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GEOGRAPHICAL ESSAYS IN HUNGARY 1984

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Contribution to the International Geographical Congress
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GEOGRAPHICAL RESEARCH INSTITUTE
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GEOGRAPHICAL ESSAYS IN HUNGARY

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INTRODUCTION

The present collection of essays has been compiled for the programme of the 25th International Geographical Congress. The papers either follow or directly supplement themes from various sections, symposia and workshops. The intention was to make more Hungarian contributions available to Congress participants in addition to those which will be read and, in this way, do justice to the Hungarian scientists who will not be able to attend the Congress. However, for the above reason, this selection by no means gives a full picture of geographical research topics and the results achieved in Hungary since the last Congress, and this holds true for both physical and human geography.

Within physical geography, new methods of applied research into the natural environment are discussed by M. Pécsi, L. Góczán et al. and D. Lóczy--I. Tózsa, while two papers review research results in the study of agro-ecological (L. Góczán) and touristic (K. Molnár--I. Tózsa) potential. L. Jakucs treats questions related to hydrocarbon research through geomorphology, and a retrospective evaluation of the role of mineral resources in the Hungarian economy is given by Gy. Hahn. Two antropogene geomorphological contributions analyze the adverse effects human activity has on the formation of present-day relief features (F. Erdősi and Á. Kertész). Both fundamental and applied geomorphological aspects are highlighted in a study on the significance of seasonal groundfrost in erosion by Z. Pinczés. Traditional analytical geomorphological methods are presented in a study on the relief formation of a Hungarian mountainous karst region (A. Hevesi).

Three essays are included in the chapter headed Cartography and Geography: two of these provide comprehensive overviews of the status of, and developments in, this field (I. Klinghammer and Á. Papp-Váry), while the third gives a detailed description of one particular case of quantitative erosion mapping (A. Kerényi).

With regard to the purposely selective nature of this collection of studies, complementary information is given on some major, national, interdisciplinary research projects which are concerned, among other things, with the application of fundamental geographical research results in the solution of pressing practical problems (M. Pécsi, L. Góczán and J. Tardy).

Economic and human geography in Hungary has traditionally developed in close cennection with regional and settlement development planning. This relationship and the links with land-scape geography, as well as the influence of the German and French schools of human geography, are conspicuous in the mixture of research topics: population and settlement geography and, to a lesser extent, agro-geography predominates. It is also true, however, that for a long time, economic geography has had a sectoral bias and regional synthesis has been less developed. At the same time, there have been important developments in research trends during the past twenty years. One trend stems from the recognition that spatial changes, both social and economic, have a long-term character and cannot be fully planned. This development kindled a strong interest in lasting historical processes (E. Daróczi) and in their results as seen in present-day village types (P. Beluszky) or the specific features of urbanization (I. Berényi and J. Tóth). Another new trend is the attention given to the economic and administrative organization of space. In a period of no growth these organizational changes gain importance in shaping the spatial patterns. Interest in this field is represented by studies on agricultural policy (T. Bernát and Gy. Enyedi), spatial organization of industrial companies (Gy. Barta), changes in administrative divisions (Z. Hajdu), regional planning (Z. Tatai) and economic regions (Gy. Krajkó--R. Mészáros). A third new pehnomenon is the maturing of Hungarian socio-geography, and the rapprochement of geography and sociology in particular. This leads partly to a choice of new research fields and partly to a new handling of traditional geographical problems (J. Nemes-Nagy, I. Süli-Zakar and B. Sárfalvi).

Hungarian geography has not experienced a "quantitative revolution", but a steady evolution in the use of mathematical and statistical methods. Only few researchers deal explicitely with quantitative methodological problems (T. T. Sikos and I. Simon).

Finally, a critical evaluation of Hungarian geographical education is given in F. Probáld's paper, which has a chapter to itself.

It is hoped that the present volume of "Geographical Essays in Hungary" will not only arouse academic interest, but will also give a realistic picture of both environmental and socio-economic issues in a European socialist country striving for self-renewal.

György ENYEDI and Márton P[illegible]

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GEOGRAPHICAL ENVIRONMENTAL RESEARCH IN HUNGARY

Márton PÉCSI

INTERPRETATION AND IMPORTANCE OF THE TOTAL GEOGRAPHICAL ENVIRONMENT

Geographical research has always included geographical environment as a fundamental topic. Thus, the investigation and interpretation of the interactions between man and his environment has a considerable number of traditions.

Attention has been focussed, in geographical research, on the evaluation of physical environment and its resources together with the whole economic and management sphere due to numerous new circumstances. Such research is demanded by accelerated industrialization and urbanization, and by modern agrotechniques and the critical related environmental disequilibria. In addition, there is a need for appropriate precautions to e made which will protect the environment, and more efforts o use the environment itself rationally.[x]

conomic production difficulties of this, and a similar, kind k of economic equilibria, employment problems, etc.) nanded an emphasis on the fact that, in the last few years, e interpretation of the geographical environment of the iety had to be precisely specified and enlarged, and its aluation answer to practical demands (M. Pécsi, 1974, 1979; Pécsi--L. Rétvári, 1980).

our opinion, the geographical environment of the society only involves natural and cultural landscapes, but also pulation, all production and economic activities, together th the means of production, the field of activity, state d changes in the state administrative and supply system.

x Using UNO data, the expansion of settlements and towns definitely takes over 0.5 to 0.8% of agricultural land annually.

"Social relations" are inseparable from the geographical environment and this connection has developed through the economic, social, cultural and political circumstances and traditions of the society within transformed, man-made environment.

Using their predominant regularities as a basis, the parts of the total geographical environment interpreted in this manner can be divided into four different sub-systems:

1. natural environment (geosphere, ecosphere);
2. man-made environment (transformed nature);
3. socio-economic environment (sphere of production);
4. political/cultural environment (sphere of consumption).

It has been shown in detail (M. Pécsi, 1980, 1982) that consideration of the internal interaction of environmental factors is of primordial significance with regard to economic decisions and the scientific foundation of rational environmental utilization. Environmental research in this sense, and the interpretation of its peculiarities, has become a central concern of academic, practical and public education.

HARMFUL EFFECTS ON THE ECONOMY OF THE BIASED CONCEPT OF THE ENVIRONMENT

A comprehensive interpretation of the geographical environment is not just a theoretical requirement, as it has significant economic and political consequences. If the interpretation of the environment is biased, at least two fundamental dangers develop:

- The geographical deterministic concept of the environment is based on a one-sided principle of cause and effect, i.e. natural conditions govern social development, but the important role of socio-economic and cultural factor systems, as well as the interaction of these trends, are neglected.
- On the other hand, the over-estimation of the effect of social activity on economic evolution and the rise in living standards creates the other danger. The most extreme form of this danger is "environmental possibilism". This view ignores the effect of the physical environment and its causal relationships on production/economic/cultural, etc. factors. It has disadvantages from both the theoretical, and especially the practical, point of view, for example, it does not take into account the possible advantages and disadvantages of the differences in ecological and geographical potential between basic resources, habitat and site at the level required for economic planning.

In contrast to this one-sided environmental concept, our model of environment, consisting of four sub-systems, applies the principle of two-way interaction between factors. As well as the problem of inadequate thought with regard to planning and production, which can deprive the economy of surplus advantages, the one-sided concept of geographical environment often leads to environmental conflicts and considerable economic damage.[x]

INVESTIGATION OF THE INTERACTION OF ENVIRONMENTAL FACTORS FROM THE POINT OF VIEW OF ECONOMIC DEVELOPMENT

The ever increasing demand for an assessment of environmental interactions comes from the fact that, in the course of its rapidly growing production and consumption capacity, the society uses and transforms its physical environment in a more and more comprehensive way. As a result, the interactions between the different environmental sub-systems and their factors tend to increase.

The purposeful utilization of the environment and complex environmental management are fundamental aims of a rational economic policy. These aims consist of numerous tasks (landscape management, water policy, establishment of economic districts, settlement organization, environmental production, etc.), the optimal solution of which requires recognition of cause and effect relationships. Unfortunately, complete success is impeded by the fact that, recently, an intergrated assessment of the potential of the geographical environment is lacking.

The rational utilization of the potential of the physical environment (or ecological potential) would enable us to encourage the accumulation of economic, technical, and other potential, which in turn would affect the historical development of the region concerned. The latter potentials may themselves become integrated environmental potentials.

Environmental potential (geographical environmental potential) integrates all the capacities of and possibilities for cultivation, production, economic and political organization, etc. The factors which constitute the four sub-systems of environmental potential embody these qualities.

A complex evaluation of both the physical factors and man's productive and non-productive activities in a region reveals the environmental potential of that region.

The planning, preparation and realization of decisions related to the development of settlements and a closely related infrastructure (road network, water and energy supply, recreation and other facilities) need assessment of the interactions between the sub-systems of the total geographical environment.

x This is indicated by an OECD report: in the industrially developed countries, the costs of environmental damage caused by large-scale construction and production amounts to 3--5% of the annual gross production.

In order to aid the effectiveness of the general environmental development, on a national or regional scale, the elaboration of economic development directives has also become traditional in Hungary. In the discussions and reports on such general concepts, geographical science has played an increasingly greater role over the past years. Nevertheless, among these discussions and reports, with some exceptions, sectoral concepts predominate. This reflects the recent predominantly sectoral management of the Hungarian economy, which does not reveal the role of intersectoral interactions to the required extent, thus failing to assure the balanced development of the economy itself.

The related disadvantages occur ever more frequently, so a comprehensive investigation of the geographical environment, as well as a complex assessment of its potential, has become a major modern concern. Recently, initiation steps were made to formulate system-based directives which would assess the interactions between natural, production and social factors.

COMPREHENSIVE INVESTIGATION OF THE GEOGRAPHICAL ENVIRONMENT AND THE ROLE OF GEOGRAPHY

Although recognition of the interactions between the factors making up the geographical environment of society and the subsequent outcome, is essential in geography, it should be noted that geography alone cannot solve this problem. However, none of the other disciplines could accomplish this alone either. The collection, storing and processing of general as well as particular natural, technical, economic, social and political information are needed to assess the total geographical environment in a region, or to judge its changes. This programme requires a close co-operation between the disciplines and the actual systems at work (economic, state and administrative).

What can geography do to further such a time-consuming program ? On the one hand, the number of geographers is relatively small and, on the other, the majority of them only deal with special areas of the geographical environment.

Without overestimating our own science, it can be said that geography has considerable traditions and multifarious methods with which to investigate the cause-and-effect relationships of the factors of geographical environment. In research into the spatial differences and temporal changes of this system of relations, geography is in an advantageous position compared to earth, and other, sciences.

As is well-known, these types of research are very complicated and are usually associated with never-ending observations and analyses. In spite of this, <u>geography should play an initiating role in the development of methods and the improvement of environmental research.</u> Geography will only be able to satisfy this social demand when geographers elaborate models for the comprehensive investigation of the given environment and make suggestions for interdisciplinary, systemized research. The International Geographical Union could ease this problem by promoting the creation and operation of an effective interdisciplinary commission.

Unfortunately, until recently, this comprehensive research of the environment has only been initiated and supported where and when conflicts or crises have occurred in environmental management.

RESEARCH TRENDS IN HUGARIAN GEOGRAPHY

The Hungarian Academy of Sciences, co-operating with government authorities responsible for social, economic, technical, scientific and cultural development, has put forward directives for medium- and long-term research projects. These research trends aim to solve those problems most important both in science and practice. A major part of research activity has attracted considerable financial support.

In the last decade, Hungarian geography has taken part in several research programmes for the government and ministries. Geography played a principal part in the three research projects below:

(a) "The comprehensive scientific investigation of Hungary's natural resources", a major research project at a government level, which is guided by the Hungarian Academy of Sciences. One of the most important institutes of research in this is the Geographical Research Institute of the Hungarian Academy of Sciences, where the co-ordination office operates.

(b) "Research into the protection of the human environment", a major research project at a ministry level, governed by the National Authority for Environmental Protection and Nature Conservation.

(c) "Research founding directives for settlement development", a major, inter-ministerial research project governed by the Ministry for Building and Town Development and the National Planning Office.

The aims of the research projects present some complicated problems and traditional geographic methods have proved unsuitable for the purpose. In addition to the comprehensive investigation of the geographical environment, the application of the systems theory, mathematical methods and combined research procedures has become necessary. This means that a considerable methodological modernization process has occurred in Hungarian geography, which also involved a rejuvenation of research attitudes.

- The above projects are partly fundamental research and partly design-oriented investigations. Through participating in these research projects, the practical evaluation of the geographical environment and the research method and concept of the systems theory, have gradually increased. This view came to the fore in the complex evaluation of different geographical regions as well as in the investigation and qualification of physical and economic geographical processes and objectives.

Methods assessing the quality of the physical and man-made environment have been elaborated which concern the possible utilization of the given geographical environment.

- A fundamental interdisciplinary concern has been to elaborate a uniform approach to the evaluation of the main natural resources, i.e. mineral resources, cropland, waters, and atmosphere, and their endowments. With regard to this methodological research, partial results have been attained.

- An overwhelming percentage of Hungary's area is predominantly agricultural. Thus the complex (ecological and economic) evaluation of land, as well as the analysis of the correlation matrix of production factors, also came to the fore.

- Within this research, the comparative, quantitative assessment of natural factors pertaining to agricultural regions, as well as the computerized determination of land capability for plant cultivation, was carried out.

- Experiments are now in progress to assess the environmental potential for recreational and touristic activities, both individually and jointly, using natural and physiographic factors as a basis.

- The elaboration of the assessment methods and the typology of rural and urban settlements and of the socio-economic processes which support national settlement development planning, are well advanced.

- In the application of digital interpretation methods on space images, geographers played a pioneering role in Hungary. Remote sensing aids the rapid and simultaneous assessment of factors of geographical environment (relief), and of the state and changes of land use over large areas.

- Previously, geomorphology was chiefly concerned with the chronology of the relief. This concern played little attention to the effect of relief on the whole of the geographical environment. The new trend stresses the application of methods which express the effect of relief on other landscape-forming factors and on the utilization of the environment. Geomorphological mapping has been improved to further this purpose. The mapping of relief types and landscape types was assisted by assessment methods.

- Methodologically, regional landscape research and landscape type assessment have been closely related to the analysis of Hungarian agro-ecological potential and agro-ecological micro-regionalization. In this type of short-term research project, geography works together with a wide range of agrarian disciplines. The prognostics of Hungarian agro-ecological potential up to the turn of the millennium proved to be a successful project.

- Within the framework of the research projects, outlined above, and using results obtained in other research areas; the geographical monography of Hungarian landscapes and economic districts has been prepared (M. Pécsi--S. Marosi, 1981). In order to complete these long-term tasks, a team was organized which included, besides georgraphers, a wide range of experts from other disciplines. This team is attempting, among other things, to determine the environmental interactions between physical, economic and social factors in larger geographical regions. Further, the state of the environment and its changes will be assessed with regard to land utilization. Nevertheless, the uniformity and development of the desired quantitative evaluation methods only seem to improve slowly and gradually.

- This short survey was restricted to the research trends of interactions occurring in the geographical environment, but it was incomplete even in this respect. More detailed information can be found in other papers of this volume which itself cannot be, however, regarded complete from the point of view of recent geographical research trends, since articles have been selected on research topics related to the concerns of the Paris Congress of the International Geographical Union. Methods and results in research trends well-known internationally, such as karst morphology, geomorphological mapping, Quaternary and loess research etc., have been excluded from this volume.

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ANTHROPOGENIC GEOMORPHOLOGICAL RESEARCH IN HUNGARY

Ferenc ERDŐSI

On investigating changes in environment due to human (anthropogenic) activity, it was to those changes which occurred in the morpho-sphere that attention was first devoted. In the 1940--50's, in several highly-developed western countries, attempts were made (with various degrees of succes) to launch a new discipline, anthropogenic geomorphology. Hungary, along with other countries in East Central Europe, which had been predominantly agrarian in the past, only faced the environmental crisis experienced by highly-developed industrial states some decades later. This time lag explains why geomorphic activity had long been neglected in Hungarian physical geography, in both scientific theory and regional geomorphologic investigations.

The lack of former interest in this field is highlighted by the fact that research started, in the early 1960's, without any theoretical basis, conforming to the economically angled regional analysis of geomorphic evolution influenced by agriculture. In his non-sponsored research in the Szekszárd wine producing region, J. Pataki (1961 a; 1969 b) directed his attention exclusively towards the agrarian influence, on relief more particularly towards the specific landforms of the sloping vineyard areas. He was the first in Hungary to consider the topical nature of this research, which was then called "anthropogenic geomorphology" and he concentrated on the major changes which accompanied the transformation in landforms from centuries of small farming to large-scale farming agriculture. Collectivization, however, was not always successful with regard to soil conservation on slopes, since the formation of many large plots ignored the original microrelief.

Within the landforms of agrarian fields, J. Pataki investigated in depth immediate geomorphic evolution and the resulting forms which were induced and further developed through cultivation. Such features are hardly ever produced by natural forces (e.g. deep-cut tracks in loess, pseudo-terraces) or if they are, either very slowly (e.g. cirques) or in a different form. Others are produced in different places and ways (e.g. loess gorges, anthropogenic cirques). Thus J. Pataki considered forms of accelerated erosion in loess, as a result of agrarian activity, to be more or less anthropogenic. He came to this conclusion through his observations on the loess mantle, finding it less dissected in forested areas and the various loess forms fewer and less developed, while other forms were missing altogether. He specified the anthropogenic landforms associated with the various branches of cultivation (vineyard, arable land, pasture, etc.) on sloping terrains, the differences in their state of erosion, indicated most markedly by pseudo-terraces several metres high on their margins.

The Tolna Hills, including the Szekszárd Hills, an area of unconsolidated deposits, remained the principal site for landform studies, concerned with agrarian production in the 1960--70's. From experience gathered here, L. Ádám (1969) was the first to emphasize that anthropogenic micro-forms (steps, gentle slope segments, residual hills, pseudo-terraces) must also be taken into account in a physical geographic evaluation of micro-regions, in addition to the landforms, since Ádám regarded the micro-forms as tools for measuring accelerated erosion. Generally the founder of research into anthropogenic activity, as manifested in the physical conditions of the Tolna Hills, L. Ádám (1975) also assessed changes connected with geomorphologic alterations and those connected with other spheres that is, those with bio-geographic, hydro-geologic, and soil geographic aspects. It was also important here to consider the total physical environment, since changes in the vegetation cover (particularly in forested areas and in the composition of treee species) have as much influence on morphological processes as flood control and drainage have in the transformation of hydrography. Ádám compiled a body of useful and exact spatial distribution data on these processes by using a deductive method. In addition to determining empirically the actual level of soil erosion (a natural anthropogenic phenomenon) in 6 categories covering each micro-region in the hilly country investigated, he also calculated the occurrences of several natural anthropogenic landforms in Hungary which influence surficial ecological changes. (The dimensions of pseudo-terraces are given in hectares, while deep-cut tracks in loess, loess gorges, recent derasion valleys and hollows are given in km). Anthropogenic factors with negative effect include open-cast mines and fishponds (areas in ha). Ádám was also the first in Hungary to calculate kilometers values of artificial canals, roads and tracks and the areas in hectares of earlier or presently inundated flood-plains and agrogeneous terrains--all off these factors having positive effects. Along with F. Erdősi (1976), he indicated the area occupied by settlements and the relevant percentage values.

He primarily saw the influence of accelerated soil erosion due to cultivation (with a rate of 2 cm per year) as the result of slope form and slope inclination (angle). He was concerned with the development and dominance of eroding, sometimes heavily, convex slopes, and the increasing steepness of slopes, increasing by a maximum of 25 per cent per year by his calculations. He saw the main apparent forms of relief modification due to cultivation as including flat derasion valleys and the above-mentioned anthropogenic micro-forms related to loess denudation.

L. Ádám believed that the geomorphic impact of anthropogenic factors would have a catastrophic effect on the future of agricultural production. He assumed that, without powerful social intervention, the present, rapid evolutionary trend of the ever-changing surface will have set into a derasion valley formation and the processes of soil erosion which accompany sheet wash and linear erosion will be widespread.

Research into anthropogenic effects on particular geo-spheres in the Mecsek mountains and its environs in Southeast-Transdanubia began in the mid-1960's and, with some years' break, lasted into the mid-1970's. In this area, the impact of mining (coal, ore and natural building material), settlement development, transport, agriculture and water management (regulations etc.) has had considerable effect on the surface, surface and sub-surface waters, the atmosphere (F. Erdősi 1966--1980) and the biota (A. Lehmann 1970). As the list shows, anthropogenic geomorphological investigations constituted only a part of the research into the complete physical environment.

The Mecsek Mountains and its environs have been affected by anthropogenic influences of a diverse nature and intensity, so a survey of their effects necessitates comprehensive and inter-disciplinary research (not detailed here). The investigations, although conducted by single disciplines, answered three main questions: the nature and rate of geomorphic evolution types of landforms and their distribution. Awareness of anthropogenic processes led to a prognosis being prepared which highlights the trends future geomorphic evolution will take and proposals have been made regarding the reconstruction of surfaces consciously or unconsciously deformed by man.

General conclusions drawn from an assessment of partial results are that, since the second half of the 19th century anthropogenic geomorphic evolution has equalled, or exceeded the rate of natural change in the following ways:

- in the area affected, forestry and agriculture have the greatest influence, followed by water construction, development of transport lines and, finally, mining;

- in the intensity of effects, settlement development takes first place, followed by mining, development of transport lines and water construction. Agriculture comes last since it only causes deep changes after a long period.

In the matter balance of the area investigated, the accumulation of processes induced by man leads to a loss of matter. Because of direct and conscious transport by technical equipment, as well as indirect matter transport processes related to natural anthropogenic relief evolution, sediment output exceeds sediment input. This peculiarity is basically associated with two factors. The first is man-induced accelerated soil erosion which forms eroded soil masses into a centrifugal drainage pattern. The other main factor is mining and building material industries which have about three times more output than input.

Examining the cause of floods in the water system of the Tisza river, L. Jakucs (1982) concluded that flood pervention measures had resulted in substantial and, in future, potentially dangerous changes in the geomorphic evolution of the Great Hungarian Plain. The rivers (particularly the Tisza and the Körös) fill and raise the surface of interlevee floodplains considerably which brings about an inversion of recent accumulation levels. The process does not only increase the chances of high water developing into catastrophic floods, but also contributes to an unbalanced alluviation in sections of the Great Plain where subsidence is especially rapid and, thus, alters the geomorphic dynamics. In 85 per cent of the areas with rapid subsidence on the Great Plain there is no process to counterbalance the relatively rapid surface lowering, since fluvial alluviation no longer operates. Jakucs believes that there are long term ways of avoiding flood-plain accumulation, increased flood hazard and the rise in the grondwater table other than channel dredging and the raising of levees. He proposes establishing barrages on the uppermost Hungarian stretches of the main rivers, the basins of which are able to retain loads for at least 100--150 years. In addition, he urges the reforestation of mountain catchments, citing his own results to show that a 10 per cent loss in forest foliage involves a 5 per cent increase in the annual run-off coefficient.

It is a paradox in the history of this science that the general theoretical and methodological issues (concept, object, tasks, approaches, system and investigation methods) were only studied in Hungary following the regional analyses of anthropogenic geomorphological phenomena. F. Erdősi presented anthropogenic geomorphology as a new field within geomorphology in his papers published from 1966 onwards (1966 a; 1966 b; 1969) along with a review of the main trends and results in research abroad. In his 1969 article, he interpreted the system of anthropogenic geomorphological forces elaborated by E. Fels (1965) and J. Jäckli (1964) and gave a global and comprehensive picture of the morphological impact of particular branches of production. the afterlife of artifically generated land-forms, the methods of geodetic, cartographic, archaeological and botanical approaches, while also raising the much-debated question of the partial revision of geological uniformitarianism.

The leading authority in Hungarian geomorphology, M. Pécsi (1971), without regarding anthropogenic geomorphology an independent discipline, first evaluated anthropogenic processes in his theoretical works from an engineering geomorphology viewpoint and, first and foremost, responded to the question: to what degree has human technical and economic activity altered the equilibrium of the relief. Following the ideas of I.P. Gerasimov, A.N. Strahler, J. Tricart and others, he assumed, as his starting-point, the fact that the relief evolves through natural dynamic equilibria over a series of geological eras. Natural relief, therefore, is characterized by a temporary and dynamic equilibrium. Surficial changes caused by social activity have, however, grown in significance leading to disequilibrium in their effect against natural geomorphic processes. Society has transformed the natural environment into 'an environment of anthropogenic activity' through economic and technical interventions. Recent geomorphic processes were divided into three groups by M. Pécsi (after F.V. Kotlow), with regard to their relationships with human activity:

- natural processes and phenomena unaffected by human activities;
- natural anthropogenic processes which have undergone quantitative and qualitative changes due to human activities;
- anthropogenic geo-processes which are entirely due to human economic technical constructional activities.

According to M. Pécsi, "anthropogenic processes primarily differ from natural ones in the following ways: 1. the anthropogenic processes result from the economic technical activity of society (genetic difference). They are, therefore, not spontaneous... activities, but may, however, be accompanied by non-desirable secondary activities ...; 2. the rate and intensity of anthropogenic geomorphic processes are higher; 3. compared to the previous natural conditions, the processes considerably transform the environment of human activity; 4. the anthropogenic processes are better mastered than natural ones." Referring to technical economic demand, M. Pécsi states that the major research task is to reveal the laws behind the interrelationships between these three groups of geomorphic processes, as well as to investigate natural processes and phenomena, from the stance of human activity rather than purely the stance of geomorphic history. He sees a common feature of natural and anthropogenic geo-processes in the government of the dynamic disequilibria of relief-forming agents and their development by zonal and local natural conditions. He found a basic difference in the fact that the anthropogenic geo-processes are active against the physical environment. He conceives anthropogenic geomorphic evolution as a consequence of all kinds of man-induced relief disequilibria.

As a concrete research task, he mentioned the collection of geomorphological information on relief. This would be of great use in the planning of landscape architecture and reconstruction within complex regional research. It would also be useful with regard to the protection of a particular environment. As a guideline, he set out in his system the direct and indirect effects of man and society on relief, dividing them into 4 groups.

Of all the achievements stemming from the comprehensive activity of the school established and directed by M. Pécsi, the works of only two researchers are cited here.

In the early 1970's, during on engineering geomorphological survey, S. Leél-Őssy (1973) determined, mapped, and grouped, using Pécsi's system, the natural anthropogenic and the anthropogenic processes and features covering an area of about 115 km^2 in the vicinity of the town of Ózd, North-Hungary, an area famous for its metallurgy and mining industries.

The survey points to the overwhelming abundance of anthropogenic landforms which have almost completely obliterated the oringinal relief. Spreading takes place radially from Ózd, along valleys or main roads following valleys. The processes which produce these forms disturb the dynamic equilibrium of natural processes, on the one hand, and transform natural landforms into natural anthropogenic ones on the other.

According to S. Leél-Őssy, natural anthropogenic processes and landforms can be grouped in two ways: by the genetics of natural processes or by the nature of anthropogenic intervention. A problem which arises with regard to the former grouping is the extent to which anthropogenic processes influence various natural processes and forms (e.g. what are the modifications in landslides, erosion streams, soil erosion or river valleys). In the second grouping, research is focussed on how anthropogenic interventions (e.g. excavation, deformation, artificial filling and relief development, etc.) change topography and what natural anthropogenic processes are then triggered off. These processes and features were only briefly treated in his paper and the partially proven hypotheses more frequently focussed on the role of anthropogenic factors in particular mass displacements (e.g. the role of deforestation or coal-mining in creating slides: a well known of example is the case of the dammed up Lake Arló in Hungary).

Á. Juhász (1974) mapped the anthropogenic effects and geo-processes in the vicinity of the coal-mining town of Komló, South-Transdanubia. Juhász was aware of the primary role of map representation in demonstrating the causal relationships between man and the environment. His map has a double purpose: on the one hand it includes the genetic forms and natural geo-processes of the geomorphological substrate; and on the other hand the specific anthropogenic (agrogeneous, technogeneous and urbanogeneous) feature and process types which occur naturally. The probable intensity of the influence of anthropogenic intervention on natural geo-processes are demonstrated and their causes are also described.

In the mid-1970's F. Erdősi, using accumulated field experience, further developed and elaborated a detailed system of geomorphic processes and landforms. He made use of achievements in the field which he could accept, for example, the basic categories of E. Fels (1965), H. Jäckli (1964) and other foreign researchers, but primarily those of M. Pécsi (1971). In the area he investigated (South-Transdanubia), he determined the place of all major processes and phenomena in a structurally modified system. He followed two guiding principles:

1. The purpose-orientedness of anthropogenic geomorphic processes. From this, he finds it useful
a) to subdivide direct anthropogenic geomorphic processes into two groups showing the extent of their purposeful nature:

- generally conscious and usually planned constructive work (excavation, degradation, planation, aggradation -- accumulation, and relief protection, stabilization, conservation and diagenesis);
- geomorphic changes due to an indirect effect not attributable to human intervention (planation).

b) to create within the basic category of indirect anthropogenic processes, the sub-categories of

- semi-anthropogenic and
- natural anthropogenic processes.

The latter differentiation seems justified if one defines natural anthropogenic processes as those which operate independently from man, with only their rate or intensity being influenced by social activity. There are, however, mass movements induced by man which cannot be separated from human intervention and, therefore, deserve the distinctive label of semi-anthropogenic processes.

The detailed subdivisions of his system call for new attributes ("montanogeneous", "industrogeneous", "urbanogeneous", "hydrotechnogeneous", "transportogeneous") in addition to those already used in international literature, which were also used by M. Pécsi (1971) (technogeneous, agrogeneous) to demonstrate the highly variable anthropogenic and natural anthropogenic features. Agrarian relief is highly dependent on the given branch of cultivation. Consequently, within "agrogeneous" processes and landforms the purpose seemed to be to differentiate between "vinogeneous" (of vineyards) and "agrogeneous" (of arable lands) anthropogenic and natural anthropogenic processes and forms.

2. The second organizing principle is the persistence of anthropogenic landforms. Their persistence generally lies behind that of natural features, not only because of their smaller dimensions, but also because of their conscious further modifications and obliteration. Nevertheless, it is still possible to subdivide them into temporary, persistent and semi-persistent subtypes, with the emphasis on the relative durability of "persistent" forms Fig. 1 represents the principal (simplified) regional types of geomorphic change due to anthropogenic influence by the dominant anthropogenic agent.

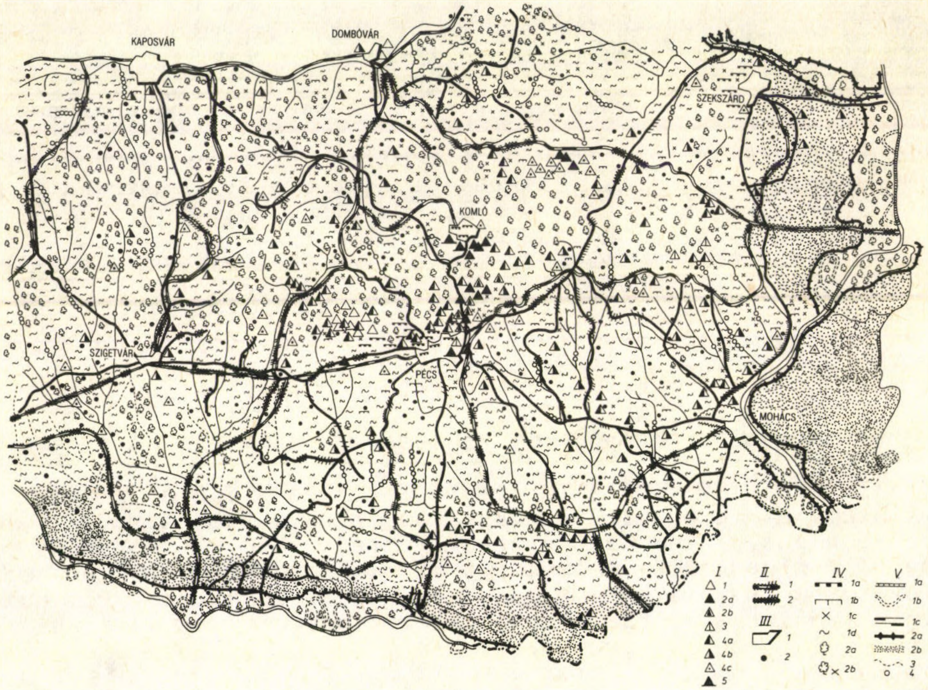

FIG. 1 Main regional types of geomorphic change due to anthropogenic effect

Roman numerals show the dominant anthropogenic (economic) agent. Arabic numerals designate anthropogenic geomorphic change and its dominant formations.
I = Mining and power industry: 1 = mining of uranium (slag-heaps); 2 = coal-mining: a = deep mining (slag-heaps and depressions), b = deep mining, open cast mining; 3 = other ore mining (small loads of bauxite and iron ore mines, collapsed shafts); 4 = mining of building material: a = stone quarries, b = brick clay pit, c = sand pit; 5 = coal and ore separators and slag-heaps of power plants.
II = Transport: 1 = major railway fillings and cuttings, erosion of slopes, accumulation in front of fillings.
III = Settlements: 1 = larger contigously built-up (urban) areas; 2 = smaller closed settlements (villages). IV = Agriculture: 1 = cultivated fields: a = areas with abundant artificial terraces, b = areas with abundant pseudo-terraces, c = areas with abundant watercourses, d = area influenced by ploughing (poor in microforms at present); 2 = forest (surfaces with slight anthropogenic modification): a = forest with few microforms, b = forest with watercourses in considerable number. V = Water construction: 1 = river regulation: a = artificial channel, b = cut-off, infilling channel, c = protected or altered bank section; 2 = flood control: a = flood control levee, b = flood-free areas (potamogeneous accumulation ceased, lower groundwater table, great ecological changes); 3 = major drainage channels; 4 = basins of artificial lakes (accumulation surfaces).

In summary, Hungarian geomorphological research has shown a proper concern for the geomorphic role of human activity in recent years. It does not seem useful, however, to separate the discipline of anthropogenic geomorphology from the other disciplines since the action of anthropogenic forces and the operation of natural anthropogenic processes and their consequences are highly dependent on the properties of the natural geologic substrate and its forms.

Anthropogenic phenomena should, therefore, be considered an active part of geomorphic evolution parallel with natural factors.

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ON THE DATING OF KARST FORMATIONS AND THEIR SIGNIFICANCE ON THE LATE TERTIARY–PLEISTOCENE FACE OF HUNGARIAN LIMESTONE MOUNTAINS: THE BUKK MOUNTAINS

Attila HEVESI

Of karst features, caves and dolines are excellent traps for sediment which contains an exceptional abundance of finds suitable for accurate dating, such as bones, pollen, charcoal and tools. Their date and mode of origin, therefore, supply data on the geomorphic evolution of the limestone mountains incorporating them. However, in order to date and reconstruct this development and to correctly interprete the data acquired, the following principles should be kept in mind:

1. The majority of limestone mountains in the Carpathian basins and mountains are mixed karsts ('allogenous, type B karsts': L. Jakucs, 1968, 1971) which evolved in the Late Tertiary--Pleistocene Era, parallel with the removal of the Tertiary cover layers from the formerly covered karst.

2. The stripping of cover layers is most rapid in areas with the greatest relative relief, a fact hinted at by Gy. Dénes (1971). Limestone is not necessarily first exposed on the highest lying mountains terrains, but often near considerably lower blocks of limestone, moving in opposite vertical directions.

3. The drainage patterns of former covered karsts can be inherited on limestone surfaces in two fundamental ways (A. Hevesi, 1978, 1980):

(a) If, at the beginning, the bed of the channel reaches the limestone layers and the karst water table is just below the surface (perhaps at a minimum depth of 1 m), channel and valley incision continues on limestone (Fig. 1Aa). Blocking at depth (bathycapture in the Jakucs terminology 1968, 1971) does not occur when a contiguous joint system exists in limestone dilated by solution, because it is filled with water almost to capacity. If the downcutting of the water-course

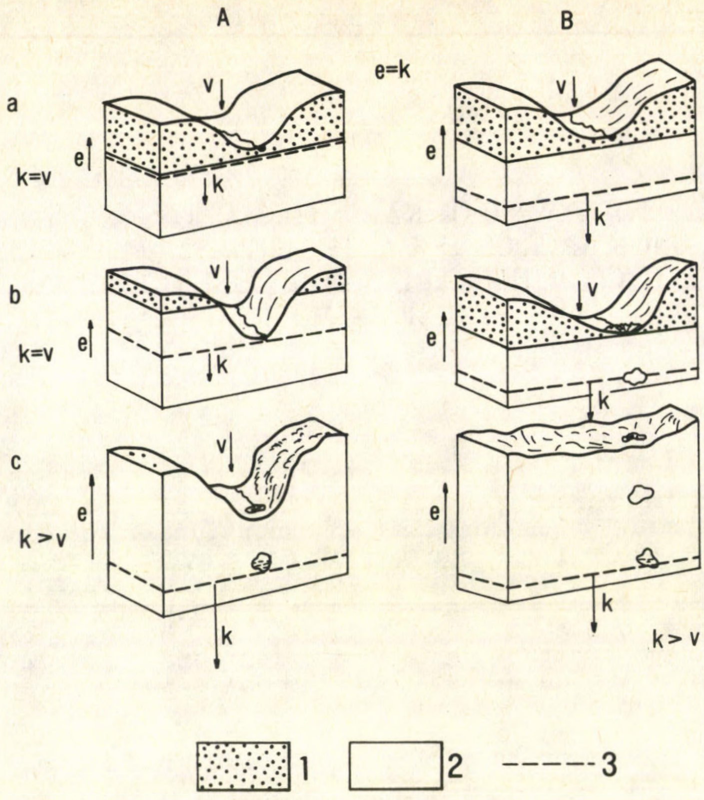

FIG. 1 The ways non-karstic drainage network is inherited over karstic rock

1 = non-karstic rock; 2 = lime-stone; 3 = karst water table; e = uplift; k = lowering karst water table; v = valley downcutting

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works at the same rate as the uplift of the area after the channel has been inherited, and there is no change in the difference of elevation between the karst water table and the channel, then no bathycapture occurs and the valley follows a 'regular' course of evolution (Fig. 1 Ab). When uplift is more rapid than downcutting, the lowering of the karst water table is not equal to the channel deepening and the limestone has a contiguous joint system well-dilated by solution[x], the water-course is captured at depth through a ponor. Further fluvial valley-shaping is seasonal, inconsiderable or non-existent (Fig. 1 Ac).

(b) When, at the beginning of the inheritance, the difference in elevation between the karst water table and the channel bed is considerable (perhaps more than 2 m), and the fissures and cracks were dilated enough, already then the water-course is bathycaptured through a ponor (Fig. 1 B). The evolution of the valley ceases and it may disappear altogether, owing to the removal of the non-karstic cover layer (Fig. 1 B).

4. The headward regression of the site of bathycapture produces valleys of ponors and dolines (L. Jakucs, 1968, 1971; A. Hevesi, 1977a,b, 1978) and, from this data the main lines in the surface drainage pattern of the former covered karst can be reconstructed (A. Hevesi, 1977b, 1980).

5. In the exhumed covered karsts, the surface karst processes start to dominate those on the subsurface. In the initial phase of exhumation, when the surficial drainage network is still dense and the recharged area is extended, ponors and cave passages primarily form. Their width decreases with their age, since, under constant precipitation conditions, the ever-reducing catchment area is divided between an increasing number of ponors and swallow caves (Gy. Dénes, 1971). The decline in, and subsequent cessation of, water recharge will cause the blocking of ponors to an ever increasing degree and will eventually transform then into dolines. The latter are further deepened and widened by solution. In the second phase of exhumation, fields of lapiés (karren) extend parallelly to the expansion of bare limestone surfaces and the sites of solution dolines are, in most cases, predetermined by blocked ponors and blind valleys. The number of purely solution dolines is low on every former covered karst terrain. Although the removal process of cover layers may be advanced, due to their lithology, the formation of ponors and caves will never cease completely on open mixed karsts.

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x Due to their structural and geomorphic history, in the majority of limestone mountains of this type of mixed karst, a contiguous and well-dilated system of fissures had formed by the Late Tertiary Period partly because the initial joint system of the limestone had been enriched by long planes of upthrust during the formation of imbricate structures mostly along the fissures in bedding-planes. Another reason is that they had been open karsts before being covered and, although most were lost, the old water level systems were largely preserved from this.

6. Avens in Hungary can be considered swallow caves with denuded catchments and a partly or totally destroyed funnel, in the opinion of J. Dancza (1943), Gy. Dénes (1971), L. Jakucs (1971) and Sz. Szeremley (1972).

7. The palaeontological and archaeological finds in karst caves only indicate the youngest possible dates for the origin of caverns. Since caverns are generally formed before their sediment accumulates, they are usually older than the sediment itself, bones, pollen, shells and tools found in them.

8. The differences in elevation between karst forms can only be suitable for dating under certain conditions.

(a) Identical karst form types located on a single macro-forms (valley, valley system, mountain, crest or range) are always comparable.

(b) Similar karst forms on similar macro-forms can also be compared, but only if their elevation above the present karst water table and their position in the limestone body are considered, instead of their height above sea level.

(c) Within a valley, or a valley system, the spring caves situated lower on the valley floor are usually younger than those higher up.

(d) The regression of the site of bathycapture explains why the ponors and dolines within a valley, or valley system, closer to the head are generally younger than those closer to the valley mouths. There is no considerable difference in age, however, between those issuing next to each other.

(e) Out of dolines and evens on a single mountain or line of crests, the higher ones are generally older than those situated lower.

(f) Cave ruins, funnels and karst gorges are fragmentary ponors, spring caves or cave passages. Their ponor or spring sections (often both) have been destroyed, so their positions are only tentatively suitable for dating, and it is also important to consider the other factors (primarily archaeological finds).

Further evidence supporting the parallelization of landfoms withthe history of Late Tertiary--Quaternary evolution in the Hungarian karst mountains is as follows:

1. The extent of uplift in the Hungarian Mountains can be estimated at 200--300 m in the last 1,800,000 years. Its marginal areas show elevations of between 100 and 200 m, while the southern foreland has subsided 200-400 m (A. Rónai 1973). Individual mountains also show uplifts of 400 m, which occured in the Pleistocene Period (B. Bulla, 1962).

2. Crustal movements causing changes in altitude above sea level had several, probably 4 or 5, phases:

(a) early Lower Pleistocene (Pregünz, Villányian) phase (M. Pécsi, 1959, E. Vadász, 1960, B. Bulla, 1962);

(b) Late Günz (Lower Biharian) phase (M. Kretzoi--E. Krolopp, 1972);

(c) Mindel--Mindel--Riss Interglacial phase (M. Pécsi, 1959, E. Vadász, 1960, B. Bulla, 1962, I. Szalay--T. Zelenka, 1979);

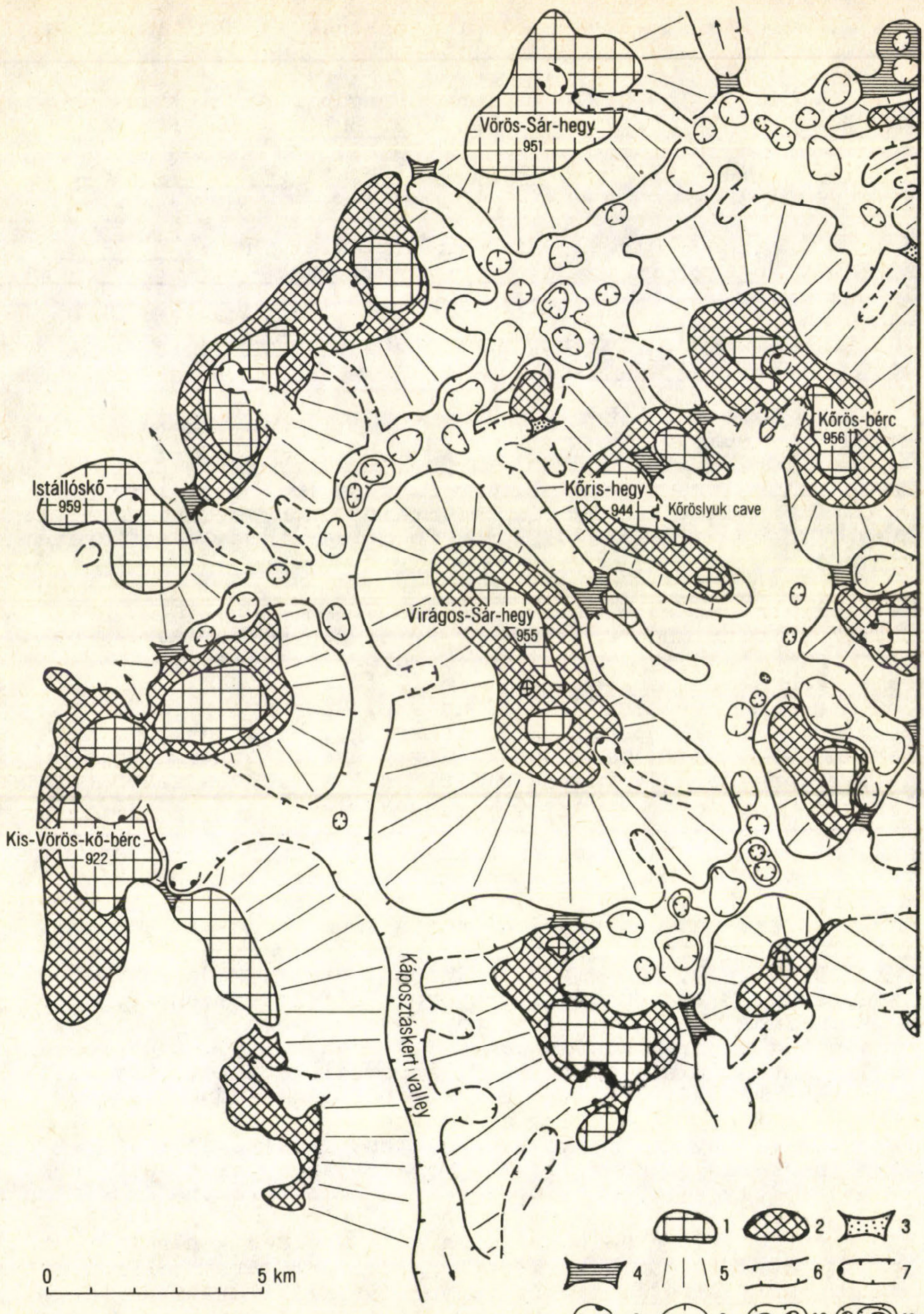
(d) Riss-Würm Interglaciál phase (M. Pécsi, 1959, E. Vadász, 1960, B. Bulla, 1962);

(e) Late Würm--Early Holocene phase (M. Pécsi, 1959, B. Bulla, 1962).

These phases are more or less reflected in the positions of karst forms in the Hungarian Mountains and, working from the above, the generations of karst forms can thus be differentiated.

We will use, as an example, of karst formations the Hungarian Bükk Mountains and our starting point can be the spring caves which are in the same position, and are presumably of the same generation, on the Great and Little Plateaux and in the Southern and Northern Bükk mountains. They are from N to E: Berva (Dró-lyuk), Istállóskő, Lök-völgy, Subalyuk, Büdöspest, Herman Ottó and Puskaporosi-kőfülke caves. Although they differ considerably in their altitudes above sea level (Drót-lyuk: 230 m, Istállóskő: 550 m), they are of the same age. This much is evident by the relation between their position and the present karst water table or by their distances from the altitude axis of the mountains running along Bél-kő, Bálvány and Kőlyuk-galya. This is also supported by archaeological and palaeontological finds from the cave sediment. The oldest are from the Lower or Middle Würm phase (Lower Würm: Drót-lyuk, Suba-lyuk, Büdöspest caves; Middle-Würm: Istállóskő, Herman Ottó, Puskaporosi-kőfülke caves; D. Jánossy, 1979). Since the above mentioned caverns were all inhabited or visited by prehistoric men (L. Vértes, 1965), and are all spring caves, except for the Puskaporosi-kőfülke, they must have been already dry in the Lower or Middle-Würm Period. This means they were lying above the karst water table of that time. They must have reached that level by the Riss--Würm Interglacial phase of the Quaternary uplift, and they were probably active spring caves in or before the Riss Glacial.

The first caves to be dated with in the older generation of spring caves in the Bükk Mountains are the karst hollows of the Pungorlyuk-tető, rising to 657 m a.s.l. On the northern slope of the mountain, from the sediment in the Kövesváradi-karsztzsák (600-615 m a.s.l.), D. Jánossy (1979) collected



Vörös-Sár-hegy
951
Istállóskő
959
Kőris-hegy
944
Kőröslyuk cave
Kőrös-bérc
956
Virágos-Sár-hegy
955
Kis-Vörös-kő-bérc
922
Káposztáskert valley
0
5 km
1
2
3
4
5
6
7
8
9
10
11

palaeontological finds from the Lower Biharian, Günz--Mindel Interglacial age. Only 200 m from a stone quarry, as the crow flies, in top position, issues the Pungor-lyuk (650 m a.s.l.), which is the only remaining remnant of the senile mouth of a one-time spacious spring cave. From its position, one can conclude that this cave is older than the Kövesváradi-karsztzsák and, when filled, it must have been in an elevated position. Consequently, its uplift must have happened before the early Lower Pleistocene (Pregünz, Villányian) period and its origin probably dates back to the end of the Upper Pliocene.

The same conclusion can be drawn when comparing the two caverns of the Ódor-vár (545 m), the Lakó and the Hajnóczy caves. In the Hajnóczy cave on the SW slope of the mountain, at 400 m a.s.l., L. Kordos has also found Lower Pleistocene (Lower Biharian) animal remains (J. Hir, 1980) and the ruined passages of the Lakó cave, at 540 m a.s.l., are possibly remnants of a larger, late Upper Pliocene cave (spring cave?).

The data on the well-dated caves of these two mountains allow us to state, with a high degree of probability, that the spring caves of the Bükk Mountains, in top position similar to that of the Pungor-lyuk, are also of late Upper Pliocene origin. Such caves primarily include the Kőrös-lyuk at 930 m a.s.l. (the highest cave in Hungary), the Pes-kő, Balla, Lambrecht Kálmán and Szeleta caves and perhaps the Három-kut system of ruin caves, the Örvény-kő ruin cave and the Vidróczki cave.

The assumption which attributes similar ages to the group of caves within this wide range of altitudes (Kőrös-lyuk: 930 m, Szeleta cave: 350 m) is justified by the following:

1. They are in top or near-peak positions, as related to their environs.

2. If there are karst valleys with doline rows in their neighbourhood, they always issue above them.

3. Apart from karren, they are the highest uplifted karst features in their environs (Lakó cave at Ódor-vár, Pungor-lyuk, Balla cave, the Három-kut and Örvény-kő ruin caves and the Vidróczki cave) and, if it is not so, there are only

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FIG. 2 Geomorphological sketch of the vicinity of Kőrös-lyuk and the Káposztás valley

1 = hilltop of main interfluve ridge; 2 = interfluve ridge; 3 = col with valley divide; 4 = col on intefluve ridge; 5 = slope between interfluve ridge and valley floor; 6 = fluvial valley, valley floor; 7 = fluvial valley shaped by soil and mudflow; 8 = plate-form hanging doline; 9 = swallow doline; 10 = twin-dolines; 11 = smaller karst polje.

solitary dolines in near-peak positions higher (Pes-kő, Kőrös-lyuk, Lambrecht Kálmán, Szeleta caves).

4. The essential differences in altitude above sea level derive from the distances of the caves from the above-mentioned Bél-kő--Bálvány--Kőlyuk-galya altitude axis and deviations in height above the present karst water table are substantially lower.

From further conclusions drawn from the position and date of origin of spring caves in this generation, the dating of solitary 'hanging dolines' in near-peak positions and valley doline rows is possible.

If we assume that in a former covered karst area, solitary 'hanging dolines' in near-peak position originated from ponors (A. Hevesi, 1980), they then replenished the older generation of spring caves. Therefore, they indicate the late Upper Pliocene level where the the surficial drainage network of the time was bathycaptured.

Investigating the relief in the vicinity of the Kőrös-lyuk, it is conspicuous that the cave issues from the head of a right-side tributary valley (later mentioned as the Kőrös-lyuk valley), with doline rows of the Káposztás-kert valley traversing the Primeval Forest (Fig. 2). The tributary once fed the surficial drainage network which cut valleys into the contiguous limestone surfaces of the Great and Little Plateaux and the SE-Bükk and were bathycaptured from the valley-floors.

It took a prolonged period of tranquility, followed by an uplift, for this drainage network to form and lose its surficial elements, working from the hypothesis that the latter are inherited over the limestone surfaces (A. Hevesi, 1980). If the Kőrös-lyuk is of late Upper Pliocene age, this stage of tranquility lasted up to the Pleistocene and the bathycapture of the drainage network, already formed by then, began in the early Lower Pleistocene (Pregünz) phase of uplift. On considering the climatic changes during the Pleistocene period and the remarkable lengths of the valley systems with doline rows, it is likely that bathycapture did not terminate everywhere simultaneously with the early Pleistocene uplift, but continued into the Late Günz (Lower Biharian) and perhaps, locally, the Mindel--Mindel-Riss phase.

More accurate datings could only be given when the animal remains of caverns and their ruins were examined. According to these examinations, the system of funnels related to the Kövesváradi-karsztzsák (D. Jánossy, 1979) and the Hajnóczy cave at Ódor-vár (J. Hir, 1980) must have existed as early as the end of the Lower Pleistocene (Lower Biharian) Age. The cave which has been truncated into the present Tar-kői-kőfülke is dated as the Mindel II Glacial (Biharian II/Age D. Jánossy, 1979), while the Poros-lyuk in the Balla valley

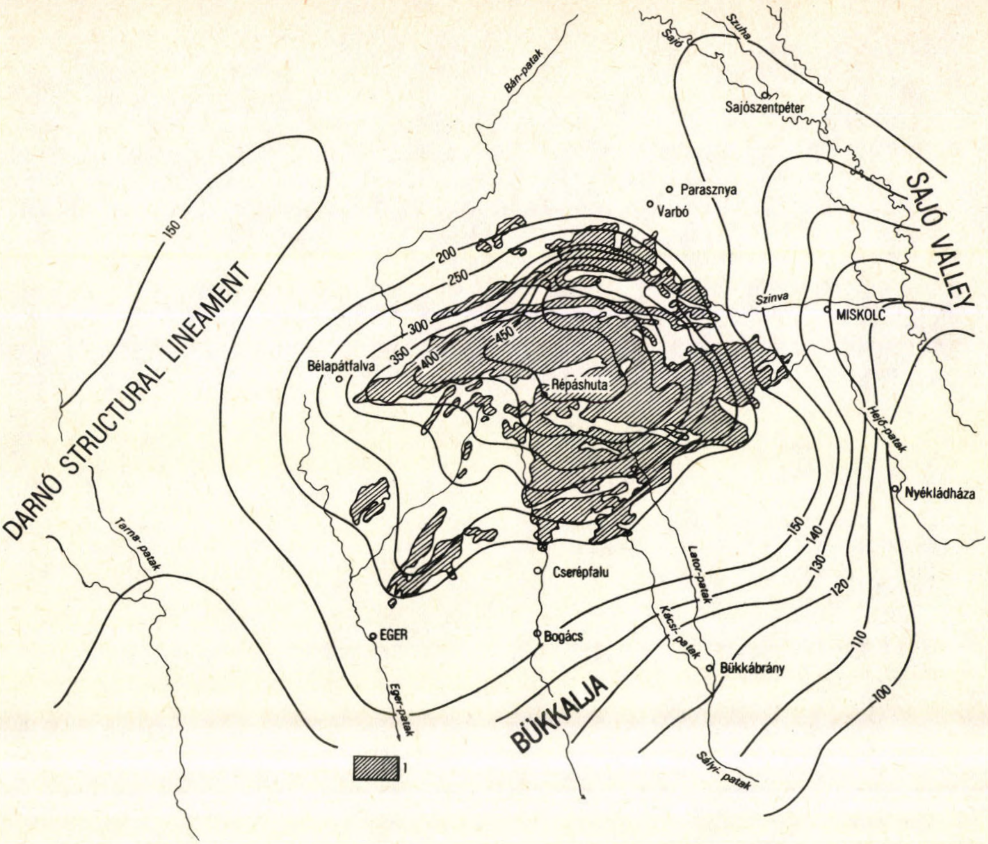

FIG. 3 The probable karst water table in the area of the Bükk Mountains

1 = limestone

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and the great passage of the Füzér-kő existed in the Riss-Würm Interglacial Age.

The above information enables us to supplement <u>the palaeo-geographical picture of the Bükk Mountains at the end of the Upper Pliocene</u> Age with some essential details. The predecessors of the solitary dolines now in near-peak position were active ponors then and their subsurface streams issued as karst springs with a high discharge at the mouths of still existing, and destroyed, older generation spring caves. Modifying my previous opinion (1978), I have to accept the view of <u>S. Leél-Őssy</u> (1954), also supported by <u>G. Tóth</u> (1979), that the Pes-kő cave and the Kis-kőhát aven are mostly late Pliocene karst formations. Moreover, the Kis-kőhát, Lyukas-gerinc and perhaps the Mély-Sárbérc avens, which are remnants of swallow caves deprived of their recharge area and funnel, may be older than the solitary 'hanging dolines' in near-peak positions at the same altitude.

If the origin of the Kőrös-lyuk valley can be dated back to the end of the Upper Pliocene, then the present valleys with their doline rows were probably formed at the same time, although without dolines, of course. Thus the drainage pattern outlined in the alignment of valley doline rows in the mountains (A. Hevesi, 1980) largely represents a late Upper Pliocene pattern.

Assuming that the actual absolute karst water table in the mountains (Fig. 3), and its convexity, highly resemble those of the Upper Pliocene, the altitudes a.s.l. for the still existant older generation spring caves were as follows:

	present altitude a.s.l.(m)	present karst water table a.s.l. (m)	difference
Pes-kő cave	745	300	445
Kőris-lyuk	930	450	480
Pungor-lyuk	650	450	200
Lakó cave at Ódor-vár	545	300	245
Örvény-kő cave	750	450	300
Három-kut cave	600	380	220
Lambrecht Kálmán cave	410	310	100
Szeleta cave	350	230	120

If we add to these values the differences in altitude a.s.l. between the caves and the mountain tops they lie on and accept S. Láng's estimation (1971)[x] that, from the limestone surfaces of the Aggtelek--Rudabánya Mountains, a 6--7 m thick layer could have been removed over a million year period, adding an extra 10 m, the W half of the Great Plateau was at an altitude of 460--540 m a.s.l. in the late Upper Pliocene, the W part of the Little Plateau was at 260--350 m, its E part at 160--250 m, while the environs of the Pungor-lyuk-tető and the Ódor-vár the 'inner' limestone terrain of the Southern Bükk in general was at an altitude of 230--270 m.

The calculation can be formulated as

$$KW_x - KW_h + CM_h + EC = H_x \ , \qquad \text{where}$$

x S. Láng's estimate (1971) is only an approximation which can be debated and must be calculated more accurately. Nevertheless, it only affects the reliability of the outcome of the calculation and not its principle.

KW_x = the karst water table at the date in question (identical with the altitudes a.s.l. of the spring caves of the time);

KW_h = the present karst water table (after the map by G. Szilágyi 1976--1977, or by the altitude a.s.l. of the karst springs in proven connection with the karst terrain of the cave in question);

CM_h = difference in elevation a.s.l. between the mountain and its cave;

EC = 'erosion coefficient' as estimated by S. Láng (1971);

H_x = height of the mountains where the cave is situated at the date of question;

x = the geologic period in question symbolized with initials, here lUP (late Upper Pleistocene).

Investigating the features of the Pes-kő cave, the Káposztáskert valley, the adjacent Kőrös-lyuk valley and its continuation, the Sima-kő-lápa and the Vörös-kő valley, one can form an idea of how, and to what extent, the W half of the Great Plateau and the SW-Bükk were separated at the end of the Upper Pliocene.

If, in the late Upper Pliocene, the Kőrös-lyuk was still an active spring cave, then this is the latest date at which, among others, the valley system of the Káposztás-kert--Sima-kő-lápa--Vörös-kő could have come into existence. On the floor of the diverging 'upper section' of the valley system, of the Káposztáskert and Kőrös-lyuk valleys, there are doline rows (Fig. 2) which as mentioned above, took shape in the early Lower Pleistocene (Pregünz) phase of uplift, at the latest. In the late Upper Pliocene, the streams in the Káposztás-kert and the Kőrös-lyuk valleys could have converged on the surface and run down to the SW-Bükk. The regular development of the valley system was stopped by the bathycaptures induced by the early Lower Pleistocene (Pregünz) uplift. While the upper plateau section was no longer cut into, in spite of subsequent uplifts, the lower reaches on the non-karstic rocks of the SW-Bükk were gradually deepened by both intermittent and permanent water-courses. The valley system consequently has broken into two: the floor of the Káposztás-kert valley, which is about 2.8 km in length with doline rows, is at 875--775 m a.s.l., while that of the Vörös-kő valley, 7 km in length with a stream, is at 575--255 m a.s.l. The two long valley sections with a related relief of 300--400 m are linked by the short Sima-kő-lápa, (1.5 km in length) a ravine lowering from 775 m to 575 m.

From all these facts, it can be concluded that the present considerable height differences between the karst valleys of the Great Plateau and the valley systems with an intermittent and permanent flow in the SW-Bükk were much less in the Upper Pliocene. So it seems certain that the present substantial differences in altitude between limestone and non-limestone surfaces must have once been moderate and took the shape of steep (as determined by the dip of the limestone layers), occasionally almost vertical, scarps of denudation 20--60 m in height. This much can be concluded from the cliff height above the mouths of the generation of spring caves from that age which issue onto non-karstic terrains.

This series of arguments also gives a better picture of the Pleistocene development of the Bükk Mountains and its palaeography. The younger generation of spring caves, which is assumed by palaeontological and archaeological finds and cave positions to have already existed in the Riss Glacial Age, adjusted to the karst water table existing after the Late Mondel--Mindel-Riss Interglacial uplift. The differences in elevation between the caves and their environs in the Mindel--Riss Interglacial were as follows, using the formula

$$KW_{mr} - KW_h + CM_h + EC = H_{mr}$$

(in brackets: present altitude a.s.l.):

Berva cave (Drót-lyuk)	(230 m)	200 m
Lök-völgy cave	(350 m)	240 m
Suba-lyuk	(300 m)	220 m
Istálós-kő cave	(550 m)	475 m
Büdöspest cave	(310 m)	230 m
Herman O. cave	(240 m)	200 m
Berva-Cseres-bér	(508 m)	470--490 m
Kurta-orom	(447 m)	330--350 m
Kut-hegy	(379 m)	290--310 m
Istállós-kő	(959 m)	850--890 m
Dolka-tető	(398 m)	300--320 m
Puskaporos	(456 m)	400--420 m

So the Bükk was at that time a mountain range of medium height, only 50--100 m lower on average than today.

These circumstances throw light on the Upper Biharian (Mindel II) fauna of the Tar-kői-kőfülke, indicating an amelioration period within the glacial. From the bones of lowland species (rhinoceros, bison) found there, D. Jánossy (1979) drew the conclusion that the Tar-kő cave lay at a much lower altitude a.s.l. As these remains had accumulated in the cave before the uplift at the end of the Mindel Glacial, actually in the Mindel-Riss Interglacial, his conclusion is correct. If we take into consideration the intensity of the two phases of uplift from the Upper Pliocene to the Riss Glacial (early Lower Pleistocene and Late Mindel--Mindel-Riss Interglacial) -- which is quite an underestimation as far as the second, the strongest Quaternary uplift is concerned -- the site of the Tar-kői-kőfülke was probably, at 450 m a.s.l. in the Upper Pliocene and 620 m in the first half of the Mindel Glacial. It should be added that the the steep scarp with an average length of 1.4--1.6 km and a 220--240 m relative relief, between the W margin of the Great Plateau and the top of the SW-Bükk, was half its present size in the first half of the Mindel Glacial. Bison and rhinoceros species could easily reach the base of the peaks ('kő' in Hungarian) from the Bükk, at 300--500 m a.s.l., at that time through the shallower valleys with broader floors (glacials), especially since their grazing lands, with dry short grass, almost stretched up to those areas (B. Zólyomi, 1952). Their bones could have been carried into the caves by contemporary felidae (Felis magna Panthera pardus sickenbergi), the ancient cave-bear (Ursus deningeri) and the sabre-toothed tiger (Epimachairodus), an hypothesis which is proven by finds in the Tar-kői-kőfülke (D. Jánossy, 1979).

Considering all these, my earlier hypothesis that the uplift which followed the accumulation of cave sediment in the Tarkői-kőfülke can be placed in the Upper Pleistocene period (A. Hevesi, 1980) must be essentially revised. It is clear from the above that the major rise occured as early as the end of the Mindel Glacial and the beginning of the Mindel-Riss Interglacial and a far less considerable portion falls into the Upper Pleistocene and Holocene Ages.

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THE EFFECT OF GROUNDFROST ON EROSION BY MELTWATER

Zoltán PINCZÉS

The problem of soil erosion has been recently considered by several congresses (Strasbourg 1978, Bedford Silsoe 1980, Florence 1981, Exeter 1982, and Honolulu 1983) and it has been the subject of a great number of papers. A common feature of all these is their almost exclusive concern whith soil erosion due to rainstorms. Much less has been said about surface denudation due to frozen ground. This is a problem found in many countries, where groundfrost occurs each year, including Hungary, and it results in a type of soil denudation varied in its processes and rich in form. In spite of this, researchers into soil erosion have not paid attention to this specific form of soil erosion. In all probability, this lack of attention can be explained by the fact that the forms produced in this way are, because of their smaller size, not so spectacular, and their frequency and variability differ from year to year. In mild winters, soil erosion is almost entirely absent, but, if a winter is hard and especially if the snow cover thaws quickly in spring or thaw is accompanied by rains, then the various forms of soil erosion (linear, areal, etc.) are sure to appear. They all have one common feature: they are all promoted by groundfrost.

At the University of Debrecen, we have been concerned with research into this special type of soil erosion for over two decades. In the course of this research we have not only succeeded in distinguishing the processes and forms produced, but we have also characterized the extent of erosion by measurements and quantitative values. In the present paper, I only wish to deal with one problem: erosion with furrows, as influenced by, and related to, groundfrost. At the time of the spring thaws, this is the most frequently occuring erosional form. Under favourable weather conditions, its development may take place on a large scale in a given area and it may be promoted by a number of factors: the looseness of the deposit or soil forming the surface, relief, weather conditions and human activity.

FACTORS INFLUENCING SURFACE DENUDATION

a) The effect of the bedrock and the soil

The erosional effect of snow water, and the formation and size of the furrows, are decisively influenced by the loose sediment and soil of the surface. The determining factors in this respect are grain size and pore size. However, these two are highly correlated to each other. The size of the pores influences the movement of moisture. Precipitation water quickly penetrates into coarse materials, whereas, in the case of fine grains, a considerable amount of humidity is retained in the upper layers. At negative temperatures, going gradually downwards, the water in the soil is frozen and up to the actual freezing level, further significant quantities of water are absorbed from below. This upward migration of moisture and its quantity are decisively determined by pore size. In coarse-grain soils (gravel and sand), this upward movement of water is practically negligible. On the other hand, in fine-grain soils, it is considerable. In consequence, in the upper layers of soil, the amount of water increases in comparison to the original state, and accumulates in the form of ice needles and ice stripes at the actual freezing level. Thus, water is distributed unevenly in these upper layers. Stripes of ice layers alternate with soil layers. On thawing, the water from the ice stripes, since it cannot penetrate into the frozen subsoil, runs off onto the surface and, together with snow water, brings about erosion.

Thus, considering grain size, frost-sensitive soils and deposits or soils exposed to frost damage are those which contain a significant proportion of loess or silt. It is in areas with these type of soils that groundfrost-induced erosional furrows appear. This accounts for their mosaic-like occurrence: they are almost completely absent over large areas, while, in other places, they occur in large amounts. These features are particularly frequent in our loess-covered hilly or mountainous regions (Z. Pinczés -- L. Boros 1967, Z. Pinczés, 1968, 1971, 1978, 1979, 1982). They also evolve on slopes covered by gley and glacial loam. The danger of erosion is also enhanced if these layers contain the weathered or fractured grains of the bedrock. The erosional furrows which form due to groundfrost are missing in sand-covered areas, although when the sand dune is covered by sandy loess or loessy deposits, the area is exposed to the danger of erosion (L. Boros -- Mrs. L. Boros, 1982). These forms are very rarely found on clayey terrains.

b) Effect of weather on the evolution of erosional furrows

The evolution of erosional furrows is decisively influenced by the weather on surfaces susceptible to erosion. Its effect is so decisive that, if there are "unfavourable" weather conditions, denudation due to groundfrost does not take place at all. The most important factor is changes in winter temperatures. A gradual fall in temperature is favourable for water to become enriched in the form of ground ice. Enduring hard frost results in a thick frozen layer and this further increases the danger of erosion. Erosion is also influenced by the duration of the snow cover, its thickness and changes in the latter during the winter. The weather during the thawing period is especially important, since it decisively determines the extent of erosion. A quick warm up creates favourable conditions for soil denudation, as the extent of denudation is determined by the thickness of the thawed soil layer. If the thawed surface of soil can be measured in millimeters, then denudation only affects this thin layer. The furrows are only capable of deepening as far down as the frozen subsoil, although their lateral development is unlimited.

The depth of the furrows formed may be several times their depth. When the spring thaw takes place slowly, and the thawed soil surface freezes again during the night, the frozen subsoil persists for a longer time. The denudation -- due to the daily repetition of freezing and thawing -- also lasts longer and during the night, the amount of water increases considerably near the surface, which again results in an increase in erosion. In such cases, an extensive network of large furrows evolves.

The dimensions of the evolved furrows are determined by the amount of runoff water and the depth of groundfrost. In general, the width of the furrows is somewhat greater than their depth. This was well demonstrated by the soil denudation which occured in the years 1964 and 1966 (Z. Pinczés -- L. Boros, 1967, Z. Pinczés, 1967, 1969). In spring, 1964, a dense network of erosional furrows evolved on Tokaj Mountain, whereas, in 1966, there were essentially fewer furrows and they were even completely absent in some places. In both these years, we performed surveys on identical plots at Tokaj -- Hétszőlő. The degree of surface erosion, determined from the dimensions of the furrows, is summarized in the table below.

TABLE 1 Data on Soil Denudation at Tokaj--Hétszőlő in Spring, 1964

Place of measurement	Exposure of slope	Angle of slope	Mapped area	Eroded material	Material per hectare	Furrow length per m^2
Hétszőlő 1	SSE	12--22^o	440 m^2	0.7367 m^3	18.42 m^3	0.70 cm
Hétszőlő 2	S	14--16^o	276 m^2	0.4349 m^3	15.76 m^3	0.66 cm
Hétszőlő 3	S	15--17^o	290 m^2	0.2244 m^3	7.74 m^3	0.71 cm

Although in the surveyed areas the exposure and angle of the slopes were nearly identical, there was a marked difference between the eroded amount of material per hectare. The lowest amount was on plot 3, which was about half that of plot 2. This lower amount of erosion may be associated with the fact that this plot lies on a higher part of the vineyard area. Thus, unlike the other plots, there was no run-off of meltwater from higher plots.

This survey was also performed in spring 1966. Furrow formation was less intensive this time. The results are illustrated in Table 2.

TABLE 2 Data on Soil Denudation at Tokaj--Hétszőlő in Spring, 1966

Place of measurement	Exposure of slope	Angle of slope	Mapped area	Eroded material	Material per hectare	Furrow length per m^2
Hétszőlő 5	S	17^o	231 m^2	0.1096 m^3	4.74 m^3	0.53 cm
Hétszőlő 6	S	17^o	306 m^2	0.1639 m^3	5.36 m^3	0.45 cm
Hétszőlő 7	S	10^o	323 m^2	0.1910 m^3	5.91 m^3	0.51 cm
Hétszőlő 8	E	25^o	378 m^2	0.1649 m^3	4.36 m^3	0.30 cm

The figures obtained in 1966 were two or three times less than those in 1964. The lower degree of erosion is partly due to the fact that the furrows evolved discontinuously in 1966. This is reflected in the figures in the last column of the table, which shows the length of the furrows per 1 m^2. Whereas in 1964 the length of the furrows was 0.66--0.71 cm per 1 m^2 of the mapped area, in 1966 it was only 0.30--0.53 cm. The difference in the degree of erosion was not only influenced by the number and length of furrows, but also by their other dimensions. In 1964, the mean width of the furrows was 6--10 cm, and the extreme figures amounted to 18 cm. In 1966 however, the mean values ranged between 3--5 cm, and the extreme values did not exceed 7 cm. On the other hand, there was no difference in the depth of the furrows. In both years, 3--4 cm deep furrows were formed, thus highlighting that, due to groundfrost, the furrows could only grow laterally.

The significant differences in the figures obtained from the two years under study can primarily beexplained by the differences in the weather conditions (temperature and precipitation). In January, 1964, the deeply frozen soil was evenly covered by a 13 cm thick snow layer. This thickened to 16 cm on February 2nd, and melted completely by February 25th. The days following were characterized by hard frosts at night (-11^oC) and a warm up through the day ($+5^oC$ on February 19th), which promoted the formation of ice accretions to its highest degree. Early in March, there was a snow cover of 1--2 cm, which also thawed fairly soon. On March 15th, due to a heavy snowfall (12.9 mm), a snow cover of 22 cm formed, which was still as deep as 10 mm on the 20th. Then, the next day (21st), it thawed completely. The following nights were also characterized by hard frosts (-7^{o} and $-8^{o}C$) followed by a warm up during the day (between 0^{o} and $+5^{o}C$). Thus, the winter of 1964 was essentially very favourable for meltwater erosion. The considerable amounts of accumulated snow thawed quickly twice and the thaw was followed by cold nights and daytime warm up.

The weather was quite different during the winter of 1966. In January, the slopes were covered by a snow cover no thicker than 3 cm, which increased to 8 cm by the 20th and then thawed gradually. On February 10th, there was again a snow cover of 8 cm, which persisted till the end of the month. Early in March, another snow cover of 8-11 cm formed and thawed in the course of four days. Thus, this latter snowfall had no influence on furrow formation.

Unlike 1964, there was only a thin snow cover in 1966, which thawed slowly each time, and neither was the formation of ice accretions promoted by the temperature. Thus, the marked differences in the degree of erosion were due to the differences in the weather conditions.

c) Influence of the relief on soil denudation

The influence of relief is also considerable, and primarily affects the degree of erosion. The relative relief of the area, the dimensions of the watershed area and the slope conditions are well-known factors. However, these effects play an equal role in the formation of furrows by meltwater in winter or showers in summer. In both instances, the system of evolved furrows is dense on steep slopes with high relief, and rare and small on mildly slanting plots (2--5^{o}). Out of the relief factors, it is the length of the slope that is most decisive. This is confirmed by measurement data obtained at Tokaj--Hétszőlő and similar figures from northern loess--covered areas in Nyirség (L. Boros--Mrs. L. Boros, 1980). In spring, 1979, the authors mapped out furrows with 6--10 cm mean width and 4--6 cm mean depth on short, 10--20 m slopes around the village Timár. On long (200 m) slopes, however, there were large-size furrows, 40--80 cm long, very often 30--50 cm wide and 15--30 cm deep, even in the case of quite mild angles of slope (2-4^{o}).

The length of the slope also affects the size of the furrows. (Z. Pinczés, 1978). The width and depth of the erosional furrows gradually increase with the amount of water. If they are 1--2 cm wide in the beginning, their width may exceed 10 cm at the bottom. The depth relations also change to some degree. Increase in furrow depth downstream is only natural. If, however, the measured data are carefully checked, it turns out that the increase in depth is not even, but follows a rhythmic fluctuation. The deeper parts are followed by shallower, as is highlighted in depth measurement data for a furrow in the Tokaj survey (2, 3, 4, 4, 5, 5, 3, 8, 4, 5, 3, 3, 3, 4, 5, 3, 2, 3 cm). From the data, and also on the map of the furrows, one can clearly see that the cutting and filling phases alternate in the furrows, with the result that the furrow base develops a graded character. The eroded material does not reach the foot of the slope in its entirety, as a part of it is deposited along the way. In consequence, small alluvial cones evolve along the furrows. The length of such an erosional rhythm may determine the longitudinal, areal extent of a vineyard plot to be marked out. By careful mapping of the erosional furrows, followed by terrain correction based on these maps, the damage done by erosion could be considerably lessened.

Erosion due to meltwater is decisively determined by the exposure of the slope. This effect can also be revealed, to some degree, in the erosional work of summer showers (for example in the effect of soil humidity on soil erosion, changing according to exposure). However, its effect is much more pronounced in the action of meltwater. The rate of erosion, which depends on the depth of groundfrost, thickness of the snow cover and the rate of thawing, is highly different on slopes with different exposures. Depending on the exposure of the slope, the depth of groundfrost and thickness of snow cover are not uniform during the winter. On northern slopes, groundfrost goes down deeper and lasts longer than on slopes with a southern exposure. At the same time, the snow cover may persist through the whole of the winter, it may be thicker than on a southern slope, on which it may thaw more than once in the course of the winter, due to the higher extent of insolation. This great difference results in qualitatively and quantitatively diverse levels of erosion on the two kinds of slopes. On the southern slope, because of the mild groundfrost, there is no, or only slight, ice-layer formation. Thus, the surface is not supplied with excess water from the deeper layers, and due to insolation-induced warming, it will become even drier. The snow cover thaws gradually and the resulting smaller amount of snow-water does not run off completely, part of it penetrates into the thawed soil. The snow-water running off such slopes is not fed by surplus water from the thawing of ice stripes, either. All this means that the soil surface is not permeated by water, does not assume a pulpy character and runoff water only induces linear erosion. Since this type of erosion is not limited by the depth of groundfrost, the deepening action of water is not hindered in any way. Consequently, on slopes with a southern exposure the furrows cut by meltwater are similar to those induced by showers. Unlike nothern slopes, the furrows here are further apart and their occurrence is scattered. They sometimes reach considerable depths of several decimetres and their depth may exceed their lateral dimension.

On northern slopes, on the other hand, characteristic meltwater furrows are formed. Thawing, primarily induced by warm air, starts later in such places and a snow cover of a centimetre or decimetre thickness covering the slope melts quickly on the still frozen soil. Erosion is enhanced if thawing is promoted by rain.

To prove the above, in spring, 1977, a survey was made of the segment of Mélyvölgy between Hajdúböszörmény and Alsó-Józsa. The valley has a semicircular run in this area, thus creating four places with identical slope angles and different exposures. The slopes are not more than 100 metres apart and offered an excellent opportunity to study the relation between exposure and erosion. Slope sections 40--50 m wide and 50 m long were marked out at all four places (N, E, S, W), then the erosional furrows and the degree of accumulation were surveyed and mapped. The data obtained are presented in Table 3.

TABLE 3 Degrees of Erosion Measured on Slopes of Different Exposure in Mélyvölgy

Exposure of slope	Mapped area m^3	Erosion		Accumulation	
		m^3	m^3/ha	m^3	m^3/ha
North	250	0.771	30.84	3.577	143.08
West	200	2.119	105.96	4.329	216.47
East	100	0.543	54.30	outside the area	
South	-	Scattered		outside the area	

From the table, it is clear that erosion was so insignificant on the slope with a southern exposure that it was impossible to measure it. The erosional furrows were also scattered and far from one another, on the slope with an eastern expcsure. Groundfrost on this slope was minimum, which is clear from the depth of the furrows, which -- particularly in the lower part of the slope -- exceeded the width. Owing to their uneven areal distribution, their mapping was also cumbersome and inaccurate.

The strongest denudation was observed on the western slope, then the northern. Both slope surfaces are covered with a dense network of erosional furrows, through which considerable amounts of material were transported to the lower parts of the slope. As compared to the northern slope, three times as much material was transported down the western slope. Recalculated for one hectare, the amount of material transported through the furrows to the lower part of the slope was 30.84 m^3 on the northern slope and 105.96 m^3 on the one facing west. Large-scale denudation on both slopes was caused by groundfrost. This remained thicker on the northern slope in February than on the western one which had already thinned. This accounts for the higher degree of denudation on the latter slope, since runoff water transported more material from the thickly thawed layer along the western slope, than on the thinly thawed surface layer of the northern slope. Besides the considerable amount of water accumulated in the upper soil layer by the end of the winter, soil denudation was further promoted by repeated rainfall in the second half of February.

The amount of material accumulated on the slope was also measured. On the northern slope, on an area of 250 m^2, we found 3.577 m^3 of material (143.08 m^3/hectare); on an area of 200 m^2 on the western slope, 4.329 m^3 (216.47 m^3/hectare). The result obtained seems contradictory at first glance, since accumulation on the northern slope, for example, is nearly five times as much as the loss calculable from the dimensions of the furrows. All this shows that, in addition to the clearly visible linear erosion, a much more considerable soil denudation takes place areally on the thawed surface of the frozen subsoil.

The weather at the end of the winter was also favourable for this high-degree soil denudation. Data received from the Meteorological Station of L. Kossuth University show that the considerably thick snow covers (10--15 cm each) thawed three times during January. After February 15th, there was no measurable snow cover, and, for the rest of this month and also through March, there was a considerable amount of rainfall, which was significant with regard to erosion on three occasions (Febr. 17th: 11.4 mm, Febr. 22nd: 8.5 mm, Febr. 27th: 9.9 mm).

The morning radiation minima were negative till the end of January, between -10° and -20°C on several occasions. The continual negative figures stopped after February 10th, and, from that time to the end of April, negative figures alternated with positive. The groundfrost, which was 25 cm deep on January 15th, decreased gradually and it was only 2 cm on March 2nd. It should be noted, however, that the data are related to flat surfaces and only reflect the general course of the weather in the region. On the whole, however, it can be stated that the periodical changes in climatic elements (precipitation and temperature) and the persistence of groundfrost till March (naturally longer on the northern and western slopes and shorter on the southern) created favourable conditions for erosion.

It is highly instructive to study the changes in erosion and accumulation -- proceeding from the top downwards -- in different stretches of the slope. Erosion was characteristic of the highest surveyed stretch (40 m^2), despite the 4° angle of slope. On the segment which followed with a 10° angle of slope, erosion and accumulation were balanced (0.366 m^3 -- 0.365 m^3). Proceeding downslope, the angle of slope decreases (6°), and accordingly, accumulation increases (1.069 m^3) compared to denudation (0.499 m^3). Consequently, the run-off water is relieved of its load and, it the next segment, although the angle of slope is still less (5°), the strength of run-off increases, r esulting in an increase in its erosional activity. Thus, accumulation scarcely exceeds denudation (0.670--0.609 m^3). Accumulation is greatest (2.199 m^3) at the foot of the slope, where the angle of slope is the smallest. At the same time, the value of denudation is higher (0.453 m^3) than on the topmost two segments of the slope, in areas with larger angles of slope. Obviously, the character of erosion is here determined, not so much by the angle of slope, but by the amount of run-off water.

Similar results were obtained by L. Boros (1980) in soil erosional studies in the northern part of Nyirség. The densest network of meltwater furrows also evolved in this region on the western slopes, whereas only small underdeveloped furrows were found on the southern slope.

d) Anthropogenic effects on soil denundation

The areal distribution and extent of soil denudation are also influenced by the action of society. Where the natural plant cover has survived, or where there is meadow, pasture, field under crop or fallow land overgrown with vegetation, erosion cannot develop. On the other hand, agricultural areas which are tilled every year, particularly if ploughing is performed in autumn, are in especial danger of erosion. The loosened soil is capable of retaining more water due to its porous texture. Thus, groundfrost can penetrate easier and moisture can move faster towards the freezing level. In consequence, the development of ice needles or ice stripes is usual almost every winter, increasing the danger of erosion. This can be easily observed in adjacent areas utilized in different ways. By spring, freshly ploughed land is covered by a dense network of erosional furrows, whereas these furrows are completely missing from adjacent fields with a similar relief, but under alfalfa.

Anthropogenic effects also influence the location and, in certain cases, the size of the developing furrows. Predetermined routes for the run-off of spring meltwater are the ruts of the tractor's wheel on fields ploughed in autumn (R.P.C. Morgan, 1979) and tracks left by the sowing machine on sown lands (L. Boros -- Mrs. L. Boros, 1980). A similar phenomenon is found in vineyard areas. Here, work connected with autumn hilling determine the place of the erosional furrows. The depressions between the rows of grapevine running downslope predetermine the course of run-off water for the spring thaw, and, if the weather conditions are favourable, erosional furrows evolve in them. The case is quite different in places where the planting of vine is sparse or where there was no hilling up in autumn. In such places much fewer furrows are formed. From several subsidiary branches a main one is formed which may exceed the size of the furrows developing in the individual rows. Nevertheless, the areal loss due to erosion is much less. This fact again emphasises the importance of making the right choice of the cultivation method.

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THE ROLE OF DEEP-CUT TRACKS IN LINEAR EROSION

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Recognition of the geomorphic role of anthropogenic processes and the subsequent establishment of a system of anthropogenic geomorphology has a history of about 30 years (E. Fels, 1954). Progress in geographical science involved developing new trends and anthropogenic geomorphological research was neglected to some extent. This did not mean, however, that geographers ignored the role of anthropogenic geomorphic evolution or that the morpho-dynamic significance of anthropogenic processes had decreased. What, in fact, happened is that today the role anthropogenic processes play is considered within the framework of individual research problems and, in order to solve these problems, previously elaborated anthropogenic geomorphological methods are applied.

There have been several attempts to establish a system of anthropogenic effects (E. Fels, 1965, F. Erdősi, 1969, M. Pécsi, 1971). A common feature in all these attempts is their consideration of both indirect and direct effects. F. Erdősi's classification (1969) is based on economic sectors (impact of mining and heavy industry, agriculture, transport and settlements); M. Pécsi (1971) chooses impact on relief (excavation of relief, deformation of relief stability, artificial infilling of relief, constructional development on relief) as the organizing principle. In a more recent classification by F. Erdősi (1979), he uses purpose-oriented nature and the persistence of landforms as the organizing principle.

Besides purely anthropogenic activities, M. Pécsi (1971) treats anthropogenic-natural processes separately. This category covers natural processes which would not operate under natural conditions or would not accelerate to an abnormal degree.

In the present paper, we will attempt to investigate anthropogenic and anthropogenic-natural processes resulting from several indirect and direct influences.

THE ORIGIN OF DEEP-CUT TRACKS

In classifying through consideration of economic sectors, the origin of deep-cut tracks is associated with the effect of transport or agriculture, and in M. Pécsi's system, it appears under the heading of "deformation of relief stability". The development of deep-cut tracks in Hungary is accentuated by the fact that much of the total area is mantled by unconsolidated sediments. Among them, it is primarily loess and loess-like deposits which are susceptible to the development of deep-cut tracks. The quality of rock is an important controlling factor in track development, for example, typical loess with a porous structure of capillaries is highly susceptible to denudation by "karstic" processes. In the opinion of L. Ádám (1964), deep-cut tracks are not typical karst denutation forms, but belong to the group of mixed (complex) forms. An important property of typical loess is its ability to remain in high, frequently almost vertical, walls. Deep-cut tracks, however, do not only develop on typical loess, but also on loess-like deposits or even sand, sandstone and clay sequences. Such tracks are found in Hungary, for example, in the Oligocene sediments of the Nógrád basin and the Helvetian conglomerate around Pécs. The type of rock different from typical loess is also reflected in track parameters: those which develop in rocks other than typical loess are of limited depth and slope. Evolution rates of tracks are also influenced by the quality of rock. According to L. Zámbó (1970), unconsolidated sediments with a basic stability and maintenance of vertical walls are generally suitable for the development of deep-cut tracks.

PHOTO 1 Linear erosion begins in wheel-tracks

Deep-cut tracks are of exclusively anthropogenic origin. The imprint of cart wheels is enough to disturb the loess mantle and track downcutting begins immediately. According to L. Ádám (1974), the effect of transport (carts, human and animal footprints, although, in my opinion, chiefly motor-cars) loosens the loess and grinds it to dust (L. Hempel, 1957, also holds similar views) and run-off water removes the loose material. I have found that, apart from this, the pressure of wheels and the subsequent compaction of the underlying layers are of equal importance. Due to compaction, a depression forms on the surface which predetermines the path of linear erosion (Photo 1). In wheel-tracks, permanent erosion occurs, depending on the slope. After a time, tracks are either smoothed off due to lateral erosion and filling (until the next rain-fall) or, more frequently, the overdeepened tracks become impassable and new tracks begin to form parallel to the old.

B. Bulla (1954), also gives wind erosion a place in the development of deep-cut tracks. L. Ádám (1964) is right to claim, however, that deflation does not contribute to their origin at all. Human activity and linear erosion are the two major factors in their genesis.

PHOTO 2 Track of medium depth in loess in the northern foreland of the Gerecse Mountains

Besides transport, agriculture is an indirect reason for track downcutting. Most deep-cut tracks have evolved from roads made by heavy traffic cutting through fields or connecting settlements with their outskirts (Photo 2). The role of the mode of cultivation was highlighted by F. Erdősi (1969) and L. Ádám (1969), who found that the network of deep-cut tracks is thickest in vineyards. According to F. Erdősi (1969), the reasons for this are, firstly, that work lasts longer in vineyards and, during this time, roads are more intensively used than elsewhere: secondly, because of fences and buildings, new tracks cannot be formed; and thirdly, vines are planted on steeper slopes than is usual with arable land. As a fourth reason, I would add plot size. Vineyards, as well as orchards, are usually small plots on private land, which necessitates a denser and practically unchangeable road network. A further significant factor with regard to agriculture will be dealt with, when the system of relationships between deep-cut tracks and erosion is studied.

The depth of tracks is controlled by slope angle, quality of rock, intensity of use and the time lapse. In L. Hempel's view (1957), the development of deep-cut tracks begins on slopes of 1 to 3 degrees if their use is intensive enough. Downcutting is effective on slopes steeper than 6--7 degrees. In the Szekszárd Hills, as investigations by L. Zámbó (1970) show, deep-cut tracks can also develop on the alluvia of structural valleys but, because of the gentle slope they are only 1--1.5 m deep. In their steeper tributary valleys, however, tracks of on average 3 to 5 m, occasionally 10 to 15 m, depth have been found. If slope angle alters along the line of the track, it is reflected in track depth. It is possible, therefore, for a deep-cut track to have one section of 1--2 m depth and another of perhaps 10 m.

The width of tracks is not necessarily equal to the gauge of wheels, because the collapse of sidewalls also leads to widening. Moreover, old tracks become impassable after a time and, consequently, new ones form immediately along them. Widening is most common where several deep-cut tracks converge or diverge.

The rate of downcutting depends on slope angle and available water. L. Zámbó's (1972) measurements in the Szekszárd Hills indicate that slopes of between 7 to 18 degrees are most susceptible to the development of deep-cut tracks. On steeper slopes, similar tracks do not occur and, on shorter slopes, there is no opportunity for water to concentrate.

The quantity of water depends on the amount and intensity of precipitation. L. Zámbó's investigations show that a minimum 20 mm rainfall is necessary to induce downcutting. If rainfall falls below this amount, rainwater infiltrates, according to the soil moisture content. Splash erosion plays a significant role in starting downcutting or, more precisely, in preparing the sediment to be removed, since it further loosens and disintegrates the material. If there is high intensity rainfall, water first runs in small channels and then, later, in wheel-tracks flowing over the track fringes and rolling over the entire width of the path.

Amount of water is also a result of the position of deep-cut tracks. The water comes down from the upper reaches of the track, if the track is on a gently sloping hilltop. Most deep-cut tracks have their own watersheds if they run over hill-slopes or valley floors. The amount of water is particularly high if there are field crops grown in the immediate neighbourhood of the track and so the slope of the watershed is temporarily bare or covered with low vegetation.

THE FURTHER EVOLUTION OF DEEP-CUT TRACKS

The ever deepening tracks transform into loess gorges. In addition to erosion, corrosion and subterranean erosion (piping) also have a role to play in the process (L. Ádám, 1964). N. Bariss and A. Bronger (1981) concluded from a comparative analysis of the Hungarian and the Oberrheingraben loess areas that rainfall intensity is decisive in loess gorge development.

In Hungary, on the surfaces of unconsolidated sediments, the majority of erosion gullies and gorges are related to track deepening. Once transformed into a gorge, the track is no longer good for traffic. For this reason, a new track is necessary, usually parallel to the old, with the possibility of a new erosion gully or stream forming. NW of Budapest, near Csákánypuszta, three neighbouring generations of deep-cut tracks can be observed (Photo 3), and this area very well exemplifies the relationships between linear and areal erosion and track development, too.

PHOTO 3 Three neighbouring deep-cut tracks in the vicinity of Csákánypuszta

Abandoned tracks transforming into gorges do not only increase the area damaged by linear erosion by headward extension of channels but paths of erosion also begin to extend headward on their steep sidewalls. This mechanism is not only observable on deep-cut tracks but on any anthropogenic excavation (Photo 4). At the foot of steep hillslopes, slopes are undermined to obtain building material (sand, loess, loessy sand), and if the disturbance takes place next to the track, erosion hazards are multiplied.

PHOTO 4 Erosion of a vertical wall of artificial origin similar to that of deep-cut tracks; a young "tributary valley" leads up to the wall (Csákánypuszta)

L. Zámbó (1970) called attention to a specific type of deep-cut track transforming into gorges. During deepening, the track may reach the Pannonian layers below the loess and, as a result, its originally rectangular cross-section becomes V-shaped at the bottom.

On the upper, 'extinguishing' reaches of tracks, headward extension intensifies laterally along tributaries. Fortunately, arable land is rarely situated in the immediate neighbourhood of the track. When, through headward extension, the track reaches arable land (Photo 5) or there is ploughland in its immediate vicinity, potential destruction by linear erosion highly increases. Erosional rills in loose deposits rapidly extend headward, enlarging the watershed area of the track now developed into a gorge. The slopes of abandoned

PHOTO 5 The head of a deep-cut track extending headward and transforming into an erosion gully reaches arable land (Nógrád basin) and, therefore, contributes to the denudation of ploughland

PHOTO 6 Abandoned deep-cut track with stabilized slopes in the western foreland of the Gerecse Mountains

gorge-size tracks may stabilize after a time and their cross-sections become trapezoid (Photo 6).

From the comparison of old maps, L. Zámbó (1970) comments on the evolution of tracks into gorges. Some of the tracks in the Szekszárd Hills were gorges as early as 120 to 180 years ago and some of these were the same as they are today. This apparent paradox is explained by the fact that the evolution of deep-cut tracks is discontinuous, taking place through intermittent, but catastrophic, rainfall. The comparison of maps drawn at various dates also indicates that a part of the tracks, and the gorges which evolve from them, have disappeared: they have been buried.

DENUDATION RATES

From the eroded mass and the area of the watershed, the height of the layer removed from the deep-cut track can be calculated. According to the calculations by L. Hempel (1957), in the event of storms or snowmelt, a 0.5 to 2.0 cm sediment layer is eroded. Annual denudation rates may reach 10 cm which gives an average of 1 m per 10 years. L. Zámbó's measurements (1970) indicate average annual rates of 10 to 15 cm for some gorges in the Szekszárd Hills. Naturally, major cloudbursts may result in greater amounts of denudation. S. Láng (1968) observed the development of 3--4 m deep and 1--2 m wide gorges following a cloudburst on June 9th, 1953 in the loess areas around the Vértes and the Gerecse Mountains.

This can be compared with K. Ruppert's data (1952) which highlights the role of denudation in the loess areas of the FRG, where loess gorges are also characteristic froms (G. Richter 1965). At Alsheim, a track 3 m deep and about 100 m long reached an average depth of 6 m over a 40--50 year period, which meant the removal of 4,500 m^3 of material.

CONSERVATION

The adverse effects of deep-cut tracks are clear from the above. Directly, they occupy vast areas of agricultural land and, indirectly, through the acceleration of linear, and occasionally areal, erosional processes, they considerably contribute to soil loss. Conservation lies in drainage. Dykes should be dug along roads and, at regular intervals, water should be diverted to the sides from the road surfaces. Erosional rills should be buried and filled; areas not taken by traffic should be covered with vegetation. The most effective means of conservation, however, is also unfortunately, the most expensive: the paving of road surfaces.

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Geographical Essays in Hungary
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GEOGRAPHY AND REFORMS OF ADMINISTRATIVE AREAS IN HUNGARY

Zoltán HAJDU

OBJECTIVES

The state is a spatially patterned institution with an inner political regional division. The geographic distribution of the population and their settlements is a characteristic of all states. The geographic division of public administration is primarily connected with the power and policy of the state concerned. Therefore, the development of the regional system, as well as the balance between centralization and decentralization, always depends on the class and power relations. Ruling classes always shape the structure of the state and its spatial pattern in their own interests. It should be noted, however, this does not exclude the development of a rational, spatial pattern: on the contrary, the evolution of an efficient spatial system relies on the exercise of power.

A number of state activities are carried out by local governments and directly affect the population. The spatial division of public administration greatly influences the mobility of the population and the functional, as well as hierarchic, relations within the settlement network. The centres of administrative areas (inasmuch as defined by legislation), by performing their administrative functions -- create spatially limited forms of population mobility.

The present study gives a short review of the development of Hungarian geography in the field of public administration, as well as investigating the interaction between geography and administrative area reform. The author outlines the views of geographers on some of the problems of the administrative spatial pattern, the contribution made by the development of theoretical geography to the transformation of theories about administrative areas, and the part of geographers in the solution of practical problems. He also describers the role of foreign geographic schools and influences in the development of Hungarian administrative geography.

Without describing the different plans for reshaping the spatial pattern and their implementation, or analyzing the figures, the author here outlines the basic questions related to geographical and spatial theories.

THE HISTORICAL RELATION BETWEEN GEOGRAPHY AND PUBLIC ADMINISTRATION

Geography and the geographical division of administration have been closely interrelated throughout Hungarian history. Up to the end of the 19th century, geography was mostly concerned with the description of the state. For a long time, its main task was considered to be the encyclopedic description of the administrative units, starting with the counties. As a result, administrative units became the basic geographic category and the main field of research, data collection and processing.

The development of geography, however, brought about changes in the approach to space. We find that there was a gradual introduction of a new system of categories, along with new and independent ideas on space within geography. Even at the beginning of this century, administrative geography was becoming only an independent sub-discipline which carried out theoretical and applied research into the organization and division of administrative areas, and which elaborated the geographical bases for the administrative division of the country.

The geographical questions related to the organization of local government areas arise at two levels: (1 administration of settlements (village, city etc.); (2 administration of areas (districts, suburban areas, counties etc.). Problems connected with geographic bases, the effects of settlement administration and the government and organization of areas all fall within the scope of administrative geography.

The basic territorial units of Hungarian administration are the counties. These are historic administrative areas with their roots as far back in history as the foundation of the Hungarian state. Their number and area has changed a lot in the course of time, of course, and some have even ceased to exist, yet the spatial division of Hungarian administration has always been characterized by a kind of historic and territorial stability.

Considerable changes in the county division of Hungary have been made in latter years: in 1876, 1923 and 1949. These territorial changes were partly caused by socio-economic and political changes and partly by the new national borders.

A chronological look at the relationship between geography and the organization of administrative areas makes it clear that, up to the end of the 19th century, geography always adapted itself to the prevailing system of local governments. It is in the early 1900's that exact criticism (based on geographical analyses of transport and isochronic maps) developed. Plans based on geographical considerations for the reform of public administration started in the 1920's. After the Liberation in 1945, geography was also involved in the theoretical and, to some extent, practical development of administrative reform on a complex basis.

Analyzing the relationships from the viewpoint of geographical theory, it is possible to state that, up to the Liberation, the dominant approach was based on the landscape theory, but the need for administrative division based on the central place theory also appeared. From the 1950's onwards, many argued for the establishment of economic regions as a possible basis for the reform of administrative areas. The most recurrant approach stems from the central place theory and proposes reform on a basis of gravity zone studies. The concept of economic regions also recurs in different forms.

GEOGRAPHY OF PUBLIC ADMINISTRATION AND EFFORTS TOWARDS A NEW ADMINISTRATIVE DIVISION BEFORE THE LIBERATION

The compromise of 1867 created the Austro-Hungarian Monarchy. Hungary then enjoyed an interior independence and, on the path of bourgeois and capitalist development, it was a major task to create a modern public administration.
The reform of administrative areas, introduced in 1876, was aimed at eliminating the feudal self-government of the areas and creating a uniform system, but it could only achieve a few moderate changes. The bourgeois system of administration was, after all, still in keeping with the historic county boundaries. At that time geography was not very developed in Hungary and for this reason it could not play a part in the preparation of the administrative reforms. Geography adapted itself to the new county boundaries and used them in describing the country (K. Ballagi-- P. Király, 1878). Geography considered the new administrative division a natural fact and saw it as a kind of spatial framework.

At the beginning of the twentieth century, political geography began an analysis of the inner political division of the country. For political geography at that time, the three basic elements of the state were the area of the country, its population and its political structure. The complexity of the Hungarian state and the strikingly disproportionate, malformed, sometimes even irrational, character of its administrative division greatly contributed to the development of administrative geography in this country.

In the first modern synthesis of Hungary's geography, Gy. Prinz (1914) gave a critical analysis of the country's interior political division and laid the foundations of administrative geography (Gy. Prinz, 1914). Administrative geography is concerned with the study of interior boundaires, concentrating primarily on county boundaries. It claims that, in order to determine the interior political boundaires, the natural, economic and transport factors should be taken into consideration. Such considerations led Prinz to criticize the existing county borders and the territorial disproportion of the counties. As a general requirement, he claimed that the administrative centre should be in the actual centre of the area under consideration, since, for most of the population, administrative division was primarily a question of commuting distance and transport available.

What has been said above indicates that Hungarian geographers began to critically analyze the geographical problems of administrative division before World War I. These studies, plus the influence of German geography, contributed to the development of administrative geography.

After being defeated in World War I, the Austro-Hungarian Monarchy collapsed and historic Hungary disintegrated. The changes in the national borders, instituted by the peace treaty of Trianon, deepened the contradictions within the geographical division of public administration. Of the previous 63 counties, only 10 remained completely within the new borders. 28 were attached to new states and 25 were divided into two or more parts. Within the new national boundaries, reform in the spatial division became inevitable.

P. Teleki, the founder of Hungarian economic and political geography, was a high-ranking politician between the two wars (both premier and minister). Motivated by theoretical and political interests, he dealt with the problems of territorial division and organization.

He claimed that geography should concentrate on all socio-economic and political phenomena connected -- in one way or another -- with our natural surroundings. He did not consider the country to be homogeneous, but a system of individual and hierarchially linked lands. Thus, landscape was a higher grade of unit. He argued for an objective view of landscape and emphasized that every socio-economic and political issue should be analyzed as determined by the landscape.

He elaborated his reform proposal in 1921. He divided pre-World War, historical Hungary into administrative units, using as a basis natural regions, a basis in keeping with his landscaped determinist approach. When drawing the boundaries of the administrative units and geographical regions, he not only took into consideration the views of minority groups but also the socio-economic and historic factors, and settlement network, along with transport and supply systems as well. Geographical regions determined in this way would have constituted the areas of individual counties and public administration would have functioned as a landscape administration (P. Teleki, n.d.).

His proposal had no practical value because it dealt with country borders which had ceased to exist. It has, however, a theoretical and historical value, since it deeply influenced geographical thinking in Hungary between the two world wars and he was the first advocate of landscape administration. Teleki's ideas were strongly influenced by the French school of landscape geography and Clémentel's ideas on regionalization. Teleki was also influenced by the views of C.B. Fawcett.

The need to reshape the administrative divisions according to the principles of landscape geography emerged again in 1940. P. Elek compares the geographical regions of Hungary (large, medium and small) and its planned administrative division. He claims that the division of administrative areas should be determined by natural regions and, in this way, makes landscaping a basic task for public administration.

Important propositions for practical territorial re-division have been put for ward by Gy. Prinz. Although he also believes in the concept of objective landscapes he gives priority to considerations of gravity zones and transport facilities.

He elaborated his reform proposals in 1922, working within the new national borders and using transport geography as a basis. He proposes that there should be 23 counties, which all represent transportation units.

These rational considerations were not taken into account in the 1923 reform of administrative areas, specifically because this reform was elaborated for political purposes. The main concern of the Horthy regime was to keep revisionist territorial claims before the public eye.

In 1933, Prinz finds a more differentiated approach to questions concerning spatial organization of public administration (Gy. Prinz, 1933). After considering and synthesizing the requirements of political science, sociology and geography, he makes an attempt to outline an optimal pattern of administrative areas for Hungary. In formulating his proposals, he took into account the transport, trade and administration functions of the centres. He mainly respected the commercial and transportation zones of attractions when proposing centres of non-urban districts. In planning the county seats, he stressed the requirements of transportation-geographical links and urban network development (Fig. 1).

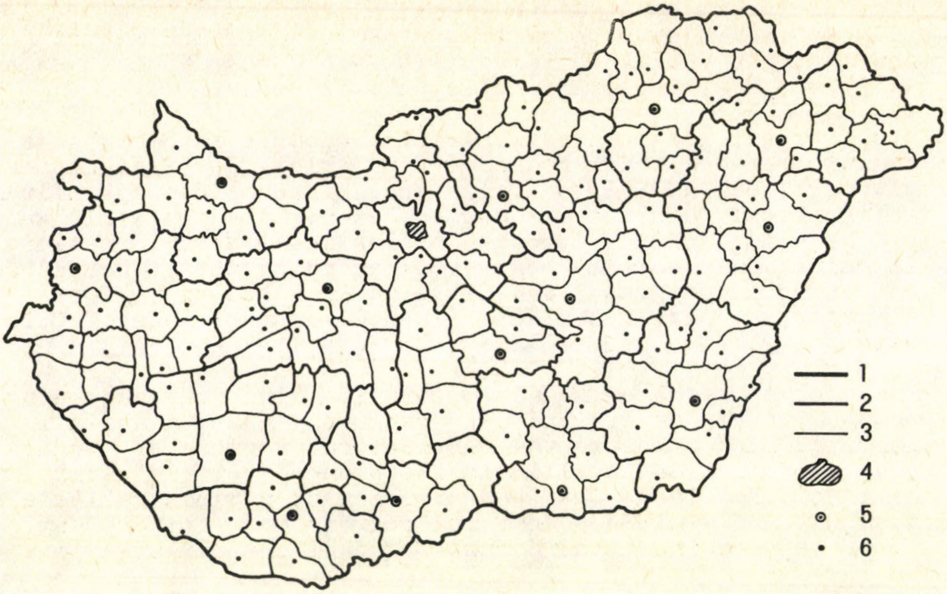

FIG. 1 Sketch of an ideal political division of the Hungarian state (Gy. Prinz, 1933).

1 = state border; 2 = planned county boundary; 3 = planned district boundary; 4 = capital; 5 = planned county seat; 6 = planned district seat.

Prinz was chiefly influenced by German results in the fields of political geography, political science and the organization of administrative areas, but one can also find the impact of the French school of landscape geography in his works.

From the 1920's, the territorial division of public administration, its geographical problems and the formulation of a rational system increased in importance in geographical research. Attention also focussed on the role of public administration, and its effect on the regions.

REFORMS IN ADMINISTRATIVE AREAS AFTER THE LIBERATION

The country was liberated on 4th April, 1945, but the Provisory National Assembly began to lay the foundations for the new, democratic Hungary as early as December, 1944. A part of this work was to regulate the new administrative areas, even if only provisionally. This move (fusion of counties, adjustment of boundaries, annexation of communes) eliminated the most striking disproportions of the previous divisions. As it was through petitions submitted by the population itself that these measures went ahead, the changes were received with unanimous approval.

In the period between the Liberation and 1949, when the new constitution was introduced, the different political parties put forward various reform ideas each according to its own purpose and concept of the future. Each party had its own ideas on administrative reform, including the reshaping of the territorial divisions.

The new constitution formulated an unambiguous and long-term system for administrative areas. It did not change the historical distribution i.e. the main units of settlement or regional administration remained the communes, districts and counties. However, by reforming the purpose, position and authority of the administrative units in a democratic way, in addition to introducing the system of councils, the new constitution could still bring about radical changes.

After the introduction of the new constitution, reforms were implemented first in the counties and, later, in the district centres. In the place of the previous 25, 19 counties were created. Thus, the disproportion among the areas and population number could be eliminated. The new counties were of medium size. The reform in district administration established 140 districts, instead of the previous 150. These new districts had relatively smaller areas and less population, and they largely formed homogeneous territories geographically, economically, and with regard to the transport and settlement networks. Most of the new district seats were the real centres of the districts.

The reform of regional administration was followed by the reorganization of settlement administration, both in area and structure. In this respect, the reshaping of the Budapest administrative area is of particular importance. (In 1949, 7 towns and 16 villages were attached to Budapest, which solved the administrative problems of the capital). Decisive changes were also made in the administrative division of communes. Before the introduction of the councils system, there had been 1,191 communes and 662 notarial districts, i.e. there were altogether 1,853 local spatial units of administration. In 1950, 2,978 councils were established, among them 170 joint communal councils from 361 villages. The structure of public administration introduced in 1950 has been transformed in several ways during the last three decades. The number of counties has remained unchanged, but, on a few cases, small pieces of land have been transferred from one county to another. There have been, however, considerable changes in the function, number and regional structure of the districts: their number had fallen to 83 by 1983. Parallel to this, local governments in suburban areas have gradually appeared and gained importance. The suburbs of 61 towns now cover the total area of several districts, while there are other cases which cover smaller areas.

There have also been a great many changes in town and village administration. To begin with, the number of towns increased from 54 to 96. In 1983, 3,004 villages were governed by 1,394 communal councils, out of which 679 were independent and 715 joint councils.

After the Liberation, Hungarian geography rejected the determinist approach. Geographers now analyze the relationship between nature and society as a dialectic interaction. All plans concerned with the creation of economic regions and gravity zones take natural surroundings and environmental effects into consideration, although environmental conditions are not regarded as dominant factors. Nevertheless, the period after the Liberation did not bring forth any reform proposals in the field of regional administration. Hungarian geography, renewed in the Marxist spirit has always paid attention to the geographic questions of administrative areas in theoretical and methodological debates. The statistical and territorial analysis of Hungary's administrative geography was published in 1948. (T. Kovács, 1948). Geographers then analysed territorial division reforms, introduced in 1949, from the angle of transportation geography, including a criticism of the area, boundaries and even the seats of the new counties in the work (A. Vagács, 1952). On the other hand, they pointed out that the theoretical and practical realization of unified economic and administrative areas/regions had been neglected (P. Beluszky, 1980).

After 1949, research into the regional division of the economy started in Hungary, much influenced by Soviet economic geography, and it became the central issue in economic geographical studies until the late 1960's. The theory of economic regionalization was not primarily concerned with formulating a rational division of administrative areas, but it concentrated on describing the spatial system of the economy through an analysis of territorial specialization and complexity, through the determination of the sectoral and complex economic regions. This theory used complex economic regions as a basis for administrative division (P. Beluszky -- T. Sikos, eds., 1982).

The various regional divisionsof the economy (mostly hypothetic in character, based only on the territorial characteristics of the country) contain different proposals for the spatial pattern and hierarchical structure. Only a few of these sketches take into consideration the specific territorial requirements of public administration (Fig. 2).

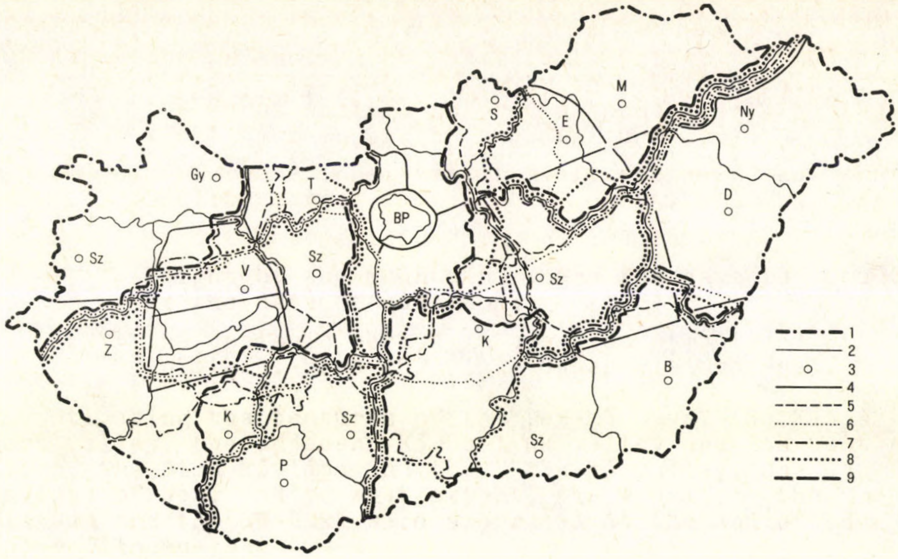

FIG. 2 Proposals for the economic regional division of Hungary

1 = state border; 2 = county boundary; 3 = county seat; 4 = proposal by Gy. Markos in 1952; 5 = proposal by S. Láng in 1959-60; 6 = proposal made by the Karl Marx University of Economics in 1960; 7 = proposal made by the Karl Marx University of Economics, second version, 1960; 8 = proposal made by the Karl Marx University of Economics, 1963; 9 = proposal made by the Attila József University, 1969.

Research into gravity zones, using the central place theory, increased in importance in the 1960's. Describing the functional and hierarchical structure of the settlement network and functionally interpreting the relationship between town and country-side led geographers to the following conclusion: the regional system of gravity zones should always be taken into account when the question of forming or reforming the administrative areas arises.

From the early 1970's, geographical research into the regional pattern of the economy, society and administration became increasingly important. This was due to the fact that this kind of research makes a sound basis for the further development of regions and public adminstration. Although the results of such research are rarely published in scientific papers (P. Beluszky, 1980), they are often used as the scientific basis for various decisions. Studies concerned with the geographical problems of administrative areas usually include studies on gravity zones, but the influence of the economic regionalization approach is still felt. Geographical studies on the spatial organization of administration have greatly contributed to the transformation of space concepts in political sciences. At the same time, we can also see that theories now outdated in the geography of public administration still have a great influence in non-geographic sciences.

SUMMARY

Hungarian geography of public administration has not developed in isolation. Its formation was influenced, on the one hand, by malformations in the Hungarian pattern of administrative areas and, on the other, by results in French, German and English studies on administration and regionalization. However, the development of the economic regionalization theory was fundamentally determined by the Soviet school. There is no general agreement on the geographical approach to questions of public administration or on basic problems of spatial organization in Hungary.

All three theoretical systems -- landscape, central place and economic regionalization -- claim to provide a total interpretation of physical, economic, social and political phenomena (although they differ in emphasis). For this reason, all three systems are concemed with the theoretical and practical problems of administrative organization, and each system elaborates its own theoretical framework and comes up with reform proposals. Since the concrete area patterns described in these proposals are different they cannot be reconciled or integrated, in spite of their common theoretical starting point.

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THE POPULATION DYNAMICS OF FUNCTIONAL URBAN REGIONS IN HUNGARY, 1870–1980

Eta DARÓCZI

The ill-proportioned structure of the Hungarian settlement and urban network, the historical and geographical reasons for its formation, as well as the changes which have occurred in the composition and the inner structure of settlements following World War II, are all of great concern to a wide range of scientists in Hungary.

Given below are only a few random examples of those who have made significant contributions to the study of this topic, covering a variety of disciplines: Gy. Granasztói, (1980) and S. Gyimesi (1975) in history; P. Beluszky (1978), T. Bernát (ed. 1981), Gy. Enyedi (1980, 1981) and E. Lettrich (1965, 1975) in geography; J. Kóródi--Gy. Kőszegfalvi (1971) in economics; S. Berényi (ed. 1978) and T. Madarász (1971) in political and legal sciences; F. Dallos--E. Szabady (eds. 1966) and J. Kovacsics (ed. 1963) in demography and statistics; R. Andorka (1979), F. Erdei (1974, reprint of 1939, 1972) and I. Szelényi--Gy. Konrád (1969) in sociology; J. Borsos (ed. 1961), P. Granasztói (1976) and K. Perczel--Gy. Gerle (1966) in urbanism and planning.

The study of developments in Functional Urban Regions (FURs) and the relationships between their constituents, the core and ring areas, has been given increasing attention since the 1960's, mainly due to the fact that commuting has become a general social phenomenon.

Literature on this topic is abundant with regard to papers (see the bibliographies compiled by I. Eke--P. Beluszky, 1970; P. Beluszky--J. Simonfai, 1975; A. Ádám, 1978 and É. Szalai, 1978): many only deal with Budapest and its agglomeration (e.g. Gy. Berkovits (1976) from a sociological, point of view, L. Fodor (1973, 1976) from an economic, T. Bernát--M. Viszkei

(1972) and E. Vörösmarti-Tajti (1971) from a geographical aspect. Now, however, there are numerous socio-economic, geographical and statistical descriptions and analyses of other Hungarian FURs. Nevertheless, P. Beluszky, a leading Hungarian theoretician and methodologist of functional spatial relationships, is still right in stating that "no comprehensive analysis of the attraction zones of Hungarian towns has yet been made. The national network of functional urban regions, the attraction zones of individual towns, and the nature and the quantitative indicators of the relationships between town and village are mostly unexplored and unknown." (P. Beluszky, 1981, p. 44)

In Hungary, the geographical and spatio-economic study of both the settlement network as a whole and individual Functional Urban Regions is dominated by a static approach aimed at exploring structures. In the case of the settlement network, analyses focus on grouping, classifying towns and villages, and setting up an hierarchical order of settlements (e.g. P. Beluszky 1968; P. Beluszky--T.T. Sikos, 1982; Gy. Bora, 1982; E. Lettrich, 1975), while, in the study of FURs, the central issue is the delimination of the fields of attraction (e.g. P. Beluszky, 1981; S. Katona, 1979; A. Kuruc, 1971; L. Lackó, 1980). The static approach also prevails among those studies which relate observations and statements to more than one series of cross-section data, i.e. where comparisons are made between points of time, or even between periods (e.g. M. Barabás, 1970; P. Beluszky, 1973; A. Faluvégi, 1972; T. Kovács, 1972, 1982; L. Pesti, 1974; M. Sümeghy, 1969 J. Tóth, 1980; J. Turáni, 1977, 1982). This remains, however, comparative statics, statements on similarities and dissimilarities between structures at various points in their development, rather than dynamic analyses, a characterization of the paths leading from one state to another.

With the intention of directing attention to dynamics, the population trends in Hungarian towns and villages, as well as selected Functional Urban Regions (both core and ring areas), were analysed over a relatively long historical period (E. Daróczi, 1983). The present paper summarizes the conclusions drawn concerning only the 26 Functional Urban Regions.

The areas under investigation (Fig. 1) were delimited according to functional relationships, mainly commuting, as perceived at the second half of the 1970's (ÉVM--KSH, 1977). It follows that population change over a long period is analysed in territories with fixed boundaries. For the sake of lucidity, FURs will be mostly grouped into three categories, according to the size and functional character of the cores (Budapest, the 5 regional centres and 20 smaller commuting centres), but the distinction between core and ring areas will always be kept.

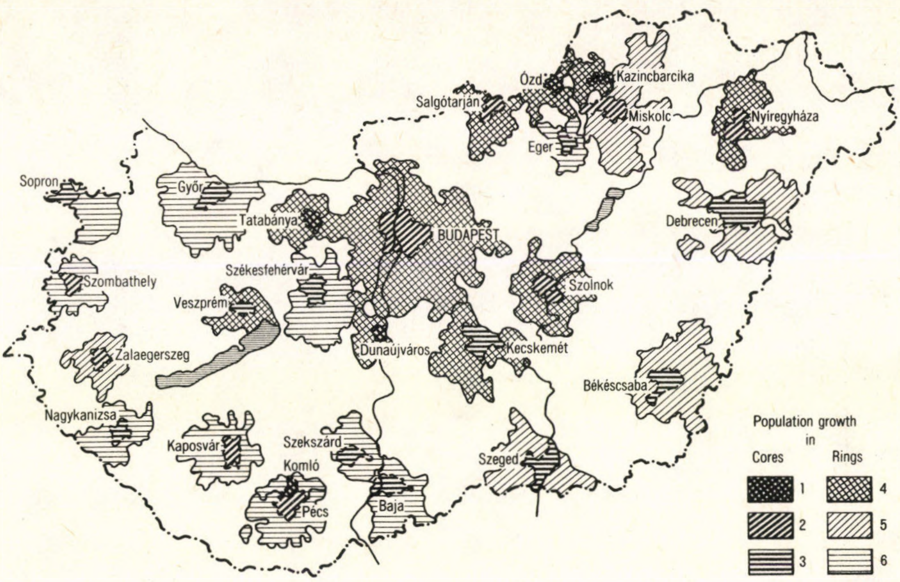

Fig. 1 Population growth in Functional Urban Regions between 1870--1980 (administrative status as of 1 Jan. 1978)

1 = outstanding (population increased more than tenfold); 2 = dynamic (by 4.5--7); 3 = moderate (by less than 4.5); 4 = significant (population increased by at least 1.8); 5 = fair (by more than 1.3 but less than 1.8); 6 = weak (by not more than 1.3).

As a starting-point, the following questions were asked:

i. What spatial concentration/deconcentration and centralization/decentralization processes have taken place over the past century?

ii. Do smaller centres follow larger ones and ring areas their cores, according to the respective development patterns?

iii. How fast do growth patterns spread?

iv. Have pre-war tendencies survied, have they been "restored" (F. Jánossy, 1966) or have they changed?

v. Is it possible to distinguish subsequent periods of urbanization with regard to core and ring population dynamics during the 110 years covered? (L. Van den Berg et al., eds. 1982)

THE POPULATION CHANGE IN COMMUTING CENTRES (CORES)

With regard to the 26 commuting centres in the aggregate, a dynamic, albeit decelerating and linear, growth can be established, when all the observations from the entire period are taken into account (Fig. 2). In the years follow-

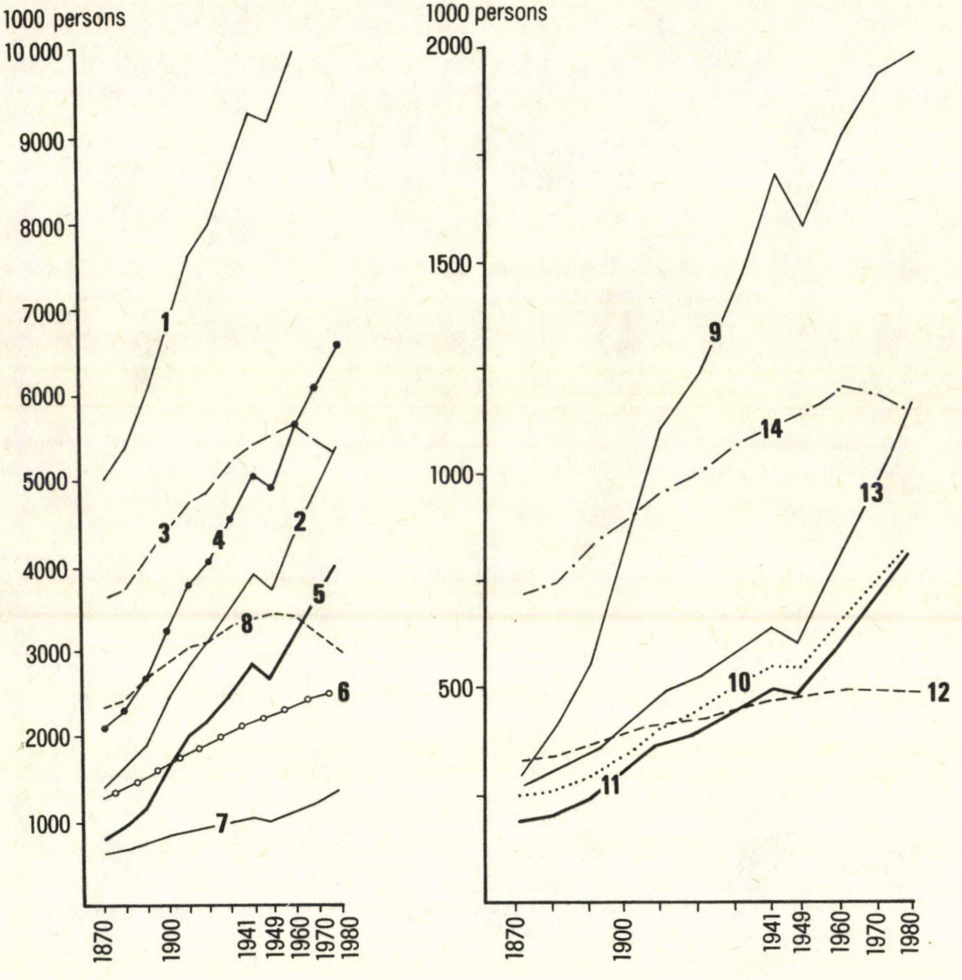

Fig. 2 Population change in Functional Urban Regions as compared to other parts of the country (administrative status as of 1 Jan. 1978)

1 = Hungary; 2 = all Hungarian towns (87 in 1978); 3 = all Hungarian villages; 4 = the 26 FURs (cores and rings together); 5 = 26 commuting centres (cores); 6 = 26 commuting

rings; 7 = 61 smaller towns; 8 = villages not belonging to FURs; 9 = Budapest; 10 = Budapest's commuting ring; 11 = the 5 regional centres; 12 = the 5 regional centres' commuting rings; 13 = the 20 smaller centres; 14 = the 20 smaller centres' rings.

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ing 1949, growth was above average, but it still was not rapid enough to reach the population growth prophesied by growth rates in the earlier peaceful periods when there were no wars and epidemics. During the 1970's, the growth rates of commuting centres dropped to a level which, altough high in comparison to pre-war times, was still lower than their growth rates in the preceding years. This drop happened before the pre-war trend could be restored. As no rapid growth can be expected in the future, it seems fairly certain that the previous path of development is unlikely to continue and a new trend is about to emerge. After a short period of exponential, followed by a longer one of linear growth, the population of commuting centres will, most likely, increase at a decelerating rate, along the line of a concave parabolic curve. The hypothesis according to which the higher the hierarchical level of an urban centre, the sooner its growth starts to decline, is well demonstrated in the hierarchical groups of commuting centres (Fig. 3):

- Budapest was in the parabolic stage as early as the 1950's. Both absolute and relative population changes fell far behind the corresponding figures for previous outstanding years, so instead of "restoration", there was a shift in the trend. Post-war population growth in the capital was therefore regarded as excessive, not because it was unprecedented, but because of the earlier unhealthy settlement development, leading to a situation where the city's overpowering proportions have grown both economically and socially intolerable.
- The development of the 5 regional centres, taken together, was relatively even and exponential over the 110 years considered. After 1949, however, none of them could again reach the average of the outstanding growth rates observed between 1880 and 1910. The aid which was given to these regional centres in the 1960's, to help develop them into counter-poles, was too late to re-channel the dynamics of Budapest. And the earlier development of these cities and their demographic state did not give sufficient backing to these plans this being the period of lowest birth rates. Regional centres failed to revert back to even their own pre-war development trend and so it was unlikely they would ever do so.
- Over the 110 years investigated, the development of the 20 smaller commuting centres was only a little slower on average than that of the regional centres and it was also

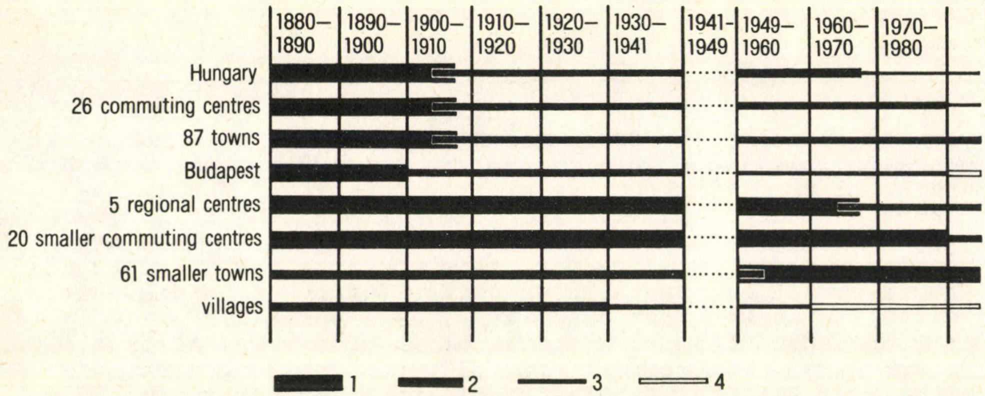

FIG. 3 Development trend patterns of population change in hierarchical groups of settlements (administrative status as of 1 Jan. 1978)

1 = exponential growth; 2 = linear growth; 3 = parabolic growth at decelerating rate; 4 = negative change.

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exponential. Their rapid growth after 1949 largely surpassed the average rate of increase between 1880 and 1910, the period of exceptional population dynamics, and thus, by the 1970's, the trend which had been forecast by the highest growth rates was restored. In the future, a slower development is expected with the trend curve becoming linear.

In conclusion, while the aggregate population growth of the commuting centres has remained steady there were significant changes within the hierarchical groups, so that the character of development trends in the larger cities has been transferred to the smaller ones. Due to decreasing birth rates, this transfer seldom involved the adoption of an identical, but rather reduced, dynamism. The hitherto rapidest annual population growth rates have been 4.4% for Budapest and 2.5% for both the regional and smaller commuting centres. The transfer of development trends was not a regular downward, step-by-step process with the passing of time. The period of rapidest growth for the regional centres coincided with that of Budapest (1890--1900) and it was only up to 1910 that they grew at a faster rate than the smaller commuting centres. Later, the 20 smaller urban centres were either in close contest with the regional centres, or left them behind. In effect, it was not only the considerable quantitative and qualitative gap between Budapest and the regional centres which prevented the latter from becoming real counter-poles. It was also the need to develop an extensive and comprehensive urban network. In addition to historical reasons, this need was a significant reason explaining how the primate city feature of the Hungarian urban settlement network has been maintained.

The size distribution of the hierarchical groups of the commuting centres is the result of their varied development over a given period, as well as variational changes over time. The most striking structural changes occurred in the first and the last decade of the 110 year period, although these changes go in opposing directions.

In 1870, an above average level of concentration was established among the 26 commuting centres (K=58.2%, calculated according to the Boldrini approximation: P. Köves--G. Párniczky, 1973, p.286). The "irregular" superiority of Budapest was already highlighted in the inflexion of the line of function between the size and rank of commuting centres, from the "regular" 45^{o} slope: using the $P_r=P_1:r^q$ formula of the rank/size rule (P.E. Lloyd--P. Dicken, 1979, p. 75), q had a value of 1.2665, which means that the slope of the line of function is close to 52^{o}.

Between 1870 and 1910, there was an extremely strong concentration process. The pace accelerated up to 1900 and remained at a high level during the first decade of this century. With regard to the hierarchical structure already mentioned, large commuting centres, as a rule, grew faster than those below them. This pattern continued, with all its major components, during the decades between 1910--1941. The only difference was in scale: the process continued at a lesser speed. The annual average relative change of K was +0.10% and of q, +0.12%, while the corresponding figures were +0.39% and +0.48% in 1870--1910. Out of the three hierarchical groups of commuting centres, the capital's growth rate remained the highest. The insignificant earlier advantage of regional centres over the 20 smaller commuting centres disappeared, their dynamics more or less levelling up. Changes between 1949 and 1980 differed essentially, qualitatively, from the earlier changes. Following the Liberation in 1945, a gradual, relative decentralization took place among commuting centres: regional centres now surpass Budapest in growth rate and the smaller centres surpass the regional centres. It was mainly the shift in the development trend of the capital and the rapid growth of smaller urban centres which contributed to the evolution of a less "irregular" size distribution of settlements. This may be compared with the highly ill-proportioned structure which had developed during the period of early industrialization. The level of concentration dropped from 70.0% in 1949 to 60.7% in 1980 (an average annual change of -0.46%) while, at the same time, the value of q decreased from 1.5839 to 1.3673 (an annual change of -0.47%).

However surprising it may sound, the favourable processes of deconcentration in size distribution and diminishing dominance of Budapest were at their most powerful during the 1950's. This is most probably related to the national demographic boom since there are more possibilities for spatial rearrangement when the growth of the population is greater. At the same time, it calls attention to the fact that, though the appearance of new industrial towns may not have been able to transform the size distribution of the entire urban network, it has had a strong effect on it. Despite the counter-pole development concept, the dynamism of change slowed down during the 1960's, and then rekindled again during the 1970's. The latter phenomenon is also related to demographic processes (i.e. the "automatic" slow-down in the capital's development due to age composition, and the temporary growth of birth-rate in younger settlements as a response to pro-natality policy measures), but it also reflects a higher level of economic development. Industry is no longer the most dynamic economic sector; this fact also manifests itself in decentralization or diffusion, where medium- and small-sized towns come abreast of large cities as regards the relative number of industrial jobs. And, last but not least, the process highlights the results of the purposeful measures taken for the development of the settlement network, measures aimed at developing the medium and small centres and increasing their force of attraction.

POPULATION CHANGES OF COMMUTING RINGS

With regard to the population of the 26 commuting rings in the aggregate, the line of development was found to be almost straight over the 110 year period (Fig. 2). But urban settlements in ring areas grew exponentially, and more rapidly, than the towns which were neither commuting centres, nor located in their ring areas. The villages in these ring areas are, however, characterized by a decelerating (parabolic) population growth their deceleration being, however, much slower than that of villages outside the Functional Urban Regions.

In order to form a true picture of the relationship between core and ring population changes, the capital's commuting ring has to be outlined first and foremost, its development being completely different from all the other urban regions. The attraction zone of Budapest is the only one among the studied commuting rings which showed a steady exponential growth. However, the dynamism seems to have been diminishing over the past two decades and tends to be linear. The development of the outer ring slackened first, during the 1960's and then the development of the inner ring followed suit, during the 1970's. The relative decentralization within the functional urban region of the capital is not a novelty, as it dates back to the first years of this century. The population growth rate of Budapest only surpassed that of its ring area between 1870--1900, this period being characterized by increasing relative centralization. Between 1900--1941, the population of the inner ring, the present "agglomeration", had a growth rate similar to, or even higher than, that of the capital and this gap kept growing after 1949, the period of increasing relative decentralization. During the 1970's, simple relative decentralization could be observed because the total absolute population growth of the commuting ring (or only that of the agglomeration) was higher than the total population growth in Budapest. With the current decrease in the population of the capital, absolute decentralization commences and, with the exception of the de-urbanization processes, all the stages in the core and ring relationship are observable (L. Van den Berg et al., eds. 1982). Budapest's growth pattern did not continue at a lower hierarchical level, i.e. in regional centres, but in its immediate ring, in its physical vicinity. The growth rate of the capital's inner ring has been faster than that of regional centres during each intercensal period in the 20th century. This gap got smaller in the 1970's, but it still exists. The acceleration of population growth in the outer ring was consierably more moderate and temporary. Nevertheless, the presence of decentralization does not necessarily mean suburbanization and conclusions cannot be drawn to that effect on the basis of changes in population alone. Migration from the centre to the suburbs comprises one of the elements of suburbanization, and migration flows are not touched upon here (see E. Daróczi, 1981).

Before World War II, the population growth in the commuting rings of regional centres was similar to that observable in the villages outside FURs and it became slightly more favourable than the total average for villages after 1949. During the 1950's, their population grew faster and then, during the 1960's, it declined at a considerably slower rate than that of villages in general. During the 1970's, population decrease continued and the relative advantage shrank further. Centralization was at its fastest between 1890--1910 and 1960--1980, taking the form of increasing relative centralization in the early period, and that of absolute centralization in the recent decades. The early and relatively quick development of large cities probably relied on migration from the immediate environs, and this reduced the dynamism of population growth in their ring areas.

In the ring areas of the 20 smaller commuting centres, the rates of population change were more favourable than the average for villages which did not belong to any of the FURs. But in tendency, they followed the trend of all villages:

the growth rates became smaller and smaller and then the population began to decrease. But the decline set in later and at a slower rate than was general in villages. Therefore, the fact, whether or not settlements belong to commuting ring areas, is of some significance in population dynamics. Up to 1960, dynamism here somewhat exceeded even the regional centres' commuting rings for each period. The fact that at present, population densities and settlement sizes are more favourable around the small centres than in the ring areas of regional centres is not the result of development over the past 20 years, but that of a long historical process which began much earlier. In lower ranking FURs, due to the relatively slow, early growth of the centres, their smaller attraction power and, usually, the high birth rate of their rings, centralization was moderate, although it accelerated after 1949. During the 1960's, contrary to earlier tendencies, population changes were more unfavourable in the commuting rings of smaller centres than around regional centres, and, in the 1970's, lower ranking ring were already loosing population as rapidly as the villages in the aggregate.

The new relative advantage of the regional centres' commuting rings is not due to any considerable difference in living conditions, but to the fact that regional centres have changed their course of population dynamics: it has shifted to linear from exponential, a shift involving less pressure on the neighbourhood. The smaller centres, still in an earlier stage of development, have retained their high growth rates and one of the source of their development has been the relatively populous environment. Some of them have only recently become de facto commuting centres.

Scrutinizing individual urban regions with regard to the nature of their population trend lines and the size of their population change, it can be said that, in general, the growth of the centres was exponential or parabolic over the whole of the period. As for commuting rings, the most frequent phenomenon is population growth followed by negative change (a concave parabolic curve). Any notable deviation from this pattern indicates a qualitative difference which is worthy of attention. All deviations, without exception, occurred in those rings, the centres of which had reached the decelerating phase in their development. Thus, their attraction force began to diminish. Naturally, this condition is not enough in itself: the development of the centre should either give a boost to the environment (like in the Miskolc--Kazincbarcika--Ózd region) or the environment should have its own resources, independent from the centre (like in Salgótarján, Tatabánya or Veszprém).

The classification of FURs according to their growth rates over the 110 years period shows that, in half of them, relative population dynamics of the centre and the ring area, when compared to its own group and the respective averages

(Fig. 1), correspond to each other. This indicates that the rings of a relatively rapidly growing centre gave better results, while the rings around a slowly growing centre gave poor results. Despite the above, a strong positive effect from the centre on the commuting ring can only be evaluated in the exceptional cases mentioned earlier (the Budapest and the Borsod agglomerations). Otherwise it is the regional tendencies that seem to dominate over both core and ring population changes. The majority of cores and rings with above average growth are located in the northern and the north-Transdanubian heavy industry regions. Usually, commuting rings on the Hungarian Plain have a better relative position than their centres. In the southern-Transdanubian region, the majority of the centres have a medium growth rate, but the ring populations in six out of the seven urban regions here has hardly increased during the past 110 years (Fig. 1).

CONCLUSIONS

From the point of view of urban population dynamics and population centralization there are three distinct historical periods. The process was rapid during the sweeping industrial development before World War I and after World War II, and moderate during the economic slump between the two world wars. A common feature of the first two (pre-Liberation) periods of Hungarian urban growth is that the ratio of urban population increased together with population concentration within the urban network. Larger places grew faster, and the dominance of Budapest also grew. The situation has essentially changed since World War II when the population flood into urban centres resulted in the rapid development of medium and small-sized towns. The dominance of the capital diminished.

The transition of development patterns is evidence of a distinct tendency. The continuation of the same course of development found in the greater units in the smaller ones does not mean a simple adoption of the formers' growth rate. However, it implies that the general character of population change trends (exponential, linear or parabolic) is its discontinuation in one group and its adoption by another. The smaller the difference between the hierarchical groups of settlements, the shorter the time needed for the diffusion of growth patterns. Economic backwardness, belated industrialization and the gap between the capital and the regional centres explain the fact that the exponential growth of regional centres was rather weak and dragging (they shifted to the linear phase 70 years later than Budapest). But smaller commuting centres follow regional centres more closely: their shift from the exponential, to the linear, trend followed within a ten year time interval.

The analysis of the growth rates of the 26 commuting centres shows that there was an unprecedented rearrangement among them during the period of modern industrial development in the 1950's. In the 1960's and 1970's, however, the coefficient of variation in their change rates was hardly greater than during the 1920's and 1930's, periods which brought little change as regards urbanization. Thus the top of the settlement hierarchy can be considered relatively well-formed and stable.

With regard to core and ring distinction, the most unbalanced distribution of population change was observed during the last decade of the last century and between 1960--1970. Although it shrank a little during the 1970's, the variation in growth rates is still very high. In this respect, the settlement network is undergoing striking changes which indicates that the present structure is not in harmony with economic requirements or the needs of the population. In other words, it is not stable.

National and regional trends, and the characteristics of the ring areas themselves, played a much more decisive role in the historical and post-war population changes of commuting rings around the major employment centres. The only and important exception is Budapest. Although there is a correspondence between the size and dynamics of the cores and the course of the development of the rings, it is very weak and often negative. Neither the properties of ring settlements, nor their changes, can be explained in an abstract way, by the size of the centres or the internal dynamics of the FURs. Only the capital had the attractive force sufficient to enable it to pump dynamism into its ring areas for a considerable time. Thus, they could adopt, and even surpass, the decelerating growth rate of the centre. Concentrating on historical trends in population development, there were opportunities for similar development in certain heavy industry areas. But, due to the one-sided and problematic development of this sector, the concentration of resources in the centres and the low standard of infrastructure in the ring areas, the dynamism of population in the commuting zone is steadily decreasing. In other urban regions, the historical ring population changes are clearly defined in the regional trends: only the towns on the Great Hungarian Plain can boast of considerable population growth in their rings and this is mostly due to relatively high natural increase and the intensification of agriculture, rather than to the effects of the centre. The direct and positive effects of commuting centres on their ring population change can only be noticed in the case of centres with decelerated growth rates and only during the past decade. At the moment, its significance is very small and falls far behind that which could be expected from regions with a highly developed infrastructure and from a more dynamic economic, and more democratic social development.

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VILLAGE TYPES IN HUNGARY

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In the decades following World War II, radical social changes (redistribution of land, collectivization of agricultural production, nationalization etc.) occurred in Hungary, simultaneous with rapid development in the forces of production and transition from an agrarian society to an industrialized one. An extremely rapid multi-faceted transition, impelled by many factors, took place in the settlement system, and, hence, in the villages.

Industrialization was a rather slow process until 1950. While in 1890 some two-thirds (67.5%) of the population living within the country's present borders were engaged in agricultural production, by 1949 their ratio had fallen to 53.8%. From 1949 to 1980, the number of agricultural wage-earners dropped from 2.2 million to a mere 900,000, thus representing a ratio of 18.6%. The process had been facilitated by the following:

- plenty of surplus labour had previously accumulated in agriculture (the majority of rural society consisted of smallholders, day-workers and farm-hands; some three-quarters of the holdings were under 5 cadastral yokes [approx. 3 hectares], and production was mostly extensive). Modernization was thus protracted, and the "traditionally peasant" society of the villages remained almost intact until World War II.
- the changes in land ownership and the drive towards collectivization slackened the ties that had been established by private ownership of the land;
- the forced rate of industrialization (as a result of which the number of industrial wage-earners grew from 808,000 in 1949 to 1,840,000 by 1970) quickly increased labour demand in other branches of the economy, thus paving the way for a professional re-stratification (the outcome of which is shown in Table 1).

Besides professional re-stratification, the fact that agriculture had ceased to be the sole means of employment in the villages, the predomination of state and co-operative large-scale farming, as well as the technical modernization of agriculture, all played decisive roles in the transformation of villages.

Table 1 Distribution of Economically Active Residents in Villages, according to Economic Sectors, 1970 and 1980

Economic sectors	Absolute number of economically active residents 1970	Relative 1970	Absolute 1980	Relative 1980
Industry	641,062	27.2	671,684	29.3
Building Industry	150,330	6.4	165,299	7.2
Agriculture	1,016,085	43.1	753,371	32.9
Transport and Telecommunication	155,006	6.6	172,693	7.5
Trade	127,115	5.4	179,151	7.8
Water management	30,832	1.4	37,442	1.6
Other services	233,270	9.9	311,689	13.7
Total:	2,353,700	100.0	2,291,329	100.0

(According to ownership, Hungary's arable land is distributed as follows:
a) 2,871,000 ha state-owned land;
b) 5,927,000 ha in co-operative ownership, 526,000 ha of which fall onto household plots; auxiliary farms cover 380,000 ha; and 926,000 ha are privately owned. In 1980, there were 1,531 large-scale farms in Hungary, not counting the forestries. Average farm size was 7,531 hectares. Again on average, there were 2,329 cattle and approx. 12,000 pigs on the farms, plus 75 tractors and 42 motor vehicles.)

Large-scale farming affects villages in several ways:

- Large-scale farms have become the centres of production, thus significantly boosting settlement development.
- Agricultural centres, are suitable for taking over the role of family farm-yards, which were usually on the same parcels as the farmhouses. This trend has helped to improve homebuilding practice in villages, thus promoting urbanization of rural settlements. The eclipse of family farming affects the way of life of the rural population (e.g. through the introduction of fixed working hours).
- Through the concentration of agricultural production in large-scale farms, it has become possible to establish a number of the complex processes which are part of the food industry (food processing and marketing, basic research work; a high level organization of production, etc.) in the rural districts themselves and this has

given an additional impetus to the development of some villages.
- At the same time, and along with the above mentioned processes, high-volume and multifarious production is still progressing on auxiliary farms and household plots.

The drop that had occurred in the number of agricultural wage-earners wasnot proportional to the increasing exodus of the rural population and the widening range of non-agricultural jobs in the villages. This is why about 40 per cent of village wage-earners are commuters, and thus residential function has become very important in the villages.

Today, villages accommodate only about one-fifth of the country's industry, employing 400,000 people. Consequently, few villages can be considered industrial (urban) settlements, with regard to their economic role, social phenomena and external appearance.

Hungarian villages have been poorly supplied with infrastructure (Table 2) in spite of spectacular modernization affecting the entire countryside (electrification, paved roads, bus services etc.), and there are significant differences in basic infrastructure and institutions among villages.

Table 2 The size of homes and their equipment in villages (in percentage of the total number of homes in villages)

Homes (supplied) with:	1960	1970	1980
One single room	63.6	45.5	26.6
Three or more rooms	2.9	8.3	24.3
Electricity	61.4	86.2	95.9
Mains water	3.1	10.8	41.6
Gas	1.6	40.5	72.0
Bathroom	6.0	16.0	45.0

In 1870, three-quarters of the country's population lived in villages. Simultaneous with a slow downward trend in their ratio, the absolute number of village residents increased until 1960. In 1980, some 5,000,000 people lived in villages, representing 46.0 per cent of the country's total population. The loss through migration has been 7.3 per cent over the past ten years.

In 1982, 3,004 villages were registered in Hungary and settlement sizes varied to a great extent. The average population was 1,650 but every fourth village had less than 500 inhabitants.

Settlement sizes are unevenly distributed over the country. While in the southern and western regions of Transdanubia most settlements have less than 1,000 inhabitants (their ratio being as high as 83.5% in County Baranya, 83.3% in County Vas and 80.1% in County Zala), on the Hungarian Plain the majority of rural population lives in highly populous villages, reaching to 5 to 10,000 inhabitants. These large villages are not towns, neither in the legal or in the functional sense of the word. In the heart of the Hungarian Plain, there are only one or two settlements per 100 square kilometres. The great distances between settlements are sparsely populated by individual farmsteads, characteristic of the region. While these farmsteads accomodated about one million inhabitants after World War II, their present population is only about 300,000.

The transformation so far dealt with has, of course, affected the methods of classifying rural settlements. Until the end of World War II, villages could be classified in Hungary according to the character and trends of agricultural production, the ownership of land, and aspects of ground plan (layout) morphology.

F. Erdei has categorized villages according to land ownership and social stratification of the peasantry (F. Erdei, 1940). As a geographer, Gy. Prinz based his typology on the characteristics of ground plans (Gy. Prinz, 1922). Village sizes were also taken into consideration by some geographically based classifications (J. Major, 1962). And when villages acquired new features in character, differentiation was based on their economic functions, degree of industrialization, rate of commuter traffic, as well as the progress of professional stratification. That approach comes through in papers on settlement sociology published both in Hungary and abroad (for example, A.H. Finte 1953, H. Linde 1953, H. Lehmann 1956, A. von Känel 1970, A.S. Kovalev 1963). In Hungary, E. Lettrich established her settlement types according to the professional structure of the population (E. Lettrich, 1965). P. Beluszky has combined the indices of the professional structure obtained from the 1960 population census with the rate of commuter traffic (P. Beluszky, 1965). V. Kulcsár has combined the professional structure of villages with their official hierarchical rank in the settlement system (V. Kulcsár, 1976). In the past ten years, the aspect of dynamism has been given special attention in the classification of settlements (see for example, F.Schaffer, 1971). Hungarian villages have been classified using dynamism as a basis by Gy. Enyedi (1976). Classification based on development objectives establishes hierarchial categories among villages with regard to settlement size and the amount of fundamental institutions. The subject already has an ample literature (T. Kovács, 1978, J. Turáni 1971 etc.). Several attempts at classification have been made by Hungarian researchers into rural sociology, for example, A. Vágvölgyi's survey covering 100 villages (A. Vágvölgyi, 1982).

The differentiating role of the villages' economic function is gradually being replaced by a group of factors fundamentally affecting the way of life in the individual settlements. The following factors are at the heart of such cluster: the standard of supply, the population size of settlement, communications, job potential, standard of agricultural production and the cohesion of the local community. These factors affect the demographical trends of settlements, the standard of living, the structure of the local community, etc.

The method suitable for exploring such complex processes and classifying the settlements accordingly should have the following qualities:

- be suitable for simultaneously considering <u>many aspects</u> (data), instead of only one or two;
- be suitable for <u>analyzing the process shaping the transformation of rural settlements;</u>
- classification should yield, not only categories mainly characterized by statistical limits, but groups (or types) that can be described by means of the <u>similarities between the processes shaping rural settlements</u>.

In our classification of Hungarian villages, the following eight aspects were taken into consideration:

1) Natural environment;
2) Position in the settlement system;
3) Economic function (professional structure, commuting);
4) Supply standards, the level of available services;
5) Trends and rate of settlement development (dinamism);
6) Communications;
7) Standard of supply with infra-structure, and home equipments;
8) Standard of general development.

The above-mentioned eight aspects have been quantified by means of 27 indices (e.g. number of population, ratio of inhabitants living on the outskirts, ratio of commuters within the total of economically active residents, ratios of wage-earners employed in industry and the tertiary sector, number of wage-earners in local industry, plus indices for changes in population, rate of home building, ratio of homes supplied with mains water, etc.). The objectives set for the study have been reached through factor and cluster analyses.[x]

The results of the factor analysis fully support the considerable progress made in rural districts. Professional structure and economic function have lost their leading roles in shaping the differences among villages, the correlation analysis clearly demonstrates that trend.

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x Data processing was directed by Tamás T. Sikos, who also took part in evaluating the results. See his contribution in Chapter 5 of this volume.

Factor 1 which is associated with settlement structure -- fundamental supply -- standard of settlement development contains 21.5% of all information. Data on professional structure and commuter traffic are included in Factor 2 (the secondary role of these aspects in differentiating among rural settlements is also due to the progress made in professional re-stratification and the general spread of commuting). Factor 2 contains 10.2% of all information. Containing 7.2 per cent of all information, Factor 3 demonstrates the dynamism of village development. Factor 4 has been clearly established as the character of natural environment. Although the latter is not an "organical constituent" of settlements, it is closely related to many elements, e.g. settlement size, volume and nature of agricultural production, communication etc., thus having a significant indirect effect. The so-called "hilly region" effect or phenomenon is also familiar in Hungary: modern agriculture has little potential in hilly regions, and production tends to shift down to the lowlands, thus triggering a heavy migration, narrowing the local range of jobs, and so forth. The process may doom the hilly regions to stagnation and depression.

Factor 5 is shaped by the ratio of individual farmstead production (outskirts). This category of scattered rural settlements is characteristic of a certain, clearly limited, region of the country, and, in spite of its gradual deterioration, it has remained the principal shaping factor of the settlement system in some districts.

Factor 6 indicates the rate of professional re-stratification, and Factor 7 the state of communication. (The other factors add only 2.5 to 4% to the shaping of village types.)

The types of village have now been established by means of cluster analysis and the MacQUEEN algorythm. A variant producing 25 clusters was adopted for this purpose and the original 25 clusters were merged into 7 major types (see the folded coloured map).

The major types are as follows:

I. Small-size Agrarian Villages Losing Population at a High Rate, Performing Weak Functions and Offering Poor Living Conditions

In Hungary, the decay and, sometimes, desappearance of villages is not associated with any specific area, but is a product of settlement size. At present, villages with less than 500 inhabitants number 832 in Hungary, whereas villages with 500 to 1,000 inhabitants number 753 (representing 52.4% of all villages). Of these, about one thousand were included in the first major type of villages where not only settlement sizes, but also their consequences, are revealing.

Since the majority of small villages have no farm headquarters in them (only every tenth village, with less than 500 inhabitants, accomodates a farm headquarters), there is very little local demand for agricultural labour. As a consequence, even the workers of large-scale farms have become commuters, having to travel long distances to work, sometimes as far as the third or even fifth, village from their homes. Most small villages are situated in the hilly regions with poor natural resources, where not only are the yields below the national average, but also the possibilities for household farming are scanty, and its traditions weak. The decline of domestic and small-scale industries, and the lack of industrial investment have further reduced job opportunities in small villages. Commuting can only temporarily solve the problem of employment, and the adverse conditions of rural living, set against the attraction of city jobs, urge many village commuters to move out. Many small villages which have, with time, become "residential villages" continue to lose their population at a high rate.

An overwhelming majority of fundamental infrastructural institutions that once functioned in small villages have been concentrated in the larger settlements. As a result, small villages have no civil services (councils), primary schools, medical service, children's care centres, post offices and similar establishments any more. By and large, all they have is restricted to a general store, pub, public library and public telephone. At the same time, centralized institutions are often difficult to reach (owing to the low level of car-ownership and the infrequent public transport services). The technical infrastructure is also of a low standard.

Thus, the scarcity and narrow choice of jobs and the adverse living conditions have started a quick and selective migration from the villages, giving rise to various processes of decay that are irreversible in many places. Small villages lose one-fifth of their population every ten years, and, in some instances, this has led to complete depopulation. Owing to the mass migration not only are some of the villages constantly on the verge of extinction, at least as regards their independent existence, but the demographic structure of the resident population who stick to their villages undergoes a final distortion as well (in some villages, more than half of the inhabitants are over 60, so their number decreases constantly and quickly due to natural reasons). The inhabitants of such villages cannot do much about improving their homes and only very little tax can be levied on them.

II. Large Villages with Agrarian and Mixed Population, and Traditional Small Market Towns

This category includes about 200 settlements, situated mainly on the Hungarian Plain and on the lowlands of Transdanubia. In most European countries, they would be called towns, after their size as they have 6,000 inhabitants on average although some can boast of as many as 15,000. Although their past is not uniform their rural character is obvious: some of them were market towns which enjoyed certain privileges under feudalism (which lasted until the middle of the 19th century in Hungary), whereas others have always been typical village communities. Their only urban function might have arisen from their role as agricultural centres for the wide fields around them (market, food processing, handicrafts, etc.). Their infrastructural institutions only cover the bare essentials. Also their professional structure is still of an agricultural character (at the time of the survey, the ratio of agricultural wage-earners was 45 to 50%, representing a relative majority). From their size, good natural resources and similar aspects, most of these settlements are now significant agricultural centres. In relation to their size, both their general appearance and standard of technical infrastructure are inadequate, in other words, rural. For example, the ratio of single-room homes is 56.0%, and that of homes supplied with mains water does not even reach 10 per cent. Most of the giant villages situated on the Hungarian Plain have wide-spread homestead regions, and their population tends to decrease at a low rate.

III. Medium-size Villages Performing "Traditional" Rural Functions and Having an Agricultural (With Additional Industrial and Tertiary) Professional Structure

Nearly every third village comes under this category. It is only natural that during the past decades, these settlements have also undergone radical changes (land ownership, social conditions and technology of agricultural production, social transformation, progress in technology, certain changes in education, etc.), but no fundamental change has occured in their position within the settlement system and their economic function, in addition their settlement shaping processes are free from "extremities". Apart from the so-called "farmstead villages" organized during the past decades, the majority of these villages have a "regular" rural past, since they have been characteristic peasant communities throughout their history. Their agricultural character has not been left intact by professional re-stratification, but, in the individual sub-categores, the ratios of agricultural wage-earners is in the vicinity of 50 per cent. Actually, their agricultural character is more pronounced than that due to auxiliary farming activities of non-agricultural wage-earners, families having wage-earners in both industry and agriculture, and pensioners and dependents engaged in agricultural production. The population of most of these villages is in the range of 2 to 3,000, their fundamental supply is either provided or at least tackled, while public transport is adequate. Consequently, no excessive migration which would affect the normal way of life is observed, although such trend is generally apparent to some degree. A large number of sub-categories have been established through a combination of several factors (conditions and standard of agricultural production, demographic processes, progress of professional re-stratification, etc.), in addition to the general characteristics.

The other types or categories include the highly transformed, non-agricultural rural settlements which usually show signs of dynamic development. Most of these have been classified as belonging to residential village agglomerations. The number of specifically industrial villages is about 50 and a separate category has been established which includes villages with some special function, like the tourist trade or communications. Finally, there are several dozen settlements holding a village status, but which also perform certain urban functions.

IV. Villages with an Industrial and Tertiary Professional Structure which also Perform Certain Urban Functions

Actually, this category had to be established, between the administrative status of a settlement (town or village) and its effective functions. Some settlements performing urban functions are in the village category from the official point of view due to the standard specifications used. The present sub-category includes these settlements. Their average population is 5,000 (which in Hungary does not automatically mean urban conditions), and their industrial role is significant (1,000 industrial wage-earners on average). Some 37% of their economically active residents are employed in the tertiary sector, and 40% in industry. Their urban role is mostly traditional (local market centres) and, at present, they are provided with specialised shops, various secondary schools, medical specialists [and in some cases even hospitals], ambulance stations, a weekly market, and services exceeding everyday needs, etc. Their general appearance also includes certain urban elements. These settlements have been designated to play the role of local centres in the settlement network development plan.

V. Dynamically Developint and Populous Industrial Villages with an Urban Environment

Having 4,000 inhabitants on average, these settlements show symptoms of life established by the presence of industries of national importance: a typically industrial professional structure, a relatively long past of social and settlement shaping effects by the manufacturing industry, considerable dynamism, backed up by the national settlement network development plan. The average number of locally engaged industrial wage-earners exceeds two thousand. Having many commuters both ways, these settlements have mostly become the cores of agglomeration processes. From 1950 to 1970, the majority of these settlements doubled or trebled their population. Also the way of living of the inhabitants is considered urban under Hungarian conditions.

VI. Rural Settlements of Agglomerations and Residential Belts

In the years following World War II, the most conspicuous changes in rural settlements were the professional re-stratification and the commuting that followed, and the increasing importance of the residential function. Our survey found about one thousand settlements in Hungary which are characterized by agglomeration processes and integration into industrial residential belts. Naturally, settlements with many commuters and an increasing ratio of industrial and tertiary wage-earners came under this category, provided that residential development had been observed. However, professional re-stratification and commuting today are less suitable in themselves for establishing settlement categories. Consequently, many sub-categories have been established in this settlement group, with regard to factors independent of professional re-stratification (e.g. different sizes of settlement, supply standards, natural environment, etc.), as well as the phenomena associated with re-stratification (e.g. population trends, changes in man-made environment, etc.):

- populous agglomeration villages, with 7 to 7,500 inhabitants, having a properly developed, man-made environment. The majority of these villages are situated around Budapest, and the ratio of commuters is nearly as high as 70 per cent of all wage-earners, in addition, the increase in their population is very high (50 per cent from 1949 to 1970);
- villages in the inner residential belt with 60 to 70 per cent non-agricultural active residents, over 50 per cent commuting ratio and moderate population increase, in the range of 5 to 6% per decade;
- villages in the outer residential belt, where the ratio of out-commuters is very high, 60 to 70% on average, reaching as much as 80% in some cases. They usually differ from villages of the inner residential belt in their unfavourable circumstances (long journeys to work, small settlement size, inadequate supply, unstable local communities due to fast professional re-stratification, adverse demographical processes, etc.).

VII. Villages Performing Special Functions

a) Recreational Settlements of National Importance

About 50 settlements of clearly recreation character come under this category and, with a few exceptions, they are all situated around Lake Balaton. Their recreation facilities and functions are highly developed, and the consequences of this are strongly felt. Most of these settlements are agglomerates of various settlement fractions with different historical backgrounds, some of them having been originally established as summer resorts, whereas others developed into such places from ancient villages. As regards the architectural appearance of these resorts, most of the buildings are second homes, villas or week-end cottages built for periodical use on private plots. A minority of them are community establishments (hotels, boarding-houses, thermal baths, beaches, etc.). 45.6% of all economically active residents are employed in the tertiary sector and the ratio of agricultural occupation is only 25.1%. Plough-lands represent a mere 17% of the their administrative areas. This settlement category has the highest rate of home (cottage) construction in Hungary. In comparison to the number of permanent inhabitants, the infrastructure is highly developed. Population increases at a high rate (44% has been recorded from 1949 to 1970).

Like the health resort type, most of these settlements only function as tourist trade centres during the summer and this feature has been given special consideration in the typology.

b) Villages Characterized by the Majority of Wage-earners Being Employed in the Tertiary Sector (Railwaymen's Villages)

This sub-category is characterized by the relative majority of railwaymen in the population, their average ratio being approx. 40%. Most of these villages were originally typical agricultural settlements, but their present function goes back many decades. A few of them are situated near Záhony, a transfer station handling heavy traffic between Hungary and the Soviet Union.

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RURAL SETTLEMENTS IN THE BUDAPEST AGGLOMERATION

Béla SÁRFALVI

INTRODUCTION

The rural settlements included in this paper are not limited to members of the precisely circumscribed agglomeration defined either officially or by other relevant studies. The official boundaries of the agglomeration only include 44 villages and developments during the last decades have already brought their validity into question. Applying more recent attempts to delimit the study area, as published by geographers or representatives of other spatio-disciplines, would also be inapt here. It seems that interrelationships between socio-economic activities play an important role in forming the criteria of any agglomeration definition. In this way, the study area would become extremely restricted: in many of the methods used, a wide range of rural settlements located in the wider surroundings would be excluded from the agglomeration. These rural settlements cannot be regarded as integral members of the agglomeration, but the capital and its agglomeration undoubtedly exert a considerable influence on the direction and rate of their development.

It follows from the above that, when defining our study area, we not only exceeded the officially accepted limits, but went beyond even the widest interpretation of the agglomeration. We did this so that we could trace--by monitoring the developmental characteristics of observed settlements--the degree to which the capital's influence varies, depending on distance and other spatio-structural effects.

AN OUTLINE OF THE DEVELOPMENT OF THE BUDAPEST AGGLOMERATION

During the last century, the process of urbanization accelerated at a rate parallel with the country's industrialization and Budapest played a prominent role in the territorially unequal development of towns. Hungary's political and economic position changed fundamentally after 1867. The capital, then situated in the centre of the country (Hungary was several times larger at that time), made effective use of its geographical position. The advantages of its position primarily rested in the Danube itself, then becoming a busy waterway, the rapidly expanding railway network which ran radially from Budapest and the newly opened coal-mines in the neighbourhood. As a result, the capital tended to attract an ever-growing proportion of increasing industry, leading to a situation where a considerable part of the country was left out of the process of industrialization and urbanization. So, from the beginning, Budapest had an advantage over the other Hungarian towns rarely found in other countries.

As a result of this process, which started during the last third of the 19th century, Budapest grew from a town of half a million inhabitants to a metropolis of two million, while a rapid agglomeration process took place in its environs. Considering its size, economic potential and the extension of its attraction area, this agglomeration is unique in the Hungarian settlement network.

The development of the Budapest agglomeration is regular, showing no deviations from similar developments in other city agglomerations. A city-type nucleus was formed at its centre, containing about 40,000 jobs per km^2, with high day-time and lower night-time population, about 130,000 daily in-commuters and a well-developed shopping centre.

A mixed zone for working and living formed around this nucleus stretching to the former administrative boundaries of Budapest. Here, there is only a slight difference between the density of economically active residents and jobs, the latter being higher: 3,100 and 3,200 per km^2, respectively.

The outskirts have been part of the capital since 1950, before this time constituting a peri-urban zone. It is a mainly residential area, with the density of economically active residents exceeding that of jobs by 50% (the relevant densities are 1,200 and 800 persons per km^2). There is a considerable amount of commuting here to the inner parts of the city.

A new periphery with several settlements of ten to twenty thousand people has developed clinging to the present administrative boundaries of the city, which were last enlarged in 1950. A significant concentration of jobs has developed in some of these settlements but, on average, at least 50% of their active residents still commute to the capital. Local agriculture employs a mere 10% of the manpower.

Moving away from the capital, the ratio of people employed in agriculture increases to 25%, and, on average, only one third of the local manpower commute to the capital. Beyond this zone, the agricultural character of settlements becomes increasingly accentuated and they often become included in the attraction zone of cities other than Budapest.

The agglomerational growth of population had a wave-like character, which is also well-known elsewhere. Until the last third of the 19th century, the present city core grew the fastest in population, but then, the outskirts ranked first in growth rates. Even prior to World War I, the pace of population growth in the new periphery attached to the city fringes exceeded that of the centre. Following World War II, the growth rate surpassed the outskirts and, at present, this is the fastest growing zone within the agglomeration.

EFFECTS OF THE BUDAPEST AGGLOMERATION ON THE DEVELOPMENT OF ITS RURAL SETTLEMENTS

The development of the Budapest agglomeration has been more or less uninterrupted, but the location of growth centres has changed. Population growth in the city of Budapest has levelled off but the overall population of the agglomeration continues to grow. The dynamics of change, which also, incidently, increase the difficulties of delimination, require a complex approach when evaluating the influence on the settlements in the area. It is significant that changes in the whole agglomeration or only in some of its spatial elements can have two contrasting effects. They may work in one and the same direction and strengthen previously formed trends; or they may work in the opposite direction and reverse them.

The overall development of the agglomeration, the evolving relationships between the core and the ring areas, rest on three pillars which have independent roles changing in time:

(a) socio-economic processes in the core;
(b) socio-economic processes in the ring areas;
(c) changes in the conditions linking the socio-economic activities of the core and ring, the two constituent areas of the agglomeration.

(a) By "socio-economic processes in the core" we mean, for example, the ageing of the population, the decline of the birth rate and limited in-migration due to the housing shortage. Since 1960, however, parallel with these demographical processes, the number of jobs continued to increase in the capital during a period of extensive industrialization and the manpower gap which ensued could only be bridged by commuting.

TABLE 1 The Number of Jobs and Commuters in Budapest

Year	Number of jobs (in 1,000)	Number of in-commuters (in 1,000)	Commuters/jobs ratio (%)
1960	1,278.3	139.4	10.9
1970	1,294.2	204.3	15.8
1980	1,207.5	205.1	17.0

The number of jobs decreased significantly in industry, so, although the number of in-commuters did not change much, their relative importance increased.

(b) Demographic processes in ring areas are just the opposite of those in the core. The population is younger, but the higher birth rate only partly accounts for this phenomenon. The number of in-migrants is significant and they are usually in the young age-groups. And here we can highlight an essential difference between the development of the Budapest agglomeration and that of western cities. While it has been largely the well-to-do who have left the inner areas of large, western cities settling in the suburbs, inhabitants of the commuting settlements around Budapest come from lower income groups who are attracted by the employment offered in the capital, but who have no access to housing in Budapest.

The collectivization and modernization in agriculture led to a rapid decrease in jobs which has had major socio-economic consequences. A restratification in agricultural surplus labour from the rural settlements occurred through out-migration, commuting and, to a smaller extent, employment in new, local non-agricultural jobs. One of the main reasons for the decrease in the number of jobs in Budapest was the decentralization of manufacturing. Consequently, several new employment centres also developed on the peripheries of the agglomeration. More than 50,000 new jobs were created in manufacturing and in services between 1970 and 1980, mainly in larger settlements and small towns within the agglomeration, although the degree of concentration of such industrial locations varies widely.

TABLE 2 New Concentrations of Industrial and Servicing Jobs around Budapest (1970--1980)

Size groups (number of jobs)	Number of settlements where new jobs were located	Number of new jobs	Average number of new jobs per settlement
below 500	87	12,967	149
500- 999	10	8,442	844
1,000-1,999	15	24,142	1,609
above 2,000	4	9,009	2,252
Total	116	54,560	470

(c) The most important condition in creating intensive relations between the centre and its peripheries is the quantitative and qualitative development of the public transport system. In this field, due to the modernization of the railway system and the expansion of the network, the potential labour resources of the capital within a 60 minute commuting distance has increased by about 70% compared to 1950.

RURAL SETTLEMENT DEVELOPMENT IN HUNGARY AND IN THE BUDAPEST AGLOMERATION

The number of people living in Hungarian rural settlements showed a constant tendecy towards growth up to 1960, but since then it has been continuously decreasing. Both the increase in population which occurred up to 1960 and the decline of the last 20 years were unevenly spread. In some parts of the country, for instance, in west and south Transdanubia, the south-east Plain and in some isolated parts of the North Highlands, contiguous zones of rural settlements began to loose their population some 50 or 100 years ago. Following World War II, this tendency gradually spread over the whole Great Hungarian Plain. A relatively steady rural population growth was limited to the zone stretching between Lake Balaton and Miskolc, to the wider environs of the capital, and to a few settlements situated in the attraction zones of other towns. The above areas gained considerably from the process of industrialization and the development of tourism after 1950, receiving a healthy proportion of new jobs. The Budapest attraction zone, however, stands out, as its rural settlements have gone through a spectacular transformation.

The population of roughly 500 villages, which is 1/6 of the 3,025 rural settlements in Hungary, grew between 1970 and 1980, while the population of the rest decreased. More than 120 of the above 500 are within the environs of Budapest. In all, they absorbed 50% of the total population growth produced by rural settlements. 20 settlements, situated close to Budapest, increased in population particularly rapidly, by more than 2,000 heads on average. Excepting a few, rural settlements located farther away from Budapest only grew by 100--200 persons, if at all.

On a national scale, each group of settlements with a population under 5,000 has shown a negative growth rate during the past decade. In the Budapest agglomeration, however, many settlements with less than 3,000 inhabitants showed considerable growth and several villages with less than 1,000 inhabitants were able to increase, or at least stabilize, their population.

Hence, a significant proportion of the rural settlements belonging to the spreading Budapest agglomeration escaped the effects of the national trend. Due to these unique conditions, these settlements have kept their capability to develop, although, in the meanwhile, their character and function have essentially changed. Many settlements only managed to stabilize their population, while some joined the majority of Hungarian villages as their population began to decrease. Nevertheless, all rural settlements in the agglomeration show signs of belonging to the only advanced population concentration in the country, whether they grow or not.

VILLAGE TYPES IN THE AGGLOMERATION

An essential distinction can be made among rural settlements in the agglomeration by their population development trends. From among the 271 settlements investigated, 97 had a population decrease, 123 either grew slightly or stagnated and 51 grew rapidly (by more than 25%) between 1960--1980. Groups of settlements with similar development characteristics form belts around the capital (Fig. 1).

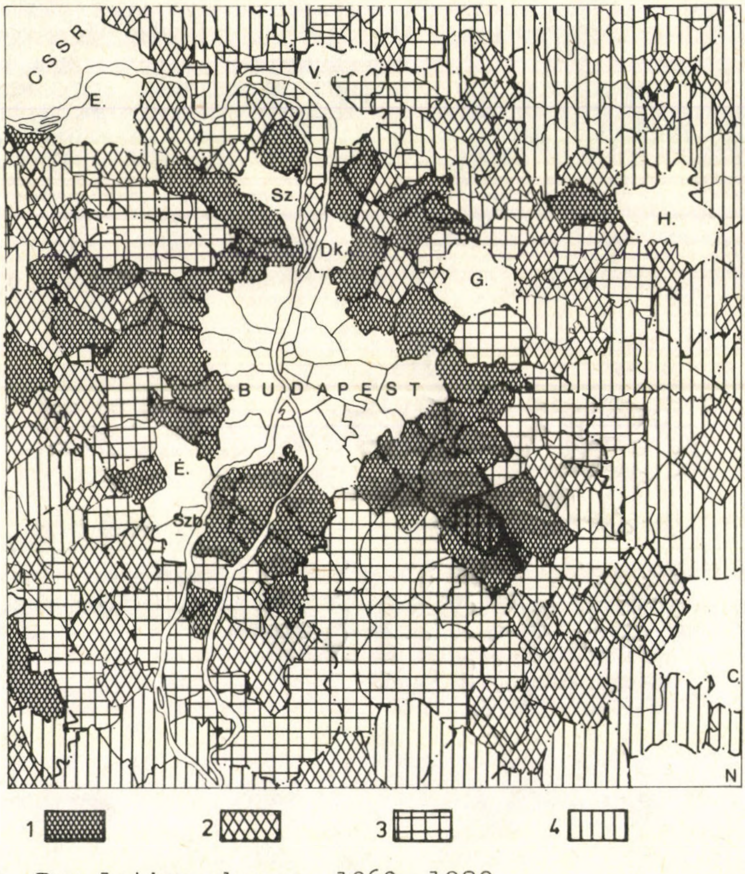

FIG. 1 Population change, 1960--1980

1 = population growth; 2 = stagnant (slightly increasing) population; 3 = stagnant (slightly decreasing) population; 4 = decreasing population.

Villages of growing population stick to the outskirts and reach out along certain traffic lines; only 4 of them are situated farther away from the capital. These either belong to the attraction zone of another town or have central or holiday-resort functions themselves. The majority of settlements, those with a slightly growing or stagnating population, also form a contiguous zone encircling that of rapidly growing villages. A few isolated settlements of this type appear under the influence of forces independent of the capital. It is also characteristic of their spatial arrangement that the faster growing settlements cluster closer to the capital, with the stagnant ones farther away. Villages with decreasing population attach themselves to the above two zones, although some of them are enclosed by growing settlements. Most villages with decreasing population are situated in an area where transport facilities are poor but one or two became holiday resorts and their permanent population is now seasonal.

During the last two decades, collectivization and large-scale farming has had the greatest impact on the population trends of rural settlements. During the 1950's, more than 400,000 workers left agriculture, while between 1960--1980 there was an additional 940,000 active workers who sought re-employment, due to lack of work and poor income in agriculture. This surplus labour was attracted by the higher earnings available in industry, where more and more labour was needed. During this process of professional restratification, the number of local jobs in rural settlements decreased, on average, by half. The union between home and work-place, which had characterized village life in the past, was broken and their capacity for retaining the population decreased. There are, however, villages which succeeded in increasing, or, at least, not decreasing, the number of local jobs.

Villages of the Budapest agglomeration were also influenced selectively by this trend and, thus, their development followed various paths. This differentiation is highlighted in the development of their local jobs (Fig. 2). Villages with an increasing number of jobs are found in all three categories of settlements (growing, stagnating and decreasing). Accordingly, settlements belonging to one and the same category may show considerably different patterns of development.

VILLAGES WITH GROWING POPULATION

This category constitutes the smallest group of settlements, but, at the same time, it includes the most populous settlements in the agglomeration area. In three quarters of them, there was an increase in both the number of jobs and the number of active residents, although the size of the increase differed considerably, as did the commuting and migration processes. Using these three indices as a basis, the 51 settlements belonging to the group of villages growing in population, can be divided into 3 sub-groups: 2 types are charac-

FIG. 2 Changes in the number of jobs, 1970--1980 (1970 = 100%)

1 = below 70%; 2 = 70--99%; 3 = 100--109%; 4 = 110--129%; 5 = 130--189%; 6 = over 189%.

terized by an increase in local jobs and one by a decrease. In most of these settlements, the ratio of white collar workers is high or, at least, above average.

A) Increase in the number of local jobs

<u>Group (a)</u> The number of local jobs increased and the need for manpower could only be satisfied by significant in-migration and natural population increase, and by commuters (Fig. 3). Local job concentration did not, however, change the dormitory character of these villages, as the number of out-commuters exceeds the number of in-commuters. There are six exceptions: these villages have such high job concentration that in-commuting is greater than out-commuting.

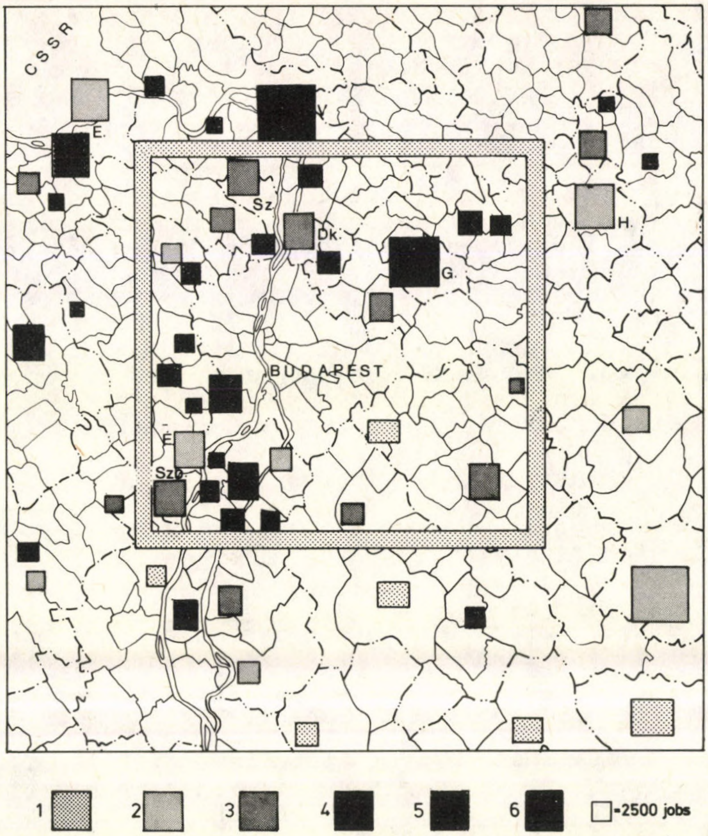

FIG. 3 Job concentration in the Budapest agglomeration (settlements with at least 500 in-commuters)

In-commuters in percentage of local jobs: 1 = below 20%; 2 = 20--29%; 3 = 30--39%; 4 = 40--49%; 5 = 50--59%; 6 = over 59%.

Group (b) The number of local jobs increased, but both out-migration and out-commuting are considerable.

B) Decrease in the number of local jobs

Group (c) The number of local jobs decreased, in-migration is moderate, while out-commuting increased.

VILLAGES WITH SLIGHTLY GROWING OR STAGNANT POPULATION

More than 120 settlements fall into this category, all of which managed to avoid, to some extent, the tendency of population decline characterizing rural settlements in general. Agriculture played an important part in retaining the population in this zone, but vigorously developing tourism and new holiday-resort facilities also helped along the Danube. In-migration is significant in areas with good public transport while isolated settlements were characterized by out-migration. Four sub-groups can be distinguished:

A) Increase in the number of local jobs

Group (a) The number of local jobs is growing, in-migration is either increasing or stagnant, while out-commuting is increasing. There are some exceptions where out-commuting has decreased, and in-commuting increased. There are holiday-resorts and "pensioners' villages" among these settlements.

Group (b) The number of local jobs is growing, and there is a considerable amount of out-commuting and out-migration. These settlements are relatively close to the capital, that is why the number of out-commuters has increased (Fig. 4).

B) Decrease in the number of local jobs

Group (c) The number of local jobs is decreasing, in-migration is significant (partly the elderly) and out-commuting is increasing.

Group (d) Out-migration is considerable, out-commuting is growing and the birth rate is above average.

VILLAGES WITH DECREASING POPULATION

The settlements belonging to this category are situated in the outer zone of the agglomeration and are not affected to any great extent by either the concentration of jobs in Budapest or any other central place in the region with regard to halting the rapid drop in population. The decrease in the number of local jobs could only be compensated for by increasing out-migration, commuting or both. Three sub-groups can be distingnished among these settlements:

A) Increase in the number of local jobs

Group (a) Out-commuting from the villages is decreasing parallel to the increase in the number of local jobs, but out-migration is continuous. The increase of local jobs is not able to restrain either out-commuting or out-migration.

B) Decrease in the number of local jobs

Group (b) Though the number of local jobs has decreased, in-migration and number of commuters increased. The settlement of retired people is considerable.

FIG. 4 Out-commuters in percentage of active resident population, 1980 (National average = 24.0%)

1 = over 80%; 2 = 66--80%; 3 = 51--65%; 4 = 36--50%; 5 = 21--35%; 6 = below 21%.

<u>Group (c)</u> Parallel to the decrease of local jobs, out-migration has increased, while out-commuting--with some exceptions--has decreased. These settlements are situated far from the main public transport lines.

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PECULIARITIES IN THE PROCESS OF URBANIZATION ON THE GREAT HUNGARIAN PLAIN

József TÓTH

The large scale socio-economic changes which followed the Second World War involved an acceleration in urbanization. This acceleration accentuated the regional differences already present at the level of urbanization and even produced additional ones. Regional differences not only reflect quantitative parameters, but also reveal the essential temporal qualitative peculiarities in the process of urbanization. In Hungary, these special features are most highlighted on the Great Plain, an area which incorporates more than two-thirds of the country.

The peculiarities in the urbanization of the Great Plain have historical roots and the most prominent has always been its relative backwardness when compared with other regions. This was even manifest at the time of feudal town development. In this period, the repopulation of the Great Plain after the desolation caused by a century and a half of Turkish Occupation (1541--1699), is in marked contrast to civic towns of other regions mainly engaged in mining, craft-work and trade. The market-towns of the Great Plain, a settlement system built around agrarian production, could only develop an incomplete social structure and a simple pattern of social functions. In the rank order of Hungarian towns, compiled using several parameters as a basis, these lowland towns ranked rather low (S. Gyimesi, 1975). Although river regulations, the establishment of railway network and capitalistic industrialization of the 19th century accelerated the rate of change in their socio-economic structure, this had very little effect on their positions within the urban network, and did not change their relative backwardness (K. Keleti, 1871). Progress during the years before and after the turn of the century was broken, first by the First World War and, second; by the Trianon Peace Treaty of 1920, which brought about drastic changes in the borders of the country. The state of the Great Plain in the late 1930's is well reflected in A.N.H. Den Hollander's book, published in Amsterdam, 1942, and, some decades later, in Hungarian (Den Hollander, 1980).

The main features of pre-war urbanization on the Great Plain can be summarized as follows:

(a) it was backward, even if compared to the general low level of urbanization in Hungary;

(b) there was hardly any industry on the Great Plain and tertiary functions were also under-developed;

(c) slow social restratification was accompanied by negligable regional mobility;

(d) except for a few, towns did not serve as foci for urbanization, as highlighted in the regional concentration of population;

(e) urbanization scarcely affected the rigid and conservative social structure of villages, among them the "giant villages" with a population above 10,000;

(f) the extensive network of "tanyas" (scattered farmsteads) was completely left out of the process of urbanization.

Due to its unfavourable position in the national division of labour, a fact which is itself historically determined, the state of the Great Plain has generally remained backward, although it was influenced by the rapid and all-enveloping socio-economic changes which followed the Second World War. However, the evidence brought forth in a series of studies in economic geography and related sciences (Gy. Enyedi, 1970, B. Sárfalvy, 1971, Z. Zoltán 1980, J. Tóth, 1981) seems to point to the fact that the Great Plain, in spite of its dynamic progress, remains a backward region as far as urbanization is concerned. So what, in fact, happened?

Due to its previously underdeveloped nature, all the major stages in Hungarian economic development found the Great Plain in a disadvantageous position. Reconstruction had to be concentrated on sites where something had existed and then been destroyed before, and where it was hoped that the restoration of facilities would result in the rapid increase of production. During the period of extensive industrialization, areas with considerable industry and, consequently better opportunities for development, were preferred and the preference lay with heavy industry, thus favouring the mining districts. Taken as a whole, industrialization took place through sectoral and regional redistribution of income drawn from agriculture by far the most important "industry" on the Great Plain. Since the development of infrastructure was also bound to heavy industry, the backwardness of the Great Plain was preserved and, occasionally, even increased in this field. Altogether these factors affected the living conditions of population adversely and, with the temporary uncertainty resulting from the organization of collective farms, led to large-scale migration from the area. Consequences of this movement made wounds which were hard and slow to heal in the demographic structure of the Great Plain (e.g. age structure, level of education, etc.).

When, in the early 1960's, the planned industrialization of the Great Plain began, it was the major settlements in the region (Szeged, Debrecen, Szolnok, Kecskemét, etc.) which were primarily affected and the other towns followed them. The differences within the region were accentuated by the time when the process of industrialization began, and when large collective farms were formed, since their potential relied on the physical environment. The resulting picture of the region is that, in spite of the progress made in comparison to past conditions, the Great Plain remained on the periphery, especially when compared to Budapest and the central areas, which made up the industrial axis of Hungary. In addition, because development concentrated on towns, some areas have been left on "the periphery of the periphery." (The term "periphery" is used here as a complex qualitative category which includes both spatial distance from the centre and temporal delay in progress. The latter means that processes, already a matter of past for the centres may have only just begun on the periphery, and the completion of these processes is quite different, often inhibited by subsequent processes which have started in the centre).

The above description of the position of the Great Plain in the regional distribution of labour in Hungary, which, due to accelerated progress, continually changes in its details, is also manifest in the peculiarities of urbanization during this period. These features, or some of their aspects, have been dealt with in a series of papers over the last decades (E. Lettrich, 1965 and 1978, P. Beluszky, 1966, E. Petri 1972, J. Becsei 1973, J. Tóth 1977 and 1981 b, R. Mészáros, 1982). Their results enable us, although some details must still be investigated further, to outline the main characteristics in the process of urbanization on the Great Plain during the last decades.

The backward position of the region within Hungary is reflected in population changes on the Great Plain. While the Population of Hungary has increased by one-sixth in the past thirty years, that of the Great Plain has remained practically unchanged; if progress had gone according to the national rate, three and a half million people would now be living on the Great Plain, instead of the actual number of three million. Large-scale inter-regional migration affected the entire Great Plain: the rural population decreased at a rapid rate exceeding the national average, while population growth in towns was only slightly above two-thirds of the average. At the same time, however, the urbaization index reflecting the role of towns within a region improves year by year, and is higher than the national average. This situation reveals the double-faced nature of urban development on the Great Plain: it is backward in comparison to other regions, but towns play relatively important roles in the concentration of population within the settlements of the region (Table 1).

This duality of urban development on the Great Plain also provides the key to its acceleration of urbanization, a goal thought desirable by many. This involves the general development of settlements in rural areas rather than increasing the rate of urban development. However, analysis of population trends over the last decades, has shown that this key has not yet been found. The still underdeveloped demographic position of the region within the country is improving decade by decade (the value of the C coefficient[x] has grown from 0.94 to 0.98) but this is exclusively caused by accelerating population concentration in towns, which was above the national rate by the 1970's. Villages are still places of out-migration. The degree of concentration is related to the backwardness of urbanization in the rural areas of the Great Plain, especially since the population of an average village in the region (2,773 people) is twice as large as in other regions of Hungary (1,365 people).

The fact that the ratio of urban population (the global indicator widely used all over the world to measure the level of urbanization) has increased from 33.6% to 45.4% in three decades, does not refer to the absolute growth of the Great Plain towns, but only to their relative dynamism when compared with the backward, rural areas in the region.

Changes in the social structure of settlements and the occupational restratification of their population are significant components in the process of urbanization. The settlements on the Great Plain were dominantly agrarian and, in spite of large-scale changes, the ratio of agricultural wage-earners is still higher than the national average. This is particularly evident at the lower levels of the settlement hierarchy, but is also manifest in the higher categories.

At first, the driving force of urbanization, as well as occupational restratification, was industry, playing the same role on the Great Plain as it played for Hungary as a whole. When extensive industrialization failed to become established in most of the Great Plain settlements, those who had abandoned farming or had been employed in industry moved from the region. However, within the decreasing total population, the ratio of inhabitants with non-agrarian occupations grew and the urbanization level of the Great Plain increased in this way (by so-called "passive urbanization").

x C coefficient shows the relative population concentration in a partial area, as opposed to the total area.

TABLE 1 Data on the Demographic Features of Urbanization in Hungary and on the Great Plain

Indicators / Periods	1949-1960	1960-1970	1970-1980	1949-1980
Population change rates, in %				
Hungary, total	8.2	3.6	3.8	16.3
Out of which: rural population	2.3	-6.3	-3.9	-7.8
urban population	16.7	16.1	11.5	51.2
Index of urbanization	1.08	1.12	1.07	1.30
Population change rates, in %				
Great Plain, total	2.1	-2.0	1.9	1.9
Out of which: rural population	-1.3	-9.8	-5.7	-16.1
urban population	8.9	12.0	12.8	37.6
Index of urbanization	1.07	1.14	1.11	1.35
C coefficient	0.94	0.95	0.98	0.87

When the second phase of extensive industrialization belatedly reached the Great Plain, it coincided with the growing non-agricultural, industrial activities in agricultural co-operatives (from the second half of the 1960's) and, thus, industry became the actual driving force of urbanization on the Great Plain. As a natural consequence, the Great Plain settlements are still in this stage, with the exception of highly urbanized towns and some smaller settlements with special functions, when, on a national scale, the leading role of industry in urbanization has been already taken over by the tertiary sector. The influence of modern agriculture on urbanization is increasing and, today, it is not only felt in villages, but also in some small urban places (Nádudvar, Mezőhegyes).

The large-scale socio-economic changes and rising living standards have also reshaped the outside appearance of settlements. The organization of large agricultural farmsteads, the emergence of industry and the development of services and communal supply have brought about new functions and, accordingly, new morphological elements in the traditional Great Plain village. New housing estates have been established in the rural zones of the traditional Great Plain market towns and the reconstruction of town centres has also begun. An ever increasing portion of the population of the Great Plain live in hygenic modern flats, although the Great Plain is still somewhat backward in this respect when compared to other regions.

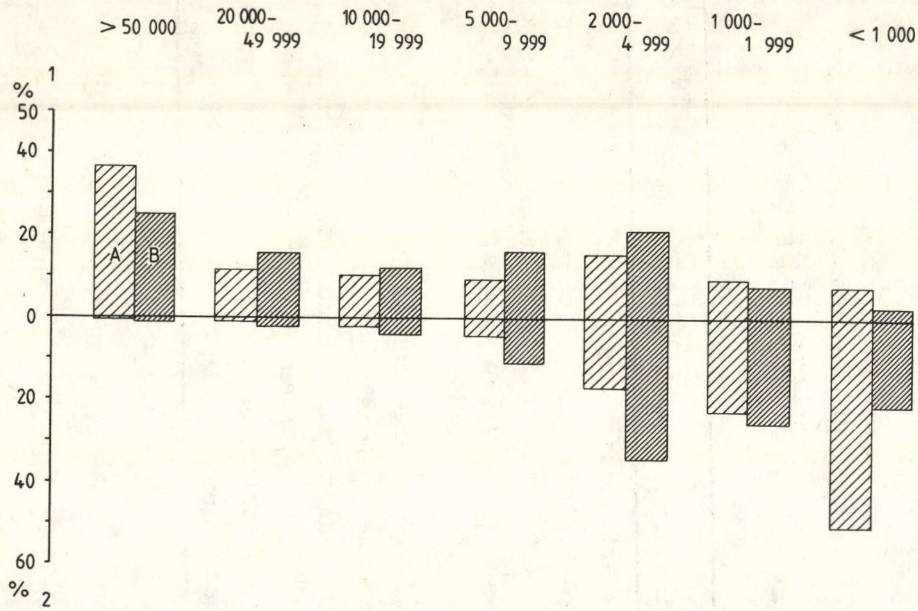

FIG. 1 Settlement size distribution in Hungary and on the Great Plain
1 = population; 2 = number of places; A = Hungary B = Great Plain

The process of urbanization on the Great Plain takes place within the framework of a settlement system which is different from the national system, since its elements are larger than is common in other regions (Fig. 1). This objective condition has not yet manifested itself, owing to the economic character and belated progress of the region, the higher than average ratio of peripheral population[x] and, last but not least, the settlement policy itself, which has resulted in over-concentration.

The rapid progress of recent decades has introduced a spatial structure into what was previously a homogeneous agrarian region, with increasingly evident features of spatial organization (Fig. 2). Settlements have not only formed a hierarchy, but have also been differentiated by their regional location. Settlements which previously functioned as more or less closed, autonomous system have become more open, with more intensive and multi-lateral settlement relationships. The centre -- gravity zone relationships have intensified, while inter-centre relationships have arisen and zones of higher level urbanization have developed. The belated development of the Great Plain can be seen, in all these processes and their existence and impact highlight the modernization of the region.

The two most highly urbanized, functionally best-developed settlements at the top of the hierarchy are the two regional centres, Debrecen and Szeged. They stand out from the other settlements in the region in their size, functions, institutional networks and economic roles, as well as in the social structure and level of supply of their population. They are only comparable with regional centres in other parts of Hungary (Pécs, Miskolc and Győr). They had a great impact on the rapid transformation of the agrarian settlements in their neighbourhood, particularly around Szeged, a town surrounded by a dense settlement network, where an agglomeration belt has developed which is, by now, administratively united with the town. The two cities are county seats, although several functions extend over larger areas than their own county.

The other four county seats on the Great Plain are among the most rapidly growing urban centres. This fact is related to the activizing, objective energies involved in developing these settlements and also to the role counties play in the Hungarian system of redistribution. The dynamic urbanization which has occurred at Nyiregyháza, with over 100,000 people, Kecskemét, which approaches that number, and Szolnok which has an exceptionally favourable geographical position with regard to transport is due to industrialization, the acquisition of new, diverse functions and subsidies from

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x Population who do not live in closed settlements, but in scattered dwellings outside the built-up area.

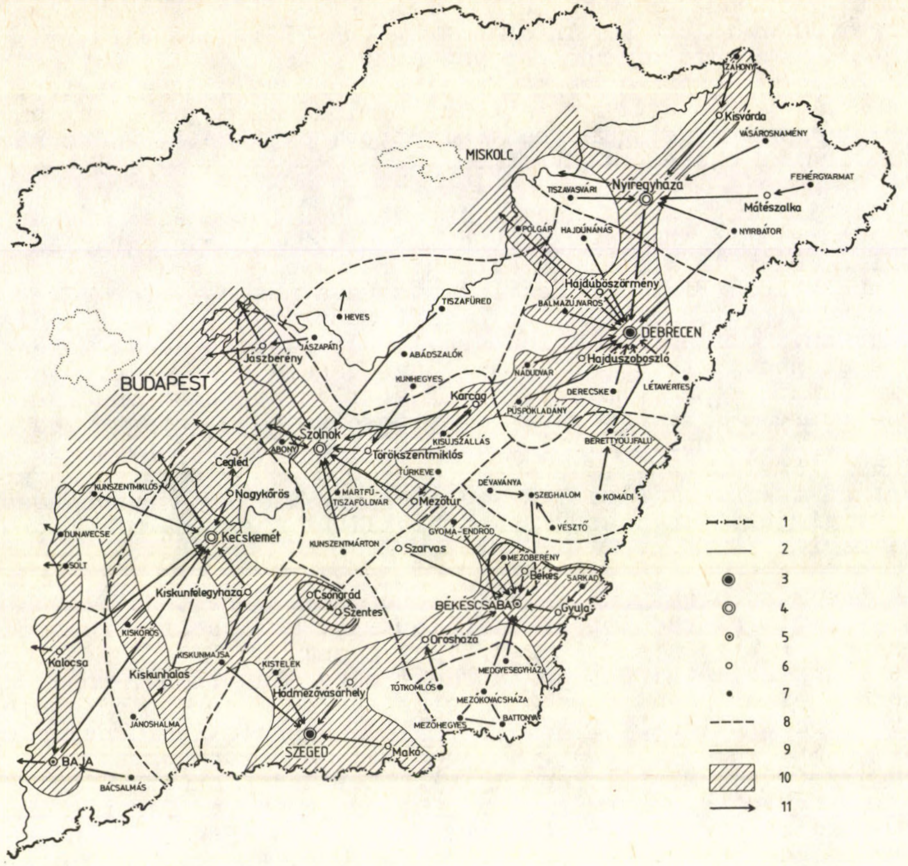

FIG. 2 Spatial structure of the Great Plain

1 = state border; 2 = boundary of the Great Plain; 3 = regional centre; 4 = dynamically developing primary centres ("paracentres"); 5 = slowly developing primary centres ("paracentres"); 6 = secondary centres (mezo-centres); 7 = small towns (sub- and micro-centres); 8 = boundaries of town groupings; 9 = boundaries of town-conglomerates; 10 = actual and potential development zones (urbanization zones); 11 = main attraction lines.

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central financial resources. The relatively moderate rate of development of Békéscsaba, the sixth of the county seats, has been influenced by the backwardness of Békés county and the close conglomerate of mid-Békés centres (Békéscsaba, Gyula, and Békés), by their specific spatial position. With coordinated development promoting the formation of a town conglomerate this latter factor can be turned into an advantage.

Other towns have substantially advanced in the process of urbanization, but they differ in the levels reached. Among them, Baja, Hódmezővásárhely and Hajduszoboszló are prominent as examples of the three sub-types of relatively rapid urbanization (poly-functional, agrarian/industrial and recreational). Former typical market towns (e.g. Karcag, Jászberény, Kiskunfélegyháza, Makó etc.) have also undergone substantial functional and morphological changes -- for the better.

The giant villages (traditionally, they were really small market towns[x]) with populations of between 6,000 and 15,000, number about forty and accomodate about a seventh of the population of the Great Plain. During the past few decades, with minimal central subsidies, they have moved from being "giant villages" of a definitely agrarian nature to join, in various degrees, in the urbanization process. A third of them have been practically transformed into small towns and, as such, they are independent foci for urbanization. Another third are bound in their development to other, more dynamic, centres, so their future progress is similarly certain, while the remainder of the villages are blocked at a lower level of transformation with regard to urbanization.

The Great Plain villages are highly diverse in their rate of development. The differences are caused by rural industry, particularly prosperous large agricultural farmsteads, favourable geographical locations with regard to transport, the proximity of towns, recreational facilities or a combination of all these. Villages with unfavourable resources, screened from traffic or lying along the state border, are unable to rise from their exceptionally low levels of urbanization. The living conditions of rural areas, therefore, show substantial disparities.

The "tanyas" (scattered farmsteads) have not escaped the influences of urbanization, either. The most decisive impact on this typically Great Plain type of settlement has been the rapid and regionally differentiated elimination of the "tanyas" and the removal of their population to towns and villages with more urbanized conditions. At the same time, the living conditions in the more established farmsteads in the Danube--Tisza Interfluve, in the proximity of towns, have substantially improved (electricity, gas, transport, medical care, commercial supply, etc.). Nowadays, the "tanya" is usually the residence of a family which does not depend

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[x] Smaller agrarian towns had limited, occasionally complete, self-government, the main function of which was to ensure the marketing of the surplus commodities in their environs.

entirely on traditional agricultural production. "Tanyas" turned into second homes are becoming more and more numerous.

In summary, one can say that the main characteristics of urbanization on the Great Plain are due to the relative backwardness and belated development of the region. These main features are coloured by the nature of the economy, the character of the settlement network and the intra-regional differences. In comparison to other regions, the differences are not only a consequence of temporal lag, as the Great Plain does not follow the course of progress found in other regions, and this will be a peculiar feature of its future urbanization.

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THE SPATIAL IMPACT OF ORGANIZATIONAL CHANGES IN INDUSTRIAL COMPANIES

Györgyi BARTA

The spatial impact of organizational changes in industrial companies has hardly been examined in Hungary at all until now. Even the question of the organization of industrial enterprises and an investigation of their out-dated structure have only recently been put on the agenda. Disputes on this topic-- primarily on means of implimenting the organizational transformation of industrial enterprises--have not by any means reached the end yet. So the timeliness of investigating the topic raised in the title above is unquestionable.

In Hungary, especially during the last two decades, the multi-plant company form of organization has become a general pattern in industry due to the development and expansion of industrial production as well as the recurrent attempts towards organizational centralization. The spatial separation of the parent company from its branch plants brings about new situations, problems and relations: differences in interests necessarily form among them, although branch plants have much less chance of asserting their claims owing to their state of dependence on the parent company.

The development possibilities of branch plants are determined by parent companies, so their self-development is limited. Thus, the industrial development of a particular area is influenced by the proportion of branch plants belonging to distant parent companies in that area compared to the number of independent industrial enterprises situated locally.

Research into the spatial relations between industrial multi-plant enterprises is still in the initial stage. So far, we have assumptions which we try to justify through case-studies and through investigations into the industry of a particular area (county). We do not yet have, however, a comprehensive survey of the industry of the whole country.

In this paper, we intend to present the economic processes which have formed the organizational structures of industrial enterprises in the last 15--20 years, its main characteristics and the most important manifestations of spatial changes.

ECONOMIC PROCESSES FORMING COMPANY ORGANIZATION DURING THE LAST TWO DECADES

Two processes, or rather measures, have played an important role in the spatial change of company organization, these being connected with the new economic system set up in 1968. The first measure gave greater freedom with regard to company investment activity, thus allowing for an expansion in the autonomy of an individual enterprise while the second measure began the amalgamation of industrial enterprises. This amalgation was carried out in cycles and was opposed to the first measure in that it aimed at reinforcing central control.

(a) The limits of industrial expansion

In Hungary, two decisive sources of industrial investment should be taken into consideration:the central budget and the development fund made of the income of state and co-operative industrial enterprises themselves. Since 1968, the proportion of central investments has delined. In the 1970's, the proportion of investments coming from companies in the industrial sector rests at about 54--56% on average (this percentage excludes investments from the agricultural and private sectors).

However, in the last two decades, industrial investment, involving the increase in jobs and labour force, met with difficulties in large cities, especially Budapest. This is primarily due to the lack of manpower, a problem much in evidence in Budapest, where the lack of space and administrative restrictions are also limiting factors.

There was a considerable labour reserve, though, in the industrially underdeveloped (mostly agricultural) areas, in provincial towns and villages, where, over the past 10--15 years, larger and smaller plants and hundreds of branch plants have come into being. Spontaneity was typical of their spatial spread. Regional policy and planning neither projected nor governed this process: it did not even reckon with the spread of industry motivated in this way or with it being of this degree and direction. The process was only evaluated, argued over and criticized later.

Naturally, certain common features and reccurring characteristics formed in this territorially unplanned process.[x] Industrialization, as realized through the individual branches

[x] Most of these statements are based on my own research on industrial locations in villages.

also had an effect on the spatial pattern of industry. In classical location theories of branch plants, the distance between the locator and the plant, or, to be more exact, the transport distance, is determinant in selecting the location of a plant (settlement).

However, in Hungary the transport tariffs did not express real costs. It is quite symptomatic that they only increased in 1980, for the first time in 30 years. Because of this, in the past, carriage represented so little a part of production costs that it did not modify the selection of the location nor did it urge a more reasonable organization of production. Since 1980, carriage costs, as well as those of passanger transport, have rocketed, and the effects of this increase are already evident in the latter sphere. It must be added that the change in the tariff system, the rise in the cost of carriage, and the combined effects of these, cannot be evaluated in isolation and a significant question is, who will bear these expenses?

Although, in our experience, transportation costs did not directly influence the distance between the locator and the plant, there was a marked correlation between the distance from the parent companies, and the density of branch plants. Between 1970 and 1975, half of the 300 plants opened in villages were separated from their parent companies by less than 50 km, and a further 20% were located at a maximum distance of 100 km. The average distance of these 300 plants from their locators was 77.1 km. Using our research as a basis, it seems that, even if transportation cost was not a motivating factor in selecting the location of a potential branch plant, distance was still important to the locator, in that access is a fundamental requirement. Access depends on the distance from the parent company and on the transport network (railway and road), although telephone and telex connections are also relevant here.

The distance at which the branch plant has been located does not only depend on access, however: it also depends on the industrialization of the settlement and the region, as well as the industrial potential of the locator. In Budapest, for instance, there was such a labour shortage that companies in the capital established branch plants even in distant corners of the country. Only 27% of the branch plants established between 1970 and 1975, which had Budapest as a centre were within 50 km of Budapest, a further 20% were within 100 km and the average distance was 121 km.

(b) Company Amalgamations

The practice of industrial locations detailed above undoubtedly led to spatial centralization[x] in that the number of

[x]By spatial centralization, I mean the process in which the management of production comes from a few, main settlements (in another words more and more settlements with production but without management function come under one directing centre.)

territorial centres did not, or hardly, increased, while plants were dispersed around the country. In 1980, for instance, some 900 villages had plants with a workforce of at least 10 belonging to state and co-operative industries.

The ever renewing process of company amalgamation following 1945, also increased spatial centralization in industry, although in another way. The opening of branch plants fell within the competance of company management, only depended on available funds. Amalgamations between companies, however, start with administrative decisions: in the selection of incorporating and incorporated enterprises, it is not only the market conditions (specialization, capital, staff, production capacity, etc.) which play in important part, but also--and often more effectively--the directing, political and power factors. The process of company amalgamation was most favourable to the mammoth companies. In the long run, company amalgamations decreased the number of potential industrial centres (settlements) and weakened the strength and independence of some of the former industrial centres.

In this paper, I would like to underline those elements of company amalgamation which have had important spatial effects. (I am not going to give full details of either the political motives behind amalgamations, or the practice of amalgamation and incorporation, and I will not touch upon its general, economic evaluation, as demonstrating these questions would go beyond the limits of this paper.)

The strengthening or weakening of company amalgamation is characteristic of economic policies in a given period. In 1962--64, the number of industrial enterprises decreased by nearly one third. In 1967--68, this process stopped, the number of enterprises even growing little. The fact that, in 1972, the need for amalgamation between companies was reemphasized, shows the consolidation of the central will. The process reached a peak in 1976--1977. Since 1979, efforts in this direction have slackened, even been held off. In addition to these facts, we can see, in recent years, centrally initiated counter-processes, for example the disintegration of large mismanaging companies and unprofitable trusts.

Since the periods of industrial expansion and company amalgamation more or less overlapped, a very strong and, in many cases, unequal struggle for the labour force began in certain areas. This was particularly evident at the beginning of the 1970's, when the labour reserve was exhausted all over the country.

As a consequence of amalgamations, the size structure of companies changed considerably. The percentage of companies employing 100 workers at most, changed from 15.7% in 1965 to 10.7% in 1970 and, by 1980, it had declined to 6.6%. The quota for medium-sized companies (100--1,000 persons) changed as well. So it seems clear that this period was characterized by an increase in the number of large companies.

Since 1980, tendencies have reversed, with the proportion of companies employing 10-2,000 workers increasing in every category (Table 1).

Table 1 Size Structure of State Industrial Companies (the total number of companies = 100%)

Size groups (the number of manual workers)	1970	1973	1975	1978	1980	1982
- 100	10.7	10.5	9.1	6.7	6.6	7.4
100 -1,000	53.9	54.5	54.3	47.9	49.9	50.5
1,000 -2,000	15.8	15.8	16.2	20.7	20.5	21.6
2,000 -5,000	14.3	14.0	15.3	18.6	17.5	16.2
5,000 -	5.3	5.2	5.1	6.1	5.5	4.3

Source: Statisztikai Évkönyv, 1982 (Statistical Yearbook), Budapest, Statisztikai Kiadó Vállalat, 1983.

Amalgamation mainly occurred in engineering and light industry. Only one or two companies represented industries like the production of chemicals and cosmetics; heat insulation, damp- and sound-proofing; silk production; vegetable oil production; confectionary; rubber industry; lime and cement production.

CHANGES IN THE FORM OF OWNERSHIP

Changes in industrial company ownership cannot be separated from the above phenomenon of amalgamation. In Hungary, industrial enterprises are state and co-operative-owned, the role of the private sector being insignificant. (In 1980, the private sector produced only 0.7% of gross production employing 2.8% of industrial employees). State-owned enterprises are under the guidance of either ministries or county and town councils (Table 2).

Most of incorporating companies come from the ministerial sector. Amalgamations mainly came about within the same form of ownership, but quite important changes came about through the expansion of the ministerial sector into that of councils. By 1982, only 133 companies remained within council industry from the 325 found there in 1970. Nearly 70% of the amalgamations took place in the same county, which shows the active participation of councils in supporting these processes. Most of the local enterprises are specialized in industrial servicing and operate at a loss rather than for a profit. This is due to the fact that county and town councils established industrial enterprises so as to provide job opportunities in the county. The financial resources of the councils, however, proved too restricted to keep up these enterprises and their investments. Moreover, there was a lack of professional administration and competence, which was generally unfavourable. Thus, the councils, having dealt with hidden or perceptible unemployment, then took pains to rid themselves of these enterprises, facilitating amalgamations with ministerial firms. No doubt the decrease in council industry contributed to the dependence of counties, and larger areas, on distant industrial centres. This, in turn, has led to a decline in local management's role in directing the industry in its own territory.

Table 2 Distribution of Industrial Companies with Regard to their Form of Ownership (percentages)

	1965	1970	1975	1980	1982
	According to the number of firms				
Ministerial	30	32	34	38	43
Councils	20	18	16	12	10
State sector total	50	50	50	50	53
Co-operative	50	50	50	50	47
Socialist sector total	100	100	100	100	100
	According to the number of employees				
Ministerial	80	78	78	81	80
Councils	9	9	8	6	6
State sector total	89	87	86	87	86
Co-operative	11	13	14	13	14
Socialist sector total	100	100	100	100	100

Source: Megyei statisztikai évkönyvek (Statistical yearbooks of counties).

After 1972, similar processes, although with different motives, took place in co-operative industry. The basic reason for the amalgamations here was that co-operatives wished to enter a "zone of prestige" through enlarging their horizons. In this way, they could effectively defend themselves against large state-owned companies striving for monopoly in production and labour force (Table 3).

One form of concentration within the co-operative sector is the merger of smaller co-operatives into larger, stronger ones. The other form of concentration was due to a drop in the industrial service network, leading to a situation where many of the multi-plant co-operatives and council enterprises had to close some of their plants. (10% of the co-operative branch plants and 40% of those belonging to council comparies ceased to exist between 1965--1980).

Table 3 Size Structure of Co-operative Industry
(the total number of industrial Co-ops = 100%)

Size groups (the number of manual workers)	1973	1975	1978	1982
- 100	41.4	36.4	13.9	11.0
100-1,000	58.1	63.0	83.2	86.7
1,000-2,000	0.5	0.6	0.5	2.0
2,000-5,000	-	-	0.4	0.3

Source: See at Table 1

Physical dissolution, the complete winding-up of a company, only occurred at the small plants (5--20 workers). The larger ones (plants employing 50--200 workers) were re-organized, incorporated, and, sometimes, their specialization was changed.

SPATIAL CENTRALIZATION IN INDUSTRY

Industrialization, through both the establishment of new plants and company amalgamation; has led to spatial centralization in industry. Parallel with and, in some cases, contra this, a spatial de-concentration of industrial production had taken place by the end of the mid-70's. As a result of these two processes, the settlement where the production itself is located is more and more remote from the place of industrial control. Out of the industrialized towns, a few industrial centres have risen to prominence and their influence is felt in a number of counties or throughout the country. In this way, large areas of the country are linked to, or depend upon, distant industrial centres and, in some cases, the entire industry of the county is in this position. Budapest, in particular, dominates the rest of the country in her industrial organizing and locating activity (Table 4).

Table 4 Number of Provincial Plants Belonging to Industrial Companies Seated in Budapest

Year	1963	1970	1975	1980	1982
Number	857	1,121	1,234	1,446	1,399

Source: Budapest Statisztikai Évkönyve (Budapest Statistical Yearbook) 1964; 1970; 1982. Budapest, Statisztikai Kiadó Vállalat.

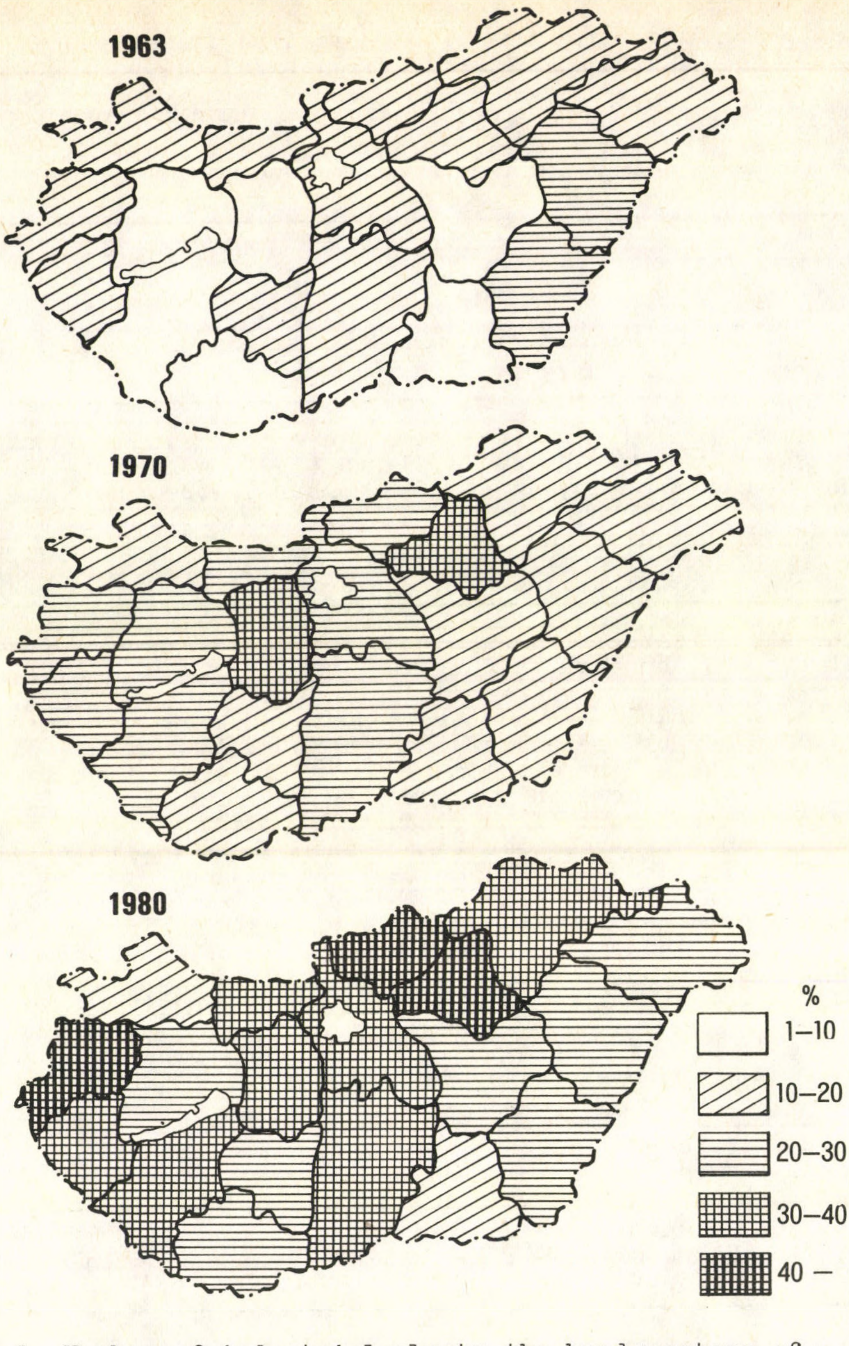

FIG. 1 Number of industrial plants the headquarters of which are located in another county, as related to the total number of industrial plants in a county (in %).

All this means that 42% of all branch plants belonging to state and co-operative industry had their headquarters in the capital in 1982. These facts prove, in part, the supposition that Budapest's role in Hungarian industry is much greater than it would at first seem from her percentage of employees in industry (24.3%), industrial fixed assets (22.3%) or even the production value.

This concentration of industrial control in the capital, not to speak of R+D, shows that, in spite of the levelling off which has occurred in spatial differences, all the most dynamic elements in industry have remained in Budapest. (Typical data: out of the 79 manufacturing companies employing over 3,000 workers, 60 have their headquarters in Budapest). Although the industrial organizing and locating role of some cities, for example, Győr and Szeged, has strengthened during the last decades, their significance is still far behind that of Budapest.

The increasingly dependent state of certain areas and counties on distant industrial centres is well highlighted in the growing proportion of branch plants which belong to parent companies seated in other counties (Fig. 1).

Some important conclusions can be drawn from Fig. 1:

- apart from a few counties, the degree of dependence on distant industrial centres has increased in the industry of the entire country;

- there is a noticeable differentiation between the counties, according to their dependence. Strong dependence has evolved near the most significant industrial centres (especially Budapest) and in areas which have only lately been industrialized, for example, West-Transdanubia;

- it is also significant that in most cases, industrial dependence increased the most during the second period, in the 1970's. After 1980, centralization continued, primarily in those counties where dependence had, by that time, reached a high point.

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GEOGRAPHICAL TRANSPORT DISTRICTS OF A RURAL AREA BASED ON TRANSPORT CONNECTIONS

Imre SIMON

GOAL AND METHOD

Underdevelopment in the economy involves lower living standards, unfavourable living conditions for the inhabitants of the region and a backward settlement network. All these lead to a rapid migration of the population from certain regions in Hungary, which also causes social tensions. The formation and survival of under-developed regions inhibits the socio-economic progress of the entire country, often depopulates areas, reduces the intensity of agricultural production, and promotes the subutilization of the existing capacities. It can also adversely influence the social atmosphere.

One of the main factors in the rise of these unfavourable conditions is the underdevelopment of the social environment and, within that, the qualitative problem of transport links. A key question in the planned development of rural areas is, what impact does the increasing dynamic inter-centre system of connections have on rural areas with regard to road transport? Opinion on this topic has been enriched by numerous partial surveys in Hungarian geographical transport literature (Z. Döbrönte -- R. Mészáros -- B. Csatári, 1975 L. Tánczos-Szabó, 1977, Gy. Krajkó -- Z. Döbrönte -- R. Mészáros 1978, I. Simon -- L. Tánczos-Szabó, 1978, F. Erdősi 1980) but delimitation problems, arising during research of regions (J. Tóth, 1977), justify the need to investigate into the geographical transport situation of relatively backward rural areas in the Szolnok--Békéscsaba--Debrecen triangle. This need becomes clear if one considers the general statements made at the end of nation-wide research projects (Gy. Enyedi, 1970), on the impact of the forming urbanization axes (Gy. Krajkó, 1977), and the intensification of its effects on a mid-Békés town-conglomerate, formation in the southern part of the area investigated (J. Tóth, 1980).

In addition to these urbanization phenomena in this typically agricultural area, of decisive importance to rural settlements are the opportunities for social involvement and the availability of urban centres. Below, we will investigate the above area, as "screened" from traffic.

The analysis is not meant to cover transport as a whole: only the bus runs in the given network are examined, and the initial data have been collected from bus timetables. Three basic factors are considered:

1. the number of runs from a given settlement to another;
2. travel time between settlements;
3. distance between settlements.

In our opinion, these factors enable us to determine the direction and frequency of public transport connections between settlements and also establishes the divisions of transport attraction.

At first, twenty centres were distinguished and their connections studied, before all the settlements in the area were investigated. In this way we could distinguish the hierarchy of transport connections.

When elaborating the method to be used the starting-point was the assumption of gravity models that a single settlement is influenced by an attraction to all centres. The primary goal of gravity models is to determine the intensity of this attraction. The method applied in this paper does not strictly follow this way of modelling. It is first assumed that the attraction intensity of a centre on a given settlement can be determined empirically, without an exact knowledge of the "masses" attracting each other. The forces determined this way are vector quantities with size and direction, so their resultant can consequently be constructed. The resultant represents an imaginary displacement, resulting from the joint attraction of centres affecting the settlements (Fig. 1).

The initial factors have been considered as the components of a vector which moves a settlement towards a centre. Since a settlement is attracted by several centres, the individual vectors can be summarized to illustrate the imaginary displacement mentioned above.

To interpret our three factors (number of runs, time and distance) as vector components, involved some difficulties. It seemed logical and, later, justified, to say that, with the amount of runs in the timetables unaltered, categories for time and distance could be established to express the inverse proportion of transport connections with these factors.

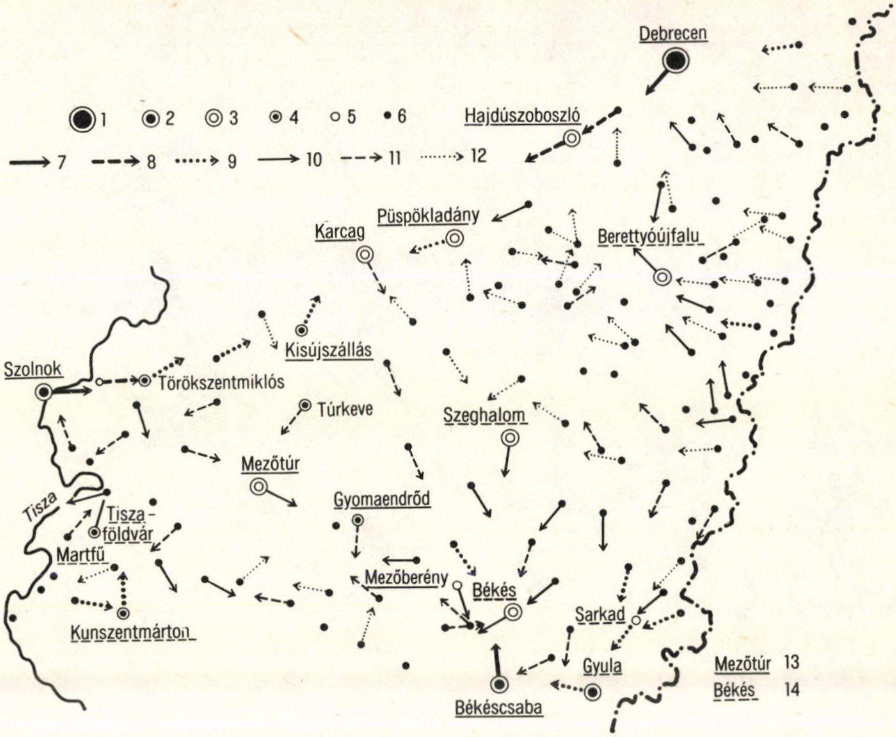

FIG. 1 Size and direction of the hypothetical displacement of settlements (1978)

1--6 = see Fig. 2; 7 = great displacement; 8 = large displacement; 9 = medium displacement; 10 = less than medium displacement; 11 = small displacement; 12 = very slight displacement; 13 = centres on the main railway line; 14 = centres on railway by-lines.

With the help of these categories, the lengths of the "transport attraction vector" directed at the various centres were determined for all the settlements:

$$|r_{ij}| = \sqrt{s_{ij}^2 + t_{ij}^2 + z_{ij}^2}\text{, where}$$

$|r_{ij}|$ = the length of the vector directed from settlement j to centre i;

s_{ij} = the distance between settlement j and centre i;
t_{ij} = the travel time between settlement j and centre i;
z_{ij} = the number of runs from settlement j to centre i.

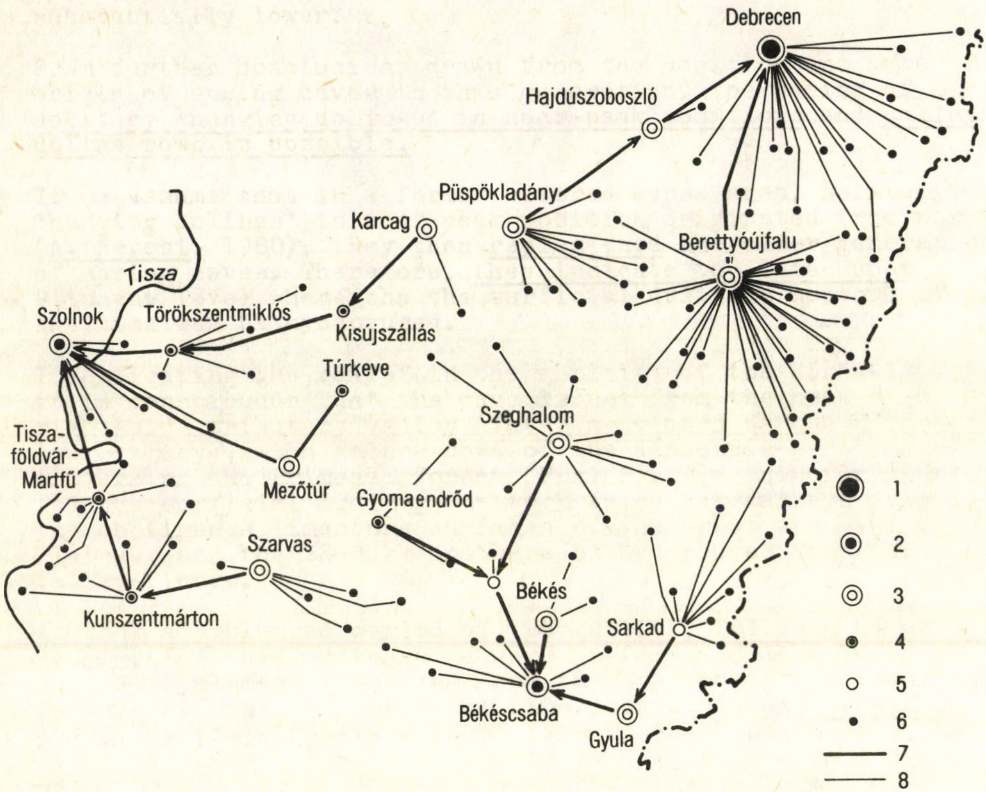

FIG. 2 Dominant directions of bus runs to settlements (1978)

1 = prominent primary centre; 2 = primary centre; 3 = secondary centre; 4 = secondary co-centre; 5 = prominent tertiary centre; 6 = other settlement; 7 = connections between centres; 8 = connections between "other settlement" and centre.

The vector r_{ij} should express the attraction intensity of centre i on settlement j. The directions of vectors point from a given settlement to any centre within reach and their lengths indicate the intensity of existing connections. Their resultant shows the above 'hypothetical' displacement.

Before constructing the resultant, the largest vector had to be selected. Through this, the measurement of accessibility to nearby centres of primary importance is feasible (Fig.2). In this case, the calculated $|r_{ij}|$ value was not only summed up vectorally, but also the

$$R_j = \sum_{i=1}^{n} |r_{ij}|$$ value was generated, where

n = 20 (number of centres) and R_j is directly proportional to the frequency of public transport connections of settlement $\underline{j}$.

Regarding the above value as the "transport mass" of the settlement, a simple gravity model can also be used. The formula applied is

$$F_{ij} = C \frac{R_i R_j}{d^2_{ij}}$$, where

F_{ij} = the number of runs between centres $\underline{i}$ and $\underline{j}$;
R_i and R_j = the "transport masses" of the two centres;
d_{ij} = the distance between centres $\underline{i}$ and $\underline{j}$;
C = the gravity co-efficient.

The regional alteration of the inter-centre relationships can be concluded from the changes in the value of the gravity co-efficient.

DESCRIPTION OF CONNECTIONS

On examining the dominant direction of runs leaving settlements and passing through (Fig. 2), it becomes clear that bus transport is a typical element of a certain micro-region. The number of runs arriving is highest in settlements which, through economic, administrative and other functions, have extended their attraction or gravity zones towards centres (Debrecen, Békéscsaba, Szolnok and Berettyóujfalu). The attraction effect, highlighted through bus runs, is moderate or even absent, in the case of centres connected to the railway network (Kisujszállás, Mezőtur).

The most intensive connections are observed between centres and the settlement supplying the labour force (more than 75% of the runs leaving the settlements are directed to the given centre). The towns of the area exert this attraction either individually (Debrecen, Berettyóujfalu), or share it with other centres (Békéscsaba, Gyula and Békés). In the latter, disregarding transit runs, the extension of the attraction zone is clear, highly improving opportunities for establishing transport links, e.g. in the North Békés rural area.

Generally, it is usual that several runs are scheduled from the outermost settlements of the counties to the primary centres. The shared functions of lower level centres (Püspökladány and Berettyóujfalu or Gyula, Sarkad, Békés and Mezőberény) manifest in their multi-lateral connections with neighbouring rural settlements.

The complex location of settlements with regard to transport (R_j), and the number of connecting bus runs, suggests that, on the Szolnok--Tiszaföldvár--Kunszentmárton--Szarvas--Békéscsaba line, the Tiszaföldvár--Kunszentmárton link is the weakest. The attraction force grows gradually from Kunszentmárton to Békéscsaba.

On the Békéscsaba--Debrecen route, the Szeghalom--Berettyóujfalu connection is the weakest link. In the entire area investigated, the part without a railway is in the worst traffic position. It is conspicuous that the Debrecen--Berettyóujfalu link is strengthening to become the secondary "axis" of the county, a fact supported by other analyses (J. Tóth, 1977). In the town series from Debrecen to Szolnok, bus travel plays a minor role although a small attraction zone has developed around Szolnok, with strong connections as far afield as Martfü and Tiszaföldvár.

All possibilities for transport links can be revealed through constructing the resultant of vectors r_{ij}, calculated for all the settlement--centre relationships. As representation of these links is rather complicated it was decided that the thickness of vectors should show their size (Fig. 1). It is possible, from this, to make the following statements: due to frequent railway runs and favourable travel times, strong transport axes have primarily formed along the railway lines, which have a rapid traffic. (The peripheral centres, as far as the area investigated is concerned (Szolnok, Békéscsaba and Debrecen), to have been displaced almost the same hypothetical point).

A similar force line has formed along the Debrecen--Szolnok and Békéscsaba--Szolnok main railway lines, although with lesser intensity with the latter. The attraction force of primary centres, decreasing with distance, marks the transitional zone of both main lines, so the direction of settlement vectors in that area will form a rectangular zone from the principal axis (Karcag and Gyomaendrőd). The strong linear effect of railway traffic highlights the fact that vectors of hypothetical displacement point towards the marginal centres in both cases. This is obvious since there is no bus transport to the centres which lie farther away from the axes.

In Békés county, with a dense network of centres, the resultants indicate the double attraction force of Békéscsaba and Gyula.

The high number of runs highlights the domination of the maximal r_{ij} vectors in the resultant and clearly delineates the two transport micro-regions.

As a consequence of the numerous transit runs, the settlements in the Szeghalom district belong to four micro-regions. In spite of its favourable geographical transport location, Szeghalom could not develop a larger attraction zone: this reflects the underdevelopment of its central functions.

The Berettyóujfalu micro-region, clearly visible in Fig. 2, is presented more distincly through vector resultants. There is a considerable "transit attraction" exerted by Debrecen and Püspükladány for both railway and road traffic, so the majority of settlements display hypothetical displacements towards Debrecen or the Berettyóujfalu--Debrecen force line.

SUMMARY

Based on similarities between transport and mathematical networks, regional differences in network development can be indicated through graph theory. The networks connecting settlements (railway, road, telephone etc.) are, in many respects, different from abstract graphs. One of the differences is that graph apexes form an equal balance, but settlements do not form any homogeneous set. The hierarchic relations of settlements do not generally manifest in the graph apexes and it is only afterwards that the apexes can be differentiated. Developing from this, it must be remembered that, in reality, the boundaries are not of same significance. For example, in the case of public roads, there are remarkable differences in the quality of road surface, width and traffic capacity, etc. In addition to the above, for practical purposes, the investigations necessitate a concentration of interest on what takes place along the actual networks. The present study broadens the scope of graph investigations, through an analysis of a partial transport network. The particular (latent or potential) natural quantities, which are somehow conveyed from one apex to another along the edges of the network, are, however, still missing. This problem points to the need for investigation into regional sectoral relationships. If the scope of graph theory could be accurately expanded in this direction (which has already been attempted, with positive, partial results), it would effect a major achievement, which could be used in both theoretical and practical research with regard to economic space.

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REGIONAL INEQUALITIES IN EDUCATIONAL LEVEL AND THE NETWORK OF EDUCATIONAL INSTITUTIONS IN HUNGARY

József NEMES-NAGY

Both Hungarian and international literature dealing with regional inequalities in socio-economic development, agree with the fact that one of the most important components of a region or human settlement is its intellectual potential and one factor of this is the educational level of the population. Analyses into regional inequalities reveal, in almost every case, different educational levels among the most dominant "development" variables in the most frequently used, modern mathematical methods. These calculations clearly reflect the real situation. It is an indisputable fact that the concentration of highly educated people is an important factor in economic development and dynamics, in the standard of material and cultural life. Prosperous urban regions create more favourable conditions, give better opportunities for schooling, while their demands of well-educated specialists in all spheres have a considerable, concentrating effect in educated circles.

In the following, we will give a short survey of the growth in the educational level of the population, the changes in regional inequalities of this level and the regional structure of educational institutes.

GROWTH IN THE EDUCATIONAL LEVEL OF THE POPULATION

The data available clearly show that, up to the present, a basic change has taken place in the education of the population in Hungary (Table 1). The ratio of non-educated people has decreased to minimal and this group now represents for the most part, the older section of the population and those who cannot attend school for medical reasons. Among those born after 1945, the 8th class practically received its full quota, while hundred thousands of the older generation subsequently finished the last four or the 7th and 8th classes of elementary school. Between 1941 and 1980, the number of secondary school graduates increased more than five times and the number of people who completed higher education courses grew to four times as many as before 1941. However, these rates are not as high as those characteristic of the developed, European capitalist countries.

REGIONAL INEQUALITIES IN EDUCATION

The increase in the educational level was not only found at a national level, but also, substantially, in all the settlements, cities and villages in the country. Although it is true that the differences in ratio between graduated elementary, secondary and high-school students has decreased lately, in comparison to 50 years ago, it is also true that regional growth in education has developed differently with respect to the different education levels.

TABLE 1 Growth in Educational Level of the Population (in percentages)

YEAR	age groups 10+ 0 class finished	15+ eight classes finished	18+ graduated secondary school	25+ graduated higher education
1910	18.6	7.2	3.1	no data
1920	13.0	11.2	4.2	1.7
1930	9.3	12.9	4.7	1.8
1941	6.4	15.1	4.2	1.6
1949	4.8	20.6	5.5	1.7
1960	3.2	32.8	9.1	2.8
1970	1.9	51.4	15.9	4.3
1980	1.8	66.1	23.4	6.5

Source: Census data related to the present territory of the country

In connection with the above-mentioned facts, the measurement of regional inequalities (Table 2) highlights this interesting phenomenon:in 1930, we could speak generally about regional inequalities in education and regional polarization was almost equal in each educational degree. Between 1930 and 1941, this differentiation increased to some extent. The effect of the introduction of a compulsory eight years of primary school on regional levelling could be already seen between 1941 and 1949. The process of evening up manifested itself later with respect to secondary school graduates, in the 1950's, while with respect to higher-education,the effect becomes evident in the 1960's. At the primary level, a drastic change took place during the period following the Liberation. In addition, the regional inequality of higher-education graduates was smaller in 1980, than that of secondary school graduates in 1960. The separational process of the three inequality trends, which were equal in 1930, together with global change and polarization, demonstrate well the slower process involved in the regional diffusion of higher education. The higher-educated circle is overwhelmingly concentrated in the towns, but, considered over a longer period, most of the smaller settlements have also shown growth in the number of higher education graduates. In 665 of the 3,052 settlements in the country, there were no graduates in higher education in 1941, while, in 1980, only 155 of the 3,122 settlements and hamlets were without higher graduates. Higher graduates from small settlements are mainly teachers or specialized in agriculture. The growth of the higher educated circle in villages was mainly characteristic of the 1950's and 1960's, as, during the 1970's, this tendency altered to the opposite, or slowed down. This process is connected with an increased focus on town development and a lessening in the function of the village. There was a general movement by higher graduates away from the villages into the towns.

TABLE 2 Changes of Inequality in Education between Counties

YEAR	Hoover's inequality index[x]		
	age groups		
	25+ higher graduates	18+ secondary graduates	15+ primary school
1930	29.85	30.9	29.4
1941	32.0	30.9	29.9
1949	31.9	28.5	21.6
1960	30.2	24.1	12.8
1970	24.4	17.6	7.1
1980	21.15	14.0	4.6

x $H = \frac{\sum_{i=1}^{20} |x_i - y_i|}{2}$; Where: x_i = the proportion of a county within the given age group (%);

y_i = the proportion of a county within the given education level (%).

THE REGIONAL STRUCTURE OF SCHOOL INSTITUTES

Hungarian education system consists of four succesive levels: nursery school for 3--5 year olds, and primary school for 6--14 year olds, up to the compulsory 8th class. Then, the student can continue his/her education at three types of secondary school: the so-called general secondary schools with a final examination; the vocational secodary schools, also with a final examination; and the skilled worker training schools, without a final examination. Higher education falls into two categories: a shorter degree (3--4 years) at a college and longer degree (4--6 years) at university.

Analyses of the education system, which have increased over the last decade, prove that the regional location of schools affects opportunities with regard to the continuation of studies. The greater part of the younger generation who gain diplomas originate from towns and regions where all educational institutions, from nursery school to university, can be found locally. It is, then, relatively easier to get a higher degree of education in such cases than if there are no higher education institutes in the locality of the student. This point raises a demand for a more equal distribution of regional educational institutes. However, this extreme decentralization, mainly in the case of higher education, but, also at a secondary school level, also decreases the efficiency of these institutions. A small institution with limited specialization cannot offer well qualified teaching staff or modern technical standards.

The oscillation between these two opposing requirements has its roots in the policy of regional educative development over the last two decades. The sixties were characterized by an extreme decentralization at secondary and higher levels, with new secondary schools and higher education establishments opening in nearly 300 settlements. The seventies were characterized by regional concentration, and between 1970 and 1980, settlements obtaining secondary schools or places of higher education decreased from 256 to 223. In particular, a great number of small country secondary schools closed. Although it is hard to form a unanimous opinion of this process, the fact remains that, today, the number of settlements which can be considered real "school-towns" are relatively few, that is, where boththe number of students and their ratio within the total number of inhabitants would be outstanding. Most secondary and higher schools today have less than 1,000 students and the percentage of students remains under 10% of the total population (Table 3).

TABLE 3 Distribution of Settlements with Secondary and Higher Schools, according to the Number and Density of Students

Number of students (persons)	Number of students as a percentage of residents (living in inner areas of a settlement) 1970/71			1980/81		
	above 10	under 10	total	above 10	under 10	total
above 1,000	49	29	78	14	54	68
under 1,000	30	148	178	7	148	155
Total	79	177	256	21	202	223

Compared to international standards, Hungarian secondary schools and higher education institutions show in rather a poor light. According to comparative surveys of, for example Poland, Romania or FRG, it seems there are far more "school towns" and intellectual centres in these countries than, here, in Hungary. There are only some country towns which manage to gain the education and cultural traditions of greater school towns such as Eger, Esztergom, Sárospatak, Keszthely, Baja, Debrecen, Szeged and Pécs. Of course,most students study in Budapest, but due to the metropolis' wide range of functions, the weight of education is not as determining as in a great number of the smaller but "real" school towns (well-known in European countries).

The problem of regional concentration or decentralization also exists with regard to kindergartens and elementary schools. During the seventies, one of the most positive tendencies was the growth of nursery schools. Today, there are nursery schools in more than two-thirds of all Hungarian towns and villages including nearly all the bigger places (over 1,000 habitants). Most of the newest nursery schools were established through local co-operation between firms and voluntary workers. In this way, the demand for child care, which itself sprang from the full-time employment of women is satisfied in most areas.

In the seventies,however, this growth in the establishment of nursery schools was not a general trend, as elementary school growth took the opposite direction. The period in which areas were divided into school districts marked the beginning of the liquidation of schools in small settlements, school-children were re-allocated to centralized schools, the need to create new districts springing from demographical facts: a decrease in the number of children in small towns and villages, the lack of teachers and the rise in the educational level. In 1970-1971, there were only 124 settlements in the country without schools, while now, there are almost 850. The liquidation of schools is mainly characteristic of regions with small rural villages and farms. This zoning of schools produced a serious social debate. Liquidation was one element in the changes towards concentrating institutions within a network of settlements (it was a secondary process, along with the concentration of public administration, and the fusion of co-operatives). The division of an area into school districts probably accelerated the process of migration from the small settlements.

There is a resolute aspiration on the part of central and local authorities to halt the further concentration of the elementary school network. However, as a consequence of the decreasing birth rate (Fig. 1), the population of many settlements (with a population of 1,000--2,000) has decreased to below the level regarded as minimal (4--5 children per year). In such cases, local schools cannot be maintained.

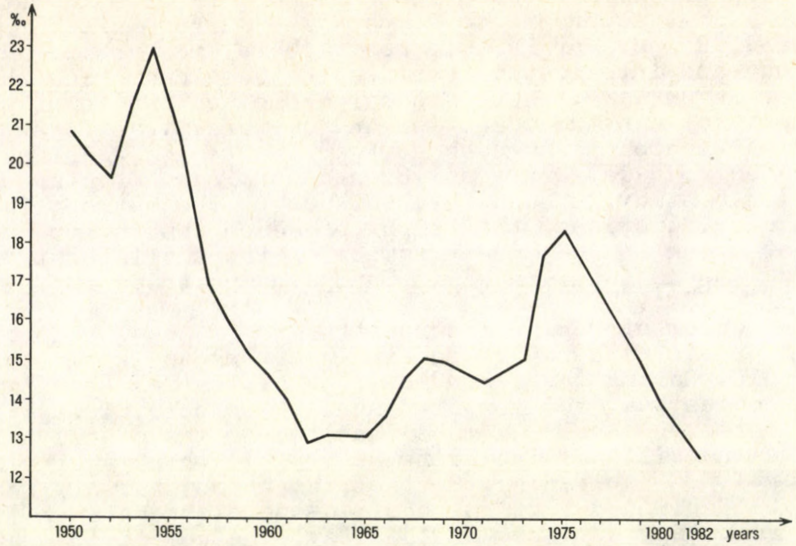

FIG. 1 Crude birth rate in Hungary 1950--1982

Rural schools with a small number of pupils can only be maintained through great financial support and significant moral and pecuniar support for teachers to increase their willingness to work in a rural settlement. In the present economic situation, it is very likely, however, that in the next few years financial support in this field will not be increased. There will be a financial concentration on developing the educational system sufficiently to ease the influx of new students in the larger age group of 1974--75 (the so-called demographical wave-hill). This demographical group continually causes class overcrowding in the schools (mainly in towns) and a lack of classroom space and teachers. The connection between this demographical situation and the school system is one of the clearest examples of the mutual effect of comprehensive, social processes and regional settlement development. This connection highlights the fact that the planning and development of the Hungarian school system could only work efficiently in the future through the use of overall, socio-economic processes, and by moving away from the narrow sectoral point of view towards a concentration upon regional connections.

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GEOGRAPHICAL EXAMINATION OF THE DEMOGRAPHIC AND SOCIAL TRANSFORMATION OF VILLAGES IN THE ZEMPLÉN (TOKAJ) MOUNTAINS

István SÜLI-ZAKAR

The Zemplén (Tokaj) Mountains form a structural unit in the north-east part of Hungary which abounds in picturesque scenery. In the basins, valleys and on the margin of this volcanic range there are 42 rural settlements. Villages in the area are typically small and it is an area which is, by Hungarian standards, sparsely populated (below 40 persons/ km^2), less than 24,000 people living there in 1980. The majority of the villages show a strong decrease in population and many of the inhabitants are aged. Thus, we see here the so-called "mountain-region phenomenon", although in a few small and tiny settlements the population has been stabilized or, in some cases, even increased especially in the Hegyköz region (Interhills area). The explanation for these different phenomena rests in historical demographic antecendents and present-day economic changes.

DEMOGRAPHY OF THE ZEMPLÉN MOUNTAINS TO 1970

The villages established in the deforested mountain areas were less bothered by the Turkish conquerors. So, during the 16th--17th centuries, a remarkable number of escapees moved here from the southern parts of the country. Detailed research work in economic history (I. Balassa, 1964) has revealed that the population of villages in the Zemplén Mountains was highest around 1626.

After the expulsion of the Turks, the Zemplén region was almost depopulated, owing to transmigration back to the southern regions. Ethnic Slovaks, Ruthenians and Germans took the place of the outgoing Hungarian population. In addition to this spontaneous migration, there was an organized settling of non-Hungarians into the territory in the last third of the 18th century.

Earning a living was assured by intensive animal husbandry and a handicraft industry (glass and earthenware). At the beginning of the 19th century, as a result of re-settlement and natural reproduction, the population of the Zemplén Mountains approximated the previous "high" of two centuries before. The density of population, very high when compared with contemporary data for the whole country, stretched the supply capacity of local agriculture and the handicraft industry to the utmost. Employment problems were further aggravated by a crisis in the handicraft industry in the first half of the lastcentury, when a lot of workshops were closed down. This is why hawking and itinerant industry (glazing, and, later, tinkering), as well as vineyard work at Tokaj--Hegyalja and share cropping and threshing on the Great Plain, became a basic source of income for those living in the Zemplén Mountains. For the women, besides field work (which was, in more than one village, done exclusively by them), the most important possibilities for extra work were gathering in the forest and in the domestic industry.

The population of the Zemplén Mountains, contrary to the nationwide tendency, decreased considerably from the middle of the last century to the first World War (Table 1). During this period, there was a population explosion in Hungary, as a whole which resulted in a rapid growth in the number of inhabitants.

TABLE 1 Changes in the Number of Inhabitants of Villages in the Zemplén Mountains between 1869 and 1980

YEAR	Number of Present Population	
	persons	% change
1869	31,490	100.0
1880	27,980	88.8
1890	28,275	89.8
1900	28,722	91.2
1910	27,916	88.6
1920	28,758	91.3
1930	31,031	98.5
1941	32,231	102.3
1949	31,327	99.5
1960	32,694	103.8
1970[x]	26,760	85.0
1980[x]	23,928	76.0

[x] Resident population

From the overpopulated mountainous region, people migrated to the sparsely populated lowland regions, until the 1880's, when subsequent emigration from the country played an ever increasing role. Emigration to America assumed devastating proportions in the case of some villages (between 1869 and 1910, the population of Vily decreased by 34%, Gönc by 29% and Filkeháza by 26%).

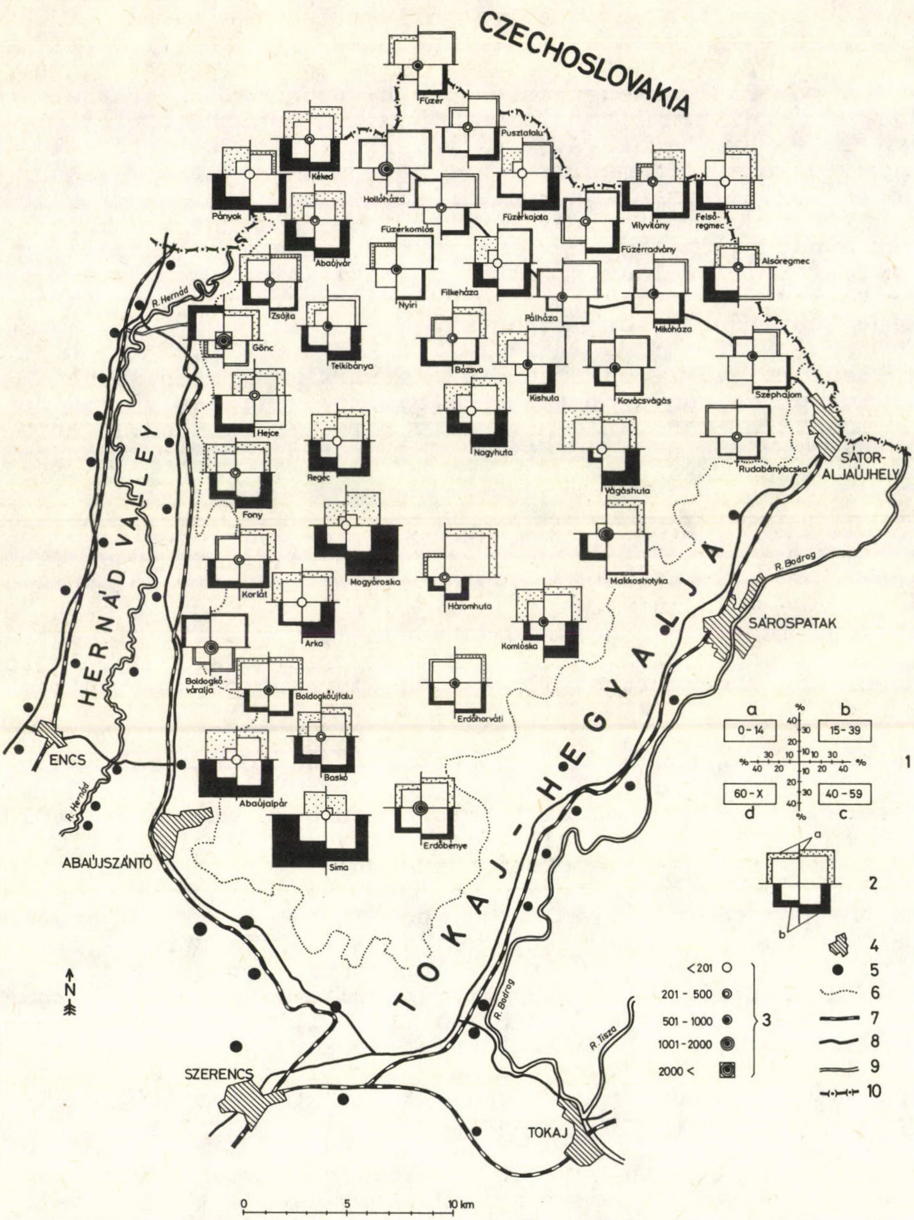
In the period between the two world wars, the number of inhabitants in the area again increased for the first time after a long period of decline. This was not primarily due to the internal strengthening of the economy, but rather to changes in external conditions. Immigration was strictly restricted by the U.S.A., and possibilities for internal migration also became limited. There was hardly any labour demand in the Hungarian industrial centres, and the regulation of river beds and railway construction no longer required as many hands as in the previous period. Thus, the succeeding generations, for lack of other possibilities, were stuck in the village and tried to make a living out of agriculture, itinerant industry and forestry.

In the forties, in addition to the wartime losses which afflicted the whole of the country, the villages of the Zemplén mountains were also adversely affected by the Hungarian--Slovak exchange of population. So, in the forties, the population dropped again.

The distribution of land after World War II enhanced the supply capacity of the territory. As a result of a new labour demand in the rapidly developing mining industry and the State Forest Industry, the population increased again in the fifties. The 32,694 heads counted in 1960 was the highest since the early 17th century in this area. (Similarly, in the majority of Hungarian villages, the largest population was counted in 1960).

The growth in population was entirely due to natural reproduction, since the villages of the region investigated suffered 15--20% loss due to migration between 1949--1960. In the 1950's--as a result of extensive industrialization --, the migratory movement strengthened all over the country. The Zemplén Mountains became an important labour reserve for the Borsod industrial area, but in the fifties, migration was still considerably hampered by several factors. A great number of men took jobs in the industrial zone, but did not sell their land, which they either cultivated in their spare time, or the work was done by their families. It was also found that the first generation of workers stuck very closely to their birthplaces, retaining their village homes. On the other hand, it must be pointed out that the possibilities for settling in the towns were highly limited.

After the high birth rate of the fifties, natural reproduction considerably slackened in Hungary during the sixties. This tendency also registered in the villages of the Zemplén Mountains and, thus, the natural birth rate could not compensate for the high rate of out-migration. Underlying the demographic changes in the Zemplén Mountains, we must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consider the collectivization of agriculture, the ever-deepening crisis within small-scale viticulture in the Tokaj--Hegyalja region, and the remarkable development in housing constructions in the towns. At the same time, it must also be pointed out that the rate of out-migration from the region studied was lower than from other rural areas, particularly under the average for similar regions with tiny villages. The reason for this is, that by the sixties, in the Zemplén Mountains, a certain equilibrium had evolved between the supplying capacity of the region and the number of its inhabitants and social restratification -- primarily reliant on local mining and industry -- took place before 1960.

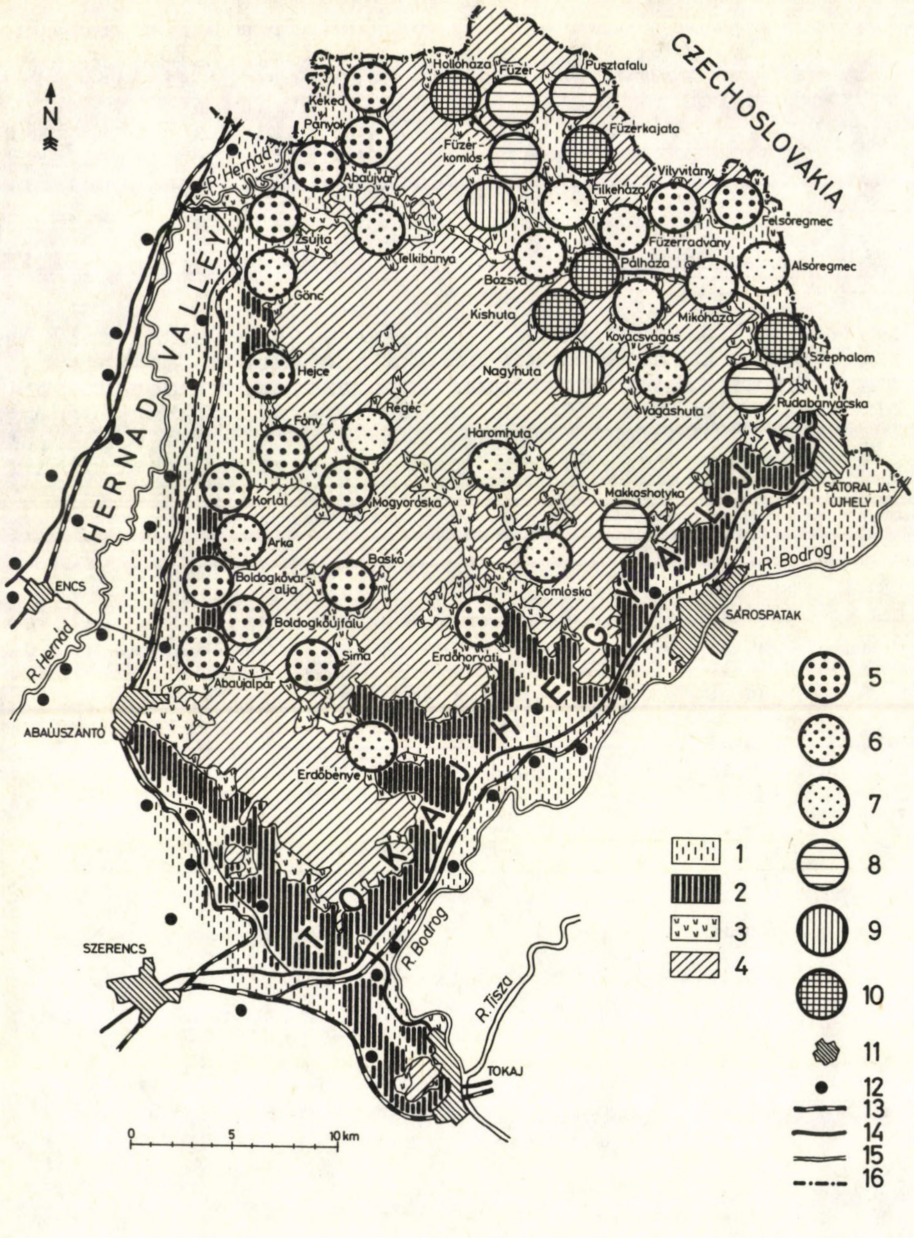
DEMOGRAPHIC CHANGES IN THE ZEMPLÉN (TOKAJ) MOUNTAINS BETWEEN 1970 AND 1980

The residential population of the area under study decreased by 10.6% in the seventies, and the basic cause of this decrease was a 11.8% loss due to migration. On account of the selective character of migration, there was a sharp decrease in the number of young women and, consequently, the number of births was very low. Natural decrease began in nearly half of the villages in the seventies; there was increase in four and actual growth in only five villages.

In addition to the decrease in population, demographic transformation involved the deterioration and distortion of the age pattern (Fig. 1). There are more and more villages in which the proportion of the elderly exceeds 30%, while that of people over 40 is more than 60%. In such villages, no demographic recovery can be imagined. Without a considerable amount of inmigration, for which there seems to be no realistic hope, these villages will probably be entirely depopulated in the future. This statement primarily holds true for tiny villages, the majority of which will soon be "dying" villages, even without considerable further out-migration.

FIG. 1 Changes in the age distribution of population in the Zemplén (Tokaj) Mountains between 1970-1980 and the number of inhabitants in villages (1980)

1 = age groups: (a) 0-14, (b) 15-39, (c) 40-59, (d) 60+; 2 = population change by age groups: (a) = increase, (b) = decrease; 3 = number of inhabitants; 4 = urban places; 5 = rural settlements beyond the area studied; 6 = boundary of the study area; 7 = railway line; 8 = important public road; 9 = river; 10 = national boundary.



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SOCIO-ECONOMIC BACKGROUND TO THE DEMOGRAPHIC CHANGES

The rapid decline in the number and proportion of active wage-earners (Fig. 2) is an important indication of this tendency towards aging. The increase in the number of pensioners and annuitant people, especially the fact that there are more and more families with inactive earners, is a serious social problem today. In the area under study, the number of active wage earners was highest just after the distribution of land (1949) and prior to the establishment of agricultural cooperatives (1960) (Table 2).

The collectivization of agriculture, quite naturally, brought to the surface the agrarian overpopulation, which had been more or less hidden within the framework of small-scale farming before. Following the foundation of co-operatives, there was a sudden increase in the number of inactive earners due to the retirement of the old co-op farmers. (At the end of the seventies, for example, the three co-operatives at Hegyköz, had a total of 742 pensioner members, the number of active members being only 901.) On the other hand, the majority of young people of working age took jobs in industry and the tertiary branches.

FIG. 2 Land use in the Zemplén (Tokaj) Mountains and changes in the proportion of active wage-earners in the total population of villages

1 = arable land; 2 = vineyard; 3 = meadow and pasture; 4 = forest; 5 = <u>decrease</u> in the proportion of active wage-earners over 20.0%; 6 = between 20.0--10.1%; 7 = below 10.1%; 8 = <u>increase</u> in the proportion of active wage-earners below 10%; 9 = between 10.1 and 20.0%; 10 = above 20.0%; 11 = urban places; 12 = rural settlements beyond the area studied; 13 = railway line; 14 = important public road; 15 = river; 16 = national boundary.

TABLE 2 Changes in the Number and Distribution of Active Wage Earners in the Villages of the Zemplén Mountains between 1900 and 1980

YEAR	Number of active wage earners		Distribution of active wage earners		
	persons	% change	Agriculture	Industry	Other
1900	12,307	100.0	74.0	11.2	14.8
1930	13,542	110.0	78.1	11.1	10.8
1941	14,086	114.5	79.5	10.9	9.5
1949	14,125	114.8	78.6	10.2	11.2
1960	14,612	118.7	63.5	18.4	18.1
1970	11,669	94.8	48.7	32.6	18.7
1980	10,463	85.0	42.4	31.1	26.5

Thus, occupational restratification was also accelerated in the Zemplén Mountains after 1960. The number of jobs only increased slightly at local mining and industrial enterprises (Hollóháza and Pálháza), so restratification essentially took place due to daily commuting (in the direction of Tokaj--Hegyalja) and long-distance commuting (Miskolc and Budapest). Long-distance commuting has decreased considerably when compared to the previous percentage of 26%. Nevertheless, today, 7.7% of active wage earners belong to this group which is still high above the national average (2.9%). The proportion of long-distance commuters is especially high in settlements which are in a communication vacuum (Vágáshuta: 47%, Nagyhuta: 26%). Naturally, in the sparsely populated areas, even a medium-size industrial enterprise may play a stabilizing role. In previous decades, the labour demand of the porcelain factory was satisfied by the labour supply from Hollóháza alone, whereas in the seventies, after reconstruction, this factory became a source of livelihood for a further 4--5 villages in Felső-Hegyköz. In this way, industrial investment assured demographic stability for a number of hamlets.

Despite the rapid process of restratification in the region, even today, 42.4% of all active wage-earners work in agriculture and forestry. This is more than double the national average. On the other hand, the age distribution of co-op members is very unfavourable: 60% of them are people over 50. During work peaks, the co-operatives face a shortage of labour, whereas, during the larger part of the year, problems arise due to lack of work opportunities. An especially serious concern is the employment of older women of working age. In addition to the great number of agricultural wage earners, this region has to overcome serious economic problems, with regard to agriculture. An old problem is the fact that the structure and trends of production are not in accord with local natural resources. Ploughland occupies 47% of the co-operatives'land and a considerable portion of these fields fall within the 5-12% slope category. Quite recently, afforestation has taken place here, or the ploughlands on steeper slopes have been transformed into pastures and the structure of crops simplified. These factors lead to the development of extensive cultivation patterns and a lessening of labour demand.

For the present, the percentage of animal husbandry work is increasing, although this does not necessarily mean a quantitative increase. In fact, a joint survey of co-operative and household stock even reveals some decrease.

As for cultivation, the co-operatives--primarily because of a temporary shortage of labour--are trying to establish a less labour-consuming crop structure. This fact, of course, further decreases the supply capacity of this agricultural area.

About a quarter of the total area of Hungary is less than suitable for agricultural cultivation. Most of this area consists of areas in hilly or mountainous regions. In these areas, the backwardness of cultivation is usually accompained by socio-economic decline (P. Romány, 1964, I. Laczkó, 1973). It has been pointed out by several authors that unfavourable living conditions are usually associated with the worse economic conditions and poor labour supply (S. Kukovics, 1972). Thus, it is not coincidental that the level of economy in co-operatives in hilly or mountainous regions is getting poorer every year (I. Enyedi, 1981). Large-scale farms in these regions are unable to compete with those farming in areas with better natural conditions, and if these mountains regions are not given some considerable assistance, then agricultural production will, in the end, cease altogether in these regions. But the country needs the agricultural goods produced in these mountainous regions. Perhaps the regulation, in force since 1980, which established a more differentiated system of assistance for farms existing under bad conditions, will bring better results (I. Enyedi, 1981). The setting up of a crop structure which matches ecological conditions will mean transferring to more extensive production, can mean nothing but the slow withering away of agricultural activity, in the opinion of some experts (L. Dorgai, 1982). This would be because a reduction of expenditure necessarily results in a decrease in production output. There are many who accuse this idea of only taking into account the comprehensiveness of agricultural production, and not considering the negative socio-political consequences which would necessarily arise.

In the Zemplén Mountains, excepting a few industrial villages, the problem of employing women of working age has not been solved. At the same time, the role and significance of household and auxiliary farms fall far behind the national average, despite the fact that this sector is one of the most suitable for the economic activation of women. In the more developed regions of Hungary, the household plot has been transformed: earlier, self-supplying farms have become increasingly specialized, producing surplus stock. However, this transformation has not taken place in the area under study. In my opinion, the decline in auxiliary farming, especially the regression in animal husbandry, can also be explained by the fact that the large scale agricultural farms and marketing co-operatives in the Zemplén Mountains gave little assistance to small farms besides co-ordinating marketing. It has been proved from nationwide examples that profitable household and auxiliary farms can only exist through the multi-lateral help of larger enterprises.

As shown by the example of the Zemplén Mountains, the "mountain-region phenomenon" arose in Hungary in the seventies as well. The underlying factor here, too, is that possibilities for modern agriculture have been narrowed down in comparison to regions with more favourable conditions (plainland areas). As a result of the crisis in mountain region agricultural activities, a large-scale out-migration started and the loss of population was followed by a decline in the lower-grade institutions and, thus, restriction in job choice. Through the impoverishment of the economic administrational servicing functions of the Zemplén villages, an ever-growing number of villages are becoming one-function residential settlements. It can also be observed that, under unfavourable transport conditions, such villages become aging ones at a very fast rate, and they are now threatened by total depopulation. Due to the selective character of migration, the population has grown old and the majority of the rural communities have lost their reproductive capability. Thus, during the last few decades, most of the area has become a stagnant, depressed region. The only exceptions are where mining and industry have created suitable jobs, and development in the basic network of institutions has brought about acceptable living conditions. In the dying settlements, social and economic drawbacks have accumulated: the areas with unfavourable demographic status, bad supply, and which yield low incomes, are, as a rule, coincident geographically. Thus, the unfavourable effects can only strengthen one another.

POSSIBILITIES FOR DEMOGRAPHIC STABILIZATION IN THE ZEMPLÉN MOUNTAINS

The rearrangement of the spatial structure of economy, even in this isolated and relatively small rural area, has grouped the settlements into two categories: those in the first category have become residential commuter villages; those in the second have developed into economic administrative centres which receive commuters. Due to the position of the area in the settlement network, only a few rural centres have evolved in the mountain area (Pálháza, Hollóháza, Gönc and Erdőhorváti), although urban centres can be found in Tokaj--Hegyalja and the Hernád valley. Thus, the basic task should be to improve transport conditions so that even the inhabitants of the most isolated mountain villages can have access to urban services.

Thorough studies (Gy. Barta -- P. Beluszky -- I. Berényi,1975 and Gy. Enyedi, 1980) have proved that, in Hungary, agriculture has remained the strongest stabilizing and determining element in the viability of villages, even if it only employs a minority of the wage-earners. On the other hand, agriculture alone seems unable to maintain the economic level of a region. Subsidiary enterprises by agricultural co-operatives have proved, in other regions, to be a considerable stabilizing factor. The Zemplén co-operatives, with poor resources, aged members and isolated from consumer markets, can only take up complementary activities with locally settled industrial establishments.

The basic co-operative branches, despite significant assistance, are still unable to make a reasonable profit. Approaching production structure to the ecological conditions (the development of extensive branches), as found in Hegyköz, was actually unable to stop the decline. So the idea has been put forward that some mountain co-operatives should be "downgraded" into specialized groups, specializing co-operatives, or that land should be cultivated by small economic enterprises on a contractual basis. This might result in positive changes, since similar attempts have proved successful in industry and in servicing enterprise. Thus, big estates may not be the appropriate form of economic production in mountain region agriculture.

Industry and mining developments have contributed to the stabilization of some mountain villages. Especially important is the role of the Hollóháza Porcelain Factory. Nevertheless, no significant development in industry and mining is expected in the Zemplén Mountains, not even in the non-agricultural activities of the co-operatives.

In many places in Hungary, it has been found that favourable conditions for tourism may succesfully contribute to the development of rural districts. Although it is not really possible for tourism to develop in the Zemplén Mountains, as it has at Lake Balaton or on the Danube Bend, it might favourably influence the rural development of the region. The beauty of the landscape, the climatic conditions and hunting facilities would all be favourable attractions. At present the Zemplén Mountains are territorial "reserves" for the tourist industry. On account of its isolation, far away, as it is from the big towns, particularly Budapest, the region can offer genuine peace and quiet and unimpaired natural beauty to the few visitors who, for the sake of the above-mentioned advantages, are willing to accept the drawbacks stemming from underdeveloped services.

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GEOGRAPHICAL TRENDS IN ENVIRONMENTAL PROTECTION RESEARCH IN HUNGARY

János TARDY

Since the 1960's, world response to the gradual deterioration of the environment has been fervent. The rapid decline in the state of the environment, brought about by the socio-economic boom, is a problem for Hungary, too. In fact, Hungary has to deal with extra problems due to "imported" pollution created by the country's given geographical location. The policy for environmental protection, launched in 1974, culminated in the 1976 Protection of the Human Environment Act. In 1980, the "National Environmental Protection Concept and System of Requirements" was approved and this determined Hungarian policy for environmental protection on a long-term basis. Legislation undoubtedly lagged behind socio-economic progress (and its adverse consequences) in this area.

The inefficiency of previous environmental protection efforts was a result of their decentralized nature. The National Authority for Environmental Protection and Nature Conservation, the coordinating, reviewing and counselling environmental protection arm of the Hungarian government, was organized to coordinate planned environmental protection in a complex way and in accordance with international practice, while at the same time, the activities under the various government agencies were maintained.

This authority (abbreviated in Hungarian to OKTH) was particularly established to oversee particular activities and projects in environmental protection and nature conservation and to coordinate national environmental protection activities. It was complemented, in 1980, by a professionally based institution, the Institute for Environmental Protection.

The present paper does not wish to review the efforts which are being made to develop the system of environmental protection, neither will it enumerate the parameters describing the state of the environment. Our aim here is "merely" to illustrate the role and contribution of geography in the field of environmental protection and nature conservation research in Hungary.

The principal tasks of environmental protection research are to highlight environmental hazards and their consequences on a systems theory basis, to determine the possibilities for their prevention or reduction and to set priorities in conservation. Although not necessarily here, fundamental questions must be answered. What role do gesciences, among them geography, play in environmental protection research? To what extent does Hungarian environmental protection and nature conservation practice exploits the achievements of geographical researc? How do practical demands influence these research trends? Can we assume the unity or, at least, the common view of academic theory and practical environmental protection?

But, to begin with, let us say something on the present state of the environment. The agricultural land area of Hungary decreased by 344,000 ha between 1945 and 1980, while the area taken out of agricultural production exceeded 1,000,000 ha. Approximately 2,300,00 ha of agricultural land is damaged by water erosion and almost 1,400,000 ha is affected by wind erosion. Owing to improper soil cultivation, secondary salinization and soil compaction,conditions which decrease fertility, are a real problem. Another particular problem is where to dispose of approximately 42,000,000 m^3 of fluid manure produced each year.

The overwhelming majority of Hungarian surface waters are polluted to a medium degree. This is due to the fact that Hungary has a centripetal drainage network, resulting from the based character of the country. This means that 96% (in August, 99%) of surface waters come from abroad, already polluted. This situation demands vast investments so that the water 'outlet' is no worse than the 'inlet'. It is an achievement therefore, that the organic matter content and oil pollution of water have decreased on a national scale, while the nitrate contents have increased in subsurface waters (primarily in non-confined groundwater). A major task, therefore, is the protection of the karstic water which accounts for 10% of the population's water supply. Only a third of the settlements connected to the water conduit system are also joined to the public sewer network. In addition to this, only 27% of the sewage undergoes biological purification.

More than a third of Hungary's population live around the capital and in the vicinity of industrial agglomerations where the air is regionally polluted. It is significant that about half the recorded air pollution in more sparsely populated areas originates from beyond the national borders.

Hungarian nature conservation has a long tradition and has 453,775 ha of protected land today: 3 National Parks, 29 protected landscapes, 98 protected areas of national importance and 5 international biosphere reserves comprise of about 4.5% of the area of Hungary. Also under protection are all caves, 340 plant species, 320 bird species, 98 other vertebrates and 153 invertebrate species. The concept of 'strictly protected' has been introduced and this category now includes 30 plants, 32 bird species, 2 vertebrates and 85 caves.

To gain an acknowledgement that secondary natural resources are in need of protection should be a prominent task of environmental research both at home and abroad, particularly in the present time of economic difficulties. In general, the quantification of both that which is already protected and that which will be protected in the future is the responsibility of geographers. It seems obvious, however, that the often mentioned 'ecological viewpoint' and the 'economic approach', so much encouraged in practice, will not easily settle the series of conflicts which has arisen between the economic sectors and environmental protection and nature conservation.

GEOGRAPHY AND ENVIRONMENTAL PROTECTION

(Work and problems as seen from practical environmental protection)

Research into the geographical environment is beyond the scope of a single discipline, since spatial units and processes are fa-reaching and complex. A continuous integration is, therefore, observed, not only between the disciplines of economic and physical geography, but there is also a multidisciplinary cooperation between sciences which would have seemed impossible before. It is only this complex approach that enables geographical disciplines to fulfil the essential work in their field: increased synthetizing activity and possibilities of prognoses, the modernization of regional planning, a thorough analysis of the interactions between natural resource utilization and environmental protection in given spatial units, and an investigation of the relationship of nature and society from various approaches.

In addition to its growing significance for the institutional network of environmental protection in Hungary the systems theory approach has gained ground in the field of geography concerned with environmental research. The level of organization and research coordination in the field of environmental protection in Hungary has improved remarkably in recent years, due to the activities of the OKTH (Fig. 1). Research continues on wide scale, even though it is still rather fragmented due to diverging sectoral projects. In the absence of proper coordination, heterogeneous and ad hoc research carried out for decades led to a situation in which, as one could say, something was studied in all fields but 'everything' in none.

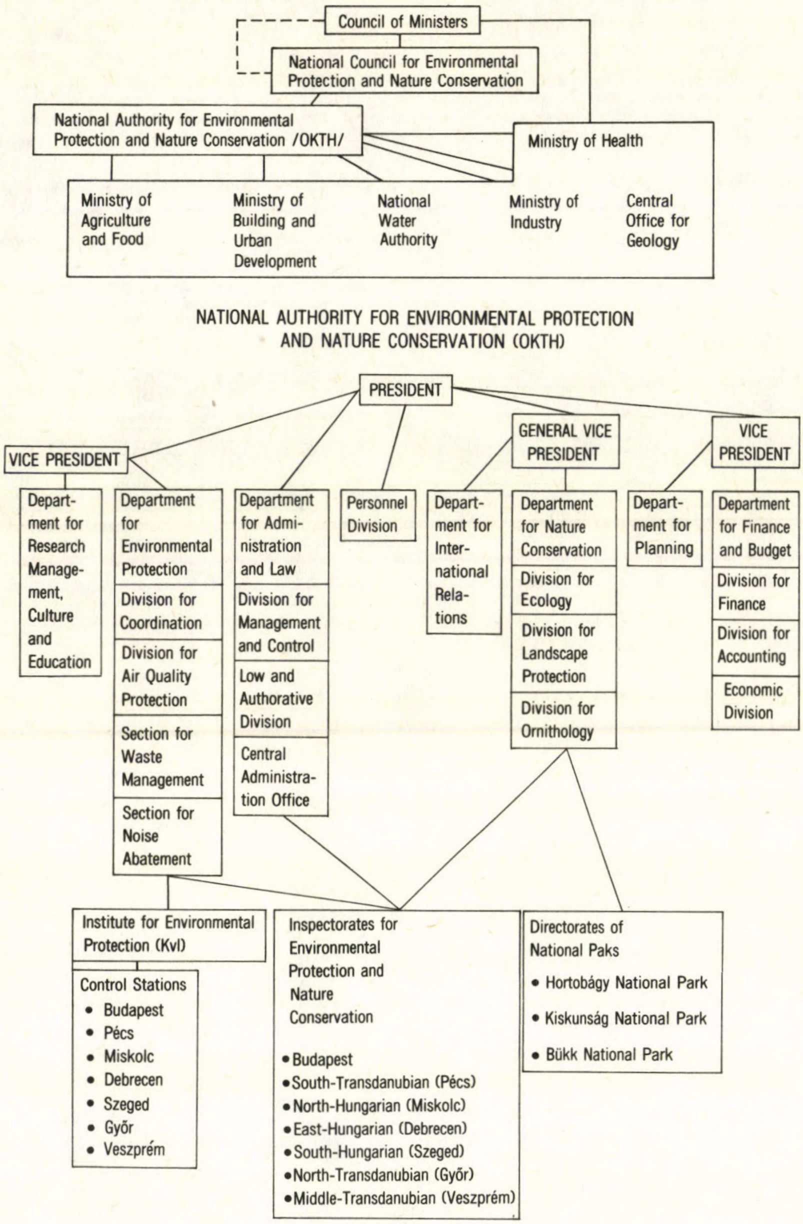

FIG. 1 Organization of environmental protection in Hungary

Large scale mapping in accurate detail is possible in the knowledge of the features of a few small smaple areas, but, unfortunately, there is hardly one reliable series of data which represent the environmental conditions for the entire country. It is possible that threre will be considerable changes now that the National Environmental Protection Information System and Data Bank, plus the environmental protection measurement network, has been established.

Until this new system is properly organised, a fundamental task of these sciences interested in environmental protection decisions is to adjust their methods to reality, that is the existing conditions. A stock should be taken of the information already available and new research, surveyvand data collection should be concentrated in certain fields where it is justified professionally and both financial and technical conditions are given.

At present, a general problem in Hungarian environmental research is the quantitative, qualitative and regional inequality and also, the occasional lack of data necessary for complex processing. It is not, however, just a 'Hungarian speciality' that research methodology is usually more developed than the conditions which ensure that the elaborated and tested methods which proved good in experiments would also become "viable" and applicable.

A serious -- and now recognized -- mistake of practical environmental protection was the former view that, separate measures should be taken against individual environmental damage (water and air pollution, endangered natural resources and wild life, noise problems, etc.). It is obvious that processes affecting the human environment are active in a particular space (environment) and that they do not operate separately, but in close interaction, intensifying or reducing their individual effect. Relatively isolated assessment procedures of environmental impact, global ecosystem and environmental elements of the biotop (in fundamental sectoral research) must inevitably be followed by an analysis and integrated evaluation of their system relationships. To neglect it and investigate individual elements and processes autotelically may lead to serious conflicts and invalid conclusions in research methodology. The geographical environment is an intricate web of interacting sub-systems and will not bear the generalizations sometimes made in practice (for ecample, what is 'more important': water quality, soil or air protection?). A series of examples will prove that the necessity for interventions, and their order and magnitude should always be determined by the resources and the state of environmental components in a given geographical unit (region, district, etc.).

From a rich choice, limitations of space only enables us to present a few examples illustrating the main trends in

Hungarian environmental research.

1. One of the most substantial points in geographical environmental research stems from fundamental research into theory and methodology. This research is meant to define the subject of environmental protection research and its system of concepts and instruments (environment and landscape typology, hierarchies and systems of relationship, etc.). Traditional (regional) landscape research at a theoretical level, and as a study of fundamental nature, has acquired a new meaning (S. Marosi, 1980, S. Marosi--J.Szilárd, 1963, M. Pécsi, 1972, 1974, 1979, M. Pécsi--P. Stefanovits--F. Martos, 1979, M. Pécsi--L. Rétvári, 1981). M. Pécsi stepped beyond the conventional concept of natural history landscape to open a new perspective on up-to-date environmental research with his definition based on systems theory.

The debate about whether the environment was a special category of space has now been settled to general satisfaction (S. Marosi, 1981). So, the subject has arrived at a level where it no longer has a paralyzing effect but it rather highlights the practical activity of environmental protectors and encourages further debate mainly at a theoretical level.

Among the problems which remain more or less unsolved, the ambiguity between the interpretation of landscape in theory and in practice still causes difficulties. The definition of landscape in the terms of practical landscape protection, landscape aesthetics and landscape planning and development is now closer to the concept of 'physical environment', which is regarded as a constituent of the geographical environment, than to the concept of 'geographical landscape'. S. Marosi has made the concepts of 'environment' and 'landscape' more exact. His essential statement (that the environment always implies some relation to something) forestalls the 'fashionable' ambiguious use of the term and rejects the fiction of 'self-contained' environment often used in everyday speech and professional terminology. He claims that while the boundaries of particular environments are quite changeable in time and space, following the movement of living organisms and societies, the boundaries of landscapes are fairly stable due to their largely physical determination. Accordingly, each landscape is a regional geographical unit, while the same cannot be said of 'concrete environment'.

2. A new evaluation of natural resources and the geographical approach to environment protection problems was first attempted when the long-term plan for the Budapest agglomeration (1973--1976) was developed (S. Katona, 1976, 1978, 1981, S. Katona--Z. Keresztesi--L. Rétvári, 1979). The system of interrelationships between spheres of the geographical environment forms one of the most intricate group of difficulties in geographical environment research and in the protection of the human environment. The relationship between the socio-economic and technical (infrastructural) spheres

and the physical environment, full of conflicts, is a direct consequence of the regional concentration of productive forces. The environmental protection Act defined a settlement environment as the totality of residential, recreational and institutional areas and other areas used for human residence. The concentrated, closely interrelated environmental effects which are manifest in the settlement environment, affect an overwhelming majority of the population and influence their living conditions. Here, all environmental damage is concentrated due to the collected consumption of population, industry and transport. Soil and subsoil conditions have deteriorated on a national scale. The lack of sewers, waste disposal problems, global and local air pollution bad ventilation, heavy noise, the growing urban pollution influencing the physical environment, the debated plan for a settlement network, etc. are all heavy burdens on the planning of a national economy. These problems have grown to such an extent that, at the moment, simply maintaining the present state of the environment and preventing further decline, is a serious problem.

With all these problems in mind, a comprehensive investigation of the settlement environment through a geographical approach seems to be a fundamental need in modern environmental management. Gy. Enyedi (1972, 1982) examines the relationship between the structure of production and ecological potential as reflected in the rural development policy. J. Tóth (1981) and his co-workers analyze the settlement network and environment in Hungary as a part of their complex interactional system. They pay special attention to the peculiarities of urbanization in the Great Hungarian Plain and to the problems of regional infrastructural development.

During research into the climatic aspects of the settlement environment, an analysis of urban climate, several trends have been noted (I. Fodor--L. Gajzágó, 1980) which are directed towards the continuation or intensification of adverse environmental effects. Primarily, during the cold season, radiation and light is reduced by polluted air, thus increasing electricity consumption. It is also worth noting that this reduction of light and heat also has negative psychological effects. The reducing influence of air pollutants is most intensive in the shortest wavelengths on the solar radiation spectrum, in the ultraviolet sphere, vital for living organisms. F. Probáld (1974) made a synthesis of the climatic conditions in and around the capital, highlighting the relationship between urban climate and environmental pollution.

Research into the settlement environment (mainly of large towns and industrial regions) (Gy. Enyedi, 1972; I. Fodor -- J. Rechnitzer, 1981, S. Katona, 1981, J. Tóth, 1981) was followed by the mapping of complex landscape and environmental quality and later, by the comprehensive evaluation and mapping of agricultural model areas and their utilization, with

prognoses. The goal-oriented mapping of the environmental quality is meant to be of some practical assistance. It should help to decide the right time for intervention by scientific bodies and authorities, aiding them to establish their site, reason, order of magnitude and urgency. It can also be used as means of judging the precitable consequences of their intervention.
The corresponding steps are (S. Katona--Z. Keresztesi--L. Rétvári, 1979, M. Pécsi--L. Rétvári, 1981):

- base maps of analysis and disclosure of potentials and comparison;
- so-called complex or integrated maps;
- maps of environmental prognosis.

Geographical/cartographical terminology sometimes confuses conventional maps of potentials with environmental protection maps. The first are the base maps of various disciplines, for example, map representations of the composition and quality of water, air and soil parameters. These maps are indispensable in the survey and assessment of the quality of the environment. Environmental protection maps, however, use only a special synthesis of these base maps, which is acquired through processing from several angles and supplying with a special key. The maps mentioned above are not environmental protection maps in the same way as environmental research is only a part of environmental protection research.

3. Within the framework of a project entitled 'An integrated evaluation of the potentials and resources of the physical environment', a working group led by L. Góczán presents an experimental method in a selected model area. After the survey of the biotic and abiotic components judged most important in the environment, he attempts to give a relative, and subsequently integrated, evaluation of these factors (near-surface rocks, relief, climate, availability of water, soils, vegetation) given an agro-ecological aspect. Here, the crucial and least settled problems of geographical environmental research (landscape and investigations into environment potentials, plus efforts to assess the quality of the environment) are faced: the quantification of qualitative criteria; the weighting of individual ecological factors against each other; the weighing of the categories of a particular parameter; the subjectivity of scoring; and the unsolved problem of the exact economic evaluation of ecological potentials.

4. A major enterprise in Hungarian environmental research is the work being done under the leadership of M. Pécsi, which emphasizes environmental potentials in the complex description of the macro-regions of Hungary, through a series of monographs (Landscapes of Hungary).

5. Following preliminary regional investigations in the test areas (Tatabánya, the Pécs agglomeration), a joint

venture between the National Authority for Environmental Protection and Nature Conservation and the Hungarian State Geological Institute has an aim of practical importance to the national economy: the first uniform cadastral survey of mines in Hungary. This survey is intended to prepare the way for a comprehensive analysis of the so-called "transformed natural environment" with the all-embracing area study of active and abandoned strip mines and quarries. In accordance with practical requirements (beginning with protected areas in Hungary), the survey presents a comprehensive picture of actual conditions in regions of the country where land reclamation is necessary. The fundamental data and synthetic maps will be useful in the geo-sciences and projects on the utilization of the environment, as well as in the protection of land, landscape and mineral reserves (P. Müller--J. Tardy, 1982).

6. The man-made constructions for water management (flood control measures) often disturb the relatively natural equilibrium of the human environment and it has been found that possible contributions from geographers in this field could have an important role to play. Three examples of this are presented below:

(a) The predictable consequences of the Gabčikovo (Bős) --Nagymaros Barrage System have been investigated through an interdisciplinary approach. The research, coordinated by geographers, covers possible changes in the natural eco-systems of the Danube and its sub-channels, the impact on agriculture of a disturbed groundwater balance, and on analysis of trends in environmental qualitative changes (water extraction, and purification, recreation, the carrying capacity of the region, etc.). As a results of these investigations, certain principles have been formulated, the realization of which is the responsibility of water management.

(b) The findings of L. Jakucs (1980) draw attention to the geographical aspects of water management in the Great Hungarian Plain. Over almost the whole Plain the flood control measures have upset the sensitive balance which previously existed between the dynamics of sedimentation and the rate of basin subsidence. The rapid accumulation of sediment on the amphibiotic flood-plains of rivers narrows the outlet sections every year, thus increasing the risk of floods.

Channel regulations, canals and changes in cultivation which modify natural vegetation have influenced run-off coefficients: In some places, they have radically changed the infiltration and evaporation capacities of sloping surfaces. The maximum amount of run-off water from the source areas in these regions has consequently increased and the duration of the flood crest has lengthened.

The reservioirs in the Great Plain increase the groundwater table in their vicinity and, in places, they cause evident deterioration in soil quality.

(c) Regional environmental research of Lake Balaton is a vulnerable spot in Hungarian environmental protection. The preservation of this area of outstanding natural wealth involves the multi- and interdisciplinary cooperation of natural, technical, economic and social sciences. Within a comprehensive program of scientific research, the preparation of a complex geographical synthesis for the lake and its environs has already begun.

7. A peculiar and rather unfamiliar field of environmental assessment research and techniques is nature conservation mapping (J. Tardy, 1983a, 1983b). Its primary goal is a program of survey and mapping, with a related methodology and uniform key, which is concemed inth the present actual capacity of environmental protection (information, financial and temporal factors, etc.). Maps of nature conservation are thematic maps, in fact a map series which reveals the multitude of protected objects, resources and wildlife: values of geologic, geomorphologic, biologic, landscape cultural, historic interest. The maps would locate them and show their condition; they would point out the environmental effects and trends; they would give information on changes in their state, the occurrence frequency of protected entities, the level of rarity; and they would contain data aiding the determination of recreational possibilities.

Due to lack of space, only fragmentary information could be given here on the geographical approach to environmental protection research. The focus was mainly on the lines which founded and promoted environmental protection in Hungary.

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Geographical Essays in Hungary
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BASIC PRINCIPLES IN THE APPLICATION OF GEOMORPHOLOGY IN HYDROCARBON RESEARCH

László JAKUCS

The traditional aims of geomorphological research do not generally move beyond establishing the features of surface relief, their genetic interpretation and cartographic presentation. Since the beginning of the 1970's, in Hungary however, we have attempted to develop beyond this in various ways.

The morphogenetics of the earth's surface can be analyzed and synthesized through physical geography, a science which possesses the inherent conditions necessary for alloying the geophysical, geological, geokinetic, hydrological, pedological and climatological research results of a region with the geomorphological knowledge. All these factors can, therefore, be assessed in terms of a complex interaction of effects and a synthesis of the significant contents. This, the individual colours in the spectrum of information become fused into a uniform beam, shedding new light on essential correlations.

Working with this in mind, we have made an attempt to show how thus complex geomorphogenetic approach can be utilized, so that it develops beyond the traditional, morphogenetic interpretation of the surface of large, individual regions. We are working towards an exploration of the reserves of geological raw material in the broader sense.

With the discovery of hydrocarbon storage structures deep beneath the Great Hungarian Plain, we have been able to find integrating geomorphological methods which expand the possibilities for the practical application of geographical science in this direction. We are here concerned with inter-disciplinary classification from a new angle, incorporating geoscientific and characteristic physico-geographical information. This will lead to the discovery of at present unknown correlations between phenomena. In addition, previously unexploited areas will open up, which could put geomorphological research energy and other, raw materials into a wider perspective than at present.

It is a fundamental principle in our research conception that every surface is, in some sense, a reflection of the deep structure. This also applies to the flat surface of the filled Hungarian Plain.

Synoptic satellite pictures do not directly show, in the form of surface lineaments, the deep structural features of the plains. Lineament-like sections do show up here and there on plain terrains, thickly covered with young fluvial and aeolian accumulations which have subsequently been smoothed out. However, these sections are more indicative of the predominant wind direction, or general slope direction, than of possible tectostructures projected up on to the surface. This is probably because fluvial or aeolian deposits act as a sediment trap in a subsiding and deepening basin and the subsequent dynamics of the effects are more strongly impressed on surface features than neotectonics. For this reason, geology does not normally give particular attention to an interpretation of the structural dynamics of satellite photos, which cover areas including large plains. Up to the present, therefore, Hungarian geologists have usually assessed the effects of neotectonics in terms of the differences in sediment thickness formed in unit time, or the results of synthesis experiments, repeated periodically at geodetically fixed points on the surface.

Nevertheless, during geomorphological interpretations of various satellite photographs of the Great Hungarian Plain, morphogenetic features have been found even in the least obvious seeming planar relations. A comparison of these features along with regional knowledge acquired through traditional geoscientific techniques (geophysical, geological, geomorphological, hydrological, etc.), draws attention to parallels which were not previously observed, or which were not considered of interest. However, these parallels indicate the existence of objective geological interconnections.

This possibility for collation is based on the fact that the features of the recent natural geographical landscape are essentially an ossified state in the development of primeval geography and geology. When considering, therefore, the factors in landscape formation which gave rise to the present natural surface of the Great Hungarian Plain, we conventionally rely on cross-checks on information recorded in geological, petrological and pedological maps.

We are now accustomed to this classical, scientific procedure, which can be applied to geological actuality with some accuracy over a short period of time. Bearing in mind the principle which is used to determine the stance of genetic landscape evaluation, the present geographical surface features are merely a recent mirror image of a sequence of palaeogeographical developments. Although the earlier stages of these developments are mainly fixed in the subsurface petro- and morphofacies, they are still of determining value with regard to the natural geographical conditions of the present age. That is, the relief, form, sediment, and soil layer covering the primary sediments are not only themselves in harmony, but, they also faithfully reflect the endogenous and exogenous natural forces and processes which gave rise to them. In this way, the surface of the natural landscape is an integrated product of the primeval, geographical events of preceding periods expressed in the material and relief-quality. Consequently, an analysis of the existing natural landscape may provide exhaustive information, not only on the sequence of development, but also on the considerable trends and processes acting on the landscape at present, processes which serve as indicators of primeval geographical and geological continuities.

Our interpretational experience highlighted the fact that, on the Great Hungarian Plain, the path is not so simple and clear-cut. Although the close correlations, given above, between the natural landscape and energies acting spontaneously in the landscape, were essentially justified in this region two hundred years ago, they are now no longer convincingly so. A new factor has emerged in the rearrangement of the landscape, an overpowering dynamism which virtually overwhelms everything else: man and his society. With our increasingly more effective methods and tools, from decade to decade, we are denaturalizing to an incredible degree the fairly permanent processes of build-up and break-down, hastening developments in what was previously gradually changing equilibrium.

The replacement of original, natural vegetation with new, forced vegetation; the changes in natural soil surfaces; the large scale denaturalization of drainage infiltration and evaporation of rainfall; the expansion of the hydrological network with new forced courses; the growth in artificially (although generally involuntarily) induced soil degration; the rearrangement of the relief, in accordance with road, rail and settlement development; the establishment of industrial, mining and urbanized constructions: all the above create significant, unecological features on what was previously a naturally integrated landscape. They frequently give the surface a completely new appearance, and, in addition, inhibit its slow, natural development from day to day. The anthropogenic landscape features, which generally appear so strikingly on satellite photographs, are therefore not only new elements in a landscape, but also controlling and regulating processes, acting on the energies of the landscape.

It is not easy, with either remote sensing synoptics or in-situ studies, to make an accurate assessment of the extent to which civilization has affected the spontaneous energies developing a landscape. It is not surprising to find, therefore, that there are radically opposed views in this area within the profession itself. In general, however, we should be wary towards all subjective opinions based on surmises. Instead, we should select methods of investigation which are unambiguously confirmed by concrete experimental results, results which reveal the connections between truly objective geological tendencies and facts, and their interaction. Thus, the investigation of possible hydrocarbon-bearing strata in the Great Hungarian Plain using remote sensing methods only promises recognition for new research possibilities if the anthropogenic, distorting elements can be eliminated from the surface morphology, the hydrogeography and from the pedogeographical and petrofaciological characteristics. Only then could one give an objective evaluation of the regional level changes which define the present areal system of local plain depression zones and relatively high areas. One would also be able to evaluate the effect of geokinetic movement in promoting the possible development of potential storage structures.

The consequent application of the above principles in the interpretation of satellite remote sensing images has allowed us to draw some conclusions, important with regard to hydrocarbon research, relating to the geostructures which determine the nature of the landscape. We present some of these conclusions below.

1. Signs of equal density in the satellite photographs of the Great Hungarian Plain reflect the homologous balance that has arisen between the surface geological formations and the pedogenetical facies. Extending the investigation to consider the permeability surface sediments to a depth of 10m, it was found that the occurrence of coarser-grained strata was in direct correlation with the height of the area above sea-level. However, this correlation is only of statistical validity as sandy facies also occur in lower areas, although these are generally connected with linear development and are of finer fractions.

2. From particular landscape features sensed on the surface, it seems that the crystalline substratum deep under the Great Hungarian Plain is comprised of sections which are also at present, subsiding, but which display partially differing dynamics of motion. In a geological sense, these movements should be regarded as fairly permanent, and probably express a plate-tectonic crust development process, starting in the Tertiary. Above the relatively dinamically subsiding substratum the sediment series of isochronic origin become thicker, the proportion of coarser strata increases in the fluviatile deposits, and the surface hydrographic network moves towards substratum geosynclines. At the same time,

above the relatively slowly subsiding substratum (or, in places, sightly elevating), the sediment layers on the Great Hungarian Plain become thinner, grain composition of the sediment facies becomes finer, the river network leaves the concameration state during bed-overdeepening and the rivers slide down the concameration wings.

It should be noted that these developmental characteristics are only typical in regions outside the fluviatile talus on the edge of the Plain. The bay deltas, at the edge, developing with quite particular dynamics, generally increase according to their own laws. Accordingly, research results indicate that local tectonism and the portions of the sediment catchment basin which subside with different levels of intensity, are of no significance at all in the determination of horizontal plan.

3. Local concameration structures in the substratum (possibly including the covering strata) which indicate probable (or proven) instances of hydrocarbon accumulation, are found in the following areas of the Great Hungarian Plain to the east of the River Tisza:

- the mid-point between Tótkomlós and Kétegyháza;
- the mid-point between Tótkomlós and Kaszaper;
- between Kardoskut and Pusztaföldvár;
- in the district of Algyő;
- the mid-point between Kübekháza and Kiszombor;
- about 4 km north of Cserebökény;
- immediately to the south of Csongrád, in the marsh on the dyked right bank of the Tisza.

It appears that, besides the above sites, the Érmellék Tépe--Pocsaj area also offers undisturbed stratification, surrounded by neotectonic belts, where the dwindling peripheral sediment series of the Körösi geosyncline may have promoted the storage of hydrocarbon. Otherwise, it is quite clear that the sediments deposited in the large geosynclines in the southern part of the Plain, to the east of the Tisza, become finer and then peter out from the centre, in the direction of the wings. In the more favourable areas, however, the curve of the dwindling porous layers at the border may ensure layer traps. This is assuming that the layer series thought of as the parent rock forms the central part of the geosyncline. With this in mind, it is now possible to consider exploration in the following peripheral areas:

- the line Maroslele--Makó--Apátfalva--Magyarcsanád;
- the line Mindszent--Szegvár--Derekegyház--Királyhegyes--Kövegy;
- the curve joining Elek--Kétegyháza--Szabadkigyós--Kétsoprony--Murony--Békés--Gyula--Gyulavári;
- the northern area of Gyoma.

In geomorpho-structural synthesis, the structural features of

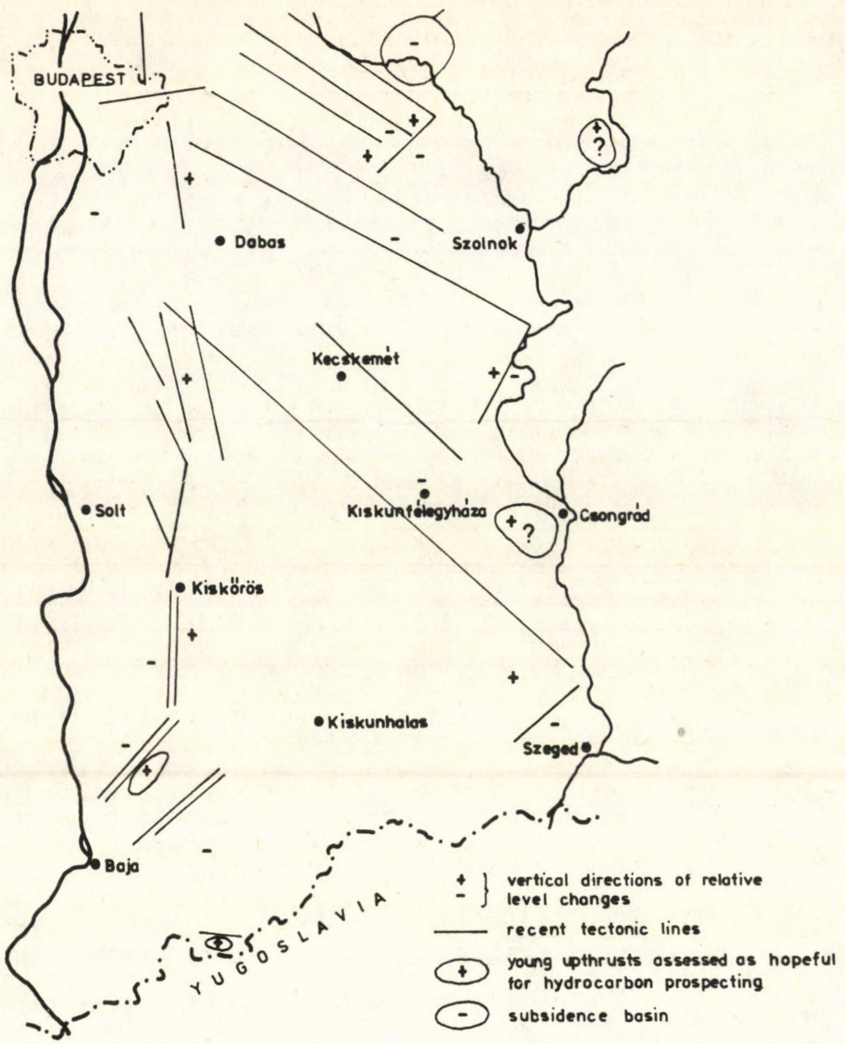

FIG. 1 Young structural phenomena identified working from satellite information

the area between the Danube and the Tisza, are characterized by the fact that large sediment-collecting, independent geosynclines are not found here. In contrast, however, the eastern half of the region seems to be a kind of extended wing, rising towards the west, of the large sediment basin covering the Csongrád--Hódmezővásárhely--Szentes area. The western part of the area is primarily characterized by the presence of maxima around the (high) concameration.

Thus, when evaluating the structural features discussed above from the view-point of hydrocarbon accumulation and research, we reach the logical conclusion that, although the maxima in the south-western half of the region between the Danube and Tisza are structurally suitable for storage, they are probably associated with small and narrow sediment-collecting synclines. Because of their size, these synclines did not ensure optimum conditions with regard to intra-Pannonian hydrocarbon formation and storage. Thus, though it is possible to find hydrocarbon in this area, its quantity will hardly be enormous.

The question arises, however, of whether there was a pre-Pannonian parent rock in this area for the accumulation of hydrocarbon. With regard to this, the areas of Illancs and Katymár--Madaras appear to be regions of promising exploration.

The situation is quite different in the area lying between the Tisza valley and the structural line Kiskunhalas--Pusztamérges--Mórahalom: this is an extensive Pannonian basin wing. In contrast to the previous highly situated maxima, possible smaller "parasitic dome structures" in this wing area (the maxima at Szank, Üllés, Algyő, or between Forráskut and Balástya, as we demonstrated in 1968) show more favourable conditions for hydrocarbon storage. They are located on the flank of the Tisza valley Pannonian geosyncline, which has a large area of thick strata, and so they may have acted as traps for the considerable hydrocarbon movement from the centre of the geosyncline.

Fig. 1 summarizes the young structural phenomena we have identified working from a complex landscape-morphogenetical integration of the satellite information. Also included are further areas in the Great Hungarian Plain region, between the Danube and Tisza, which are considered promising from the point of view of hydrocarbon exploration.

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THE ROLE OF MINERAL RESOURCES IN THE ECONOMIC HISTORY OF HUNGARY

György HAHN

Evolution, the multiplication of every living organism, is influenced by its environment, and geographic position has an effect on the habitat of mankind. A great many human fossil findings can be dated back to the approximately 700 thousand-year-old Brunhes-Matuyama paleomagnetic inversion. Since then, both glacial periods hindering development and interglacial periods stimulating development have created manifold alterations. The different fields of science, when analysing the Quaternary period, still fail to give a straight-forward explanation of the fact that the emergence of man from the animal world was a slow process up to the end of the first glacial, when it suddenly took what may be considered an explosive-like leap forward. This is strange as the extent of the Holocene interglacials up till that time is put at ten to twelve thousand years, as opposed to the earlier hundred thousand year Mindel-Riss, and the seventy thousand year Riss-Würm, ice-free eras.

The social progress of manking took place in a reasonably steady environment (geographical, climatic, etc. conditions). Varying economic requirements, however, gave preference to different areas of the earth's surface. At first, cultural centres were linked to river valleys with a warm climate, regularly meliorated by nature (flood areas), which could provide a reliable, permanent supply of food. Later, Mediterranean areas with a balanced heat regime and varied precipitation in the winter, turning to dry during the summer, became the state-forming economic centres. Changing social and economic requirements gave priority to different natural condition systems in certain parts of the earth, but never on its entire surface.

Important elements in natural condition are mineral raw materials. In the early periods in the development of mankind, it was mainly the tractable, but very hard, quartz pebbles and quartzite deposits which were utilized. This period was followed by eras of different ores and the metals made from them (copper, bronze, and iron). During these eras, centres evolved in wooded, easily defendable areas where there are accessible metal deposits. Mankind reached the era of individual surplus production and differentiating distribution of labour during this period. Thus, the scale of mineral raw materials necessary for meeting the demand increased, for example, meat was conserved by smoking, spicing and salting at this time. For centuries, salt was considered to be one of the most important raw materials. Salt mining and its trade were state monopolies and formed a basic part in the treasury income.

In the Mid-Danube or Carpathian Basin, the area which can be considered historical Hungary, the recovery of crude oil derivates has been going on for almost 1,000 years, although its practical importance has only recently become evident. Mining and the processing of iron ore started about 2,500 years ago, and that of precious metals about 2,000. Metallurgy made good use of the ore occurrences and the near-by wooded mountains around the area but the processing and minting of precious metals can only be dated from the first Hungarian king, István (Stephen) I. During the time of national autarchy, approximately until the reign of Béla III, (1172--1196) the mining of precious metal and its converted products, gold and silver coins, did not play a dominant role in the economic life of Hungary. The importance of mining is linked to the dissemination of literacy which began in the reign of Béla III. After this, the social distribution of labour made the Hungarian mining and minting industry important both at home and abroad. The country suffered its first short crisis in 1241, when the Mongolians ("Tartars") invaded the country and Hungary, in addition to a considerable part of her population, lost the economic accumulation of centuries. Economic historians have not yet studied in detail the important role played by mining and metal processing in the economic recovery of the country.

After the Tartar invasion, mining, metallurgy and minting were reorganized in the manner of the most advanced technology found in Western Europe, with the labour, imported from these countries along with royal privileges. From the second half of the 13th century, Hungary produced a third of the precious metal output of the known world, including five-sixths of gold production and a fourth of silver produced in Europe. As a result of these facts, the importation of African and Asian gold through the Levant was banned by the Papal court, which then, almost simultaneously, backed Charles Robert I (who had strong Italian and French connections) in claiming the throne of the extinct Árpád dynasty. There was a subsequent strengthening of the royal hegemony and a reassertion of Hungary's influence over much of the world through this acquisition of mineral resources. Thus, during the fourteenth century, several things, including the mining of precious metals and minting in Hungary, an activity of outstanding importance at that time, elevated Hungary above the group of middle-size powers /Louis the Great (1342--1382) and Sigismund (1387--1437)/.

It is characteristic of ore mining that technology and equipment must, at some point, compensate for the steady diminution of metal content, on one hand, and the worsening of the natural conditions for mining (growing depth, and the increasing danger of flooding) on the other. At that time, these alternative requirements could only be partially met by Hungarian mining, by increasing the number of mining localities to about one hundred, by opening mines in Transylvania and Szatmár in addition to those in Northern Hungary, by updating technology and processing (water-pumping, driving aids and the refining of metals), by establishing concentrated mining plants using the capital of the Fugger and Thurzó families and, after the reign of King Matthias, by increasing copper production instead of precious metals.

In the sixteenth century, several factors, including a fatal conflict with the stronger Turkish Empire, created a permanent crisis in Hungary. The population decreased by almost 50 per cent over approximately 150 years, and intense crop cultivation have been replaced by extensive animal husbandry. There was a halt in technological development and the mining industry suffered accordingly: as the higher grade ores near to the surface had been exhausted, deeper shafts containing less metal could not be dug. In order to facilitate the importation of spices needed in the conservation of meat, the outflow of European stocks of precious metals began. In order to bring this process to a halt and with the aim of opening new roads to the East, rulers of the Iberian countries initiated inter-continental navigation, which, in turn, led to great geographical discoveries. Thus, the precious metals already recovered, as well as deposits from other continents, became involved in world trade. This all resulted in an increase in gold and silver production and supply and a decrease in precious metal prices. It is no wonder that the difficulties in Hungarian metal mining, the Turkish invasion and internal conflict, as well as the dumping of cheap precious metal on the European market, had a negative effect on production and processing. The decreasing Hungarian labour force left the financially crippled mining industry for the mobile branches of the national economy. A short boom was only experienced at the turn of the 17th and 18th centuries, when, with the aid of German, Swiss, Polish, Italian and Papal assistance, the Turks were driven out of the country. At this time, however, the orientation of world trade moved from the Mediterranean to the Atlantic Ocean and the inter-continental precious metal turnover increased a thousandfold. This deprived Hungary forever of its earlier important role. Hungary's annual gold production was 1,000--3,800 kg, silver production was 3,000--30,000 kg and copper mining averaged 1,000--2,500 tonnes per annum which gave it a significant share in world production for almost five centuries, up to the First World War. Metal and salt mining, as well as minting, constituted 25--50 per cent of the national income and sometimes counter-balanced 80--90 per cent of the country's imports.

Thus, only the iron ore and coal mining industry were in a position to be important factors in Hungarian industrialization which started in the middle of the 19th century. Finding iron ore and coal deposits situated relatively close to each other is a crucial factor when choosing the site for a metallurgical plant. Unfortunately, in historical Hungary, there were only deposits of brown coal instead of good quality coking coal in the neighbourhood of iron ore mines, the only exception being the hard-coal basin in the Bánság and Krassó-Szörény Ore Mountains. These circumstances forced the Hungarian industry, which was, from the beginning, in a disadvantageous position, to import 4,800,000 tonnes of hard-coal and 80 per cent of its coke demand.

In the middle of the last century, the gross return from iron production was almost equal with the gross return from the declining precious metal production. Around the turn of the century, iron mining and metallurgy production was many times that of precious and base metal mining and processing. In the years before World War I, the annual quantity of iron ore mined in Hungary was one to two million tonnes, half of which was exported to Austria and Germany. During World War I, the boom in raw material gave a boost to Hungary's ore production, when gold, silver, copper, lead, zinc, tin, antimony, bauxite, manganese, nickel, cobalt, molybdenum, chromium, tungsten, mercury, magnesite, bismuth and tellurium were mined.

Salt mining, with its annual production of 250--300,000 tonnes held a significant share of the mining industry. In the last century, coal, as a basic source of energy, was used in smelters and locomotives replacing the use of wood for these purposes, and thus, became the predominate material.

Before World War I, energy was supplied by an annual wood production of 17,000,000 cubic metres and by a hard-coal production of 8--10,000,000 tonnes, as well as the importation of coking coal and coke. During the war, the annual ore production increased to 33,000 tonnes of copper and 170,000 tonnes of bauxite. The annual gross return from construction materials (stone and clays) was 120,000,000 korona (Crowns). The annual output of the 5,000 building material quarries in the country amounted to approximately 50,000,000 tonnes, which, compared to present day production, is low. This meant an average annual production of 10,000 tonnes per quarry. Losing the war resulted in many significant changes in the economic history of the country.

Hungary lost 67% of its territory, 58% of its total population, including one third of the Hungarian population,60% of its cities and 30--85% of its agricultural areas, including plough-land, meadows, pastures, woods, and vineyards, etc., the statistics going as follows: 86% of its woods, 90% of wood production and 80% of its wood industry plants; 37--68% of its main agricultural croplands (wheat, rye, barley, oats, corn, and potatoes); and 49--72% of the most important types of livestock (horses, cattle, hogs and sheep). On the industrial side, Hungary lost 51% of industrial plants, 44% of the annual production returns, half the labour force, machine driving power and iron and metal industry, 80% of banks, co-operatives and insurance companies. 58% of its railroad network, 69--83% of railway vehicles, 60% of highways and 65% of navigable waterways to neighbouring countries.

This change also had an effect on natural resources, since two thirds of the spas, 90% of the potential sites for hydraulic power and possible areas for water storage became the territory of neighbouring countries. Losses within the mining industry were also significant, although 70% of the coal deposits (mainly brown coal) with an annual production of appoximately 6,000,000 tonnes remained within the central, basin-type territory of the country. The ore and salt mines of the mountainous margins, with the exception of the Rudabánya iron ore deposits and the Urkut manganese mines, fell outside the borders, as well as 95% of the stone quarries, 38% of the cement industry and 47% of the oil refineries.

These economic disadvantages, caused by the lost war, together with the decreased possibilities for earth science experts to work, encouraged some of these specialists (P. Teleki, J. Cholnoky, etc.) to become xenophobes, nationalist instigators, whilst others (J. Balázs, S. Papp, E. Vadász, etc.) were encouraged to discover new deposits.

Between the two world wars, in 1926, bauxite deposits were discovered in Gánt based on experience in Transylvania. From this discovery, the development of the Hungarian alumina and aluminium industry arose. In 1932, the Eplény mangenese mine was opened. In 1937, other specialists, using experience gained in Transylvania and the Muraköz (now part of Yugoslavia) discovered, with foreign financial aid, the Zala county and Bükkszék oil fields, the latter field being less important. After 1926, Hungarian ore mining reopened the Recsk-Lahócahegy copper mine with enargite as main mineral, containing gold and silver. These initiatives, along with other economic-financial maneuvres, resulted in a lowering in the production decrease and price changes during the 1929--1933 great economic crisis as compared to that of other countries.

In spite of these positive phenomena, a considerable amount of the mineral commodities required for the almost stagnant economic/social life between the two world wars, was imported. The contemporary economic press regarded this as evidence of the country's poor mineral wealth, an argument which was persuasive for public opinion and state administration. Less and less was said about the fact that cheap overseas ore production and shipping costs had hindered the precious and base metal mining of historical Hungary over the centuries. Thus, the country had been compelled to import these products, plus coking coal, since 1880. Even before 1914, crude oil, which was of little importance at that time, was also imported. The fact that ores and salts in Hungary had been mined in the past by people belonging to the nationalities who inhabited the mountain belts was ignored. Although this work was a contribution to the treasury, these territories were not developed in accordance with their output. No emphasis was put on the fact that an exaggerated mineral wealth is not only beneficiary. The medieval Hungarian state could buy any industrial products or luxury articles in return for mineral products and, therefore, it did not develop the domestic industry.

Between the two world wars, although agricultural product prices were at a low, disadvantageous level for the country, the "price scissors" imposed by the mining cartels of the imported mineral commodities was not fully operational. The Hungarian mining industry reached an unprecedented peak during World War II and produced 800,000 tonnes of cured oil, 300,000,000 cubic metres of natural gas, more than 15,000,000 tonnes of hard-coal, 1,000,000 tonnes of bauxite and 75,000,000 tonnes of manganese ore. After the war, extensive industrialization needed an increasing quantity of raw materials. In the mid-sixties, the hard-coal production of the country reached a maximum of 31,000,000 tonnes per year in order to fulfil this need. Iron ore production reached a climax of 775,000 tonnes in 1964. Manganese production, in 1955, was 308,000 tonnes, including low quality carbonate ores, with a maximum production of 121,000 tonnes in 1967. Production of non-ferrous metal ore reached 200,000 tonnes at Gyöngyösoroszi in 1970, and 94,000 tonnes at Recsk, in 1975. Crude oil production has averaged 2,000,000 tonnes per annum since 1970, and natural gas, $6 \cdot 10^9$ cubic metres p.a. since 1973. Bauxite mining has been at an annual level of 3,000,000 tonnes for years, while the output of industrial minerals stands at 4,000,000 tonnes per year. Total production capacity for the construction material industry reached a peak of 80,000,000 tonnes per year in 1978.

Our nuclear metal mining industry, the reserve base of which was found in 1953 and its pexploitation put into action in 1958, is a result of intense prospecting and exploration and it has become significant on a European scale. The ore is utilized in a Soviet-Hungarian co-operation.

Gy. Markos, using the 1960 nomenclature as a basis (which is different from the present one), estimated that Hungary had reserves of $4\text{--}5 \cdot 10^9$ tonnes of hard-coal, 29,000,000 tonnes of crude oil, 200,000,000 tonnes of bauxite, 20,000,000 tonnes of iron ore and 30,000,000 tonnes of mainly carbonate type manganese ore. In view of the fact that, over the past 20 years, exploration continuously compensated for recovery, the above quoted reserves could not change in scale. Exploration not only had to compensate for production, but for the mineral reserve losses resulting from the closing of mines, a process, initiated in the middle of the 1960's. At the end of the 1960's, economic practice suggested a reduction in mining, adapting the principle of the greatest mutual benefit. Over the past 18 years, approximately two thirds of the operating coal mines were either concentrated, abandoned or closed with a reserve base approximately as large as the quantity recovered during this period. In this way, the coal mining of the country dropped to 25--26,000,000 tonnes annually instead of increasing to the desired 40--50,000,000 tonnes, and this quantity represented 70% of the earlier production in caloricity. At the same time, from 1973 to 1978, four oil-based power plants and the Adriatic pipeline failed to run succesfully.

The cuts of the mining industry also involved ore mining, setting its level at approximately half its previous peak of production (iron, manganese, lead, and zinc). First the lead and zinc mines (1953 and 1973) were closed; later, the fluorite mines in the Velence Mountains (1954); the Eplény manganese ore mine in 1975; and, in 1980, when precious metal prices rose to a height, the Recsk slope (gold, silver and pyrite-bearing) copper mine. Production of anchorite in 1968, Rudabánya siderite ore and Urkut carbonate manganese ore, in 1981, stopped. The abandonment of the Gyöngyösoroszi lead and zinc mines is being considered at the moment.

Serious losses have occurred in the mining of materials for the construction industry as well. At the turn of the century, the number of clay pits was 292. After the Liberation (in 1945), it dropped to 198 and it is now about 135. This concentration of production is favourable for the companies themselves but, since prices are set mainly by delivery costs, and the length and costs of delivery has increased three-fold, every closed brick factory means losses at a national economy level. It is similarly unfavourable that the pebble pit on Csepel, supplying 700,000 cubic metres of gravel annually to the southern part of the capital, was closed down, leaving 40,000,000 cubic metres of industrially utilizable gravel behind. This material must now be delivered to Budapest, either by road (35 km), railroad (45 km), or waterway (60 km), a considerable transportation cost factor. Badly-made decisions are easy to follow. At present, the construction industry of Hungary's second largest city, Miskolc, is compelled to go without gravel from the pits around the town. Whilst several clay-pits and gravel mines under government control were closed for "soil protection" reasons, almost 100,000,000 cubic metres of utilizable material has been abandoned over the last 10 years covering an area of about 11 square kilometres. This area has been converted into artificial lakes for the simple reason that the companies involved did not have baggers effective 5--6 metres under ground water level. Regulations in land protection law impose an annual surplus of 200,000,000 forints on mineral product prices. Local mining, at the same time, yields annually 600,000,000 forints of net profit for the agricultural co-operatives.

So-called "environment protection" is the main reason for closing quarries, and it is not only the reasonable abandonment of the Badacsony quarry, which has been effected: the irrational halting of the Pécs, Szentendre, Visegrád, Gyöngyös, Gönc, Tarcal II, Bagókő and Magyarbánya quarries can also be thought of as its "victims".

Since home production of mineral commodities is stagnant or decreasing, the quantity of imported fuels and raw materials steadily increased until 1978, and their cost continues to rise. Estimates put the share of imported raw materials within domestic supply at 50% as opposed to the 20--35% of previous decades. This negative tendency could only be reversed through the intense development of domestic deposits and a vertical integration in industry. It is impossible to incrase hard-coal production without co-operation with the power plants and without price correction. Problems in the ore mining industry cannot be solved without co-operation with metallurgy and price corrections are also necessary here.

Besides resources recovered up to 1982, mineral exploration massed crude oil reserves worth $129 \cdot 10^9$ forints, natural gas, $528 \cdot 10^9$ forints, and bauxite, $34 \cdot 10^9$ forints. But newly discovered deposits could only substitute, fully or partially, for the recovered quantity of these commodities. It is therefore more reasonable to lay emphasis on the processing of raw materials instead of increasing production quantity.

The improvement of coal mining, with an expected profit of $661 \cdot 10^9$ forint, the exploitation of copper ore, with an in situ gross of $72 \cdot 10^9$ forint, and industrial minerals and building material quarrying of $210 \cdot 10^9$ forint is not limited by resource quantity. It is reasonable to continue the mining of iron ore reserves worth 10^9 forint, manganese ore worth $2 \cdot 10^9$ forint and lead-zinc ore reserves worth $14 \cdot 10^9$ in a vertical organization structure, separate from the mining of industrial minerals. The total integration of home ore production (uranium, aluminium, iron, manganese, copper, lead and zinc) is also possible.

The unfavourable experiences of the past 20 years has showen that other sectors of the national economy are not capable of counter-balancing the decrease in the production of raw materials and disorders in export/import balance, which can lead to a stagnant economy, standard of living and investments.

It is time for competent decision-makers, possessing information available since 1966, not only on the mineral resources balance of the country, but on international statistics and trends as well, to take the necessary measures for the enlargement of the vertical integration of Hungarian extracting and processing industry. All internal and external material as well as mental resources are required in order to utilize Hungary's mineral resources (with a total volume of around 10 km^3 which is worth $1.5\text{--}1.7 \cdot 10^{12}$ forints, and constitutes a considerable part of our national wealth), in order to eliminate part of the import burden from our economy.

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THE AGRO-ECOLOGICAL POTENTIAL OF HUNGARY

László GÓCZÁN

What do we mean by agro-ecological potential?

In an area, soils, parent material, relief, climate and availability of water, with their joint and specific effects, resulted in well-defined ecotops.

In their natural state, ecotops had a natural fertility typical to them. Through land cultivation over various periods of time, the ecötops have been transformed. In addition the unique features of neighbouring ecotops have, to some degree, been homogenized, due to uniform long-term cultivation and the influence of cultivated crops not bound to one spot. As result, agricultural production has produced special agricultural sites different in both properties and location from the original ecotops. Instead of the original natural fertility, they now have a technically transformed effective fertility. Effective fertility is usually assessed in terms of its crop cultivation capabilities. The basis of assessment is to what degree these transformed ecotops are capable of producing valuable crops, in greater amounts, under average technological conditions.

The agro-ecological potential is the above capacity, the exploitation of which is characteristic of modern agriculture.

A survey of a country's agro-ecological potential consists in determining the land capability for crop production on regionally different sites with effective fertility, and assessing the geographical variations in land capability and then making a summary of the data. The results show that, if the agro-ecological potentical is rationally exploited without damaging the environment, the population's food supply problems will be easier to solve and it will be possible to indicate which commodities, if any, should be considered for export. The survey also increases the possibilities for long-term prognoses and facilitates planning.

It is clear from the above therefore, that knowledge of a country's agro-ecological potential is of strategic importance in economic management. The Hungarian Academy of Sciences realized this fact when it began a survey of the agro-ecological potential of Hungary and the preparation of a prognosis for its exploitation in the year 2000. The work which covered a two year period involved about 400 experts from 50 research institutions and utilized all the available data. As a participant in this work, the author gives a brief summary of the results of the survey below.

In order to make a survey of Hungary's agro-ecological potential, the country was divided into physical regional units where the ecological factors primarily influencing agricultural cultivation produce approximately uniform conditions or include uniform units in more or less regular combinations. We regarded the 35 physical geographical meso-regions of Hungary suitable for this purpose. Their boundaries were adjusted to the administrative limits of municipalities to facilitate data collection and statistical calculations. The 35 geographical meso-regions were accepted as <u>agro-ecological regions</u> (Fig. 1)

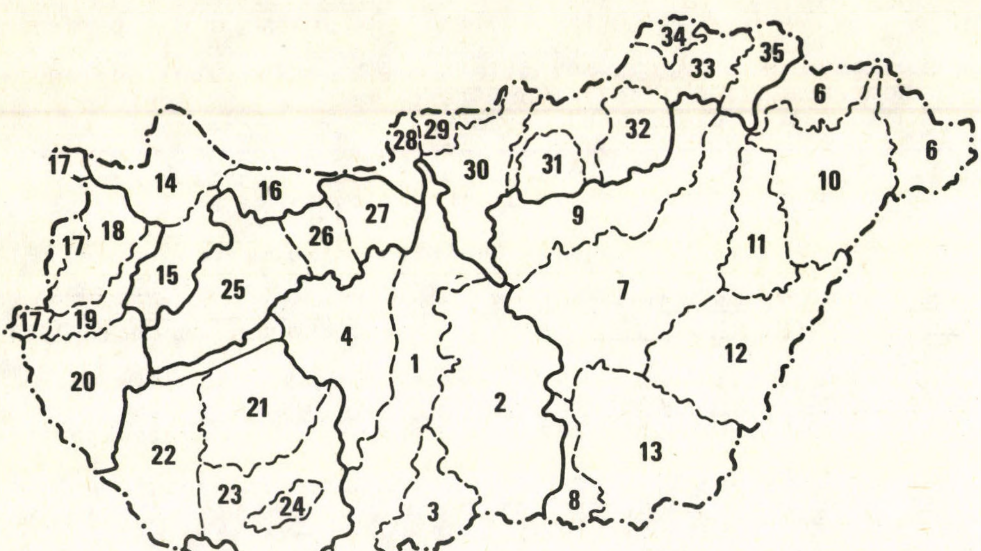

FIG. 1 Agro-ecological regions in Hungary

The geographical meso-regions are regional combinations of smaller areal units of similar landscape history and, due to the interaction of dominant ecological landscape factors, the resources of agricultural sites and landscape potential are more or less similar. This also means that each ecological region consists of some related, but not completely identical, landscape types, or groups of eco-geographical units.

The next step in the survey was to demonstrate, on maps with a scale of 1:100,000 the soils determining agricultural site resources and the major soil properties influencing fertility within the agro-ecological regions. The smallest area represented on the maps is 1 cm^2, i.e. 1 km^2. Altogether 6,000 areas of soil types were delimited.

Digit 1 and 2: genetic soil type and sub-type;
Digit 3: parent rock (in 9 groups);
Digit 4: soil reaction and lime conditions (grouped into 5 categories);
Digit 5: soil texture class (7 categories);
Digit 6: water balance of soils (9 categories);
Digit 7: organic matter reserve of soils, in t/ha (6 grades);
Digit 8: depth of fertile layer (presence of stones, gravels or groundwater inhibiting root growth in 5 categories).

The regional data of the mosaic-like areas delimited on the map are summarized in a table through showing counties and agro-ecological regions and their areal extension (in absolute value, ha, and in relative value, percentage) of soil types, sub-types and the 6 coded soil properties.

The next stage in the determination of agro-ecological potential was a survey of regional agro-meteorological and agro-climatic conditions, which was accomplished through focusing on the agro-ecological regions. The data for this work covered the period 1951 to 1976. In agro-meteorology, measured data of factors indispensable for plant life were used, while temperature, rainwater and solar radiation was measured for the survey of climatic potential.
The following aspects describe the effects of temperature:

- temperature influencing plant growth, development and produce of plants;
- temperature cumulatives characterizing air temperature.

The following aspects describe the effects of moisture:

- precipitation as the almost exclusive source of water for plants;
- relative moisture influencing plant evaporation;
- potential evapo-transpiration;
- potential water deficit, defined as the difference between evaporation capacity and precipitation.

Data on hours of sunshine were used to represent solar radiation, since this datum not only shows the sum total of periods with sunshine, but, through a close linear relationship, it also give the intensity of solar radiation.

The chosen parameters were included in the investigation, partly as monthly totals and partly as cumulative totals derived from them, and they represented periods of crucial importance in plant life.

The agro-meteorological or agro-climatic investigations necessary for thes survey on agro-ecological potential are directed at estimating the maximum yields made possible through the effects of agro-climate in the given area. At the same time, the risks which arise with regard to the cultivation of certain crops in the area are also considered. In this way, apart from determining the productivity of climate, an assessment of adverse meteorological influences during the growing season can be given by surveying both crops and regions. Adverse effects include <u>frost</u>, a risk factor which causes reduced yields, and <u>potential water deficit</u>, through which damage by drought can be estimated.

The next step in the determination of agro-ecological potential is to survey hydrological conditions. This covers the mapping of the groundwater table in lowland areas and of areas endangered by excess water.

After following the above-mentioned steps, a true picture was formed of the present ecological productivity of agricultural land in Hungary. This ecological potential could then be compared with the average yields produced with modern methods of agrarian technology. As a result, the degree to which the agro-ecological capacity of fertile land is being exploited, could be estimated while still unutilized reserves of land could be explored in Hungary.

The improvement which can be produced through irrigation and amelioration on a long term basis was added to unutilized reserves.

With this knowledge on Hungary's present agro-ecological potential in hand, it was possible to prepare a prognosis of the growth in ecological potential attainable by the turn of the millenium and also of the possibilities of raising the average yields. The possible areal extension of irrigation and amelioration had to be considered as well.

In summary, then, it may be said that the survey analysed land use in the past and present, in order to give a future estimate (for the year 2000) of the area of agricultural land which will deteriorate with time.

SURVEY AND RESULTS

In this chapter, the results of assessing the country's agro-ecological potential will be briefly summarized.

The available areas (in 1,000 ha) are the following: total agricultural land: 6,675 (of which arable land: 4,839) forest: 1,579 and areas taken out of cultivation: 1,013.

Out of the country's 35 ecological regions (Fig. 1), 1 to 24 are dominantly agricultural (1 to 16 have a lowland relief, regions 18 and 19 are plain, 20 to 23 are hilly while regions 17 and 24 have an intermontane basin relief). Regions 25 to 35 are dominantly silvicultural with a mountainous relief -- a third of their area is used particularly for forestry.

The parent material of soils in the 18 lowland regions, which occupy about a 60,000 km^2 area, is a loess-like deposit of $CaCO_3$ content. This is mantled by fertile chernozems of excellent quality, due to the dominantly continental steppe climate. 60% the hilly regions, covering 11,500 km^2, have loess-like parent materials and 33% of the total area of these regions is equally divided between Ramann's brown forest soils (slightly calcareous) and chernozems. In 44% of the plain and hilly regions, covering about 70,000 km^2, soil parent materials are made up of alluvial and loose periglacial slope deposits with chernozems and brown forest soils, as well as meadow and salinic soils (the latter in almost an area 9 km^2).

More than 65% of the soils in lowland and hilly regions have a favourable texture: loam, and sandy or clay loam.

Soil reaction (pH) is also good in agricultural areas: 81% is neutral or slightly acidic and organic matter content is a beneficial 200 to 250 t/ha on average.

There is more variation in the regions in the amount of water in the soils -- both in lowland and hilly regions. In some low-lying regions, permeability is low and in three flat regions water capacity is poor owing to blown sand.

Water availability is the least favourable and most restrictive factor in Hungary's agro-ecological potential. While there is a climatic water deficit in the lowland areas during the crop, growing season in 11 regions, areas suffering from excess water altogether occupy 5,600 km^2. Out of 72 km^2 of plain and hilly areas, only 10% can be profitability irrigated. However, the climatic water deficit during the growing season can be essentially reduced by the careful induction of rainwater into the soils and its long-term storage there.

This periodical survey demonstrated that, apart from good quality soils, in almost 60 per cent of the area of Hungary, adverse soil properties create obstacles in raising the crop yields. The water allowance is bad in 46% of the soils, 13% of them have a highly acidic pH and, in 16% of the areas serious erosional damage lessens fertility.

The majority of these unfavourable soil properties can be reduced, and in some cases eliminated, by intervening with amelioration. It would undoubtably be useful to improve fertility through complex amelioration, or one of its techniques, over a 3,500,000 ha area.

The climate of Hungary is generally favourable for crop cultivation. This becomes obvious if the climatic productivity of Hungary is compared to those of neighbouring countries. The European area of the Soviet Union, south of the 60th line of latitude, has 100 units of productivity, Poland has a total of 105, the GDR 113, Czechoslovakia 118, Romania 126, Hungary 139 and Bulgaria 145.

Climatic conditions influencing the production of field crops were assessed by focusing on crops. For each species, the meteorological factors exerting the most important positive or negative influences on yield were determined. The parameters of the investigation defined climatic year types, plus probable individual types.

Year types

for wheat, winter barley, rye, maize, sugar-beet, potato, sunflower, pea, soya-bean and lucerne are

arid-warm
arid-cold
humid-warm
humid-cold

for rice

cold
intermediate
warm and

for spring barley and red clover

arid
intermediate
humid.

The meteorological parameters used for individual crops were the following:

for wheat, winter barley and rye: total amount of precipitation in April and May and the monthly temperature total for May and June;

for maize: the total amount of precipitation between April and September and the total number of days with a temperature above 10°C for the same period;

for sugar-beet: total amount of precipitation between April and September, the total number of days with a temperature above 5°C for the same half year, hours of sunshine and the air evaporation capacity.

for potato: the total amount of precipitation, and range of temperature between July and August;

for sunflower: the total number of days with a temperature above 5°C, and hours of sunshine, for the period between April and September, total amount of precipitation from April to October, and from October to March, plus the monthly precipitation for September and October;

for pea: total amount of precipitation from March to June, the total number of days with a temperature above 5°C, hours of sunshine and availability of water over the same period;

for soya-bean: the total number of days with a temperature above 5°C for the summer (from April to September), hours of sunshine, total amount of precipitation for the period, the total precipitation for the winter and the total precipitation for June and July;

for lucerne: total precipitation from March to September, the total number of days with a temperature above 5°C, hours of sunshine and availability of water for the above period;

for rice: the total number of days with a temperature above 5°C from April to September, hours of sunshine from May to August and the air evaporation capacity;

for spring barley: the total precipitation from March to June;

for red clover: total precipitation from April to September.

The genetic soil types and sub-types were categorized in a similar way using the requirements of the plants.

After outlining the agro-ecological potential through suitable regional parameters, we indicated parallel to them the average yields covering many years. Through consideration of the regions and crops, we produced evaluation charts for use by experts specializing in individual crops, thus enabling them to make prognoses for average yields in the year 2000. These prognoses, made by groups of experts and covering 205 mosaic-like agricultural sites, underwent statistical analyses. Parallel with this, the development paths of average yields were statistically analyzed by computer.

The results of the latter analysis supported the reliability of the estimations made by the experts.

The following national average yields were predicted for field crops without irrigation and amelioration (in t/ha):

wheat	5.3
rye	3.0
winter barley	5.4
spring barley	5.1
maize	6.3
sugar-beet	43.0
potato	26.0
sunflower	2.7
pea	2.1
soya-bean	2.5
lucerne	8.7
red clover	7.4

With amelioration and irrigation, the averages are modified (t/ha):

wheat	7.0
rice	3.6
sugar-beet	57.6
maize	9.3
potato	38.1
pea	4.5
soya-bean	3.6
lucerne	14.0

Meadows and pastures (grasslands) together take up 1,292,000 ha. Hay yields may rise from the present 1.5 t/ha to 3.7 t/ha by 2000.

The following prognoses may be made for average yields in the cultivation of field crops with the utilization of the agro-ecological potential: the national average yield (at present 8 t/ha can be increased to 10 t/ha; 18 t/ha of green paprika can be produced by 2000 and, with better organization of work, this average can be raised to 20 t/ha; under average weather conditions the yield of tomato, a crop highly sensitive to weather, is expected to be 40 t/ha.

Yields expected from the following (t/ha):

biennial onion	26--30	
annual onion	18--25	(50% rise)
green pea	4--5	(under average weather conditions)
green bean	8--9	
water melon	16	
musk melon	10	
cabbage	30	
lettuce	7--10	
garden sorrel	5--7	
carrot	45--50	(under average weather conditions)
parsley	16	

celery	18
sweet corn	15

The average yields of fruit production (t/ha):

	forecast for 2000	present yields
apple	22	13.4
pear	15	9.4
cherry	5--6.7	2.3
sour cherry	5--5.5	1.6
plum	12	5.4
apricot	6	1.6
peach	12	4.1
walnut	2--2.5	
chestnut	3	
strawberry	7.5	4.4
raspberry	3.5	1.4
blackcurrant	5	0.45
redcurrant	10	3.4
gooseberry	10	2.2

The average yield from grapes, cultivated on 176,000 ha, is at present 4.7--5.0 t/ha. The forecasted figures for 2000, using various ways of increasing ecological potential, are 7.2, 8.2 or 9.2 t/ha. Erosion control is an important means of raising ecological potential in Hungarian vineyards.

The ecological potential survey for forests covered an area of 1,666,000 ha. By the year 2000, with the establishment of 296,000 ha of new forest, the percentage forest area will have risen from the present 18% to 21.1. The yield of timber by groups of species will be the following:

sclerophyllous species	form	5,160,000 m^3	to	7,000,000 m^3
deciduous species	from	1,470,000 m^3	to	2,100,000 m^3
coniferous species	from	510,000 m^3	to	580,000 m^3.

By the year 2000, the modernization of forestry will have resulted in a 20 to 30% growth in the yield of timber in the present forested areas.

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AGRICULTURAL POLICY AND REGIONAL DEVELOPMENT OF THE HUNGARIAN AGRICULTURE

György ENYEDI

INTRODUCTION

Regional differentiation in agriculture has been thoroughly studied in Hungary, by both geographers and rural economists. It is possible to cite a number of books and articles, published in the last fifty years, which try to analyse the regional pattern of Hungarian agriculture. The basis approaches followed in these studies can be classified as follows:

- traditional human geography, which looks for differences in the morphological pattern of agriculture (e.g. the form of parcels) (I. Györffy, 1935 and J. Major, 1965);

- ecological approach, which tries to analyse the physical conditions of agriculture, in a regional context (L. Beke, 1941 and G. Géczy, 1968);

- land use studies (Gy. Enyedi, 1960 and 1969; J. Kostrowiczky, 1965);

- agricultural regionalisation mostly based on the structure of agricultural production, i.e. crop combination (T. Bernát--Gy. Enyedi, 1961 and L. Görög, 1954), or the gross production value (F. Erdei--L. Csete--J. Márton, 1959 and V. Kulcsár, 1969);

- type-of-farming studies (Cs. Csáki, 1971);

- agricultural typology, partly using Jerzy Kostrowicki's method, but mostly concentrating on quantitative methods (Gy. Enyedi, 1965, and T. Bernát--Gy. Enyedi, 1977);

- locational theory, formulating the optimal geographical location of crops or farming systems (Gy. Enyedi, 1974 and J. Sebestyén, 1960).

The greater majority of these studies outlined the regional pattern of Hungarian agriculture for a single year. Time-cross analyses were rather exceptional (T. Bernát--Gy. Enyedi, 1968 and I. Enyedi, 1978). Dynamic studies generally stated that different socio-economic factors were mostly responsible for regional changes. Physical factors played a limited role in territorial changes, at least they have done in the last few decades and the reason for this is much debated. According to certain agricultural economists, the role of physical factors in agricultural production is diminishing on a parallel with technological modernization. I believe, however, that the role played by physical factors has now taken a different form (F. Vági, 1966). It is not so influential on the yield and on production patterns, as in peasant farming but it still has great importance on the economic efficiency of farming.

The present paper intends to summarize the regional changes which occurred in the 1970's. Special attention will be given to the effect of agricultural policy in shaping agricultural regions. Finally, I will consider whether regional changes have had a positive or negative effect on the overall development of agriculture.

REGIONAL CHANGES IN AGRICULTURAL PRODUCTION

Two aspects of regional pattern in agriculture will be discussed here: (a) specialization of agricultural production; and (b) differentiation in the level of farming. Data were collected in 1970 and 1980 on a large-scale farm level (state farms and producers' cooperatives) and aggregated in 63 agricultural regions (I. Szücs, 1979). Large-scale farming directly produces 2/3 of the total agricultural output (in gross production value) of the country.

(a) Specialization of Agriculture

In the socialist period of economy, there has been a continuous expectation that geographical specialization will strengthen. Instead, the general tendency has been a geographical levelling of the structure of production.

This was quite understandable in the 1950's. As a consequence of the radical land reform of 1945, small peasant holdings replaced the former estates. These peasant farms had a strong self-sufficient character. Compulsory delivery, with homogeneous norms for the whole country, also contributed to this regional levelling (compulsory delivery was abolished in 1956).

After the collectivization of agriculture (1959--1962), it was logically supposed that large-scale farms would be more specialized than peasant holdings. This was not so immediately after collectivization, as, for many reasons, large-scale farms remained multi-sectoral. In the 1970's, there was a growth in specialization within large-scale farms, although this penomenon was not followed by a subsequent growth in regional specialization. The hypothesis arguing the strong interrelationship between farm and regional specialization, formulated by agricultural economists (F. Erdei--L. Csete--J. Márton, 1959) was not verified. The reasons behind this tendency of levelling were as follows:

1) Agricultural policy focussed on the food self-sufficiency of the country after collectivization. Twenty years ago, Hungary imported wheat from the Soviet Union, and the per capita meat production was about 55 kg. Policy implementation consisted of concentrated modernization programs for different food products. Instead of an overall modernization in agriculture, key sectors were selected, and, with a heavy concentration of capital and different government subsidies, their technological development was speeded up. Chronologically, the wheat program was first, followed by corn (maize), then meat (pork) and poultry. This order reflected necessity as well as a certain technological logic. Because of this strong government support to modernized sectors, these "modernized" products were placed in a highly advantageous position compared with the more traditional products. In 1969, the net income of cooperative farms was 70 per cent assured by wheat alone! Wheat became--and still is --the most profitable crop throughout the country, including the ecologically less favourable areas. Corn production was stimulated by both possibilities for export and the expanding needs of the meat program. There was a growing development gap between modernized sectors and still labour intensive sectors as the earlier manpower surplus disappeared. Consequently, the wheat-corn-meat combination has penetrated all corners in the country. The former specialization of western and northern Hungary in dairy farming and industrial crops has been weakened and the economic advantages of wheat overrule the ecological disadvantages in hilly or poor soil areas.

2) The intense wheat-corn-meat specialization on large-scale farms became possible due to the special, dualistic organization of Hungarian agriculture. Household and auxiliary farms have gradually become an integrated part of the Hungarian agri-business. They have taken over various labour intensive crops, as well as animal husbandry, in most of the socialist countries with a collectivized agriculture, although the role, importance and organization of Hungarian individual farming is exceptional (Gy. Enyedi, 1983). We can conclude from this that uneven technological development and the exceptionally favourable economic position of certain products has given them leading roles to play in agricultural production in most of the agricultural regions of the country. From this, we may logically suppose that optimal ecological

zones for the main crops (wheat and corn) have largely profited from this advantage, and development has been concentrated in the favourable areas (i.e. on the loess-ridge of the Great Plain). Actually, this has not been the case.

(b) Differentiation in the Economic Level of Farming

In the 1970's, regional differentiation in the economic level of farming had only a limited (and diminishing) connection with soil quality. This was contrary to the trends of the 1960's, and contrary to the expectations of agricultural policy. The role of counties with good soil conditions has diminished with regard to the total output of agricultural enterprises. (These counties cover 35.2 per cent of the total agricultural land in the country, but their share in gross production dropped from 34.9 to 32.1 per cent between 1970 and 1978 (I. Enyedi, 1981). Rapid growth was concentrated in a few counties (Bács-Kiskun, Hajdu-Bihar, Komárom and Pest), which have average or less than average soil conditions. However, three of them are joined to the Budapest agglomeration, and it seems that agricultural growth was concentrated in the most urbanized and industrialized rural areas. The explanation for this pattern lies in the following factors:

1) The position of agriculture among the other economic sectors is deteriorating:

Paradoxically, this deterioration started when the importance of agriculture in the export trade grew substantially and the government declared the need for the rapid development of agriculture.

One of the reasons behind this deterioration is the disparity between industrial and agricultural prices. Between 1975 and 1979, the average rise in agricultural prices was 13.6%, when industrial goods used in agriculture had a 20.7% rise. In 1980, industrial prices rose another 19.4%, while agricultural prices increased by 11.4%. So, in 1980, this price disparity alone channelled some 25,000 million forints from agriculture into industry. The average agricultural price level is 30 per cent lower than the world price level, while taxes continue to rise. In 1970, 23% of the net income was paid to the budget in tax; by 1979, this had reached 48%. Government subsidies for investments also diminished and in 1982, 13.5% of agricultural investments came from the central budget, whereas, in industry, it was 40%.

These data have overlooked some great differences, however. It is possible to state now that, in the majority of agricultural regions, where ecological conditions are not much above average, agricultural activity is not profitable at all. This fact has forced large-scale farms to develop non-agricultural activities.

2) <u>The growing importance of non-agricultural activities on large-scale farms</u>:

There is a growing importance being placed on non-agricultural activities on large-scale farms. These "side activities" cover various fields, from food processing to the retail trade, rural services to the manufacturing industry. These activities reached a peak at the end of the 1960's and various government measures were introduced to limit them. Nevertheless, these activities continued to develop and from the mid-seventies increased government support was given to aid the non-agricultural sector on large-scale farms. Now, these sectors employ 1/3 of the "agricultural population", and produce 40 per cent of the gross income. The reasons of this spectacular growth are as follows (<u>Gy. Barta</u>--<u>Gy. Enyedi</u>, 1981):

a) the economic reform, introduced in 1968, which gave farm managers freedom in developing their activities;

b) the development of vertical integration, in which some large and prosperous farms played a leading role;

c) enlarged employment opportunities, and a seasonal movement of the workforce from agriculture into non-agricultural work, and <u>vice versa</u>;

d) because of price disparities, non-agricultural activity is more profitable, than agricultural activity. Non-agricultural activities assure a higher income to the enterprises themselves as well as to the agricultural population. This income has largely been reinvested in agriculture;

e) Hungarian industry is, in some respects, over-centralized. The lack of small- and medium-size industrial enterprises often produces shortages and there are a number of consumer goods, or industrial spare parts, which do not fit into large-scale industries. Small industrial plants, run by large-scale farms, serve as a background industry for larger state industry;

f) the rigidity of huge state enterprises made it necessary to organize activities in the service and building industries within large-scale farms.

By the end of 1970's, the level and growth of non-agricultural activities had become defining feature behind the dynamism of large-scale farms. Thus, the proximity of urban agglomerations and industrial zones gained importance among the locational factors of agriculture, with soil quality, or, more generally, ecological conditions coming after.

3) <u>The need for a developed infrastructure in technologically advanced agriculture</u>:

Technologically developed large-scale farming needs a highly developed infrastructure: road network, running water, electric energy, etc. These conditions must generally be ensured by the rural settlements. The infrastructural level of Hungarian rural settlements is very unevenly developed and in traditional agricultural areas, rural infrastructure is especially backward, since the urban-biased settlement policy has, for a long time, neglected rural development. Thus, more urbanized areas offered advantageous locations from the point of view of infrastructure.

In summary, different aspects of agricultural development in the 1970's created an advantageous dynamic development in the more urbanized north-western and central regions of the country. Agricultural development did not concentrate in areas of good soil and, consequently, the ecological potential has remained rather under-utilized.

THE EFFECT OF RECENT CHANGES IN AGRICULTURAL POLICY ON REGIONAL DIFFERENTIATION

Between 1980 and 1982, a number of changes were introduced in the economic regulation of agriculture. Agricultural prices were raised twice: in 1980, by 11 per cent and, in 1981, by 5 per cent. Agricultural prices remained practically unchanged in 1982. The cost of different industrial goods used in agriculture, of energy and irrigational water, etc. rose at a faster rate. Investment subsidies declined rapidly (for example, from 1979 to 1980 it declined by 40 per cent). In 1982, poor agricultural areas received more financial support than before and special measures were taken to promote non-agricultural activities on collective farms in these zones.

To analyze the effect of these changes, we calculated the economic results for agriculture in 1980, 1981 and 1982, using the price, subsidizing and tax systems, valid in 1979. The differences between the actual and the calculated economic results highlight the effect of the changes in economic regulations.

In 1980, the changes resulted in a 25 per cent (3,200 million Ft) drop in the net income of large-scale farms. The changes introduced in 1981 and 1982 were responsible for a further 1,800 million forint drop.

Geographically, these changes were so startlingly differentiated that, in a few regions, the net income grew; meanwhile, in a number of regions, the entire profit disappeared, and 1/3 of large-scale farms already operate at a loss (Fig. 1).

The main characteristics of geographical changes are as follows: a) disadvantageous regions suffered the greatest loss; b) the main grain/pork zones of the Great Plain were more sensitive to the changes than Transdanubia (west of the Danube); c) farms in urbanized rural areas suffered the slightest loss, and in some case, the changes even strengthened profitability; d) the changes widened the gap between developed and less-developed regions. In 1982,

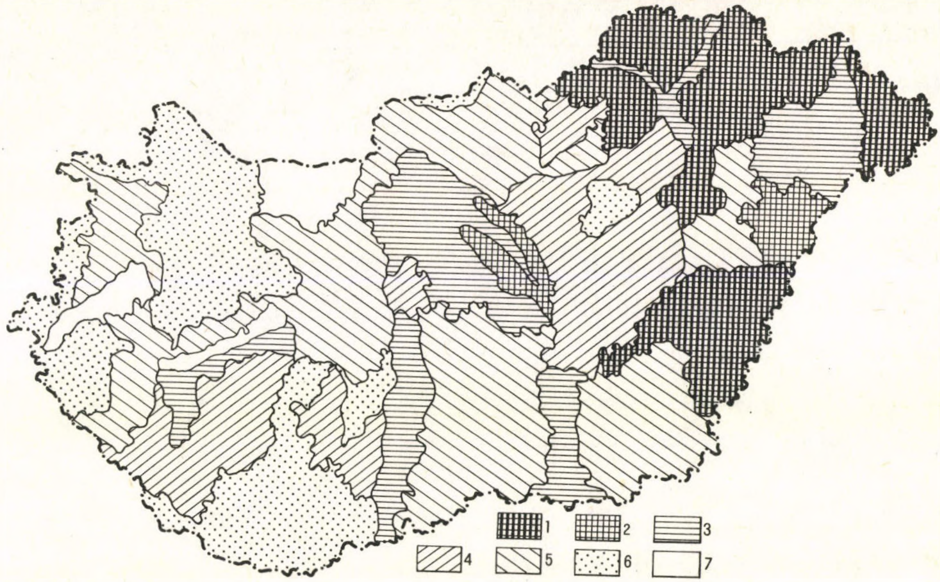

FIG. 1 Drops in the net income of agricultural co-operatives as a result of changes in economic regulations during 1980--82, related to the potential total net income which could have been gained under 1979 conditions.

1 = extremely significant; 2 = well above average; 3 = above average; 4 = average; 5 = below average; 6 = well below average; 7 = no drop but increase.

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some new measures slowed down the decline of less-developed areas. Nevertheless, we have to raise the question: how can agriculture support this continual drop in profitability in a period of its technological revolution?

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MARGINAL AGRARIAN REGIONS IN HUNGARY

Tivadar BERNÁT

This study aims to give a survey of the situation of economically backward agrarian territories, so-called marginal regions, in Hungary, and there are various important questions connected with this. What specific environmental and socio-economic factors determine the character and development possibilities of these regions, and what measures have been taken so far -- both in agriculture and the other economic sectors -- to ensure their development? What aims should be specified in a study of the existing problems? In a socialist country -- which develops its productive forces according to a global social plan and strives to attain regional harmony -- what means are available for mitigating the existing regional disparities, and to what extent are they made use of? The basic question we raise, however, is what inequalities are completely unacceptable under socialism.

Being fully aware of the fact that, within the limited scope of the present study, it is hardly possible to give substantive answers to all these questions, we shall confine ourselves to a few narrower subject areas. Thus, in the first part, we shall discuss in brief the space-related problems of differentiation and present the spatial differentation and marginal regions of Hungarian agriculture. We shall raise some views on marginality, for discussion or, more precisely, recent disputes on government subsidization policy in Hungary. In the concluding part of this paper, there will be a consideration of the concepts which appear suitable for making the existing subsidization policy more effective.

THE DIFFERENTIATION OF SPACE AND OUTPUT

Agricultural territories lacking in natural resources account for more than one-third, or 2,000,000 ha, of the total area of arable land. These territories are the country's least fertile and most backward regions, contributing to the gross national produce much less than their share of the country's arable area.

Two major types of marginal regions occur in Hungary: mountainous and hilly areas, on the one hand, and sandy, acidic lowlands exposed to ground water and floods, on the other:

1 The greater proportion -- two-thirds -- of the regions deficient in natural resources with respect to agricultural production falls to the category of mountainous and hilly areas. These territories are mainly the Central Middle Mountains crossing the country in a south-west, north-east direction, the moderately high uplands of the eastern stretches of the Alps and the South Transdanubian Highlands. The heavily leached and water-eroded forest soils of the mountainous and hilly areas are of low fertility. Here, the average slope of the land used for agriculture ranges between 5 to 25% and, therefore, their cultivation involves substantial surplus costs. Although there are no high mountains in Hungary (the highest point is 1,010 metres in the Mecsek Mountains), farming output in moderately mountainous and hilly countryside is increasingly dropping behind that of more developed areas and its production appears to be stagnating. These mountainous and hilly areas have been given special attention when drawing up regional development plans.

The industry of the mountainous areas is insignificant, and their relatively dense population (30 to 60 persons per km^2) is mainly engaged in agriculture, in spite of its unfavourable conditions.

2 The sandy, sodic and water-logged plainlands (the Danube-Tisza Interfleuve, the Hortobágy and the Tisza valley), highly unfavourable for cultivation, constitute the second type of marginal region. Especially significant among these is the extensive sandy areas exposed to deflation.

In two-thirds to three-quarters of these two types of marginal region, there is agricultural activity by co-operative and state farms.[x] The poor supply of jobs and institutions in these margial regions, together with low incomes, affect about one million people (10% of the country's total population), and therefore, the social implications call for particular attention.

Before answering the question of what diparities are acceptable, we must specify exactly the constituents of this disparity, the characteristics of the disadvantageous situation and the opportunities for promoting the expected developments. Most often, backwardness is not merely an economic question, as it involves political implications, which must also be taken into consideration. Therefore, when considering this problem, we must agree with the conclusions drawn by agrarian politicians who are convinced that regional policy in its strict sense is motivated by social and political, rather than economic, factors. "On the grounds of

x All data and statements refer to the collectively cultivated land and economy of large-scale farms.

economic theory, the problem of whether regional policy was necessary to reduce regional disparities remained unsolved." (G. Orlando - G. Antonelli, 1981).

THE PROBLEMS OF DISADVANTAGED, MARGINAL REGIONS

In Hungary, regional disparities in per-capita personal income are, by international standards, moderate. Greater regional inequalities and low per-capita incomes are found almost exclusively in under-developed, depressed areas which are also extremely backward in infrastructural facilities. This fact points to the socially disadvantageous situation of these areas and their rapid development has been, from the very outset, a crucial issue in regional development and planning policy in Hungary. But why use the term "marginality" to characterise a disadvantaged area.

Ricardo's and Marx's rent theory is based on marginality. In their classification of land quality by productivity, "marginal" is a piece of land which is last brought under cultivation and in which the resulting revenue just covers the production costs, thus giving no rent. This theory must be modified in Hungary, however, because the whole system of Hungarian economic regulation (prices, taxes, credits etc.) is based on average production conditions: thus, it is the costs relations of the economic units, working under average conditions, which decides the price formation, not the input of marginal land still under cultivation. Therefore, the proportion of farming units operating with poor economic efficiency, often at a loss, is greater in Hungary and their role in agrarian policy is different from that of countries where marginal productivity is the determining factor of policy. For enterprises in a disadvantageous position, the state tries to create conditions for production by various means of support.

Marginality, which is determined by average productivity, is not really suitable here, as the research findings of both ourselves and others have proved that, on land of below average fertility, several farms manage to attain medium or good results. According to our last survey (1980), it was found that 55% of agricultural units belong, due to the poor fertility of the land, to those farms giving a below average output. For the remainder, physical resources were not at all unfavourable. Therefore, the analyses which disclose the causes of and connections between, deviations in the level of farming, are of special significance.

With regard to large-scale farming (co-operatives and state farms), it is possible to say that "marginal" is a farm, the income of which does not cover its costs. Hence, it operates at a loss. Many of the large-scale farms are trying, regularly or spasmodically, to balance their financial problems and economic difficulties. 13% of the state farms and 30% of the co-operative farms -- primarily those operating under adverse conditions -- finished the farming year with a loss, either once or several times between 1976 and 1980. These farms were unable to accumulate funds to extend reproduction and had difficulties in keeping stock at a healthy level. The number and character of marginal farms is gradually changing, although this hardly occurs at all with farms working under explicitely adverse conditions. It is largely within this category that the 153 co-operative farms (12% of total number) which have annually run at a loss during the past five years come.

Marginal regions have come into being as a spatial aggregation of the territorially concentrated large-scale agricultural units which operate at a loss. These regions also always include farms and territories not belonging to the above unit which attain a better degree of production.

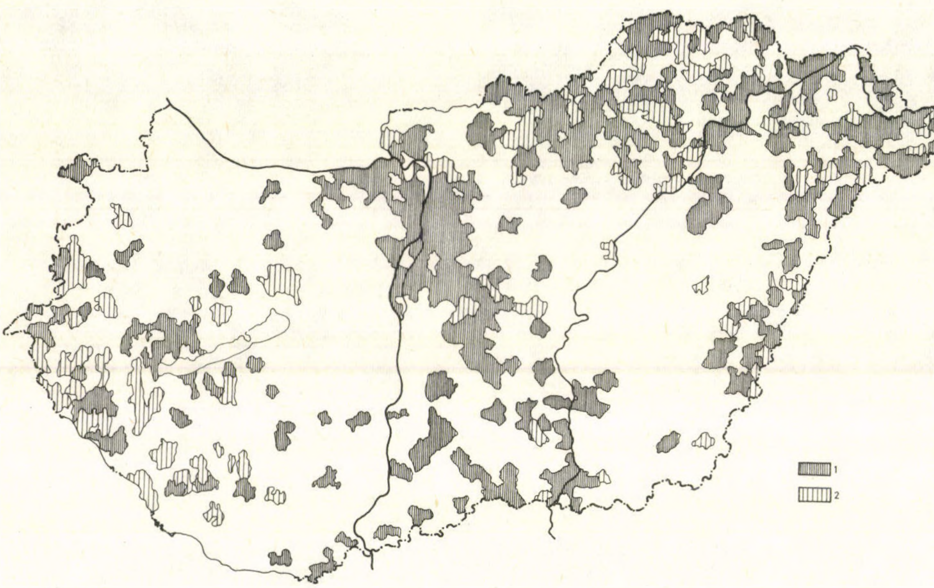

FIG. 1 Marginal agricultural regions in Hungary

1 = areas where crop cultivation results in financial loss;
2 = areas where there is no profit on crop cultivation.

The territory covered by large-scale farms suffering from adverse productive resources constitutes one-third of the country's total area under cultivation. It also employs one-third of all agricultural wage-earners. Agrarian areas with a low production level due to adverse physical resources, as shown on the map based on efficiency indicators, largely coincide territorially with areas with poor soil qualities (Fig. 1). This large-scale coincidence is due to the fact that the farms in these areas, with their scanty resources, are not in a position to offset the effect of unfavourable natural factors, unlike the well-equipped farms. The majority of the areas on the map are located in relative contiguity, but they also occur, not infrequently, in a mosaic-like pattern.

(a) Production conditions now appear to play a somewhat less important role in shaping the level of farming considering the country as a whole, the impact of very poor soils alone, is, however, becoming increasingly pronounced. The relationship between the soil quality of a farm and the synthetized farming indicator is shown by the value of the correlation coefficient being 0.7686. This points out that farms working on very poor soils have no means available (capital, credits, resources, etc.) to upset their adverse conditions.

<u>The Intensitey of Relationship between Land Quality and Various Farming Indicators on Large-Scale Farms in Hungary</u>

Independent Variable: Land Quality (in golden crowns per ha)	Variables	Correlation Coefficient (R)	
		State farms	Co-operative farms
	Fixed capital (Forints per ha)	0.5004	0.4890
	Income related to cultivated land (1,000 Fts per ha)	0.1848	0.8112
	Labour productivity (1,000 Fts per person)	0.2976	0.5713

(b) Owing to the relatively low altitude above sea level, climatic conditions in Hungary are favourable for cultivation in marginal regions. The adverse resources in the majority of these areas are due to poor soils (heavily acidic forest soil and loose, sandy and alkali soil, poor in nutrients), sloping and heavily eroded land and poor water distribution. Sloping terrains in the one hand, hamper the use of up-to-date, mechanized agricultural equipment, and on the other hand, due to relief conditions, ploughing increases soil erosion.

(c) The supply of marginal farms with machinery lags about a quarter behind the national average (as related to surface area), although, owing to unfavourable relief and other conditions, it is here that more specialized machines are needed. The use of machinery is, because of the sloping terrain, 10 to 30% more expensive than in a flat territory, while yields are about 30% lower than the national average. The lack of equipment is a consequence of inadequate accumulation capability in its turn and, therefore, these farms cannot find a way out of this vicious circle.

(d) An important characteristic of agricultural activity working under unfavourable conditions, is the relatively high labour density. But the low output level also sets limits to labour management, which means that the worse the farming conditions and the yield, the more unfavourable the structure, degree of organization and utilization of the labour force. Disparities in income have caused a large-scale out-migration of the young working population, leading to a lack of labour capable of operating modern equipment.

As a result of the above situation, gross income per hectare in the hilly areas is only one-third of that realized in areas with good soils.

(e) While profitable large-scale farms assign an increasingly important role to diversification, manufacturing and auxiliary industrial activities, and direct sales (running to 40% of the national total agricultural income), farms in marginal regions seldom engage in such extra activities. Such a restructuring of productive activities might be a possible way out of the above-mentioned vicious circle. Auxiliary activities have now been given a greater opportunity, within the framework of free enterprise, to become more efficient than the agricultural work, where profits are continually deteriorating. However, most of these regions are peripherally located, not having any large urban settlements and thus are less able to utilize the advantages inherent in industrial co-operation and marketing activities. The drawbacks of peripheral location are further enhanced by poor transport and infrastructural facilities. In Hungary, tourism in the hilly districts has not yet been able to substitute for a declining agriculture, though its role and significance are likely to increase in the future.

The above relationships combined indicate that there will be a growth in the desparity between the economic output of areas with favourable resources and those with unfavourable resources, in addition, tensions arising from disproportions in personal income and living standards will cause serious social problems.

DIFFERENTIATION OR LEVELLING-OFF

The methods and goals of economic policy connected with the mitigation of the processes of differentiation outlined above have been given a diverse reception and assessment. What is the subject of the dispute? What are the concepts based on?

Studying domestic and foreign literature on the question, one comes to the conclusion that there are two major theoretical approaches:

1 According to the first, the deterioration in the position of marginal regions, i.e. their differentiation, is a normal consequence of economic development, and it is futile to fight against it. Several economists adopting this approach criticize the official economic policy, maintaining that it is completely useless and misleads the local population by guaranteeing it the fulfilment of fanciful promises. It would be more useful if politicians explained to the people that they had better leave these regions and look elsewhere for their source of livelihood. G. Wibberley, Professor of Rural Planning in London University, provides a concise formulation of this tendency:"Government and regional agencies have continued to support agricultural and rural areas as being of special importance so much so that the EEC appears to many to be mainly a gigantic combination of agricultural fundamentalists. Much of the continued subsidization of purely agricultural interests has been associated with little or no control over the activities of farmers on land use and the rural environment generally." (G. Wibberley, 1981 pp. 165-6). In his final conclusion, he goes even farther: "The agricultural sector has been receiving too much attention from Governments (supranational, national and regional), from politicians and even from University research workers and it has certainly been receiving too large a share of the finance available". (Op. cit., p.166)

2 The representatives of the other approach - with a very different argument - are convinced that the support and promotion of marginal regions by the state is an important social and economic interest. The view held by G. Orlando is worth quoting. In answering the question of whether the role of the state in the economy and regional policy ought to be decreased or increased, he said the following: "In Italy... the government performs a significant equalizing function both in the field of price formation and in the harmonious regional development of resources. In addition, society is made up of so many and different components - which have evolved in the course of the history of the sharpening conflict between government and the equalizing endeavours opposed to it - that only a superior power is able to hold them together... Therefore, it is necessary to supervise the role and the direction of the development of agriculture: to develop the hilly regions in the middle of the country, to increase research and through it productivity, to work out the evaluation of the food industry; of the commercial organization and services, to examine all irrigation plans which have always been drawn up in favour of the anyway rich plainlands..." (op.cit.in T. Ferenczi, 1982)

In Hungary, during the preparation of the new economic mechanism during the sixties, there was a debate on the subject of working out a system for subsidizing agricultural enterprises with adverse conditions. It was, in fact, in this debate that these two approaches came face to face.

The advocates of the first approach tackled the problem from an exclusively economic aspect, that is, from the standpoint of efficiency. They added, of course, that social assistance should be given to the people living in these regions, by channelling them to industrial work and resettling them to other regions. State support should be granted, "in the spirit of equity", to the aged, who would be incapable of re-settling and tied to their region through their houses, private plots, etc. Thus the aim of the regional support policy was placed in, and justified by, social justice. But when it was found that the total cost of transforming the production structure of marginal regions (changing the branch of cultivation, afforestation, lawn-making, grape- and fruit-growing, amelioration, etc.) would amount to 10% of the Hungarian GNDP, the financial representative of this approach declared that, even if the Hungarian national economy had such an amount of disposable capital available, it would be a mistake to invest it in the agriculture of marginal regions, as practically no return would come from the investment.

The followers of the other approach also called for vigorous state support for the marginal agricultural regions, while also emphasizing, strangely enough, efficiency, or more precisely, regional and social efficiency. The right way of increasing regional efficiency is, according to the advocates of this approach, to distribute the resources of a given area (district) among the utilizing economic sectors in such a way as to ensure optimal economic growth (under conditions of environmental protection). This calls for a transformation in the production structure of agrarian regions with few resources. "In the mountainous and hilly countryside, the main direction of development is the transformation of the production structure in favour of animal husbandry, along with the expansion of pastures and fodder-growing lands. Both this structural change and the development of a well-chosen auxiliary activity require state support." (National Planning Office, 1972). In other words, the efficiency of the farming system as a whole is bound to decline unless the utilization of the resources on marginal regions is optimized. The most important means of achieving this is to keep the agriculture of these regions functioning and this is only possible through state support. (And this requires money, a lot of money. However, one of the arguments voiced by the representatives of this approach was that, if these regions were left to themselves, then the damage done to the environment would require almost the same amount to put right as supporting regional development would.)

Besides social commitments, another argument for this approach was that growing food prices justified the continuation of production, as an overwhelming proportion of the agricultural activity in these regions was still, in the face of increasing world economic prices, economical.

The latter arguments -- although not fully proved theoretically -- were generally accepted, and it was largely using this as a basis that the essential elements of the still existing support system were formulated. These elements are as follows:

- amelioration and the modification of land use are implemented, fully, or the greater part, by state subsidies;
- the mechanization of agriculture, the application of fertilizers and pesticides, construction and settlement investments also have support;
- co-operative farms under unfavourable conditions, and below a certain land quality, are given state support in the form of complementary prices and income supplement, income- and land-tax allowances.

Of the above forms it is complementary prices which are particularly significant, as they are a kind of substitutes for regionally differentiated prices and make the production of commodities indispensable to the national economy, profitable. Since the other forms of state support are not regionally differentiated, they do not adjust to the special requirements of farming in different territories and, consequently, give approximately the same subsidy, related to land to farms with favourable and those less favourable resources.

It is, primarily, due to this fact that the state support policy outlined above was, in essence, unable to offset the effects of farm differentiation. It must be noted here than the differentiated operation and development of farms is a consciously accepted element of Hungarian agrarian policy. But differentiation, as a result of the unfavourable world economic situation, has increased during the past few years, creating an ever-widening gap between farms yielding good returns and those yielding poor. Thus farms operating in marginal regions are being reduced to an increasingly hopeless situation. Moreover, besides this widening gap, differentiation has also increased within the group of poor farms itself.

It is practically impossible and would be inefficient to "level off" farming in both favourable and poor regions. The principle that investments must primarily be made in projects which return the investment costs within the shortest period and in the most efficient way remains valid. At the same time, "accelerating" differentiation, as experienced in the 1970's, must also be halted, this being equally justified by economic and social considerations.

The demand for a differentiated handling of marginal regions continues to make itself felt at the level of national economic policy. Experiences over the past decade has highlighted the fact that what is needed is a more co-ordinated, and differentiated economic policy, which increasingly allows for regional disparities. It is highly important to recognize that the development of marginal regions is not exclusively agricultural, but a complex problem incorporating all sectors of the national economy. Along with progress in national development, a greater role has to be assigned to regional and local initiatives. As regards possible solutions to the problem of agricultural production and agricultural production units, primarily co-operative farms, the following may be said: A solution is invariably needed, first of all, for the transformation of the agricultural production structure and its adjustment to local conditions. This is, of course, impossible to put into practice without an appropriate central subsidization policy, just as it is impossible to raise the technical level of production without taking such subsidization measures. Apart from increasing the agricultural output, the model of economic activity as a whole also requires modification, often radical modification. What we have in mind is, first of all, to give the so-called auxiliary branches and their profitable operation the same significance as by agricultural activities. For this reason, it would be better to speak uniformly of "multi-oriented" activities instead of the traditional "basic and auxiliary branches".

It would seem, then, that significant reserves are hidden in co-operation between enterprises -- both agricultural and non-agricultural -- as well as in organizational, labour and management relations changes within the enterprise. This would make solutions to the problems that have so far proved rigid more flexible. The concrete methods for making these changes cover a wide scale, ranging from the modification of collective labour organization to family cultivation and leasing. Finally, in connection with this, mention must also be made of the virtually untapped possibilities which lie in optimizing the combination of large- and small-scale farming.

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SPATIAL RELATIONSHIP OF URBANIZATION AND CHANGES OF LAND USE STRUCTURE

István BERÉNYI

The objective of the Land Protection Act, passed in 1961, was to decelerate the decline in agricultural land which began after World War II. By 1970, agricultural land had been reduced by about one million ha (about half a million of this total became forest). In order to protect land, the Act has been amended several times, making the non-agricultural use of land rather difficult. Restrictions include a compensation to be paid for land conversion which progressively increases in accordance with the quality of the land. As a result of these strict measures, the area of land withdrawn annually from agricultural use has fallen by 50%. However, this declining process has not stopped, since the cause is rooted in general socio-economic development and its regional disparities.

The disruption of previous land use patterns was brought about by a number of factors, principally the extensive industrial and urban development of the 1950's, the collectivization of agriculture and the overall rearrangement of productive forces, involving spatial concentration. Urban population rose from 36.5% in 1949, to 53.6% by 1981, a rise which necessitated the construction of approximately one million town dwellings. Urbanization also gained speed in rural areas, where, new towns were inaugurated, and new settlements created, through the development and concentration of agricultural plants. The improvement in living conditions and the increase in free time gave rise to a growing demand for holiday and recreation facilities, so resort and suburban weekend areas were established. On balance, all this meant a reduction in agricultural land.

The growing demand for urban development, combined with both the need for agricultural production and its importance to the national economy, has made land use and its rational planning into one of the most important questions in spatial development policy and regional planning.

Research conducted over the past 10 years has clarified the main regional peculiarities in the relationship between the changes in land use and urbanization. Although the main phenomena of the Hungarian urbanization process do not basically differ from those in other European countries, that is, in such phenomena as the growth of towns, the rapid increase in traffic, the separation of dynamic rural areas, and the development of holiday areas and tourist haunts, etc., there are, nevertheless, certain regional features which are unique.

The direct and indirect effects of urbanization on land use have been analysed in several ways and it was usually found that urbanization necessarily leads to a decrease in the agricultural land (I. Berényi, 1974; W. Wendling, 1966). During the period of rapid urbanization, the above relationship also applies generally for Hungary. Regional differences, however, are significant and urban population growth did not lead to an inevitable decrease in the agricultural land in all Hungarian towns. Consequently, land use regulation will be difficult to realize if the individual peculiarities in the spatial relationship between urbanization and land use are not taken into consideration.

In order to clarify the problem, three specific spatial relationships should be mentioned here:

(a) In the five regional centres (Miskolc, Debrecen, Szeged, Pécs and Győr), the so-called counter-magnets, and other county seats, population growth and an increase in building construction lead to a decrease in agricultural land, whereas the "inner areas" failed to expand in proportion with the expansion of the town itself. The explanation of this situation rests in the fact that the inner areas of Hungarian towns designated for development are usually "overbound". Extensive parts are still in agricultural use, classified in the statistics as gardens, although they can be arable land, meadow, pasture, vineyard, etc. This kind of agricultural land very often has little value to large-scale agricultural farms because the plots of land are too small and scattered all over the town. Most of them are privately owned. There are usually two ways of utilizing this kind of land: highly intensive (early vegetables, flowers, etc.) or extensive (wheat, pasture) farming. However, the latter is considerably restricted by the size of the land, as this determines its economical utilization.

Thus, large-scale agricultural farms have brought about a "devaluation" of urban and suburban agricultural land. Consequently, if there was a demand for suburban recreation areas, collective farms were easily able to dispose of their unwanted land, land which had been fallow for years anyway. The general practice in West European urban development in the 1950's was to leave agricultural land fallow or let it become overgrown with grass. (G. Voppel, 1958). This was especially common around large industrial towns, due to the population re-stratification process ("Sozialbrache" "friche sociale", social fallowing). In Hungary, however, the phenomenon manifests differently, since, from the 1970's it is the "re-stratified" family itself which maintains agricultural activities in suburban areas, or seeks the possibility to do so. Here, it is the economic conditions of large-scale farms which facilitate a devaluation of suburban agricultural land. It is also through collective farms that a functional change of land use occurred for example, turning land into holiday resorts. This was impossible in those West-European towns (J. Marbach, 1960), where private farmers retained the suburban land as reserves.

Question: when agricultural land shrinks or changes its function, is it as undoubtedly negative as is often claimed? Should these processes be drastically hindered or, on the contrary, should a method be found for the rational utilization of the area, and regulations to that effect be put into operation? This paper attempts to justify the viability of the latter view.

(b) Naturally, urban growth usually included an expansion in the inner areas of towns. Thus land was appropriated for building which could be used by large-scale farms. There have been two main types in this process, as follows: On the one hand, there has been the development of new industrial towns for example, Dunaujváros, Kazincbarcika, Százhalombatta, Leninváros, etc. The construction of these towns necessitated on extensive appropriation of agricultural land, as these new industrial estates were realized on considerably larger plots than similar estates in already urbanized areas. In fact, only a third, or maybe a fourth, of the area appropriated for these constructions was built up and extensive space was left for further development. In addition, the appropriation of oversized industrial plots was facilitated by the token compensation which had to be paid and some towns and local authorities helped companies to open branches in rural areas, by offering land free of charge.

On the other hand, large areas were utilized for industry in towns like Zalaegerszeg, Nagykanizsa, Szekszárd, Baja and Eger, etc., where there were hardly any industrial estates. With regard to the above settlements the agricultural land around the inner city was utilized and, over the past 20 years, these small historical towns have become medium-sized towns with a considerable industry. However, the utilization of land by industry, and the enlargement in living quarters, was not at such a high level as in the case of the towns mentioned earlier, this being largely due to the differences in their respective industries. The new towns, like Dunaujváros, Kazincbarcika and the others, bulge with heavy industrial plants which mostly produce semi-finished products and need extensive space. The small towns mentioned in this paragraph mainly favour manufacturing which rely more heavily on labour force than land.

Thus, from the point of view of land utilization alone, it seems more reasonable to develop industry (and, consequently the settlement itself) in already existing centres, as this requires the appropriation of smaller areas. Naturally, this may not always be the case and it cannot serve as a basic principle for spatial development. In the future, however, it seems more reasonable to establish branches of industry which are in some way related to agricultural production in intensive agricultural zones. It would not be necessary to have those branches of industry in mind which process agricultural produce only: an agro-industrial structure for the utilization of arable land would certainly give rise to a socio-economic interest system which would ensure the protection of arable land. New regulations would help to achieve this end, since the urbanization of agricultural regions is accompanied by a decrease in agricultural land, anyway.

(c) Little is said on the fact that the shrinkage in agricultural land far from the centres or zones of urbanization should also be considered as a part, or an indirect effect, of this process. A well-known problem is that of agricultural land (for example, fallow land) which has been abandoned as a result of the migration of the active population. The phenomenon is as much the result of social effects as economic. If a plot of land cannot be profitabily cultivated at a given level of production, the small farmers in the capitalist economy are compelled to leave it fallow just like the large-scale agricultural plants in a socialist economy.

The utilization intensity has, beyond doubt, fallen in remote areas, far from the mainstream of urbanization. An example of this is found in results of research in the border zones.

METHODS OF ANALYSIS

The first step in the analysis was to determine the regional differences in urbanization, using three indicators: the density of population, calculated for the inner city areas in person/km^2; the ratio of white-collar workers as a percentage of the total wage-earners; and, lastly, the proportion of dwellings built between 1970-79. Deviations in these three factors from the national average are expressed by scores and an aggregate is calculated using data from villages and towns in the various districts. Using this method, we believe it is possible to identify the regional differences triggered off by the process of urbanization. This, however, does not indicate the actual level of urbanization, as this is the result of several qualitative and quantitative factors; but, it can indicate the direction of social activity and the main zones and cores of land uti-

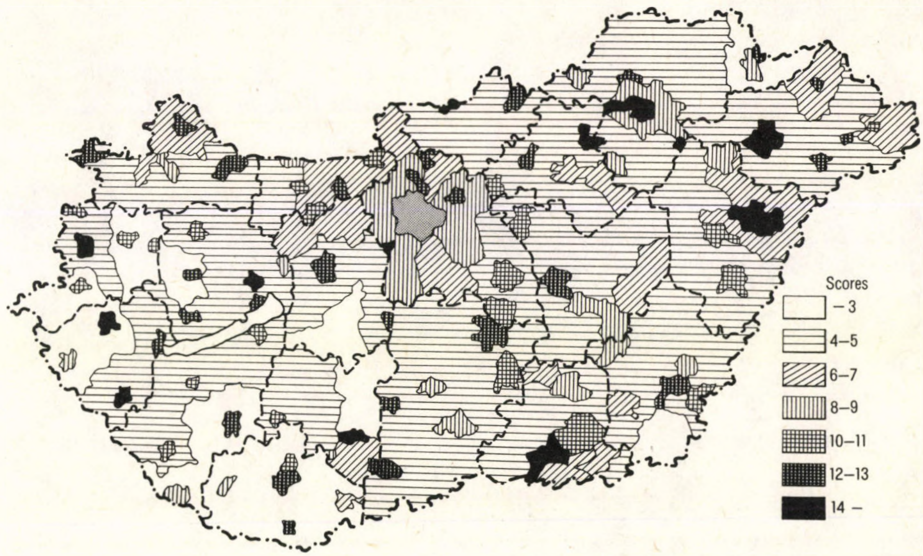

FIG. 1 Spatial variations in the level of urbanization, 1980

Indicators considered:

Score	Population density in the inner areas of settlements persons/km^2	Non-manual active earners in % of all active residents %	Dwellings built between 1970--79 in % of all dwellings %
1	500.1-1,000	12.1-20.0	-15.0
2	1,000.1-1,500	20.1-25.0	15.1-25.0
3	1,500.1-2,000	25.1-30.0	25.1-35.0
4	2,000.1-2,500	30.1-35.0	35.1-45.0
5	2,500.1-	35.1-	45.1-

lization (Fig. 1).

The second step is the determining of the regional types of agricultural land use. The forms of land use can be classified into three main categories: arable land (A), orchard-vineyard (special agriculture) (B), and pasture land (extensive land use) (C). Then, the amount by which these forms deviated from the national average was analysed. The types which reflect the true situation best emerge as a combination of the above-average (A, B, C), and the below-average (a, b, c) values (Fig. 2).

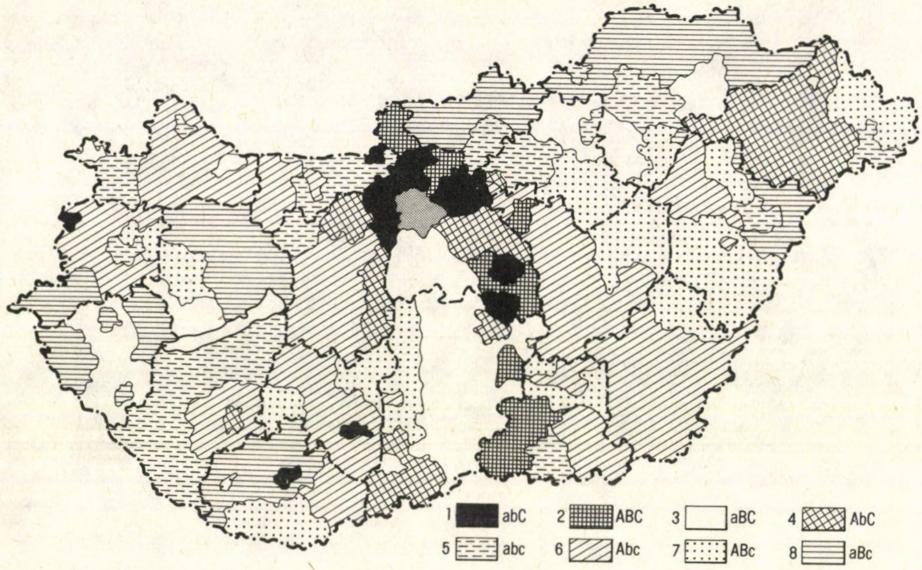

FIG. 2 Agricultural land use patterns, 1970

1 = suburban; 2 = lowland mixed; 3 = sand and hill-foot vineyard; 4 = orchard and suburban garden; 5 = hilly mixed; 6 = lowland intensive, arable land; 7 = lowland extensive; 8 = hilly extensive.

	National averages (in % of the total area)
A+a = arable land	54.1
B+b = meadow and pasture	13.8
C+c = orchard and vineyard	4.3

A, B, C = above national average; a, b, c = below national average.

REGIONAL TYPES IN THE RELATIONSHIP BETWEEN URBANIZATION AND LAND UTILIZATION

With regard to highly urbanized areas and land use patterns, it is possible to differentiate three regional types:

i. From the point of view of basic social amenities (dwellings, jobs, transport, services, education, entertainment, and holiday/recreation), the capital and its agglomeration is the most "completed" region of the country, the development of which took about a hundred years (M. Viszkei, 1972).

The even pace of constructions between 1880-1920 was replaced by a breathtakingly rapid spatial expansion between the two world wars. This was partly due to the fact that, following the division of the country after World War I, Budapest was the only real urban centre. Then, because of the slump in agriculture, which dragged on and on, people without land to cultivate migrated towards the capital in the hope of finding some sort of work. The population of settlements around the capital grew dynamically during this period.

Urban sprawl around the capital was controlled, to some extent, by planning: the authorities made efforts to keep land use under control by building dwellings for workers and by selling plots. Both types of construction were characterized by a low level of facilities and dwellings of rural character, complete with gardens, like in Mátyásföld, Csömör, Cinkota, Pestlőrinc, and Pestimre, etc. The metropolitan inner core, and the enormous and low-standard periphery of Budapest, was built over a few decades at the turn of the century. The contrast between the two became especially strong after World War II, when the public administration of these working class peripheries merged with that of the capital. The development of industry between 1950--60 increased the number of jobs in the capital, which again boosted migration into the capital. The introduction of the regulation stipulating that one could only obtain permission to rent or buy his/her dwelling in the capital after five years continuous employment in Budapest did not do much to help matters. This did not stop migration, it only diverted it to the neighbouring settlements beyond the city limits. Although the policy of industrial decentralization became general from the middle of the 1960's (Z. Tatai, 1977), the number of people moving into settlements on the fringes of the capital, or into the capital itself, only slightly decreased. The population of Érd, Budaörs and Budakeszi, for example, doubled between 1960--70 and this trend lasted well into the mid-seventies. Small towns located 25--30 kilometres away from Budapest, for example Vác and Gödöllő, became medium-size towns. The environs and periphery of Budapest, underwent crucial changes between 1965--80, the main feature of which was the mass housing construction and the establishment of new industrial outlets.

The above process of urbanization has thoroughly transformed land use in the capital and in its environs.

i.1 Between 1935 and 1970, the agricultural land in the 44 settlements added to the Budapest agglomeration decreased by 22% on average, (I. Berényi, 1979) varying between 30--40% decrease in settlements near the city limits (Csömör, Kerepestarcsa, and Ecser) and 5--10% in settlements 25--30 kms away from the centre (Monor and Ócsa). From the centre towards the periphery, a certain irregular concentricity can be observed in land use, since migration and consequent construction has been influenced by the main transport routes.

i.2 Another feature was the rapid increase in the number of gardens. Statistically, the garden is classified as agricultural land, but it is also part of the so-called "inner city areas", which means, from the point of view of land use, they can be built on. The cultivation of the garden can take several forms (for example, arable land, vineyard, orchard, etc.), but the size of the plot must not exceed 1,400 m^2. Since it is possible to build in gardens, the rapidly developing settlements do their best to acquire as much agricultural land as possible for their inner city areas to satisfy in-migrants' growing demand for land. Therefore, it is understandable that there is a strong correlation between strengthening urbanization and the growth in the ratio of gardens in most of Hungary's urbanized settlements (Fig. 3).

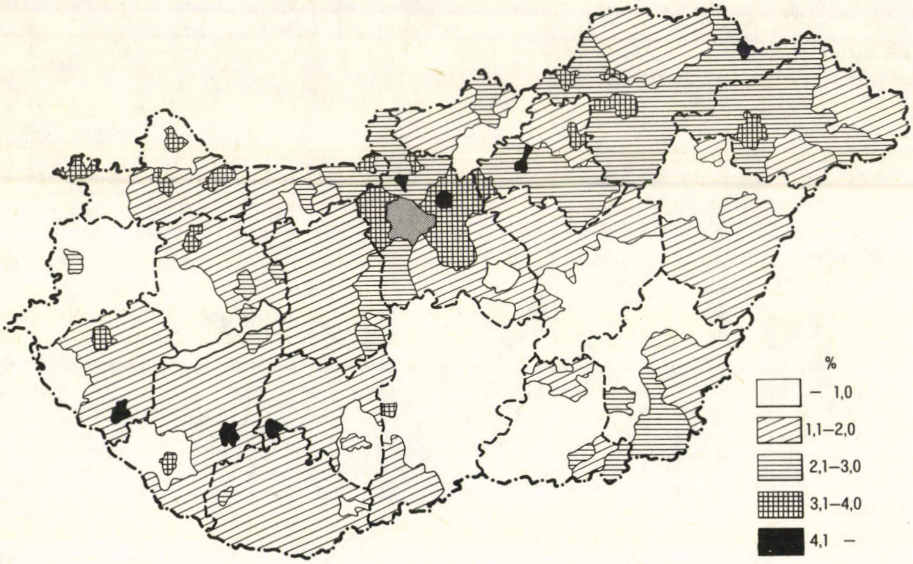

FIG. 3 The proportion of gardens in percentage of the total area

Specific though this relationship may be, but it is not regular. In the case of rural towns on the Hungarian Plain, which have always had great open areas (managed by the public administration), the strengthening of urbanization could not have triggered off an increase in the number of gardens, since sufficient amounts of land were already available.

As urbanization strengthens, gardens acquire several functions: although, usually, its agricultural character gradually diminishes and its "hobby garden" character is accentuated. Then, there is a shift towards the weekend house and permanent dwelling. This process can be seen clearly in the vicinity of the capital and typical areas going through this phase of development can be distinguished from the rest. The striking increase in its area is based on the above differentiated possibilities for use in urban areas (I. Berényi, 1981).

However, the social conditions needed for the growth of gardens are rather diverse:

i.2.1 The population on the outskirts of towns need gardens: many active earners working in industry or in the service sector, have no qualifications in any field. Therefore, their wages are low, and cultivating the garden gives them a supplement to their income. They do not usually produce anything for the market or engage in animal breeding, although this latter is often prohibited anyway. Gardens are used for various purposes: vegetables, vine and fruits are generally planted, but, in addition, the garden is also a source of relaxation. These types of gardens are usually located in the inner zones of the agglomeration, on both sides of the present city limits. In fact, it is the so-called outer residential zone of the capital which is undergoing strong structural changes (I. Berényi, 1979).

i.2.2 The growth of garden areas is generated by people who move into urban areas from rural environments. That is why the number of gardens grew to such an extent in the agglomeration settlements between 1960--80. Coming from rural areas, families with a moderate amount of capital were able to purchase plots in settlements relatively far from the capital (20--30 kms), where the prices of plots were lower. Incidentally, the environment tailored itself to their initial life style rather well, since house building forced them to seek additional sources of income and mortgage loans were less favourable in rural areas. Here, the garden provided possibilities for market production, because in the rural environment, conditions were optimal for animal breeding.

As a result of the mass migration of couples following mixed employments (for example, the husband employed in industry, the wife in agriculture), the demand for building plots rose quickly on the outskirts of the agglomeration. Councils could only cope with the demand by adding newer areas to the inner city and, in this way, the proportion of so-called garden cultivation areas grew further.

i.2.3 The third social condition contributing to the development of gardens was people who sought weekend recreation in the vicinity of towns. The rapidly growing demand for plots could be satisfied by two ways: on the one hand, part of the inner and outer city areas were officially reclassified as resort areas; and, on the other, in the outskirts of settlements areas which cannot be used for large-scale cultivation, were sold as "closed gardens". In this latter, construction is partially prohibited so that no building bigger than 30 m^2 can be built on them.

So, although the agricultural nature of the closed garden must be preserved, it is often only formal, since the real function of the garden is to ensure that the owners can enjoy a holiday and relax.

There are about fifty to sixty thousand gardens complete with week-end cottages on the Danube bend, north of Budapest. The number of plots with a holiday or closed garden purpose is much higher.

The development of resort areas in the vicinity of towns necessitates the establishment of service and retail outlets, and, consequently, building is on the increase.

i.3 The third peculiarity in the transformation of land use in the Budapest agglomeration is the extension of forest area.

The densely populated downtown areas and new housing estates must have parks of some description and, so, growing areas of forested parks have been developed. They usually spread at the expense of the agricultural land. In addition, the cultivation of land within the agglomeration for large-scale farms is rather difficult, because, on the one hand, the application of agro-technology (the utilization of machinery and chemicals) is limited, and, on the other, there is a lack of labour. Consequently, co-ops and state farms are easily persuaded to put these areas at the disposal of the forestry companies.

The development of green zones on the outskirts of towns, which would make the body of a town less condensed and create a transitional area between the town and the natural environment, has a rather haphazard nature. Even though ideas are worked out on the drawing board, in practice the areas have gained a mixed function over the years and many such areas are built on.

i.4 The most obvious feature in the land use of the Budapest agglomeration is the increase in built-up areas, mostly due to the construction of the new housing estates. (In the country towns, reconstruction and the development of more urban-like buildings played a very important part, in such towns as Kecskemét, Debrecen, Miskolc, etc.).

Although the construction of industrial plants increased in the Budapest agglomeration between 1960--80, it did not become a decisive feature in land use. Industrial plants were gradually moved out of the inner city areas (Z. Tatai, 1977) which had been ringed with workers' quarters between the two world wars. The industrial plants were re-established in settlements not far from the capital which were easily accessible to one of the main motorways, for example, Gödöllő, Vác, Szentendre, Dunakeszi and Budaörs.

The diffusion of industrial construction in the agglomeration seems favourable, since neither outsize industrial premises nor the problems of environmental protection are concentrated. Viewed from another angle, it can be regarded as a negative phenomenon as well since sources of industrial contaminants are scattered and their isolation becomes more difficult. Traffic outside the towns increases and the development of an industrial infrastructure is more expensive.

It is possible to say, however, that the main danger in the use of land in the environs of the capital is not industrial plants, but the increase in population density, and the establishment of large housing estates, the construction of which was determined by economic, and not ecological, consideration.

On balance, it seems probable that the development of the big cities in Hungary, especially the Budapest agglomeration, is not unfavourable. Although this development trend has produced a growing urban-industrial zone and, consequently, a high density of buildings, the settlements have spread spatially and the basic social functions are, therefore, better distributed. Even though this has obvious disadvantages (deficiencies in the infrastructure), the absolute advantage is that there is a chance to create a more humane urban environment.

ii. The other specific type of relationship in the transformation of urbanization and land use emerged between 1950--80, along with the extensive development of industry. Two relatively large areas can be mentioned here as examples: the Transdanubian Highlands and the Borsod valley.

Urban and industrial constructions in the Transdanubian section of the Hungarian Highlands do not constitute as uniform a zone as those in the Borsod valley, but the functional links among settlements are evident and possibilities for further development available. From the point of view of land use, there is one common feature, which arises from the fact that the industries in these zones are based on local sources of energy, like coal, bauxite, manganese, etc, and the spatial requirements for mining are great.

The ratio of land occupied by settlements to that of land occupied by industrial plants is 1:3. Many of the towns developed between 1950--1980, for example, Ajka, Oroszlány and Tatabánya, are more densely built-up than historical towns like Tata, Esztergom or Komárom.

A particular feature of the new towns is that the garden zone is missing. Mass housing construction kept pace with the number of people moving into the towns. Industrial development and town building ran more or less parallel. Therefore, conditions for the emergence of a garden zone were non-existent. New towns were often built in the neighbourhood of the old miners' villages, but independent of them, and, until now, they have been unable to assimilate them (Tatabánya). The new and old settlements are not only morphologically different, i.e., from the point of view of land use, but also in social structure.

From the beginning of the 1970's, week-end plots with resort cottages kept appearing in the vicinity of the new towns.

As a natural consequence of the above, the urbanization process in the urban regions of the Transdanubian Highlands was accompained by highly intensive use of land. Agricultural land decreased by 55% in Tatabánya, for example, between 1950--70.

Land conversion in the industrial zones of the Borsod valley did not reach as high a level as in the above example, as it was largely processing industries which moved there (Kazincbarcika), or new sections were added to the old industrial outlets (Ózd). The ratio of land occupied by settlements to that of land occupied by industrial plants is 1:1 or 1:2, which is more favourable than the ratio in the urban regions of the Transdanubian Highlands.

Miskolc plays a key role in this industrial zone as the administrative centre of the region. Consequently, the criteria concerning land use are a lot more uniform here than in the regions of the Transdanubian Highlands, which belong to three counties. Miskolc and its environs is the second most fully developed urban and industrial agglomeration in the country and its basic functions show significant spatial concentration.

It can be said that, in these regions, urbanization was accompanied by an enormous expansion in urban/industrial construction, as a result of which a completely new human environment was created. The new urban environment, which seems to be more homogeneous from the point of view of housing, is increasingly less capable of satisfying the needs of a highly diverse society. For this reason, some section of the society look for living quarters out of town which can better satisfy their needs.

iii. Urbanization and land use has developed in a specific way in and around the country towns demonstrating a planned development over the past 10 years.

The population of the five regional centres (Miskolc, Debrecen, Szeged, Pécs and Győr) grew by 15% and the built-up areas also increased. Types of building were highly diverse in each town and, in Miskolc, Pécs and Győr, the town spread spatially. In the case of Pécs and Győr, the spatial spread was brought about, partly by the protected downtown areas, and partly by the construction of industrial outlets. The built-up area of Miskolc also increased, but the town structure changed as well, due to the commencement of large-scale reconstruction. The effects felt due to the urbanization of land use were different in Debrecen, where there was an immense inner-city area and zones with buildings reminiscent of those found in small towns. In Debrecen, construction increased dynamically and the enlargement of the body of the town had only minor significance.

A widening of the zone containing detached houses with gardens was also characteristic of the five large cities, together with the development of villages near the towns with a residential function and of week-end plots close to the towns.

The rest of the county seats has become significant cores of urbanization since the early seventies. The population in these 14 centres[x] increased by 30%, while the built-up land grew by 5%. The regional isolation of urbanization is shown in Fig. 1, highlighting the fact that these towns have a background of a strongly agricultural nature. The county seats on the Great Hungarian Plain were very often agricultural towns (like Nyiregyháza, Békéscsaba, and Kecskemét) with large inner city areas, and a relatively loose structure, recalling small towns. Consequently, urbanization was primarily reflected in the intensity of construction and not in the spatial growth of towns.

Land use in the rapidly changing market towns on the Great Hungarian Plain is characterized by a certain dissonance: the well-developed inner city core is often enveloped by an extensive zone where the style of construction resembles that of small towns or villages. This, in its turn, is surrounded by metropolitan-style housing estates.

It is characteristic of towns that urban land immediately gives way to pure agricultural land. The outskirts of the towns do not differ from the outskirts of neighbouring villages, so there is little agricultural land given over to supplying the town. This function is very often taken over by gardens in the outskirts of the town, and by gardens in the neighbouring villages (in order to produce vegetables and fruits).

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[x] excluding the 5 regional centres and Budapest

iv. There are many indirect effects felt due to the urbanization which can be observed in the changes of land use in rural areas. The whole range of problems found in rural areas is often summarized independently from the process of urbanization, for example, the problems of backward regions or regions with poor ecological properties, etc. But one must not forget that all this is the result of the spatial rearrangement of production forces, thus concentrating social activities into the urban areas instead of the rural. As a consequence of the above point of view, separate development and maintenance programmes are drawn up for rural areas independently from urbanized regions.

The changes in the main trends of land use may also indicate that the answers to several problems in urban and rural regions can only be found through joint research and design work. This view is supported by the decline in the use of land far away from urbanized regions and the strengthening of the so-called "pasturization process".

In the low-production capacity areas of the south-western and north-north-eastern hilly regions of Hungary, the area of pasture and grassland has risen by 20--30% over the past 50 years (Fig. 2). The extensive character of agricultural production (grazing and sheep breeding) has become more accentuated, but, in addition to this, much of the abandoned agricultural land was turned into forest. All this is an obvious result of the rapid decline in population, or the ageing process.

At the same time, some places became centres of quick urbanization in certain rural regions (Nagykanizsa, Zalaegerszeg, and Nyiregyháza), although their effect on the neighbourhood is weak. Thus, a very strong contrast grew between the town and its environs.

The green belts which have developed away from the towns, are now socially disadvantaged and backward regions, but they may play an important role in the future, when a sort of "hinterland" to the towns is established, as such a region will provide resort and recreation facilities, water storage reserves and national parks, etc. Thus new possibilities for utilizing these catchment areas should be sought out. In addition, it is by no means certain that the enforced maintenance of cultivation of this land is healthy, by either legislation like in Hungary, or by the excessive subsidies given to producers like in Alpine countries.

SOME OF THE MAJOR RESULTS OF THE RESEARCH

After World War II, two main urbanization trends were strengthening in Hungary: on the one hand, there were those regions where town development was already significant between the two world wars, for instance, the Borsod industrial district, the industrial regions in the Transdanubian

Highlands and the Budapest agglomeration (Fig. 1); on the other hand, the economic policy of decentralization, stemming from the mid-sixties, gave a boost to the development of the five large cities, (Miskolc, Debrecen, Szeged, Pécs and Győr) and that of the other county seats.

In the first case, urbanization concerned a larger, homogeneous area and not a single settlement. This reflected itself in the changes in the job structure of the population, and the modifications in their living conditions and life style, the improvement in the quality of flats and the urbanization of the land use structure. It meant that the proportion of fenced-off areas, forests and green belts increased, and that of agricultural land declined sharply. Depending on the region, the proportion of gardens rose steeply.

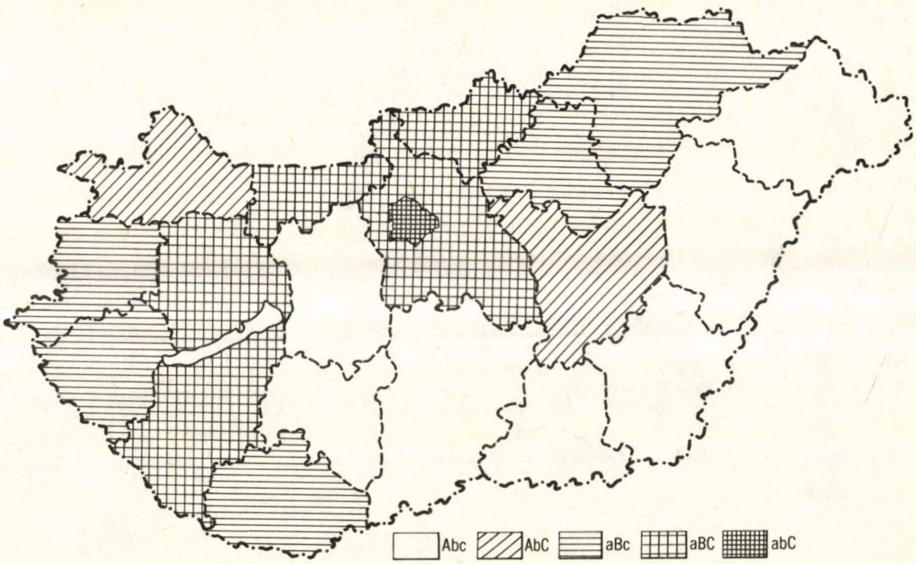

FIG. 4 Land use patterns, 1970

	National averages (in % of the total area)
A+a = agricultural land	74.1
B+b = forest	15.9
C+c = land withdrawn from agricultural cultivation	10.0

A, B, C = above national average; a, b, c = below national average.

In the second case, urbanization was concentrated in the towns, which were either county seats or had an equally strong gravity zone, in accordance with the National Settlement Development Plan. This kind of urbanization shows strong isolation, although its effects can be felt in villages in the immediate vicinity of the centre (e.g., Szolnok--Rákóczifalva and Szajol or Kaposvár--Szentbalázs, etc.). The attraction of the centre is likely to grow parallel to the development of its services and functions. No such transition can be detected in land use, as is the case in more advanced regions in the agglomeration (e.g. the environs of Miskolc, Pécs, and Győr, etc.).

The structure of Hungary's land use (that is, the proportion of agricultural land, forest, and areas withdrawn from agricultural cultivation) is a good reflection of the country's underlying socio-economic spatial structure (Fig. 4); including the urban-industrial regions, agricultural regions and under-developed natural regions. It can be said that there is a spatial connection between the intensity of land use and the degree of urbanization in Hungary. The correlation between the high ratio of urbanization and gardens is a special feature in Hungary, even though it is not unprecedented. It has special causes, deeply rooted in the social, economic and regional development.

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SOME THEORETICAL PROBLEMS CONCERNING THE STUDY OF ECONOMIC REGIONS

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Research in the field of economic regions started three decades ago in Hungary. The intensity of the research has varied but the work itself has been continuous and resulted in a rich accumulation of theoretical and methodological material. Essentially, there have been two directions of research: one concerns the study of economically specialized areas, while the other involves the study of integrated regions.

In most socialist as well as some capitalist countries the economic regions used in regional planning are based on scientific research which have been accepted by the majority of researchers. Unfortunately, the same does not hold true for Hungary. Several regional plans were made here particularly in the 1960's which were based on diverse methods and had various aims. These plans were made independendently and, although they showed many features in common, they did not overlap territorially and each had its weak points. Therefore, none of them was 'officially accepted'.

The evolution of a common voice was hindered by a number of circumstances. Due to changes of economic management in the second half of the 1960's, there was a strong demand for a scientifically-based regional plan and researchers were unable to produce one. The situation was worsened by the fact on the one hand that Hungarian administrative units differ significantly from the economic regions and on the other hand that regional planning cannot be separated from the administrative units. Eventually, there was a compromise: the results of research into economic regions were not taken into consideration but the boundaries of administrative units remained unchanged. Thus, the so-called 'planning economic region system' was created (a region usually covers two or three counties and is supposed to serve as a framework for regional planning). This system was recognized by some forums and some geographers even use them in teaching geography.

However, there are still many diverse views among researchers concerning the economic region. About as many plans have been made as there are researchers, and some of these even question the objective existence of an economic region.

The recognition or rejection, of the objective existence of economic regions is a very important question of principle, basically determining the methods of study. That is to say if the notion of region is considered as subjective, then there is no need for research: it is enough to simply delineate the borders of the region. If, however, we accept the objective existence of regions, then we are forced to attempt a description of objective reality using scientific methods. At the same time, we must realize that, even if we accept economic and social regional processes as being objective, it does not mean to say that all experts will arrive at the same conclusions in the identification of regional models.

If we accept the objective existence of economic and social processes (which among other things develop and shape economic regions), then we must also accept the objective existence of region boundaries. Which does not mean, however, that these boundaries should be considered rigid: it is precisely because of their mobility that the above-mentioned processes are never sharply delineated. Boundaries remain unclear especially if we try to determine them in a 'top to bottom' manner. This is why it is necessary to grasp the territorial differences in economic and social processes and this can be accomplished by starting with the smallest units in the division of labour.

THE CONCEPT OF THE ECONOMIC REGION

In our opinion, economic regions are territorial units of the societal division of labour, they exist objectively and specialize production through advantageous natural and social characteristics but are also complex in their character. Accordingly, they have inner and outer economic connections and the hubs of economic regions are the territorial production complexes. Considering the directions, pace and standard of their development, economic regions are relatively independent units and, as such, they serve as a good framework for territorial research and regional planning.

International literature often defines the economic region differently from the above. In West European literature (especially French, English and German), the term 'region' primarily means a planning region. It is also frequently used to denote solely administrative units or territories separated by population movements while experts in settlement development use it mostly to mean a unit in the settlement network.

Term 'region' is also frequently used in Hungary to denote gravity zones of settlements if socio-economic phenomena are considered when setting boundaries. We think that 'region' and 'economic region' are not synonymous terms as there are functional as well as significant territorial differences between them.

An economic region always has an economic centre and a territorial unit without such a centre cannot be considered an economic region. It does not follow from this, however, that an economic region comprises of only the gravity zone. This problem is particularly evident in case of micro-regions where there is frequently a territorial overlap between gravity zones. In addition to this, there are important differences between the two types of territorial units:

(a) The concerns of an 'economic region' are different from those of gravity zones. In the former, emphasis is laid on both the features of the production sectors and the socio-economic relationships while in case of gravity zones only socio-economic relationships are of importance.

(b) In terms of function, the economic region is a production unit while gravity zones cannot be defined as such.

(c) Gravity zones may change without necessarily affecting the boundaries of an economic region (for example, the moving of an administrative function to another settlement, the introduction of a particular type of school, building of a shopping centre etc.). The converse, however, does not apply.

(d) Within an economic region several gravity zones may form and they are usually arranged hierarchically.

(e) A gravity zone is more closely bound to, and dependent on the territorial system of administration than the economic region.

The above differences do not mean that there are no similarities between the two types of unit. They are both territorial forms of economic and social activity where the intensity of many socio-economic phenomena changes proportinately with travelling distances from the centres dependent on the conditions of transportation. The zone-forming role of the centre depends on the taxonomic level: it is stronger in the micro-regions and as each unit gets larger, the role decreases.

SOME MAJOR FEATURES OF THE ECONOMIC REGION

1. The production profile. The physical, social, transportational and productional, etc. conditions or traditions of economic regions differ. Accordingly, there are significant territorial differences in the geographical division of

labour that these conditions represent and these differences are primarly expressed through the production profiles (specialization) of the regions.
Specialization is the most important region-forming process and results from the development of several sectors of production on varying levels. Specialization is therefore not a static category, but a process and any definition of specialization must include the above-mentioned process. Those who try to be exact by defining branches of regional specialization with a single equation, oversimplify reality and represent only one side of the process--usually the quantitative side. For this reason, a quantitative representation of specialization gives distorted results, and the smaller the area of application, the stronger the distortion tends to be. Thus, it would be necessary to also carry out a functional analysis of specialization. The questions that have to be answered are as follows:

i. What is the role of specialization in the regional production complex?

ii. What are its physical and social conditions?

iii. How is it related to the direction of development in the given area and what is its role?

All those branches belong to regional specialization which represent a significant proportion of production in the region, the country as a whole and also in foreign trade and promote the economic program of 'minimal input - maximum output' through their region-forming power and making use of favourable conditions.

2. Complexity. Economic regions do not only specialize, but also have a complex nature. By complexity we mean the many-sided and planned utilization of inner relations and the proportional development of sectors of production. It is an established standpoint that, besides the sectors representing specialization, an important role is also given to the development of auxiliary branches and those of mainly local importance. It is obligatory for us to create conditions for complex development.

3. Regional production complexes. From the above, it can be deduced that the production structure of integrated economic regions comprises of, on the one hand, specialized sectors, and, on the other, complex sectors. The separation of the two is largely theoretical as they usually stand in productional relation to each other, covering a smaller or larger area of production, and they form a regional production complex utilizing local natural resources and labour. Regional production complexes are the most essential feature of economic regions. Without them, an integrated economic region cannot exist. At the same time, we must realize that the territorial aspect of productional relations--even considering it in its whole complexity--does not by itself

fully account for the concept of the economic region. This becomes evident when one considers that the economic region is not only a unit of production, but it is also a unit of consumption. It is also a part of the field of social functioning and human activity. These relationships are especially conspicuous with regard to the micro-region network which leads back to the problem of gravity zones.

4. The relation between sectoral regions and integrated regions. When delineating the boundaries of an integrated economic region, the fact that sectoral regions work on a territorially different system is often a disturbing factor. There is a general consensus among economic geographers that in terms of contents, the sectoral unit and the integrated economic unit are territorially different. However, the two notions are often used interchangeably, especially when marking boundary lines based on the dominant sector.

THE TAXONOMIC SYSTEM OF ECONOMIC REGIONS

Spatial pattern of production creates various levels in an economic region. An economic region by itself, separated from the other levels, loses its meaning and can only function and have a role in a given system. From this it follows that an assessment of taxonomic units cannot be done piecemeal. There is no absolute standard to work from, anyway, since the status of a region does not only depends on its particular characteristics, but on its relationships with other regions as well.

In our view, Hungarian economic regions form a four-level system: micro-regions, sub-regions, mezo-regions and macro-regions (Fig. 1).

Micro-regions are the smallest units in the geographical division of labour which still have the most important features of an integrated economic region. It is possible to determine the highest level of micro-region by considering their role in the geographical division of labour, although its effect is frequently of an indirect nature. Usually, an integration of several micro-regions forms a more widely-based territorial production complex. Thus, the size of a micro-region is determined by the territorial differentiation of the economic and social processes in larger, higher-level regions.

When marking boundaries of micro-regions, we used research results concerning the settlement structure with special emphasis on factors which have a zonal spatial pattern (gravity zones, territorial production relations, the geographical transport situation of settlements, population mobility, the production types of economic sectors, physical environment etc.). The work was done in three phases:

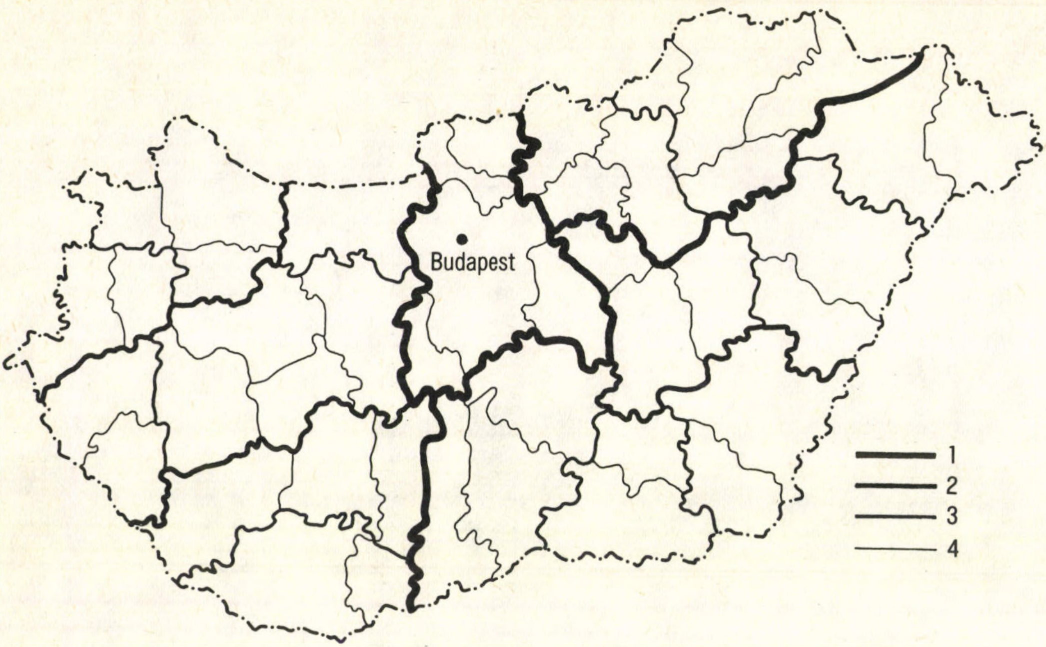

Fig. 1 The taxonomic system of Hungarian economic regions

1 = boundary of macro-regions; 2 = boundary of mezo-regions; 3 = boundary of sub-regions; 4 = boundary of micro-regions.

- determining the inner territorial structure of the regions through a synthesis of the above factors;
- identifying the territories and peripheral zones closely attached to the centres;
- classifying the settlements into micro-regions based on the results from territorial structure research.

The separation of micro-regions is necessary in order to delineate the higher-level regions. An analysis of lower-level socio-economic processes creates the possibility of elaborating the territorial differentiation of higher-level regions.

Micro-regions are not directly linked to mezo-regions but connect with them through a network of sub-regions. Micro-regions and sub-regions have many in common: both levels are objective territorial units of the division of labour; micro-regions are a part of sub-region; and thus, their outer boundaries are identical to sub-regional boundaries.

Besides these similarities, however, a number of differences are discernible:

- micro-regions are the smallest units of division of labour, while sub-regions represent a higher level, being territorially larger and more complex;
- the territorial production complexes of sub-regions include more sectors;
- sub-regional production and transport connections are wider and often extend over the whole country;
- conditions and development trends of sub-regions are not the straightforward sum of similar factors in micro-regions, they are wider and more general;
- the functions of sub-regional centres cover a wider area, although they do not necessarily include the whole of the sub-region.

A number of important points justify the classification of regions as the 'indispensable links' between micro- and mezo-regions:

1. micro-regions may show significant differences in character and state of development but these are unified in the sub-region;
2. the characteristic socio-economic processes of micro-regions meet at sub-regional level;
3. a sub-region is more or less homogeneous, has its own character and development trend while for the most part, specific features get amalgamated in a mezo-region;
4. a delineation of sub-regions bridges the differences caused by taxonomic problems which occur between diverse region-plans, while helping to identify the mezo-regions; furthermore, it is an indispensable element in creating a uniformity of economic and administration functions.

A detailed analysis of <u>mezo-regions</u> is not necessary as the features for the other regions described above apply by and large to these as well. It should be mentioned, however, that within the mezo-regions, sub-regions often form a loosely connected network, and in this respect there are significant differences between industrially well-developed and less-developed areas (in less-developed territories, the formation of sub-regions is usually more clear-cut).

<u>Macro-regions</u> are less frequently found in practice, but their existence is indicated in several ways. We think that in Hungary four macro-regions are identifiable: the Great Plain, North Hungary, Transdanubia and the Central Region.

A general rule of the taxonomic system of regions is that the higher the level, the less marked the unity of functions will be. In other words, higher-level economic units are less homogeneous than lower taxonomic units. Taxonomic units do not necessarily form a growing pyramid (e.g. the macro-region of North Hungary is at the same time a mezo-region; the Central Region is immediately divided into micro-regions).

Finally, the study of economic regions cannot be restricted to only modifying boundary lines or discovering new regions. This would lead to an over-simplification of regional research as the task is much more complex than this. Ultimately, the task involves all regional analyses, plus research into the spatial structure of economy and micro-level analyses of socio-economic processes. Such a wide-ranging study would eventually lead to a description and explanation of the changes in economic regions.

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REGIONAL DEVELOPMENT PLANNING

Zoltán TATAI

When developed socialism is being realized in a country, a fundamental function of regional planning is to ensure that the means of production are both sited and improved with an eye to the requirements and maximum efficiency of the national economy. Regional planning should also help reducing unreasonable differences between individual areas and settlements which arise in the course of history with regard to living conditions and standards. It is likewise important that a conscious effort is made to take stock of the natural and social resources of each community, district or region and resources should be utilized in such a way as to promote overall economic growth and social development. The work of regional development is therefore closely linked with the aims of realization of a developed socialist society outlined in the Programme Declaration of the Hungarian Socialist Workers' Party.

LOCATION OF PRODUCTIVE FORCES

Planned location of productive forces should ensure that each economic unit is located where the regional resources provide optimal conditions for the operation of a certain branch of industry. Attention should also be given to the utilization of the available natural and social resources in each district ir order to promote the economic development of the country as a whole. It means that a complex approach is needed to assess the efficiency of productive activities and the effective use of regional resources. Such considerations would lead to a situation in which maximum results are achieved with minimum social input.

The reduction and eventual elimination of the differences in economic level of various areas can only take place among the larger economic districts and within the framework of an extended historical process.

Industry is the most important factor in the country's economic growth, although the economic level of individual areas and settlements is not just raised by industrial expansion. Activities encouraging the economic growth of both the country and the area concerned must correspond to the local conditions. Great importance should be placed on the utilization of natural resources. The HSWP Platform points out that nuclear power plants will play an important role in the country's energy production. New large capacity power plants are to be established utilizing Hungarian coal and lignite deposits. We shall make the most of our copper, mineral, oil, gas and other natural resources. Water systems will be further improved and the hydro power provided by Danube and Tisza rivers will also be better utilized.

The flow of manpower between different areas and branches of the economy is also a means of increasing productivity. Migration of population within the country and the effective deployment of manpower must be directed that this process should take place harmoniously along with rational changes in the economic structure. Long-distance commuting separating families for longer periods of time must be moderating through changes in regional development. At the same time, however, it is possible to foresee an increase in the number of daily commuters. To overcome problems of short-distance commuting, it is necessary to improve mass transport facilities.

The development of communication which ensures smooth passenger and goods traffic as well as undisturbed information flow among the different parts of the country, is an important national task: it provides the necessary conditions for the evolution of proper social and regional distribution of labour. Moreover, it provides conditions for the realization of a higher standard of socialist way of life.

NARROWING THE GAP BETWEEN TOWN AND COUNTRY

Differences of urban and rural settlements and the problems coming from them are more varied today than earlier. This is largely due to the rapid social and economic growth of the past few decades. Earlier, the distinction between city and village was usually highlighted in the substantial difference between the living conditions of the working class and the peasantry. The majority of peasants is still living in villages. However, the economic structure of these villages and the class structure of rural population have undergone a radical change. Modern large-scale collective farms have become dominant in agriculture and class relations have also altered by the development of cooperative farm peasantry.

Apart from the industrialization of much agricultural activity, the role of industry has grown in villages which is partly due to the development of previously established industrial plants, partly to the emergence of new plants. While only one-quarter of the country's industrial activity is situated in villages, larger proportion of the workers (about 50%) live there, many of them working in urban industry and building construction.

The technical standard of agricultural production--principally linked to the villages--continues to rise rapidly. Up-to-date machinery and material are used, and industrial-type farming activity is rapidly gaining ground. The home environment of agricultural workers has considerably improved, although not at the same rate as their working conditions. The dichotomy between modern work-places and less up-to-date dwelling places may become a source of tension and strain, which, in turn, affects production, slowing down the rate of modernization. This problem occurs particularly among people living in villages and working in towns. Here, the extra burden of commuting which varies in level of convenience according to the distance and quality of transport, adds to the problems of a backward residential area. This is especially evident in the urban agglomeration around Budapest, the capital city, and other industrial centres.

The differences between rural and urban areas condense the socio-economic problems deriving from the diverse conditions and resources of the various settlements. But neither villages nor towns are homogeneous. Difference of large cities and small towns is greater than between the average Hungarian towns and larger industrialized villages. There are some villages having favourable geographic and economic site where average incomes are high and living conditions are good. Alternatively, there are villages where we find most of people living in extremely backward conditions.

URBANIZATION GATHERS MOMENTUM

The increasing prevalence of urbanization running parallel with the development of the forces of production, manifest itself in the social restratification of population, in migration of people from agriculture to industry, from village to the city, in the large-scale growth of old cities and rapid emergence of new towns and in the dominance of an urban way of life.

The improvement and geographical concentration of means of production, plus requirements of the people call for circumspect planning with regard to the development of settlement network. The Government has worked out a long-term development plan which is expected to lead to efficient realization of work involved in settlement development. A hierarchy has been established among settlements to represent their present and future functions and development tendencies have been forecast for the major central places. The final aims of this classification is to satisfy the needs of every Hungarian citizen regardless of where he lives. It should be stressed, however, that these are long-term objectives thus the established hierarchy should remain stable over an extended period to enable settlements to fulfil their role and function.

REGIONAL MOBILITY AS A FACTOR IN SOCIAL MOBILITY

In order to ensure that people can freely choose their work- and dwelling-place, objective conditions should be provided. The regional mobility of the population can only be kept in line with societal interests and economic requirements through rational regional development. A situation in which the location of residence is decisive concerning the access to goods and services--and thereby a portion of state subvention--is not acceptable, it is not justified.

Transport plays a very important role in making social mobility a reality. Only when road and transport services operate efficiently among different regions of the country, among the capital city and provincial areas and settlements, can people choose their dwelling- and work-places freely, and cultural, medical and administration services can be accessed by everyone in this way. Thus, transport has important socio-political functions: it contributes to regional mobility and raises living standard in relatively backward regions to the level of more advanced parts of the country.

Significant differences in living conditions which have developed among various regions have to be reduced to avoid adverse consequences of an administrative control of migration. For example, restrictive measures introduced to decrease in-migration to the capital generated massive influx in surrounding settlements creating serious socio-economic problems.

One possible effective way in decreasing regional and increasing social mobility is the decentralization of intellectual activities. Such efforts should also extend to remedying a situation in which activities involving primarily intellectual work are spatially isolated from the fields of production or which otherwise fail to fit into the regional population pattern. The 1970 resolution of the Political Committee of the HSWP Central Committee established the fact that Hungary's intellectual life was too concentrated in the capital city, that is why economic and cultural growth in the provinces, and the consequent development of a healthy balance throughout the country was difficult to achieve. In order to counterbalance this exaggerated concentration of science and culture in the capital, greater efforts should be made to develop the areas outside the effective radius of Budapest.

The importance of regional development of intellectual life is stressed in the Government resolution on regional planning:

"A more proportionate regional location of intellectual manpower is a problem in regional development for which a solution has yet to be found. The cultural and scientific bases in large cities and in some growth centres should be more vigorously developed. Through locating new branches of existing Budapest institutes in the provinces, through the development of existing research centres and the establishment of new research jobs and places there, we should promote the growth of provincial scientific centres, each with a definite profile of its own. The headquarters of research, planning and educational institutions, administrative organizations and large national companies whose activities are not necessarily linked to the economic and cultural life of the capital, should be gradually moved out of Budapest to regional centres of development."

However, if production moves too far from the company headquarters, scientific research, technical and economic planning, professional training and services which are parts of production and management (e.g. computer centers), it can be detrimental to the economic processes. In other words, it may make for higher costs (input) and lower results (output) which should be considered in decisions on industrial location and cultural administrative decentralization.

NATURAL RESOURCES AND NATIONAL WEALTH

In a socialist society, soil, natural resources both on and below the surface of the land, and all historical remains and monuments in the country are part of the national wealth, property which belongs indivisibly to the people.

They should be used giving primary attention to the interests of the national economy, making them accessible --as much as the requirements and possibilities warrant--to all Hungarians.

The rational utilization of agricultural land is a primary social interest. It is important to ensure the increased protection of arable land, the economic use of tillable areas, increased agricultural utilization of fertile land and the improvement of poor quality soil.

Advantages derived from the diverse quality of land, from regional differences in the productive capacity of agriculture, and from other favourable, local natural conditions, should benefit the whole nation and not exclusively the area where they occur. That is to say, they should not exclusively serve the collectives which make these natural resources socially accessible. Those who live or work in these areas should also share these advantages according to their contribution towards tapping the resources concerned.

Particularly due to the increasing need for raw materials and energy carriers, plus to growing costs of obtaining them, special attention should be devoted to securing more extensive and better organized information on the natural resources of the country and to ensuring their more efficient and economical use. It is particularly important to keep prospecting for domestic fuel resources and to have adequate data on our coal and hydrocarbon deposits.

The role of water is increasing in every branch of the national economy and in every part of the country. Limited amounts of natural water and its unequal distribution call for better water management. For the same reason, growing significance can be attached to the development of regional water systems.

The above suggestions involve a large amount of work which would not be easy to put into practice. In searching for and gaining various minerals, the national economic interests must have consistent priority over regional and departmental interests. Collective interests must continue to hold first place in the course of regional development. A system of taxation and income distribution should be applied which would increase the interest of the collectives and individuals involved in the exploitation of natural resources but thus taxation should also prevent local accumulation of extra profit.

PROTECTION OF THE ENVIRONMENT

The problem of providing adequate protection for the human environment has become increasingly important. Throughout the world, the protection of environment is regarded as a technical task and a social responsibility of first order and this holds even more true for the socialist system which is the society of the future.

Rise of scientific-technical revolution has produced good many unforeseen consequences which--in contrast to earlier phases of economic development--are not just sporadically present in the human environment temporally and spatially, but continue over longer periods in ever growing geographical areas.

Because of her potential features, natural resources, geographical situation, climatic conditions, small size and large density of population, Hungary is particularly depending on environmental hazards. The water of most Hungarian rivers arrives at the borders already polluted. One quarter of the country's area lies below flood level and about one-third of the national wealth is located in these lower areas. Due to dominant winds, the air is constantly threatened by pollution --even from great distances. Wooded areas of Hungary are relatively small and her mineral wealth and other natural resources are modest. Moreover, the ores and fuels mined in this country contain a relatively high percentage of impurities and inert materials.

On account of the relatively high density of population, environmental pollution covering a unit area or river length affects more people than in less densely populated countries with similar conditions. For this reason, Hungary has to pay even greater attention to environmental protection than the countries of similar development which are more favourably situated.

The HSWP Programme Declaration formulated the basic goals of environmental protection in the following terms:

"We will increase protection of nature through cooperation by State bodies, companies and social organisations, and the population at large. We shall set up a system of environmental protection that not only prevents damage, but, in fact, promotes improvement." The realization of this objective is contained by the Human Environment Act, 1976, according to which the work of environmental protection will be incorporated into the fifth five-year plan of Hungarian national economy.

Environmental protection is an integrated system of activities and measures which includes elimination of the causes of pollution, remedying of damage, planned development of the environment, and rational and economic use of natural resources.

As financial resources of the country have also to be considered, the important resort areas are to benefit from effective protection measures, whereas elsewhere the accent is placed on keeping under the present level of contamination or reducing the rate of pollution increase. Priority must be given, however, to directly protecting human life and health.

Environmental protection must activate all levels of society in order to benefit society as a whole and to lay foundations for the future. The fact that work involved in environmental protection cannot be realized through the activity of government organizations alone, is supported by a statement in the Final Act of the Conference for Security and Co-operation in Europe, according to which "...the success of any environmental policy pre-supposes that all population groups and social forces, aware of their responsibilities help to protect and improve environment..."

In accordance with this, Hungarian environmental protection policy rallies all citizens to do something to combat pollution. In this respect, the role of the national and local organisations of the Patriotic People's Front is particularly important.

CONSIDERATION FOR MINORITY INTERESTS

In Hungary, it is the Hungarian ethnic group which makes up the vast majority of the population, and only 4--5% of population belongs to other nationalities. In accordance with the Hungarian Socialist Constitution, it is important that conditions be ensured which guarantee equal rights to minorities in Hungary. Planned regional development is essential for the realization of this policy. The rights of different minority groups can be adequately observed only if the proper subjective, institutional and objective conditions are ensured where minorities live. A merely quantitative equality concerning access to social wealth and benefits is formalistic and does not guarantee real equality for minority groups. As the minority groups are widely scattered and usually inherit backwardness and poor external conditions, extra facilities are needed to ensure genuinely equal conditions for them.

Regardless of the general concentration of the population in urban centres, it would be expedient to move the culture houses, schools and libraries catering for minority groups closer to their homes. When such institutions as these are designed, the actual requirements should be observed, even though meeting these requirements may exceed the 'normal' level of expenditure for the given population size. National customs should be considered when shops are developed, and existing shops should ensure a range of commodities in accordance with the ethnic taste prevalent in the area. The ethnic traditions should also be observed in the architecture of public buildings.

Minority interests should also be present in the regional development of industry. Lack of local jobs induces a change of dwelling place, usually migration to the capital or another industrial centre. This will result in a weakening of national feeling. Efforts were made to pay attention to these considerations in the decentralized development of industry over the last twenty years.

GROWTH OF SOCIALIST DEMOCRACY

The role of county and municipal councils as well as social bodies and of the population at large, is considerable in regional development work particularly in the most efficient use of development funds earmarked for regional and local purposes. There is a good reason why the councils which represent the settlement and the population itself, should play a decisive part in determining local tasks. The councils and other local bodies can explore and tap local resources ensuring that the requirements of the population are quickly and fully met with through efficient economic activity.

The equalization of living standards throughout the nation, one of the fundamental goals of settlement development can never be perfectly realized. So, achieving regional balance in living standards is a continuous, ever-renewing task. Involving the masses in local tasks is also an important way of making a socialist democracy flourish. The management of regional and local affairs and the solution of regional and local tasks creates the area where the masses can actively participate in public affairs.

INTERNATIONAL DIVISION OF LABOUR

Being active in the international division of labour is advantageous for every country and it is vital for small countries which want to develop their economy, improve living standards, keep abreast of the rapid changes taking place in the world, and utilize the advantages of the technological revolution.

The form and contents of international co-operation vary with different socio-political systems. For Hungary, because of her social order, political commitment and geographical position, participating in international division of labour is mainly achieved through the Council of Mutual Economic Assistance (CMEA). International division of labour is primarily effected through foreign trade but direct co-operation in production is steadily increasing.

A good many types of regional division of labour have already developed among the socialist countries. The Hungarian-Soviet alumina-aluminium agreement and the integrated power system — of the CMEA countries, for instance, are good examples of the utilization of different natural resources for the mutual benefit of each partner. The Hungarian-Soviet-Czechoslovak model for co-operation in the chemical industry an agreement responsible for the realization of the olefin programme, shows a technological and regional division of labour among companies showing the way for the future. Also, it is worth studying the instances of production co-operation found in several branches of engineering, for example, the manufacture of component parts by Hungarian companies for Soviet-made cars.

Co-operating in the most practical regional use of manpower is only just beginning among the socialist countries. There are certain other possibilities for mutually advantageous co-operation which have not yet been explored, for example opportunities open for international co-operation in lending temporarily free manpower in certain fields over certain periods; making the best use of local manpower redundancies in the border-zones of one country to fill the need for manpower in the neighbouring country; bridging transitional difficulties by training specialists for which there is a national economic need in a country where such training is better or more open.

In Hungary, border-zone trade and tourism have been traditionally facilitated so as to broaden local choice of goods and create a better supplies system in each country. There are still, however, extensive possibilities left for widening this type of co-operation. Joint production in border-zone areas and use of advantages stemming from the geographical proximity of some plants, although they are in different countries, has shown very small progress in spite of the possibilities inherent in this field. Foreign trade and industrial relations which have developed among various countries as well as joint functioning of transport systems are important factors in the expedient labour division within Hungary but they are still not adequately utilized.

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THE CENTRAL MAP INFORMATION SERVICE

Árpád PAPP-VÁRY

Today 80,000 maps are published a year worldwide, two-thirds of which are thematic maps. The amount of maps published is far outnumbered by that of thematic maps compiled in manuscript. A considerable proportion of published and manuscript thematic maps are prepared for economic and, within this, regional, planning.

Theoretical studies in this area state that the utilization of maps constitutes an integral part of regional planning and the great number of maps used for planning justifies this statement. Towards the end of the sixties, cartographic activity in the field of planning came to be denoted by a special term, planning cartography.

Since 1975, international courses have regularly been organized in Western Europe, thus promoting co-operation between cartographers and planning experts. Up to now the courses have aired the problems of planners and cartographers, promoted a greater interaction of views, and drawn attention to the unelaborated methodology of planning and thematic map interpretation (reading).

Although planning experts agree that maps are necesarry throughout planning, their thematic content, scale and appropriate representation in the various phases are not yet clear and are still under debate.

At the same time, there are also different views on the role and use of maps. Most users and planners only consider and use maps as a means of demonstration.

Let us examine possible solutions to the problems outlined above.

THE CARTOGRAPHICAL DEMANDS OF PLANNERS

Although a methodology of planning is not yet fully outlined, it is possible to state, in the light of international practice, that planners need thematic maps which show actual, spatial structures (natural environment, social life, economic situtation, etc.). They use maps primarily to develop their ideas with regard to regional development and planning. Consequently, these maps can be divided into two major groups, according to their role in regional planning:

1 Status maps;
2 Maps for regional development and planning.

The maps containing status information present, on the one hand the state of natural or transformed (artificial) environment, working from a basis of mapping done in various sciences and data from measuring stations. On the other hand, these maps demonstrate the development stages of the socio-economic environment by presenting statistical data and its spatial distribution. These maps promote better decision with regard to further development.

The following general requirements are needed for status information maps to support the planning process:

(a) The maps should present the necessary data on objects for planning;

(b) The scale system and the representation of maps should focus upon readability and ease of comparison. It has been found better to use only a few scales and representation methods;

(c) The data on maps should refer to the same date or time period;

(d) The interval between the publication of the map and the data survey should be as short as possible.

The range of necessary data for planning is always affected by the purpose and nature of the planning (the size of the area studied, the duration of planning, i.e. if it is a short-, medium- or long-term plan). Within the complex environment of the society, natural and socio-economic phenomena and processes are in close connection, and form various sub-systems which mutually influence one another (for example, eco-, techno- and production-consumption sub-systems). The cartographic presentation of data with diverse natural and socio-economic possibilities and resources presents certain difficulties because map production is a time-consuming process. It is almost impossible to consider the production of maps in great number and the presentation of natural and economic data to demonstrate spatial structures in the process of planning. As map production is time-consuming, most planners only map one decisive factor instead of presenting a wide range of data. Conclusions are drawn after analysis of the object or phenomenon (or several objects and phenomena) considered the determinant. Without due caution and an examination of a wider range of factors which influence the result the result itself may be false.

So that regional planning is able to consider as many factors as possible, maps helping to establish the current situation (the answer to the question, what is happening now?) must be made available to planners, before they start planning. This work ought to be carried out by cartographers and the state cartographic centres.

During planning, despite the most comprehensive map information service, a need for newer data and the inclusion of parameter groups may emerge. Such maps should be prepared simply by the planner himself and used as tools and auxiliary material. In case of efficient central map service, these planner-made maps would only amount to one tenth of all status maps needed.

The planners, in possession of status maps, statistical data and other information, must work out different regional development and planning variants. In other words, the making of maps for planning is an integral part of the planning process, while status maps present information required to establish planning.

Due to the close relationship between the planning process and cartography, so the role of the latter becomes a methodological support in the preparation of maps for planning. According to this view map-making is concerned with:

(a) developing a method of representation which expresses reality most clearly, assisting in the graphical expression of the contents;

(b) making accurate basic maps for planners;

(c) compiling keys which show clearly what already exists or is planned for the near or distant future, and which give an easily readable connection between the thematic planning material and the geographic base map;

(d) developing cheap and fast methods of producing copies of maps needed in small numbers.

THE CENTRAL MAP INFORMATION SERVICE

As stated above, it is advisable to give planners maps representing the spatial distribution of objects and phenomena on the area in question, independently of, and before, the planning process.

The maps should be made by central state cartographic services, working on a state budget. In Europe, this method began, in the case of geologic maps, more than 100 years ago, as since then, the results of geologic surveys have been regularly published in the form of a state-sponsored map series. Climate, soil, land-use and environment pollution maps are also frequently distributed.

Population census maps are the most common examples of maps in surveys of statistical data.

National and regional atlases have tried to present both slowly-changing information on natural environment and rapidly-changing information on socio-economic environment. State administration has also realized that atlases are of great use in the field of planning, as now the majority of national and regional atlases are published with the financial support of planning ministries.

We think that the work of planners would be much helped by a centrally published map series which had is contents and scale adjusted to suit the various levels of regional planning (large area, national, regional small area).

It would be sufficient to publish a map series showing natural factors in periods of 15 to 25 years. Occasionally, of course, it may be necessary to expand the physical-geographic series with additional maps, for example after new surveys and new scientific results.

The maps showing social phenomena contain the results of the population census held every 10 years. The date of their compilation should immediately follow the publication of the statistics.

According to demand we suggest that economic data should also be published in map form, at least every five years.

The suggested form of presentation is an atlas for medium-sized European countries at the national planning level while, for regional or small area planning, a map series would be preferable.

From the suggested methods, the greatest demand is for data supporting national planning. This demand can only be supplied within the required and necessary short period by highly automated map production.

When establishing thematic map systems, the aim should be to present certain parameters on several kinds of maps, so as to increase easy-usage. Besides analytical maps, it would also be practical to present a topic together with other related phenomena on complex maps. At the same time, it is suggested that synthetic (regional and topical) maps are developed through different mathematical methods.

Hungarian cartographers have been concerned with the need for a map system in regional planning for one and a half decades. The idea, outlined above, is clear: the state cartographic services must not only place at the users' disposal the chorographic (cadastral, topographic, geographic) maps, but a national, central thematic map system must also be established on chorographic maps.

The central state pulication of chorographic maps dates back 200 years. A proposal for a central service for thematic maps was first raised a century ago (presumably, Ágoston Tóth was the first in the world to formulate this idea in 1869). The idea was not realized, and it is still original today, due to the multifarious development of thematic cartography, combined with specific disciplines. The demands of economic and regional planning, the technical conditions of rapid map production (which itself requires large investments), the development trends in cartography (its becoming a separate, knowledge communicating science), all make the establishment of a cartographic information service in the near future timely and necessary. Hungarian research and practice, although with small steps, is carrying the development of Hungarian cartograpy in this direction.

SURVEY OF DATA WITH GEOCODES

Population census data are collected from census tracks with a roughly equal number of inhabitants, and also from production units. Then, with this combination, the resulting information is projected onto administrative units. The data taken out of their spatial environment, and which originally referred to spatial points or certain areas, appears as average totals representing larger regional units on thematic maps. Naturally, such statistical data, representing calculated average totals for larger areas, are only suitable for an overall general analysis and an evaluation of large economic (macro-economic) units (macro-geographic method).

When exploring the actual spatial structure and its detailed spatial distribution, however, we must start from the mosaic-like variety of the geographical environment. First, the smallest more or less homogeneous districts and regional units must be determined from various angles, and then -- through analysis and evaluation of the small units -- to determine the peculiarity (individuum) of the larger unit under consideration. This type of research method requires detailed field surveys, special large-scale thematic map surveys and the collected economic data of small areas. In geographic literature, this type of research method is often called micro-geography.

Because of the long research period involved, a generalized physical or economic-geographical profile of the whole country cannot be made through micro-geographic studies. That is why research results from certain minutely researched districts are used for larger regions. With the increase in the size of regions, the error factor in generalization proportionally increases.

We cannot agree with those who regard the two mentioned methods as completely separate saving that, as their reference bases are not the same then there are also theoretical and methodological differences between them. In our opinion, the two methods cannot be separated, as one is necessarily built on the other and they mutually complete each other.

The generally accepted principle for compiling chorographic maps, namely small scale maps derived from large-scale maps by gradual reduction, is not always realized in practice. In addition, at the beginning of national mappings only small scale, overall maps were compiled, and the more detailed, large-scale surveys only began later. In several countries, a gap exists between large scale and small scale maps. The maps with a scale of between 1:4,000 -- 1:5,000 are continuously produced, but the small scale maps do not derived from them, but from a quickly accomplished independent mapping, method, with scales between 1:10,000--1:25,000. Automation in surveying technology and the development of data banks in this field now make it possibile to create map systems from the largest to the smallest scales, correct them continuously, build on them and use them to compile further maps.

The method wich moves from larger to smaller regions is more obviously dominant in thematic cartography. To begin with, in the field of geosciences rather hypothetical maps were produced which used as a basis few, scattered data, using the spatial distribution of the data to cover larger areas, as well. Later on, with an increase in the comprehensiveness of available data and in the results of field-surveys, more detailed, but still general maps were made covering larger regions. Then, parallel to this detailed thematic maps were published covering smaller districts.

Consequently, the history of thematic mapping in geo-sciences indicates that there is no contraction between detailed and general mapping. Hence, in our opinion, there can be no contradiction in economic-geographical (statistical) mapping, either. The apparent contradiction arises from the fact that the reference units in data survey differ in large and small scale economic-geographical thematic mappings. In the former, the units are concrete areas with different features (field, plot, geographical point), while in the latter, they are abstract, homogeneous, enlarged regions. This way, the two sets of reference units cannot be combined. This contrasts with physical geographic mapping, where the units of data survey are identical and spatially determined in all scales.

Realizing the shortcomings of statistical data surveys, several attempts have been made since the first decade of the century to connect the surface data with space, to reduce the data to fit areas of smaller units. This method has mainly been applied in population maps, where the impression of continuous settlement patterns on statistical maps is particularly striking against the concentrated placement of population in settlement units. Triangular, quadratic and hexagonal grids were placed on chorographic maps and the population of each geometric unit in the network was determined by calculation the ratio of the number of farms compared with the area of the settlement covered by the unit.

These experiments reflected the demand for concrete, localized data surveys covering small areas, which were applicable on every scale. This demand was clearly expressed by city planning experts in the fifties. With the establishment of city data banks for city development, square-grid data survey and processing was introduced, a method using several approximately identical squares of sides 200--250 m. Data were assigned to the geographical co-ordinates of the parcels. The introduction of square-grids in data surveys proved to be a particularly laborious method, so it was abandoned. The geographical co-ordinates for centre identification were called simply geocodes. Square-grids are still used to illustrate the combination of data and geocodes, but now a computer automatically compiles the grid from a given point and summarizes the data which falls within the grid and combines with the geocodes. The size of the meshes (grid units) can be changed, depending on the amount of data, by gradually decreasing (or increasing) the square of 1 km.

Establishing co-ordination between the created, parallel data banks (covering population registration, land registration, geological borehole registration, etc.) also demanded the introduction of a uniform identifier in each system. The geocode, recording the surface relief, proved to be the most practical.

In the second half of the seventies, more and more countries changed over to statistical data survey and data processing with geocodes. In Hungary, it was also necessary to change and the government passed a resolution concerning this in 1981.

Of course, the establishment of data survey with geocodes is not the work of a day. Data survey based on the location of vegetation and buildings will still be used in the industrial field and in certain towns. The data survey with geocodes, however, can be introduced gradually in population, communal settlement supply, and agricultural data.

The apparent contradiction between mapping based on field and statistical data surveys and physical- and economic-thematic mapping is cancelled out by the geocode method. Through this methods it will be possible to express concrete, spatially localized facts and data, on any scale, during the mapping of physical and economic phenomena.

At the same time, data survey based on geocodes facilitates the natural establishment of properly detailed map systems, built one on the other, and adjusted to the level of planning.

PROBLEMS OF INTERPRETING (READING) THEMATIC MAPS

The fact that a methodology of thematic map interpretation remains undeveloped is a great disadvantage in the practical utilization of these maps.

The most important methods in the analysis of chorographic maps have developed in the field of cartometry. However, authors of handbooks on thematic maps have not even attempted to write a chapter on map analysis and developments in the field of thematic map analysis. That is why one of the central tasks of cartographic research is to develop a methodology of thematic map analysis ans thematic cartometry.

In developing thematic cartometry, it is possible that the false idea, which regards a thematic map as only an expressive and easily, understood aid, will disappear. A thematic map which reflects reality, is not just a demonstration aid: it is a research device for exploring reality. Thus it follows that maps, like other source material, must be analyzed, studied and interpreted in detail to reach the natural conclusions. Only long, analytic research will disclose the secret of the map and give us the opportunity to acquire new knowledge.

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AUTOMATION OF THEMATIC CARTOGRAPHY IN HUNGARY

István KLINGHAMMER

Within modern cartography, new scientific and technical developments are expected the importance of which cannot be overstimated. The cartographical use of semiotic concepts and the information theory, as well as conclusions concerning the quality and coding of data, the speed of their transmission and their extension and appearance involves the introduction of new theories and ideas. These new approaches are basically important if we wish to solve problems of automation. Just as the change from hand-made maps to printed ones was a vast step forward, so is the advent of automation about to bring a new cartographic revolution.

The cartographic symbol system communicates information spatially as a two-dimensional configuration and not like laguages as a sequence in time, as a process. Exploiting this capacity has resulted in a rapid development of thematic cartography. Thematic cartography must cover such a vast field nowadays that one can only keep abreast of the work by using automation. For this reason it is worthwhile studying the causes of this abrupt development and discussing why thematic maps today represent two-thirds of world map publication.

If we consider that thematic cartography is a synthesis which demonstrates the spatial connections of scientific content, we can give a short answer to the above question: we have realized that graphical representation is very useful in elaborating and transmitting information. Developments within the last 20 years have led to an unhearde of increase in the amount of information which has to be incorporated into thematic mapping. Maps rank and fix detailed results of surveys, observations and studies and are an effective instrument of spatial research in which the geographical arrangement of information serves as a solid and universal frame of reference.

The flood of information also makes the introduction of new methods necessary due to the rapid rate of data obsolescence. In states with a high standard of cartography, for example, the USA and Canada or a few European countries, great efforts are made to automate cartographic activity. The formation of chart content and cartographic construction is the general work of both the specialist in the particular, given field and the cartographer, although the leading role is taken by the cartographer who has geographical, graphical and mathematical knowledge at his disposal.

In thematic cartography, the cartographers tasks are analysing the problem, choosing the form and the method of representation, as well as deciding on a psychologically effective use of colour and composition. The cartographer also prepares the basic data for computer handling. In the foreground of practically orientated developments in cartographic representation, we find practical considerations, that is producing a graphic cartographic representation by the quickest, most economical and easily reproduced means and taking into account the extent of the loss in information. A further task of the cartographer, therefore, is the control and checking of the map production process.

Economic progress and urbanization in Hungary make great claims on geodetical, geographical and, primarily, on thematic cartography. In the fields of planning and economic control, there is now an increasing call for thematic maps which can be used to investigate areal and economic possibilities as well as to plan operations. The working program for the years ahead has two main aimes:

- to run the production of sheets of the new "Uniform National Map System" (EOTR) continuously;
- to develop -- using automation, standardization of thematic map construction and uniformization of representation methods -- atlases which support spatial and sectoral planning and mapping series for environmental protection land use planning and water works.

The most important task in Hungarian cartographic research is to find and develop the actual upward trends in quality, speeding them up and using them in the interest of science as well as for practical and productional interests. The aim of our investigations is to develop a way of semiotically interpreting the representation methods of thematic maps and, based on this, to elaborate automated methods for data collecting, processing and mapping. In addition, it would be important to introduce a uniform cartographic planning code system.

The work design of map construction can only be automated when the phenomena presented on the map are expressible mathematically. On the other hand, however, it is generally easier to automatically compute the special thematics to be fixed on the map than the basic topographic map itself.

Topographic maps give facts, while thematic maps give information on statements and temporarily a digital formulation of those statements is easier to give than to digitalize the surface facts.

In Hungary, automation research began at a time when the initial euphoria and overenthusiasm with regard to information systems and data banks, as well as their categoric rejection in some quarters, had been replaced by a more sober, sound consideration. The first task was to formulate correctly such basic concepts as data, data bank, system objects, sign information and, where it proved necessary, their cartographic definitions. Today, these concepts are correctly and uniformly used by both cartographers and specialists using the maps. Another problem has been whether it is possible to apply the completely different automation concepts starting from the classical rules pertaining to maps intended for occasional use with manual processes something which would open up new vistas in the field of cartography. It is our opinion that this is quite impossible. Thus we have to find new bases for cartography and apply a semiotic and theoretical approach in order to automate thematic map construction. Nevertheless, the automation of cartography and its present development, based on a semiotic and theoretic approach does not signify a negation or rejection of earlier accomplishments. Continuity is as much a factor of cartographic development as it is with all disciplines: the cartographer applies the notions discovered by previous generations, even if those notions are redrafted or built on new foundations.

The processing and graphic representation of information connected with the surface of the earth necessitates the following steps:

- data acquisition and storage;
- fixing the thematic structure and its most significant variables;
- construction of representation methods suitable for the visulization of data.

We have made many investigations and measurements in order to ensure that data processing and storage, as well as the communication of extended calculations and the results, should be economic and rational. The procedure system elaborated on the example of planning cartography, follows the conceptual and methodological order enumerated below:

- Cartographic assessment of the physical, and social space and formulation of its structural and areal types. Establishment of a geographical reference system of data, an information grid connected with the surface of the earth;
- Establishment of rules and conventions for the unification of areal problems and cartographic information;

- Semantic study of computerized data processing and representation, depending on the complexity and frequency of the information needed;
- Preparation of cartograms suitable for production on computer line printers. Calculation and cartographing of diagrams and symbols.

Our investigations are always map-oriented. We have taken care that the system of procedures should be open to further development, instead of being of an abstract closed form. In addition, we kept in sight the practical applicability of the system in Hungary. The essence of establishing automation procedures for thematic cartography is not to create a universal data processing and evaluating system, but to bring about a processing method directed towards map construction. Thus, we assure a balance between the needs of system application and the information gain obtained, in relation to both time and finances.

ESTABLISHING A GEOGRAPHICAL REFERENCE SYSTEM OF DATA CONNECTED TO THE EARTH'S SURFACE, BASED ON THE INFORMATION NETWORK

The traditional statistical system of acquiring data, which works by census tracks makes recognition of areal features and their exact distribution over a territory, very difficult, particularly, if there is a need for making general statements on overall regulatities. This difficulty can only be eliminated by applying a reference system with a relevant data collections which would facilitate the quick comparison of absolute quantities as well as the direct determination of spatial features. The procedure elaborated is the first system in Hungary for the surveyance and comparison of spatial data based on uniform reference units and its introduction assures the spatial linking of planning and sectoral data banks. In elaborating the system, taking the following aspects were taken into account:

- the areal reference units must be well divisible, in that they must be able to be integrated into greater units according to module principles, in order to increase the number of observation points and to be able to form larger units out of the smaller ones as the case may be;
- the area of the reference, units should be easily determined and adaptable for further procedures (e.g. for calculations of a relative values);
- the areal units must be suitable for computer display (e.g. a line printer), so they must be plotted.

The above requirements can best be satisfied by a quadratic reference unit, that is, a quadratic net built upon these requirements. The network of the country consists of squares of 1000 m length (an area of 100 ha); these are further subdivided into 25 squares of 200 m length (an area of 4 ha) in districts around towns, recreation places and areas with intensive farming. In towns, the 200 m squares can be further sub-divided into four squares of 100 m length (an area of 1 ha). The square grid is fixed to the lines of the general national kilometer network (EOTR), since the coordinates of the intersection points of the kilometer network are registered with the central cartographic data-registration authority, in a computerised form. The squares can be pinpointed by the coordinates of the SW corner points. The form of the elements in the quadratic net must be adapted to that of buildings and parcels, yet we must also make efforts to keep to the area they occupy. (In order to facilitate small scale data collection, the limits of census tracks must be adapted to the meshers of the square grid.) The modified limits of the surveyance square are put on maps of 1:5,000 and 1:10,000 scale or on air photograps. To ensure better reviewing the results of surveyance have been transferred onto smaller working maps (of 1:25,000 -- 1:100,000 scale). To spatially identify the areas represented by squares of various colours (tone-values) a smaller detail density is sufficient. The general move to the new method requires accurate and costly preparation work, so that it is not possible to apply the system to the entire country in one step. After fixing the code-number system of the big mesh (1,000 m) national network, data surveyance can be made in mosaic-like areal units. The initial data surveyance can be made in mosaic-like areal units. The initial data surveyance only performed on towns and planning units, can be developed further at a later date.

CARTOGRAPHIC APPLICATION OF FACTOR ANALYSIS

Factor analysis is a procedure which has already been introduced in economic and planning sciences:

The ultimate aim in thematic cartography is to construct a unique complex map which includes all the significant information on the special theme under consideration and the proposed introduction of factor analysis into this field would be a considerable step forward. Besides its usefulness in the processing of the large amounts of data involved in present-day planning economic atlases and maps and in representing the connections between various characteristics, it also aids in the detection of internal data connections as well as in the separation of common tendencies from the mass of data without significant loss. A program has been elaborated through the seventies for the compilation of cartographic works. The procedure is suitable for a factor analysis, in the strict sense of the word, as well as a main component analysis:

- the factor analysis transforms concepts not directly measurable (e.g. the economic development level of regions, urbanization level of settlements) into measurable quantities, thus solving the problem of too

many variables through showing only a few main factors.
- Using the main component analysis, we can form groups and determine how the various groups represent the totality of data.

Using the procedure elaborated in cartography, large and complex data systems can be condensed through a few maps.

THE COMAPO SYSTEM OF PREPARING AREAL CARTOGRAMS AND THE FOTOMASK PROCEDURE

The FOTOMASK procedure, with its high level mechanization, elaborated towards the end of the sixties was the first step towards automation. The advantage of this procedure is that it does not require any new technical equipment and can be introduced in any photo laboratory. The method can be applied to any administrative division (region, county or settlements). The graphic basis of cartograms prepared following this procedure is a grid of points based on the symbol continuity of the surface. A visual comparison of statistical quantities is made from a black and white (density) ratio of the area with a ratio of small black circular areas constituting the grid of points. For the map-user, the value conditions are not given by point dimensions but by the "picture" formed of all the points of equal dimensions in the area involved.

In Hungary, the results of the first line printer experiments were published in 1970, but the first Hungarian procedure suitable for the digital construction of maps is the COMAPO system which gives a flexible automatic representation of planning statistical data. A primary aspect of an areal cartogram produced by computer line printer is that the reference surfaces (administrative units) are continuously filled up by the symbol supply of the line printer as raster points.

In the COMAPO system, we can produce settlement maps with scale ratios of 1:200,000, urban district maps of 1:500,000 and county maps of 1:1,000,000. The three-part system is suitable for a gradual value representation. The starting data is arranged into a fixed number of groups (2--55) and threshold values and group intervals are outlined, using statistical methods (KISHIMOTO's groups). The choice of data intervals for the representation of statistical area is of decisive importance, because the user's given picture of reality is determined by it. The application of statistical/ mathematic methods makes it possibile to objective value limits.

The map is, first of all, a representation of an arrangement in space and not of statistical values. With the COMAPO system, the original statistical values are also printed by the program in the form of tables. To improve the drawing quality of maps produced on the line printer, we applied a photo-reduction of the basic maps. Our experiments have shown that the most practical reduction ratio is 28x36 character/ inch. Therefore, the starting scale ratio should be chosen so that a two-third reduction in scale ratio be possible. To improve the application of the analytic map, we have elaborated two procedures: the transparent overlap system, containing the limits and the identification code number of reference areas, and the background map system, which increases the information content of the cartogram and furnishes additional planimetric elements.

AUTOMATIC COMPUTING OF DIAGRAMS AND THEIR CARTOGRAPHIC PROCESSING WITH THE DIASIG PROGRAM

As a second step in automatic representation, a program system was elaborated to illustrate phenomena suitable for quantitative representation through symbols and diagrams. Numerical values, bound to some point on the surface, refer to a relatively restricted area. Taking as an example settlement network mapping, centres of settlement gravity, or in the case of a small scale ratio, a single point referring to the whole administrative area, stands for the more complex distribution conditions. The choice of the gravity centre is determined by the nature of the study. For a graphic representation of data referring to a particular point, the use of geometrical symbols and diagrams is most practical.

It is the cartographer's job to chose the suitable symbol or diagram type, as well as fixing advantageous scale and symbol dimensions. With of all these parameters, we are still free to some degree and this itself offers various choices. Until now, the cartographer had to make decisions based on experience and small test samples with regard to the variants under consideration. Our program system makes it possible to get a quick oversight of the overall, final picture. The construction, which are carried out quickly with the computing and drawing program, can be immediately revisied and any problems will be highlighted and dealt with. The kind of problems that may occur are, for example. Will small but important, values still be legible when printed?; can the effects of overlapping and oversettling be estimated?; does the scale provide sufficient details?; and what values will be unduly reduced or even lost? Our procedure, based on the computing and drawing program, makes decisions easier and more objective, instead of the subjectivity of the earlier method. The elaborated program provides the map designer with substantial help in producing a true image of locally-bound statistical values or measurements. Using the system, the designer can produce 11 frequently used diagram types. In the framework of the program the following alterations can be made:

- change in diagram type;
- change in diagram scale;

- change in the scale of the cartographic basis.

Under the given conditions, the program fixes the dimensions of the diagram or symbol types chosen and provides them with their cartographic representation, it then prints the results in the form of tables. The descriptiveness of the types chosen, their graphical impression and their conformity to the scale can be estimated via the automatically produced sketch. Within a few minutes, several variants can be computed and drawn.

Thus one can quickly decide on the optimal representation type and construction work is essentially reduced. Finally, the sketch, drawn to a suitable scale by the automatic coordinatograph is transferred to a graphically definitive map. The procedure provides an objective and quick constructional basis to use in the cartographic processing of large amounts of data (for example, a National Atlas).

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QUANTITATIVE MAPPING OF THE FURROWED FORM OF RECENT EROSION

Attila KERÉNYI

ANTECEDENTS

Particularly dynamic research on soil erosion flourished in Hungary during the sixties: L. Ádám, 1964, 1967; T. Duck, 1960, 1969; Z. Fekete, 1966, 1969; L. Góczán, 1967, 1969; B. Kazó, 1966, 1966a; S. Marosi--J. Szilárd, 1969; Z. Pinczés, 1968; P. Stefanovits, 1963, 1964, 1966; and L. Szücs, 1966. One of the greatest achievements of this period was the completion of a global soil-erosion map of the country. Another significant step forward, linked with the above was the further elaboration of common theoretical bases in soil erosion mapping. The essence of the soil erosion mapping method is that the thickness of the eroded segments is compared with the non-eroded segments in a given micro-region, and three degrees of erosion are mapped with limits of between 30 and 70% (weak, medium and strong erosion). A map constructed in this way reflects the result of the centuries-long process of denudation, the present state of soil erosion.

The author's observations on the terrain suggest that the areal intensity of the present processes differs from the state denoted on traditional, erosion maps. This was primarily formulated by registering where erosional furrows, produced at a time of high precipitation, occurred.

To prove the areal heterogenity of furrowed erosion, the regional group of our University Department compiled a map in the Bodrogkeresztur half-basin, to the scale 1:10,000. Mapping was directed by Prof. Zoltán Pinczés (Z. Pinczés--A. Kerényi--K. Marton-Erdős, 1978). Erosion was caused by a downpour of rain (80.6 mm) on 20th -- 25th May, 1976 and the density of furrows was determined on each agriculturally cultivated plot within an area 9 km^2. Then, using this data, the intensity of furrowed erosion was mapped in three grades, and, in two of these grades, the extent of accumulation was also recorded.

Our mapping procedure was semi-quantitative: i.e. the number of furrows did not always accurately reflect the extent of loss in the soil.

THE METHOD OF MAPPING

To obtain more accurate data on the areal differences of furrowed soil erosion and accumulation, a field-survey scale of 1:2,880 was found most suitable.

With the help of five university students, an on the spot survey was completed in the eastern part of the Bodrogkeresztur half-basin in February 1979, following the elaboration and mastering of the common theoretical bases. The following data were measured on the terrain: depth and width of furrows, the approximative shape of their cross-section, and the length and number of furrows. The cross-sectional data was measured in several places: at every 10 m (the closest) and at every 50 m (the farthest). This compromise was possible because the dimensions and shape of the furrows did not change considerably over a certain distance on long, moderately steep slopes. On steeper slopes the changes were often greater over shorter distances, and the same holds true for the place or origin of the furrows. In these cases the number of measuring places was increased.

Working from data gathered on the terrain, the amount of eroded soil was determined by volumetric calculations. The degree of accumulation was also determined in this way, after an accurate registration of the thickness of the newly-deposited soil.

Notes were made on the crops cultivated on the given plots if any (in February). Also registered was whether the grapevines (the predominant crop) were supported with stakes or cordon trained. Records were kept on the method of cultivation (ridging, downslope ploughing, etc.), and the estimated date of the last tillage, which could be established from the compactness of the soil and the amount of weeds.

The angle of slope was measured on each plot, and the data obtained in this way was compared, during processing, with the data of the cadastral slope-category map.

The slope lengths were determined from the cadastral basemaps. Notes were made concerning the influx of water from places of higher relief, as well as the direction of surface run-off.

The dimensions of furrows were also measured on the dirt roads, although it is necessary to point out that only rarely were roads ploughed cross-wise. It was found that previously formed furrows persisted for long, only becoming partially levelled after continuous treading. On cart roads, the ruts are, from the beginning, deeper than the area between them, and furrows in the ruts. There is a greater degree of uncertainty in establishing loss from roads than is the case with cultivated plots, since the depth of fresh ruts is difficult to measure and a certain degree of subjective judgement is inevitable. Therefore, the data on road soil loss is dealt with separately, and is not thought as accurate as the precise conclusions reached in plot soil loss.

The survey on the terrain was performed between February 18th--23rd. The erosional furrows were produced by the rains at the end of January (23rd--25th) and the thaw early in February (2rd--3rd), and then again by rainfall between 12th--15th of February. The quantity and intensity of these furrows together with the data on the precipitation and air and soil temperature, and the conclusions drawn on the state of the soil, are summed up in Table 1. The table is based on observations from the nearest meteorological station (Tarcal).

With the denudational data, two maps were drawn to the original scale of 1:2,880. The maps are found scaled down in the present paper. Fig. 1 shows the direction and intensity of surface run-off, as well as the volume of the eroded soil (m^3). Fig. 2 shows the specific amount of denudation (m^3/ha).

AREAL DIFFERENCES IN FURROWED EROSION

Working from the two maps (Figs. 1 and 2), the most obvious areal differences in the intensity of furrowed erosion can be established.

According to Fig. 1, four areas stand in the highest danger of erosion: the S foreland of Lapis-tető, the S slope of Cigány-hegy, and the W slope and the S slope (along the highroad) of Vár-hegy. According to the specific erosional values (see Fig. 2), roughly the same areas prove to be eroded: however, there is some change in the order of magnitude, and, in many places, the small absolute values cover high specific erosion. It is worth noting that, at the place of maximum absolute denudation -- on the vineyard plots in the Lapis-tető S foreland --, the specific denudation value fell only within the category of medium erosion (5.1--10.0 m^3/ha). If one also considers that denudation takes the form of a very large furrow (in some parts reaching the size of an erosional ditch), with smaller ones forming on dirt roads, one can see that, in this area, erosion does not threaten the soil over a large surface. On the other hand, the danger of ditch formation is greater, which hinders the mass cultivation of grapevines and could easily lead to its total eradication in narrow zones.
On the large-scale vineyard plot N of Vár-hegy, both absolute and specific denudation are of medium extent.

The areas with the highest specific erosion form a mosaic, e.g. on one of the small-size plots on Cigány-hegy (plot No. 1003), soil erosion was as great as 81 m^3/ha, and on the SW

TABLE 1

Data of Precipitation Leading to Denudation and the Meteorological Factors Including Erosion

Temperature of air (°C)						Precipitation (mm)	Form of precipitation	Thickness of snow (cm)	Temperature of soil at 0 cm (°C)				State of soil		
Month	Day	7h	13h	19h	Average			7h	7h	13h	19h	Average	7h	13h	19h
Jan.	22	-4.2	-3.8	-4,0	-4,0			0.2	-1,9	-1.6	-2.1	-1.9	8	8	8
	23	-1.5	0.8	-2.1	-0.9	3.1	rain		-1.6	0.2	-2.0	-1.3	4	4	4
	24	2.0	3.1	0.5	1.9	12.1	rain		1.4	1.8	-0.3	1.2	4	4	4
	25	2.3	3.0	0.7	2.0	0.3	rain		1.0	1.6	-0.2	0.9	2	2	2
	26	0.5	1.2	-0.2	0.5				0.0	0.5	-0.4	0.0	2	2	2
	27	0.4	1.6	1.2	1.1				-0.4	0.9	0.3	0.3	2	2	2
	28	3.7	5.8	4.3	4.6	2.3	rain		1.7	2.3	1.5	1.8	2	2	2
	29	4.2	6.1	2.3	4.2	4.9	sleet		2.1	4.5	1.8	2.8	2	2	2
	30	0.4	0.2	-0.5	0.0	3.5	snow	1.5	0.3	0.5	-1.0	-0.1	8	8	8
	31	-4.0	-0.9	-1.9	-2.3	tr	snow	2.0	-0.1	0.3	-0.1	0.0	8	8	8
Febr.	1	-2.5	1.0	0.1	-0.5			3.0	0.0	0.3	-0.1	0.1	8	8	8
	2	1.6	2.0	1.8	1.8	tr	sleet	2.5	0.1	0.1	0.1	0.1	8	7	7
	3	3.4	3.8	1.9	3.0				0.9	1.2	0.1	0.7	6	6	6
	4	1.8	4.9	2.7	3.1	tr	rain		0.2	1.6	0.4	0.7	4	4	4
	5	1.9	3.8	1.5	2.4	1.3	rain		-0.3	1.2	0.3	0.4	4	2	2
	6	1.8	5.5	1.2	2.8				0.6	2.5	0.4	1.2	2	2	3
	7	-1.6	-0.2	-1.1	1.0				-1.4	-0.3	-1.0	-0.9	3	3	3
	8	-1.0	2.8	0.5	0.8	3.1	snow		-0.8	-0.1	-0.2	-0.4	3	2	2
	9	-0.4	1.8	-0.1	0.4	tr	snow	4.0	0.0	0.8	0.3	0.4	8	7	7
	10	-0.8	1.9	-0.9	0.1	1.4	snow	2.5	-0.2	0.6	0.2	0.2	8	8	8
	11	-0.6	1.5	0.0	0.3	tr	snow	4.0	-0.2	0.4	-0.1	0.0	8	7	7
	12	1.8	4.7	2.1	2.9	5.1	rain		-0.2	4.2	2.1	2.0	4	4	4

13	2.3	5.4	3.4	3.7	1.2	rain	0.4	5.1	3.1	2.9	2	2	2
14	1.2	4.3	3.1	2.9			0.8	5.3	2.6	2.9	2	2	2
15	5.0	8.6	7.3	7.0	5.8	rain	2.2	8.2	6.1	5.5	2	2	2

Key of state of soil:

1 = soil surface moist; 2 = soil surface moist, covered with water; 3 = soil surface frozen; 4 = coating or ice on the soil, excepting snow or thawing snow; 5 = snow or thawing snow (with or without ice) covering less than half of the soil surface; 6 = snow or thawing snow (with or without ice) covering more than half of the soil surface but not the whole; 7 = snow or thawing snow (with or without ice) covering the whole soil surface; 8 = loose, dry powdery snow covers more than half of the soil surface;

tr = trace of precipitation.

Lapis-tető
Vár-hegy
Kovács-tanya
Csirke-árok
Galagonyás-árok
É
0 100 200 300 m
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FIG. 1 Areal distribution of erosion with furrows in the central and eastern parts of the Bodrogkeresztur half-basin, between February 18th--23rd, 1979 (Scale of the original map, 1:2,880).

The arabic numbers are the identification numbers of the plots;
1 = boundary of plot; 2 = intensive surface run-off (thickness of arrow reflects approximately the intensity of run-off); 3 = weak surface run-off; 4 = considerable accumulation (areally delimitable); 5 = sporadic accumulation spots; 6 = boundary of watershed area; 7 = grass-covered ramp; 8 = dirt road; 9 = erosional furrow; 10 = the area of circle proportionate to the volume of soil eroded from the given plot (on the original map 0.25 cm^2 corresponded to 1 m^3); 11 = soil denudation of 0.2 m^3 or less; 12 = no soil denudation; 13 = no measurement on the plot; 14 = pseudo-terrace; 15 = building.

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and N slopes of Vár-hegy (plots No. 145 and 990) 35.2 m^3/ha and 45.71 m^3/ha, respectively.

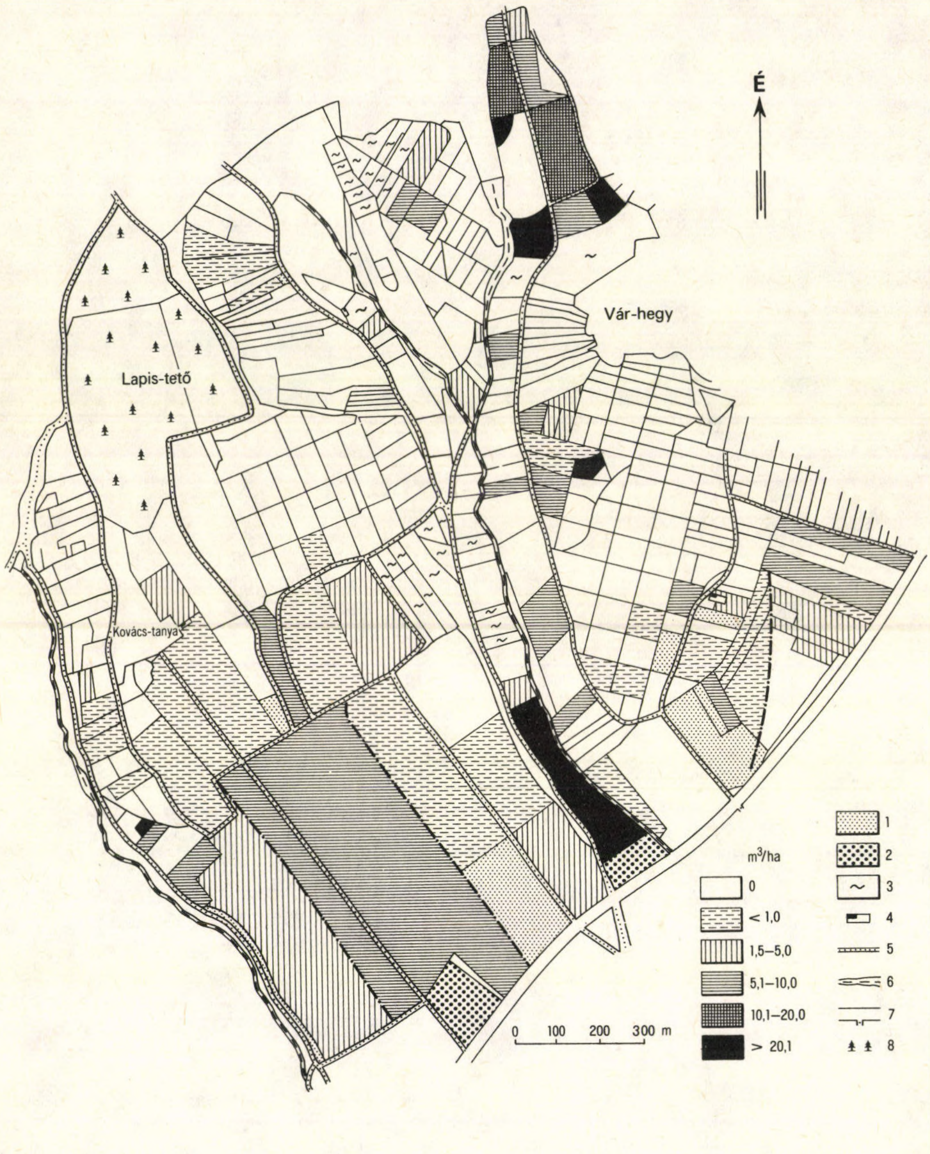
The causes of areal differences were investigated using mathematical-statistical data processing.

MATHEMATICAL DATA PROCESSING

The data obtained during mapping proved suitable for computer processing. As an initial step, the measuring data were ordered in the way shown in Table 2. Soil and cultivation are always qualitative categories which must be encoded for computer processing. The meaning of the code numbers is at the end of the table. In column 8 of Table 2, one can find the volume of soil eroded from the given plot (positive) and the volume of soil accumulated on the plot (negative). Column 8 indicates whether the two opposite processes have occurred on the plot (it so, a positive and negative number exist side by side) or if one of the processes forms an exclusive characteristic of the plot (it so, there is no data in column 8). In the former case, the value in column 6 is obtained by reducing the two component values. The value of the length of slope is not in every case identical with the length of the plot, since, in the case of inflow from a higher terrain, the length of slope was measured from the place where run-off took its origin.

Data from 210 plots were involved in the mathematical processing.

It is necessary to point out that, in the course of covariance analysis, a significant problem emerged. Computer processing was first attempted by encoding three factors. However, with the codes of soil, plant and cultivation, there occurred combinations to which no measurement data had been assigned. To enable the machine to perform the calculation, one of the



É
Lapis-tető
Vár-hegy
Kovács-tanya
m³/ha
0
< 1,0
1,5–5,0
5,1–10,0
10,1–20,0
> 20,1
1
2
3
4
5
6
7
8
0 100 200 300 m

FIG. 2 Specific extent of erosion with furrows (m^3/ha) in the central and eastern parts of the Bodrogkeresztur half-basin between February 18th--23rd, 1979 (Scale of original map, 1:2.880).

1 = low degree of accumulation (lower than 5 m^3/ha); 2 = considerable degree of accumulation (higher than 5 m^3/ha); 3 = no measurement on the plot; 4 = building; 5 = dirt road; 6 = erosional furrow; 7 = highroad; 8 = pine-wood.

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encoded factors had to be dropped, and reduction to two encoded factors was possible due to the close connection between cultivation and the plant. Ridging only occured with stake-supported grapevine, ploughing with cordon-trained grapevine, under germinating wheat, and after autumn deep-ploughing without any plants. The soil-covering capacity of cordon-trained grapevine (3.5 m distance between rows) and that of germinating wheat does not differ considerable from that of plantless soil in February. This was underlined by similar erosional data gathered from identically sloping plots with similar soils. With regard to measurements, it was also possible to establish that the volume of soil eroded from diverse overgrown parts depends more on the method of cultivation than on the insignificant degree of plant overgrowth. For example, in the Vár-hegy foreground, under the same sloping conditions and on an identical type of soil, loss of soil was 11.74 m^3 on germinating wheat ploughed downslope, and 0.01 m^3 on plantless soil ploughed parallel to the contour line.

Plots uncultivated for at least a year were identical to the fallow land, alfalfa fields and weedy vineyards, whose contiguous overgrowth was assured. These are the only plots on which the practical, protective effect of vegetation can be considered; otherwise, the role of vegetation can be neglected. All this made it possible to encode for mathematical processing no more than the method of tillage and type of soil (variant). However, in the evaluation of the results, the fact that the term "soil not cultivated for at least a year" meant complete overgrowth was taken into account. Moderately weedy plots were left out of the evaluation.

There was also a reduction in soil types: the lessivated brown forest soil and Ramann's brown forest soil were contracted into one, due to their almost identical water retention capacity at A_{sz} level. (The contraction of rows was based on measurements performed using the frame- and Vér methods: these proved that there is practically no difference at cultivated levels between the two soil types, tilled and fertilized with manure for centuries.

After this, the contraction covariance analysis was made with five variables (two of them encoded). The mathematical method elaborated by R. Jennrick and P. Sampson and marked P2V 15.2

TABLE 2

Part of the Data Ordered for Covariance Analysis (the original table contains data for 210 plots)

1. No.of plot	2. Soil	3. Method of tillage	4. Angle of slope (degree)	5. Length of slope (m)	6. Denuded soil (m^3)	7. Specific extent of denudation (m^3/ha)	8. Material reaccumulation within the plot (m^3)		9. Denudation from dirt roads (m^3)
157	2	3	3	720	3.0	0.5	3.4	-0.4	
157/A	2	3	3	1100	124.5	5.06			
157/B	3	3	2	150	-139.0	-104.51			
157/C	2	3	2	280	-3.0	-0.81			
159	3	4	2	240	13.75	4.58			
160	3	4	2	300	3.15	0.77	6.6	-3.45	
161/A	3	4	2	300	11.22	7.48	11.52	-0.3	
161/B	3	1	2	300	0	0			8.0
161	3	3	2	300	0.49	0.16	1.09	-0.6	
162/A	4	3	3	250	1.00	0.52	1.1	-0.1	
162	3	2	3	250	0.1	0.04	0.2	-0.1	
163	2	4	5	150	8.5	1.26			3.37
164	1	1	2	20	-3.42	-3.68			12.95
165	1	2	11	310	0	0			
166	1	2	11	130	1.5	1.8	1.8	-0.3	
167	1	2	12	100	0	0			
168	1	2	12	430	0	0			

Key:

Soil: 1 = lessivated brown forest soil; 2 = trenched variant of lessivated brown forest soil; 3 = deluvial sediments of forest soils; 4 = highly eroded stony soils; 4 = highly eroded stony soil;

Tillage: 1 = not tilled for at least a year; 2 = tilled with ridging; 3 = ploughed parallel to the contour lines; 4 = ploughed downslope.

was selected for the calculation from the BMDP program package (Analysis of Variance and Covariance Including Repeated Measures). This method examines the combined effect of the quantitative and qualitative independent variables on the dependent variable.[x] In our case, the qualitative variables are as follows: method of tillage and type (or variant) of soil: the quantitative variables: angle of slope and length of slope: and the dependent variable is the volume of eroded soil.

The data from covariance analysis are presented in Table 3. Using the tail probability values as a basis, it is the possible to make the statements below.

Out of the qualitative independent variables, the type (or variant) of soil significantly affects the volume of eroded soil, whereas the method of cultivation is only significant at the very low probability rate of 0.102. The rate of soil erosion also depends on the interaction between the two.

Out of the two covariants, the tail probability of the slope length is very high: we accept, on the basis of an almost 100% level of reliability, the hypothesis that the length of slope affects denudation. It is interesting that the tail probability of the 1st covariant (angle of slope) is very low. This proves that, in the case of given precipitation conditions, slope length is more significant with regard to the increase in intensity of furrowed erosion than the angle of slope.

With two covariants, it is possible to use the method for further evaluation. For this, we must ensure that, in the application of the method, the following model is matched with the data:

$$E(Y_{ij}) = \mu + \delta_i + \gamma_j + (\delta\gamma)_{ij} + \beta_1(x_{1ij} - \overline{X}_1) + \beta_2(x_{2ij} - \overline{X}_2)$$

where $E(Y_{ij})$ = the expected value of the independent variable;

μ = constant;

δ and γ = qualitative variables;

x_1 and x_2 = 1st and 2 nd covariants;

β_1 and β_2 = constants; and

$\overline{X}_1$ and $\overline{X}_2$ = the corresponding sample averages.

The method can be used to examine the mathematical relations involved actually filtering out the significant covariant (x_2 = length of slope. See estimation of $_1$ and $_2$, Table 3), and taking into consideration the covariance effect. In

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[x] The program was elaborated by Mrs. E. Rutkovszky, KLTE Computer Centre

TABLE 3 Results of covariance analysis

Group	1	2	3	4	5	6	7	8
	NTILL LBF	NTILL TLBF	NTILL DSF	NTILL HES	RIDGE LBF	RIDGE TLBF	RIDGE DSF	RIDGE HES
Frequency	27	6	15	2	38	2	26	6
Covariant 1								
α (^{o})	7.185	7.667	12.200	8.000	7.395	11.000	6.038	13.500
s	3.375	1.366	4.057	1.414	3.753	0.0	4.467	6.189
Covariant 2								
d(m)	93.333	86.667	151.667	340.000	93.684	95.000	123.461	103.333
s	46.513	9.832	117.817	226.274	72.305	91.924	129.389	56.804
Dependent variable								
$V^{+}(m^{3})$	0.303	0.017	0.0	2.200	0.089	1.160	0.298	0.887
s	2.170	0.041	0.0	0.283	0.268	1.075	0.789	0.489
Theoretical means estimated with consideration to covariant effect								
$V^{+}(m^{3})$	1.947	1.855	-2.560	-8.407	1.658	1.689	0.783	0.332

Denomination	Sum of squares	Degree of freedom	Average square
TILL	933.316	3	311.105
SOIL	1413.551	3	471.184
TILL-SOIL	2728.160	9	303.129
COVAR-1	159.124	1	159.124
COVAR-2	5985.730	1	5985.730
COVAR 1-2	5995.441	2	2997.721

NTILL = soil not tilled for at least a year;
RIDGE = tillage with ridging;
PCON = ploughing parallel to the contour lines;
PDSL = ploughing downslope;
TILL = tillage;
LBF = lessivated brown forest soil;
TLBF = Trenched variant of lessivated brown forest soil;
DSF = deluvial sediments of forest soils;
HES = highly eroded stony soil;

9	10	11	12	13	14	15	16	17
PCON LBF	PCON TLBF	PCON DSF	PCON HES	PDSL LBF	PDSL TLBF	PDSL DSF	PDSL HES	Marginal value
18	8	15	1	27	14	3	2	210
5.333	6.500	2.467	6.000	5.185	6.143	2.000	8.000	6.757
2.787	3.505	1.356	0.0	2.450	2.931	0.0	1.414	
79.444	386.250	137.333	50.000	128.148	176.786	280.000	97.500	129.405
32.033	443.007	94.979	0.0	69.727	54.265	34.641	31.820	
0.234	26.237	-12.841	0.0	2.952	11.521	5.613	19.630	1.667
0.670	45.895	36.094	0.0	3.731	8.434	4.867	5.134	
3.056	13.781	-12.066	4.077	3.439	9.376	-0.443	20.849	

Value of F-test	Tail Probability	Beta estimation
2.10	0.102	
3.17	0.025	
2.04	0.037	
1.07	0.302	0.27079
40.33	0.000	0.04877
20.20	0.000	

α = angle of slope;
s = standard deviations;
d = length of slope;
V^+ = volume of denuded soil.

the analysis one row of data denotes the theoretical averages estimated, considering the covariance effect on each cell (Table 3). These values fit the mathematical model due to the effect of the first covariant variable. They highlight the soil protective effect of ridging cultivation, as opposed to tilled areas thickly overgrown with vegetation. Ploughing parallel to the contour lines has no considerable protective role, whereas ploughing downslope may result in the highest extent of denudation. Out of the soil types the most favourable properties are found in the deluvial sediments of forest soils. In several cases, no realistic results were obtained from the estimated theoretical averages. A possible reason may be that there was little data to be found in the cells (e.g. Table 3, columns 4, 12 and 15).

In addition to establishing the general (tendential) regularities, further assumptions can be made with regard to the cell averages which are valid in actual given situations.

From the pedological point of view, it is important to note that most of the soil was eroded from the trenched variant of lessivated brown forest soil and from the highly eroded plots with stony soil (Table 3, columns 4, 6, 10, 14 and 16).

Both soils have bad permeability, but the trenched variant of the lessivated brown forest soil has significant field water storage properties (Vk_{sz} = 26--32% by weight), whereas the highly eroded stony soil contains unfavourable properties in this respect (Vk_{sz} = 6--10% by weight). Thus, the amount of run-off water is considerable, even with low precipitation.

In connection with tillage, one can positively say that ploughing parallel to the contour lines on very long slopes ($\overline{X}$ = 386 m) does not give any protection from soil erosion. This is due to the large amounts of water which run off the trenched lessivated brown forest soil. The denuding effect of a high-waterflow cannot be prevented by agronomical methods, but its development can be averted. In our case, large-scale runoff could have been prevented by deep tillage without turning the soil, prior to planting the grapevines.

On shorter slopes ($\overline{X}$ = 50--80 m), ploughing parallel to the contour line gives good soil protection with slope angles of 5--6°.

The plots ploughed downslope are highly eroded, even with very small (2°) angles of slope (Table 3, column 15).

The best protection against the erosion of soil is provided by the ridging system of cultivation: the amount of eroded soil is fairly small even at 11--13° angles of slope (Table 3, columns 6 and 8).

There was hardly any denudation on untilled plots, which are identical to contiguously overgrown areas. It is very important from a pedological point of view that the water capacity of the highly eroded stony forest soil is so bad that the erosional affect of water running off its surface cannot be prevented, even by contiguous overgrowth by weeds.

Finally, it should be noted that the negative number in column 11 of Table 3 refers to accumulation. Accumulation is not only due to the small angle of slope and the method of ploughing-parallel to the contour lines -- as the causeway of the high road acts as an artificial dike. However, it was not possible to take this into account as a modifying factor with covariance analysis. This, together with the problems previously raised, calls attention to the limitations of mathematical analysis. On the other hand, results based on calculation are more objective, and the statistical data "screen out" most of the extreme assumptions stemming from individual phenomena.

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ECOLOGICAL APPLICATIONS OF LANDSAT IMAGE PROCESSING

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One of the aims of regional environmental research carried out at the Geographical Research Institute of the Hungarian Academy of Sciences, is to assess the physical environment in given territories with regard to their suitability for certain utilization purposes. We assess physical environment from a data basis covering climate, ground water, topography and soil properties. Data processing was done with the purpose of outlining areal units with the best environmental resources for major cultivated crops (wheat, sunflower, maize, sugarbeet and lucerne). The spatial distribution of these units also defines types of agricultural sites. However, it is not enough to simply determine sites with environmental resources which meet the needs of, for example wheat. We must also know whether the local farm grows the right crop (e.g. wheat) on the site in question. So we have to compare the computer-made ecological suitability map with cultivation pattern maps covering a period of 3--4 years from all the farms. This way we get a general view of the degree to which the agro-ecological potential of a given area has been "exploited".

The manual construction of cultivation pattern maps covering all the farms in a county (several thousand square kilometers) would be a time-consuming and expensive task to perform every year. For this reason available LANDSAT data are used instead as a tool in the compilation of cultivation pattern (and land cover) maps of investigated areas. The annual LANDSAT digital land cover maps--which can be constructed relatively quickly --are appropriate for comparison with agro-ecological potential maps, as the image has a resolution of about half a hectare, while agro-ecological potential maps cover one hectare. Also, the classified LANDSAT image, with an average of 80 per cent reliability, is about as precise as the small scale map generalization of large scale cultivation pattern maps. On the arable plains of Hungary is the large agricultural land of state and co-operative farms, so the LANDSAT pattern

FIG. 1 The geographical situtation of processed LANDSAT image parts A, B and C

methods ensure relatively good results, despite the use of Hungarian developed computers (R-10 and TPA-11-40) and image processing and display systems which are not too up-to-date.

The above method was used in an <u>environmental assessment</u> of <u>agricultural sites in Komárom county</u>, in the Northern part of Transdanubia, Hungary (see part A in Fig. 1). Its territory -- 2,250 km^2 -- is mainly an agricultural plain along the Danube. We chose sites from empirical ground information for every land cover class we wanted to represent on the cultivation pattern and land use LANDSAT maps.

Class	Number of Training Sites	Colour Code
wheat and barley	5	yellow
maize	4	light green
sugarbeet and/or small private gardens	2	orange
reed	2	light blue
meadow, field, pasture and clover	2	red
lucerne	2	light grey
sunflower	2	purple
vineyard	1	pink
flax	1	grey
orchards, gardens, villages, fruit-gardens	3	brown
industrial areas	2	black
could-cover	-	white
forest	3	dark green
water	1	blue

The Bayes classification program calculated average intensities, standard deviations and correlation coefficient matrices of the site in each of the 4 spectral bands. Then, according to the most probable possibility principle, the program classified each site from the analyzed part of the image into the above-listed 14 classes. The output was displayed by a TV monitor and digital colour plotter. The original scale was 1:50,000. Wheat, maize and water surfaces were classified with the best results (over 80 per cent reliability). Settlements, forests, flax and vineyard were also well recognized (about 70 per cent accuracy). Pastures, fields and lucerne were recognized less accurately (50 per cent reliability). The worst result came from sugarbeet, sunflower and reed (only 20 per cent accuracy). Sugarbeet and sunflower do not cover the surface fully in June and, owing to the soil's reflection, these croplands cannot be precisely recognized in the image. In future, we plan to use multitemporal processings, so as to increase the reliability of LANDSAT land cover maps.

By comparing the agro-ecological potential map with the annual LANDSAT land cover maps, it is possible for us to "control" the cultivation patterns of farms.

The first experimental digital processing of a LANDSAT image was made in Hungary in 1980. Its aim was to make a land cover map of an urban area. Urban areas are changing fast: the ratio between built-up areas and parks changes from year to year. It is difficult, however, to trace the recent changes on maps. Satellite images make it possible to obtain maps showing the most recent changes in settlement structure and they also show the effect built-up areas have on the physical environs of settlements.

In the first processing, a LANDSAT image acquired on 1st April, 1976 was used. Using selected sites and the Bayes categorizing method, a part of Budapest administrative area (part B in Fig. 1) was classified into the following categories:

Class	Number of Training Sites	Colour Code
water surface	1	blue
commercial and residental built-up areas	2	red
industrial areas and transportation	4	purple
modern residental territories (blocks of flats)	3	brown
garden suburbs	2	pink
orchards, weekend houses and recreational areas	2	orange
improved open space (parks, sport fields, cemeteries)	2	green
forest land	2	bright green
pastures and agricultural land	2	light green
cropland and barren land	2	yellow
unidentified areas	-	white

Owing to the date of the image (early spring with little vegetational cover), the output (a colour plotted map with a scale of 1:100,000) is fairly reliable (about 80 per cent), except for pastures and croplands, which have a low degree of accuracy (about 30 per cent).

Such multi-temporal satellite maps of urban land use, obtained every second or third year, may contribute significantly to the study of ecological changes caused, or being caused, by urbanisation.

In this decade, a significant hydrological construction project will be put under construction. Along the Czechoslovakian-Hungarian border, the Danube channel system is to be changed (new canal, water power plant, and reservoir). This large scale work will effect the physical environment. A number of research institutes have made prognoses for these different effects. One means of controlling and monitoring ecological states and changes is through satellite image interpretation. With the help of these images the extensions of certain land cover types can be regularly mapped.

In 1982, we completed an experiment in which we made a land use map (scale 1:50,000) of the state of the Szigetköz area in 1981. Szigetköz is a food plain along the Danube in the northern part of Transdanubia, on the Hungarian Plain. (part C in Fig. 1). We classified the following land use categories, using a LANDSAT image acquired on 13th June, 1981:

Class	Number of Training Sites	Colour Code
water	10	dark blue
reed	6	light blue
meadow, pasture	7	yellow
gardens, villages	5	brown
towns, dense built-up areas	3	red
forest	11	green
cropland and others	-	white

As we did not have training sites for every land cover type (the cropland types), the Bayes classification method could not be applied. From the intensity statistics of the sites, we established the lowest and uppermost intensity limits in the 4 bands, before applying them to the 7 land use categories, that is to say, we applied the so-called BOX method to classify the LANDSAT image. The best recognized categories were forest land and water. There were errors in the accurate recognition of gardens, pastures and croplands, but still, the changing nature of village boundaries (due to the building of weekend houses) is apparent when one compares the LANDSAT land use map to topographic maps constructed more than a decade ago (in 1971). Also, the changes in forested areas are significant in the LANDSAT image.

In future, it will be worth applying satellite images to monitor the areal extension of urban land use or various land cover types and to detect any sudden changes.

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AN AUTOMATED ASSESSMENT OF ENVIRONMENTAL QUALITIES. ASSESSING CROP CULTIVATION

Dénes LÓCZY and István TÓZSA

It is not necessary to argue at length that the exploitation of potential qualities in the physical environment is of major importance in Hungarian agriculture. Apart from meeting the requirements of the internal population, foreign trade interests also motivate the quantitative and qualitative development of agricultural production. For these reasons the far-reaching consequences of interventions which occur during the use of the environment should be considered, and this is only feasible within a framework of environmental management which is founded on reliable information. Environmental management is not purely a matter of economics, since a mere cost-benefit analysis would not detect the long-term impact produced by human interventions. The planning of crop cultivation, an agricultural branch with the closest connections with the physical environment, demands an analysis of the environment and a close monitoring of changes over a period of time.

Agricultural land occupies nearly 70% of the area of Hungary and any land-use decision necessitates a knowledge of the quality of land in question. With an inventory of environmental factors which is continuously updated, it would be possible to avoid using precious agricultural land for new roads, industrial plants, open cast mines or even recreation.

PRINCIPLES OF AGRO-ECOLOGICAL EVALUATION

The assessment of the physical environment is concerned with the degree to which ecological demands of the major field crops are satisfied with further branches of cultivation (vineyards, orchards, meadows and pastures, etc.) included, a fuller picture can be obtained covering all the natural potentials of crop growing.

Our method was founded on the following assumptions:

1. Although the ecological requirements of field crops are generally similar, differences may also be significant, for example, there are crops which are especially sensitive to temperature. Moreover, within each category, preferences for warmer or cooler, humid or arid, conditions during certain phenophases vary. The ecological requirements with regard to individual soil properties (cohesion, soil reaction etc.) are also highly variable.

2. Parameters describing the detailed ecological requirements of cultivated crops can be found in agronomic literature or through consultation with experts in the field.

3. In theory, areas of average fertility are assumed to exist where environmental factors are favourable for crop production at the level average for Hungary. Land capability in other areas can be related to these standards, in order to highlight regional contrasts.

4. Large agricultural farms need detailed regional data in order to plan cultivation patterns. The data base in our assessment is so plentiful that any processing method, other than computer, is just not feasible. In addition the evaluation technique is automated.

It is hoped, on developing the method, that agricultural farms will make use of the results of our research.

METHOD

The steps in the procedure of land capability analysis for crop cultivation are as follows (D. Lóczy, 1982):

1. First, an evaluation goal has to be specified, since the diverse environmental states can be estimated with a view to their possible economic utilization. The goal has to be restricted, however, until the positive and negative effects of the individual parameters can be determined without ambiguity. In our assessment we were concerned with crop growing possibilities and considered the following crops: winter wheat (with 26.8% of the harvested area in 1980) maize (with 26.4%) lucerne (with 8.1%) sunflowers (with 5.8%) and sugar-beet (with 2.2%).

They represent grain, fodder and industrial crops. An alternative method would be to investigate the ecologically suitable crop from a group of similar utilization.

2. The next stage was to compile the field data necessary for the evaluation. The general nature of the agricultural landscape is outlined through some well-chosen relief parameters (slope categories, exposure, perhaps slope length and horizontal dissection as well). Climate is

described synthetically, with the indicator of climatic macro-region delimited by solar radiation values and the thermal and water supply indices for the growing season. Within the genetic soil types, further differentiation is made through some agro-ecologically significant properties. The environmental factors considered, and their combinations (intended to reflect actual interactions), are shown in Table 1.

TABLE 1 Environmental Factors in the Assessment Data Base with Regard to Crop Cultivation

I Relief

1. Slope (angle category and exposure, 12 categories)

II Climate

2. Climatic region (35 regions)

3--10. Thermal conditions in the various months (from March to October)

11--17. Monthly climatic water levels, as related to the individual crops, including the major soil texture classes.

III Soils

18. Genetic soil type, humus content and depth of humic layer

19. Parent material and depth of origin

20. Soil texture class

21. Minimum depth of groundwater (compared with Arany's cohesion index)

22. Lime conditions and soil reaction of the top 30 cm.

3. When the factors are compiled, the data base has to be prepared for computer processing. Only the square grid storage and retrieval system can be used, as the processing system must relate the environmental state to comparable regions units. Each unit of the grid is given a code for the given factor. A well-chosen square grid gives a matrix which satisfactorily reflects the spatial distribution of the variable, although it is not suitable for exact measurements of the area (Fig. 1)

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0 0 0 0 4 4 4 4 4 4 4 4 3 3 3 1 3 4 4 4 1 4 4 4 4
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0 0 0 0 4 4 4 4 4 4 3 4 3 4 4 3 3 1 3 4 1 4 2 4 1
0 0 0 4 4 4 2 4 4 4 3 4 2 2 4 4 1 3 3 3 4 4 2 2 1
0 4 4 4 4 4 4 4 4 4 1 4 1 2 4 5 1 4 3 3 4 4 4 3 1
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4 4 4 4 4 4 4 4 3 4 4 2 2 4 1 3 3 4 6 4 6 7 7 7 4
4 4 4 4 4 4 4 4 4 4 4 4 2 4 1 3 3 3 3 4 4 4 7 7 7
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4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 3 3 3 3 3 3 7 7
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 3 3 4 7 7 7 7
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FIG. 1 Coded "map" of soil texture classes (Factor 20) in the data base (for the Mocsa test area)

TABLE 2 Coding Table for Soil Classes (Factor 20)

Code	Soil texture class
1	Sand
2	Loamy sand
3	Sandy loam
4	Loam
5	Clayey loam
6	Loamy clay
7	Clay

Code	Soil texture class
8	Peat
9	Stony (25--50% rock fragments)
10	Very stony (over 50% rock fragments)

The computerized data base can be visualized as a series of data matrices superimposed on top of one another. Partial environmental maps can be printed from the data base for special purposes (e.g. for regionalization).

4. The area investigated is evaluated with the help of "suitability indicators". Until now, the data base has not involved any kind of preliminary evaluation. This part, then, is the "supply" side of environment utilization. The "suitability indicators" are statements about the environment categorizing environmental conditions into the quality grades of excellent, favourable, neutral, restrictive, highly restrictive and unsuitable. The indicators are listed in a table where one can see the degree to which coded conditions are suitable when set against the requirements formulated in the evaluation goal (Table 3).

TABLE 3 Suitability Indicators for the Cultivation of Winter Wheat (example: groundwater)

Factor	Suitability indicators:[x] excellent	favourable	restrictive	highly restrictive	unsuitable
21	17, 25, 32, 33,	10, 18, 19, 26, 31, 34, 39, 41,	12, 20, 30, 38,	13, 21, 37, 44,	1, 6--8, 14, 15, 22, 28, 29, 36, 43,

[x] other environmental conditions are regarded of medium quality.

The number of suitability grades can be increased according to the requirement list of each plant. In this case, the data available made it possible to apply the above six-grade classification.

In tables of "suitability indicators", weighted factors (mainly complex ones, such as climatic region ad genetic soil type) must be indicated in the computer evaluation. The weighted factors are assumed to hold more significance in the total environment than the others.

5. Now it is necessary mathematically compile an evaluation algorithm, i.e. to formulate a mathematical process in which the coded values in the data base are compared to the coded values in the table of "suitability indicators". The the partial scores are summarized and, through categorization, the program arranges the given areal units on a scale from 0 to 9. This scale is used in other methods when assessing environmental quality and was elaborated by the Geographical Research Institute, Hungarian Academy of Sciences (L. Góczán et al. 1979). Given the goal of evaluation 0 denotes the least suitable and 9 the most suitable areas in Hungary. The intermediate grades indicate that the higher rank score represents an area of more potential than the one a degree lower.

6. "Maps" of integrated environmental potential for the crops are "drawn" automatically by the plotter. The figures or coloured squares are devised so that they can be arranged in a matrix of the desired scale. Numerical figures facilitate the mathematical, and colouring the visual, interpretation.

7. The evaluation used a scale of 1:10,000 which enabled us to analyze the suitability of individual large-scale farm fields for crop cultivation. The mosaic-like character of the "map" was helpful in the statistical processing of the one-hectare squares. An order of preference was established between the major field crops and this can be used when planning rotation patterns (Fig. 2).

Application in Test Areas

Two areas in Komárom county were selected to test our method. Both belong to the physical region of the Komárom--Esztergom plain. They are rolling lowland areas with a warm, moderately dry, continental climate and chernozem soils derived from a parent material of fine sand.

The results given by the method show a higher ranked score for major field crops (remarkably so in the case of winter wheat), in fact more than the national average. The high range of scores for sugar-beet reflects this crop's high ecological sensitivity.

The results were experimentally compared with other research findings an assessment of agricultural potential (L. Csete, 1973); a map in the series on soil utilization in Hungary (G. Géczy, 1957--68); and a map on agricultural site quality (L. Góczán et al., 1969). Comparison with the crop yield gives only limited information, since yields are influenced by several factors outside those which are natural.

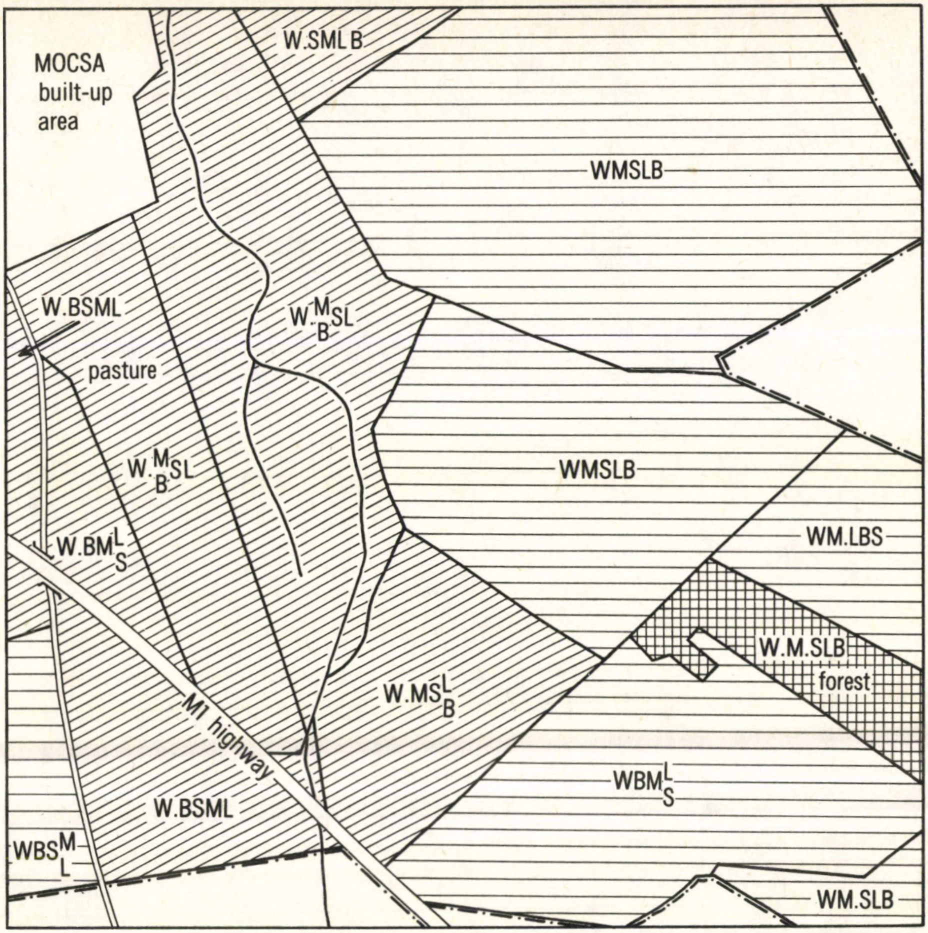

FIG 2 Land capability map with orders of crop preferences for the Mocsa test area

W = winter wheat; M = maize; L = lucerne; S = sunflower; B = sugar-beet.

<u>The Specific Features of the Method:</u>

1. The evaluation has a well-defined goal.
2. The parameters used are unambiguous and mostly measured.
3. Repeated use of the data base is possible and it can be extended over the whole area of Hungary.
4. The factors can be weighted according to their significance.
5. The assessment procedure in itself is fully automated, although the acquisition of data is not.

Although the initial results have been promising, further development and application of the method in additional areas is necessary, in order to prove its usefulness.

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COMPUTERIZED ASSESSMENT OF TOURISTIC POTENTIAL

Katalin MOLNÁR and István TÓZSA

Assessing the integrated system of geographical environment[x] from a practical (e.g. cultivational) point of view is one of the principal tasks of the Geographical Research Institute. After assessment, suggestions are made which should promote the optimal utilization of environmental resources. The computerized method for assessing the touristic resources of an environment is presented below.

INTRODUCTION

The special requirements needed for tourism, holiday-making and recreation are provided, or restricted, by the condition, quality or interaction of physical and socio-economic environmental factors, which vary from region to region. In our particular method, we have a computer programme which is used to classify small areal units of a larger area according to their degree of suitability for special touristic utilization. The area of study is evaluated from the viewpoint of its special, as opposed to its general, recreational features, e.g. which sites would be best as winter sport's centres, hiking areas, artistic colonies, riding schools, pioneer camps, sanatoriums, water resorts or camping sites. Many such places are established without due consideration of all the important physical or socio-economic environmental factors. Therefore, adverse conditions are sometimes recognized when it is too late, e.g. wind blowing smoke from a factory in the derection of the rest-house, horse stables polluting the spring water, and no food shop, parking places, restaurant or electricity in the vicinity.

x Geographical environment is composed of (1) physical, (2) anthropogenous (altered physical), (3) socio-economic and (4) political cultural environments (M. Pécsi 1979).

METHOD

To prevent misguided decisions and help in the choice of the best from among the available possibilities, the computer classifies the analysed area into one hectare units with categories from 0 to 9. Each category denotes the suitability of the units for special, given recreational developments and, using this method, one can obtain the desired information remarkably quickly. In this way it is not only possible to outline the places with the best environmental resources, but one can also immediately decide which recreational type the given area is most suited for.

During this survey, we do not recommend the establishment of hostelling and supply facilities: on the contrary, working from the existent hostelling and supply facilities, we decide which sites are the most favourable among the one hectare units.

In the assessment, we use code numbers for the following 16 factors to quality possible environmental interactions and conditions: degree of slope; exposure of slope; altitude above sea level; water supply; total hours of sunshine per year; number of clouded days per year; number of snow-covered days per year; natural and agricultural vegetation and land use; characteristic animal species; attractive natural resources; touristic, medical and recreational possibilities; cultural and sporting facilities; public transport facilities; accomodation and services; water and sewer system, electricity network and environmental pollution. This code number collection is the data bank.

We cover the 1:10,000 map of the studied are with a square grid, the size of the squares being 1 x 1 cm -- representative of one hectare. Then, with the help of topographic and climatic maps, statistical data, estimates and a local expert's knowledge, we fill in the square grid with representative code numbers from the data bank. These numbers represent the dominant state of the environmental factor of interaction in each unit, this process is repeated for each factor, i.e. 16 times. The 16 digitized maps, converted into matrices, are the input for the computer, forming the data basis of the studied area.

Next, we decide the special recreational purpose behind our assessment of the area. To this end, we define those conditions and interactions of environmental factors which are indispensable (these code numbers -- if they occur -- are 4 times positively weighted); needed (these -- if any -- are 2 times positively weighted); favourable (these are taken into account); restrictive (these are negatively weighted); very restrictive (these are 2 times negatively weighted) and unsuitable (these signs are 16 times negatively weighted).

A qualifying program compares the code numbers of the data basis with the suitable indicators listed above. It takes into account the weightings for each indicator, and, depending on the results, assigns the territorial units ranged scores from 0 to 9. In order to facilitate visual interpretation, the output matrix of numerical figures can be transformed

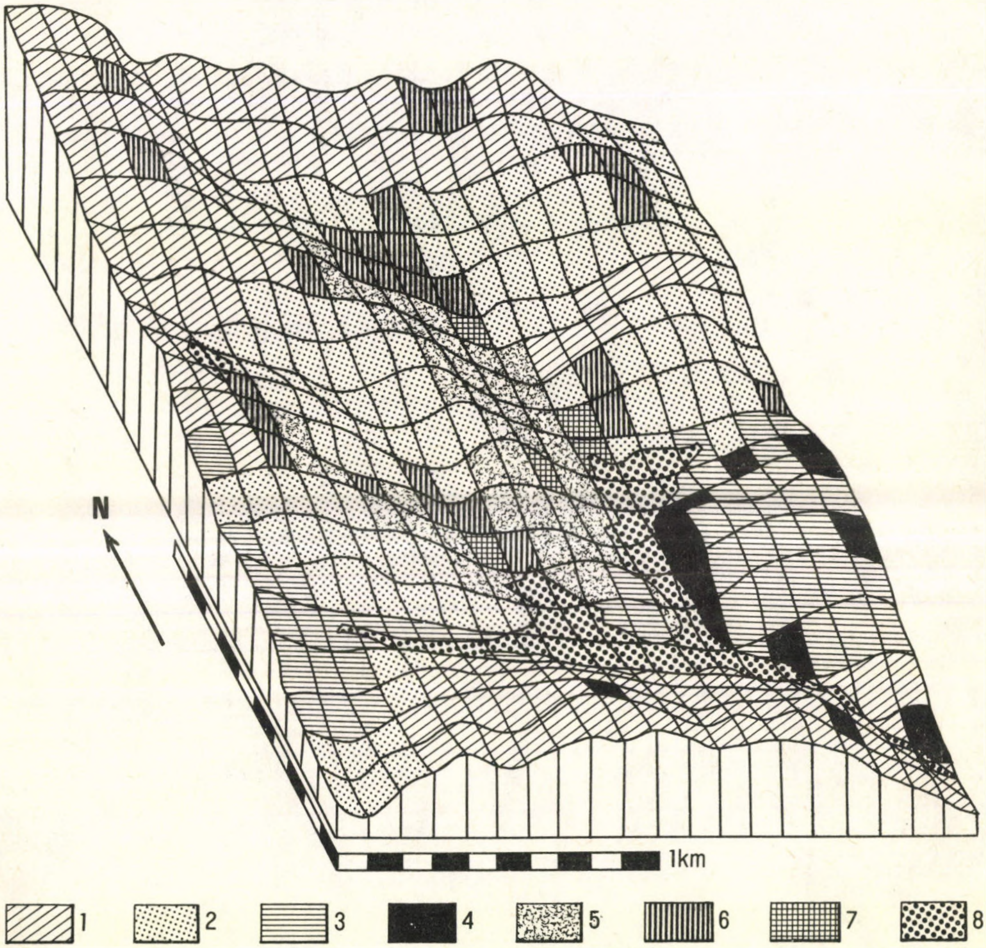

FIG. 1 Digital axonometric diagram of the model area. A sketch of land use

1 = birch; 2 = oak; 3 = mixed birch; 4 = rocky forested terrain; 5 = cropland; 6 = pasture; 7 = meadow; 8 = settlement, gardens.

into a plotted colour mosaic. This is the assessment "map" of the area from a special touristic angle. As the computer's input includes the data on the area's height above sea level, it is also possible to print an axonometric landscape, with the colour mosaic representing the results of the assessment (Fig.s 1 and 2).

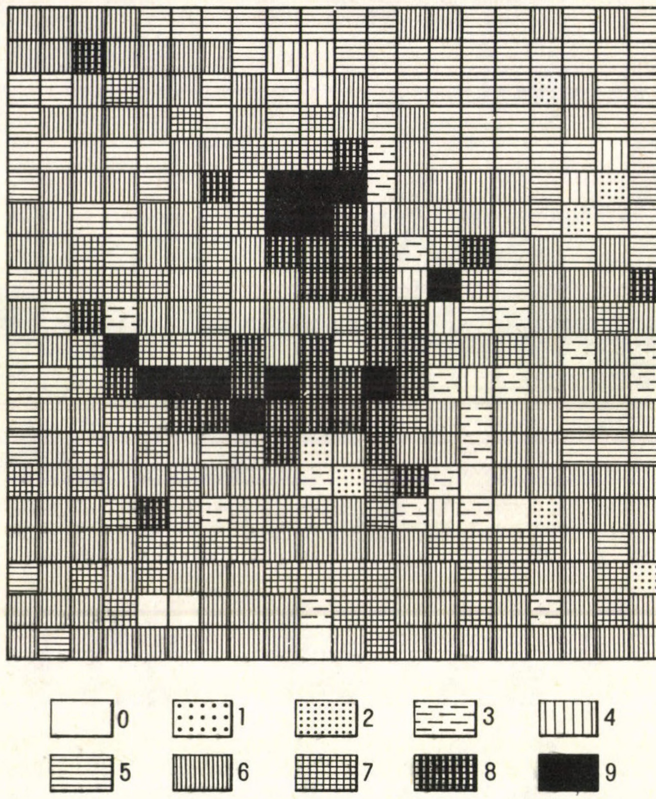

FIG. 2 A computerized assessment map of the Répáshuta model area with regard to developing a winter sport's centre

Suitability grades for the areal units:
0 = unsuitable; 1 = highly restrictive; 2 = restrictive; 3 = neutral; 4 = adequate; 5 = satisfactory; 6 = good; 7 = favourable; 8 = very favourable; 9 = excellent.

DATA BANK

Coded conditions and/or interactions of the main environmental factors from a recreational/touristic viewpoint in the Hungarian hilly regions (related to the areal units):

I Physical Factors
Topography:

1. Slope angle;
2. Slope exposure;
3. Height above sea level.

Water:
4. Ground-, karst- and geo-thermal water supply.

Climate:
5. Annual hours of sunshine;
6. Annual number of clouded days;
7. Annual amount of snow-fall.

Vegetation:
8. Natural and agricultural vegetation as well as the ratio of built-up areas.

Fauna:
9. Occurrence of native animal species.

II Aesthetic and Socio-Economic Factors

10. Attractive natural resources (e.g. stream, caves, waterfall, national park) on the spot, or within 1 km;
11. Touristic, medical and recreational possibilities on the spot, or within 1 to 5 kms;
12. Cultural and sporting institutions or opportunities on the spot, or within 1 to 5 kms;
13. Public transport on the spot, or within 1 to 5 kms;
14. Accommodation and services on the spot, or whithin 1 to 5 kms;
15. Water sewer and electricity networks;
16. Environmental pollution (e.g. refuse disposal sites, air and water pollution).

MODEL AREA

To show the application of this method, we chose a 4 km^2 area in the Bükk Mountains in Northern Hungary, around a village called Répáshuta. The small village is situated below the southern edge of the Bükk Plateau in a valley, and it has a population of 640. On the slopes around the village -- which have skeletal soils of very low fertility -- the fields are out of agricultural use, the population is employed in forestry. The management of the Bükk National Park has forbidden the building of weekend houses in the environs of Répáshuta. This does not mean, however, that the so far unexploited natural resources "hidden" around the village should not be revealed and utilized.

A comprehensive study could outline the most favourable attributes of particular touristic potential offered by the environs of Répáshuta. It should also decide which would have the least effect on the protected natural environment, and which could be realized with the least outlay. This area -- though rich in natural attractions -- is totally unexploited from a holiday viewpoint, so it seems to be a good site on which to perform this computer analysis.

As a first step, we have to compile the data basis of the model area: we cover the topographic map of the model area with a one hectare unit square grid and write in the appropriate code numbers from the data bank on every square. The codes represent the dominating or characteristic conditions or qualities of the environment in each square (areal unit). The scale of the map is 1:10,000. Thus, we obtain 16 coded square grids which from the input for the computer. From this data collection, the assessing program, can assess our 400 one hectare units, finding out each unit's particular recreational capacities in a very short time. With regard to Répáshuta, suitability assessment could be made for any of the following projects:

- a winter sport's centre,
- a horse riding school,
- a resort,
- a sanatorium,
- a pioneer camp,
- a camping site,
- a motel or tourist house,
- a hunters' house,
- a colony of artists,
- and an excursion centre.

SUITABILITY INDICATORS

Our Répáshuta data basis (the input) contains the environmental conditions or interactions represented by code numbers from the data bank. The next step is to choose the suitability indicators, using the data bank code numbers again. As an initial experiment, we want to assess Répáshuta's environmental resources with regard to establishing a winter sport's centre. We therefore have to collect the code numbers indicating optimal environmental conditions for establishing a winter sport's centre as follows:

1. Among the natural resources, we have to have adequately steep and long slopes or valleys. It is better if they are facing north and are not forested. We should have a high number of snow-covered days in the area and a relatively high position above sea level. It is also best to have some other natural attractions (like a look-out place or unpolluted environment).
We must also enumerate the codes indicating those conditions which restrict or render impossible the establishment of a winter sport's centre (for skiing and sleighing) on an areal unit, e.g. slopes facing south or a flat territory, built-up

areas or water surfaces.

2. Among the socio-economic factors we must know (and code) the existent hostels and the supply capacity of the area, services and accommodation, and infrastructure.

We then weigh these suitability indicator codes according to their significance with regard to establishing a winter sport's centre, as descibed earlier.

ASSESSMENT

The weighted suitability indicator codes provided 32 points for the areal unit/s/ with relatively good resources for establishing a winter sport's centre. Considering only the units with scores above 30, we can detect two major sites (slopes), indicated by number 9 (Fig. 2): one is 5 hectares in size, while the other is 7 hectares. They are both north from the village on slopes facing eastwards. The length of the slopes varies from 400 to 600 metres, and there is no forestry or uneven rocky surfaces on them. The village -- with its unfortunately small capacity for services (water, electricity, road, post office and food shop) -- is not far away.

It is, of course, a very simple task to choose these sites without any computer program. It is worth noting, however, that we assessed the model area from the angle of a winter sport's centre first of all, so as to "control" the computer output. The same territory can be assessed with the same data basis to gauge its resources for various other touristic purposes. And, thus, we can take into consideration only what is "best" in deciding the most favourable way of utilizing the area.

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Geographical Essays in Hungary
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APPLICATION OF PATH ANALYSIS IN REGIONAL STUDIES

Tamás T. SIKOS

Path analysis was first used by S. Wright in 1920. It was he who first revealed the genetic structure of population using this method in 1951. In the 1950's, the method began to be used to solve social problems, mainly sociological ones. The use of this technique on a wider scale, however, only started in the 1960's.

The most important disciples of the method through this period were as follows: A. Lughod and M. Foley (1960), P.A. Morgan (1961), O.D. Duncan (1963, 1966), H.M. Blalock (1963, 1964), M. Murphy (1964), C. Pelz and V.M. Andrews (1964), C. Turner (1964), A.Z. Harris (1966), E. Mueller (1967), J.M. Simmons (1968), R.R. Boyce (1969), and A.S. Barnett, C.G. Pickvance, R.H. Ward (1970).

Application of the method in Hungary began in the 1960's and early 1970's, by I. Osváth (1961, 1968), P. Juhász-Nagy (1966, 1972), I. Précsényi (1971), and L. Gráf (1962), primarily in the field of biological and meteorological problems.

Available international and Hungarian research experience shows that the method is best applied in the investigation of the structure of various (natural and social) systems and, therefore, in the analysis of regional problems. The method is relatively simple and easily applicable in various types of research, which is always, of course, an advantage.

BRIEF DESCRIPTION OF METHOD

Through this method one can answer the question: what are the actual relationships, the direct or indirect influences, inherent in the problem we must analyze?

In international literature, there are two trends used to determine path coefficients. One of them deduces the path

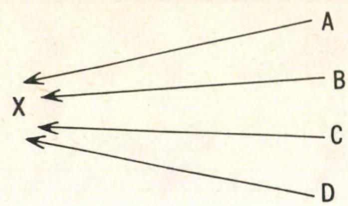

FIG. 1 A simple path diagram

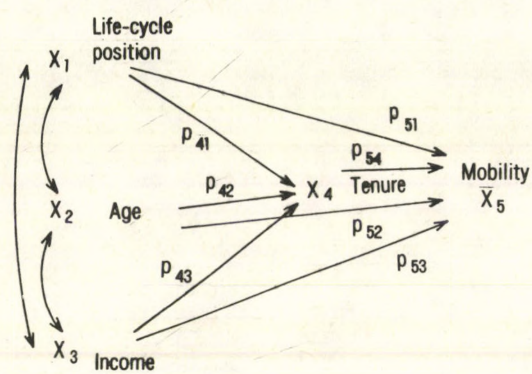

FIG. 2 C.G. Pickvance's (1973) causal model describing the relationship between residential mobility and five variables

coefficient from standardized, partial, and regressional coefficients, the other from partial correlation coefficients. Correlation coefficients may be unstable, depending on the conditions of sampling: therefore, they are only suitable for our analyses in certain circumstances, the details of which are not dealt with here. Standardized, partial and regressional coefficients, however, are constant in any circumstances: thus, the estimations which rely on them reflect more accurately actual conditions and are more suitable for further analyses here.

Path analysis can also be called a causal system. As a preliminary condition to path analysis, a causal model has to be constructed which connects the variables within our field of interest. Since the number of possible 'paths' or "influencing ways", is high, even if only five variables are included in the investigation, a model has to be constructed which provides the most likely representation of the relationships involved.

Let us take a simple example (Fig. 1): in this system, the $\underline{X}$ dependent variable is determined by the $\underline{A}$, $\underline{B}$, $\underline{C}$ and $\underline{D}$ independent variables.

Arrows connecting causes to effects are called paths and such structures are the path diagrams.

Essentially, the method is the construction of a diagram where variables -- messured or not -- are determined by other variables in a complete and additive way, the correlations of which are supposed to be known.

Let us consider C.G. Pickvance's model (1973) for residential mobility (Fig. 2). The causal relationship between the five variables describes residential mobility.

According to the model, life cycle ($\underline{X}_1$), age ($\underline{X}_2$) and income ($\underline{X}_3$) are determined outside the model, they are exogeneous. Tenure ($\underline{X}_4$) is determined by the mutual effect of the three exogeneous variables. Therefore, Fig. 2 conforms to the condition of recursivity (which is a precondition of path analysis), i.e. no variable is determined by a subsequent variable. Symbols $\underline{u}_4$ and $\underline{u}_5$ designate unmeasured or 'implicit' variables, whose effects are also present in the model. The curved arrows between $\underline{X}_1$, $\underline{X}_2$, $\underline{X}_3$ indicate the presence of correlations between these variables, whose causal structure is unanalyzed, since the three variables are exogeneous.

In Pickvance's model, the arrows between the five variables represent lines of influence or 'causel paths'. The size of these paths is estimated from the data, by calculating path coefficients, ($\underline{p}_{ji}$), which represent the paths to a given variable, $\underline{X}_j$, from the antecedent variable, $\underline{X}_i$, i.e. the size of the path coefficient is indicative of the change in $\underline{X}_j$, influenced by the standardized unit of change in $\underline{X}_i$.

Since pat coefficients are standardized, their range of variation is not likely to lie outside -2 to +2, and will usually lie within the range of -1 to +1.

The establishment of such, and similar, schemes is promoted by the inclusion of unknown factors as variables independent of the others. Each variable can usually be divided into two factors, one with a determined variability and another which is the error in estimation and sampling.

To put it in another form:

$$\nu = M/X/ + B/\varepsilon/, \text{ where } \varepsilon \text{ is error.} \qquad /1/$$

The error components are supposed to be independent of the variables they relate to, as well as the others. Error components can be combined into a collective value which is called the path error in path analysis.

The logic of path analysis always demands that those carrying out the analysis form a clear idea of the system. In any case, the researcher performing the analysis has to decide what variables are chosen as causes, which are the effects and which are of mixed nature (e.g., $\underline{X_4}$ in Pickvance's model).

Take variable $\underline{X_o}$ as completely and additively determined by variables $\underline{X_1}$, $\underline{X_2}$, $\underline{X_3}$... $\underline{X_n}$. Then, $\underline{X_o}$ can be estimated by linear regression.

$$X_o = a + b_1x_1 + b_2x_2 + \dots + b_nx_n \qquad /2/$$

or standardized as a variable:

$$X'_o = b_1\frac{\sigma_{11}}{\sigma_{oo}}x'_1 + b_2\frac{\sigma_{22}}{\sigma_{oo}}x'_2 + \dots + b_n\frac{\sigma_{nn}}{\sigma_{oo}}x'_n \qquad /3/$$

or put in another way,

$$B_j = b_j\frac{\sigma_{jj}}{\sigma_{oo}}$$

$$X'_o = B_1X'_1 + B_2X'_2 + \dots + B_nX'_n \qquad /4/$$

In a system where $\underline{X_o}$ is in causal relationship with variables $\underline{X_1}$, $\underline{X_2}$, ... $\underline{X_n}$, the standardized regressional coefficient is called the path coefficient.

In order to have path coefficients equal to standardized regressional coefficients, the following conditions must be fulfilled:

1. $\underline{X_i}$ must be a near or distant cause during the analysis;
2. all other variables in the estimation equation must be the cause of $\underline{X_o}$;
3. all important variables must be taken into consideration.

With the above conditions fulfilled, regression methods can be used in applying the path coefficient. In addition, however, the correlations between all the variables must be known and, from them, the path coefficient can be directly obtained through normal equations.

The basic equation of path analysis is (O.D. Duncan, 1966):

$$r_{ij} = \sum_q p_{iq}r_{jq} \qquad /5/$$

So, in Pickvance's model:

$$r_{54} = p_{51}r_{14} + p_{52}r_{24} + p_{53}r_{34} + p_{54} \qquad /6/$$

Equation /6/ demonstrates that the correlation coefficient between $\underline{X}_4$ and $\underline{X}_5$ (r_{54}) can be decomposed into four components: three indirect effects (the first three relations) and one direct effect (the fourth relation). The three indirect effects correspond to the three paths by which $\underline{X}_4$ and $\underline{X}_5$ are linked through the three exogeneous variables. The direct effect, of course, is the direct path from tenure to mobility. Thus the question posed earlier, whether tenure /$\underline{X}_4$/ has a direct effect on mobility /$\underline{X}_5$/ can be restated in the form of a hypothesis, viz. $\underline{p}_{54} \neq 0$. Similarly, the question of whether the indirect effects of tenure on mobility are present can be restated in a second hypothesis, viz.
$p_{51}r_{14} = 0$, $p_{52}r_{24} = 0$, and $p_{53}r_{34} = 0$.

Path analysis also allows us to test the adequacy or 'fit' of the model to the data. The adequacy is indicated by the size of the 'residual paths' from $\underline{u}_4$ to $\underline{X}_4$, and from $\underline{u}_5$ to $\underline{X}_5$. If these paths approach zero, then the five variables explicitly included in the model would illustrate perfectly variation in tenure /$\underline{X}_4$/ and mobility /$\underline{X}_5$/.

Conversely, if the values of the residual paths approach 1, then the model is a poor 'fit' for the data. Path analysis, therefore, enables one to calculate the relative size of the paths hypothesized between the variables in the model. It does not, however, assume that a model is necessarily correct. It only puts a postulated model to the test. It must be remembered that path coefficients are here calculated from cross-sectional data: it cannot be said that they hold true for changes in time. They represent a snapshot of a structure, instead of the dynamics of a structure.

It is clear from the above that, in order to determine the correlation between any two variables included in the path analysis, one should sum up all the ways from one variable to another and the following rules should be kept:

1. one cannot move forwards first and backwards afterwards (i.e. having moved in the direction of the arrow, no way back can be taken along either arrows);
2. one may move backwards first and forwards after;
3. in the case of related variables, as many steps as necessary can be made, either backwards or forwards;
4. there can be one, and only one, double arrow from one variable to the other. A double arrow goes in both directions.

Path analysis is most frequently applied together with variance/covariance analysis and correlation analysis, as their complement. Much useful information can be gathered, for example, when calculating correlation coefficients, if we derive correlation coefficients from path analysis: it enables us to see the relationships between variables, the division of correlations between the variables by the factors causing them.

Path analysis can be of great help in choosing the variables for factor analysis, and in revealing the relationships between them.

The degree of subjectivity present at the selection of factor analysis indicators can be reduced by application of the method. In the following there is an example outlining the joint application of factor and path analysis. More exactly, it will be shown how a previous factor analysis investigation can be complemented by path analysis.

RELATION OF PATH AND FACTOR ANALYSIS IN PRACTICAL APPLICATION

When establishing the village types in Hungary (P. Beluszky--T.T. Sikos, 1979, 1980, 1981, 1982), path analysis method was used. Path analysis was carried out on the 3,134 rural settlements in Hungary.[x] The purpose was to reveal the changes in the cause and effect relationships between the variables investigated, or, to put it another way, to find out how accurately correlation variables describe the actual relationship between the factors. An attempt was made to find out whether the method would be suitable for an investigation of regional structure. Apart from these targets, we began to analyze the inner structure of Factor F_1, obtained in the national investigation. F_1 stands for settlement size/basic supply/transport position.

The cause and effect relationships within Factor F_1 are demonstrated in Fig. 3.

The explanation of indicators numbered in the diagram is as follows (double arrows indicate correlations):

Index 15: general development stage of village;
Index 3: average settlement size in 1970;
Index 4: per capita retail trade turnover of industrial commidities in thousand forints;
Index 23: travel time to the nearest town (or non-urban district seat);
Index 21: standard of basic supply and service institutions;
Index 26: development stage of transport networks;
Index 27: frequency of public transport runs to towns.

Factor F_1 groups settlement morphological processes in a complex way. The path diagram in Fig. 3 is meant to show to what degree the indices composing Factor F_1 determine the development stages of settlements. The correlation between

x Villages were investigated in accordance with the administrative divisions valid on January 1st, 1977. See P. Beluszky's paper on previous pages of this volume as well as the enclosed coloured map representing the results.

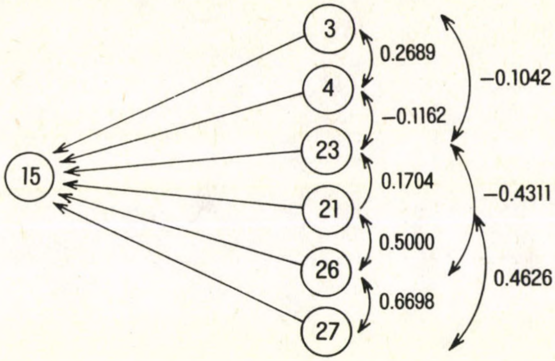

FIG. 3 Path diagram of the internal structure of Factor[1] basically determining the morphological processes of settlements in Hungary

the development stages of a settlement (Index 15) is considered dependent variable, while the others are exogeneous. Using the basic equation of path analysis already presented, the following relationships are obtained:

$$r_{153}=p_{153}+p_{154}\,r_{34}+p_{1523}\,r_{323}+\underline{p_{1521}}\,\underline{r_{321}}+p_{1526}\,r_{326}+\underline{p_{1527}}\,\underline{r_{327}}$$

$$r_{154}=\underline{p_{154}}+p_{153}\,r_{43}+p_{1523}\,r_{423}+\underline{p_{1521}}\,\underline{r_{421}}+p_{1526}\,r_{426}+\underline{p_{1527}}\,\underline{r_{427}}$$

$$r_{1523}=p_{1523}+p_{153}r_{233}+p_{154}\,r_{234}+p_{1521}\,r_{2321}+p_{1526}\,r_{2326}+p_{1527}r_{2327}$$

$$r_{1521}=\underline{p_{1521}}+p_{153}r_{213}+p_{154}\,r_{214}+p_{1523}r_{2123}+p_{1526}r_{2126}+\underline{p_{1527}r_{2127}}$$

$$r_{1526}=\underline{p_{1526}}+p_{153}\,r_{263}+p_{154}\,r_{264}+p_{1523}r_{2623}+\underline{p_{1521}}\underline{r_{2621}}+\underline{p_{1527}}\underline{r_{2627}}$$

$$r_{1527}=\underline{p_{1527}}+p_{153}r_{273}+p_{154}\,r_{274}+p_{1523}r_{2723}+\underline{p_{1521}}\underline{r_{2721}}+p_{1526}r_{2726}$$

The substitution of the appropriate values into the equations results in the following:

	1.	2.	3.	4.	5.	6.	7.	
0.3825 =		0.0061	+0.0370	+0.0042	+$\underline{0.1746}$	+0.0480	+$\underline{0.1122}$	/7/
0.5167 =		$\underline{0.1377}$	+0.0016	+0.0047	+$\underline{0.2048}$	+0.0615	+0.1061	/8/
-0.2643 =		/-0.0408/	+/-0.0006/	+/-0.0160/	+/-0.0555/	+/-0.0607/+	+/-0.0905/	/9/

$$0.6282 = \underline{0.3257}+0.0033+0.0866+0.0069+0.0069+\underline{0.1351} \qquad /10/$$

$$0.5788 = \underline{0.1408}+0.0021+0.0607+0.0176+\underline{0.1628}+\underline{0.1951} \qquad /11/$$

$$0.6021 = \underline{0.2913}+0.0023+0.0502+0.0126+\underline{0.1511}+0.0943 \qquad /12/$$

The first column of equations /7--12/ contains correlations in pairs between Index 15 and the indices determining it. For most of the relationships, a slightly above intermediate correlation is characteristic. The second column of equations shows the real direct relationships between Index 15 and the other indices in a pair by pair correlation with it. Column 2 clearly reflects that only two indices have considerable direct relationships and they give 50% of the pair by pair correlations (Equations 10 and 12).
Index 21 is the level of institutions of basic supply services and Index 27 is the frequency of public transport runs into towns.

On the basis of Equation /10/, it is possible to decide, apart from the direct relationships, to what extent indirect effects influence the correlation between settlement development level and basic supply-service institutions (0.6282). Of the indirect relationships, Index 27's contribution (frequency of public transport runs to towns) to the total correlation value is about 25%, the remaining 25% being determined by the other four indirect relationships.

One can see a similar phenomenon in the case of Equation /12/, where the direct relationships also make up about 50%, with the difference being between Index 15 (settlement development level) and Index 27 (frequency of public transport runs to towns). With the indirect relationships, it is Index 21 (level of basic supply-service institutions) which has the highest contribuiton, at about 25%. The remaining 25% of the total correlation value is also made up here by four other indirect relationships.

Naturally, it is not surprising that the development level of a settlement is directly influenced by the level of basic supply and the frequency of public transport runs, and the two factors themselves are closely interrelated. This is reflected in the medium intensity of correlation (0.4640) between the model and the two indices.

A common characteristic of Equations /8/ and /11/ is that both are basically influenced by one direct, and two indirect, relationships. Furthermore, the contribution of the existing two indirect relationships to the total correlations is higher than that of the direct relationship.

The present stage of settlement development is strongly related to the per capita industrial retail trade turnover in Equation /8/ and to the development level of transport networks in Equation /11/. In both equations, there are two considerable additional indirect relationships through Index 21 (level of basic supply-service institutions) and Index 27 (frequency of public transport runs to town). It is a logical connection, since the better basic supply-services are, and the higher the per capita turnover value in industrial retail trade, then the higher the standard of settlement development will be; this latter is, of course, beneficially influenced by the frequency of runs and the accessibility of particular services.

A most surprising observation made during the analysis was in relation to Equations /7/ and /9/, where it was found that indirect relationships are stronger in these two equations than direct ones. Of the indirect relationships, Indices 21 and 27 again dominate, as with Equations /8/ and /11/. Re-examining Equation /7/ and the other equations, it is surprising that settlement size has 'no measurable direct or indirect influence' on the level of settlement development, since, in the more populated settlements, the system of basic supply-service institutions and retail trade shop network etc. are more developed. The fact that settlement size has a relatively limited role in the development level of a settlement is also manifested in the formation of types (clusters). Settlements with different numbers of inhabitants occur beside one another in a cluster.
The reason for including settlements with diverse population totals in a single type is that basic supply-services, per capita industrial retail trade turnover and the frequency of public transport runs are the fundamental determinants of rural life, rather than the population of a settlement. Population is not optimal as an index, either, since it only partially reflects the differences between settlements: rather, it establishes the main groups of settlements.

When setting up a hypothetical path diagram, we have to consider the possibility that all the relevant factors may not have been considered, or even known. The error in the complete path diagram drawn here (based only on Factor $\underline{F}_1$) is outlined in the following formula:

$$p_e^2 = 1 - \sum_{i=1}^{n} p_{oi} r_{oi}.$$

In calculation, it is supposed that the path error is not correlated with the final reasons: $p_e^2 = 0.45$ and $p_e = 0.67$, which means that the path error is of medium size. This does not reduce the intensity of elementary path relationships; it only indicates that, in further factor analysis, components occur which, though left out of the present diagram, influence the development level of settlements.

If we wish to construct a complete causal system, the size of path error can be minimized by considering additional causes, i.e. by iteration.

In the example presented above, we only intended to demonstrate a possible application of path analysis. We believe our investigations to have proved that path analysis, complemented by factor analysis or by itself, is suitable for regional analyses, for the examination of regional structure and for a more precise disclosure of cause and effect relationships.

The application of path analysis in regional studies facilitates a detailed exploration of the internal structure of correlation coefficients which should not be missed if an exact definition of fundamental processes determining settlement development is required.

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THE STATUS OF GEOGRAPHICAL EDUCATION IN HUNGARY

Ferenc PROBÁLD

THE HUNGARIAN EDUCATION SYSTEM

In Hungary, education is free and compulsory from 6 to 16 years of age. The basic section of the school system is the common primary school which comprises of eight grades and provides a general education, working with a uniform curriculum. In the upper sections of primary school -- from the 5th grade onward -- the different subjects are separated and taught by teachers who hold a college or university degree and usually specialize in two different academic fields. About 85% of the pupils complete the 8th grade of primary school at 14 years of age, while another 10 per cent do the same with a delay of one or two years.

On completing primary school, 93 per cent continue their studies. They have three main options in the field of secondary education:

(a) About one half of those graduating from primary school take up an apprenticeship in one of the numerous vocational schools, which grant tradesman's (skilled worker's) diplomas after the completion of a three year training program. This diploma does not entitle the student to apply for higher education, except later at evening school or corresponding preparatory courses. The vocational schools receive over 80% of their apprentices from among young people of working-class origin.

(b) The diverse group of vocational secondary schools (vocational or specialized high schools) attract almost 30% of those continuing their studies at the secondary school level. Vocational schools either train skilled workers for the more qualified professions or trades, or provide a medium-level education in specific fields. In addition, their four year program also has to cover general education. Although the final examination and leaving certificate of this type of school entitles the students to apply for admission to any college or university, real opportunities for an academic career remain restricted, for the most part, to fields congruent with the vocational secondary school course the student completed.

(c) The third alternative, chosen by more than one-fifth of primary school graduates, is to enroll in the general secondary school (high school), also called in Hungary "gymnasium". Its main task is to prepare its students for higher education and the "gymnasium" accounts for 70% of the students admitted to Hungarian colleges and universities.

According to a recent plan for the further development of the Hungarian education system (1982), secondary schools will be maintained as a separate section. The distribution of students, however, to the above-mentioned institutions will be altered to place more emphasis upon those secondary schools which offer their graduates a leaving certificate (baccalaureate). Contrary to the trends of the last decades, one can now expect an increase in enrolment at gymnasium and vocational secondary schools will probably gain ground, to the detriment of vocational schools. Educational policy envisages an evolution towards the structural integration of the three secondary levels, which are, at present, separed from each other. At the initial stage of instruction, the basic contents of general education should essentially be the same, both in gymnasiums and vocational high schools, thus opening up the possibility for movement between the different types of secondary school, in accordance with the talents and wishes of the students.

GEOGRAPHY IN PRIMARY SCHOOL

The curricula and syllabi of Hungarian schools have lately been subjected to basic reform, introduced in primary schools through a series of steps, in the period between 1978/79 and 1985/86. Before examining the subsequent changes in the geography curriculum, the present state of the subject must be outlined briefly, since the reforms have not yet been introduced in the upper forms of the primary schools. According to the old syllabi, effective since 1962, geography was an independent subject, taught in two hours (class periods) a week in the 5th, 6th, 7th and 8th grades of primary school. Geography courses could build upon the environmental studies courses completed in the lower sections of primary school: in the 3rd and 4th grades, concepts like weather, climate, landforms and economic sectors were touched upon, and an initial introduction to map-reading was given. Besides further study of maps and the globe, 5th grade geography mainly included a regional, geographic view of Hungary and the neighbouring countries. The 6th grade provided the pupils with a geographical perspective on most

Europen countries and the Soviet Union, leaving the introduction of all remaining continents to the 7th grade, where the old syllabus, in 1984, is still in force. While in Europe every country was treated separately, according to the well-known scheme of regional geography (Länderkunde), the complex description of the other continents is studied through the presentation of only the most important countries. The 8th grade is mostly devoted to a detailed physical and economic geography of Hungary. The course finishes with an outline of the solar system, the Earth as a planet and the movements of the planets.

According to the recent reforms in education, geography and biology in the 5th grade, which both had 2 hours at their disposal, have been replaced by "environmental studies", receiving 3 hours a week in both 4th and 5th grades. Although conceived as a subject integrating the fields of geography and biology, environmental studies only partially satisfies this demand, as its syllabus and textbook chapters still reflect the different character of the two subjects. The content of the 4th grade course is particularly abundant in topics of geographical relevance. Starting from simple groundplans and the cardinal points of the compass, light is thrown upon the most common types of maps, including the interpretation of scale and key. The rotation and revolution of the Earth is explained in connection with the changes of day and night and the seasons of the year. Finally, there is a broad outline of Hungarian landscapes and their economic life. In the 5th grade, the amount of geographical topics hold more humble place. The student is given guidelines towards orientating the world map and the globe, thus further improving the student's skill in map reading. The concepts of climate, weather and its elements, and climatic factors and zones are also discussed through, examples taken from the European climate types. The explanation of the origin and evolution of typical Hungarian landscapes is connected with the introduction of their vegetation and fauna, in this way revealing their relationship to local physiography and climate.

The substitution of geography by environmental studies has obviously taken place in the framework of a curriculum which sets much higher standards, when compared to its predecessor in the field of physical geography. This holds particularly true of the 4th grade which must struggle with difficult topics, not easily mastered at 9--10 years of age. On the implementation of this reform, the importance of a thorough professional training in the instruction of environmental studies must be stressed. To be more exact, the instruction of this subject should have been given to graduate teachers specializing in geography and/or biology. For organizational and administrative reasons, however, this planned change could only be accomplished in half of the schools, thus raising doubts about the successful teaching on environmental studies, particularly as far as laying the foundations of geography is concerned.

The number of hours assigned to geography in the 6th, 7th and 8th grade remains unchanged by the recent reforms: a different arrangement, however, is to be applied. The far continents will be dealt with first, followed by a regional geography of the European countries and the Soviet Union, in the 7th grade. The topics treated in the 8th grade will remain much the same as before, focussing on the geography of the native country. Thus, the order of succession has been reversed by the reform, now moving from the distant areas towards the closest. This new sequence, which at first gave rise to much controversy, reflects the recognition of the fact that, in an age of mass communications, a different approach is justified, particularly from the view-point of the psychology of education. Pulpils have a natural interest in exotic, remote countries and their peoples which stimulates their motivation to learn geography in the initial stages, while the upper grades are able to benefit from a more detailed coverage of the closer areas, which for us, are more important. Regional geography at primary school has long been regarded as a means of elucidating general, geographical connections, and, also, processes and concepts. This tendency has been strengthened by the new curriculum: the individual geographical concepts are pushed more and more into the background, and the number of place-names decreases even further. The reformed curriculum also reflects, however, the deep conviction that geography must not abandon its fundamental task: it cannot renounce the claim of providing a systematic perspective of the whole world. The picture drawn by geography may be incomplete, perhaps even superficial due to the shortage of time; but, nevertheless, it has to serve as a framework enabling young people to absorb and arrange later information.

Through these reforms, the range of material available to geography teachers will be extended: new collections of slides and transparancies are being prepared for each grade and available to every primary school throughout the country. A small new atlas has been edited for environmental studies taught in the 4th and 5th grade, and a revised, updated atlas has been published for geography lessons in the upper grades. A new wall map program has also been launched, to replace the currently used foreign maps (mostly German) by Hungarian ones.

The new uniform, nationwide geography textbooks, guided by the new curricula, will be published between 1983 and 1985. Tentative, experimental versions of the new books give the impression that the deadlines dictated by the reforms were too strict for a thorough structural and didactic renewal: one cannot break away from the sometimes dull stereotypes of conventional, descriptive geography. The unduly small size and the rather poor appearance of the new books reflects a questionable effort to maintain a low, nominal price. It has been customary for several decades now to keep the cost of textbooks down, despite the limits of government subsidies, and often to the detriment of aesthetic and professional education. In connection with the textbooks, each grade also receives a new exercise-book and test series, although these study-aids have lately been subjected to criticism: they pattern class work and check performance in too uniform a way, thus exerting a negative influence on the development of some abilities and skills among students.

GEOGRAPHY IN SECONDARY SCHOOLS

The syllabus of the general secondary school (gymnasium) has also been subjected to the current reform. The change was here completed in the school-year 1982/83. Further innovations in the curricula are forecast on the completion of primary school reform at the end of this decade, when first phase work should be taken into consideration, too.

According to the old syllabus, geography was taught for 2 hours a week in the first three grades of gymnasium. The contents of the first grade covered general physical geography, the second was devoted to the economic geography of capitalist countries and macro-regions, while the third grade covered the economic geography of socialist countries, including a rather detailed treatment of Hungary. Thus, the contents of the second and third grade were a concentric extension of topics already discussed in the primary school, with stress now being laid upon economic problems. The program was arranged according to the principles of regional geography (Länderkunde), and covered the whole world.

The uniformly fixed time-tables of the old gymnasial syllabus left only a limited amount of time for teaching one or two subjects in a greater number of hours to particular classes. The most striking new feature in the current reform is the introduction of facultative subjects, which alow more freedom of choice as far as the time-tables of the two upper grades of gymnasium are concerned. The number of hours devoted to compulsory general education subjects had to be drastically cut down at the upper levels, and consequently, these subjects are now covered in the lower grades of gymnasium. Geography has 3 hours in the first grade and 2 hours in the second grade, but it is no longer included among the compulsory subjects of the third grade. Thus, a thorough revision of the whole geographical curriculum has been necessary, resulting in a completely new structure. This structure may be summarized as a linear extension of primary school geography, focussing more on general geographical laws and principles. The extent and the direction of the change is clearly highlighted in the new, common geography textbooks, lately published for gymnasium.

The first major topic to be covered has remained general, physical geography, which receives about two thirds of all class periods available for geography in the first grade.

Chapters in the first grade textbook separately deal with the different geospheres and their characteristic processes, also referring to their role in human society. The chapter on lithosphere includes the fundamentals of plate tectonics and their connection with the origin of mountain systems and volcanic activity -- a new feature compared with the preceding textbook. It was included to acknowledge the recent rapid development of earth sciences. The chapters on hydrosphere and atmosphere are followed by a complex survey of the geographical zones.

The rest of the school year -- about one third of all class periods -- is devoted to general economic geography, integrating knowledge connected with other academic disciplines (e.g. economics, sociology and demography) not represented in the gymnasial syllabi. Firstly, there is a classification of countries according to their social system and economic achievements. The chapter on the geography of population deals with contemporary demographic processes and the changing global distribution of population, as well as problems of urbanization. Further important topics are sections on agricultural geography, which includes the global problem of food, the geography of industry (raw material, energy issues, and location) and a broad view of world trade.

Although geography in the second grade seems to be organized according to the regional approach, it has been deliberately shaped in such a way as to serve the purpose of general economic geography as well. The problems of less developed countries are summarized here and illustrated through examples like Latin America, the Middle East and the Indian subcontinent. The origin, functions and effects of economic integration are also included, with a survey of the EEC and CMEA as a whole. The major teaching units are built upon homogeneous groups of countries or global scale macro-regions. The regional perspective no longer attempts to include the whole world or to add more to the student's rather imperfect topographic knowledge. Only the most important countries (USA, USSR, Japan and China) are treated individually, but, even with these, there is no claim to systematic completeness. The main purpose is to emphasize the most characteristic features and discuss some problems of particular interest. The same holds true of the economic geography of Hungary, taught at the end of the school year in approximately one third of the time available in that grade.

The textbook is far from being the only source of information or, the only means of geographical education at gymnasium. Taking advantage of the higher age and selected composition of the students at secondary level, greater emphasis is laid on the independent work of the students with regard to the evaluation of statistic tables and thematic maps, as well as the analysis of newspaper articles and excerpts from scientific books. The textbook contains many questions which can only be answered through reference to various other sources of information. It also points out many problems worth further discussion, thus developing the student's ability to think independently, draw conclusions and express personal views.

The fact that geography, as a compulsory subject, is taught only in the lower sections of gymnasium is regarded as regrettable by geographers for many reasons. There is no opportunity to develop an effective co-operation with history, which is taught continuously through all grades. In addition, geography can no longer be included in the entrance examinations for institutions of higher education. Nevertheless, a new frontier has been opened for geography by the current reforms, as facultative education now has 7 hours a week in the third grade and 9 hours in the fourth at its disposal. Facultative programs will be compiled and the students will choose from a wide variety of optional subjects. The combinations chosen either prepare the student for particular fields of higher education or develop skills and offer further general education to those students not intending to apply for college admission. Apart from time reserved for facultative courses, another 2 hours have been left open in the time-table of both upper grades for completely free subject choice.

The system of facultative education first started in the 1981/82 school-year, in the third grade of gymnasium. Since then, there has not really been sufficient time to weigh the final balance on the position of the various subjects. As expected, the most popular subjects coincide with those required for admission into the major university departments. Geography appears in at least one facultative program in about half the gymnasiums, and roughly one in ten students take a geography course during the 3th and 4th grade. The topics suggested by the syllabi for optional geography courses cover the systematic economic geography of the world for the third grade and the geography of Hungary and several other selected countries for the fourth grade. The course will probably be completed by a review of current global problems of geographical relevance. Although textbooks have also been prepared for the upper grades, a lot of freedom will be given to teachers in the selection of topics and methods of instruction.

In most vocational secondary schools, which place emphasis upon general cultural education, geography (a short economic geography of the world) is taught in one school-year, 2 hours a week. In several vocational secondary schools (e.g. those with training programs for foreign trade or hydro-technology), geography appears in the timetable for two years, with programs similar to those of gymnasium.

In the syllabi of vocational secondary schools whose primary task is to train skilled workers, geography does not appear at all, nor is it taught in vocational shools. Consequently, the majority of young people enrolled in secondary schools are not given any geographical education at all. However, it is expected that this shortcoming will be eliminated to some extent through the mutual aims of general education in different secondary school-types, probably including the introduction of geography courses in vocational high schools.

CONDITIONS IN THE STATUS OF GEOGRAPHICAL EDUATION

The above-outlined status and content of geographical education in Hungarian schools should by no means be considered satisfactory. The socio-economic development of the last few decades would justify increased emphasis on geography in public culture: consequently, one would expect a higher social demand for geographical education. Particular significance can be attributed to the following factors:

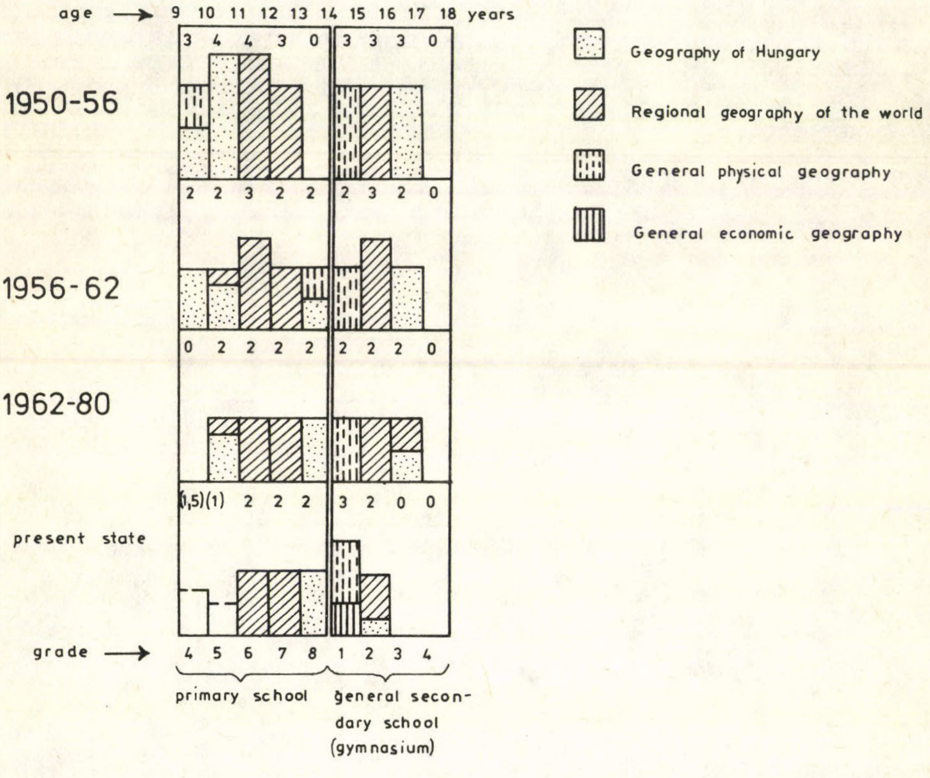

FIG. 1 Changes in the state and content of geographical education in Hungary during the last three decades

(a) The intellectual comprehension of information which is showered on the people by the mass media, particularly the wide-spread use of television, is hardly conceivable without fundamental, geographical knowledge.

(b) The Hungarian economy connects, at an international level, with the most open economies. The heavy reliance on the international division of labour, and the eminent role played by foreign trade, increase the necessity for geographical perspectives. An understanding of emerging global problems and modern processes in world economy also stresses this requirement.

(c) A similar effect has been exerted by the rapid increase in international tourism. (Since the mid-seventies, the number of foreign tourists visiting Hungary has always been above ten million a year, while four-five million Hungarians travel abroad annually.

(d) The reform of the Hungarian planning system, implemented in stages since 1968, laid great emphasis on the development and spreading of a way of thinking with national, economic aspects in the foreground. Geography in schools could ably contribute to this purpose.

(e) The global ecological crisis, and the increased value of natural resources has led to general acceptance of the need for environmental education, a major new area where geography will have to play a particularly important role.

In sharp contradiction to the supposed effectiveness of the facts listed above, the prestige and importance of school geography, as reflected in the number of hours assigned to it in the syllabi (Fig. 1), has shown a steady decline during the last three decades (K. Udvarhelyi and I. Göcsei, 1973). The status of Hungarian geographical education does not seem too favourable on an international scale, either (Fig. 2). This holds particularly true if, besides the number of hours, the requirement levels are also taken into consideration (H. Haubrich, ed. 1982, and F. Probáld, 1982).

The present situation can be at least partly explained by the widening gap between Hungarian school geography and geographical science. Increasingly, the content and attitude of geographical education lagged behind the developments of science. Thus, school geography failed to adjust quickly enough to new needs dictated by socio-economic changes (M. Pécsi, 1982). At the same time, academic and social organizations concerned with scientific geography, as well as earth sciences, have been -- unlike other branches of sciences -- unable to present the case of their school subject with sufficient prestige and consistency. If they had succesfully presented their case, then these geographical sciences would have been granted a place among the decision-making bodies

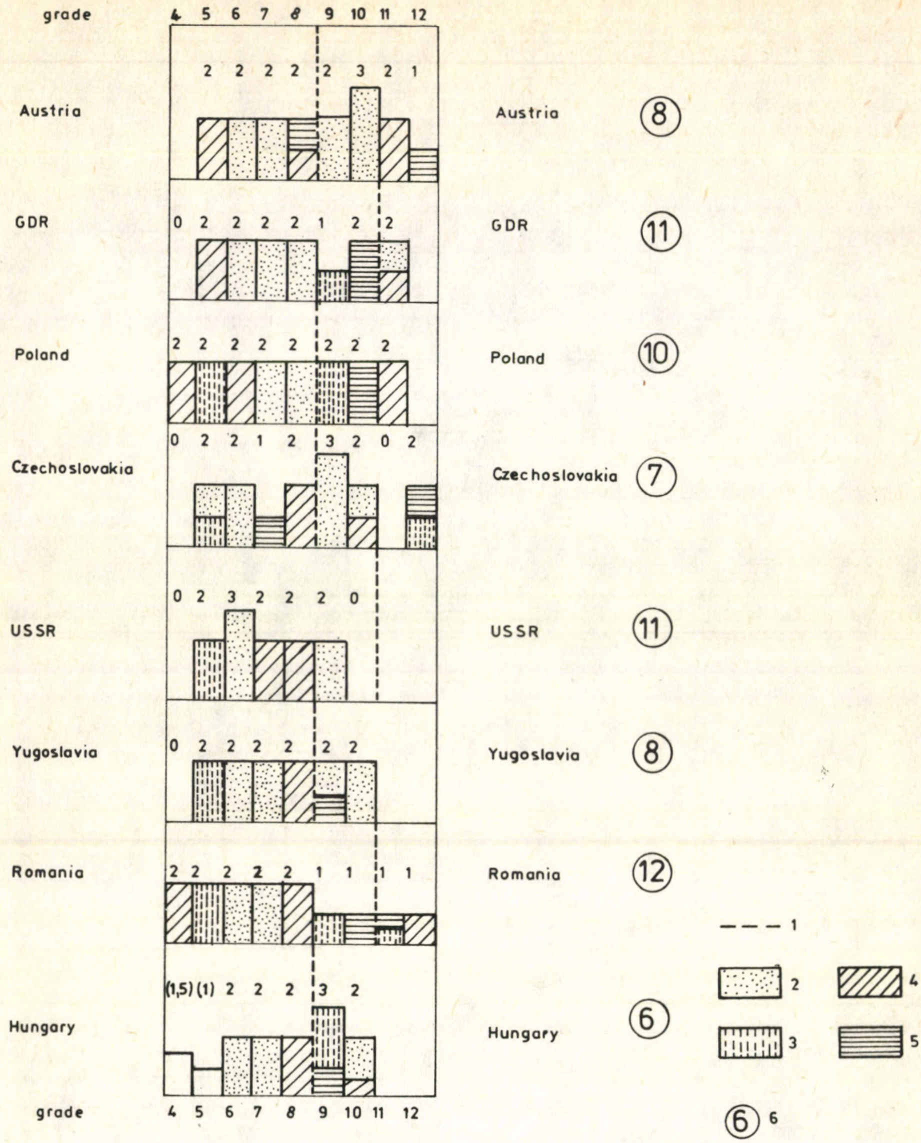

FIG. 2 International comparison of the state and content of Hungarian geographical education

1 = upper limit of the compulsory educational school-type; 2 = regional geography; 3 = general physical geography; 4 = geography of the native country; 5 = general economic geography; 6 = the number of weekly geography lessons summarized throughout the grades of the compulsory educational school-type.

of educational affairs. Recent attempts to transform the traditional structure of diverse subjects by merging them into large blocks of science and social studies, have also led to more unfavourable uncertainty about the status of geography in the educational system. Geography focusses its research activity on the system of relationships between nature and society. Therefore, it cannot find an appropriate place in either the science group of subjects, crystallizing around physics, or social studies, dominated by history.

The present status of Hungarian geographical education is torn by the contradiction between enormous tasks and dwindling possibilities. Geography has to meet this challenge: this is the only way to retain its place in the cultural stage of future generations.

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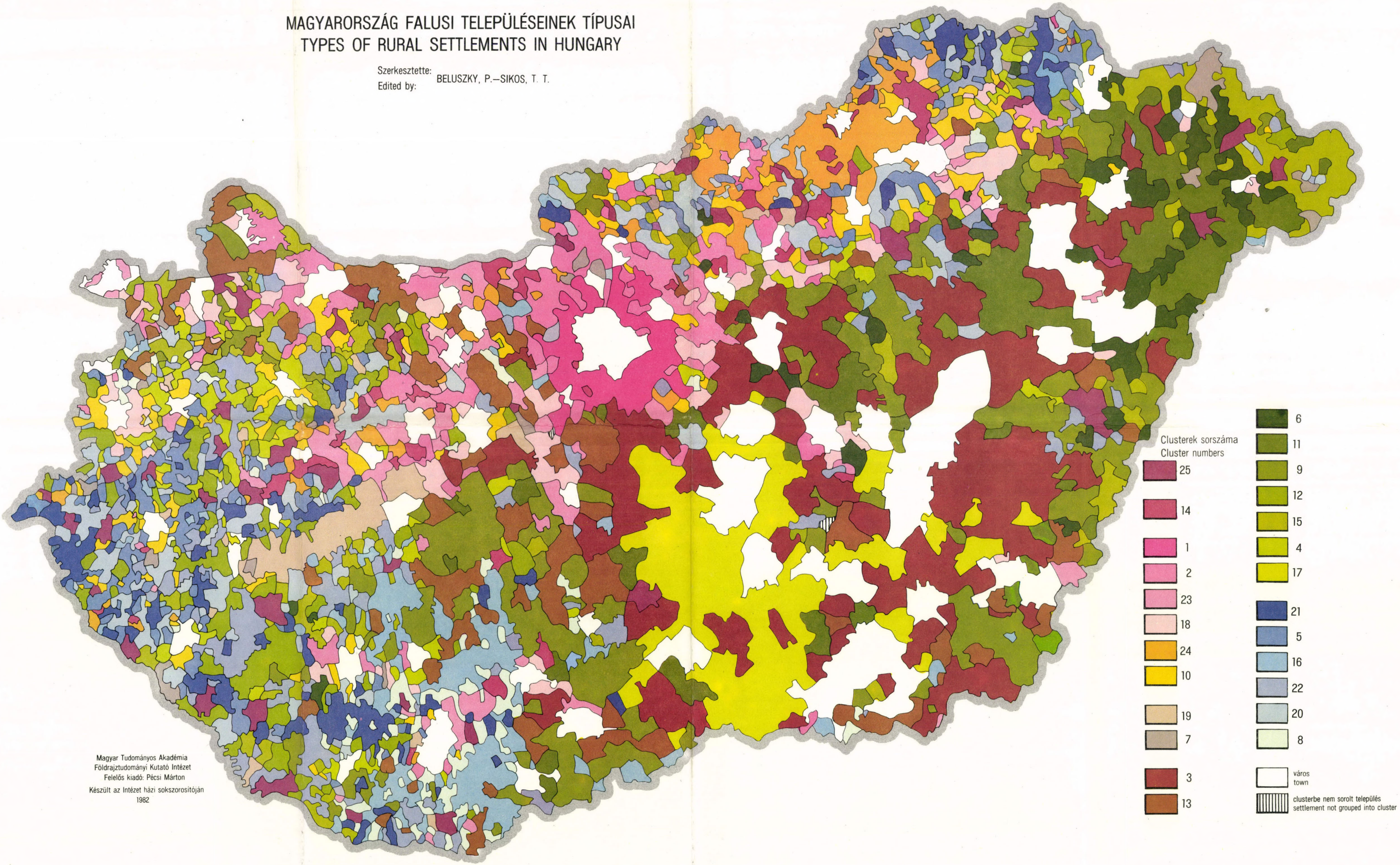

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