid system can only be traced back to the 17th century. At that time, the village was grouped around the centrally located market-place in a radically arranged

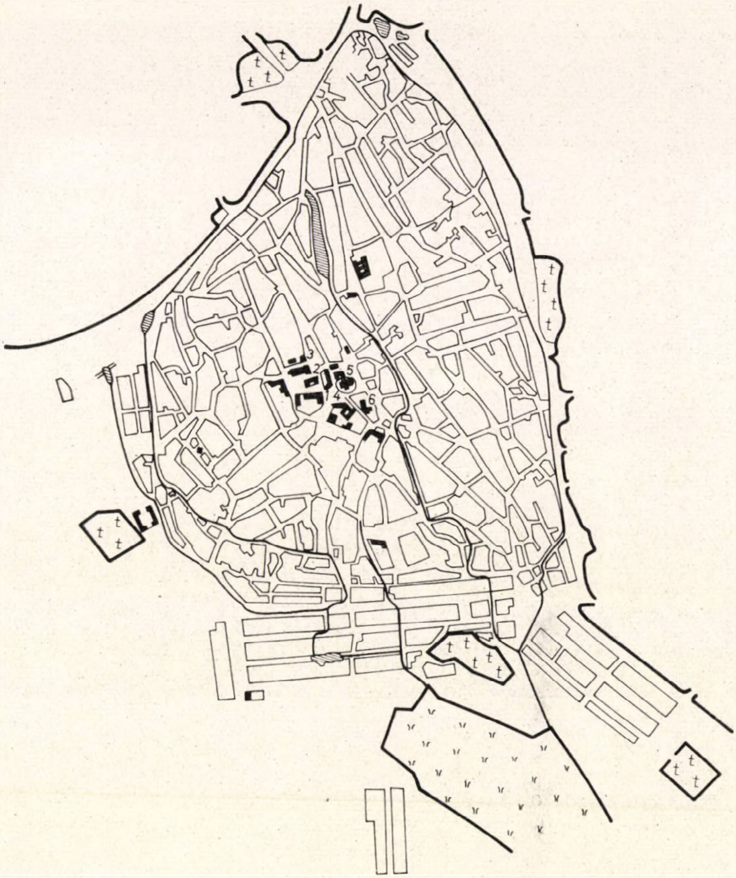


Fig. 3. Schematic map of Kecskemét in the early 19th century

1 = Townhall; 2 = Catholic church; 3 = parsonage; 4 = Franciscan church and cloister; 5 = Calvinist church; 6 = Calvinist college

pattern. The almost circular settlement was surrounded by a network of trenches, in which were five gates for the main roads running out radially from the centre. Beyond the fortifications of the town were rows of orchards and vineyards, the predecessors of the present green belt while the inner pastures extended in these outlying areas in the middle of the 19th century, whose rigid and regular street lines were in sharp contrast to the congested street pattern of the mediaeval settlement. They did not expand further spatially until the end of the 19th century (Fig. 3).

Rather a *process of consolidation* started, in connection with which a wide urban residential belt of unbroken rows of houses was formed around the town centre. During this time, *the town centre also developed both in terms of functions provided and geographically*. The central market, which functioned as a place for fairs, became the site for public institutions, and the ground

Picture 2. The junction of the main trunk roads in the centre of the town, forming there a characteristic space system

floors of a large number of multi-storey buildings constructed for new administrative, cultural, and financial purposes, were occupied by increasingly specialized shops. The centre thus also became an urban shopping quarter. The former main commercial road—Nagykőrösi Street—was no longer able to cope with the increased traffic and the construction of a new main road leading from the railway station to the town centre became necessary. This road—at present Rákóczi Road— was opened in 1912. Subsequently, *the centre of Kecskemét during the process of urbanization expanded rapidly in an eastern direction, extending along the new road almost as far as the railway station* (Picture 2).

Due to the large-scale outmovement of the agrarian population to the scattered farmsteads, a relatively small number of primary producers remained in the town. In a *wide residential belt of the outskirts, segments of rural character have remained.* The majority of the population of this belt, however, consisted of people in non-agrarian occupations such as industrial workers, or transport employees, who were unable to convert the old and obsolete dwellings for lack of financial resources.

Since the environment of the farm town was not able to reflect truly the transformation of its functions, it is understandable that even in the 1930s Kecskemét appeared to be an agrarian town markedly rural in character to foreign geographers who knew little of its unique course of development.

The rapid industrial development of the country during the past twenty-five years has brought with it urbanization. The techniques and organization of agriculture make it possible as well as necessary to increase agricultural production by employing the least possible number of agrarian wage-earners. As a result of this, there has been a considerable decrease in the proportion of agrarian wage-earners, which nationally had dropped to approximately 30 per cent by 1968. Owing to their underdeveloped industrial state, the towns of the Great Plain are unable to absorb the redundant manpower leaving agriculture because expansion was concentrated in those towns that were industrially more developed, as well as at the sources of energy and raw materials.

The question of decentralizing industry was raised at the end of the 1950s. It was feasibility studies aimed at the realization of this which provided Kecskemét, situated 100 km from the capital with several new industrial plants. Its existing food, especially canning, industry was also considerably expanded. Kecskemét, situated on one of the main highways of the country, has thus obtained a significant industrial base and impetus is given to further development by the favourable situation of the town from the point of view of traffic.

Due to the effect of accelerated industrialization, Kecskemét has also become one of the active centres of urbanization and during this transformation, its environment has also changed. The slow growth of population in the mid-nineteen-fifties changed and an increase of more than 10,000 was experienced during the early nineteen-sixties (Table I). Its zone of labour attraction has expanded to include the neighbouring agrarian towns of Nagykőrös and Kiskunfélegyháza—and the neighbouring villages which have good communications with the town. Its industrial plants employ 1,414 commuters in addition to 11,389 of the residents of the municipal area. The growth of industry in Kecskemét, and its changing industrial structure are reflected to some extent by a comparison of the number of wage-earners according to industrial branches in 1930 and in 1963 (Table II).

TABLE II

Industrial wage-earners in Kecskemét in 1930 and 1963

Industrial branches	1930		1963		Index 100 in 1930
	persons	per cent	persons	per cent	
Food industry	900	15·2	4·935	38·5	547
Heavy industry	2·247	38·1	4·598	35·9	202
Light industry	2·667	45·2	2·168	16·9	81
Other industries	86	1·5	1·102	8·7	97
Total	5·900	100·0	12·803	100·0	217

In 1950, Kecskemét became the *administrative centre of County Bács-Kiskun* While it had formerly functioned as the urban centre of *Kecskemét District* its new role made it necessary to transform it into the most developed town in the *county*, largest of the country with its population of nearly half a million and an area of 840,000 hectares, but with poor communications. Initially Kecskemét was unable to fulfil its increasingly complex tasks because the development of its institution network made only slow progress during the 1950s. Later, however, it received considerable investment in, for instance, public health, cultural and commercial establishments, which has made it able to fulfil its new role as one of the medium-size towns of the country.

Yet although its fast developing industry also facilitates the further extension of its institutional infrastructure, it is still a long way from the point where it will be able to perform both comprehensively and completely the role of a county centre.

CHANGES IN URBAN LAND USE

The process of urban encroachment on neighbouring settlements can be followed precisely in closed settlements which developed regularly. In the Great Plain, however, where the expansion became increasingly haphazard with distance away from the settlement centre, and the transition between the town and the world of scattered farms almost imperceptible, it is more difficult to ascertain where the one begins and where the other ends.

Demographic data from the 1960 census by enumeration district have been used to solve the task. These districts are of relatively small area, and the mosaic picture of population distribution that emerges reflects the real situation with comparatively little distortion.

The 26,385 ha administrative area of the town is divided into the *administrative municipal area* (2093 ha) and the *administrative suburban area* (*24,293 ha*). Today, the municipal area is already smaller than the actual area of the town because it annexed a part of the suburban region (Fig. 4).

Spatial variations in the density of population and the occupational and age structure of the administrative suburban area which consists of 63 enumeration districts produced of three distinct zones: 1. the surrounding green belt of the town merging with it functionally, and sometimes also areally; 2. the belt of gardens, that is of orchards and scattered residential buildings among them; 3. the 3rd inner tanya-belt fading imperceptibly into the former (Fig. 5).

Part of the redundant manpower in the area of scattered farms moved to other settlements. Others took industrial jobs in the municipal area of Kecskemét, who because their income did not allow them to leave agriculture completely, endeavoured to settle in the *green belts of the town*. These two-occupations families are to be found increasingly in this area which has regular bus services to the city centre. The distribution of available building sites for accelerated residential development here consisting of family houses developed in unbroken lines. Over a few years, these have expanded into islands along some sections of the main roads leading to the town. In the sparsely developed areas between them which are situated less favourably from the point of view of transport, more and more new dwelling houses

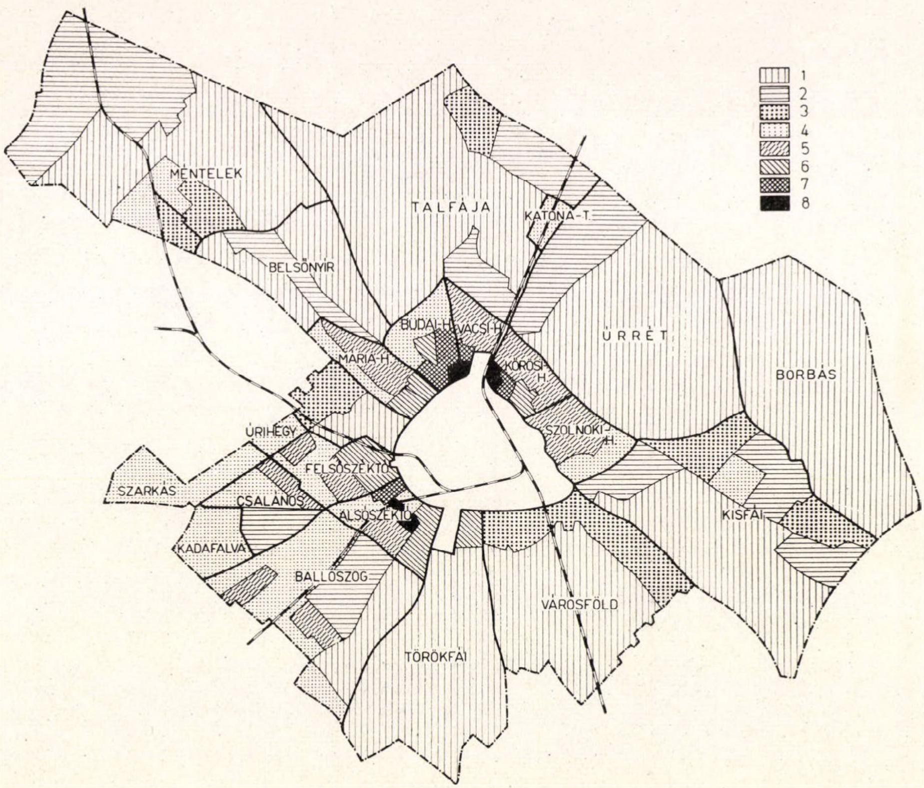


Fig. 4. Population density in the outer administrative area of Kecskemét. 1960 census

1 = 20—49; 2 = 50—69; 3 = 70—99; 4 = 100—199; 5 = 200—299; 6 = 300—499; 7 = 500—999; 8 = 1000—2000

TABLE III

The territorial distribution of Kecskemét in the administrative area of the town in 1960

Territorial division	Population number	Density of population	Wage-earners				
			number	distribution by occupation (per cent)			
				agri-culture	in-dustry	other	total
Municipal area	46·351	3·991	26·017	11·0	35·8	53·02	100·0
Absorbed from green belt	3·652	621	1·767	26·1	42·6	31·3	100·0
Garden regions	4·712	286	2·452	41·5	29·2	29·3	100·0
Inner tanya-belt	12·127	68	6·354	78·7	10·3	11·0	100·0
Total	66·842	253	36·590	25·4	31·0	43·6	100·0

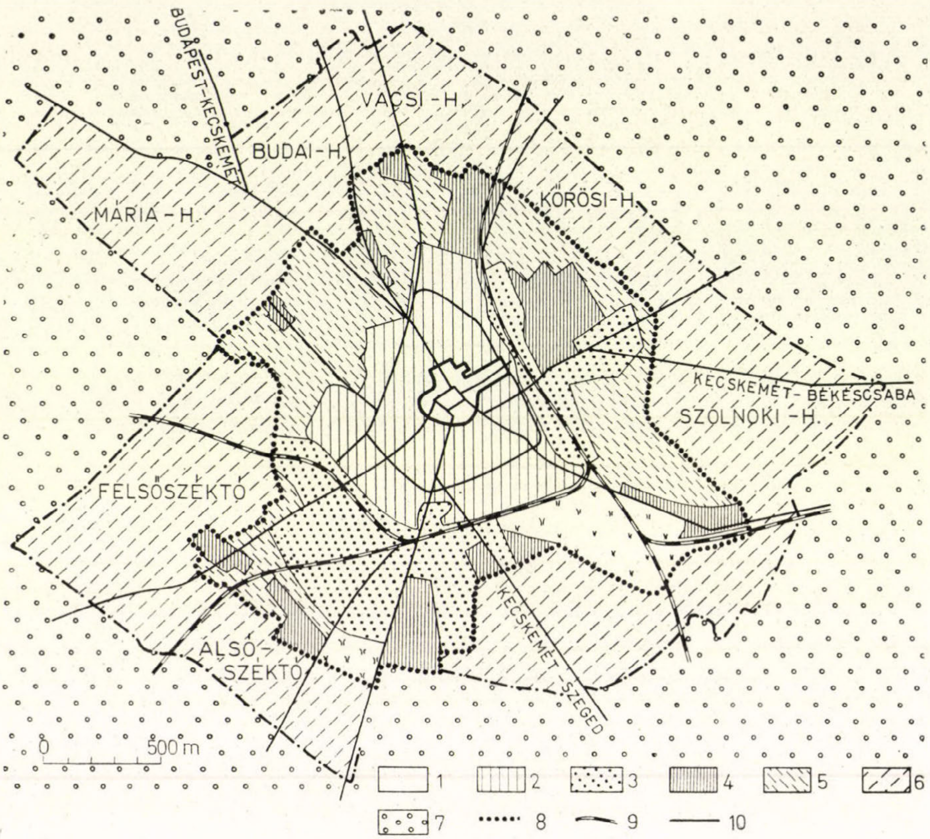


Fig. 5. The town and its vicinity

1 = centre; 2 = historical extent of the town (18th century built-in area surrounded by palisade trench); 3 = industrial belt; 4 = isolated colonies along the main roads in the outskirts; 5 = loosely built-in outer belt with orchards; 6 = gardens; 7 = inner tanya belt; 8 = boundary of the town in the geographical sense; 9 = railway; 10 = main trunk roads

have been constructed, and the agrarian population has been increasingly forced out of this belt (in 1960 the agrarian quota was 26·1 per cent, and since then has decreased by almost one half). The high density of population (621 persons per sq.km.) and the high proportion of industrial wage-earners (42·6 per cent) show that *this whole region is an area forming an integral part of the town functionally*, the administrative incorporation of which should take place before long.

The actual garden zone is considerably less developed, having a density of population of 286 inhabitants per sq.km. on average. The age structure of its population is such that the proportion of people over sixty years of age is very high because the older and more well-to-do farmers like to withdraw into this zone of higher site values, where they can operate dwarf farms

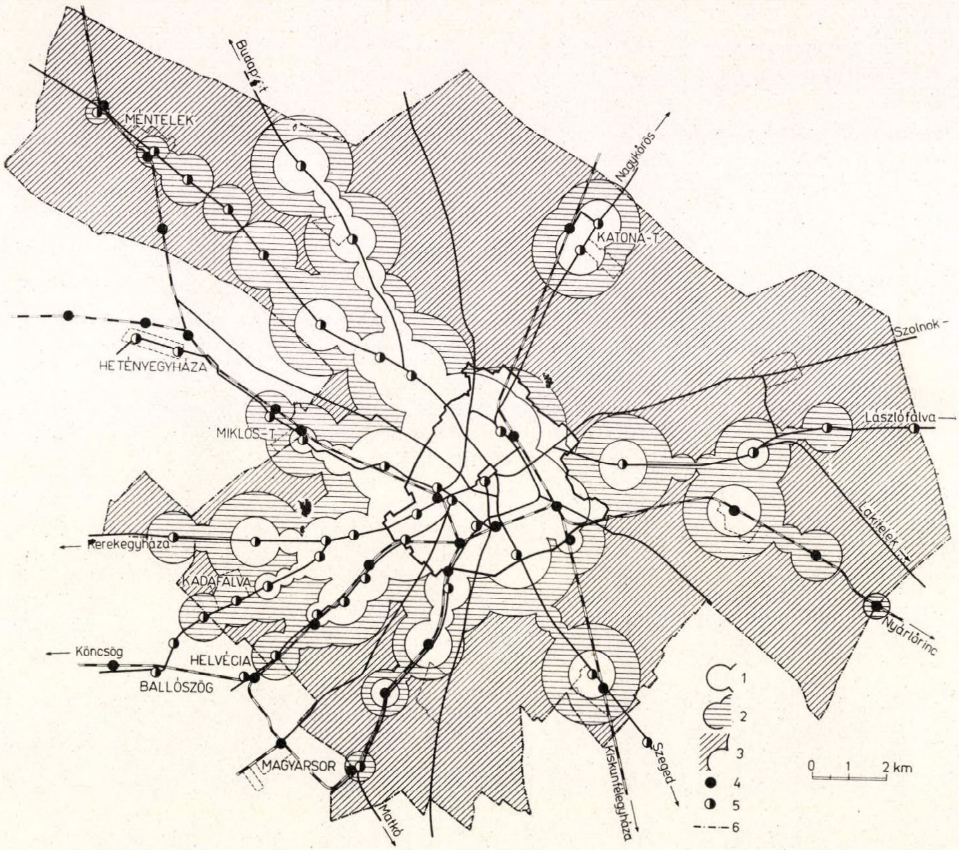


Fig. 6. Isochronous map of the communication system in the environment of Kecskemét

1 = within 20 min. by bus or railway from the centre; 2 = within 30 min.; 3 = more than 30 min.; 4 = railway station; 5 = bus stop; 6 = administrative boundary of the town

and sell their products in the daily market of the town. However, the proportion of the agrarian population which in 1960 was 41·5 per cent is gradually decreasing here, as well, and those deriving income from two occupations is gaining ground.

The overwhelming majority of the administrative suburban area of Kecskemét (22,199 ha) is occupied by the *inner belt of scattered farms*. In 1960, the spacious confines of the town still had 12,127 residents, which since then has decreased by nearly one-third. The transformation of the region which has a density of 68 persons per sq.km, and is inhabited overwhelmingly by agrarian families has also begun. In areas which have favourable transport connections with the town, the construction of minor residential neighbourhoods is in progress with the assistance of farmers' cooperatives (Fig. 6). The scenes of such experiments are the suburban settlements of Kadafalva, Méntelek, and Katonatelep, from which the town centre can be reached by bus or by train within 20 minutes. Twelve farmers' cooperatives share the production area of the inner tanya-belt which are cultivated by the total membership of 2,784 persons. Characteristic features of the area are 5 cooperatives, comprising about 4,500 cadastral holds of vineyard and orchard who grow as well as process their fruit.

THE TRANSFORMATION OF THE TOWN STRUCTURE OF KECSKEMÉT

Increased urbanization is indicated not only by the mass inflow of the population, by the rapid decrease of agrarian population, and by the transformation of the occupational structure of the population, but also by the modification of the form and structure of the town. This change, however, has occurred at a slower pace, and despite development, the former agrarian characteristics of Kecskemét although not dominant are still apparent today (Fig. 7).

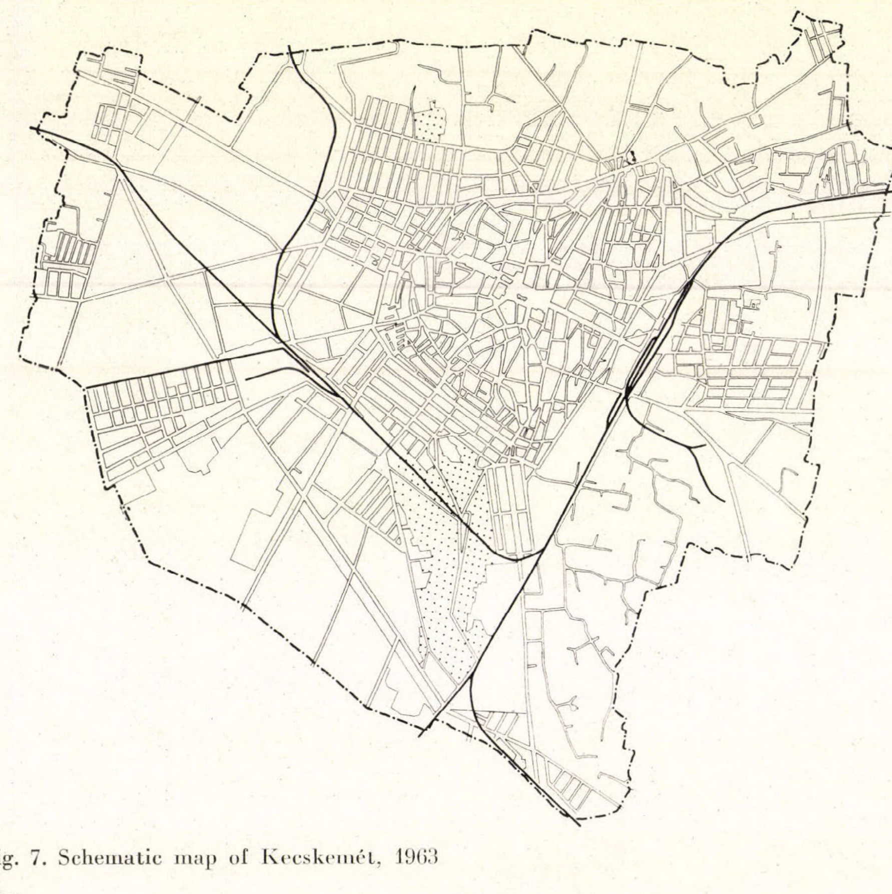


Fig. 7. Schematic map of Kecskemét, 1963

Compared with the area defined by the old moat along the palisade (palisade French), the town body has expanded substantially although it has not yet been able to turn the incorporated areas into an integral whole. These suburban residential settlements form separate elements even today in the structure of Kecskemét. Thus, structurally the town is heterogeneous. However, Kecskemét is already at that stage in its structural transformation when the new functional zones which are still forming can already be outlined distinctly. (See Fig. 5.)

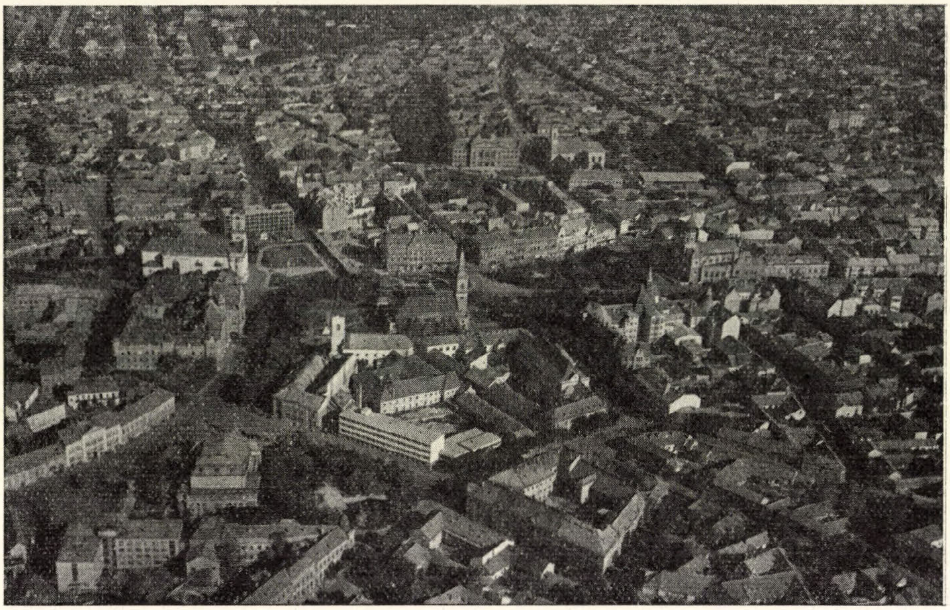
Kecskemét is divided into the following functional-morphological belts: 1. *town centre*, 2. the urban *inner residential* zone developed in unbroken lines and, on its periphery, 3. a belt of scattered dwellings and rural in character, 4. *industrial areas*, 5. family housing developments forming part of the *outer residential belt* (suburban residential settlements), and 6. the loosely knit and scattered sections of the outer residential belt. The territorial extent of the individual zones is highly characteristic, and reflects their historical development.

The *town centre*, which is also the geometrical centre of Kecskemét, is still no larger than one-fifth of the historical town despite spatial expansion. The concentration of tertiary institutions has assumed large proportions in this area in the past decade, which almost has led to the vertical squeezing out of residential activity. The numerous public buildings, department-stores and shops surrounding the huge square of the town have a considerable turnover (Picture 3).

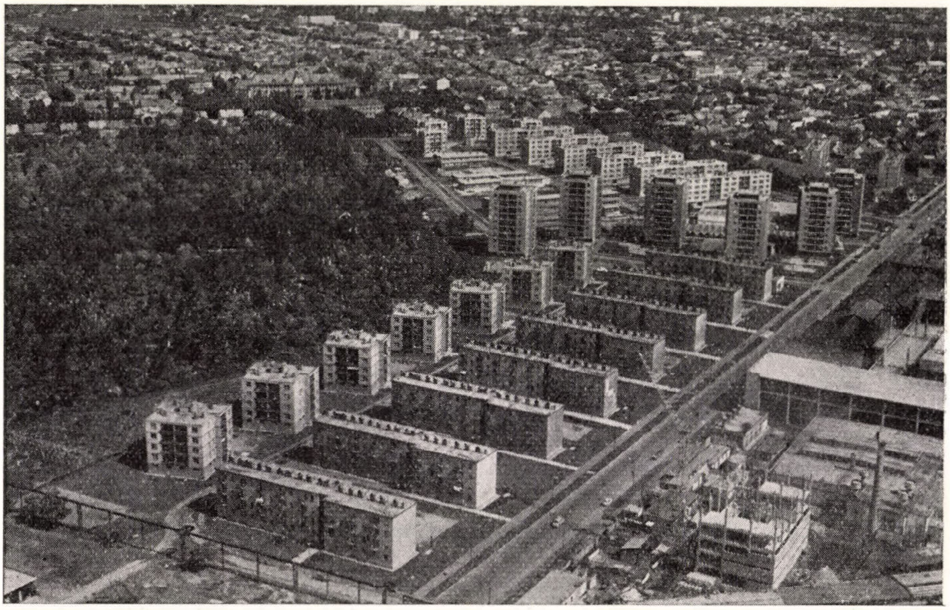
The *urban residential belt* developed in unbroken lines completely surrounds the town centre (Fig. 8). Spatially it has hardly grown during the past quarter of a century, so it does not fill the entire area of the historical town (Picture 4). This indicates that compared with Szeged, Debrecen and Szolnok, the other developed towns of the Great Plain, the morphological development of Kecskemét progresses more slowly. The rebuilding and transformation of this inner residential belt with its congested street system is made difficult because of several factors. Seventy-eight per cent of the dwellings of the area, which comprise a mosaic of very small plots, are one-storied, privately owned houses comprising 2—3 apartments, nearly half of which are built of adobe. One-third of the area is only partially provided with public utilities, there being electricity and water, but no sewage system, which hinders modernization.

The characteristic features of the *rural part of the inner residential belt* —which developed in an indented pattern—are that the longitudinal axes of the houses are at right angles to the line of the street, and that neighbouring houses are separated from each other by courtyards. It was formerly the zone of the agrarian population, and even today is spatially the most extensive belt of Kecskemét. This quarter, several parts of which have become slums, whose demolition has already begun in order to make way for a multiple-storey, modern residential quarter, has been inhabited by a non-agrarian population for a long time. However, because of the high costs of reconstruction, the elimination of this zone will still require considerable time.

The inner residential belt formed on filled-up fens situating more towards the centre is surrounded on the east, south-east and south by an extensive



Picture 3. The town centre surrounded by a residential belt with a concentrated ground plan



Picture 4. The new residential blocks adjoining the industrial belt: Lenin District

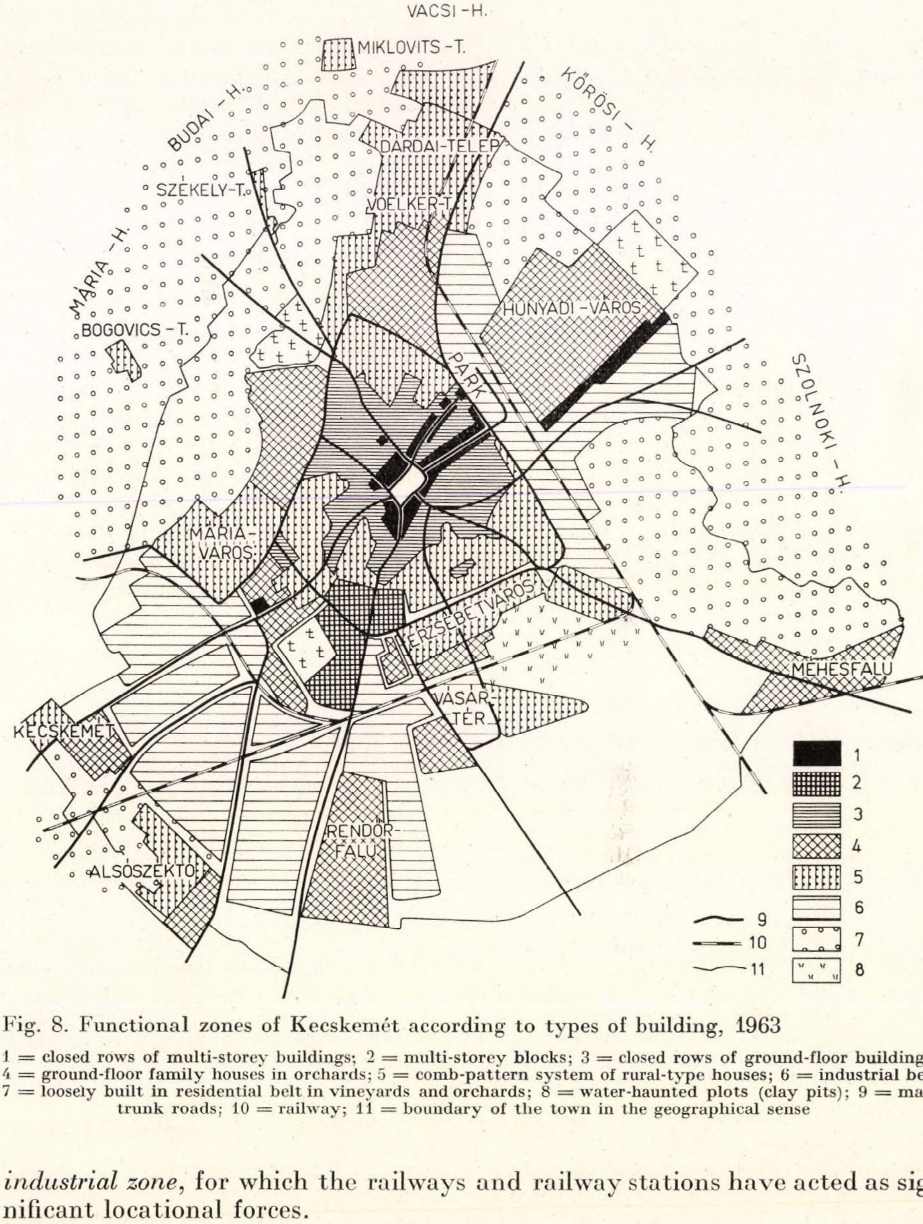


Fig. 8. Functional zones of Kecskemét according to types of building, 1963

1 = closed rows of multi-storey buildings; 2 = multi-storey blocks; 3 = closed rows of ground-floor buildings; 4 = ground-floor family houses in orchards; 5 = comb-pattern system of rural-type houses; 6 = industrial belt 7 = loosely built in residential belt in vineyards and orchards; 8 = water-haunted plots (clay pits); 9 = main trunk roads; 10 = railway; 11 = boundary of the town in the geographical sense

industrial zone, for which the railways and railway stations have acted as significant locational forces.

Its favourable situation from the point of view of transport and good public utilities contributed to the fact that the industrial plants transplanted from the capital found favourable sites here. The series of up-to-date industrial plants located here provide employment for the townspeople as well as for commuters.

The interposition of the industrial zone bisects the residential area of the town into an inner and an outer residential belt, which are in contact spatially only in the north and west. A characteristic structural feature of the *outer residential belt* is that it consists of several independent, island-like residential neighbourhoods or settlements developed in unbroken lines and separated by loosely developed areas, which were formerly part of the garden region. In contradistinction to the inner residential belt, this outer residential belt does not form a spatially contiguous zone. This belt is a mosaic-like agglomeration of areas which are at different stages of being incorporated into the town and have different functions.

The individual functional zones of Kecskemét are connected by the urban road network while the town also has *a radial trunk-road system*. The inner boulevard, which follows the line of the mediaeval moat and the partially constructed outer boulevard, which follows the outer residential belt, as well as the broad trunk-roads running out radially from the town centre represent, on the main, the traffic system of the town. The transformation of the system of branching and sinuous by-streets, blind alleys and lanes, is a process associated with the rebuilding of the inner residential belt. Internal urban transport is handled by a bus system with 11 routes, while the interurban services which connect Kecskemét with the region of its tanya-world may be considered favourable.

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CENTRAL PLACES DEVELOPING IN COUNTY SZABOLCS-SZATMÁR

by

PÁL BELUSZKY

Between 1960 and 1968 the proportion of wage earners employed in the service branches rose from 26·3 to 30·0 per cent, and is expected to reach 40 per cent by 1980. Parallel with the increase in service provision as demand grows and the associated rise in the number and proportion of people so employed, service institutions play an ever increasing role in the formation of the settlement network. For this reason, the investigation of the spatial aspects of the service branches, the service network has become an urgent task. In Hungary, the planned development of service functions is made possible by the tools of national economic planning. The objectives are: to provide within the institution network that combination which makes possible the optimum supply to the population with the least social input. This effort is successful only if the demonstrable regularities, particularly those of a geographical nature in the functioning of these institutions, are known.

The investigation of the network of urban hinterlands deserves special attention because:

— The relationships formed by basic urban functions play a determining role in the organization of settlements into a settlement network; it is these relationships which constitute the existing frame which links the individual settlements within the network.

— The findings of investigations into urban hinterlands can be used directly in planning and economic management, and in the organization of the institutional network.

— The significance of investigations into hinterlands is increased by the fact that knowledge acquired about them may play an important role in the solution of the most complex task of economic geography, namely the delimitation of economic regions, as well as the exploration of the internal structure of these regions.

The hinterlands of Hungarian towns are mostly unexplored; the main features of the interrelationships between town and country are known only imperfectly, while the quantitative parameters of these interrelationships are completely unknown.

In our study we shall show the characteristic relationships between towns and villages in Hungary in the course of investigating the hinterland of Nyíregyháza, a medium-size town in the Great Plain.

Nyíregyháza with a population of 71 thousand in 1970 is the dynamically developing administrative centre of County Szabolcs-Szatmár. It has but a short urban history, as the settlement which stood in the site of the present town was almost entirely destroyed during the historical upheavals at the turn of the 17th and 18th centuries. Development was accelerated by a large-scale resettlement campaign in the 1750s, and by 1789, Nyíregyháza comprised a population of 6,923. It began its evolution into a market town at the beginning of the 19th century and between 1803 and 1823, released itself from the supremacy of the landowners, and developed its system of scattered farms. It performed an urban function by means of its fairs, handicraftsmen, secondary school and merchants. With its growth between 1858 and the turn of the century as the railway centre of the northern part of the Trans-Tisza Region, its development into an urban place became faster. The town became the administrative, transport, cultural and handicraft centre of County Szabolcs, while its agricultural role became steadily less significant. However, Nyíregyháza was unable to acquire any considerable manufacturing industry (only 30 per cent of the wage-earners in the city were employed in the secondary sector). The situation remained basically unchanged until the early 1960s, when 52·8 per cent of its inhabitants were employed in the tertiary sector, and less than 20 per cent in agriculture. Since 1960, a new feature in the functional development of the town has been the rapid growth of manufacturing industry, and by 1968, the total number of employees in this branch had exceeded 12 thousand. In addition, a further four thousand were working in the building industry. Meanwhile the cultural, sanitary, commercial and service functions of the town have further increased with for instance the founding of a Teachers Training College, and a Secondary Agricultural School. Today, Nyíregyháza is primarily a settlement performing basic urban functions (i.e. it is a transport, administrative and supply centre) but it also possesses a rapidly growing and already significant industry, although its agricultural role is declining.

The feature determining the background of the town and the economic life of County Szabolcs-Szatmár which has an area of 6,000 sq.km and a population of 540 thousand is the low overall degree of industrialization. In 1967, Szabolcs-Szatmár occupied last place when counties were ranked on the basis of the number of wage-earners employed in the socialist industry, its value being 430 per 10,000 inhabitants. In 1968, 43 per cent of wage-earners were still working in agriculture. The effects of the low level of industrialization on the settlement network are:

— large-scale outmigration: the migration loss per 1,000 inhabitants was 13·8 in the 1960s, while the village population of the county decreased by 60 thousand between 1960 and 1969;
— industry plays a role only in the development of Nyíregyháza; the number of the inhabitants of the town centres stagnates or decreases;
— commuting within the county is insignificant, although, on the other hand, 13—14 per cent of total wage-earners work in distant regions of the country;
— the per capita income is low, which, of course, influences the turnover of urban institutions (for instance, retail trade per capita is the lowest of all the counties).

The settlement structure of the county differs from that of other parts of the Great Plain (Fig. 1) in that 62·7 per cent of the settlements have less than 2,000 inhabitants. A considerable number of the settlements do not possess even the basic services while the settlement structure of small villages does not make possible the distribution of urban functions. By contrast 24·3 per cent of the population of the county live in 4 per cent of the settlements, which in turn handle 62·2 per cent of retail trade. On the basis of the quantitative development of basic urban functions, Nyíregyháza ranks 7th in the country and 11th on the basis of qualitative development (Beluszky, P. 1966, 1967, 1968). Its service function to rural areas is outstanding in that 57·5 per cent of its turnover of industrial articles, 65·7 per cent of its secondary

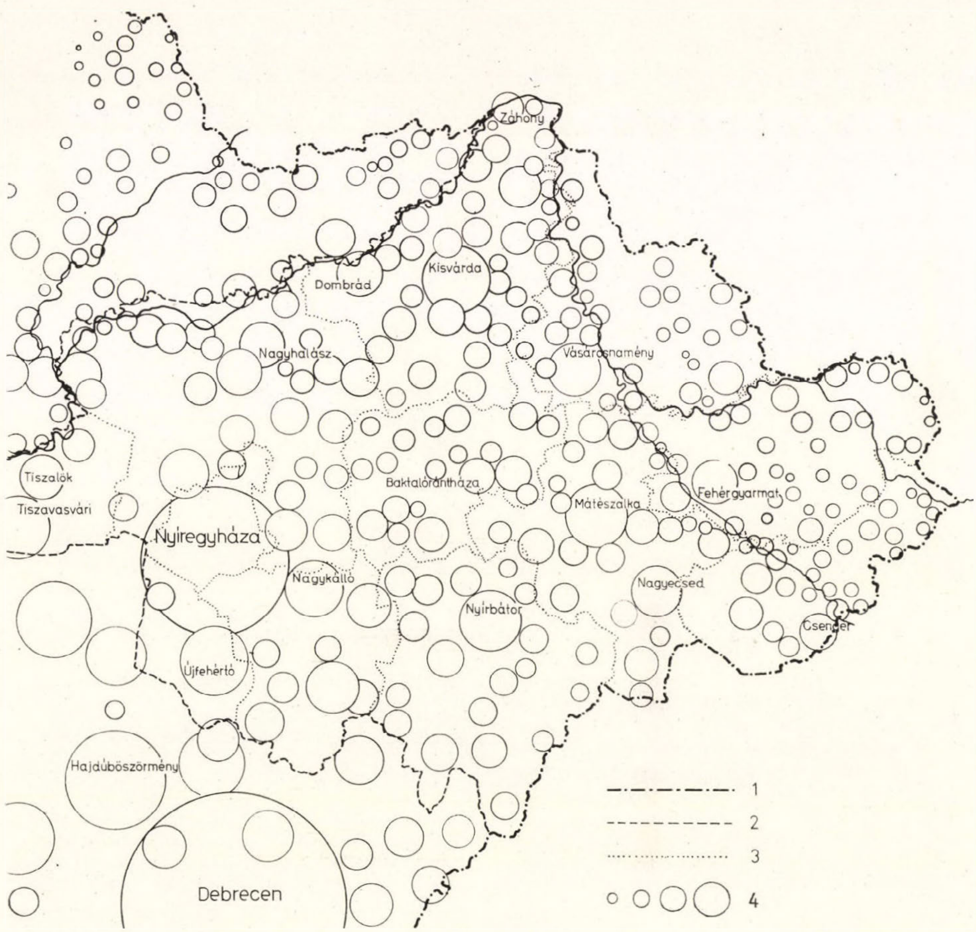


Fig. 1. Map of the examined area

1 = frontier; 2 = county border; 3 = district border; 4 = settlements

school accommodation, 72·6 per cent of its hospital accommodation, and 78 per cent of patients visiting specialist clinics fall to the share of the surrounding rural population.

Nyíregyháza is a transport node. Some 67 passenger trains arrive at its station daily from 9 directions, 20 of these between 4 and 8 a.m., while the number of incoming bus services is 99 every day. In all 260,000 people live within the transport field of the town. It should, however, be noted that the eastern one-third of Szabolcs-Szatmár is between 4 and 9 hours travelling time from the county seat.

Nyíregyháza and the other central places of County Szabolcs-Szatmár have several common characteristics, in that their agricultural and industrial sectors are insignificant, and their prime functions are as administrative and supply centres. Thus since the services they provide to the surrounding rural population are considerable, the quantitative development of their urban functions in relation to their size and position in the urban hierarchy is noteworthy. Yet, the development of their central place functions is not conspicuous. They have modest pasts in terms of urban history, while their population size and morphology do not reflect their position in the urban hierarchy. Additionally their form, supply with public utilities, development of local functions, and cultural level, i.e. their infrastructure in general, do not reach the level of towns with similar positions in the hierarchy. Where the county borders the Great Plain are found market towns of lowland character which are densely populated compared with their urban functions, and perform a significant agrarian role. Of the other urban centres of Szabolcs-Szatmár only Kisvárda and Mátészalka perform functions at a similar level to Nyíregyháza.

The urban centres of Hungary can be grouped into a 6 order hierarchy on the basis of the development of their institutional network as follows:

The Capital.

First order centres comprising Debrecen, Szeged, Pécs, Miskolc and Győr whose functions cover several counties. Their characteristic institutions are, for instance, universities, clinics, centres of wholesale enterprises, publishing houses for literary periodicals, and regional offices of the Railways and Post Office.

Second order centres include the county administrative centres. Their characteristic institutions comprise the administrative and judicial offices of counties, theatres, archives, specialist hospital departments, and tourist agencies.

Third order centres include the towns which lie between the county and district seats in the hierarchy; examples of their characteristic institutions are the basic plus some specialist hospital departments, specialist secondary schools, for instance, those providing language courses, travel agencies and special optical and vehicle shops.

Fourth order centres comprise the district level towns. Their characteristic institutions include district administrative, judicial and financial functions, ambulance stations, health service clinics, specialist secondary schools, and furniture shops.

Fifth order centres whose characteristic institutions comprise, for example, revenue offices, branches of the National Savings Bank, general grammar schools, dental surgeries, T.B. dispensaries, markets and shops for shoes, household articles and textiles.

Mátészalka and Kisvárda proved to be third order centres, and Nyíregyháza a second order place.

The specific objectives of this paper are the delimitation of the urban hinterland of Nyíregyháza, and an analysis of its structure. It is also aimed to investigate the interrelationships between individual members of the settlement network. We are not in a position either to analyse in detail the fields of influence formed by individual central functions—such as education, public health—, or to analyze the factors determining the formation of the network of hinterlands produced by higher and lower order services. Only retail trade and public health central functions will be dealt with, partly because it is these that form the most intimate relationship between villages and towns, and partly because the retail trade and public health spheres of influence represent two characteristic features of the urban field. This is because, first

— the formation of the sphere of attraction of retail trade is considerably influenced by interrelationships established with other central functions; the development of central functions in the central place is interrelated with the attraction of retail trade.

Secondly, the sphere of attraction of retail trade is determined by the subjective decisions of customers and is thus free from administrative influence.

Thirdly, the network of shops is in equilibrium with the order of the town in the urban hierarchy. Irregularities within the institutional network do not influence the formation of the urban field.

Fourthly, relationships established by retail trade are lasting, and are subject only to slow change.

By contrast with retail trade, the territorial extent of public health institutions is determined *mainly by boundaries laid out by administrative authorities*. For this reason, the boundaries are sharp, the zone of attraction closed, and the role of geographical factors small.

Markets, fairs, handicrafts, entertainment establishments and in part educational-cultural institutions can be included within the type of "retail trade spheres of influence", on the other hand financial, credit and insurance institutions and most forms of administration cannot be so assigned for as with public health functions, their boundaries are laid down by various authorities.

After the 5 large county towns of Debrecen, Pécs, Szeged, Miskolc and Győr, Nyíregyháza plays an outstanding role in the retail trade of the country. On the basis of turnover in industrial articles, it ranks 7th among the towns, and on the basis of the theoretical population size it serves 6th, where theoretical population size served is given by

$$\frac{T_{cp}}{T_c:I_c}$$

and where T = value of retail trade turnover in Ft,
I = number of inhabitants,
cp = data relating to the central place,
c = data relating to the county.

According to indirect data, the town plays an outstanding role in the supply of the surrounding rural population; the per cent capita turnover in industrial articles being more than double the county average. Indeed, on the basis of the 93,500 rural population served which has also been obtained theoretically, it ranks 2nd amongst the provincial towns, being approximately equal in status to Debrecen and Győr, but behind Miskolc, which supplies 157,000 people. The theoretical value of rural population served is given by $\frac{T_{cp}}{T_c : I_c} - I_{cp}$. Some 250 shops are functioning in the town, of which 63 are specialist shops and department stores for clothing and industrial articles, whose sales area exceeds 5,000 sq.m.

Numerical data concerning the attraction of retail trade are available. Customer counts were carried out in the specialist shops for industrial articles in the settlements of urban character in the county over two periods, each of one week duration, during which the residence of customers arriving from outside the administrative boundaries of the given settlements was registered. Over the two weeks of the survey, 115,000 customers exclusive of local residents were observed in the towns of the county. It was found that 14·2 per cent of the rural population visited centres *every week*, which means that approximately half of the families living in rural areas visit commercial centres every week for shopping purposes. The intensity of such movement is high in the county, the number of rural customers attracted to the individual commercial centres being greater than the value expected on the basis of their positions in the urban hierarchy (Table I).

TABLE I

Data concerning commercial centres and their hinterlands in Szabolcs-Szatmár

Centres	Number of provincial customers per week	Number of the inhabitants in area of intensive contact[1]	Number of inhabitants in relative hinterland[2]	Number of inhabitants served[3]
1. Nyíregyháza	21,406	166,150	183,690	158,000
2. Kisvárda	7,204	55,400	73,670	39,680
3. Mátészalka	8,084	46,530	61,070	32,030
4. Nyírbátor	8,224	46,590	41,800	31,790
5. Vásárosnamény	4,240	29,430	35,250	23,880
6. Fehérgyarmat	2,037	17,550	32,600	25,290
7. Csenger	1,767	10,260	20,220	11,650

[1] the number of purchases per 100 inhabitants is at least 4 every week
[2] up to 40·0 per cent share in customer output
[3] values obtained theoretically

(For comparison's sake we may mention that over the country as a whole the following rural customer visiting patterns were observed during a typical week: in first order centres 18,610 visits, in second order centres 10,450 visits, in third order centres 4,870 visits and in fourth order centres 2,400 visits.) Thus on average 3,600 customers from outside the town make daily purchases in the specialized shops of Nyíregyháza; the centrality of the town within its county, taking into consideration the own turnover of the centres as well, is 0·42 (Fig. 2).

(*Centrality* equals the number of established contacts between the centre investigated and its own space unit divided by the total number of established contacts starting from the space unit.)

The retail trade hinterland of Nyíregyháza is broadly coincidental with the county examined (Map 1 attached). The zone of intensive contact, where the number of purchases per 100 inhabitants is at least 4 weekly, is separated by rather sharp boundaries from the outer areas of the hinterland. It covers 54 villages and a population of 166,000 and while comprising 28 per cent of the population of the entire urban hinterland provides 76·4 per cent of all rural customers. In this zone, purchases average is 9·84 a week per 100 inhabitants, while from certain villages 25 per cent of the inhabitants even visited the special shops of Nyíregyháza weekly. This area of intense contact spreads into adjacent rural districts as well. For instance, the centrality of Baktalórántháza district (exclusive of the internal turnover) is 0·30, that of Nagykálló 0·15 and that of Tiszalök 0·27. The distance of the settlement farthest from Nyíregyháza in the zone of intensive contact is 37 km. Villages —with a weekly purchasing frequency of 3·9 items per 100 inhabitants—are situated around the boundary of the zone of intensive contact, beyond which is a wide outer zone where average purchases are 0·93 weekly per 100 inhabitants. The inhabitants of this area rarely visit Nyíregyháza *exclusively* for shopping purposes.

The hinterlands of retail trade show similarities to the hinterlands formed on the basis of the intensity of contact (settlements are listed under one zone or another according to the frequency of contacts made with the centre of that zone) (Map 2 attached). The bulk of settlements focus on a single centre. Thus, of the 234 administrative units of the county 142 belong exclusively to the hinterland of one place (80 per cent of consumer activity being directed towards that place). Two-thirds of the population live in such settlements. The 130,000 inhabitants of 63 villages belong predominantly to the hinterland of some centre (60—80 per cent share of customer output contact being with that centre). The hinterlands of central places are separated either by distinct boundaries, or by narrow territorial zones. Thus 128,000 people live exclusively in the hinterland of Nyíregyháza, while a population of 55,000 resides in the transitional zone where 40·0—59·9 per cent of consumer contact is with the town.

The intensity of contact is determined by the transport possibilities. A multicorrelation analysis with 10 independent variables was carried out to assess the role of various factors in the formation of urban hinterlands. A multiple correlation coefficient of 0·8359 was obtained. Of the partial correlations the strongest association was between the intensity of contact and the time and cost, the correlation coefficients being —0·6268 and —0·6230, respectively. The relationship between commercial and transport hinterlands is very close. A close association can be also observed between transport hinterlands and administrative areas, i.e., transport considerations are taken into account when administrative boundaries are decided, while already designated administrative boundaries influence the provision of public transport facilities (those of the buses primarily) in turn. It is conspicuous that retail trade hinterlands rarely overlap if the respective central places are of the same order in the urban hierarchy. In the county of Szabolcs-Szatmár only the commercial transport and administrative hinterlands of Nyíregyháza are able to expand into adjacent districts.

The effect of the settlement structure on the intensity of contact is insignificant; it is not the small villages and tanya centres, but the settlements with 2—3,000 inhabitants that maintain the closest relationship with the towns.

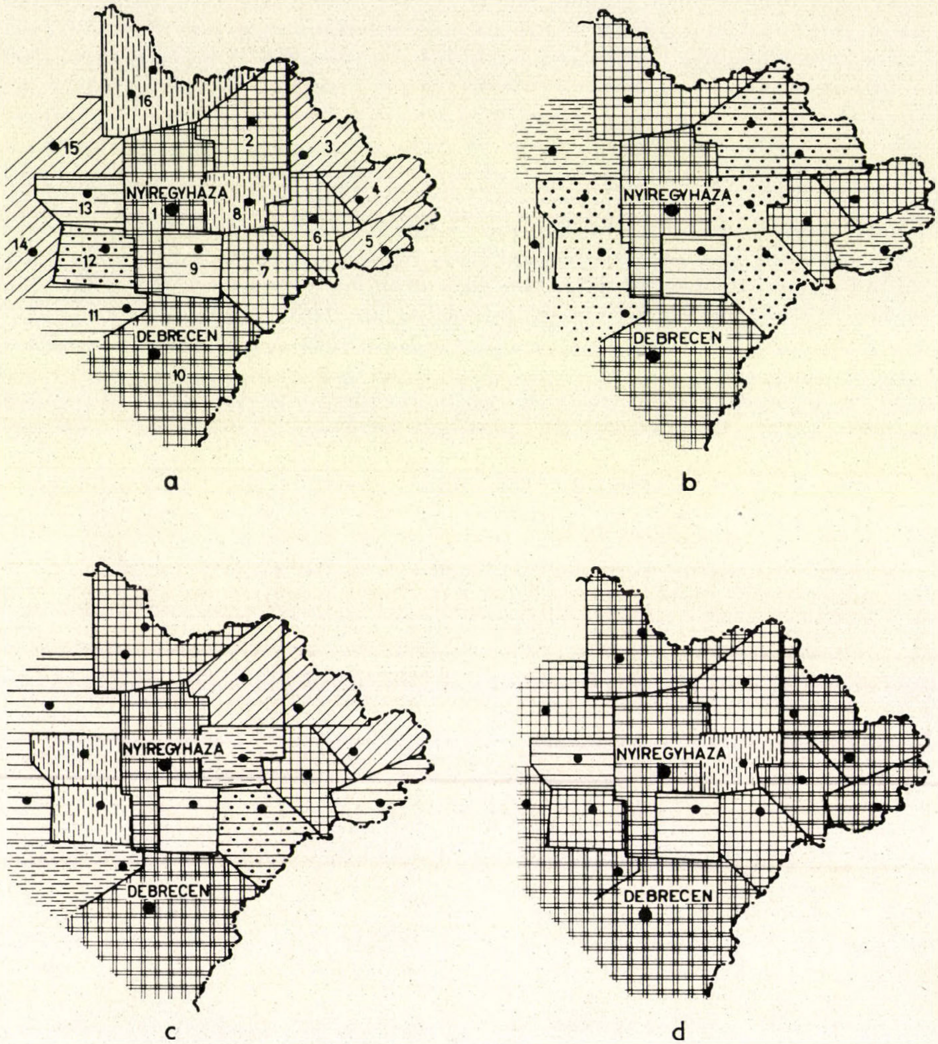
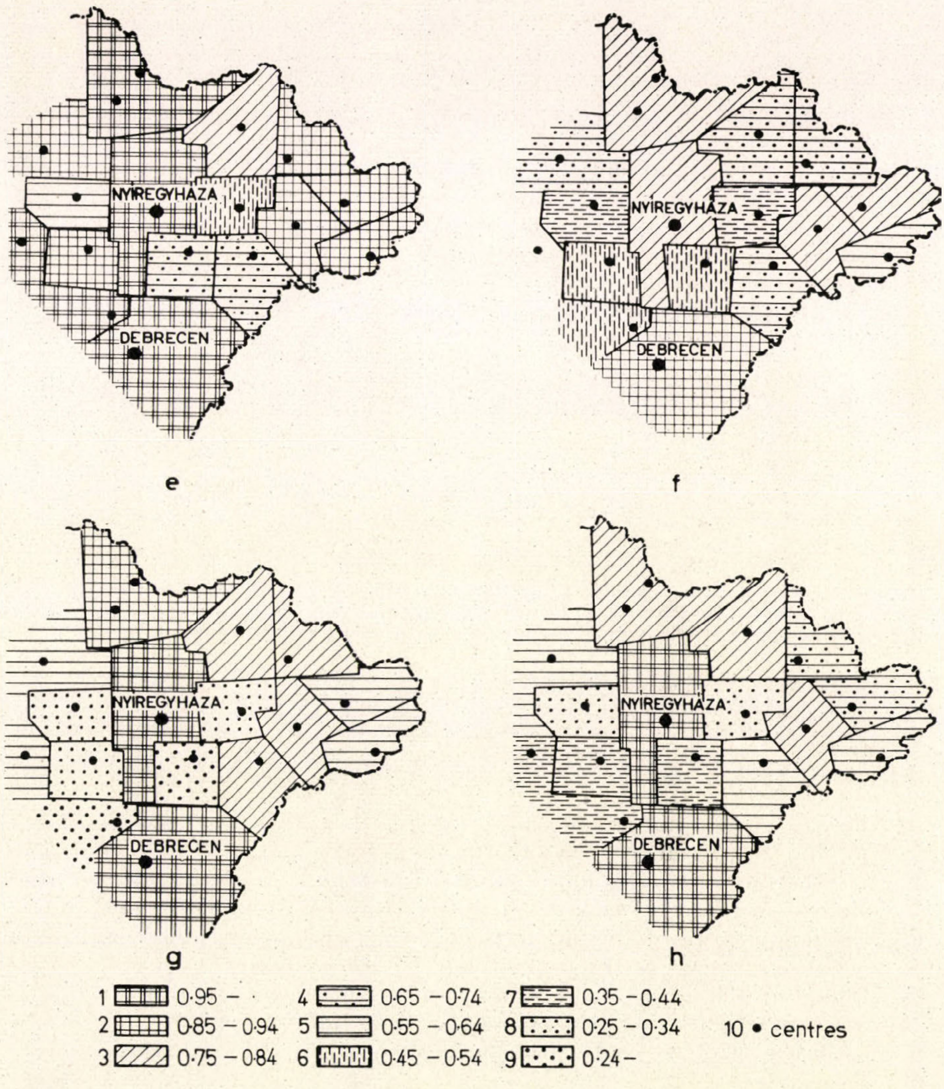


Fig. 2. Centrality of the space units of the centres in the environment of Nyíregyháza.
1—9 (legend see on
a = centrality on basis of retail trade attraction (trend towards district centres and the turnover of the central
tion (central place of the space unit and the trend towards Nyíregyháza); d = attraction of sanitary institution
district centres and the turnover of the central places); f = average centrality (central place of the unit and the
h = average centrality (turnover of the central place without the trends toward it)

It is striking that the shopping facilities of individual settlements and the proximity of other low order centres have little effect on the gravitation towards centres of a higher order. The inhabitants of the settlements with populations of 5—12 thousand situated near Nyíregyháza such as Nagykálló,



Index of centrality:

the map); 10 = centres
places); b = see prec. (without the turnover of the central places); c = centrality on basis of retail trade attrac-
(trend towards district centres and the turnover of the central places); e = average centrality (trend towards
trend towards Nyíregyháza); g = average centrality (turnover of the central place and all trends towards it;)

Rakamaz, Újfehértó and Baktalórántháza also use its shopping facilities. The correlation coefficient between spatial variations in daily commuting to the town—incidentally, not significant in Szabolcs-Szatmár county— and the strength of the retail trade hinterland is 0·5416; the interaction of the two factors cannot be judged accurately, owing to the fact that transport possibilities are the same for both. It can be ascertained from the findings of investigations carried out in other regions of the country that the attraction of labour does not play a determining role in the formation of commercial hinterlands.

The commercial hinterland of Nyíregyháza is one of the most significant in the country (Table II). Its formation was facilitated by the excellent transport situation of the town, by the insignificant level of retail provisions in the surrounding villages, by the high population density and by the fact that the neighbouring centres of Baktalórántháza, Nagykálló, and Tiszalök have not evolved as competitors.

TABLE II

The commercial hinterlands of selected country towns

Centres	Number of provincial customers observed	Number of settlements	Number of inhabitants
		in zone of intensive contacts	
1. Miskolc	23,716	119	210,830
2. Nyíregyháza	21,406	54	166,150
3. Debrecen	16,885	32	165,470
4. Győr	25,761	94	152,560
5. Pécs	14,993	198	138,000
6. Szeged	13,653	32	109,220
7. Székesfehérvár	11,466	46	99,590
8. Szombathely	12,332	106	91,400

The commercial hinterland can be broken down into the following belts:

— Within the rural hinterland of Nyíregyháza and in the western half of Baktalórántháza administrative district, Nyíregyháza performs almost exclusively the role of commercial centre, and 80 per cent of the inhabitants of this area effect their purchases in the county seat (exclusive of the attraction of lowest order centre);

— It performs the role of the commercial centre in conjunction with adjacent centres in the districts of Tiszalök and Nagykálló, and in the eastern half of the Baktalórántháza district as well as in the region of Tokaj;

— These two belts and a few other settlements—Nyírbátor and its surroundings—constitute the 3rd order hinterland of the town, that is, the area for which Nyíregyháza satisfies the overwhelming majority of requirements. The 3rd order hinterland of the town is more or less identical with the zone of intensive contact. The intensity of contact decreases rapidly at the outer boundary of this zone and in the eastern half of the county, as well as in some villages bordering on the county there are no significant differences in the intensity of contact. The trip frequency is below the value of 1 purchase per 100 inhabitants weekly.

In Hungary, the role of public health institutions in establishing relationships between town and village has increased rapidly. Between 1957 and 1969, the number of patients treated by the public health institutions of the county increased from 850,000 to 2,500,000. Of these 1,300,000 visited the public health facilities at Nyíregyháza, 70 per cent of whom from outside the town. The territorial extent of public health institutions is for the most part coincident with administrative areas. Despite this, the network of public health hinterlands is complex, as the institution network of the neighbouring centres is made up of different basic units. The hinterlands of individual centres therefore are widely different.

A close relationship exists between the intensity sectors and functional sectors of the public health: services' hinterland. The internal sector includes the rural districts of Nyíregyháza, Tiszalök, Nagykálló, and Nyírbátor, and a few villages in the western part of Baktalórántháza district. In this area, Nyíregyháza performs the public health functions of rural district level, even though some "provincial" institutions, primarily the clinic of Nagykálló, also participate in the supply of the population. The intensity of contacts in this zone is 9—10 established relationships weekly per 100 inhabitants. In the district of Kisvárda and in the eastern villages of the district of Baktalórántháza, Nyíregyháza performs the third order public health functions as well, since the institutional network of Kisvárda is deficient at this level. Here the intensity of contacts decreases to 1—2 established relationships weekly per 100 inhabitants. The third zone includes the eastern one-third of the county, and is linked with Nyíregyháza through the specialist facilities offered at county level such as urological and orthopaedic hospital departments, an epidemiological station and county welfare-centres. The intensity of contact is 1 established relationship weekly per 100 inhabitants.

Some 4,600 pupils attend the secondary and high schools of Nyíregyháza, of whom more than 70 per cent come from outside the town. In the field of administration and organization, the authority of nearly 200 institutions extends beyond the boundaries of the town. Although the role of the food and cattle-markets has decreased, 2,000—2,300 still visit them every week, of whom 55—58 per cent come from the rural areas. On the other hand, the utilization of different personal services and industrial services has increased.

In summing together the hinterlands created by individual central functions, in order to delimit the hinterland produced by the totality of central functions, we took into consideration the closeness of the relationships with the environment, the area served, and the extent to which it was served by the institutions at different levels on the hierarchy. The delimitation of complex hinterlands was made by additive methods.

It did not appear correct to sum up automatically the number of "established associations" caused by the different groups of functions for the measurement of the closeness of relationships; for this reason, the intensity of contacts was related to a settlement with average contact intensity for each group of functions, by considering the deviations from the average:

Our process was as follows: the degree of contact of settlements $A_1, A_2, A_3 \ldots A_n$ belonging to the hinterland of some centre with that centre was determined on the basis of criteria $\alpha_1, \alpha_2, \alpha_3, \alpha_m$:

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{1m} \\ a_{21} & a_{22} & a_{23} \dots & a_{2m} \\ a_{31} & a_{32} & a_{33} \dots & a_{3m} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ a_{n1} & a_{n2} & a_{n3} & a_{nm} \end{bmatrix}$$

The elements of the matrix A are the values of contact intensity standardized for the number of inhabitants of settlements $A_1, A_2, A_3 \dots A_n$. These values were then compared with the values of a settlement $\bar{A}$ of *average contact intensity* on the basis of criteria $\alpha_1, \alpha_2, \alpha_3 \dots \alpha_m$ for each group of functions. The average values for settlement $\bar{A}$ are given by the arithmetic means of the individual columns of matrix A, i.e. $\bar{A} = \frac{\sum_{i=1}^{n} ai_1}{n}$. Criteria $\alpha_1, \alpha_2, \alpha_3 \dots \alpha_m$ of $A_1, A_2, A_3 \dots A_n$ were then compared with values $a_1, a_2, a_3, \dots a_n$ of settlement $\bar{A}$:

$$A' = \begin{bmatrix} \frac{a_{11}}{\bar{a}_1} & \frac{a_{12}}{\bar{a}_2} & \frac{a_{13}}{\bar{a}_3} \dots & \frac{a_{1m}}{\bar{a}_m} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \frac{a_{n1}}{\bar{a}_1} & \frac{a_{n2}}{\bar{a}_2} & \frac{a_{n3}}{\bar{a}_3} \dots & \frac{a_{nm}}{\bar{a}_{nm}} \end{bmatrix}$$

The elements of the matrix contain the deviations of the standardized values of individual settlements from the measures of "average contact intensity". The complex index of contact intensity for individual settlements is given by the square root of the sum of the squares of corresponding rows of the matrix. For settlement A_1 this is:

$$A_{1M} = \sqrt{\left(\frac{a_{11}}{\bar{a}_1}\right)^2 + \left(\frac{a_{12}}{\bar{a}_2}\right)^2 + \left(\frac{a_{13}}{\bar{a}_3}\right)^2 + \dots \left(\frac{a_{1m}}{\bar{a}_m}\right)^2}.$$

In the delimitation of functional sectors, our basic principle was that only the boundaries of hinterlands of institutions on the same hierarchical level could be contracted. In the summations, the hinterlands of individual groups of functions were considered to be of the same value. No "average limit" was constructed between the limits of institutions on the same hierarchical level; within the hinterland of fourth order services of an individual centre, we delimited, first, that sector depending exclusively on the centre for every function, i.e., the town concerned has at least 80·1 per cent of the custom generated by fourth order institutions; secondly that sector generating 60·1—80·0 per cent of the custom; and thirdly that associated with a 30·1—60·0 per cent of the custom. A similar process was undertaken for third order services.

Some 125,000—and if the population of Nyíregyháza is included, nearly 200,000—people live in the area of intensive contacts; i.e. that area in which all urban needs are satisfied by the county seat. Consequently, when planning the lower-order institutional network, the satisfaction of approximately 200,000 inhabitants has to be taken into account. From the zone of intensive contact, 46—48 per cent of the population visit Nyíregyháza weekly; in the innermost sector (namely that delimited by the half-hour isochron, the intensity may reach the value of 60 established trips weekly per 100 inhabitants. This figure does not include the data for commuters. The institutions of the town performing central functions are visited by about 10—11,000 people daily, from the rural areas, and indeed urban tertiary functions increase the "day-time population" of the inner part of the town by approximately 20 per cent. (This value must be taken into consideration not only in the planning of the network of urban functions, but also in the establishment of the infrastructure of the town.)

The sector of regular contacts is inhabited by 180,000 people. It includes the districts of Tiszalök, Nagykálló, Baktalórántháza and Nyírbátor and its farthest point is almost 60 km distant from the town. The number of established trips per 100 inhabitants is 9—10 on the average; this sector must be provided by the county seat with medium-order services such as hospitals, specialist shops, specialized departments of clinics and specialist secondary schools. In the outer sector of the hinterland, the intensity of contacts is only 2—3 established trips per 100 inhabitants weekly.

A breaking down into functional sectors gives a more differentiated picture of the complex hinterland of the town than the investigation of intensity sectors. A high degree of similarity, however, is observable between the two types of sector: the sector of intensive contact corresponds approximately to the area served by the institutions of district level in the town, and the sector of regular contact to the area served by 3rd order functions. The prominent role of the town in supplying the country-side can be explained primarily by the conspicuously large hinterland defined by functions of district level. It covers four districts having a population of 195,000, while if Nyíregyháza itself is included the population served rises to more than 260,000. This sector of the urban hinterland extends 40—45 km towards the east, 34—36 km to the north, 40 km to the west, but only 22—28 km to the south. Among other county towns only Miskolc, with 340,000 inhabitants, and Debrecen, with 215,000 inhabitants, have similar sectors which surpass that of Nyíregyháza in terms of population served provided the inhabitants of the centres themselves are not counted. The magnitude of the hinterland defined by second order services requires above all the *quantitative* development of the institutional network of the town, in particular, a relatively large-scale expansion of lower-order urban services. The capacity of the institutional network (for instance shop floor area, number of hospital beds, secondary school classrooms and basic services, etc.) still falls behind the demand. On the basis of the capacity of the more important institutional functions, Nyíregyháza ranks between 8—12 in the hierarchy of county towns. As the economic level of Szabolcs-Szatmár county approaches the national average, it will be necessary to plan for an increase in urban services required, which will necessitate a considerable expansion in the capacity of the institutional network.

The urban hinterland for third order functions, i.e. those immediately above district level is somewhat larger in that it serves a population of 260,000 or over 320,000 if the population of Nyíregyháza is included. The hinterland of 3rd order functions extends beyond that of second order services primarily in the direction of the district of Nyírbátor. As a great part of the third order hinterland provides basic urban institutions as well, the intensity of contact is high. The extent of the hinterland of 3rd order functions is not so outstanding large when compared with other centres as that of the basic urban functions and follows those of Miskolc, with 568,000, Debrecen, with 538,000, Kaposvár, with 367,000 and Pécs with 335,000 inhabitants, in terms of population served. The 3rd order hinterlands of Győr and Székesfehérvár are similar in magnitude to that of Nyíregyháza.

Finally, the hinterland of county level functions, naturally, includes the whole of Szabolcs-Szatmár, as well as a few villages outside the county. Some 560,000 inhabitants are served (Map 3 attached), the farthest point being some 110 km distant from Nyíregyháza. It is difficult to assign sectors within this area. The intensity of contact is low, and generally the relationships determined by administrative functions constitute its structure. The demands made by this area are primarily on the quality and degree of differentiation within the institutional network of the centre. Despite the rapid development in recent years, the degree of differentiation within the institutional network does not yet reach the level to be expected on the basis of the magnitude of the hinterland.

The structure of the hinterlands of towns having a developed, multiple institutional network is rather complex. A different picture is obtained when the intensity of contacts, position of relationships with the town, or the place of the town in the urban hierarchy are investigated. *The extent of urban hinterlands cannot be given by a single datum, and the tasks of settlement planning cannot thus be performed by relying on a single datum.* It is not satisfactory to characterize and to quantify hinterlands by selecting, or by summing individual sectors by means of certain calculations, because the different internal structures make different demands on the institutional network of centres. *The magnitude and the internal structure of the hinterlands of centres at identical levels in the urban hierarchy are also different.* For this reason, even a general model of the hinterlands of centres at the same hierarchical level cannot be constructed. Since, for instance, settlement transport, economic, and demographic endowments cannot be transformed radically in a short period of time, hinterlands of different magnitude and structure are also characteristic of centres of identical rank in the hierarchy. Individual features cannot be overlooked in long-range planning either. The proportional development of institutions performing functions at different levels should be determined with prior knowledge of the structures of urban hinterlands.

The model where the rural population shop in higher order centres and maintain below average relationships with lower order centres, cannot be considered general. While third and fourth order contacts may be regarded as "regular" and general, the gravitation towards higher order centres is only occasional and occurs mainly for compelling reasons, i.e. trips to public offices and public health institutions which are to be found only in the county seats. This is indicated by the fact that in the urban fields of the third order centres of Kisvárda and Mátészalka within Szabolcs-Szatmár county contacts with the county seat are of very low intensity, and do not become organized into intensity sectors. According to personal observations, only a small stratum of the population visits the county seat more regularly. It follows from all this that the structure of the network of urban hinterlands is formed by the fields of influence of second and third order functions.

In addition to third and fourth order functions forming the backbone of the network of urban hinterlands, the spheres of influence of a large number of first order centres make the pattern of the network of urban hinterlands complicated. There is little regularity and expediency in the location or planned development of first order centres. In general, they influence the spheres of influence of higher-grade centres to a small extent. The intensive area of contact of lowest order centres may include more than 20,000 people. Trip intensity is high, and may reach values of 20—25 weekly per 100 inhabitants.

The location and even the development of lowest order centres shows little regularity and purposefulness. In some places they are located close to each other such as Tarcal, Tokaj, Rakamaz and Gáva-Vencsellő, and the villagers regularly visit as many as 2—3 such centres. In other case, they are missing even in areas where the travel time to the nearest higher-order centre is as much as one hour or one hour and a half.

The trip frequency of people of different occupations, age and income to the central places differs considerably. During the planning of the institutional network, the occupational structure, income conditions, and demographic characteristics of the population within the potential hinterland should also be considered.

As has already been shown, the relationships between the centres and their hinterlands are already close. During the planning of the capacity of the institutional network, our planners already take into account the requirements of the "rural areas" in most cases. However, they hardly take into consideration the movement generated by institutions having central functions during the planning of the infrastructure of the towns. The towns undertake even more rarely the *conscious* role of serving the surrounding countryside.

On comparing the intensity of contacts within the complex hinterland with factors relating to transport conditions, the settlement network and demographic structure (by using factor analysis) it can be shown that the individual factors play the same role in creating the intensity of contacts within the complex hinterland as they do in retail trade. The multiple correlation coefficient of the relationship between the factors taken into account and the intensity of the complex hinterland is 0·7820. The role of transport is even more emphatic than in the formation of the sphere of influence of retail trade. It may also be noted that the partial correlation coefficient between the intensity of the complex hinterland and cost-distances is —0·717. On the other hand, the role of the settlement network, settlement structure and demographic factors is very small in the development of the intensity of contacts.

However, administrative boundaries play an important role in the formation of the complex hinterlands. They also have an effect on the evolution of general hinterlands through the following mechanisms:

— The spheres of influence of institutions of public administration are determined by administrative boundaries.
— The authority of many institutions such as finance, credit and insurance affairs and public health authorities which are assigned by administrative means also conforms to administrative boundaries.
— Traffic generated by the above institutions may be connected with the visiting of other institutions as well.
— Public transport facilities take into consideration administrative boundaries. (Bus services for example conform to rural district boundaries.)

Expected trends in the evolution of the town and of its network of hinterlands are as follows:

— The importance of service functions taken in the wider sense has steadily grown during the past fifteen years, and this trend will continue in the future.

— The hierarchical value of urban functions constantly changes. During the past fifteen years, for example, the rank of such functions as secondary schools, hospitals and clinics has fallen rapidly.

It would follow from these that the development of the institutional network of the rural areas involves a decrease in the significance of towns, and an equalization of the level of services provided. These measures would naturally weaken the relationship between village and town. This view has been expressed by those concerned with settlement planning as well.

However, one cannot ignore the following considerations:

First, while certain institutions drop lower and lower in the hierarchy of values, new institutions constantly appear at the top of the hierarchical order.

Secondly, with the increasing requirements and growing purchasing power of the population, the broadening of social, public health and educational services, for instance, counterbalances the possible growing centrifugal effect of the rural institutional network. In spite of the fact that the *share* of the towns, or more specifically certain towns, in supplying services decreases their volume of turnover, in the overwhelming majority of cases actually increases. Consequently urban areas establish closer and more varied relationships with their environments.

The growing demand made on urban services can *increase* (or decrease) *the significance of individual towns. The changes naturally vary both in extent and pace.* Additionally, the differences may manifest themselves at various levels of the hierarchy and from sector to sector. There are no unequivocally accepted forecasts concerning the expected evolutionary trends in the urban hierarchy. According to certain assumptions, the role of towns providing higher-order services is growing, and, parallel with this, the significance of minor centres is gradually declining. At the same time, with reference to changes in the opposite direction, namely the already mentioned decentralization of certain service and supply institutions, and the rapid development of the institutional network of several lower-order centres, plans are being made for the general development of the institutional network of lower-order centres. The sources of contrary opinions are in part to be found in opposite trends which are also occurring in reality: for instance, the growing demands made on urban services which *manifest themselves in both the more frequent utilization and visiting of centres providing higher-order services.*

This dual manifestation of growing demands maintains the different trends for the time being.

Thus, the increasing utilization of urban services farther away from the larger towns *increases the significance of lower-order centres.*

At the same time, the demand for higher-order services gives prominence to the increasing role and relative significance of the larger towns. Parallel with this, the functions of small centres in the vicinity of large and medium size towns are becoming relatively less significant. Their hinterlands are disintegrating and villages are establishing direct relationships with higher order centres. This process has characterized the relationship between Nyíregyháza, on the one hand, and Nagykálló, Baktalórántháza and Kemecse on the other. The relative decrease in travel costs, the increase of leisure time, and the spread of private transport facilities will in all probability accelerate this process.

During the past fifteen years, the rapid development of lower order centres was observable in the area investigated. The growth of Nyíregyháza, and of the third order centres of Kisvárda and Mátészalka, lagged behind the desired standard. Yet the growing requirements of the population will necessitate above all the future expansion of the urban functions of these centres.

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BIBLIOGRAPHICAL ABBREVIATIONS

MONOGRAPHS OF GENERAL INTEREST:

A dunai Alföld (1967) (The Danubian Great Plain). *Magyarország tájföldrajza* (Regional geography of Hungary), No. 1. Ed.: M. Pécsi. Akadémiai Kiadó, Budapest, 358.

A tiszai Alföld (1969) (The Tisza Plain). *Magyarország tájföldrajza* (Regional geography of Hungary), No. 2. Ed.: M. Pécsi. Akadémiai Kiadó, Budapest, 381.

Földr. Mon. = Földrajzi Monográfiák (Geographical Monographs). Akadémiai Kiadó, Budapest.

Földr. Tanulm. = Földrajzi Tanulmányok (Geographical Studies). Akadémiai Kiadó, Budapest.

Studies Geogr. = Studies in Geography in Hungary. Ed.: M. Pécsi. Akadémiai Kiadó, Budapest.

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PERIODICALS:

Agr. Tud. = Agrártudomány (Science of agriculture). Budapest

Bány. Lapok = Bányászati Lapok (Mining Gazette). Budapest

Demogr. = Demográfia (Demography). Budapest

Élelm.Ip. = Élelmiszeripar (Food industry). Budapest

Földr. Ért. = Földrajzi Értesítő (Geographical Bulletin). Budapest.

Földr. Közl. = Földrajzi Közlemények (Geographical Review). Budapest

Földt. Közl. = Földtani Közlöny (Bulletin of the Hungarian Geological Society). Budapest

Hidr. Közl. = Hidrológiai Közlöny (Hydrological Gazette). Budapest

Konzerv és Paprikaipar (Canning industry and paprika processing). Budapest

M. Tud. = Magyar Tudomány (Hungarian Science). Budapest

MTA FKI jel. = MTA Földrajztudományi Kutató Intézet jelentései (Reports of the Geographical Research Institute of the Hungarian Academy of Sciences). Budapest

Megyei és Városi Stat. Ért. = Megyei és Városi Statisztikai Értesítő (Statistical Bulletin of Counties and Towns). Budapest

Műv. és Hagy. = Műveltség és Hagyomány (Culture and Tradition). Debrecen

OVF kiadv. = Országos Vízügyi Főigazgatóság kiadványai (Publications of the National Office of Water Management). Budapest

OT Tervgazd. Int. Közl. = Országos Tervhivatal Tervgazdasági Intézet Közleményei (Publications of the Institute for Economic Planning). Budapest

Stat. Szle = Statisztikai Szemle (Statistical Review). Budapest

Társ. Szle = Társadalmi Szemle (Social Review). Budapest

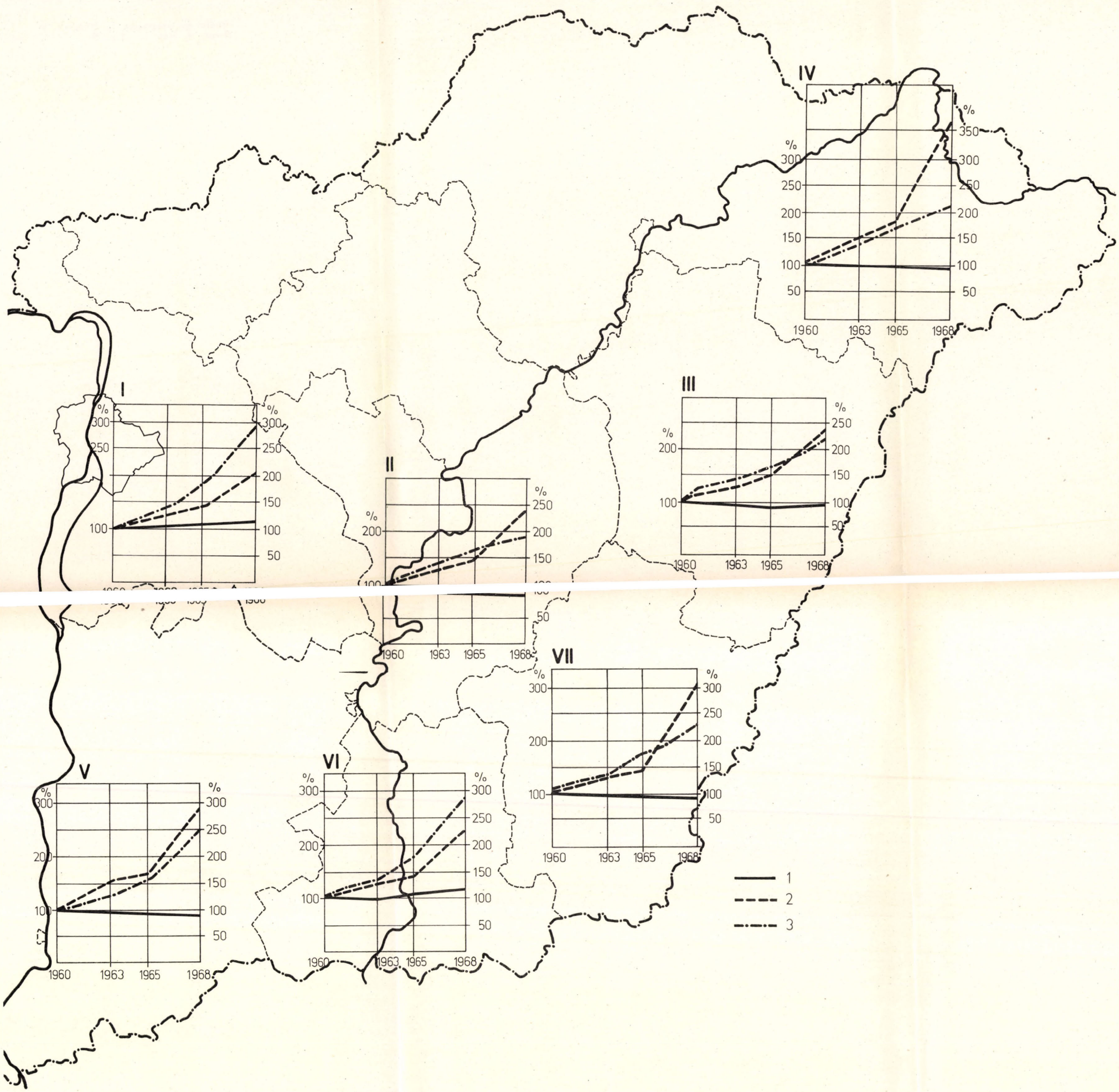
Ter. Stat. = Területi Statisztika (Territorial Statistics). Budapest

Valóság (Reality). Budapest

Városépítés (Town-planning). Budapest

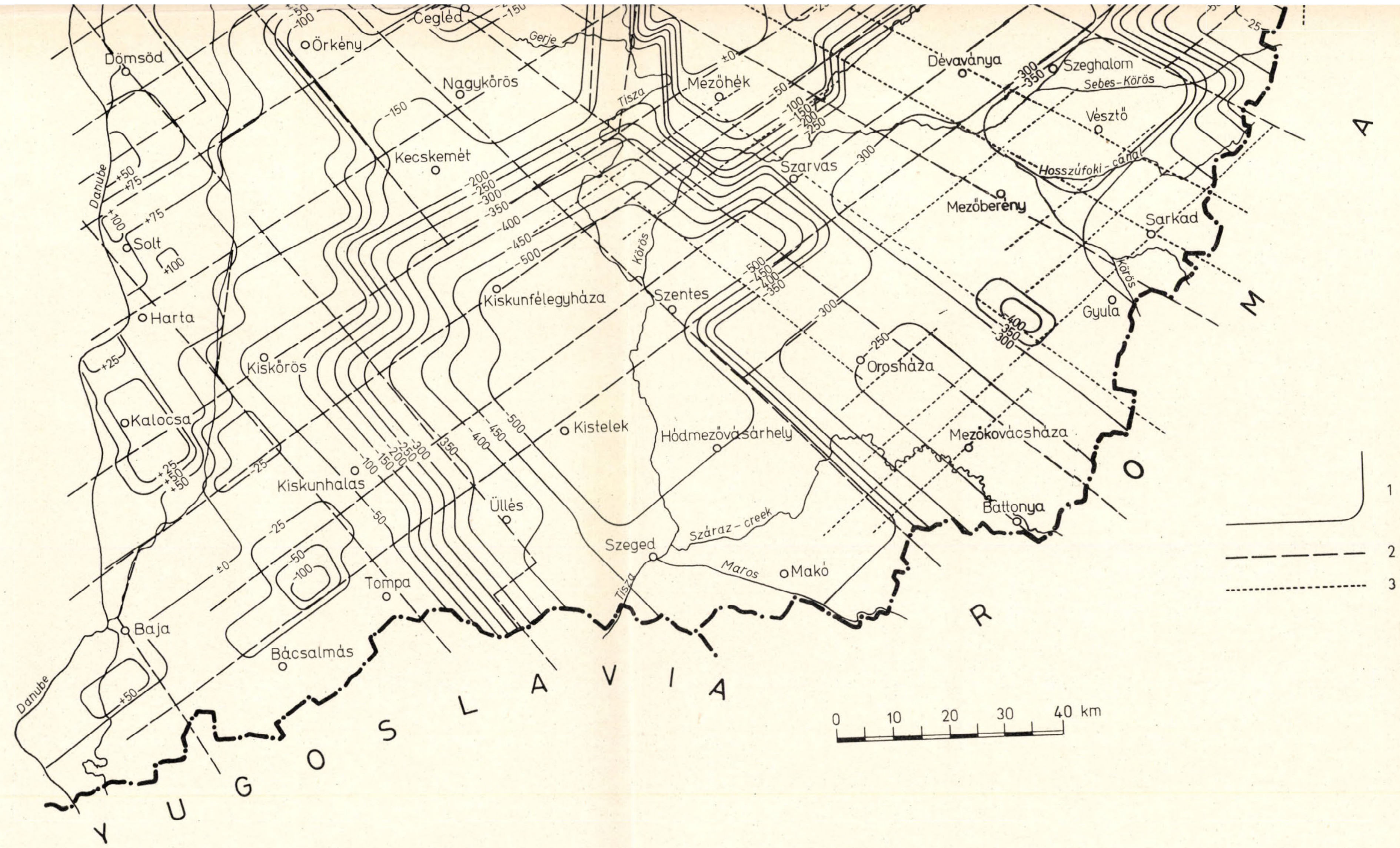
VITUKI Tanulm. és Kut. Eredm. = VITUKI Tanulmányok és Kutatási Eredmények (Studies and Reports of the Research Institute for Water Resources Development). Budapest

Vízügyi Közl. = Vízügyi Közlemények (Hydraulic Engineering). Budapest



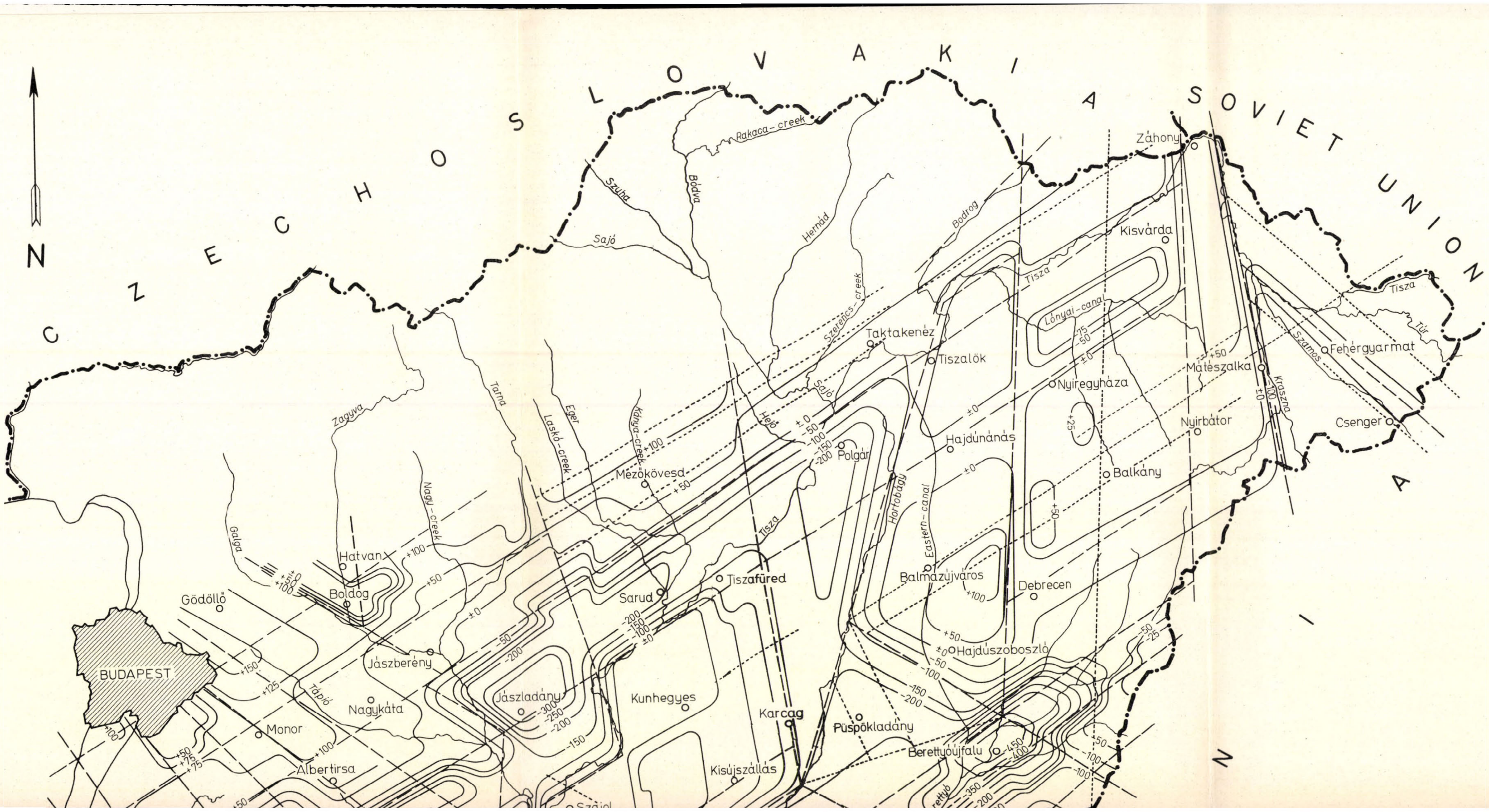
Map 1. Population changes in the counties of the Great Plain (1960 = 100 per cent)

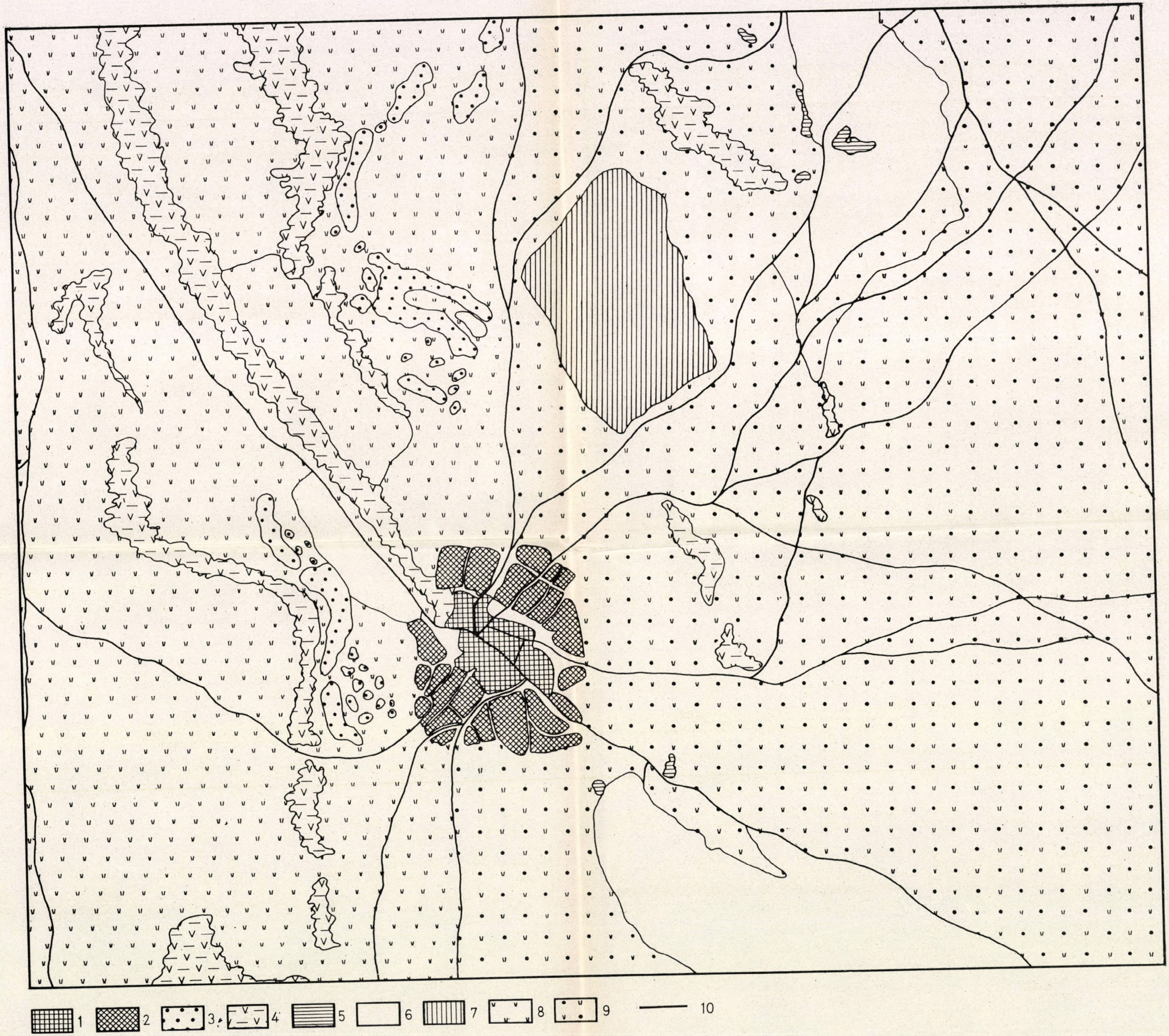
1 = change in the number of population; 2 = increase in the number of industrial wage-earners; 3 = increase of fixed assets. Counties: I = Pest; II = Szolnok; III = Hajdú; IV = Szabolcs—Szatmár; V = Bács—Kiskun; VI = Csongrád; VII = Békés



Map 1. Height (above sea level) of Quaternary sediments of the Great Plain with hypothetical structural lines (after J. Urbancsek)

1 = first order structural line and hydrographical district border; 2 = first order structural line; 3 = second order structural line



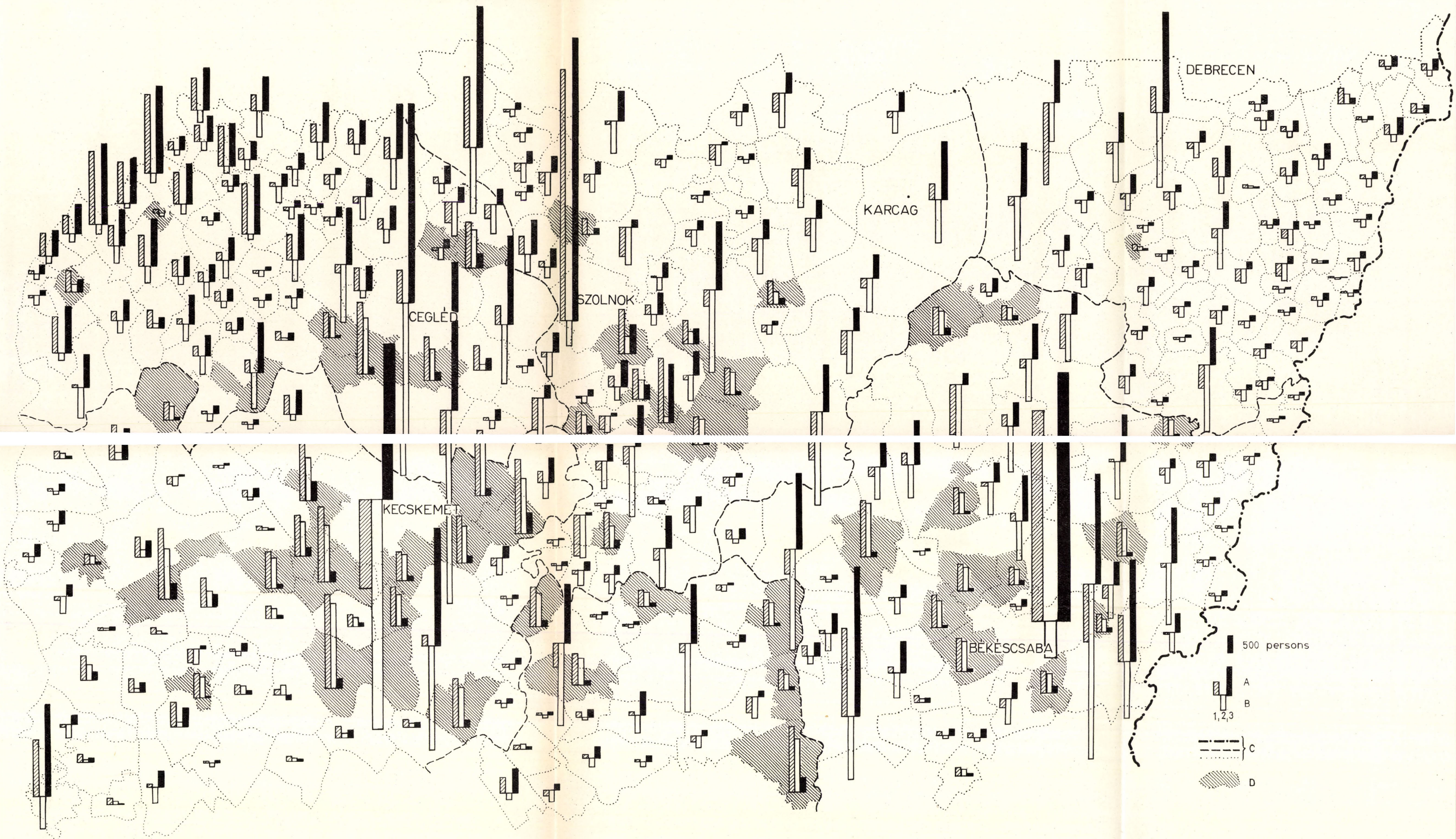


Map 1. Agriculcural land-use map of the Kiskőrös region, 1770

1 = built-up inner area; 2 = inner area of garden belt; 3 = marshy woods; 4 = reeds; 5 = water-covered area; 6 = arable land; 7 = vineyards; 8 = meadow; 9 = pasture on sandy soil; 10 = earth road

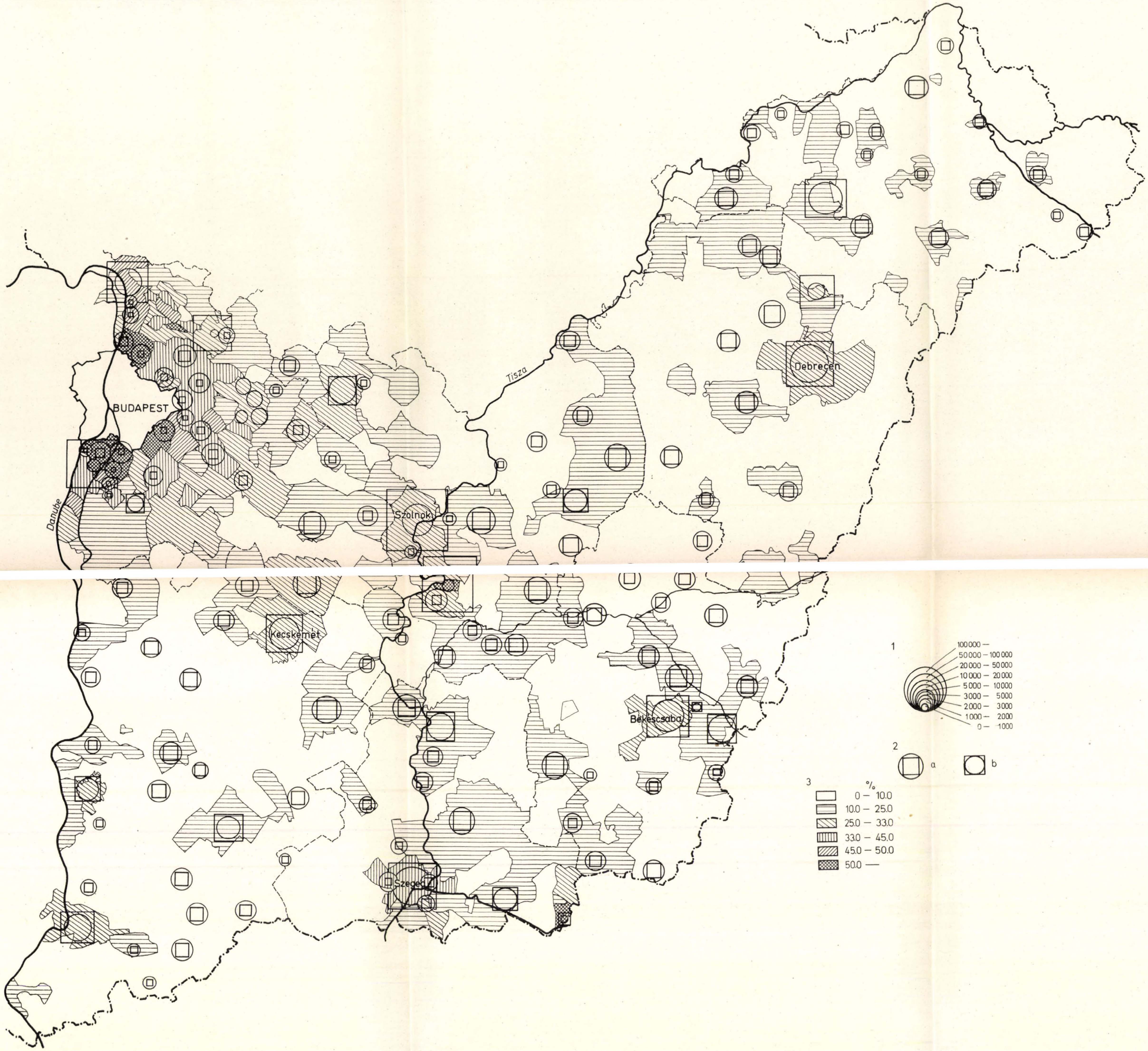
Map 1. Nyíregyháza as an attraction centre of retail trade. Degree of intensity measured by number of weekly purchasers per one hundred inhabitants

1 = above 15·1; 2 = from 8·1 to 15·0; 3 = from 4·1 to 8·0; 4 = from 2·1 to 4·0; 5 = from 0·6 to 2·0; 6 = below 0·5; 7 = no data; 8 = frontier; 9 = county border; 10 = district border; 11 = boundary of intensive attraction; 12 = commercial centres; 13 = number of purchasers attracted



Map 1. Occupational restratification of wage-earners, 1949—1960

A = increase; B = decrease: 1 = total wage-earners; 2 = agricultural wage-earners; 3 = non-agricultural wage-earners; C = administrative boundaries; D = settlements qualified as communities after 1949

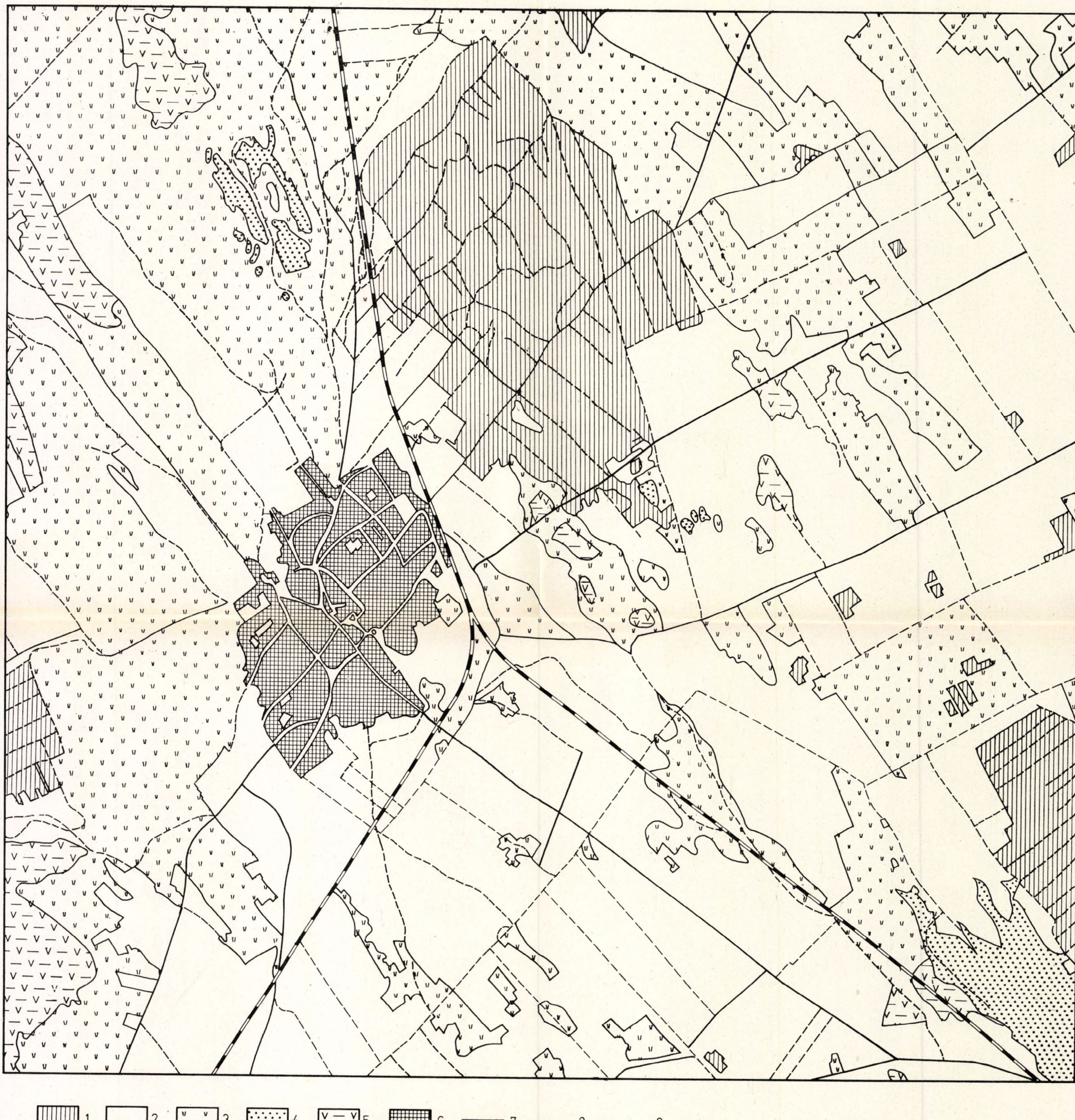


Map 2. Ratio of resident to non-resident wage-earners in the industrializing settlements of the Great Plain

1 = number of resident wage-earners (1,000—100,000); 2 = percentual ratio of resident wage-earners to all wage-earners (diameter of the circle: 100 per cent; the square being related to this); a = the number of resident wage-earners exceeds that of non-resident wage-earners; b = the number of non-resident wage-earners exceeds that of the resident wage-earners; 3 = ratio of industrial wage-earners to all wage-earners

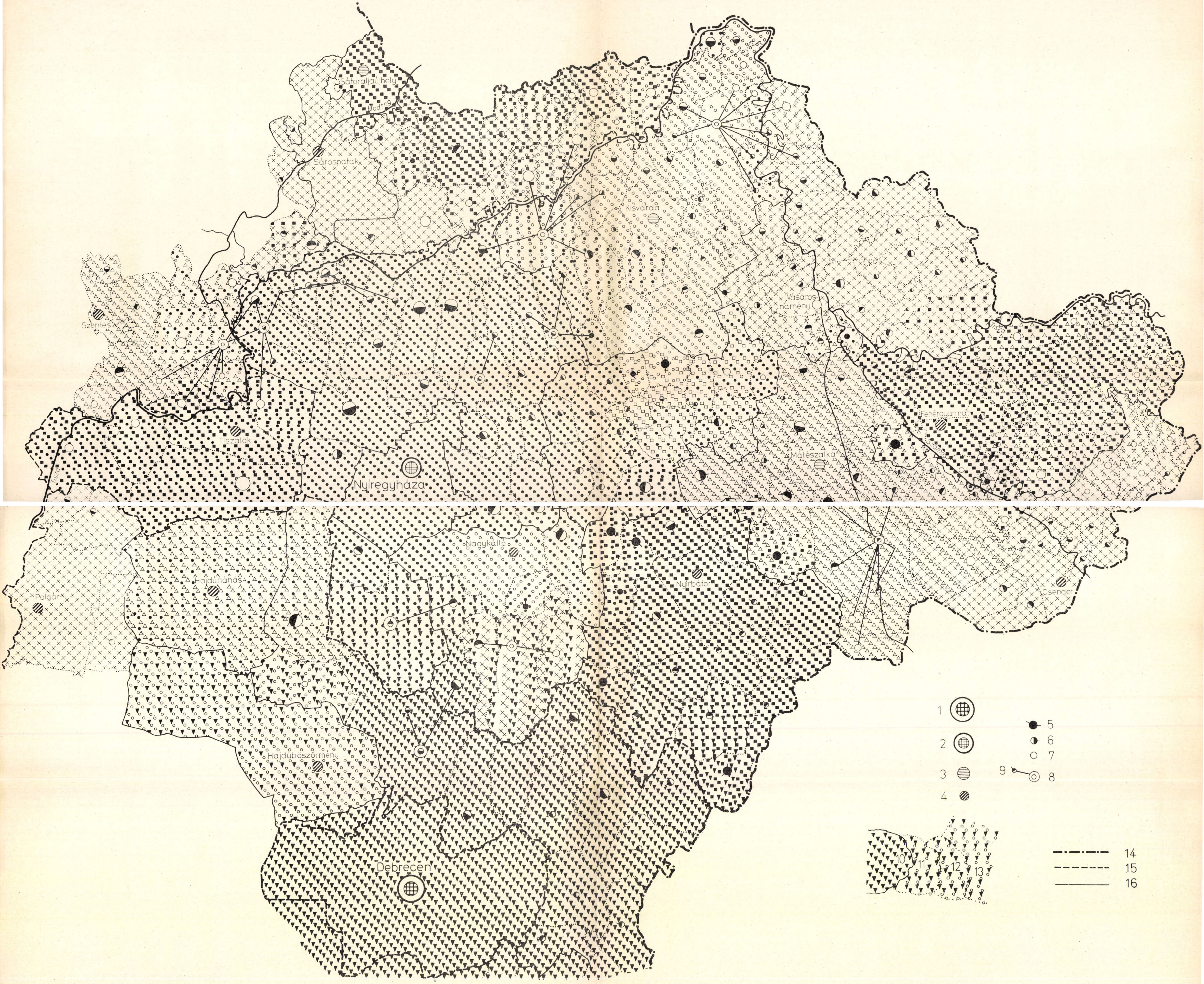
Map 2. Sites of hydrocarbon prospecting in the Great Plain

1 = petroleum; 2 = natural gas; 3 = carbon dioxide; 4 = nitrogen; 5 = seismic structure; I = first order prospective site; II = second order prospective site; III = third order prospective site; IV = site unsuitable for prospecting



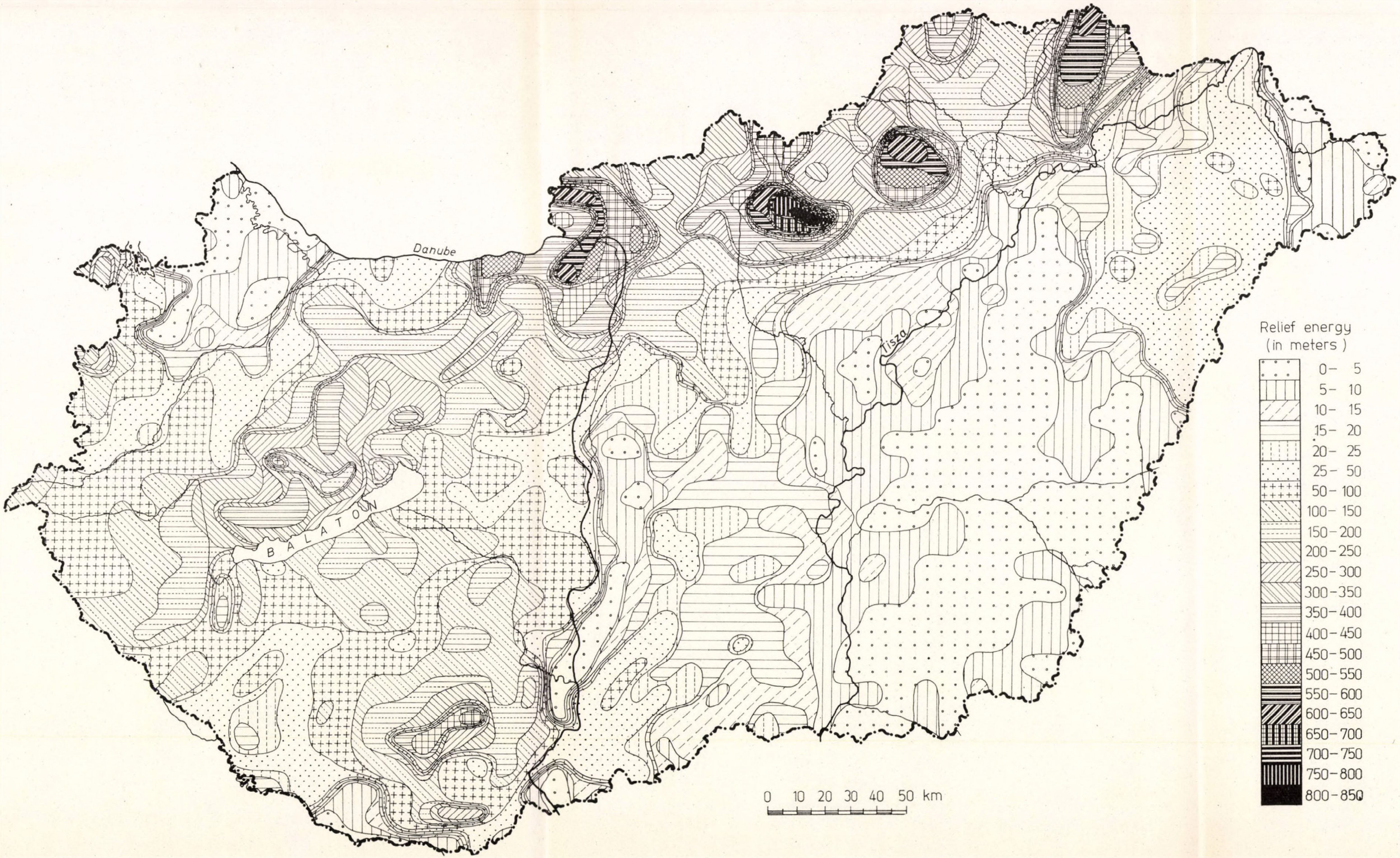
Map 2. Agricultural land-use map of the Kiskőrös region, 1880

1 = vineyards with interplanted fruit-trees; 2 = arable land; 3 = meadow, pasture; 4 = forest; 5 = reeds; 6 = inner area; 7 = railway; 8 = earth road; 9 = earth track

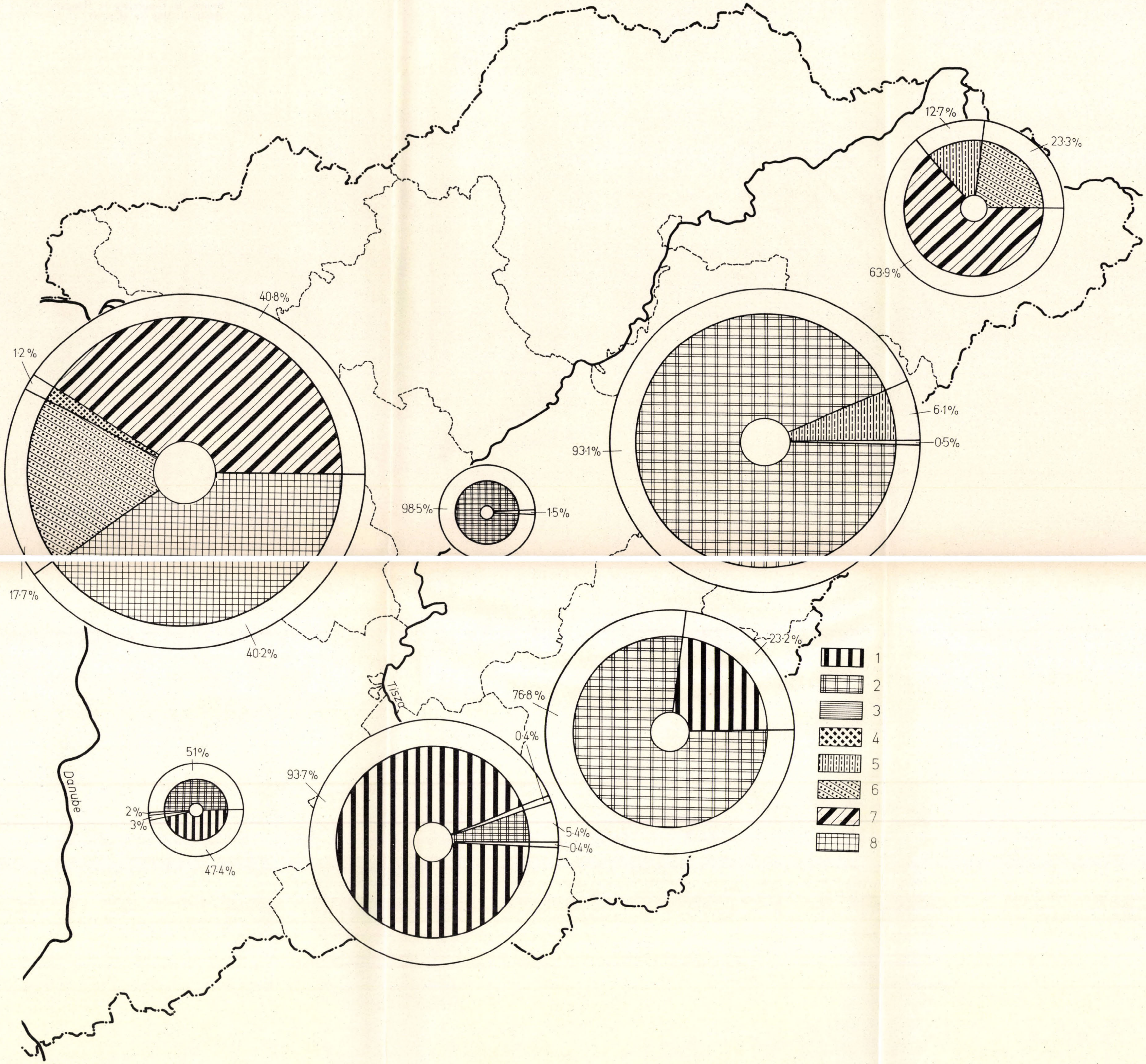


Map 2. Spheres of attraction in retail trade of the district centres in County Szabolcs-Szatmár

1 = first order; 2 = second order; 3 = third order; 4 = fourth order; 5 = settlement influenced by several centres; 6 = settlement intensively attracted by one centre; 7 = settlement not intensively influenced by a higher order centre; 8 = fifth order centre; 9 = settlement intensively attracted by a fifth order centre; 10 = exclusive sphere of attraction; 11 = dominating sphere of attraction; 12 = transitional zone; 13 = partial sphere of attraction; 14 = frontier; 15 = county border; 16 = district border

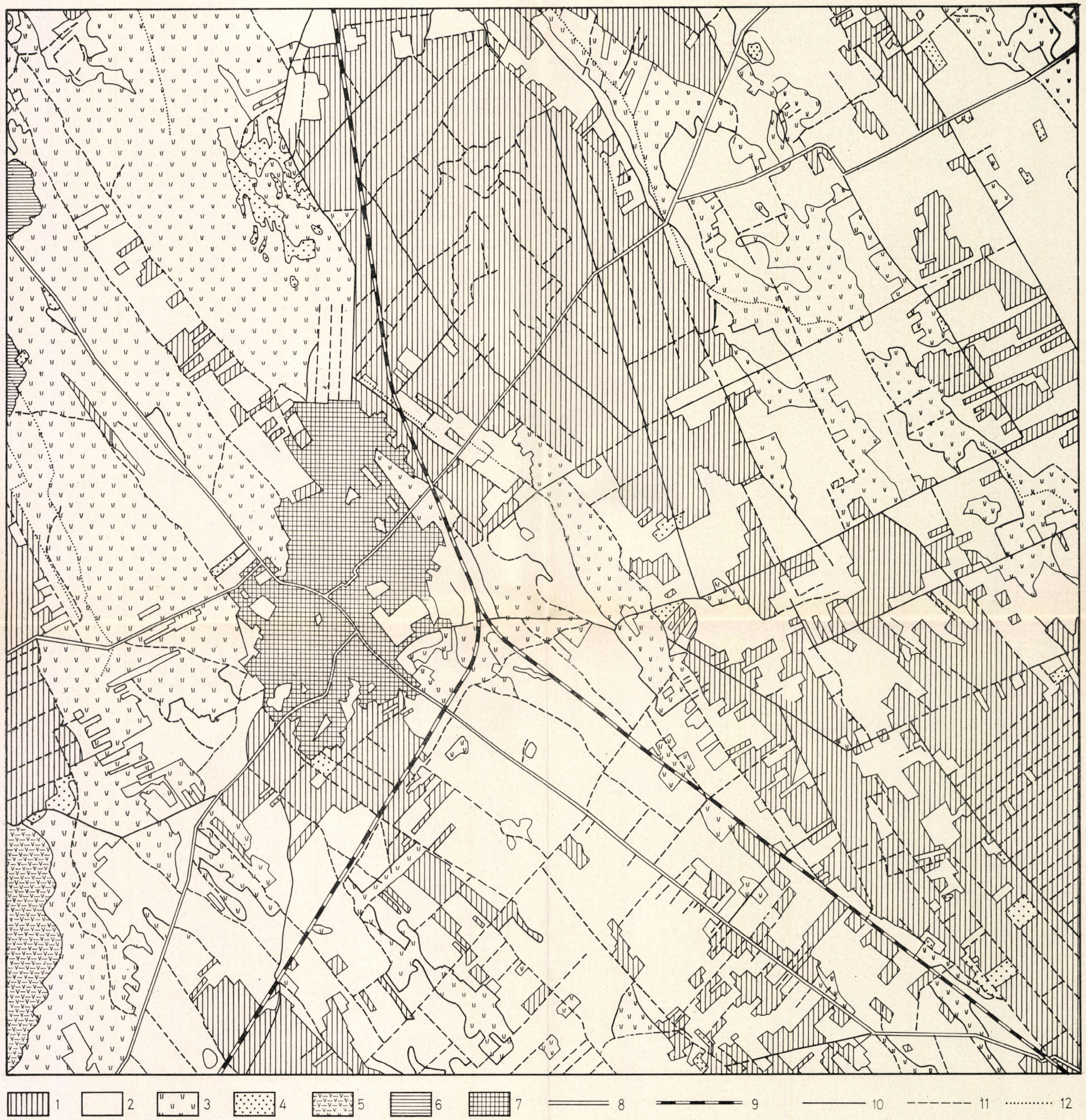


Map 2. Relief energy map (m per sq. km) of Hungary (after S. Láng and K. Vass)



Map 3. Energy production (Gkcal) of the Great Plain in 1968

1 = petroleum; 2 = natural gas; 3 = coke; 4 = town-gas; 5 = propane-butane; 6 = petrol; 7 = gas-oil and kerosene; 8 = fuel-oil

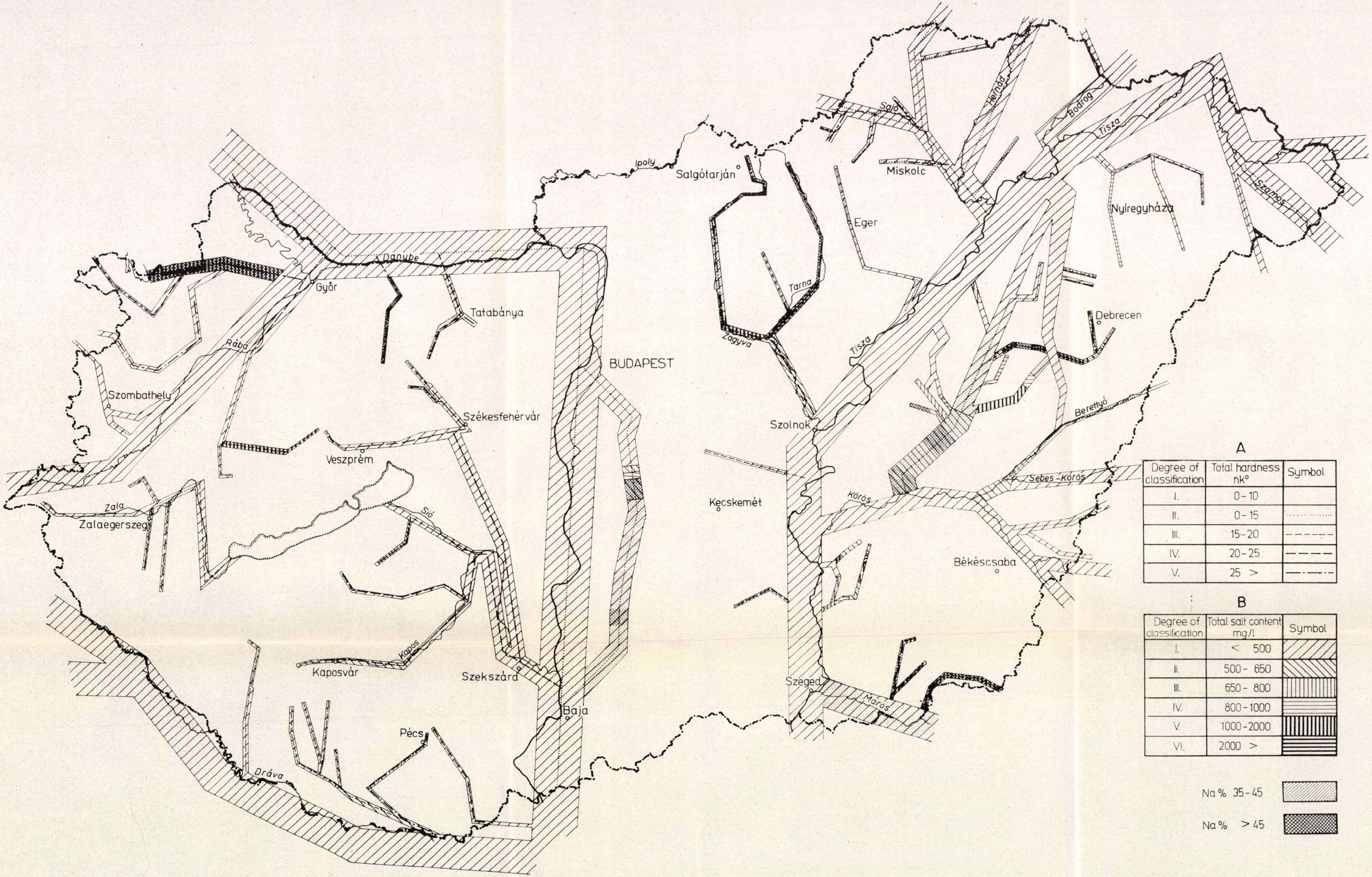


Map 3. Agricultural land-use map of the Kiskőrös region, 1950

1 = vineyards with interplanted fruit-trees; 2 = arable land; 3 = meadow, pasture; 4 = forest; 5 = reeds; 6 = water-covered area; 7 = inner area; 8 = highway; 9 = railway; 10 = earth road; 11 = earth track; 12 = drainage

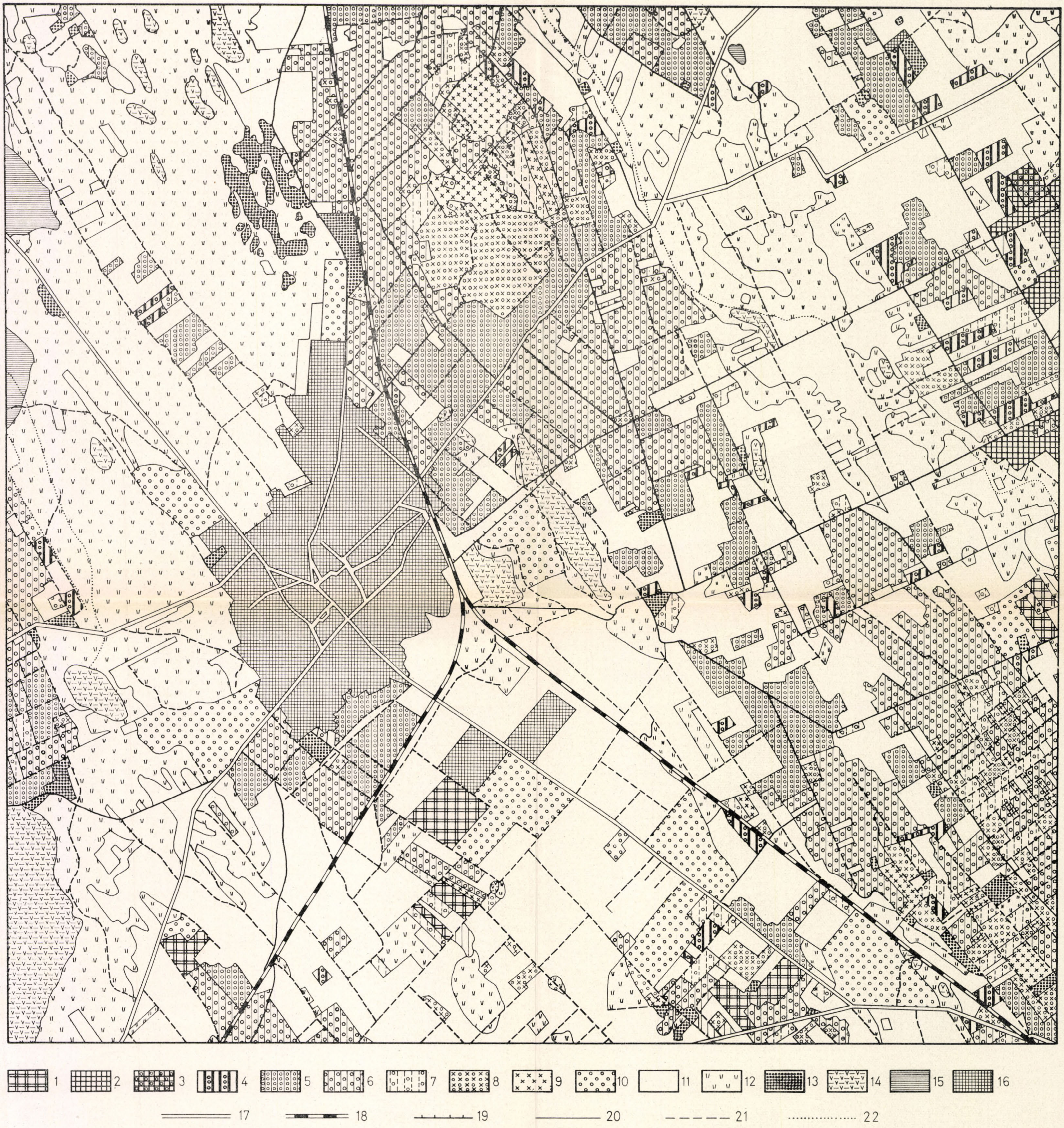
Map 3. Functional belts in the attracton zone of Nyíregyháza

1 = first order; 2 = second order; 3 = third order; 4 = fourth order; 5 = fifth order; 6 = exclusive fourth order; 7 = predominantly fourth order; 8 = partial fourth order; 9 = exclusive third order; 10 = predominantly third order; 11 = partial third order; 12 = attraction zone of county functions; 13 = partial attraction zone of county functions; 14 = fringe area of the attraction zone of Nyíregyháza; 15 = settlements intensively attracted by Nyíregyháza; 16 = settlements belonging to the fourth order zones of nearby centres; 17 = settlements belonging to the fifth order zones of nearby centres; 18 = frontier; 19 = county border; 20 = district border



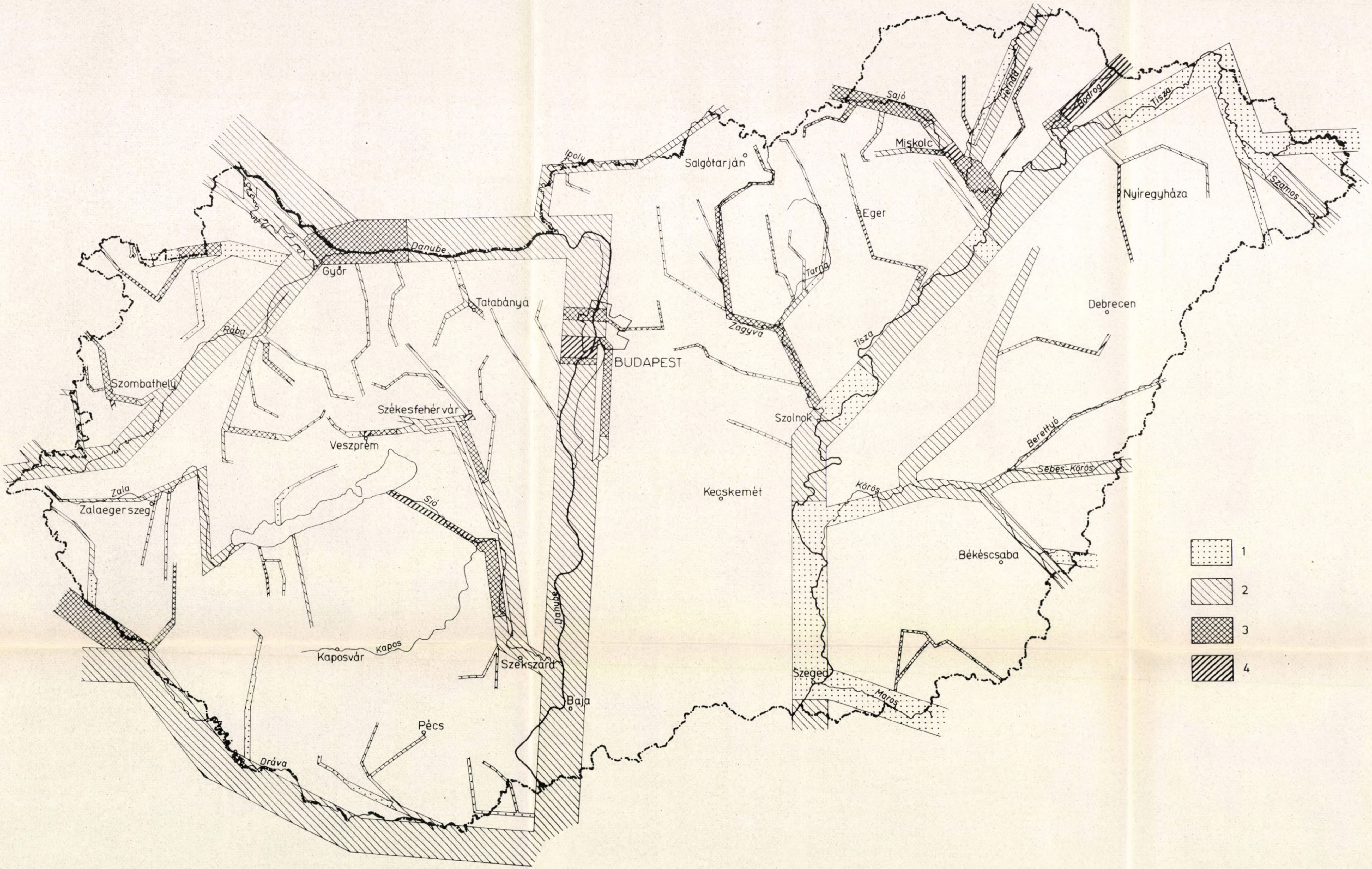
Map 3. Hardness, salt and sodium content in per cent of running waters (VITUKI)

A = qualification on the basis of hardness; B = qualification on the basis of salt content



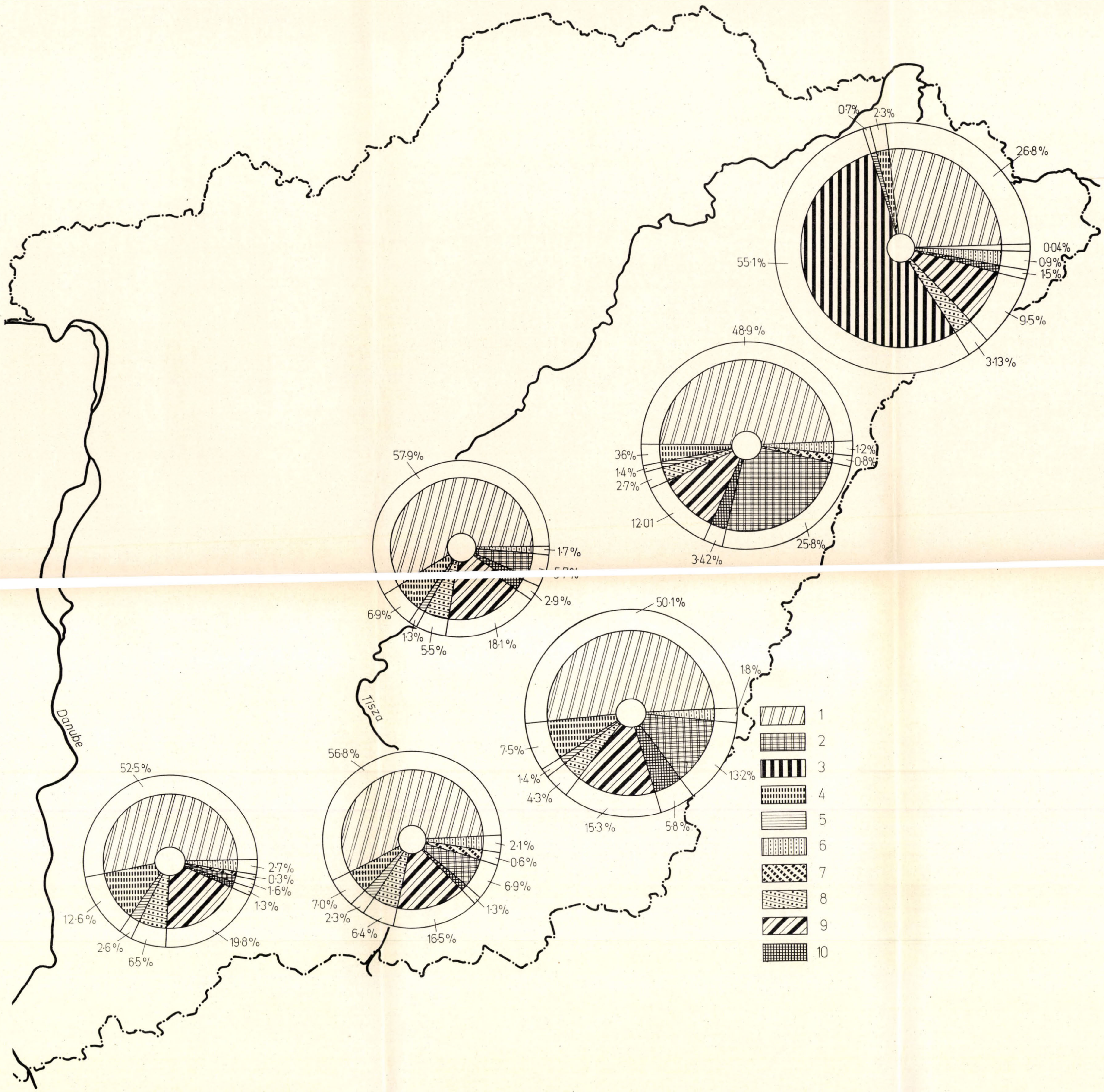
Map 4. Agricultural land-use map of the Kiskőrös region, 1965

1 = young trellis vineyard before bearing age, without interplanted fruit-trees; 2 = young productive trellis vineyard, without interplanted fruit-trees; 3 = young productive trellis vineyard with interplanted fruit-trees; 4 = young productive stake-vine with interplanted fruit-trees; 5 = renewed old stake-vine with full system of interplanted fruit-trees; 6 = renewed old stake-vine with incomplete system of interplanted fruit-trees; 7 = old, partially decayed stake-vine with incomplete system of interplanted fruit-trees; 8 = old decaying stake-vine with incomplete system of interplanted fruit-trees; 9 = decayed vineyard; 10 = orchards; 11 = arable land 12 = meadow, pasture; 13 = forest; 14 = reeds; 15 = water-covered area; 16 = inner area; 17 = highway; 18 = railway; 19 = narrow-gauge railway; 20 = earth road; 21 = earth track; 22 = drainage



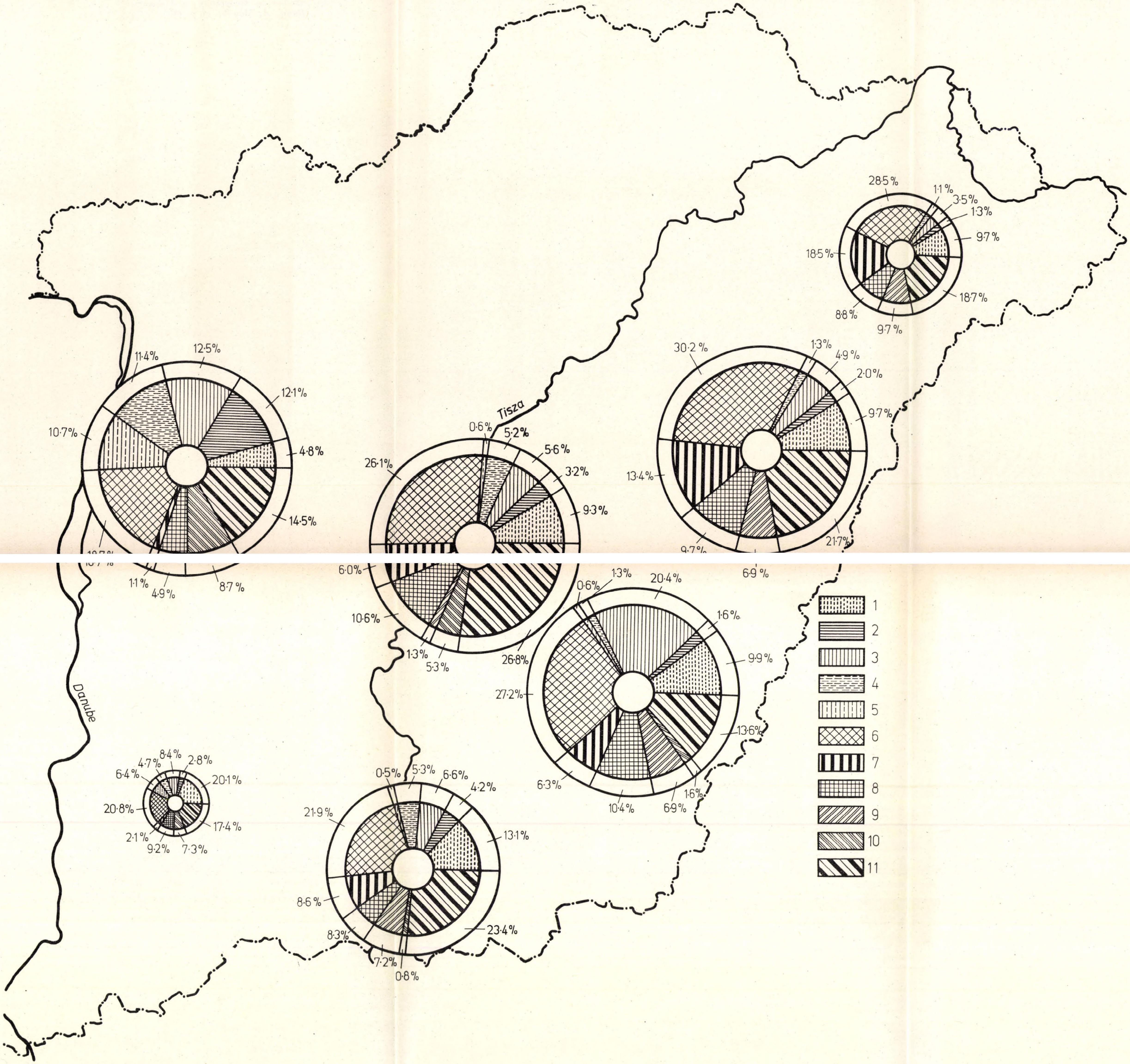
Map 4. Classification of the running waters of the Great Plain, from the point of view of public health (VITUKI)

1 = clean; 2 = slightly impure; 3 = impure; 4 = very impure. The width of the strips marks the extent to which the output of streams are used for household purposes (or in case of canals, for irrigation)



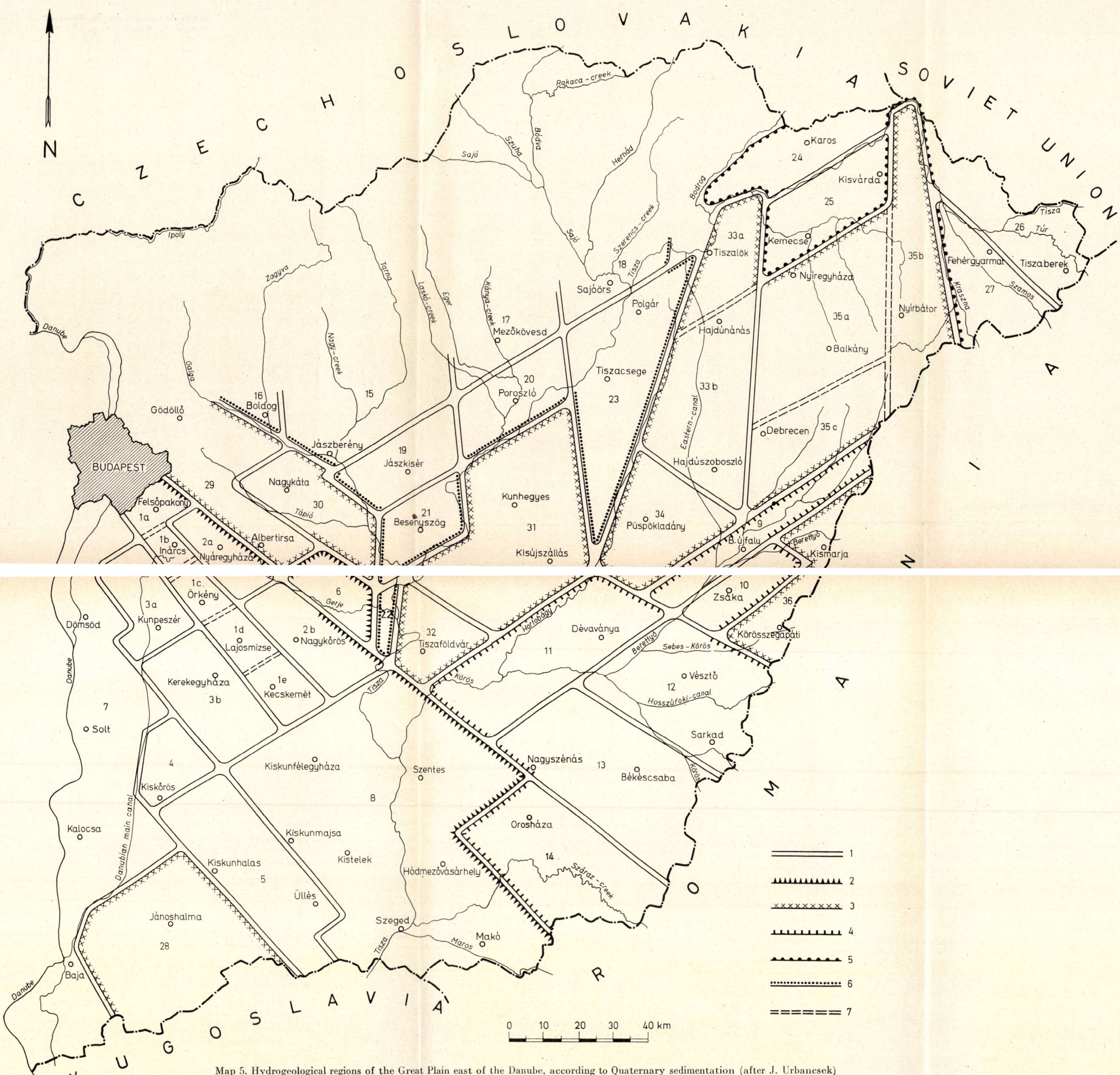
Map 4. Energy consumption (Gkcal) of the Great Plain in 1968

1 = coal; 2 = natural gas; 3 = petroleum; 4 = briquets; 5 = coke; 6 = propane-butane; 7 = town-gas; 8 = petrol; 9 = gas-oil and kerosene; 10 = fuel-oil



Map 5. Coal consumption (Gkcal) of the Great Plain in 1965

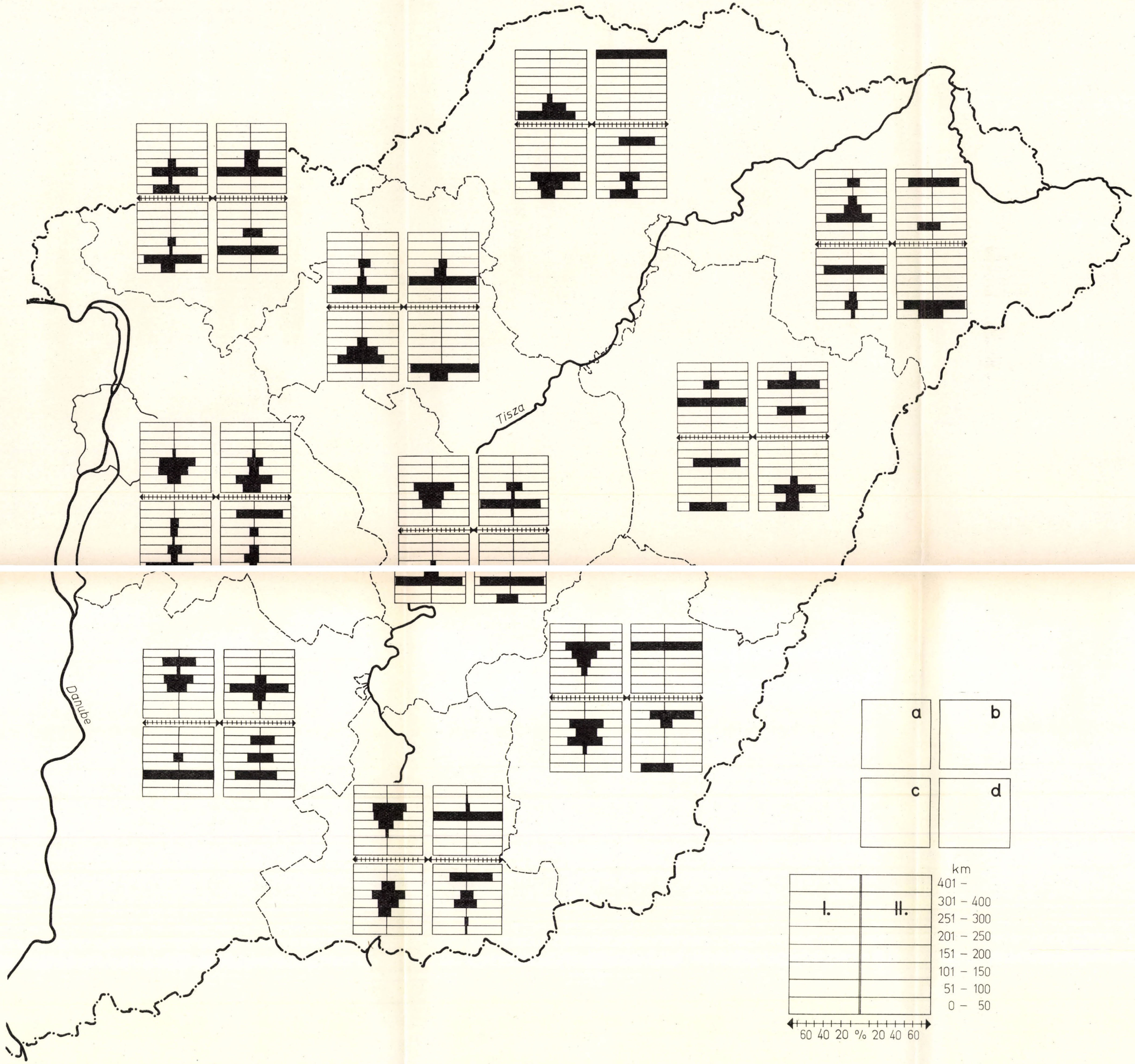
Place of origin: 1 = the Mecsek region; 2 = Dorog; 3 = Tatabánya; 4 = Oroszlány; 5 = Central Transdanubia; 6 = Borsod; 7 = the Ózd region; 8 = Nógrád; 9 = the Mátra region; 10 = Várpalota; 11 = imported



Map 5. Hydrogeological regions of the Great Plain east of the Danube, according to Quaternary sedimentation (after J. Urbancsek)

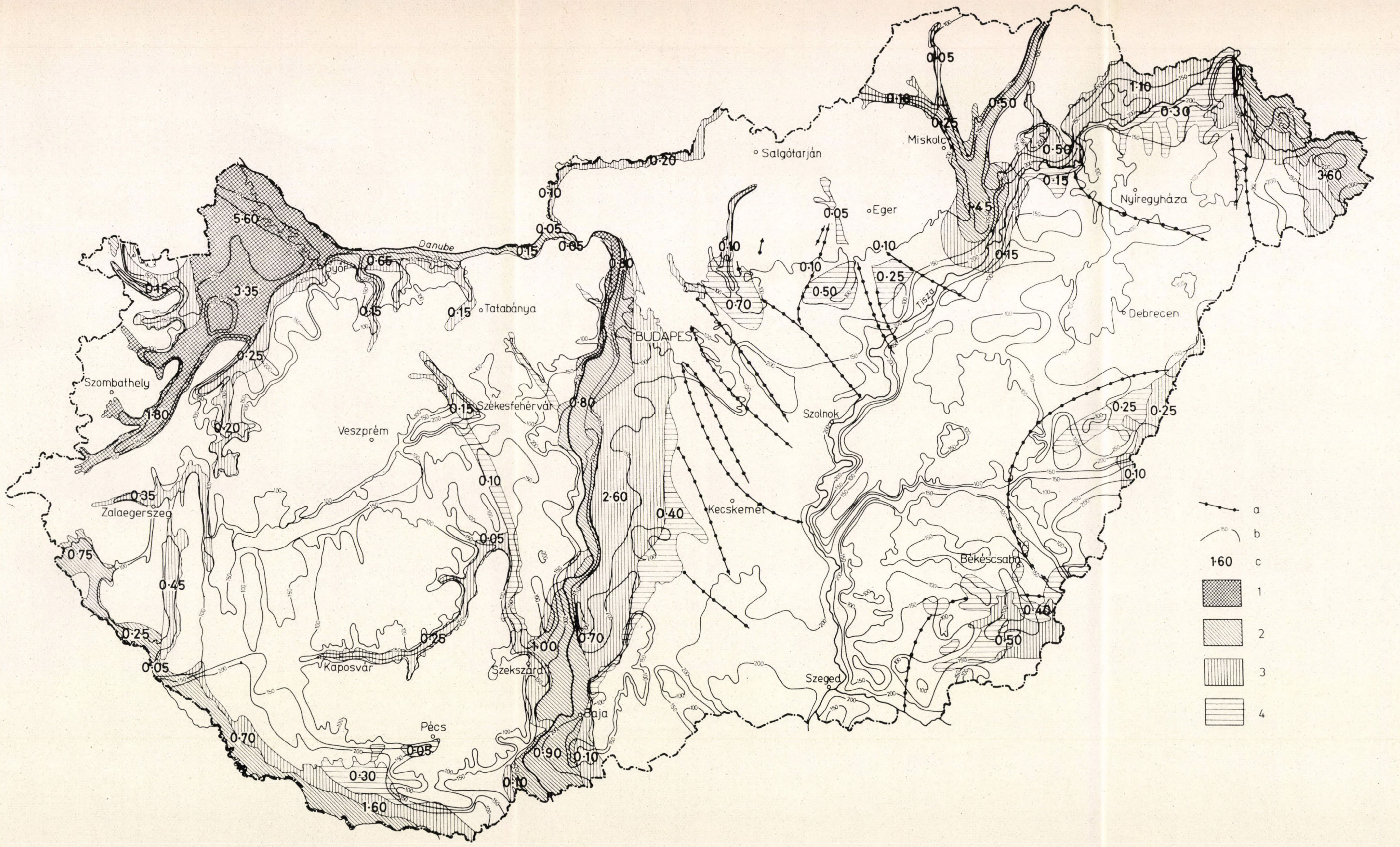
1 = borderlines of hydrogeological regions; 2 = structural basin of the Danube; 3 = elevated Pannonian ridge covered with Quaternary sediment; 4 = subsidence area of the Körös rivers; 5 = marginal subsidence of NE-Great Plain; 6 = subsidence of the N-Great Plain; 7 = borderlines of subregions in the hydrogeological regions.

Regions and subregions: 1 = middle part of the structural basin of the Danube: a = subsidence of Felsőpakony; b = ridge of Inárcs; c = subsidence of Örkény; d = ridge of Lajosmizse; e = subsidence of Kecskemét; 2 = NE-part of the structural basin of the Danube: a = Pannonian ridge of Nyáregyháza; b = Pannonian subsidence of Nagykőrös; 3 = SW-part of the structural basin of the Danube: a = Pannonian ridge of Kunpeszér; b = Pannonian subsidence of Kerekegyháza; 4 = subsidence of Kiskőrös; 5 = ridge of the Kiskunság; 6 = subsidence of Cegléd-Jászkarajenő; 7 = Danube valley; 8 = subsidence of the S-Great Plain; 9 = structural basin of the Berettyó; 10 = marginal subsidence of the E-Great Plain; 11 = Körös—Hortobágy Interfluve; 12 = subsidence of the Körös; 13 = subsidence of Békéscsaba-Nagyszénás; 14 = alluvial fan of the Maros; 15 = alluvial fan of the Zagyva and Tarna; 16 = basin of the Bodrog; 17 = alluvial fan of the Eger and Kánya; 18 = Sajó-Takta Interfluve; 19 = subsidence of the Jászság; 20 = subsidence of Heves; 21 = Zagyva—Tisza Interfluve; 22 = structural basin of Szolnok; 23 = alluvial fan of the Sajó; 24 = the Bodrogköz; 25 = the Rétköz; 26 = subsidence of Szatmár—Bereg; 27 = Szamos—Kraszna Interfluve; 28 = ridge of N-Bácska; 29 = Pannonian ridge of Gödöllő—Albertirsa; 30 = Zagyva—Tápió Interfluve; 31 = ridge of the Nagykunság; 32 = SW-part of the Nagykunság; 33 = the Hajdúhát: a = N-part of the Hajdúhát; b = S-part of the Hajdúhát; 34 = SW-part of the Hajdúság; 35 = the Nyírség: a = middle part of the Nyírség; b = E-part of the Nyírség; c = S-part of the Nyírség; 36 = Pannonian ridge of the E-Great Plain



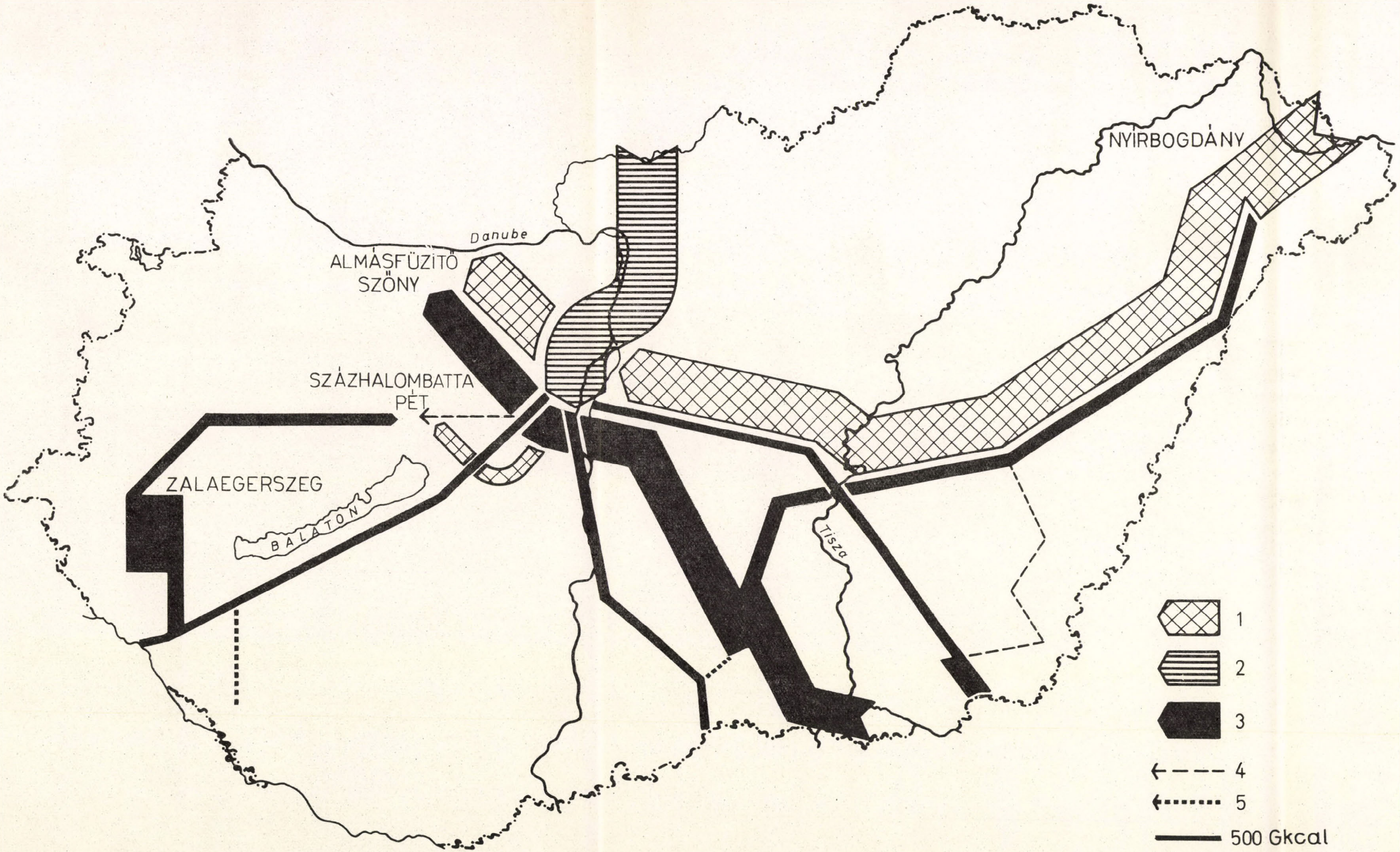
Map 6. Participation in per cent of the counties in the energy sources according to transport costs and distance

I = quantities varying according to distance; II = transport costs varying according to distance: a = coal; b = briquets; c = coke; d = wood



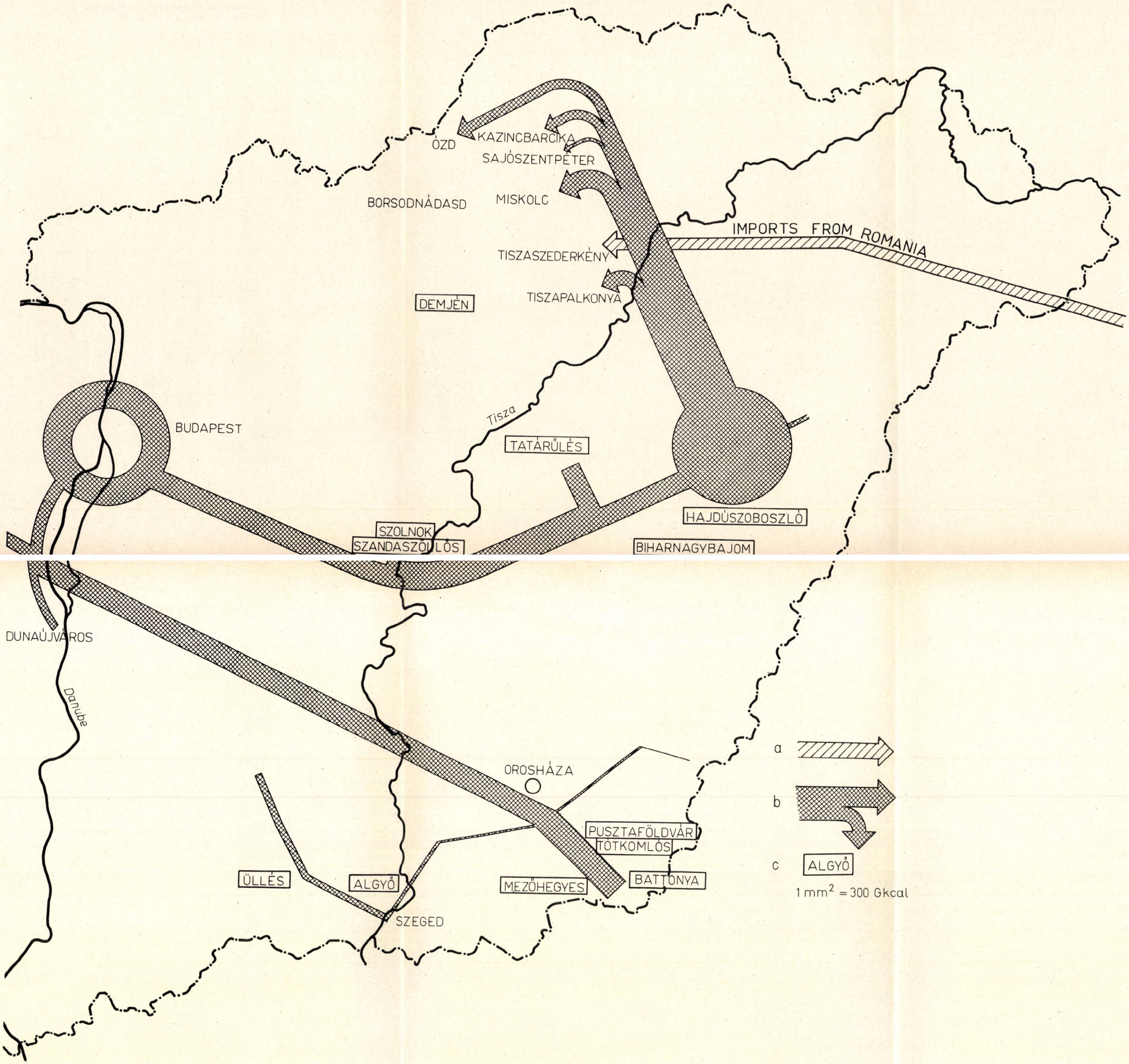
Map 6. Sites suitable for tapping groundwaters in the Great Plain (VITUKI)

a = hypothetical borders of alluvial fan wedging into the Great Plain (after E. R. Schmidt); b = average annual fluctuation of the groundwater level in mm. 1—4 = total circulation of the groundwater areas of thick productive layer (7·0—5·0), and of this, the par twhere horizontal water circulation takes place (3·5—2·0), counted on the basis of unit area (1/min/km²); c = total amount of groundwater reserve suitable for tapping (m³/min)



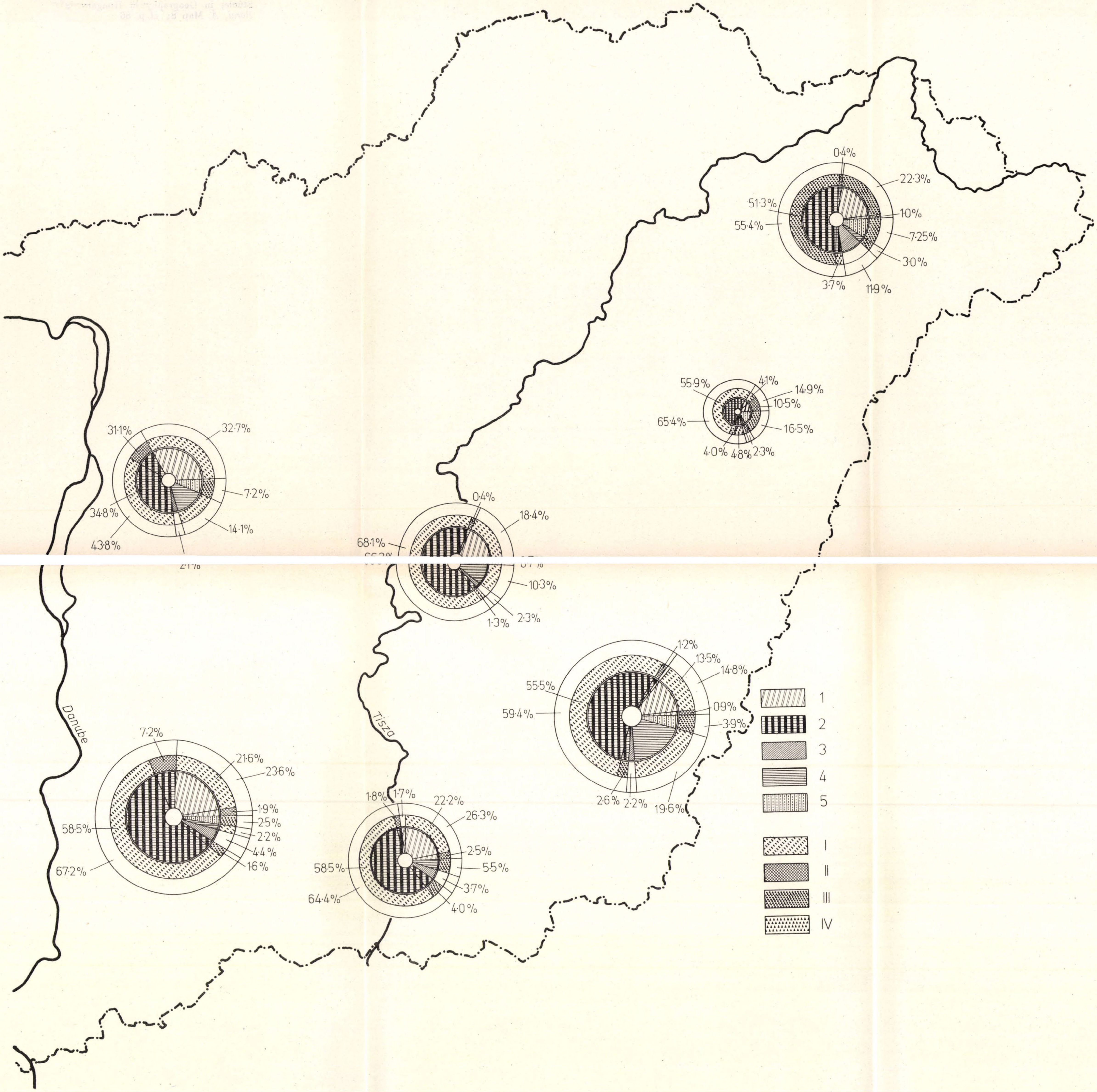
Map 7. Trends of petroleum transport (Gkcal) in 1968

1 = import by railway; 2 = import by pipeline; 3 = transport within the country; 4 = quantity below 300 Gkcal; 5 = quantity below 100 Gkcal



Map 9. Distribution of the natural gas consumption (Gkcal) in the Great Plain in 1968

a = import; b = home produced; c = natural gas field



Map 8. Consumption of petroleum products (Gkcal) by counties of the Great Plain in 1968

1 = petrol; 2 = gas-oil; 3 = kerosene; 4 = light sulphuric fuel-oil; 5 = desulphurized fuel-oil; I = Danubian Petroleum Refinery, Százhalombatta; II = Petroleum Refinery of Komárom, Almásfüzitő; III = Petroleum Refinery of Nyírbogdány, IV = Import from the U.S.S.R.

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