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Hungarian industry in a context of settlement network and pattern

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Abstract

The economic sectors have always played an important part in shaping the actual settlement pattern and network. Agriculture used to dominate for centuries, whereas industry came to the fore during the past two hundred years and its immanent changes have formed the settlement network. The present paper is aimed to describe the post-1989 impact of the transformation of the industry and its branches upon the settlement pattern and prospects are outlined for the forthcoming decades. It has become evident that in the post-industrial phase the impact of the sector upon the settlement network is less spectacular and rather indirect. The industrial enterprises have kept on concentrating in urban settlements of the 20–50 thousand and over 100 thousand population size categories. The distribution of various branches of industry according to settlement pattern shows considerable differences. In the future a further diminishment of the weight of the industry within the economy is anticipated and it is going to shape the settlement network to an even lesser extent.

Keywords: industry, settlement network and pattern, Hungary

Introduction

The present settlement network of Hungary is a result of long historical development. Various factors (natural, social, economic etc.) have played different part in its emergence. In the beginning the natural conditions were deterministic in the formation and pattern. Later, at a higher stage of development other factors had gained growing relevance.

Over long centuries agriculture dominated, then during the past two centuries industry came to the fore and has been the key force in the formation of the network of settlements. The impacts of industry on the settlement network also depend on the changes taking place in it. The main purpose of

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this study[2] is to demonstrate the effects of changes taken place in industry after 1989 on the network, the size of settlements and their functions. Will the industry keep being formative in the post-industrial phase or other factors are going to be decisive? Among others these are the questions to be answered in the present essay based on the elaboration of secondary sources which might contribute to the understanding of the interrelationship between industry and settlement network and pattern.

The linkage between industry and settlement network is presented below using databases of statistical publications and firm catalogues. Along with the experience with special literature it was the distribution of industrial enterprises (1999 and 2009) and that of industrial employees (1990 and 2001) by statistical microregions (LAU 1, formerly NUTS 4 by the EU standards) that provided further information. No doubt data by individual settlement and more recent figures would be more adequate. However, data by settlement is available only about the enterprises without subdivision by profile. A conclusion can be made that the more enterprises operate in the settlement in concern, the higher the probable number of the industrial ones. On the other hand only the 2001 census data is available and will be that for a couple of years to come. Another hindrance when comparing the data between microregions is posed by slight modifications of administrative divisions in the meantime. Further information was provided by industrial parks (there were 210 estates declared as industrial parks by 2010) and by a survey conducted among them in 2006. Moreover, industrial enterprises with more than ten employees (7,300 firms) as to late 2008 and sectoral distribution by settlement were examined to reveal structural specificities of the industrial branches.

Naturally it should be taken into account that international effects i.e. processes of world economics and politics exert their impact upon the domestic economics including the industrial sector thus modifying settlement network. With the advancement of globalization this influence tends to strengthen partly because Hungarian industry is going to be increasingly dependent.

First of all some concepts are to be defined. Primarily it is settlement network which denotes settlements of a given area taken together, in our case those of Hungary (Kovács, Z. 2001). It is akin with settlement pattern which is the sum total of the settlements taken by size. Thirdly, industry is the secondary sector of the economy and incorporates mining, manufacturing and energy, gas, steam and water supply. Of them manufacturing is the most important one either by the number of the employed or by the share of export and of production value within the sector as a whole. It should be also accentuated that nowadays settlement network is still affected by several factors and industry is

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only one of them. Furthermore those changes will be basically mentioned that have occurred in the organization, structure, ownership, spatial pattern etc. of industry and have influenced directly or indirectly the settlement network or might have an effect upon it.

Apart from the introduction this study has two main parts. First the linkage between industry and settlement network is traced in the times prior to 1989, as the knowledge about the past is indispensable for the interpretation of current processes. Then some aspects of changes following 1989 will be outlined in detail. Finally, a summary follows with an outline of future prospects.

Characteristic features of the industry- settlement relations prior to 1989

The relationships between the economy (including industry) and settlement network in Hungary and their historical development have already been studied by several experts (Barta, Gy. and Enyedi, Gy. 1981; Becsei, J. 2000; Beluszky, P. 1999; Beluszky, P. and Sikos, T.T. 2007; Dövényi, Z. 2003; Szigeti, E. 2002), even though in different depth. This is why this study is to focus on the most important phases relevant from the viewpoints of the current and future processes. It is because the inherited settlement pattern has left its imprint on the actual structure and its impact is here to stay for the future decades as well.

For centuries industry had not played a particular role in shaping the network of Hungarian settlement. In the preindustrial phase it was the farming that determined the settlement pattern with dwarf villages as its basic component. The first clusters of settlements with 100 to 200 inhabitants came into being between the 11th and 13th centuries (Szigeti, E. 2002). Preconditions for the emergence of urban settlements were created by the early 13th century due to non-agricultural activities, primarily craftsmanship and commerce (Beluszky, P. 1999). Urban development flourished in the 14th–15th centuries generated by industrialization in the free royal towns from the mid-14th century. In contrast, urbanization on the Great Hungarian Plain (Alföld) accelerated with an almost century's delay and could be explained by the growing importance of cattle breeding (Becsei, J. 2000). Although the strengthened position of craftsmanship and cottage-industry had promoted urbanization, it had not induced either spectacular development or foundation of new settlements. So industry did not play significant role in this phase but its influence was growing steadily.

A relevant turn only followed from the second half of the 19th century: since then industry has become a more and more influential element of shaping and developing settlements. Big industry gave an especially strong impetus to economic life of larger, populous settlements. In 1880 barely more

than one fifth (21%) of industrial employees was occupied in large factories, but their ratio had risen to 40% by 1900 and kept on growing in the early 20th century (Berend, T.I. and Szuhay, M. 1973). Industry had contributed to the acceleration of urbanization considerably and mainly resulted in improving living standards and provision of infrastructure. It had enriched the functions of the settlements, changed the local social structure and outward appearance of towns and cities. New urban settlements had appeared at a modest rate (1900: 42; 1914: 45). Concomitantly there had been a persistent decrease of settlements due to the accession of villages to urban settlements, from 13,170 in 1870 down to 12,557 by 1910 (Beluszky, P. 1999).

Rural development in the second half of the 19th century was also the consequence of industrialization. Along with the craftsmanship (still a major employer where 85% of the workers in the villages were occupied back to 1900) big industry had started to expand (Barta, Gy. and Enyedi, Gy. 1981). The industrialization of villages mainly occurred in the vicinity of extractive industries in the stripe of middle mountains (industrial axis of the country). Several new mines and quarries were opened and in some places (e.g. Felsőgalla, Karancsalja, Komló, Mecsekszabolcs, Pilisszentiván, Zagyvapálfalva) mining had become the leading branch employing with more than 50% of the earners in 1910 (Edvi, I.A. and Halász, A. eds. 1920).

In the early 20th century the number of industrial employees did not reach one hundred in most of the settlements whereas their share among active earners reached 30% only in few villages (e.g. Abaújszántó, Bajót, Hollóháza, Mezőcsát, Nyergesújfalu, Piszke, Putnok). Nevertheless a close relationship between the settlement size and degree of industrialization could be recognized even at that time. The number of industrial employees as a rule showed a fairly direct correlation with the number of inhabitants. This is also supported with the fact that in the settlements with no industrial employees (e.g. Kámaháza, Keménygadány, Kispöre, Kosárháza, Ladomány, Simaháza, Szőgye, Zalaszombatfa) in most cases population did not reach 200 in 1910. Although, it is also possible that industry did not develop because of the few inhabitants.

There was a profound difference between rural craftsmanship and big industry in their function and spatial distribution. The former was purposed for the satisfaction of the local needs so it had a much more uniform pattern. The expansion of the large industrial estates had also transformed the structure of rural industry but spatially they kept on being confined to the industrial axis. The spatial concentration of rural industry is also indicated by the fact that the 76 thousand rural miners and industrial employees worked only in 226 settlements in 1930 (Barta, Gy. and Enyedi, Gy. 1981). As a whole the industrial sector imposed a highly concentrated spatial effect in the late 19th and early 20th century. The major locations of the industry could be found in

Budapest and its agglomeration and in north, northwest Hungary (Edvi, I.A. and Halász, A. eds. 1920).

As a consequence of the state border changes following First World War the number of settlements dropped and roughly their one-fourth remained within the current state territory (Beluszky, P. 1999). Thus quite many smaller settlements known about their raw material or energy sources, became the territory of a neighbour state. Also towns and cities as important centres of manufacturing (e.g. Pozsony/Bratislava, Zágráb/Zagreb, Temesvár/Timişoara, Arad, Nagyvárad/Oradea, Kolozsvár/Cluj-Napoca) shared the same fate. These towns with 10–18 thousand industrial employees in 1910 mainly belonged to the 50–100 thousand settlement size category and formed the majority of medium-sized cities (*Figure 1*).

Between the world wars industrial development slowed down and its impact on settlement network decreased. At the same time no substantial shift occurred in regard to the previous spatial distribution of industrial concentrations.

The second huge wave of industrialization took place during the decades of socialism, in the beginning in a concentrated spatial pattern and later in a more diffused manner. Starting with the 1950s the emphasis was primarily put on the branches of heavy industry (mining, iron- and steel industries, energetics) spatially confined to major mineral deposits and energy sources within the middle mountain zone and led to the emergence of several so called socialist towns (e.g. Ajka, Kazincbarcika, Komló, Oroszlány, Várpalota). Partly this is why the number of urban settlements had grown from 50 to 63 until 1960, and the ratio of urban population had also increased from 36% to 39%. The overwhelming majority of the new towns had less than 20 thousand inhabitants which is far less than nowadays. Consequently, after granting the urban status their population number had grown rapidly mainly due to in-migration induced by the attraction of local manufacturing and/or extracting industry. In some places, predominantly along the industrial axis, industry appeared as a new function. However, beyond the industrial district stretching northeast–south-west, i.e. in the Great Hungarian Plain and South Transdanubia the rural regions were chiefly dominated by farming activities and only slightly affected by industrialization and urbanization.

Industrialization of rural spaces that started with the 1970s and expanded over the major part of the country had already affected much more settlements. On the one hand it has played a positive role with strengthening the sector in urban settlements of the countryside and accelerated the urbanization process over the country. As a result the number of settlements with urban status had grown from 63 up to 96 between 1960 and 1980 stemming partly from a deliberate development of the network of small and medium towns. On the other hand, industry settled in a growing number of villages

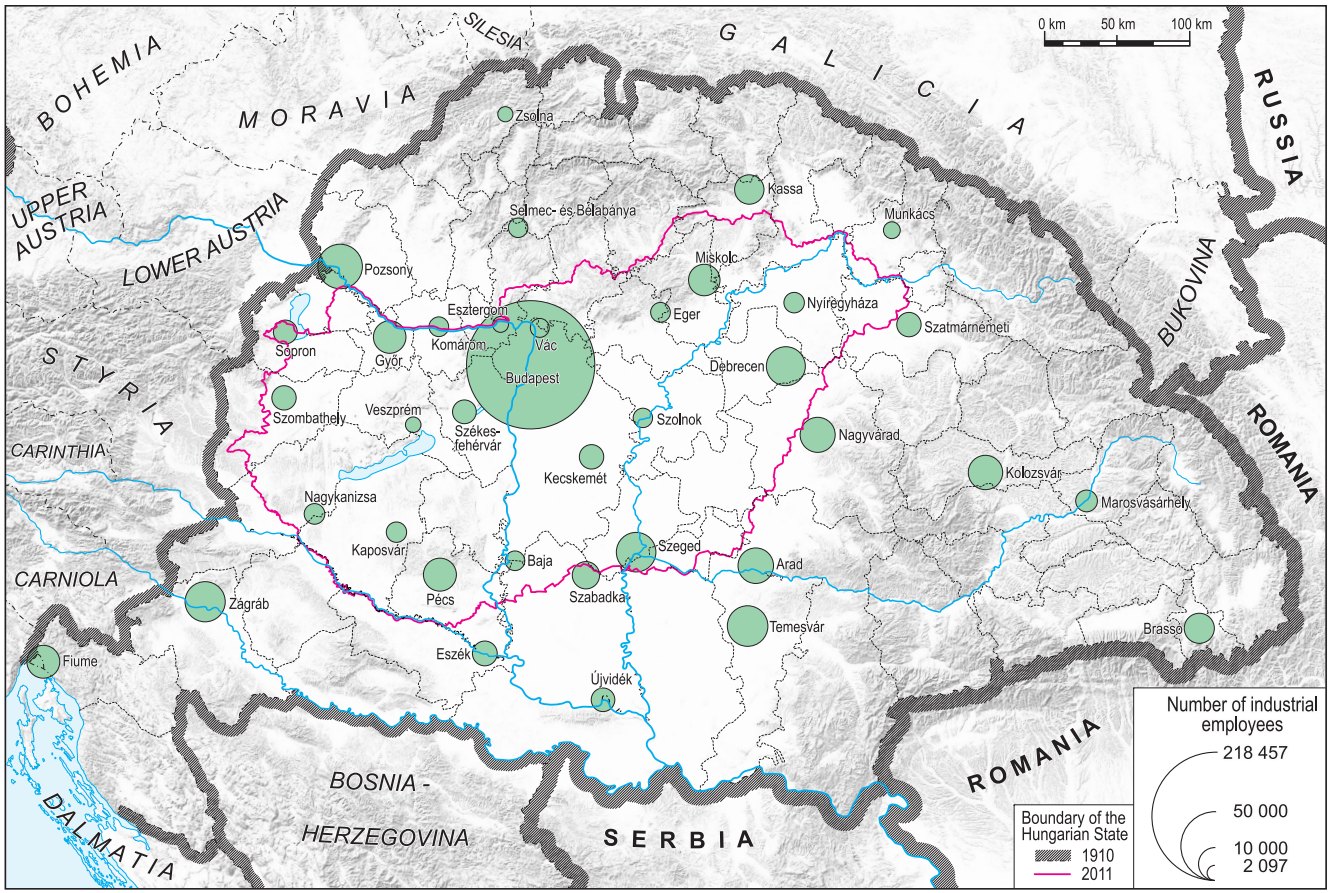

Fig. 1. Number of industrial employees in some settlements, 1910 Source:Hungarian Statistical Review. (48) 1910

and made them "multi-functional". But the real impact of industrialization on the villages depended on the weight of industry within the settlement and the time of its emergence (Beluszky, P. and Sikos, T.T. 1982). Accordingly, rural transformation was typical of the villages where significant big industry settled as early as the late 19th and early 20th century.

During the socialist era industry appeared in many places as a subsidiary of a company with its headquarters in a large town or an ancillary of an agricultural cooperative in the form of e.g. dressmaker's workshop or a unit to manufacture fittings. Important companies operated only in few villages. Thus the impact of industrial firms with different size and profile on the life and economy of villages was very diverse. Industrial sites pursuing mostly primitive labour intensive activities caused deep changes only rarely, still they provided work and income for the manpower released by farming. This dichotomy had been surfaced by typifying rural settlements in early 1980s. At that time Beluszky and Sikos (1982. p. 52) distinguished altogether 46 settlements (e.g. Almásfűzitő, Lábatlan, Nyergesújfalu, Rudabánya) belonging to the V. category entitled "Dynamically developing industrial villages with fast growing population...".

These were rural settlements with industrial plants of national importance and average population number of 4,000 persons. At the same time much more villages belonged to the two types of rural settlements (III. and IV. categories), where industrial function appeared along with the agricultural or urban functions. Bodrogkeresztúr, Nemesgulács were examples for the former type, whereas Barcs, Vasvár, Devecser were those for the latter one. Partly, the consequence of them was that a mere 16–17% of the industry operated in the rural settlements in the 1980s whereas 40% of the country's population lived there (Beluszky, P. and Sikos, T.T. 1982).

Possibilities for extensive industrialization exhausted by the late 1970s and the switch to intensive development had not proven to be successful. An outdated industrial structure had preserved while problems surmounted in the operation of the socialist industry during the 1980s. In addition, unfavourable changes in global economy had expanded onto Hungary by the end of that decade. These factors in a cumulated way had led to the radical changes in the industry following 1989.

Major changes after 1989

A closer insight into the impact of industry upon the settlement network after the change of regime can be partly gained by the analysis of industrial enterprises. More enterprises at a given settlement might provide job opportunities for more people probably improving its position in ranking by size.

Prior to 1989 few thousand industrial companies operated with several thousand subsidiaries. After the change of regime these huge companies had gone through substantial transformation together with their branches. Most of them and/or subsidiaries ceased to operate owing to their uneconomic and inefficient production. Others were reorganized whereas in many of them all of the subsidiaries or part of them withdrew and became independent firms. Many of the latter have not proven to be viable for different reasons (e.g. outdated technology or technical equipment, lack of adequate local management, unskilled workforce). This way the number of industrial plants has decreased from 12,934 to 7,052 between 1990 and 1997 (Kiss, É. 2002). The shrinkage was especially drastic in the capital city with a drop by almost three thousand industrial plants. This can be explained by environmental pollution, congestion, growing tertiarization, and higher production costs. Nowadays there are much less enterprises with one or more subsidiaries all over the country but no exact data are available in this respect. Probably, the enterprises with headquarters at Budapest have branches in the countryside. In the 1990s the number of industrial plants outside the county where the firm's headquarters was located became less (with the exception of Komárom-Esztergom County), thus organizational dependence coupled with spatial dependence has eased considerably.

In the decisive majority of industrial units productive activities still are going on, even though since the late 1990s an increasing number of establishments shifted to non-productive profiles (e.g. trade, logistics, services) (Kiss, É. 2002). This trend is in accord with the transformation of industrial production, its tertiarization (Szalavetz, A. 2002). The part of Budapest played in the guidence of industry has reduced with a concomitant growth of the role of county seats (e.g. Debrecen, Győr, Miskolc, Nyíregyháza, Székesfehérvár), but most of the headquarters still are to be found at the capital city. This is mainly due to its favourable conditions which are convenient to the enterprises and their top managers.

Parallel with organizational changes the number of industrial enterprises was on the increase, partly due to the units having gained independence, partly to the emergence of newly established firms, most of them are SMEs. The number of registered industrial enterprises with legal entity amounted to ca three thousand in 1990 and had grown to 50 thousand by 2009. The latter still form nearly 9% of all enterprises, but only about three-fourth of them actually operates. Even though their number was growing steadily over the past decades, they share a decreasing part because more firms have been established in other sectors. The considerable proportion of industrial enterprises were concentrated in early 1990s and even nowadays in Central Hungary Region, primarily in the national capital. Explanation of this is manifold: central location, industrial traditions, advanced infrastructure, substantial skilled workforce, large consumer market, population of considerable means and responsive to innovation. So Budapest as far the largest settlement of

the country, in conformity with its traditions keeps playing a key role in the industrial production with most of enterprises and employees. In 1992 37% of companies with legal entities operated in the capital and 19% of the employees of the sector worked there. By 2009 there had been some diminishment (29% and 16% respectively) but their share still is significant. The remainder was distributed among 3,061 settlements in 1992 and among 3,151 in 2009. There were 2.8 registered industrial enterprises with legal entity per settlement in 1992 and already 15.4 firms in 2009.

The number of sole proprietors in industry exceeded 25 thousand in 2009 but their occurrence is similar to that of companies with legal entities. 25% of them are to be found in Central Hungary Region. However, these small-scale industrial enterprises have a restricted impact on the settlement network due to their limited size.

In compliance with the inherited traditions industry was mainly concentrated in urban settlements after the change of regime too. Along with Budapest industrial establishments were found primarily in towns with 20–50 thousand and cities with 100–300 thousand inhabitants concerning both the number of plants and that of employees. At the same time the share of villages with more significant industry remained very low and no substantial change is expected in the future *(Table 1)*.

In the 1990s the importance of industry had primarily grown in the smaller urban settlements (which belonged to the 2–10 thousand size category), because new units emerged and employment widened, meanwhile its weight diminished in cities with 100–300 thousand residents. While the former phenomenon is due to the appearance of newly declared towns (over this period the number of urban settlements had grown from 177 up to 218), the latter one can be explained with the expansion of other sectors in the big cities.

Table. 1. Number of industrial firms and employees in the towns of Hungary by size categories of population, 1992–1997

Towns by size categories of population	Number of local industrial units, firms		Number of industrial employees	
	1992	1997	1992	1997
2,000–4,999	33	85	1,922	5,164
5,000–9,999	350	461	35,623	36,500
10,000–19,999	817	917	112,886	103,340
20,000–49,999	919	1,001	157,190	125,742
50,000–99,999	583	602	115,587	88,864
100,000–299,999	692	797	156,597	124,552
Budapest	1,000	848	149,823	91,908
Total	*4,394*	*4,711*	*729,628*	*576,070*

Source: Regional Statistical Yearbook, 1992, 1997.

In the beginning of the 21st century urbanisation continued and the number of small towns, especially those with less than 5,000 inhabitants has increased very fast. (Even though, nowadays there are not exact statistical data on the distribution of industrial enterprises by town-size categories, the latest data by settlement size were available for us.) In 2009 only 12% of all registered enterprises of industry (including construction) operated in settlements with less than 2,000 inhabitants (probably, in the rural ones) and 35% of them did in settlements with 100–300 thousand inhabitants. Moreover, 23% of industrial enterprises were located in Budapest and 24% in settlements with 20 to 50 thousand inhabitants. These indirect statistical data also confirmed that the share of industrial enterprises by settlement size categories has not changed basically in the last decade.

Using the number of all industrial enterprises (including incorporated enterprises and sole proprietors) per 1,000 inhabitants and by microregions is another approach to study the industry in a context of settlement network. During the past decade the number of industrial enterprises has increased, but their spatial distribution has not changed considerably. Their occurrence has been enhanced in the capital city region and in large towns. Generally, their density (number per 1,000 inhabitants) shows a close correlation with their population number: the larger is the settlement, the more significant its industry is. Apart from the settlement size there were obviously other factors (e.g. geographical location) that have also contributed to the specific spatial distribution of industrial enterprises *(Figures 2* and *3).*

Back to 1999 the number of industrial enterprises per 1,000 inhabitants showed high values in the Budapest agglomeration and in some areas of Transdanubia, e.g. in Győr and Székesfehérvár microregions named after their big cities (Győr, Székesfehérvár) with more than one hundred thousand residents. The seats of Tatabánya, Veszprém and Zalaegerszeg microregions had inhabitants between 50 and 100 thousand. The exceptions were represented by microregions surrounding the capital city (e.g. around Budaörs, Dunakeszi, Pilisvörösvár, Ráckeve, Szentendre) and Lake Balaton (e.g. around Balatonfüred, Keszthely, Siófok), both with less populous centres. In the former case it was the presence of population well provided with capital that promoted the high occurrence of industrial enterprises, but in the latter case it was mainly associated with tourism (with the high number of sole proprietors). By 2009 the number of industrial enterprises per 1,000 inhabitants has grown in every microregion so the industrial function seems to have expanded. Considerable spatial concentration took place as the number of industrial firms had risen, especially in microregions with less populous urban settlements (e.g. Aszód, Dabas, Monor) in the Budapest agglomeration ring and in northern, north-western parts of Transdanubia (e.g. Dorog, Csorna, Esztergom, Kapuvár, Tata, Zirc) and in some other regions of the country (e.g. in the Eger, Kecskemét, Nyíregyháza, Pécs microregions).

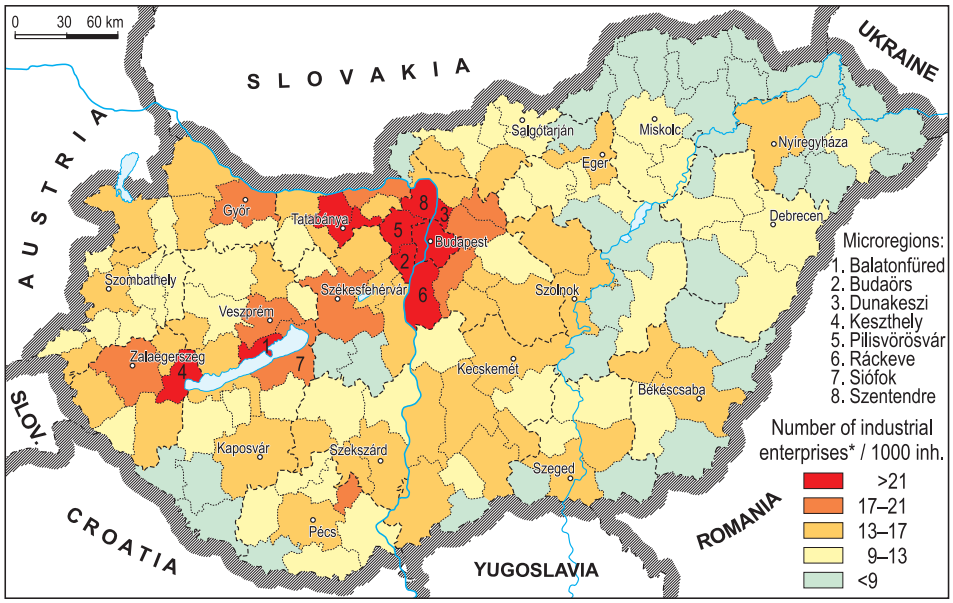

Fig. 2. Number of industrial enterprises by 1,000 inhabitants and microregions, 1999. * included enterprises in construction. *Source:* Regional Statistical Yearbook, 1999

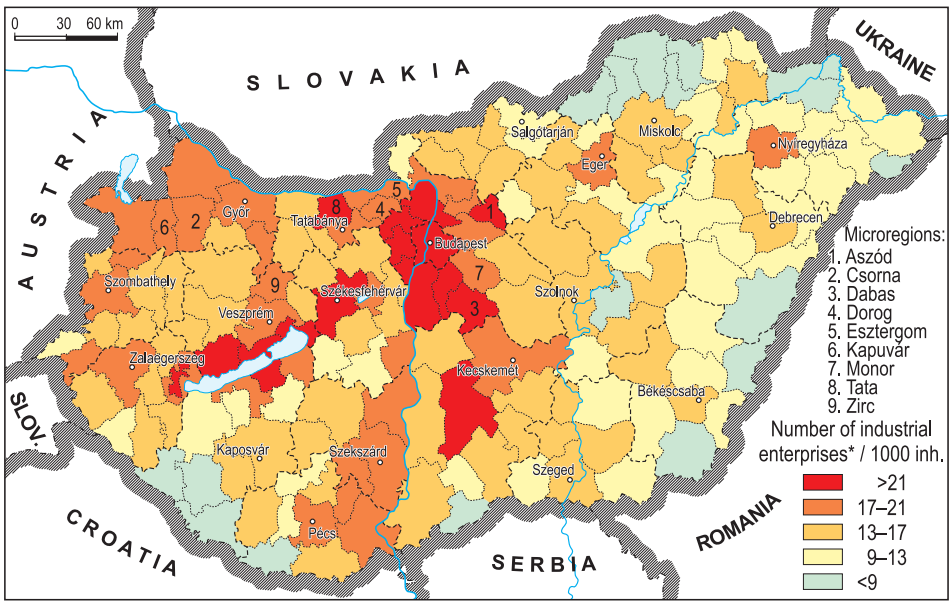

Fig. 3. Number of industrial enterprises by 1,000 inhabitants and microregions, 2009. * included enterprises in construction. *Source:* Regional Statistical Yearbook, 2009

Relationship between the industrial enterprises and settlement pattern is described in a most realistic way by the database of firm catalogue presenting the state-of-the-art in late 2008 (Cég-Kód-Tár 2008). The files contain records about 44 thousand industrial enterprises; those with a staff of more than ten persons i.e. altogether 7,318 of them were analyzed by their whereabouts (settlement size categories) and by affiliation to industrial branch. At the end of 2008 one-fifth of them operated at Budapest, followed by urban settlements with 20–50 thousand inhabitants. Categories of 100–300 thousand and 10–20 thousand ranked next as far as the number of industrial enterprises was concerned. It is interesting that urban settlements with 50–100 thousand population was not too attractive for industrial location as they had roughly the same number of enterprises over ten persons' staff as the small towns between 5 and 10 thousand inhabitants. It is also worth mentioning that several branches of manufacturing (leather, footwear, paper, printing and publishing, primary metal production) did not have any enterprise at settlements with residents between 500 and 1,000. The share of settlements with less than 1,000 inhabitants which have some kind of smaller industrial enterprises amounted to some per cents only (*Table 2).*

The spatial pattern of the enterprises by manufacturing branches according to settlement size categories only partly resembles to that of the whole manufacturing sector. Food industrial enterprises by settlement size categories have the most uniform distribution which is due to the specific features of the branch. Food processing is strongly linked to consumer market and should be located relatively closely to it. On the contrary, in big cities with over 100 thousand inhabitants, pharmaceuticals and printing are located in a most concentrated pattern (61% and 53%, respectively) which could be attributed to the strong demand on highly skilled manpower and consumer market from a relatively qualified population. Wood processing, rubber and plastics manufacturing and metalworking also show a more or less uniform distribution among settlement size categories. Primary metal production preferred three categories apart from the capital city. Several sub-branches of engineering (machinery and equipment, computers, electronic and optical devices and electric engineering) preferred the same settlement categories, namely towns with inhabitants between 20–50 thousand and cities over 100 thousand. In contrast enterprises of road vehicles manufacturing are to be found in urban settlements with residents of 10–50 thousand and 100 thousand plus categories. The capital city is the only settlement where the number of industrial enterprises of each branch is very high.

Of the industrial enterprises those with foreign interest should be treated with special attention as their presence is important for the fate of the host settlement. About 40% of FDI that has arrived in Hungary since 1989 have flown into the industrial sector. Industrial enterprises with foreign inter-

Table 2. Number of industrial enterprises with more than 10 employees by branches and settlement size in Hungary, 2008

Denomination	Number of industrial enterprises in settlements by population size group										Total
	–499	500–999	1,000–1,999	2,000–4,999	5,000–9,999	10,000–19,999	20,000–49,999	50,000–99,999	100,000–299,999	Above 1,000,000	
Manufacture of basic metals	3	–	6	19	7	14	19	9	19	23	119
fabricated metal products	22	38	72	149	120	223	283	122	237	287	1,553
machinery and equipment	3	10	24	32	49	69	117	64	96	136	600
electrical equipment	1	3	6	18	19	21	58	27	24	64	241
computers, electronic and optical equipment	–	4	4	21	5	38	51	28	33	104	288
transport equipment	2	4	12	18	21	32	39	24	32	18	202
non-metallic mineral products	6	8	16	31	33	38	73	43	41	58	347
chemical products	2	3	10	23	17	27	12	11	12	48	165
rubber and plastic products	8	11	37	83	67	69	74	50	103	98	600
pharmaceuticals, medicinal chemicals, botanical products	1	1	–	6	–	2	8	3	2	22	45
textiles and textile products	8	11	38	81	37	79	98	61	103	147	663
leather and leather products	2	–	4	23	9	29	18	10	24	23	142
wood and wood products	20	29	40	77	50	71	44	31	43	42	447
pulp, paper, paper products	1	–	5	17	23	18	22	13	25	36	160
Publishing, printing, reproduction of recorded media	3	–	2	10	8	22	46	36	56	144	327
Manufacture of food products and beverages	18	45	124	234	157	208	181	91	130	231	1,419
Total	100	167	400	842	622	960	1,143	623	980	1,481	7,318

Source: Cég-Kód-Tár. (Database of enterprises), the end of 2008.

est have grown rapidly for the past two decades and had come close to 3,600 by 2008. This accounts for 12% of all companies with foreign interest that is slightly below that of the year 1998 (16%). Budapest is highly attractive for industrial enterprises with foreign interest. At the turn of the millennium it was host to 32% of these enterprises while the rest 2,274 was located at the other 3,134 settlements of the country. Ten years after 2,497 industrial enterprises with foreign interest operated at 3,151 settlements of Hungary, which means that theoretically, on the average at two settlements out of three there was one industrial establishment with foreign interest. But the reality is different.

The spatial distribution of industrial enterprises with foreign interest (outside of the national capital) is even more concentrated than that of all industrial enterprises. Their large majority is located in the northern part of Transdanubia, along the Vienna–Budapest axis, in West Transdanubia and in the largest settlements of Budapest agglomeration, mostly in urban settlements of different size (e.g. Győr, Esztergom, Komárom, Szombathely, Szentgotthárd, Tatabánya). In this respect no spectacular change occurred between 1998 and 2006 as it was verified by the examination of databases of two catalogues on *Large and Medium Enterprises of Hungary* (Magyarország nagy- és középvállalatai, Hoppenstedt Bonnier) published in 1998 and 2006 (Kıss, É. 2010). In the other regions of Hungary these enterprises now are confined mainly to the county seats which as a rule belong to the size category of 50–100 thousand population. Naturally, there are substantial differences by industrial branches because printing and publishing is confined to large urban centres, whereas industrial units of light industry are dispersed among settlements with highly diverse sizes and functions.

A closer association of the foreign capital with the larger centres is probably due to the availability of highly skilled workforce, fairly good infrastructural provision and of rich cultural and recreational opportunities at these settlements. These are more and more important factors in site selection. In other words, in the very focus of capital flows the larger centres are located as the targets of foreign investments.

Since the change of regime the spatial pattern of the industrial sector has been basically defined by the decisions of the investors as to site selection, which settlement is to be chosen from the "market of settlements". The central government has only very limited means to interfere in these decisions. Site selection for an enterprise is a resultant of several factors. During the past decade with the abatement of differences between the settlements in terms of their capacities (e.g. qualification of workforce, provision of infrastructure) "homogenization" of the hard factors occurred. Consequently, soft factors (quality of built environment, townscape, flexibility of local administration) emerged as increasingly decisive, and generally they are more favourable at the populous settlements (Kıss, É. 2010). In fact, these are the settlements, where industry is

to survive longer because foreign enterprises usually are bigger and better provided with capital than the domestic ones.

Further information about the distribution of industrial enterprises with foreign interest was provided by a survey of those operating in industrial parks and conducted in 2006. The survey extended to 72 industrial parks of the 181 which operated in the country at that time. (Only they had shown willingness to fill out the questionnaire distributed.) 1,718 enterprises were registered that made up 53% of the total settled in industrial parks. Of them 109 were those with foreign interest. Most of them (54%) preferred urban settlements with 10–50 thousand inhabitants and the less had chosen the smaller ones. This way an ideal settlement size for the industrial parks and enterprises with foreign interest could be determined *(Table 3).*

Table 3. Industrial parks by the occurrence of enterprises with foreign interest in Hungary, 2006

Denomination	Size of settlement										Total
	–499	500–999	1,000–1,999	2,000–4,999	5,000–9,999	10,000–19,999	20,000–49,999	50,000–99,999	100,000–499,999	Above 1,000,000	
Number of industrial parks with foreign enterprises	–	–	–	2	5	12	16	4	7	1	47
Number of industrial parks without foreign enterprises	–	–	1	5	4	7	4	1	3	–	25
Total	–	–	*1*	*7*	*9*	*19*	*20*	*5*	*10*	*1*	*72*

Source: Survey by the author in 2006.

Industrial parks have been expanded in Hungary since 1997 and this process can be considered as a new wave of industrialization. The 210 parks that existed in 2006 were located in 165 places, in over 5% of the settlement stock; in some settlements there were two or more of them. The majority of the industrial parks are to be found in urban settlements and this is not by accident: towns and cities are able to insure the conditions for their operation.

Most of them preferred small towns in the 10–20 thousand population size class but many have fallen in the 5–10 thousand and 20–50 thousand categories. For two thirds of the industrial parks these categories have proven to be ideal. Those established in villages (e.g. Pacsa, Sóskút, Timár, Tuzsér, Zalaszentiván) preferred the 1,000–5,000 size. The only one at a settlement below 500 residents is Nagylak Industrial Park in Makó microregion *(Table 4).*

Table 4. Industrial parks by size and function of settlements in Hungary, 2010

Denomination	Size of settlement										Total
	–499	500–999	1,000–1,999	2,000–4,999	5,000–9,999	10,000–19,999	20,000–49,999	50,000–99,999	100,000–499,999	Above 1,000,000	
Number of industrial parks in towns	–	–	1	16	32	46	34	11	8	1	142
Number of industrial parks in villages	1	4	8	9	1	–	–	–	–	–	23
Total	1	4	9	25	33	46	34	11	8	1	165

Source: Ministry of Economics, 2010.

Those industrial parks are the most viable ones which accommodate enterprises with foreign interest. Based on different estimations 30–35% of the industrial parks are on shaky economic grounds and 10–20% of them do not really work (Regős, Zs. 2007). The most advanced and mature of them are to be found in North Transdanubia and in Central Hungary Region. The majority of enterprises with foreign interest have settled here as testified by the survey of 2006 (*Figure 4).*

The relevance of industry for settlement network can be deduced (with some reservation) from the distribution of industrial employment by statistical microregions *(Figures 5* and *6).*

Back to 1990 1.3 million industrial employees worked in Hungary but the deep structural recession cut their number and it had dropped down to 760 thousand by 1995. Especially the settlements of microregions in the industrial axis along middle mountains were affected. Owing to the deep industrial crisis many settlements, socialist towns became nailed similar to villages qualified in 1982 as highly industrialized and granted with urban status by 1990. A lot of mines and factories were closed down and industry had lost in weight within the local economy as reflected by employment too.

Starting with the mid-1990s the sector gathered strength and new industrial spaces emerged. In some places, particularly at the urban settlements of the North Hungarian Mountains (e.g. Miskolc, Ózd, Salgótarján) the recovery from the profound restructuring process of industry is still going on. By 2001 industrial employment had mainly grown in the northern half of Transdanubia whith a prevalence of small villages. The increase was especially significant in e.g. Celldömölk, Kisbér, Mór and Sárvár microregions. In

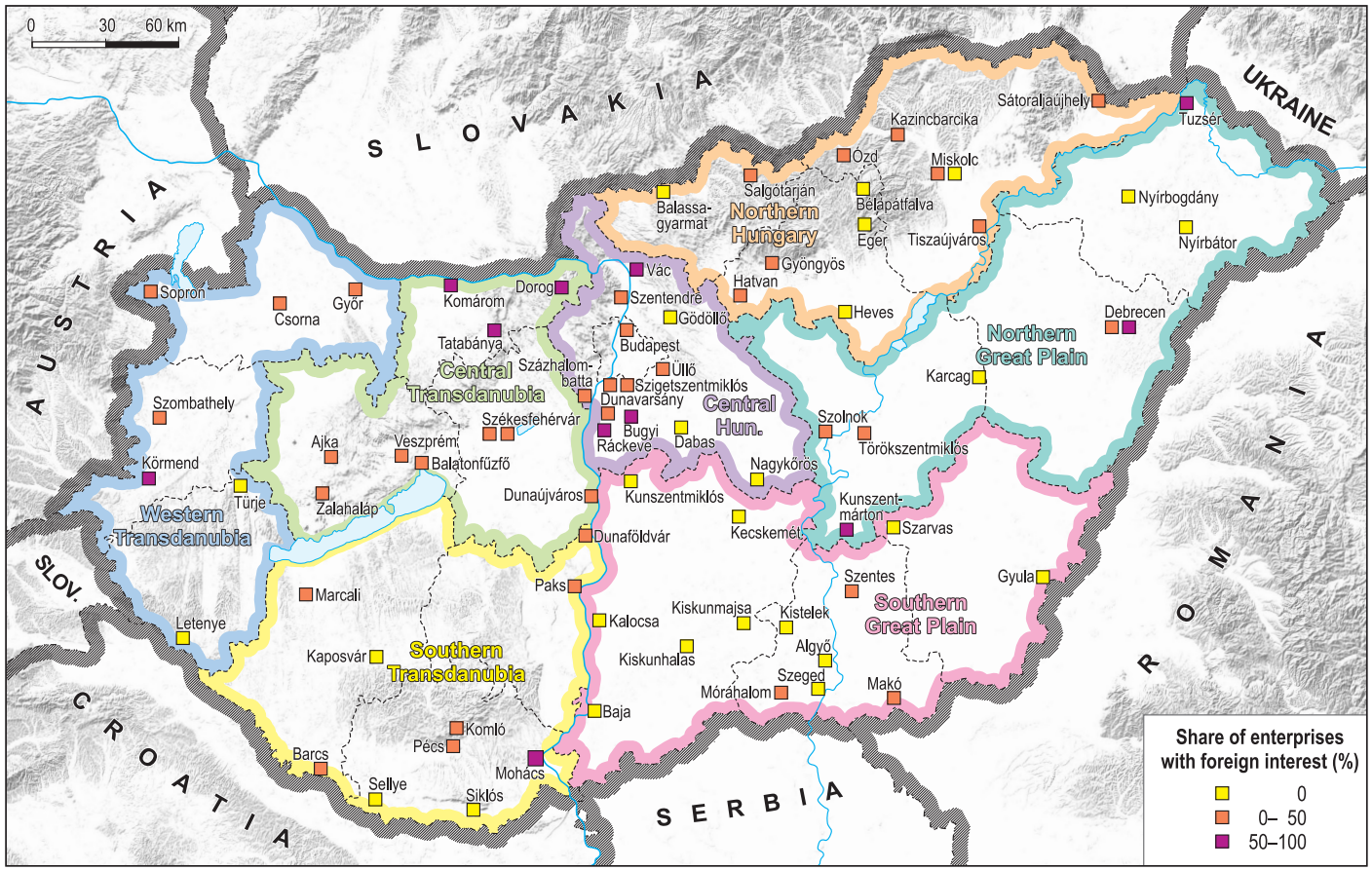

Fig. 4. Enterprises with foreign interest in industrial parks, 2006. *Source:* Survey carried out by the author in 2006

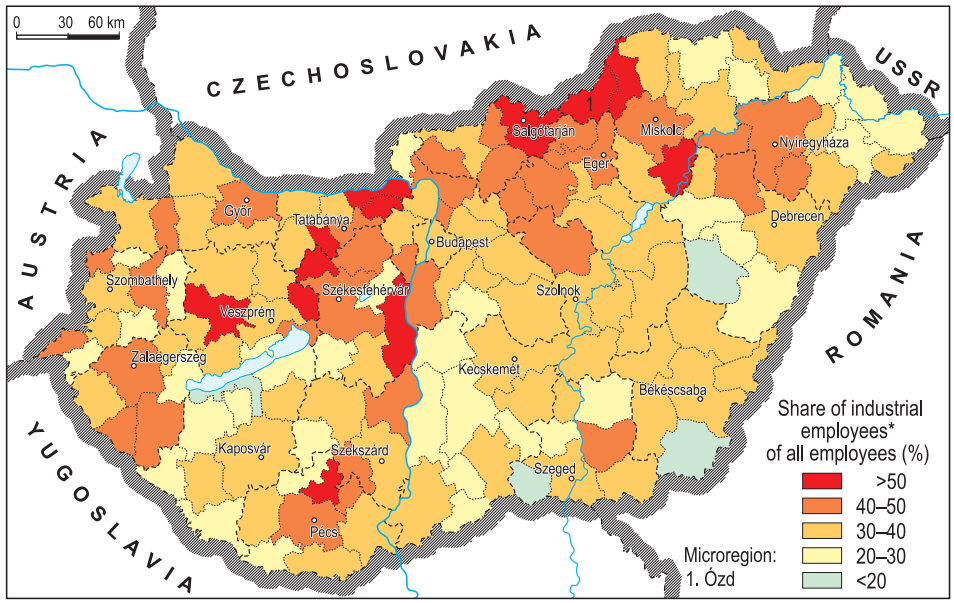

Fig. 5. Share of industrial employees by microregions, 1990. * included enterprises in construction. *Source:* Regional Statistical Yearbook, 1990

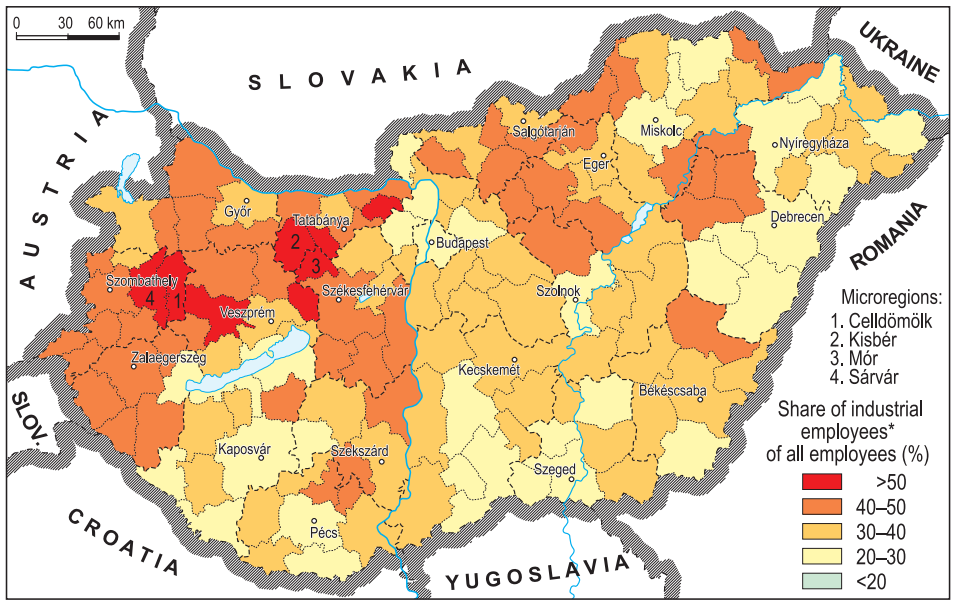

Fig. 6. Share of industrial employees by microregions, 2001. * included enterprises in construction. *Source:* Regional Statistical Yearbook, 2001

many of the small villages (based on the map compiled by Beluszky and Sikos in 2007) industrial employment (including construction) reached 50–65% – a considerably high ratio.

A comparison of two figures (villages with population below 1,000 and ratio of active earners employed in industry by settlement) published by Beluszky and Sikos in 2007 also indicates unambiguously that the share of industry had became significant in the local employment in the minor settlements of the northern and western parts of Transdanubia by the early 21st century (Beluszky, P. and Sikos, T.T. 2007, p. 142, 172). This is probably due to the low number of jobs in the local tertiary sector. Here should be mentioned that industrial workers from the small villages are not employed locally but they mainly commute to work to a nearby urban settlement. This is one reason why category V. of the types of rural settlements of the 1982 survey virtually disappeared by the beginning of 21st century. So when performing typification of villages in the early 2000s no category referring to rural industry could be established (Beluszky, P. and Sikos, T.T. 2007). Another reason might be that since 1982 many settlements with relevant industry have been granted urban status.

At the same time in the industrial employment of the microregions located in the other parts of the country (e.g. on the Great Hungarian Plain, South Transdanubia) there has not been recorded any significant change, except for a slight decrease by 2001, and this could be continued in the last decade too.

Conclusions

While during the period of socialism industrial development "revolutionized" the settlement network, after the change of regime its impact became less spectacular and rather indirect. Whereas industry was losing its positions the settlements have not disappeared but their economic basis was shaken. New settlements were not founded either as it had occurred during socialism because industrial investments were made at the already existing ones. A further difference was that the new objects (e.g. industrial parks) were confined primarily to the urban settlements.

Thus industry rather became an urban phenomenon again in late 20th and early 21st century. In most rural settlements industry was pushed to the background and the circle of villages virtually without industrial activities has widened. Indisputable that their declaring a town has also contributed to this. Craftsmanship, cottage industry, repair and services are more frequent again in villages while big industry disappeared almost completely (Beluszky, P. and Sikos, T.T. 2007).

A further specific feature of industry is a high concentration so it does not play any part in the mitigation of disparities between regions and settlement; just the other way round, it generates spatial differences. Another difference is that industrialization did not coupled with urbanization during the past twenty years and their close relationship has loosened a lot. Nowadays it is not typical at all that e.g. industrial companies give assistance to the development of local infrastructure. In many cases there is no connection between the enterprise and local government or local social and economic organizations; the former exists and operates as an alien element. This is especially valid for the enterprises with foreign interest; the duration of their presence is almost incalculable.

The outcome is that even if a settlement flourishes and has several such enterprises at the moment, in fact it is highly vulnerable. As a consequence of the dependence and exposedness of the industry forming its economic basis there is a permanent risk of losing this function partly or completely. However, these settlements usually are populous therefore the collapse or cessation of the industrial function would not probably lead to the vanishing of the settlement. Even more that in almost all of them tertiary sector is the dominant one. With no doubt the economy of settlements is going to be hard hit by the cessation of industrial activity in the future as well. This is because in them there is only few possibilities for the emergence of new functions (cultural economy, knowledge-based economy, creative industries) representing the new challenges of the 21st century. It is clear that within the Hungarian settlement network it is the capital city and the largest urban settlements in the countryside that have the best chances to join the process of globalization absorbing new economic functions. At the same time in the rest of the settlements "traditional" economic functions are to survive for a longer time along with a more restricted impact of industry upon the settlement network.

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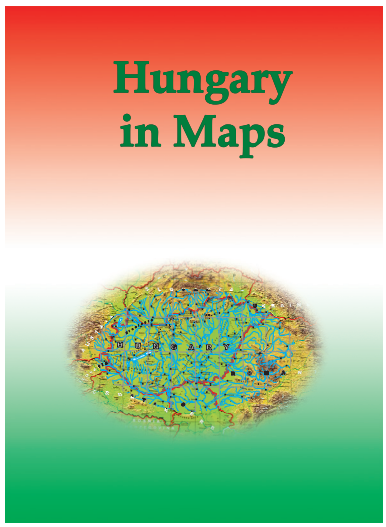
Hungary in Maps

Edited by
Károly Kocsis and Ferenc Schweitzer

Geographical Research Institute Hungarian Academy of Sciences
Budapest, 2009. 212 p.

'Hungary in Maps' is the latest volume in a series of atlases published by the Geographical Research Institute of the Hungarian Academy of Sciences. A unique publication, it combines the best features of the books and atlases that have been published in Hungary during the last decades. This work provides a clear, masterly and comprehensive overview of present-day Hungary by a distinguished team of contributors, presenting the results of research in the fields of geography, demography, economics, history, geophysics, geology, hydrology, meteorology, pedology and other earth sciences. The 172 lavish, full-colour maps and diagrams, along with 52 tables are complemented by clear, authoritative explanatory notes, revealing a fresh perspective on the anatomy of modern day Hungary. Although the emphasis is largely placed on contemporary Hungary, important sections are devoted to the historical development of the natural and human environment as well.

In its concentration and focus, this atlas was intended to act as Hungary's 'business card', as the country's résumé, to serve as an information resource for the sophisticated general reader and to inform the international scientific community about the foremost challenges facing Hungary today, both in a European context and on a global scale. Examples of such intriguing topics are: stability and change in the ethnic and state territory, natural hazards, earthquakes, urgent flood control and water management tasks, land degradation, the state of nature conservation, international environmental conflicts, the general population decline, ageing, the increase in unemployment, the Roma population at home and the situation of Hungarian minorities abroad, new trends in urban development, controversial economic and social consequences as a result of the transition to a market economy, privatisation, the massive influx of foreign direct investment, perspectives on the exploitation of mineral resources, problems in the energy supply and electricity generation, increasing spatial concentration focused on Budapest in the field of services (e.g. in banking, retail, transport and telecommunications networks), and finally the shaping of an internationally competitive tourism industry, thus making Hungary more attractive to visit.



This project serves as a preliminary study for the new, 3rd edition of the National Atlas of Hungary, that is to be co-ordinated by the Geographical Research Institute of the Hungarian Academy of Sciences.

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DEM based examination of pediment levels: a case study in Bükkalja, Hungary

János VÁGÓ[1] and András HEGEDŰS[1]

Abstract

Bükkalja is the southern pediment of Bükk Mountains. According to the geographic literature this area is divided into two pediment (geomorphic) levels. Using the methods of quantitative geomorphology, the Bükkalja pilot area was examined in this paper. The main objectives of the investigation were the validation of examinations based on the digital elevation model by the accepted scientific achievements (referring to the dual pediment), and the analysis of the role of Miocene welded ignimbrite cuestas in the evolution of the pediment. Applying different GIS based methods, the height and location of these levels were determined and their area calculated as well. Relationship was established between the location of the upper pediment level and the occurrence of welded ignimbrites on the surface. The leading role of welded ignimbrite cuestas was also confirmed by the morphometric analysis of tuff formations.

Keywords: planation surface, DEM, SRTM, Bükkalja, ignimbrite, morphometry

Introduction

In the present paper, GIS based geomorphological methods were applied for the study of planation surfaces. Bükkalja was chosen as the pilot area. Hopefully, on the basis of this case study, through the application of the methods suggested, general conclusions can be drawn also valid for the evolution of other pediments.

Planation surfaces, like pediments, glacis, pediplains, etchplains are among the most common landscapes on the Earth's surface. The term "planation surface" describes a geographically flat surface resulting from denudation. At the junction of slopes and plains the gently inclined, rock-cut surfaces, the pediments are the most prevalent landforms (Migoń, P. *et al*. 2005). In the Carpathian Basin, these denudational landforms, especially the pediments

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also can be found often on the margin of the mountains (Pécsi, M. 1963, 1964, 1969; Székely, A 1972, 1977). The evolution of pediments typically depends on the climatic conditions: they come into being only under semiarid climate. In Hungary there were periods, when the conditions were suitable for the evolution of planation surfaces. In our days these landforms are strongly dissected into interfluve hills (Gábris, Gy. 2007).

Authors of numerous international and Hungarian studies have examined the evolution of planation surfaces: paleo/fossil surfaces were investigated by e.g. Johansson, M. (1999), Feng, J. and Cui, Z. (2002), Coltorti, M. *et al.* (2007), Grohmann, C.H. *et al.* (2007). Some authors (Migoń, P. *et al.* 2005) tried to determine the age of the surfaces, and to reconstruct the landform evolution events that shaped them, others (Tokarev, V. *et al.* 1999; Csillag, G. 2004) applied digital elevation models (DEM) as well.

In the investigation of planation surfaces DEMs (digital elevation models) were used for denudation rate estimations, and for the calculation of eroded and transported sediments (Van Balen, R.T. *et al.* 2002; Roessner, S.–Strecker, M.R. 1997).

In the DEM based examination of planation surfaces the rock quality (resistancy to the erosion, i.e. "hardness") was also taken into consideration (Coltorti, M. and Pieruccini, P. 2000). In the Hungarian geographical literature, the studies of (periglacial) planation surfaces have played an important role (see the review by Gábris, Gy. 2007).

Quantitative geomorphology is the practice of terrain modeling and ground surface quantification, applying the knowledge of Earth science, mathematics, and computer science (Pike, R.J. 2002). Using of SRTM (NASA Shuttle Radar Topography Mission) based DEMs in GIS is an inexpensive method to regional geomorphologic examinations, which allows speed and precision for the calculation of morphometric parameters (Grohmann, C.H. *et al.* 2007).

In the present paper the study area of Bükkalja has been examined with methods of quantitative geomorphology. This research has three main goals. Firstly, to check the examinations based on SRTM DEM in pediment (in the study area of Bükkalja) by the accepted scientific achievements. The delineation and subdivision of Bükkalja (geomorphologic levels) was also carried out. Secondly, beside the validation, efforts were made to obtain results, which have led to further examinations.

The third main goal was to prove the role of Miocene welded ignimbrite cuestas in the evolution of pediment. Although the geomorphologic conditions of Bükkalja are well known, this knowledge comes mainly from traditional methods of morphologic examinations. The present research is an attempt to complement this knowledge from a different aspect, so that compared with the subjective methods a modern GIS based morphometric analysis could yield a more exact result.

The study area

The Bükkalja is the largest margin pediment in the North Hungarian Mountain Range, in fact in the whole Hungarian Mountains. Its area is 813 km^2 (Dövényi, Z. ed. 2010). The western and eastern boundaries of the area could be drawn easily: Tarna and the Sajó Valley, respectively.

The conventional southern border is situated along the row of settlements Kerecsend–Maklár–Mezőkövesd–Mezőnyárád–Bükkábrány–Vatta–Emőd (Dobos, A. 2006). However, it is difficult to mark the narrow boundaries to the south and north, because of the wide borderland between the Borsod Plain and Bükk Mountains. In this study, the boundary of the examined area is based on the official Hungarian landscape divisions (Dövényi, Z. ed. 2010) (*Figure 1*).

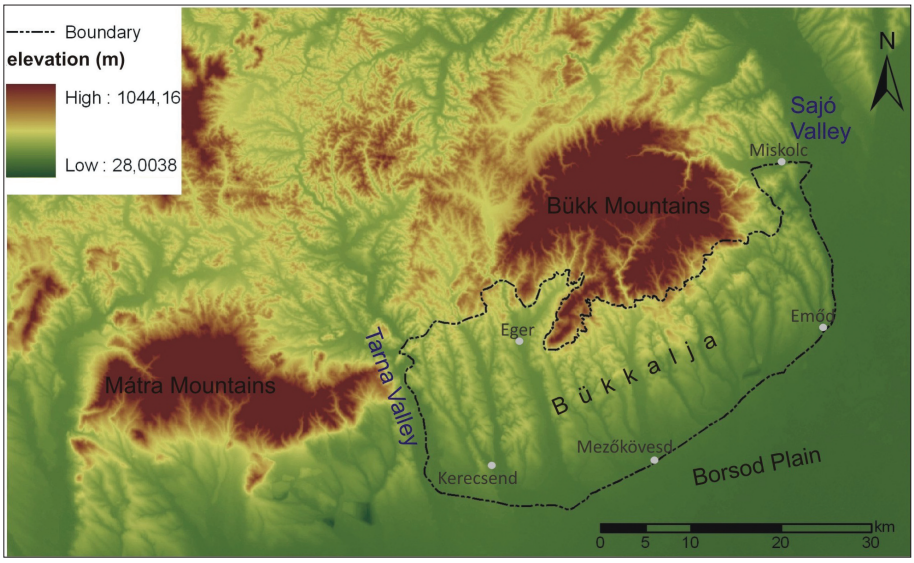

Fig. 1. The location of Bükkalja in the North Hungarian Mountains and the SRTM based DEM of the vicinity

Geological setting

The erosion, and therefore the evolution of planation surfaces as well – beside the climate, vegetation, and other geographic conditions – mainly depends on the geological setting. In the study area the rock quality ("hardness") has the most important role in the evolution of the surface.

The geological structure of Bükkalja is very diverse, determined mainly by Miocene pyroclastic rocks; and by younger, Pliocene-Pleistocene sediments. In the north the Bükkalja is joined to the Mesozoic rocks in the South Bükk with a narrow, interrupted, early Tertiary band of sediment: Eocene gravel, conglomerate and breccia, mottled clay; Upper Eocene limestone, marl, clayey marl; Oligocene clay, marl, clayey marl, flint, sand and sandstone.

The Eocene limestone near Bükkzsérc is classed as the Szépvölgy Limestone Formation. The Eocene–Oligocene marl, clayey marl belongs to the Buda Marl Formation. Between Noszvaj and Bükkzsérc, the stones of Oligocene Kiscell Clay Formation build up the bedrock (Pentelényi, L. 2002; Less, Gy. 2005).

The Bükkalja inclines to the Borsod Plain with Pannonian and early Pliocene marine sediments, and Pleistocene terrestrial deposits. The former are represented by Lower Pannonian sand, sandstone, mottled clay, clayey marl; Upper Pannonian sand, clay, gravel and seams of lignite, whereas the latter are Pleistocene gravelly-sandy deposits and loess (Hevesi, A. 1997). The wide central part of Bükkalja is built up of Miocene rhyolite, rhyodacite- and dacite tuffs, and welded ignimbrites (rheoignimbrites) *(Figure 2)*. The quality, compound of the pyroclasts is very diverse; they are classified into four formations by their properties *(Figure 2)*. The long cuestas of the lava rock hardness welded ignimbrites – oriented towards SWW–NEE − had played a decisive part in the evolution of Bükkalja valley system (Hevesi, A. 2002), and in the shaping of planation (pediment) surfaces as well.

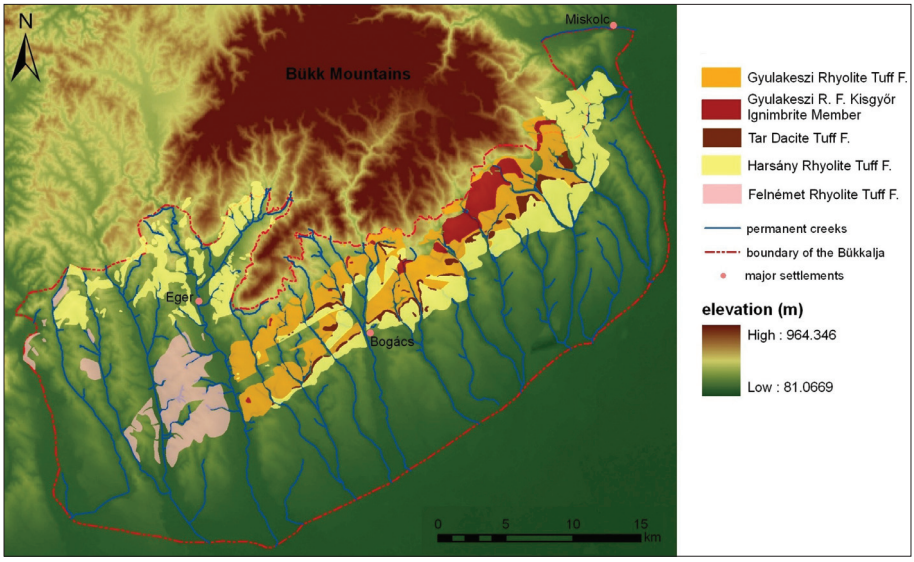

Fig. 2. The position of the Miocene pyroclastic rocks in Bükkalja. (*Source:* Gyalog, L. 2005)

The volcanism, which produced the 45 km long, 6–10 km wide band (Pentelényi, L. 2005) of pyroclasts, lasted from the Ottnangian period of the Miocene to the early Pannonian age (in terms of absolute age 21–13 million years ago). The volcanism, however, was not continuous, with interruptions between the eruptions, and the intensity of these eruptions, and the amount and quality of the materials were changing as well (Pentelényi, L. 2002, 2005; Lukács, R. *et al*. 2010).

The first part of the volcanism was the most intensive, which resulted in the widest formation, the Gyulakeszi Rhyolite Tuff Formation (Lower Rhyolite Tuff). The proportion of the welded-clinkered (rheo)ignimbrite variants is less than 50% (Pentelényi, L. 2002, 2005). These welded ignimbrite variants, which were previously delineated as lava cuestas (Balogh, L. 1963), are classified into the Kisgyőr Ignimbrite Member (Pentelényi, K. 2005). The center of the eruption must have been in the eastern foreland of Bükkalja (Pentelényi, K. 2002; Lukács, R. *et al*. 2010).

The volcanism recommenced at the end of the Carpathian. This eruption caused the appearance of the terrestrial dacite tuffs in the area. This is the Tar Dacite Tuff Formation (Middle Rhyolite Tuff). 90% of this formation consists of well-clinkered, welded ignimbrites (Pentelényi, L. 2002, 2005), therefore these are the "hardest" rocks among the pyroclast formations, the most resistant ones to denudation. This formation (and the Kisgyőr Ignimbrite Member as well) has had the most important role in the evolution of the pediment.

The volcanism resumed in the Badenian, which resulted in terrestrial, and marine rhyolite tuff. This is the Harsány Rhyolite Tuff Formation (Upper Rhyolite Tuff). Contrary to the Lower and Middle Rhyolite Tuff, this deposit does not contain welded ignimbrite, rheoignimbrite variants (Pentelényi, L. 2002, 2005).

On the western part of Bükkalja, between the valleys of Eger and Szóláti streams the pyroclasts belong to the Felnémet Rhyolite Tuff Formation. These rocks were formed during the Badenian and Sarmatian, and with results of further investigations, these could be drawn together with the Harsány Rhyolite Tuff Formation (Pentelényi, L. 2005). (The classification of these rocks is ambiguous: on the geologic map of the Bükk Mountains [Pelikán, P. 2002] the pyroclasts of the Tárkány-embayment, and north-western Bükkalja are illustrated as rocks of the Felnémet Formation, however, on the geologic map of Hungary [Gyalog, L. 2005] they are drawn as part of the Harsány Formation.)

According to Varga, Gy. (1981), the cause of the above mentioned intense welding is the low (3–5%) ash-content of these volcanic rocks. Because of the powerful eruptions, these pyroclasts were thrown some 10 kilometres far from the eruption center (Lukács, R. *et al*. 2010).

The evolution of pediment

The Bükkalja is a *dissected, dual pediment* surface. Along the margin of Bükk Mountains, the conditions of planation were given several times in the Miocene and at the Pliocene–Pleistocene boundary as well, but the exact date of the planation is still uncertain (Dobos, A. 2006).

As a consequence of the Bükk Mountains' rising, the Bükkalja mostly became a terrestrial area by the end of the Miocene. With the termination of the Miocene volcanism, the evolution of Bükkalja began at the end of Sarmatian age (Hevesi, A. 1978). In the Pannonian (Sümegium, Bérbaltavárium; 8–5.5 million years ago) under arid-semiarid climatic conditions the surface suffered sheet erosion mainly by torrents which continuously changed their riverbed and direction (Hevesi, A. 1978). At this time the ancestors of streams of the recent drainage network (Eger, Hór, Laskó and the Tárkány streams) began to form. The streams deposited their load into alluvial fans. These fans – built side by side – effected the shaping of a homogeneous planation surface (Dobos, A. 2006).

The mountain building processes caused the Miocene pyroclasts to topple from their originally horizontal position, so the beds incline with 8–25° steep slopes to south-west direction (Dobos, A. 2006; Pentelényi, L. 2002). The escarpments of the "hardest" welded ignimbrites (Tar Dacite Tuff Formation, Gyulakeszi Rhyolite Tuff Formation, Kisgyőr Ignimbrite Member) being distinctly higher than their surroundings, form long cuestas running south-west–north-east. Between the valleys of Kács- and Eger streams, tectonic movements caused these cuestas to occur in two parallel stripes. Geomorphologically these rocks can be found on the top of the interfluve hills. At present these escarpments at 300–350 m altitude (a.s.l.) represent much of the *older pediment* (Dobos, A. 2006).

In consequence of further rising of the Bükk Mountains (5.5–3 million years ago), and the growing relief, the older pediment was dissected by the permanent streams. At the end of Pliocene (Villányium, 2–1.8 million years ago) under dry, semiarid conditions, a *younger pediment* developed about 100 metres below the older surface, growing continuously to the detriment of its area (Pinczés, Z. *et al*. 1993; Dobos, A. 2006). Nowadays the portions of this younger and lower pediment are located at 200–280 m a.s.l. (Dobos, A. 2006).

The dissection of this dual pediment started already at the beginning of the Pliocene. Because of the rising quantity of precipitation and lowering temperature, landform evolution became controlled by the linear streams. By the end of Pliocene epoch, only those parts of the older pediment survived, which are the "hardest" i.e. the most resistant to denudation and primarily built up by welded ignimbrites (Pinczés, Z. *et al*. 1993). In the arid phases of the periglacial climate during the Pleistocene, sheet erosion, planation formed the surface, while in the humid periods the strengthening erosion of the stream

channels formed V-shaped valleys. This process produced the long, parallel valleys, in which most of the permanent streams of the Bükkalja run up till now (Pinczés, Z. *et al*. 1993, Dobos, A. 2006). Apart from the valleys shaped by erosion, numerous dry valleys were formed by the process of derasion.

Materials and methods

As the older, upper level of the dual pediment is situated in the area of the welded ignimbrites, only the eastern part of the pediment (i.e. that lying east of Eger stream) was examined, where these rocks outcrop.

Apart from the uncertainty in the dating of planation, the location of the surfaces of dual pediments was also undefined. In order to exclude the subjective approach, to locate these pediment levels was attempted using GIS based methods.

Beside the SRTM digital elevation model, the welded ignimbrite hilltops as parts of the older, upper pediment also became involved in the study. They

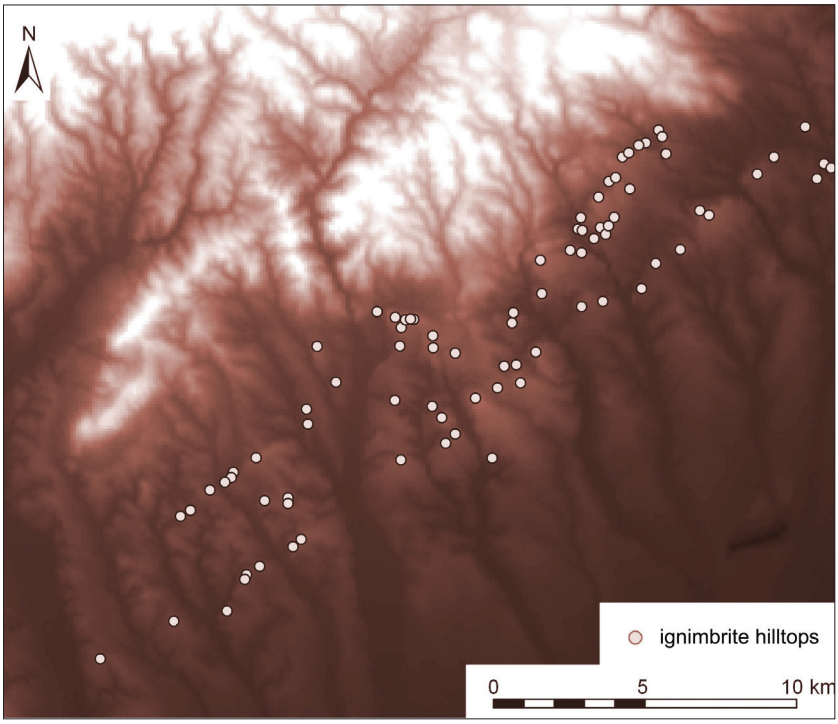

Fig. 3. The SRTM DEM of South Bükk, and Bükkalja showing the digitized ignimbrite summits

were digitized as the highest points of the interfluve hills. They were necessary for comparison with the location of pediment surfaces, defined by SRTM. These points were also used at the interpolation of a trend surface. The digitization of the height of hilltops was based on topographic contour maps at 1:10,000 scale, and on geologic maps at 1:100,000 scale (Pelikán, P. 2002; Gyalog, L. 2005). In this process, the height data of all welded ignimbrite hilltops of Bükkalja were determined. The SRTM database was used for the examination of the pediment, and the delineation of pediment levels *(Figure 3)*.

SRTM is a free digital elevation model, with a resolution of about 90 metres (Timár, G. *et al*. 2003). ArcGIS 9.3 software package was used for the analysis.

The investigation of relationship between the situation of welded ignimbrites and the upper, older level of dual pediment was also based on SRTM DEM. In the examination of the landforms only the ridges were used. They were identified by the "Topographic Position Index" (Weiss, A. 2001 cited Jenness, J. 2006).

For the morphometric analysis of ignimbrite cuestas, all of the patches were digitized, where the Miocene pyroclast formations occur on the surface. These polygons were digitized from geological maps of 1:100,000 scale (Pelikán, P. 2002; Gyalog, L. 2005).

Results and discussion

Examination of pediment levels

There was an attempt to determine the area of pediment based on the DEM histogram. In order to classify the pixels the local minimum, maximum, and inflection points of the histogram had to be determined. The histogram was approached with an eight-degree polynomial function. With the first derivation of the polynomial function, the minimum and maximum points could be calculated, and the second derivation of this function determined the inflection points. As the first step the pixels of the DEM were classified by the minimum and the maximum points of the histogram (which is about equal to the polynomial function points).

On the classified DEM, the class of the pixels between 175 and 370 m a.s.l. expressly shows the pediment *(Figure 4)*. The boundary of Bükkalja was vectorized previously on the base of the topographic map of 1:10,000 scale following the contour lines. Although this boundary is in well conformity with the border of the pediment classified from the DEM, there are some differences between them. Applying this method, the northern border of Bükkalja – which is difficult to delineate with the classic geomorpologic methods – could be

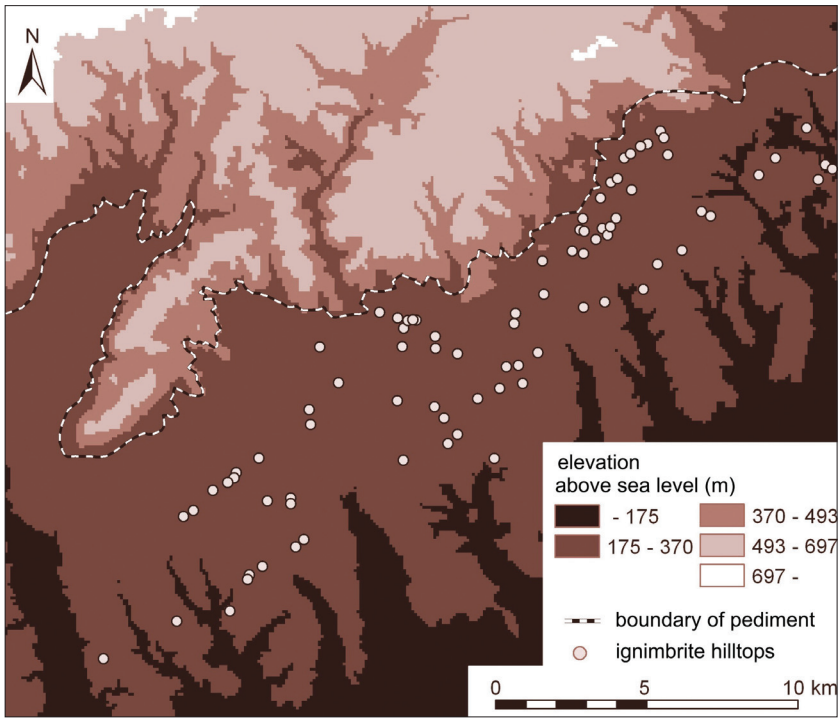

Fig. 4. Classified DEM on the base of the histogram's local minimum and maximum points

drawn exactly. According to this, the method described above can be used in the landscape classification, delimitation as well.

The other way to classify the DEM is the usage of the inflection points of the histogram *(Figure 5).* The DEM, according to the inflection points, shows the two different levels of pedimentation *(Figure 6).* The lower level is between 151–243 m, the upper is between 243–426 m. This figure shows that 87% of the ignimbrite summits are situated at the level of the upper pedimentation. This fact confirms the observation that the upper pedimentation was formed from the volcanic rocks. 13% of the ignimbrite summits are located along the north-eastern and south-western edges of the ignimbrite cuestas. The upper, older level is dissected along the streams springing from the South Bükk and running towards the Great Hungarian Plain (Alföld). On the north-eastern part of Bükkalja, the ignimbrite summits are arranged into two stripes. The southern stripe is more dissected than the northern one, and at the edges of this southern cuesta there are isolated ignimbrite blocks.

This examination leads to the result that the pediment is not uniform, it is fragmented both vertically and horizontally *(Figure 6)*. There are two different levels: the upper, older (243–426 m); and the lower, younger one (151–243 m).

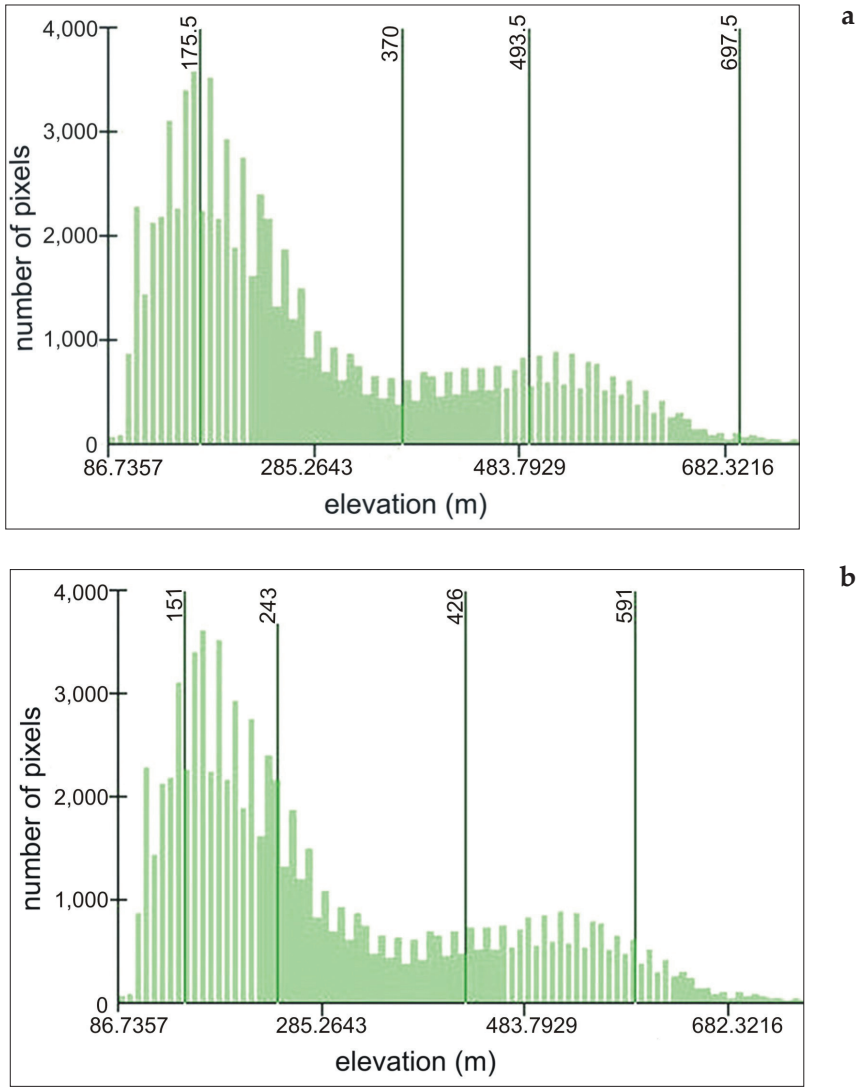

Fig. 5. Classification of pixels on the base of the histogram; a = local minimum and maximum points; b = inflection points

Based on the heights of the ignimbrite peaks a trend can be interpolated. This trend provides information from the spatial distribution of ignimbrite hilltops. The second-degree trend shows a saddle surface. The centre of the saddle coincides with the area of those ignimbrite summits, which form part of the less dissected pediment. The descending sides of the saddle show the more fragmented areas *(Figure 7).*

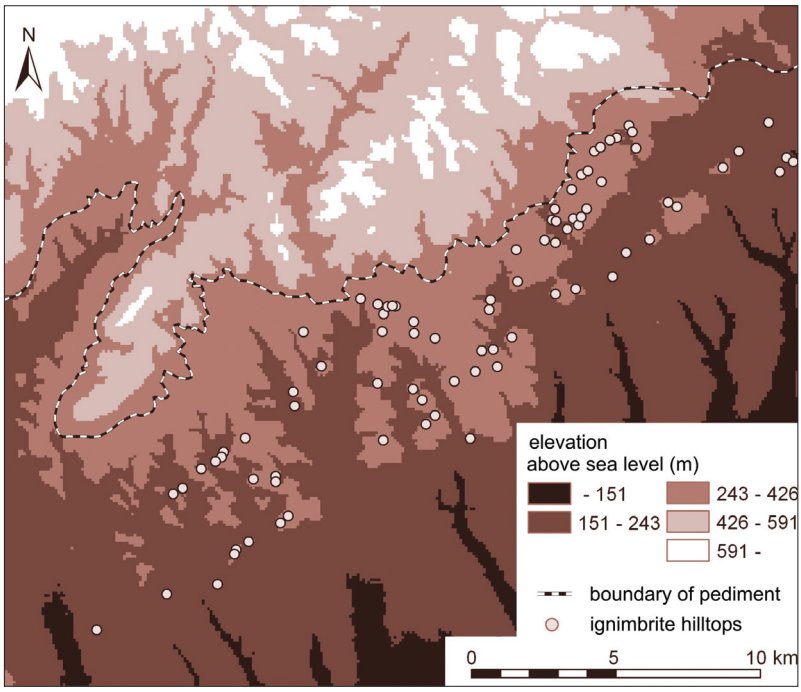

Fig. 6. Classified DEM on the base of the histogram's inflection points

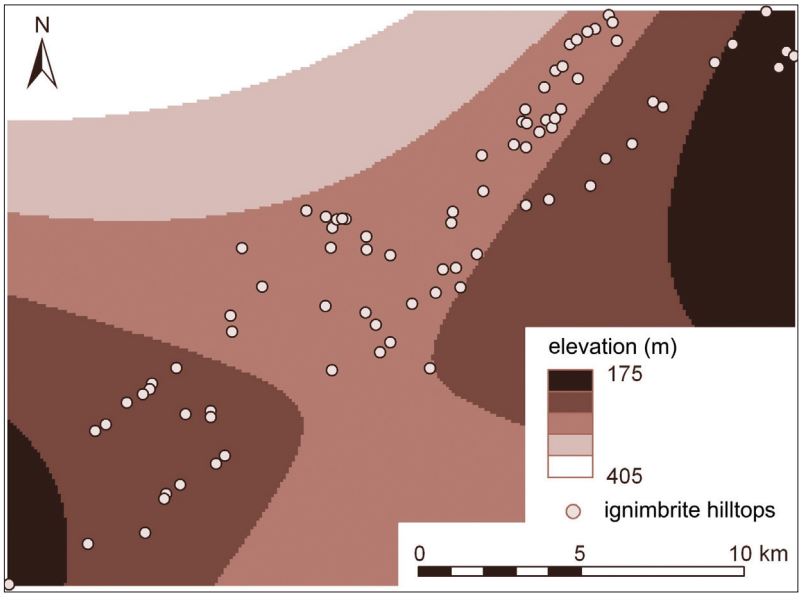

Fig. 7. Trend surface interpolated from elevation of ignimbrite hilltops

It shows that the pediment is divided into three parts from north-east to south-west. The central part of the surface is higher than the flanks, which indicate tectonic movements.

Delimitation of geomorphologic levels based on ridge height classification

In accordance with the dual pediment character (Dobos, A. 2006; Marton-Erdős, K. 2002) the pixels (ridges) of DEM by their height have been classified into two geomorphologic levels *(Figure 8)*. For the classification the ArcGIS 9.3 software Iso Cluster clustering algorithm (Spatial Analyst Tools/Multivariate) was used.

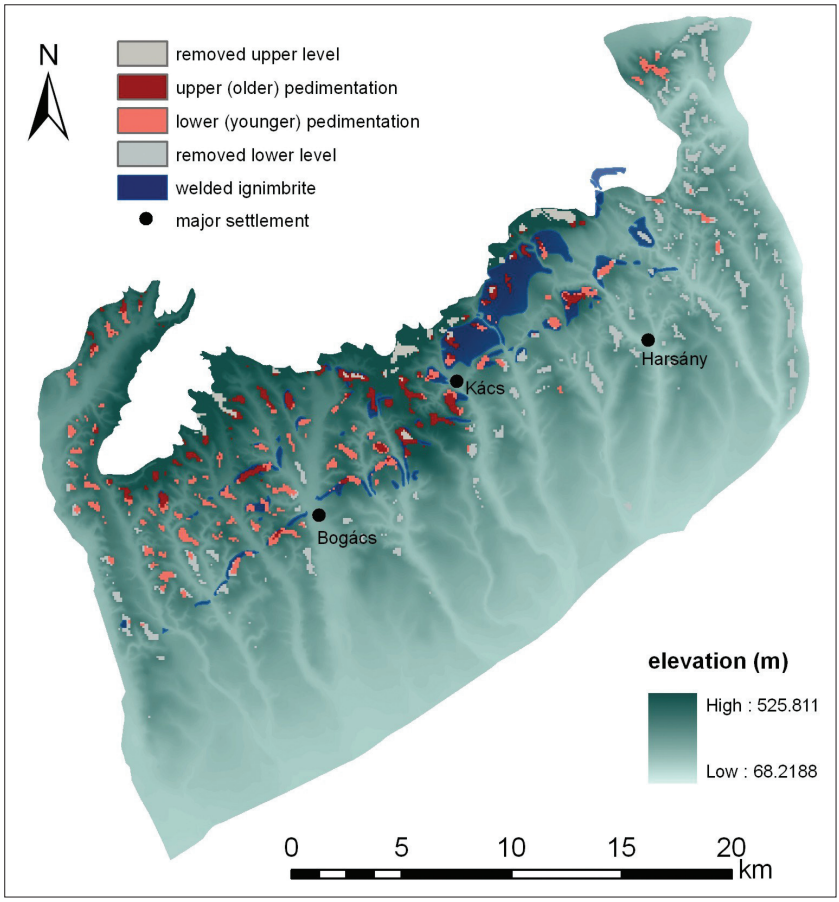

Fig. 8. Geomorphic levels of Bükkalja according to the classification of pixels (ridges) height

The selection of ridges with the Weiss method (Topographic Position Index) causes some problems. It classifies some landforms of the surface into the ridge category, which – according to the topographic maps and field observations – are not real ridges. Such landforms are the heights pushing from the South Bükk into the northern border of Bükkalja, the feet of landslides higher than the surroundings, or the southern, lowering part of interfluve hills.

To get around these problems, the pixels (ridges) were classified by their height into four classes applying statistical methods (*Table 1)*. Then the lowest class (which contains pixels classified by the method into ridges, being in fact not real ridges) and the highest one (the heights of northern border) were removed from the database. The easy separability of the pixels (by height and location equally) made this method possible *(Figure 8).*

The pixels of first (lowest) class apparently may be part of ridges as well from geomorphologic point of view. Nevertheless, because of the low – often only some metres high – relative height, these pixels do not represent typical ridges. By removing the lowest and the highest classes, a rectified map was generated *(Figure 8)*, with the ridges of the pediment classified into two height classes which represent two geomorphic levels: the level 2 is the younger, lower; while the level 3 is the older, higher level of the pediment *(Figure 8, Table 1)*. The combined area of the two levels is 16.88 km^2, which is less than 2% of the whole territory of Bükkalja. The older, upper level is smaller: 673.24 ha, the younger, lower level comprises 1015.25 ha *(Table 1)*.

Table 1. Data of ridges classified into four height classes (calculated from pixel numbers)

Class/ geomorphic level	Area (ha)	Proportion of area (%)	Pixels on welded ignimbrites	
			Area (ha)	Proportion (%)
1 (lowest, removed)	1244.63	38.55	72.23	5.8
2 (lower level)	*1015.25*	*31.46*	*185.49*	*18.2*
3 (upper level)	*673.24*	*20.86*	*226.07*	*33.6*
4 (highest, removed)	294.80	9.13	19.87	6.7

During the analysis of the relationship between the welded ignimbrite cuestas and the ridges of the upper pediment level, the proportion of the pixels was also examined, identified as ridges by the above mentioned method of both geomorphic levels, occurring on ignimbrites (ArcGIS 9.3 Spatial Analyst/ Zonal Statistics as Table tool, *Table 1*).

According to the calculations, pixels of the upper pediment level occur in the greatest proportion on welded ignimbrite surfaces (33.6%, *Table 1*). Accordingly, this rock type has a leading role in the evolution of upper pediment level. The rest of the pixels belonging to this class are located mainly on the relatively high saddles between the welded ignimbrite ridges, and on the southern slopes of Nagy-Eged Hill (536 m).

On the examined eastern part of Bükkalja, following the direction of welded ignimbrite cuestas, the ridges of pediment levels are arranged into 2–3 parallel stripes.

Between the Tardi- and Kácsi streams, on the highest zone of the pediment, the stripes of the upper pediment level – breaking the lower level – are merged *(Figure 8)*. Portions of the younger, lower pediment level are located mainly to the south of the upper level.

In the Bogács–Cserépfalu depression, these lower ridges can be found between the stripes of the upper level. Even though the applied method has uncertainties, the results, i.e. the location of pediment levels are more complete and detailed than those in the former geographic literature (e.g. Dobos, A. 2006). The list of the major hills of the pediment (geomorphic) levels, based on the applied method, is shown in *tables 2* and *3*.

Table 2. Major ridges of older, upper geomorphic level

Name of hills	Elevation (m)	Formation
Kis Eged-hegy	302	Szépvölgy Limestone Formation
Sík-hegy	305	Kiscell Clay Formation
Mész-hegy	332	Gyulakeszi Rhyolite Tuff Formation Kisgyőr Ignimbrite Member (KIM)
Kavicsos-tető	332	Kiscell Clay Formation, Noszvaj Member
Ibolyás-tető	334	Kiscell Clay Formation, Noszvaj Member
Kőkötő-hegy	318	Tar Dacite Tuff Formation
Gyűr-tető	293	Tar Dacite Tuff Formation
Ravaszlyuk-tető	358	Kiscell Clay Formation
Nyomó-hegy	340	Gyulakeszi Rhyolite Tuff Formation KIM
Vén-hegy	291	Tar Dacite Tuff Formation
Mész-hegy (Cserépfalu)	353	Tar Dacite Tuff Formation
Kecsor-tető	295	Tar Dacite Tuff Formation
Sós-tető	342	Tar Dacite Tuff Formation
Szaduszka-tető	331	Gyulakeszi Rhyolite Tuff Formation KIM
Nagy Barátrét-tető	342	Kiscell Clay Formation/Gyulakeszi Rhyolite Tuff Formation
Mangó-tető	325	Tar Dacite Tuff Formation
Karud	371	Tar Dacite Tuff Formation
Szentkereszt-bérc	322	Tar Dacite Tuff Formation
Vár-hegy (Kács)	325	Tar Dacite Tuff Formation
Pallag	302	Gyulakeszi Rhyolite Tuff Formation KIM
Poklos	348	Gyulakeszi Rhyolite Tuff KIM
Kecet-tető	350	Gyulakeszi Rhyolite Tuff KIM
Dobrák-tető	350	Gyulakeszi Rhyolite Tuff KIM
Vár-hegy (Kisgyőr)	333	Gyulakeszi Rhyolite Tuff KIM
Kerek-hegy (Kisgyőr)	311	Gyulakeszi Rhyolite Tuff KIM
Halom-vár	317	Tar Dacite Tuff Formation

Table 3. Major ridges of younger, lower geomorphic level

Name of hills	Elevation (m)	Formation
Nyerges-tető	254	Gyulakeszi Rhyolite Tuff Formation
Aranybika-tető	286	Gyulakeszi Rhyolite Tuff Formation
Elő-hegy	269	Eger Formation/ Gyulakeszi Rhyolite Tuff
Ispán-hegy	260	Tar Dacite Tuff Formation
Deber-tető	255	Eger Formation
Méti-hegy	240	Eger Formation
Csobánka	275	Gyulakeszi Rhyolite Tuff Formation
Vásáros-hegy	268	Gyulakeszi Rhyolite Tuff Formation
Borda hegy	276	Tar Dacite Tuff Formation
Pipis-hegy	266	Tar Dacite Tuff Formation
Ortvány	270	Gyulakeszi Rhyolite Tuff Formation
Gyűr-hegy	264	Harsány Rhyolite Tuff Formation
Őr-hegy	272	Tar Dacite Tuff Formation
Berezd-tető	274	Gyulakeszi Rhyolite Tuff Formation
Égés-tető	282	Gyulakeszi Rhyolite Tuff Formation
Tardi-hegy	277	Gyulakeszi Rhyolite Tuff Formation
Vár-hegy (Cserépváralja)	291	Tar Dacite Tuff Formation
Kecskekő-tető	274	Tar Dacite Tuff Formation
Mátéka-tető	240	Harsány Rhyolite Tuff Formation
Meredek-hegy	277	Tar Dacite Tuff Formation
Bánya-tető	241	Tar Dacite Tuff Formation
Dongó-tető	240	Harsány Rhyolite Tuff Formation
Leányvár-tető	269	Harsány Rhyolite Tuff Formation

Morphometric analysis of ignimbrite cuestas

As the dual pediment of Bükkalja formed by ignimbrites, these rocks must have played a very important part in landform evolution. Applying the morphometric analysis an attempt was made to determine the degree of this importance. The territory of the older pediment is overlapping with the top of ignimbrite stripes, which points to the fact that they have a key role in geomorphic evolution. Among these formations, the most important rocks are the welded ignimbrites: Tar Dacite Tuff Formation, and Gyulakeszi Rhyolite Tuff Formation Kisgyőr Ignimbrite Member.

Compared to the neighborhood, these rocks are more resistant to erosion, their denudation is slower and less effective, therefore they form the higher, typical landforms of Bükkalja (this type of hill is the so-called “nyomó”, after the famous Nyomó Hill, located in the Bogács–Cserépfalu depression). These ignimbrite cuestas had taken decisive part in the evolution of the drainage network as well (Vágó, J. 2006). Despite the leading role of the welded ignimbrites, we examined not only these rocks, but all of the Miocene tuff formations.

The GIS based detailed morphometric investigations were aimed to confirm the field observation, that the major properties of the terrain on the welded ignimbrites are significantly different from the properties in their neighborhood. The average elevation (a.s.l.), slope conditions and average relative relief values of tuff formations were compared with the same parameters on the whole territory of Bükkalja *(figures 9, 10* and *11)*. The patches covered by tuffs on the surface were vectorized as polygons. The polygons of each tuff formation were considered as a single shapefile. During the calculations, the above mentioned properties of these polygons were determined on the basis of SRTM elevation model, and summarized by formations.

The average elevation of the whole area is 186.96 m. Average elevation of each tuff formation is above this value *(Figure 9)*, most of them are higher

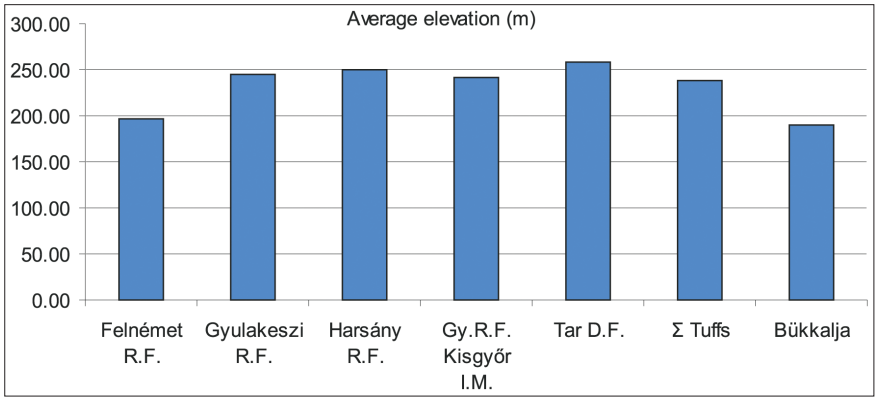

Fig. 9. Average elevation (a.s.l.) of tuff formations, compared to the average elevation of Bükkalja

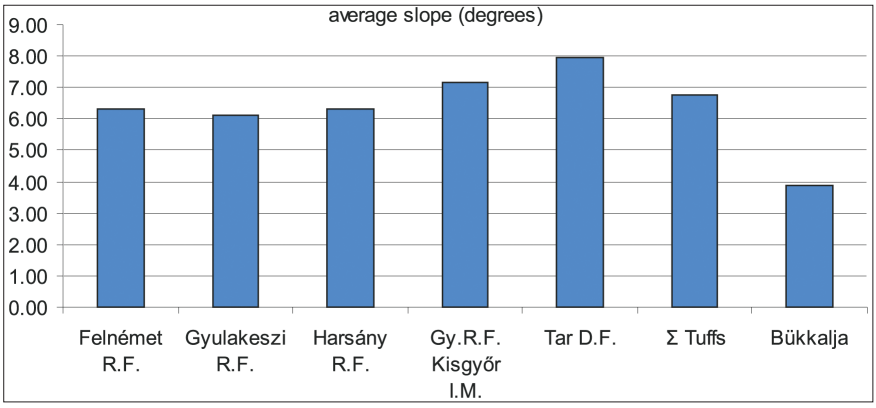

Fig. 10. Average slope angles of tuff formations, compared to the value of Bükkalja

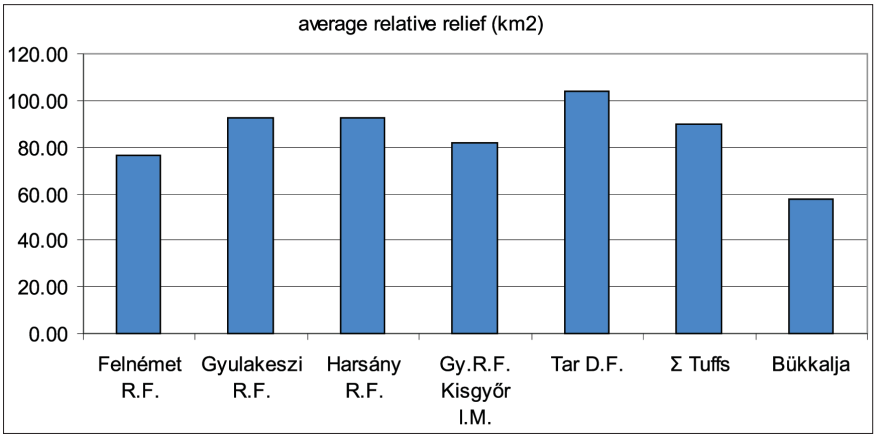

Fig. 11. Average relative relief of tuff formations, compared to the value of Bükkalja

than 240 m. Even the less resistant rocks with high erodibility, like unwelded blocks of Felnémet-, and Harsány Rhyolite Tuff Formations are higher than the average. The highest value belongs to the hills of Tar Dacite Tuff Formation (259 m) covered by rheoignimbrite, which confirms a great resistance to erosion of the welded ignimbrite variants.

The value of average slope *(Figure 10)* on the Bükkalja is less than 4°. Similarly to the elevation, the values of average slope in the case of all tuff formations are higher than the average. The highest slope data can be found at formations, which predominantly consist of welded ignimbrite variants. On the area of Tar Dacite Tuff Formation, Gyulakeszi Rhyolite Formation Kisgyőr Ignimbrite Member this value is double of the average.

The value of average relative relief on the pediment is less than 60 m/km^2 *(Figure 11)*. This parameter is also higher in the case of tuffs: the greatest values measured on the patches of Tar Dacite Tuff Formation are higher than 100 m/km^2. The relatively lower values of Kisgyőr Ignimbrite Member are explainable with the patches flatter, plateau-like appearance on the north-eastern part of Bükkalja. According to the results obtained, the welded ignimbrite stripes are well distinguishable from the other parts of Bükkalja, therefore their effect on the pediment is apparently evident.

Conclusions

According to the former results, the southern pediment of the Bükk is spatially demarcable using digital elevation model. The coincidence between this calculated pediment and the pediment border derived by classical (topographic based)

methods is fairly good, but it is not perfect. The variation comes from the different objectivity of the methods. The DEM based calculation is more objective.

According to our results, classifying the SRTM by the inflection points of the histogram, pediment levels can be delineated. The Bükkalja is divided into two pediment levels: the upper, older level is situated between 243–426 m; and the lower, younger level evolved between 151–243 m.

Examining the spatial distribution of the hilltops a trend surface was interpolated. The second-degree trend shows a saddle surface. The highest, central part of this saddle surface is situated on the area of those ignimbrite hilltops, which are part of the less dissected pediment section.

Using an alternative method, analyzing the ridges in Bükkalja by their heights, the area of pediment levels was determined, and relationship was found between the location of welded ignimbrites and the upper level of pediment. The area of the upper level is 673.24 ha, while the area of the lower level is 1015.25 ha. According to the calculations, the welded ignimbrite surfaces have had a key role in the formation of upper pediment level.

With the morphometric analysis of ignimbrite cuestas the role of Miocene ignimbrite formations in the landscape evolution became verified.

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The survey of spatial disparity in India with the application of the SENTIENT Index

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Abstract

Most of the articles written on India treat spatial disparity within the country at the level of the member states and union territories which is an imperfect approach. Reality is hidden behind the averages of the extremes. In this study the data of 593 districts of India were elaborated, based on the district level information of the census held in 2001. As a result the districts of India were classified by the relative level of development, using the so-called SENTIENT Index. The index of complex development that I created on the basis of the tetrahedron model sensitively "reacts" to the changes occurring in the geographical environment. It is modified as an effect of the events taking place in the individual spheres, so it can be a tool producing spectacular results of comparative spatial studies. The present paper explores the coherences of the spatial disparity within India and the internal correlations of the state of development or backwardness also become clear.

Keywords: India, districts, spatial disparity, SENTIENT Index

Introduction: issues to be discussed

It can be stated with an absolute certainty that India is one of the most diverse countries in the world from human geography aspect. The ethnic, language, religious and caste division of its population all result in heterogeneity practically unmatched in any other country. This is accompanied by the differences of the physical geographical endowments of this huge state: within India one can descend from peaks of the highest mountain of the planet to seaside plains, get from tropical deserts to rain forests. This extreme diversity naturally has led to considerable regional disparity.

Most of the Hungarian language literature written on India look at spatial disparity within India at the level of the states and union territories (Cseke, L. 2009; Surányi, S. 1978; Szegedi, N. and Wilhelm, Z. 2008; Trócsányi, A. and

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Wilhelm, Z. 1996), which – although the very analysis itself is a brave deed – is an imperfect approach. As an example we can look at the characteristics of urban residents recorded by the census of 2001. If we do not take the union territories actually consisting of almost purely urban spatial types (e.g. Delhi, Chandigarh, Pondicherry) into consideration, none of the spatial formations making the second tier of Indian administration *(Figure 1)* (i.e. the member

Fig. 1. Administrative divisions of India: member states and district. – 1 = Sikkim; 2 = Nagaland; 3 = Manipur; 4 = Mizoram; 5 = Tripura; 6 = Daman & Diu; 7 = Dadra & Nagar Haveli; 8 = Goa; 9 = Pondicherry

states) reach a 50% urbanisation level. In addition, the giant administrative units (among the EU 27 states, it is Spain or Poland that is comparable in size with an average state in India), and the administrative belonging to the megalopolises of the Indian subcontinent can basically modify the statistical and accordingly the cartographic data. If Delhi were not considered a union territory, the proportion of urban inhabitants in Uttar Pradesh, one of the states would be almost 6% higher (26.44%) than it is calculated now (20.78%), but if it were annexed to Haryana state, also neighbour to the capital city, we would get the most urbanised province of India, as the state would suddenly have a 55.71% rate of urban population. The calculation also works the other way round, as Mumbai (Bombay) and Kolkata (Calcutta), with populations larger than that of Delhi, are not union territories, therefore they are featured among the statistical data of Maharashtra and West Bengal states. If Mumbai were seceded from Maharashtra, the proportion of the urban residents would diminish from 42.42% to 30.72%. The change would be even more drastic if Kolkata were given a union territory status, as in this case the urbanisation level of West Bengal state, 27.97% – at the national average – would drop to 13.75% (Wilhelm, Z. 2008a). It all suggests that the survey of the present urbanisation features of India should not be conducted at the level of the member states, not to mention other human geographical examinations. The averages of the high/low extremes hide the real proportions.

Objectives

It seems to be more reasonable to analyse the data of the districts, the tier below the administrative hierarchy level of member states/provinces and union territories and producing manageable statistical databases, in order to feature the spatial disparity within India. Of course, not even the districts are entities comparable from all aspects, stemming from the administrative differences within the country[2], nevertheless a much more accurate picture can be obtained than that provided by the surveys at member state level.

The analysis of the spatial disparity in India was carried out on the basis of the data of the census of 2001. These data seem to be rather old to calculate with, but in view of the enormous size of the country the statistical offices of India are still publishing new data sets which are primary products from this last census. The essay is also designed to create a database that shall

[2] The proportion between the districts with the largest and the smallest number of population is like comparing the number of inhabitants in Hungary (just over 10 million) to that of Esztergom (a town with approximately 29 thousand inhabitants).

be comparable with the data of the next census probably to take place in 2011 so that we can clearly demonstrate the trends of and the reasons for the changes.

The author also tries to explore a new method of analysis built upon the data of the last census in India, which reveals first to the public in this paper.

Method

The districts of India have been classified by the relative level of development, using the so-called *SENTIENT Index.* The basis of this method was the tetrahedron model created by Tóth, J. in 1981. The essence of this model is as follows: a settlement is to be comprehended as a system of economic, social and technical structures in a given geographical environment, and in intensive interaction with the elements of this environment.

This concept can be best visualised, assuming the balanced development levels of the respective structure in the optimal case, by a tetrahedron, the foundation of which is the geographical environment, the other three sides are the economic, the social and the technical (infrastructural) spheres. Along the edges, between the respective spheres there are interactions of different intensities, depending on the development level of the structures; a settlement is the complete system of these spheres (and their interactions), which as a single organism is in close interaction with the natural environment.

Depending on how complicated these systems are (taking the characteristics of the complete settlement network and the relative differences of the individual elements into consideration), different settlement types can be identified (Tóth, J. 1981).

I am convinced that the tetrahedron model is not only suitable for the definition of the settlement types; both as theoretical and practical bases it is also an excellent tool for the measurement of the development level of larger units[3]. For the definition of the qualitative feature of the respective spheres I used statistical data taken from the results of the last census conducted in India.

Giving to the temptation of using acronyms so popular in the West, which refer in a simple way to the research method and the results with meaningful words, an acronym was created pointing to both the method that we used and the monitoring of the changes in the research area. This acronym is:

[3] The method of spatial analysis based on the tetrahedron model is not a new phenomenon. It was initiated by the research team led by Tóth, J. in 1995 (the so-called TÁGINTER-analysis), when submitting a proposal for the tender announced for the making of the development concept of Baranya county in Hungary.

SENTIENT Index = Society, **E**conomy, i**N**fras**T**ructure, phys**I**cal environm**ENT.**

Synonyms for the word "sentient" are feeling; attentive; aware. The complex development index that I created on the basis of the tetrahedron model sensitively "reacts" to the changes taking place in the geographical environment; it is modified as an effect of the events taking place in the individual spheres, so it can be a tool producing spectacular results of comparative spatial studies.

In the study, data of 593 districts of India were involved, based on the district level data of the census held in 2001. The data were not freely available in electronic version, so we had to read all data, district by district from the Java based GIS maps that were generated on the website of the census of India – with several months' work – from which I was able to create our own digital database. The same website contains other information as well that is not directly related to the districts (data of the member state and the union territories); these pieces of information can also be used in the future as the basis of further calculations. This time they were neglected and, with the emphasis put on the mathematical-statistical data instead, data series serving as the basis of the complex index were analysed. In order to define the rank by the level of development, with simple relative ranks were involved, using the averages of the positions.

For the description of the social sphere the following data were used:

D1 = proportion of urban population;
D2 = literacy rate;
D3 = differences in the literacy rates by gender;
D4 = proportion of diploma holders;
D5 = proportion of people with disabilities.

In the case of D1, D2 and D4 no explanation is necessary. Data of D3 were used because in India it is extremely important to recognize the disparity of literacy rates between men and women older than seven years within the same districts. It is easy to understand that in this mainly male-centred society, if the respective figure of women is close to that of men, we are in a district relatively more developed, at least as regards its human endowments. The index of D5 was selected because the more closed a given social circle (castes, sub-castes, isolated rural communities etc.), and the worse the living conditions (malnutrition, environmental damages etc.), the higher the chances that babies with disabilities are born. At the same time, it is very sad that in India there is frequent mutilation of children carried out by parents or so-called "beggar masters", in some cases even self-mutilation occurs in order to secure the stable living from begging (Nieuwenhuizen, P. 2006). On the basis of the above-said, in my opinion the less the proportion of the disabled is, the more

developed a district is in India. In addition, the institutions that receive the disabled do not distort these figures, given the usually very high population of the administrative units in question.

The development levels of the economic sphere in the districts were measured by the following indices:

D6 = proportion of full-time employment;
D7 = proportion of non-agricultural workers;
D8 = proportion of inactive population;
D9 = use of banking services;
D10 = proportion of households possessing a car.

Data on infrastructure – in relation to the characteristics of the data collection – is concentrated on the public utilities supply of the households and the comfort level of the homes *(Photo 1.)*. The search, acquisition and calculation of the data describing the economic, entrepreneurial environment can be realized in a later phase of this work. Presently we are using the following data:

D11 = bathroom in the house;
D12 = no toilet belongs to the house;
D13 = lighting with electricity;
D14 = number of telephones.

Photo 1. Households without any conveniences in the centre of Surat District ranked 94th by SENTIENT Index and once home to the first British colony in India

The application of parameters describing the natural environment is a most pressing task, as no data are available on the state of the environment by components. I made attempts to generate an index focusing on the human comfort sense due to the climate, but this index is not usable yet in the framework of this study.

Therefore only upon population density (D15) data were used in this analysis. The lower the number of inhabitants per square kilometre, the less degraded environment is expected, i.e. districts with lower population density are ranked higher in the order. Of course this parameter does not describe the quality of human life adequately, because life is rather harsh e.g. in the Himalaya of Ladakh, in an almost intact natural environment (Kiss-Csapó, G. 2009).

In addition to the data mentioned above a number of other data were also recorded and used in this essay, such as the population of scheduled castes and tribes, religious breakdown, and the number of inhabitants residing in the most populated settlements of the district. These become interesting when doing the mathematical-statistical calculations, e.g. correlation analyses.

Results

The towns and cities of India were home to almost 28% of the population of the country in 2001. There is a significant disparity at the level of member states and union territories in this respect, but this difference is even more extreme at the level of the districts: in nine districts the whole population is urban, in ten districts all inhabitants are rural dwellers. All of the districts in the first group are incorporated into metropolises or into union territories (Pondicherry). The districts remaining below 10% urbanisation level make an almost contiguous belt in Northeast India, from East Uttar Pradesh via Bihar, Orissa and the northern territories of West Bengal to the Himalaya region and the small northeast states. In addition, there are extended territories with urban void in the Western Himalaya region (Himachal Pradesh, Uttaranchal, Jammu & Kashmir).

When looking at the map featuring the districts concentrating urban population above the national average, we can see that "urbanisation axes" are being born in India, mostly linking the metropolises *(Figure 2)*. It is interesting to note that no such axis has emerged so far between Kolkata and Delhi – despite the communication role of the Great Trunk Road –, but such an axis does trend towards the city of Lahore in Pakistan. The urban junction being born on the boundary of Tamil Nadu and Karnataka is also remarkable *(Figure 2)*, which, according to my hypothesis, projects the favourable development of a number of further indices.

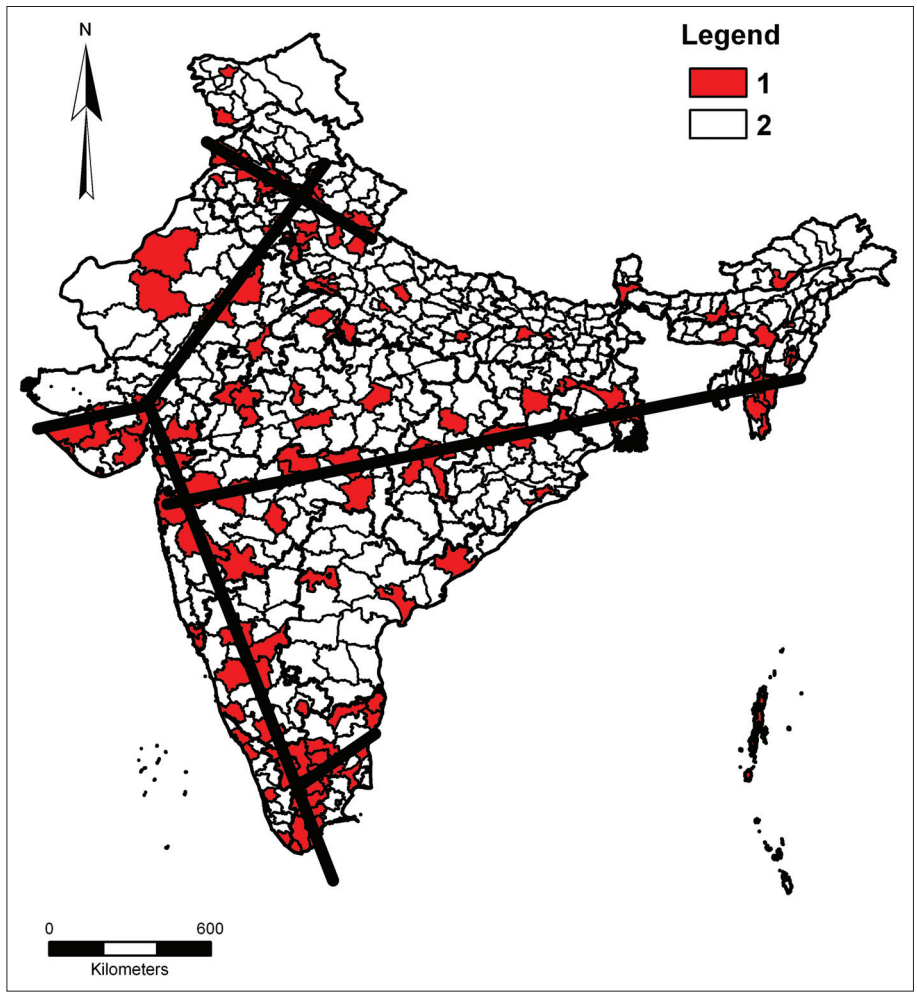

Fig. 2. Districts with over 30% share of urban population and "urbanisation axes" in India in 2001 – 1 = urban population over 30%; 2 = urban population 30% or below

If one wishes to use the analogy of generalised graphics solutions applied to visualise some spatial characteristics in the technical literature (e.g. Golden Triangle, Pentagon, Blue Banana etc.), the picture that most precisely depicts the urbanised areas of India (both in quantitative and qualitative aspect) is that of a drawn bow *(Figure 2)*. Let us introduce this discovery of ours to the professional circles under the name 'Indian Drawn Bow'.

The proportion of literate persons within the population over seven years is 65.38% in India, according to the latest census. If we draw an isopleth map with the district averages, we can see again the axes known from

Figure 2, but the districts of the Himalaya and of the small northeast states are also on the map in large number. In the case of the latter the explanation may be the high proportion of Christians, but the districts in the former category have a religious component in the index as well: the Buddhists and the concomitant numerous educated monks may be the reason. At the same time other socio-cultural elements characteristic of the population in the mountain regions also contribute to this parameter considerably.

All over India there are significant differences between the number of literate men and women, because of the social traditions, for the advantage of men. There is only one district in India where the literacy rate of women exceeds that of men: this is Jaintia Hills in Meghalaya state. The literacy rates of the genders are almost the same in two other districts of this state, two districts of Kerala and four districts in Mizoram, and also in Mahe located in Pondicherry. There are 2.5 times more men than women who can read and write in the district Supaul in Bihar and in Shrawasti district in Uttar Pradesh. The frontier region to Nepal is one of the most backwards regions of India. The worst figures of the respective index can be found in the districts making an almost contiguous block. South Indian districts can only be seen at a multiplier of 1.8, this is the Mahbubnagar district in Andhra Pradesh, with a considerable Muslim population. No district in Kerala, on the other hand, has an index worse than 1.1.

The proportion of diploma holders within the adult population is the highest in big cities with considerable administrative functions. Accordingly, there is a significant deviation on the map featuring this index. Within the age group older than 18 years old the largest number of diploma holders can be found in the district of New Delhi (22.9%), the least diploma holders can be found in the South Garo Hills district of Meghalaya: 0.9% of the population. It is interesting though that this district performs better than 117 other districts when it comes to literacy rate.

When looking at the proportion of those with disabilities within the districts, we find strikingly high figures in some areas with overwhelming of secondary sector. The "most" in this respect is the district of Valsad in Gujarat, with the – hardly believable – figure of 58.77%. Nevertheless this is one of the most polluted areas of the world, around the city of Vapi, a centre of chemical industry, where e.g. in 2007 the mercury concentration of subsoil waters was 96 times higher than the WHO standard[4].

Among the selected indicators of the economic sector, the rate of full-time employees (with employment for more than six months a year) is high in

[4] The World's Worst Polluted Places. The Top Ten of the Dirty Thirty. Blacksmith Institute 2007. http://www.blacksmithinstitute.org/wwpp2007/finalReport2007.pdf (Last download: 9 December 2009)

districts with a strong secondary and tertiary sectors, or where high-quality agricultural production is typical, based on the larger amount of precipitation or irrigation (Wilhelm, Z. 2008b; Wilhelm, Z. *et al.* 2009). Accordingly, the southern, the Himalayan and the north-eastern states are prominent in this respect. The first position is held by the district of Lahul and Spiti in Himachal Pradesh: 57.8% of the employees of this district have full-time jobs. The last place is occupied by Deoria in Uttar Pradesh with 17.2%.

The share of non-agricultural workers, naturally enough, is the highest in the urbanized areas, and is also outstanding in the areas with strong tertiary sector. According to the data of the census of 2001, there is not a single agricultural employee in the islands of Lakshadweep, famous for their tourism industry. Good positions are held in the order by this index by the districts home to the ancient trading settlements and tourism industry centres in Konkan and on the Malabar Coast. The worst position in this rank is held by the administrative units of the agricultural zones in the large northern states, mainly by those of Bihar, Uttar Pradesh and Chhattisgarh. (The district of Dindori in Madhya Pradesh is ranked last with 9.8%.)

The rate of the inactive persons within the total population tells a lot (especially for the Hungarian readers). If we draw a map of the districts with indices from 2/3 to l', the primarily agricultural Hindustan plain, east of the Delhi plateau, grows dark. In the south it is Kerala that has the highest value in this respect, the district of Malappuram with its figure of 75.9% is the record holder in the whole of India. On the other hand it should be mentioned, that in Kerala the higher revenues of the active employees allow a relative well-being for the inactive as well, while the citizens of the northern areas usually live in deep poverty, either with some meagre income from seasonal agricultural work or in a jobless status.

The use of banking services by the respective households depends on the existence of several factors: income, credit standing, adequate infrastructure (telephone or internet) etc. Among these, income is the most important, because nowadays anybody is able to manage their bank affairs from anywhere. Anyway, in areas where a significant share of the people uses banking services are probably areas with advanced business environment.

The number of cars does not only suggest the income positions of the population but also indicates the presence of modern companies, and the existence of the infrastructure background. Accordingly, the big city centres – especially metropolises and the centres of the union territories – have the best positions, together with the districts with advanced secondary and tertiary sectors. The districts of Punjab have a strikingly strong representation in this respect. The density however is the highest in the district of West Delhi, where 17% of the households possess cars, while barely 0.3% of all households in Sahibganj district in Jharkhand have this privilege, occupying the last place.

The worst positions are almost exclusively held by districts in Bihar, Orissa, Jharkhand and Chhattisgarh. It should be noted that the cars registered in the statistics are not included among the heavy-duty vehicles usually strongly polluting the environment or in the category of two-stroke, two- or three-wheel vehicles that run in large numbers in the big cities of India and have a detrimental effect on air quality in the cities.

Looking at infrastructure (bathroom in the house; no toilet belongs to the home; lighting with electricity; number of telephones), we can only rely on the census data in this case again, given the limits of this essay. Naturally, in further analyses, the infrastructure of communication geography typical of the districts will have to be scrutinized as well.

Even without correlation analysis it is evident that the urbanised areas have the best positions as regards to the infrastructure endowments. The best positions are held by the southern states and Punjab. It is contrasting that while people in 94% of the households in Hyderabad live in flats equipped with a bathroom, in 100 peripheral districts of the country this proportion remains below 10%. The situation is even worse when it comes to the occurrence of toilet in the houses: in the Aizawl district in Mizoram it is only 2.7% of the homes that do not have toilet in the flat, in 172 districts of India this proportion is above 80%. The district in the worst position in this respect is that of Jashpur in Chhattisgarh with 4.7% of the households. It shows that the hygiene trap coming from the lack of communal infrastructure is still a serious problem in India.

It might be sound conspicuous that the use of and the very access to electricity still has to be taken into consideration as one of the measures of the development level in India in the 21st century. It is especially curious if we know that only 3.1% of the homes in the district of Sheohar in Bihar use electricity for lighting. In Lakshadweep, 99.7% of homes are lit with electricity. The low share of the homes using electricity is even more surprising if we consider that the Indian government subsidises that provision considerably (Wilhelm, Z. *et al.* 2009).

India is the second largest mobile telephone user in the world (by the number of telephone sets sold), where cheap and good quality service is provided by a dozen of companies. India has full coverage in this respect. On the other hand, the number of landline phones is still an important development index, because the traditional lines are necessary for several social and economic activities. The number of telephones shows a strong correlation to the proportion of the urban population.

The index of population density is only used as a measure of man induced impacts. It should be acknowledged that low population density in a country otherwise densely populated indicates areas least suitable for the settlement of humans, i.e. it denotes the peripheries. It also has to be added that

quasi natural conditions, as components of the sphere giving the foundations of the tetrahedron model, can be found in these areas. However, a sparsely populated area is not necessarily a rural one.

The two extremes can be found in the district of Lahul and Spiti in Himachal Pradesh: 2 persons/km^2, and the index of Northeast Delhi: 29,467.5 persons/km^2. Low population density is usually a characteristic feature of the Himalayan, the Northeast Indian and the desert districts. The counterpole is made by the sectors of the megapolises, with their hardly habitable environment.

Making an average of the positions occupied on the scale of 593 items, there was an order by the relative development level based on the 15 selected indices. *Figure 3* features the first 100 districts marked with red. A red circle, framed black, designates all nine districts of Delhi, as they are in the set concentrating the most advanced one hundred districts. Red quadrangles framed are used to show the union territories while quadrangles without a frame feature the small sized districts mostly belonging to megapolis.

It is clear from the map that the most developed, relatively large and almost contiguous area of India can be found in the southwest, along the Ahmedabad–Mumbai–Goa–Kanniyakumari axis. This means that the industrial regions and traditional ports of the central and southeast territories of Gujarat state, the western edge of Maharashtra, with the financial and commercial centre of India, Mumbai, and its agglomeration, belong to this area. Extending southwards this axis is continued by Goa state, with the highest GDP per capita in India and a "super power" of the tourism industry *(Photo 2.)*; several districts of Karnataka, a state famous for its computer software industry, also joins the group of the most advanced districts. It is interesting that Kerala renowned for its human resources (where the literacy rate of males is higher than in Portugal or Malta) is only represented by six districts in this zone. If only the indices of human resources are taken into account, a contiguous zone in the central and southern parts of Tamil Nadu stretches across developed administrative units. The complex index, however, reaches maximum at the district Aizawl, in the centre of Mizoram state. The average value of its positions is 43.6. Its leading position is surprising among other things because this district is home, according to the statistics, to a large proportion of people with disabilities: scheduled castes and, what is more, scheduled tribes. Megapolises are represented by Kolkata, in the second place. Outstanding positions are held by the districts of Delhi and Goa, and by the district with the fourth position in the rank, a new city: Chandigarh. It is absolutely evident that this region of India can be called the Indian Blue Banana, its shape resembles the fruit much more than that of its European counterpart does. In addition, one has to remark, although it has nothing to do with the present analysis, that India is the number one banana producer in the world…

Photo 2. The Bom Jesus Basilica, built by the Portuguese conquistadors in India's most developed state Goa, also famous for its tourism industry

The first 100 districts outside the above-mentioned axis are usually big cities, megapolises and their agglomerations: Delhi, Kolkata, Chennai, and Hyderabad. A different development path is represented by the majority of the rich districts of Punjab (Delhi–Lahore axis), and the developed districts of the smaller northeast states with a substantial Christian population.

The inferior performance of the states in the northern Hindi zone that hold the leading role in political life, is striking. There cannot be found among the first 100 districts one single from the states of Rajasthan, Bihar, Chhattisgarh, Jharkhand, Orissa, Uttar Pradesh or Assam. Kolkata from West Bengal, and another unit from Madhya Pradesh are the two districts among the most developed such entities of India *(Figure 3)*.

It comes from this analysis that the least developed districts are situated in the territory of the Ganges plain, in the first place. Drawing – with blue – the last one hundred districts on a map *(Figure 3)*, we actually get a contiguous block of backward districts. This region of India is the Aryan/Hindu core, which is also the cradle of the Hindu civilisation. This religion led by the (Brahman) caste of the priests is the stronghold of rural life, and anti-urban feelings. Religious reform movements have been organised against this, the ones now known and Buddhism and Jainism (Wilhelm, Z. 2008a). These movements, however, could become successful in urban environment. In the

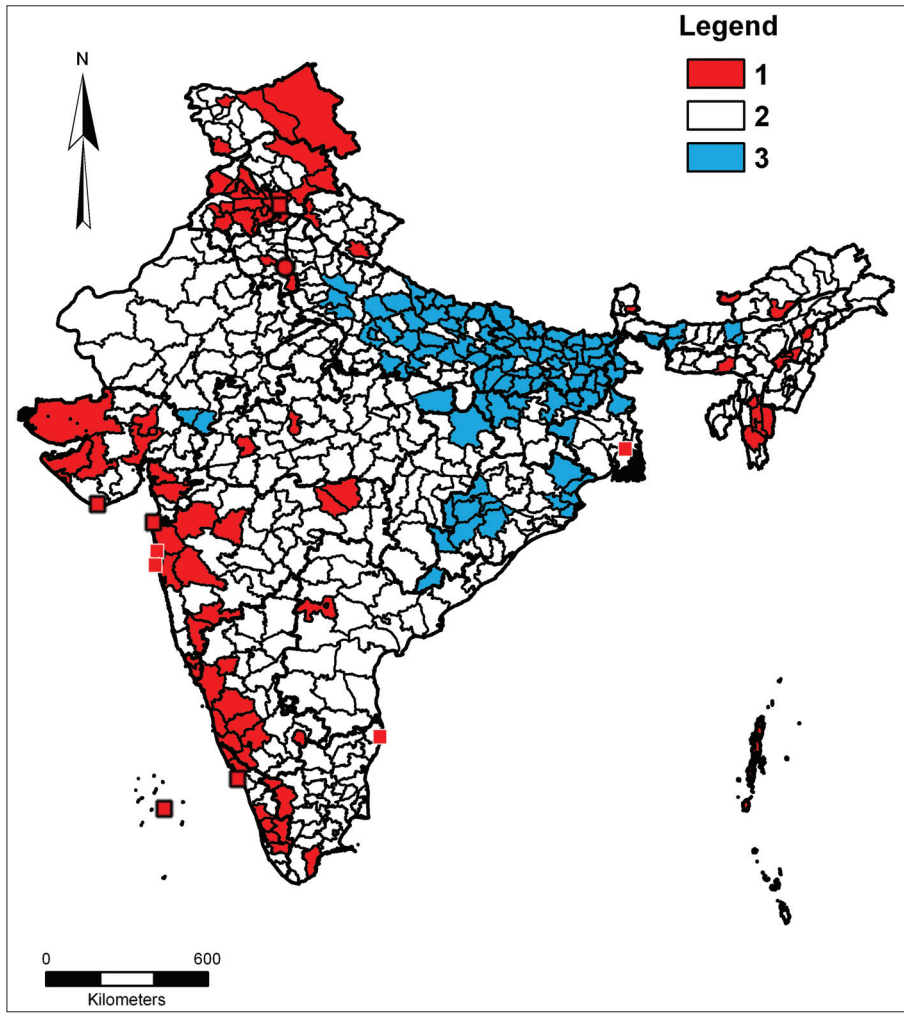

Fig. 3. The hundred most developed (1) and the hundred least developed (3) districts in India by the SENTIENT Index, 2001. – 2 = districts with medium values

region of the Ganges Plain, a region with excellent agricultural endowments but burdened with religious ties, the socio-economic system has naturally remained rural.

This way a characteristic South–North dichotomy has emerged in India, the opposite of what is typical in the "developed" world, as in India it is usually the North that is backward and the south that is developed. In addition we can also witness a West–East opposite, but this one is functioning "normally". If we compare the averages of the geographical coordinates of the

most populated settlements in the hundred most developed districts (using World Gazetteer and Google Earth) to those of the least developed districts, the statement made above is verified *(Figure 4)*. The centre of development moves towards southwest, the centre of backwardness towards northeast *(Figure 4)*. We have to remark that the focus of the most developed districts can be found in the middle of the country, as these districts are located scattered on the map, as opposed to the block of the backward districts. We have to realise, however, that coming from the shape of the country ("narrower" south), the more ad-

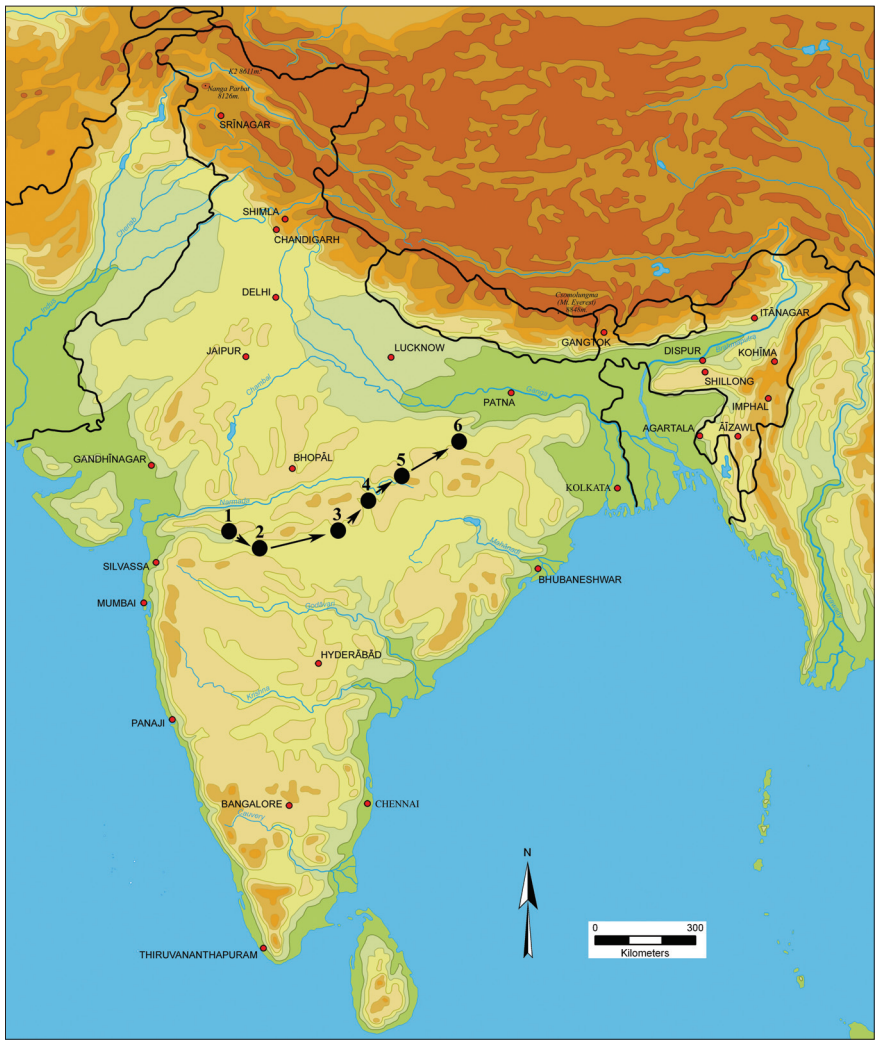

Fig. 4. Shift of the focal points of population in the districts of India, by the six categories created with the use of the SENTIENT Index, 2001

vanced districts closer to the Equator have to have an overweight so that the development pole of India can be found in the central part of the country.

It is worth looking at the "movement" of the focal points of the categories made from the 593 districts on the basis of their development level, where the first group consists of 98 elements, all others have 99 elements *(Figure 4.)*. The first two groups are relatively close to each other. The reason for this is that the bulk of the districts making group 2 can be linked to the southern regions. The elements of the next group are also more connected to the South, but the focal point is moving towards the eastern territories. The focal points of the remaining groups are evidently moving towards northeast.

Without giving lengthy details of our statistical analyses, it is worth taking a look at the correlations of religion and development level, extremely important in India. We surveyed the correlations among the proportions of the different religious communities in the districts and the development level shown by the SENTIENT Index. In India, the majority of the inhabitants are believers of two large religions: they are Hindus or Muslim *(Table 1.)*. The political division of South Asia in 1947 and way of the accession of the ducal states also took place on the basis of religious considerations. This was followed by the largest involuntary migration process of the world so far, with massacres (Wilhelm, Z., Pete, J. and Kisgyörgy, P. 2006). The situation has considerably changed since then.

Table 1. Breakdown of the population of India by religious affiliation, 2001

Religion	Number of believers	Proportion (%)
Hindu	827,578,868	80.5
Muslim	138,188,240	13.4
Christian	24,080,016	2.3
Sikh	19,215,730	1.9
Buddhist	7,955,207	0.8
Jain	4,225,053	0.4
Other (Animist, Parsi, Israelite etc.)	6,639,626	0.6
Non-religious	727,588	0.1
Total	*1,028,610,328*	*100.0*

Source: Census India 2001

The averages of the different indices – note: the lower the figure, the more developed the district – are correlated to the number of the believers of the respective religions present in the district.

The value calculated for the Hindus is r=0.183786, i.e. a very weak but existing correlation can be demonstrated between the high proportion of Hindus and backwardness. The value for the Muslims is r=0.1369. There is an even weaker but still demonstrable correlation between the larger share of Muslims and backwardness.

Analysing the smaller religious communities, one must consider the following: Christians (r=-0.16069), Sikhs (r=-0.24259), Buddhists (r=-0.15207), Jains (r=-0.26089), believers of other religions (r= 0.018413) and non-religious (r= -0.048). No correlation was found in the case of those belonging to the latter two groups, but the presence of the believers of other religions in larger number in a district induces development. Of course it is not to say that there are "backward" and "developed" religions. The explanation for this phenomenon is heterogeneity. In areas where Hindus or Muslims have a dominant proportion, the presence of other religions minorities is much less typical. However, *districts* that are *heterogeneous from a religious aspect are more developed*.

It is just this heterogeneity, diversity and tolerance – the tolerance of the majority society – is where the power of India and the key to the development of the country lies. Paul Johnson, British historian writes in the Forbes magazine, 21 June 2004: "India is another example. It is the nature of the Hindu religion to be tolerant and, in its own curious way, permissive. Under the socialist regime of Jawaharlal Nehru and his family successors the state was intolerant, restrictive and grotesquely bureaucratic. That has largely changed and economy is soaring… When left to themselves, Indians (like the Chinese) always prosper as a community. Take the case of Uganda's Indian population, which was expelled by the horrific dictator Idi Amin and received into the tolerant society of Britain. There are now more millionaires in this group than in any other recent immigrant community in Britain. They are a striking example of "how far hard work, strong family bonds and a devotion to education can carry a people who have been stripped of all their worldly assets" (Johnson, P. 2004).

Summary

The creation of the SENTIENT Index requires the processing and analysis of a considerable amount of data. As an achievement of this work, the internal correlations of the index have also become clear *(Appendix 1)*, which allows the later "fine-tuning" of the index.

Using rank correlation analyses it was possible to analyse the correlations between development level and relative positions *(Table 2)*. Despite the fact that the most accurate measure of development level is the access to those services and comfort amenities in India that are everyday services and amenities in Hungary (use of electricity, bathroom in the flat, telephone), the proportion of diploma holders is still ranking lower than the acquisition of the very basic skills as a way of climbing up the social hierarchy *(Table 2)*.

We have to pay special attention to the correlation between the proportion of the scheduled castes (handicapped castes = untouchables = Harijans =

Table 2. Rank correlation between relative development level by the SENTIENT Index and the different parameters in India, 2001 (ed. Wilhelm, Z.)

Code	Component	r_s
D1	proportion of urban population	0.714493
D2	literacy rate	0.755857
D3	differences in the literacy rates by gender	0.700396
D4	proportion of diploma holders	0.441732
D5	proportion of people with disabilities	0.050592
D6	proportion of full-time employment	0.479330
D7	proportion of non-agricultural workers	0.675819
D8	proportion of the inactives	0.157722
D9	proportion of households using banking services	0.559538
D10	proportion of households possessing a car	0.701077
D11	proportion of homes with bathroom	0.858375
D12	proportion of homes without a toilet	0.681254
D13	proportion of homes using electricity for lighting	0.878803
D14	number of telephone landlines	0.863425
D15	population density	0.081960
D16	proportion of scheduled castes	0.137104
D17	proportion of scheduled tribes	0.061192
D18	territory of the district	-0.069730

Dalits = the oppressed) and development level. It is strange to see – for those who know the Hungarian circumstances – that the higher share of handicapped people means more developed districts, or at least does not induce backwardness. The reasons can be varied. Rural areas are usually left by those who have no property or chance of development, or suffer from negative discrimination. They increase the population of the big cities, so their proportion is higher in these settlements. This hypothesis, however, is not supported by the correlation matrix of *Appendix 1.* There is only one significant element of this correlation: it is the lack of toilet.

We may think then that India has mostly been on the right track over the last sixty years and the quality of life of the oppressed might have improved (positive discrimination), although their housing conditions are still worse than the average. Presumably they are working in the secondary and tertiary sectors of the advanced districts in larger numbers.

The scheduled tribes mostly consist of rural inhabitants (*Appendix 1*), which is not surprising, as they usually live on the outer or inner peripheries, often still following ancient social organisation patterns. They usually have a full-time job, the proportion of the inactive population is low, and there are few diploma holders among them.

Where the proportion of scheduled castes is high, that of the scheduled tribes is low. In other words, they are usually missing from the territories with strong Hindu influence. Consequently, they usually belong to religious minori-

Table 3. Standard deviation of the districts in the sub-national units of the Indian sub-continent, 2001 (ed. Wilhelm, Z.)

Administrative unit	Standard deviation
Andhra Pradesh	21.44
Arunachal Pradesh	24.40
Assam	27.00
Bihar	19.38
Chattisgarh	22.74
Delhi	9.76
Gujarat	31.72
Haryana	18.84
Himachal Pradesh	19.57
Jammu & Kashmir	34.15
Jharkhand	31.54
Karnataka	29.42
Kerala	12.34
Madhya Pradesh	25.60
Maharashtra	25.70
Manipur	16.70
Meghalaya	31.87
Mizoram	37.75
Nagaland	27.44
Orissa	22.27
Punjab	15.33
Rajasthan	28.22
Sikkim	28.87
Tamil Nadu	25.40
Tripura	12.65
Uttar Pradesh	28.51
Uttaranchal	23.50
West Bengal	41.63
Districts total	*44.81*

ties, Christians in the first place, so their human development indices are good. On the whole, their presence does not coincide with backwardness *(Table 2)*.

The spatial diversity of the administrative units is thus of basic importance in a country of extreme heterogeneity. We looked at the homogeneity of the second tier of the administrative hierarchy. Evidently, it is only worth making standard deviation calculations for the states that have a large territory and a large population number *(Table 3)*.

It is understandable that Delhi, a unit in the union territory category, produces the least spatial disparity (nine districts). On the other hand, the extreme diversity of West Bengal is striking among the member states *(Table 3)*. There is a huge contrast between the districts of Kolkata and its agglomeration, and the rural areas of the Ganges-Brahmaputra Delta that have been agricultural regions for centuries. In accordance with what we have said in the introduction, without Kolkata this state would be one of the least urbanised sub-national units of India, with all of its impacts on the general development level.

Nevertheless we can see that the spatial disparity is the smallest within the most developed and the least developed states. Among the states that can be positioned to be around the Indian average both in their size and population – in the Indian Blue Banana and the Indian Drawn Bow area – it is Kerala, Punjab, Haryana and Himachal Pradesh that represent the most advanced states least struck by spatial disparities.

Also, Bihar features standard deviation below 20; however, it is one of the most backward areas of India without a single district with development potential in the near future. The situation is almost the same in Chattisgarh and Orissa states as well.

Although the present database created with a painstaking effort even in its present form offers good opportunities for analysis, its continuous upgrade will be endeavoured, since enlarged with data further calculated from other sources it might give us an increasingly accurate picture of the spatial disparity in India.

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Appendix 1. Autogenous correlation matrix of the SENTIENT Index, complemented with two more indices (ed. Wilhelm, Z.)

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16
D1	-	0.533795	-0.45888	0.724205	0.120491	0.127156	0.748517	0.218803	0.36311	0.699026	0.652382	-0.5082	0.571857	0.75882	0.5697	-0.02227
D2	0.533795	-	-0.83304	0.326302	0.101933	0.236283	0.628882	-0.00454	0.462457	0.475671	0.598145	-0.53703	0.662753	0.638641	0.222749	-0.02728
D3	-0.45888	-0.83304	-	-0.25714	-0.07638	-0.28229	-0.56062	-0.00925	-0.29468	-0.42175	-0.56349	0.626494	-0.58805	-0.54256	-0.17908	0.1236
D4	0.724205	0.326302	-0.25714	-	0.071182	-0.09087	0.633583	0.33529	0.374596	0.763307	0.455686	-0.42172	0.35571	0.630038	0.535543	-0.00343
D5	0.120491	0.101933	-0.07638	0.071182	-	0.04428	0.129271	-0.00814	0.024875	0.029965	0.050244	-0.01859	0.093701	0.080001	-0.00814	-0.04737
D6	0.127156	0.236283	-0.28229	-0.09087	0.04428	-	-0.02855	-0.79777	-0.03707	0.060126	0.254392	-0.06191	0.464146	0.169259	-0.03019	-0.17402
D7	0.748517	0.628882	-0.56062	0.633583	0.129271	-0.02855	-	0.362416	0.470121	0.724286	0.64151	-0.67976	0.528969	0.797807	0.457465	-0.06987
D8	0.218803	-0.00454	-0.00925	0.33529	-0.00814	-0.79777	0.362416	-	0.186809	0.217026	0.08655	-0.2087	-0.22309	0.149359	0.215175	0.193498
D9	0.36311	0.462457	-0.29468	0.374596	0.024875	-0.03707	0.470121	0.186809	-	0.501248	0.565779	-0.26462	0.452902	0.594092	0.206999	0.152062
D10	0.699026	0.475671	-0.42175	0.763307	0.029965	0.060126	0.724286	0.217026	0.501248	-	0.63755	-0.55311	0.51808	0.81015	0.500048	-0.00652
D11	0.652382	0.598145	-0.56349	0.455686	0.050244	0.254392	0.64151	0.08655	0.565779	0.63755	-	-0.56187	0.751452	0.764492	0.300958	0.010697
D12	-0.5082	-0.53703	0.626494	-0.42172	-0.01859	-0.06191	-0.67976	-0.2087	-0.26462	-0.55311	-0.56187	-	-0.41724	-0.5773	-0.27123	0.291546
D13	0.571857	0.662753	-0.58805	0.35571	0.093701	0.464146	0.528969	-0.22309	0.452902	0.51808	0.751452	-0.41724	-	0.683196	0.190387	-0.03494
D14	0.75882	0.638641	-0.54256	0.630038	0.080001	0.169259	0.797807	0.149359	0.594092	0.81015	0.764492	-0.5773	0.683196	-	0.507047	–0.00369
D15	0.5697	0.222749	-0.17908	0.535543	-0.00814	-0.03019	0.457465	0.215175	0.206999	0.500048	0.300958	-0.27123	0.190387	0.507047	-	0.001339
D16	-0.02227	-0.02728	0.1236	-0.00343	-0.04737	-0.17402	-0.06987	0.193498	0.152062	-0.00652	0.010697	0.291546	-0.03494	-0.00369	0.001339	-
D17	-0.19071	-0.11766	-0.07294	-0.25096	-0.00574	0.290978	-0.22593	-0.42342	-0.30694	-0.15659	-0.21981	-0.12112	-0.09608	-0.17886	-0.14208	-0.60886

D1 = proportion of urban population
D2 = literacy rate
D3 = differences in the literacy rates by gender
D4 = proportion of diploma holders
D5 = proportion of people with disabilities
D6 = proportion of full-time employment
D7 = proportion of non-agricultural workers
D8 = proportion of the inactives
D9 = use of banking services
D10 = proportion of households possessing a car
D11 = bathroom in the home
D12 = no toilet belongs to the home
D13 = lighting with electricity
D14 = number of telephones
D15= population density
D16= scheduled castes
D17= scheduled tribes

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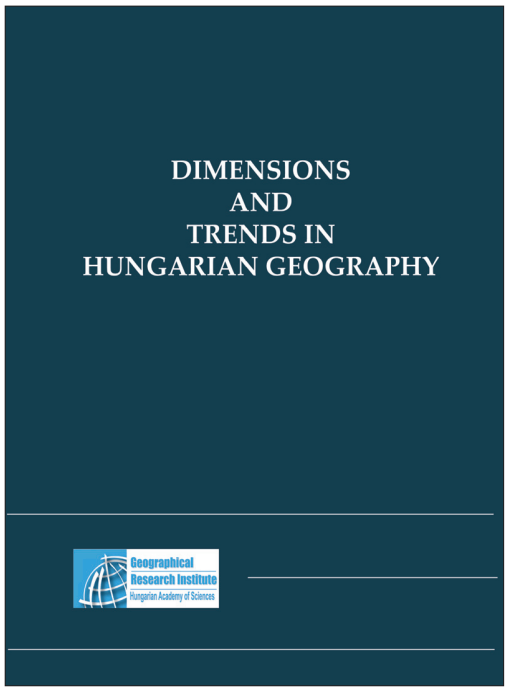

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An analysis of changing land use pattern and its effect on Umtrew Basin, Northeast India

Pradip SHARMA[1], Dhanjit DEKA[2] and Ranjan SAIKIA[3]

Abstract

Land use change is accelerating throughout Northeast India and is the cause of many environmental problems. The Umtrew is a major river that originates on the Meghalaya Plateau, flows down to the Assam Valley, and is one of the tributaries of the Brahmaputra (Roy, P.S. and Tomar, S. 2001).

The Umtrew Basin covers an area of 1253.1 sq km, mostly in the foothills of the Meghalaya Plateau. Remote sensing and GIS techniques are used to explore the changing pattern of land use/land cover. The study employs satellite data from Landsat-MSS and IRS-1C LISS III for the years 1977, 1999, 2004 and 2007. Its aim is to formulate a plan/strategy for maintaining environmental quality.

Keywords: land use, basin, remote sensing, GIS, GPS

Introduction

Managing land use/land cover change in the river basin ecosystems of Northeast India is an extremely complex problem. However, success depends on having appropriate information on land use/land cover in the form of maps and statistical data. Although primarily a hydrological unit, a drainage basin also represents a natural unit for physical, economic, industrial and social planning and development (Iyer, K.G. and Roy, U.N. 2005; Reddy, Y.V.R. *et al.* 2008).

Changes in any of the components of the basin may change the overall environment of the basin. Today, anthropogenic impacts on land cover are rec-

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ognized as critical factors influencing global environmental change (Lambin, E.F. and Geist, H.J. 2006; Nagendra, H. *et al.* 2004).

Northeast India is rich in flora and fauna. It falls in one of the world's 25 biodiversity hotspots. Its physiography, climate and soils provide suitable conditions for luxuriant forest growth. However, unchecked economic activities and population growth have left their scars on the landscapes, particularly in the last few decades.

Over the last thirty years, the forest cover has changed significantly due to relocation of the people to the riverside, extensive deforestation, farm and grazing abandonments, intensification of agriculture and industrial activities.

Symptomatic of the environmental problems in the region are:

a) Dwindling rainfall, as recorded in the world's wettest part, the Cherrapunjee–Mousinram area.

b) Increasing floods and soil erosion in the major river basins, particularly the Brahmaputra and the Barak.

c) Habitat destruction the consequence of which is increasing human–animal conflict.

d) More frequent landslide activity and consequent disruption of transport and communication networks as well as river valley aggradation.

The Umtrew Basin is similar to that of many rivers in Northeast India and is taken for a case study of changing land cover and land use impacts.

This paper also seeks an appropriate methodology for other studies in this region using remote sensing integrated with GIS as a tool (Rhoades, R.E. 1998). Since many parts of Northeast India are difficult to access for precise field study, remote sensing and GIS techniques are the most adequate methods of analyzing land use and land cover change.

Study area

The Umtrew River Basin of Northeast India lies in between 25° 35' 15″ N to 26° 14' 18″ N latitudes and 91° 35'17″ E to 92° 00' 15″ E longitudes *(Figure 1).* The river has its source in the East Khasi Hills of the Meghalaya Plateau and then it flows down from the south-western corner of the hills northward.

After crossing the national highway № 37 near Sonapur it ultimately receives the Kolong River near Kajalimukh of Chandrapur area. The upper reaches of the river course lie in Ri-Bhoi District of Meghalaya where it is called Umtrew whereas the lower course is found in Kamrup district of Assam where it is named as Digaru.

The total area of the basin is 1253.1 sq. km of which the upper and lower Umtrew basins cover 1035.6 sq. km and 217.5 sq. km respectively *(Figure 2).*

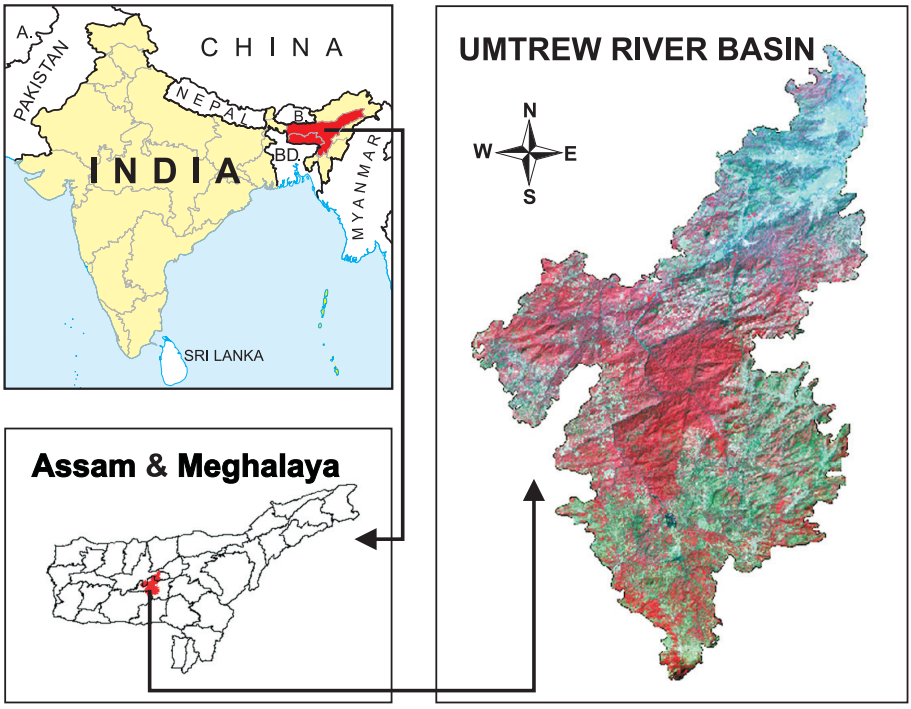

Fig. 1. Location map of the study area

Aims and objectives

The study focuses on the geo-environmental issues of the Umtrew Basin with special emphasis on land use/land cover changes.

The specific objectives of the study were the following:

a) Assessment of changing pattern of land use/land cover, particularly in the last three decades using remote sensing data.

b) Assessment of the cause and effect relations of such changes responsible for the alteration of the geo-environmental condition of the region.

c) Finding a strategy for maintaining environmental quality mainly through identification of potential areas for afforestation.

Dataset used

To analyze the land use/land cover change dynamics in Umtrew River Basin, multi-temporal satellite imageries were used. Additionally, the Survey of India

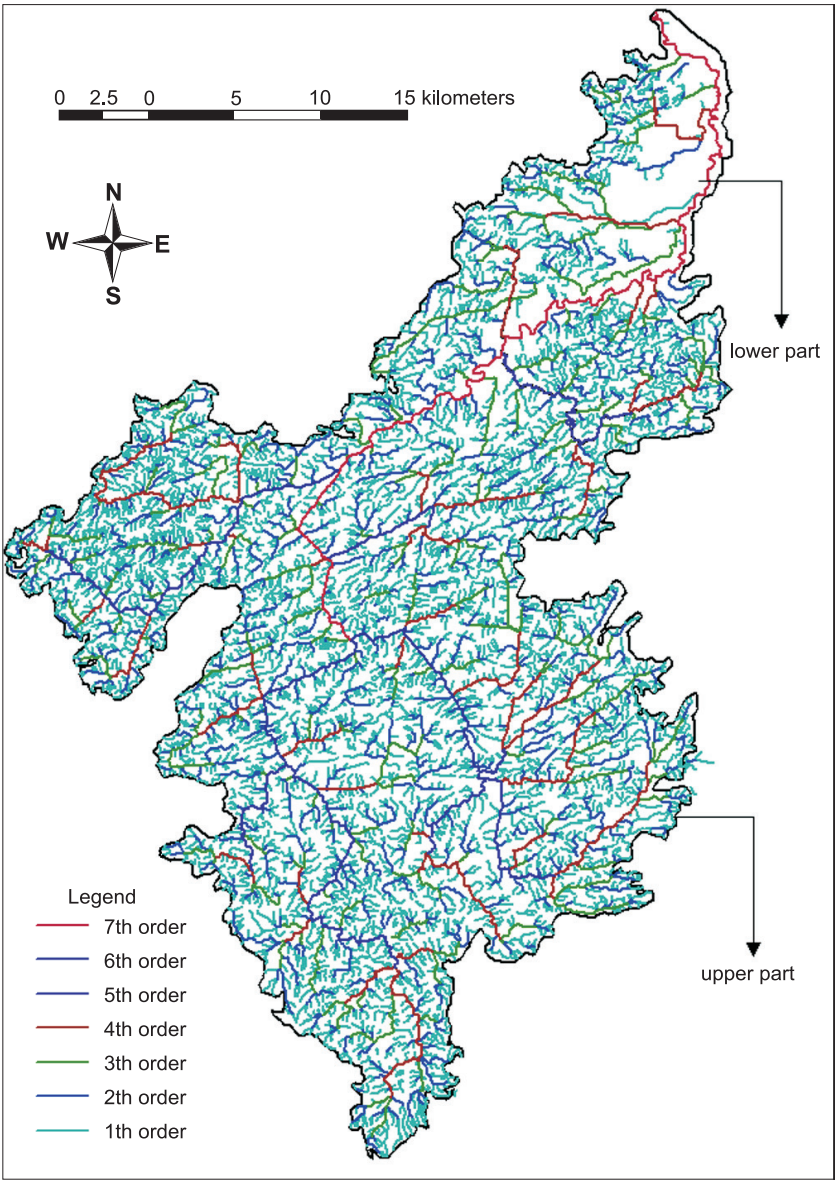

Fig. 2. Drainage map of the study area

topographic map sheets № 78 N/16, 78 O/9, 78 O/13 and 78 O/14 at a scale of 1:50,000 were used to delineate basin boundary and to generate baseline information of the study area *(Table 1).*

Table 1. Sources and types of data used

Data Type	Path/Row	Date of Acquisition
Landsat MSS	146/42	22.02.1977
IRS LISS III	110/53	15.03.1999
IRS LISS III	110/53	7.03.2004
IRS LISS III	110/53	25.03.2007
SoI Toposheet	No- 78 N/16, 78 O/9, 78 O/13 and 78 O/14	1974

Methodology

The methodology adopted here for detecting land cover changes was based on the comparison between the satellite imageries of different years. Satellite imageries of Landsat MSS for the year 1977 and IRS 1C LISS III for 1999, 2004 and 2007 were used to assess the land use/land cover change dynamics in the study area. The Landsat MSS of 1977 was downloaded from the NASA's Global Land Cover Facilitator's (GLCF) website and satellite imageries of other years were procured from National Remote Sensing Centre, Hyderabad, India. The downloaded imagery was geometrically corrected using the UTM/WGS 84 projection system. Other imageries were geometrically corrected by taking the Landsat image and the topographic sheets as the reference. As the spatial resolution of the Landsat MSS imagery was only 80 meter compared to other images with the resolution 23.5 meter used in this study, it has been taken only as a base for assessing the changes in land use pattern. Sub pixel image to image registration accuracy was obtained through repeated attempts. Subset operation of satellite imageries of all the years was carried out by creating an area of interest (AoI) layer from the vector layer of the basin boundary, which was digitized from the Survey of India topographical sheets at 1:50,000 scale.

After generating the subset of all the imageries, supervised classification using parametric rule and maximum likelihood operation was used to assess the land use/land cover change dynamics in the Umtrew River Basin. This is a type of automatic multi-spectral image interpretation in which the user supervises feature classification by setting up prototypes (collections of sample points) for each feature, class, or land cover to be mapped. It is the procedure most often used for quantitative analysis of remotely sensed data. It rests upon using suitable algorithms to label the pixels in an image as representing particular ground cover type, or classes. The pre and post field visit has been done with an eTrex vista GPS receiver and using a set of questionnaire designed for the purpose. Just 50 GPS points were selected for ground truth validation and verification of location (latitude and longitude) and elevation. Then the four satellite imageries of different dates mentioned above were su-

perimposed to identify the changes in land use over a period of around thirty years. For various GIS and remote sensing operations the image processing software ERDAS 9.1 and GIS software ARC GIS 9.1 have been used.

Analysis and findings

Quantitative analysis of the nature and trend of land use and land cover change provides the basic picture of probable environmental degradation. Since LISS III data were not available during the 1980s, Landsat MSS imagery was used as the base-line database. All subsequent land use and land cover estimations were made using IRS LISS III data *(Figure 3a).* From previous field knowledge, the study area was classified into seven land use/land cover types. Comparative analysis of the land use pattern of 1977, 1999, 2004, and 2007 clearly shows changes: the categories of fallow land, barren land and mixed built up area have shown an increasing trend in all the years, while all forest categories show a decreasing trend *(Figure 3b).* The only increase of forest cover between 1977 to 1999 have taken place because of an extensive afforestation programme taken up by the government of Meghalaya during the 1980s and the presence of an extensive reserve forest, Nangkhylleum in the central part of the upper basin. This area is inaccessible to some extent, hence human interference was comparatively less, and an increasing trend of forest cover was recorded during that period. By contrast, forest cover in the lower part of the basin, which lies in the territory of Assam, suffered most degradation because it is, by and large, a plain area and provides easy access to all kinds of human activities.

Description of different land use/land cover classes

*Forest Land***:** All categories of forest show a slow declining trend, particularly in case of open forest from 1977 to 2004 at an average rate of 1 sq. km per year. From 2004 to 2007, this trend increased massively attaining the average of 14 sq. km per annum. The land use maps show that all these changes occurred in the lower part of the basin and the area near National Highway № 40, which passes through the eastern side of the upper part of the basin. By contrast, the dense forest category shows an increasing trend from 1977 to 1999 due to the afforestation programme held in the upper part of the basin. From 1999 to 2007, it decreases at an average rate of 34 sq. km per year *(Figure 4, Table 2).*

Scrub Land: The **c**onversion of forest into scrub land is a general trend across Northeast India. Extensive tree felling leads to the development of dense scrub as the first stage of degradation, which in course of time degrades

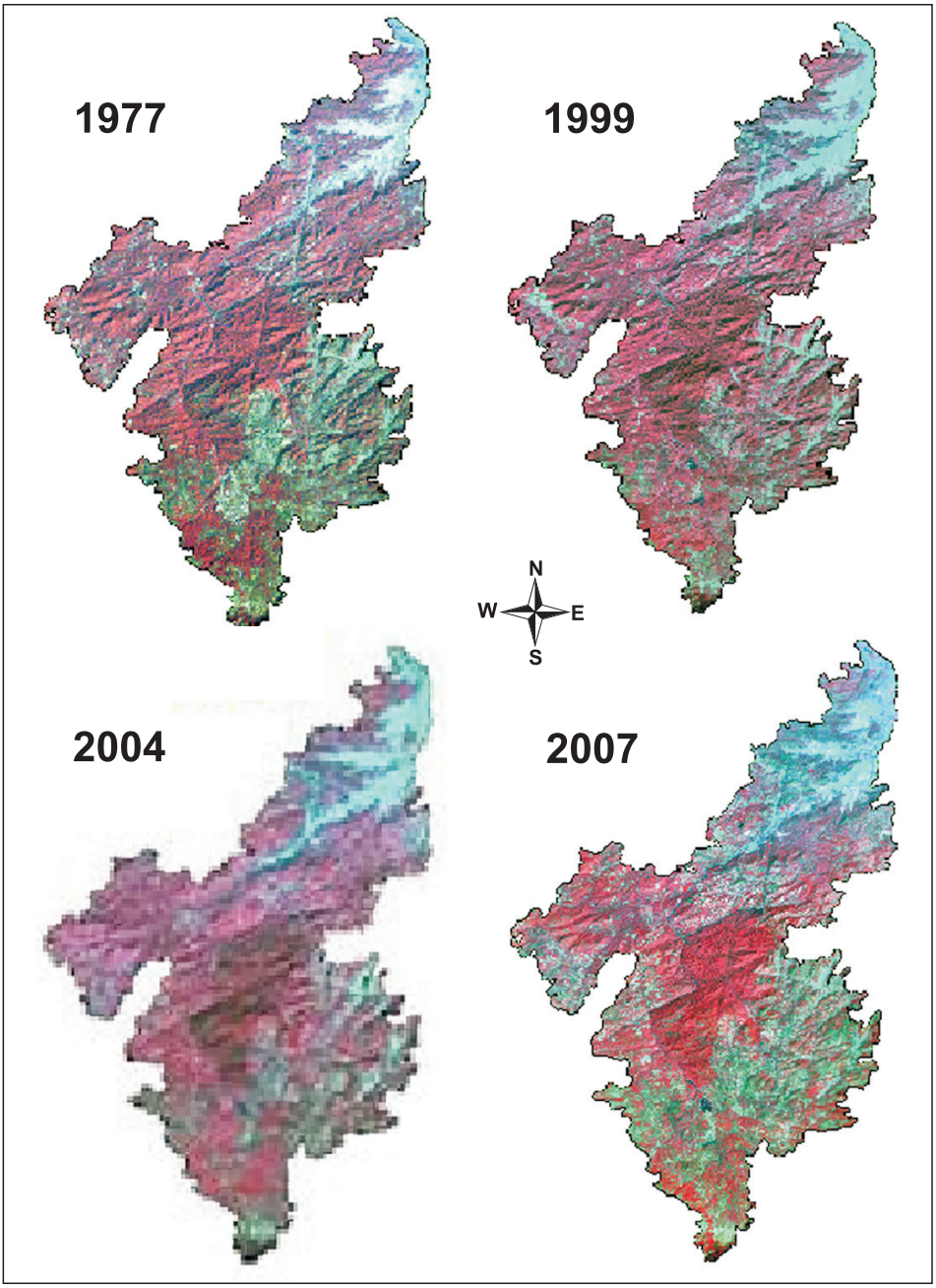

Fig. 3a. Satellite imagery of different years and land use map showing pattern of change during 1977–2007

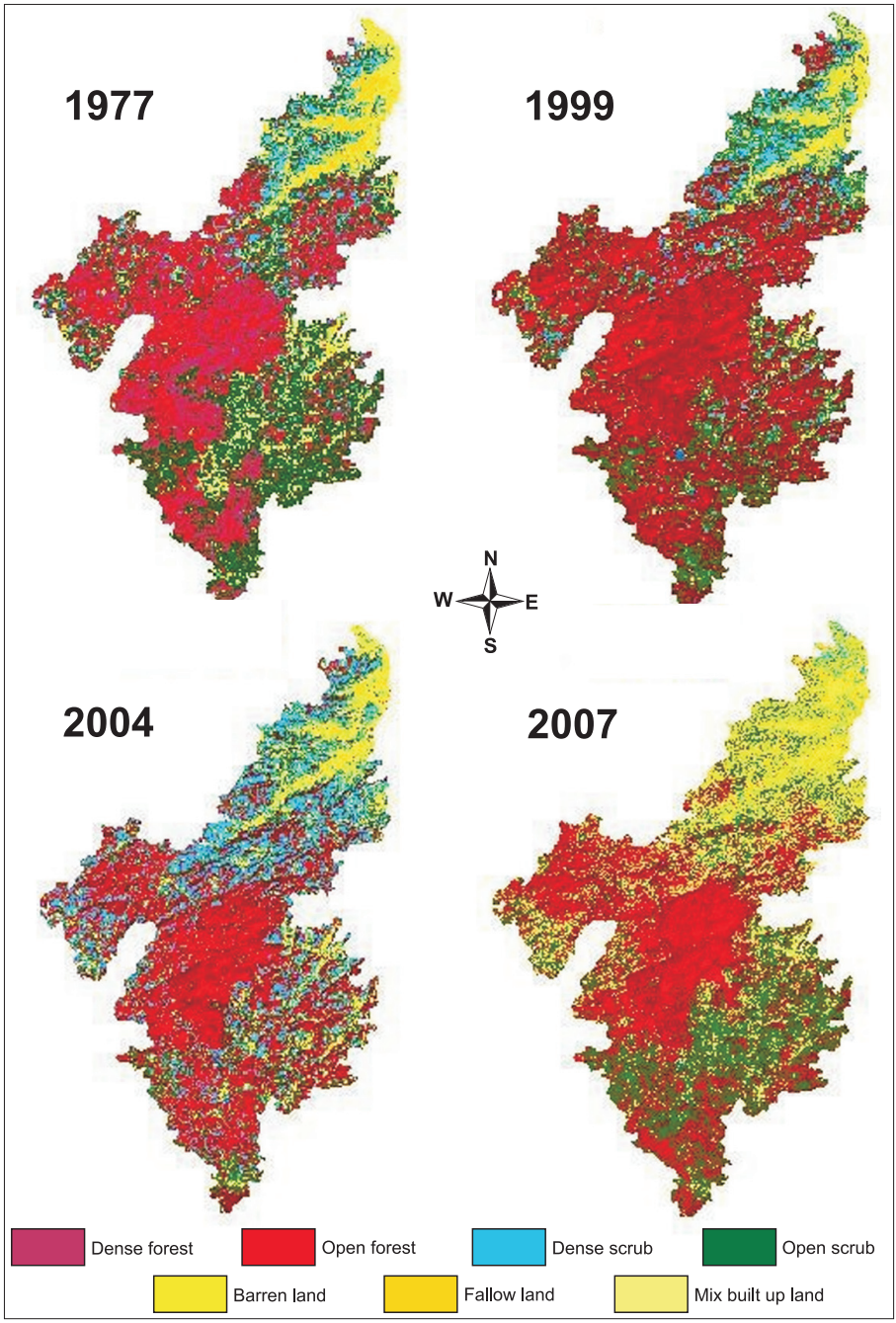

Fig. 3b. Satellite imagery of different years and land use map showing pattern of change during 1977–2007

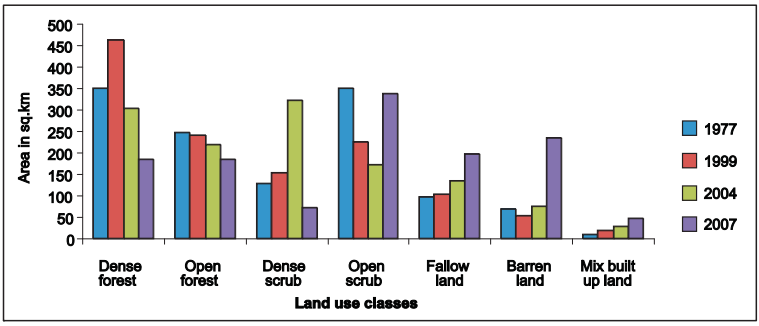

Fig. 4. Category wise land use change in different years

Table 2. Area and net change of land use/land cover from 1977–2007

Land use class/ Area	1977 (sq km)	1999 (sq km)	2004 (sq km)	2007 (sq km)	Net change (1977–99)	Net change (1999–2004)	Net change (2004–07)
Dense Forest	350.38	461.35	302.06	185.84	+110.97	-159.29	-116.22
Open Forest	248.22	239.68	219.00	182.82	-8.54	-20.68	-36.18
Dense Scrub	129.49	153.76	321.70	71.17	-24.27	-167.94	-250.53
Open Scrub	351.20	225.62	172.78	338.09	-125.58	-52.84	+165.31
Fallow Land	95.37	103.58	139.95	195.39	+8.21	-36.37	+55.44
Barren Land	68.81	53.15	75.87	233.50	+15.66	+22.72	+157.63
Mix built up Land	10.00	17.31	28.01	46.41	+7.31	+10.70	+18.40

to open scrub before ending up as either agricultural land, fallow land, or barren land. The statistics show the same pattern across the entire study area. Significantly, since 1977 to 2004 some of the area under open scrub land has been converted not only to agricultural land but reclaimed as forest and dense scrub, partly due to the afforestation programme. The area under open scrub was 351.20 sq. km (1977), then decreased to only 172.78 sq. km in 2004, but rose again up to 354.09 sq. km by 2007, which indicates an increased degradation of forest within the basin since 2004. As reflected in the above data and graph it is established that as the open scrub land increased, while the area under forest and dense scrub decreased during this period.

Mixed Built up Land: The mixed built up land category includes settlement as well as agri-plantation areas. It increased from 10 sq. km to 28.01 in 2004 then to 46.41 sq. km in 2007. From 2004 the growth rate has accelerated to around 4.5 sq. km per year.

Fallow Land: Acquisition of satellite data took place in February and March. As a result all the agricultural land looked fallow in the imageries. The category of fallow land has been continuously increasing since 1977 but was very high between 2004 and 2007 attaining an average increase of 20 sq. km

per year i.e. from 139.95 sq. km to 195.39 sq. km. This indicates the increasing pressure of population on the land.

Barren Land: The category of barren land showed a decreasing trend from 68.81 sq. km to 53.15 sq. km between 1977 and 1999. However, a slow increasing trend from 1999 to 2004 accelerated from 2004 to 2007, attaining an average of around 40 sq. km per year i.e. from 75.87 sq. km to 233.5 sq. km in absolute figures. This happened mainly due to the establishment of a large number of brick industries in lower part of the basin and presence of high amount of abandoned jhoom or jhum (shifting cultivation) fields in the upper basin.

Accuracy assessment

Accuracy of the supervised classification of the satellite imagery was derived by using a reference template from the margining data with 50 randomly selected samples on the latest imagery, from which overall accuracy and Kappa statistics were derived. The Kappa statistics incorporated the diagonal elements of the error matrices and represents agreement obtained after removing the proportion of agreement that could be expected to occur by chance (Yuan, F. *et al.* 2005). The overall accuracy was found to be 90 per cent whereas overall Kappa statistics was 0.8899. The statistics shows that the result was overall good.

Discussion

This study shows the changes in pattern of land use/land cover in Umtrew River Basin. These have caused a number of environmental problems like soil erosion in the upper part and siltation, river bank erosion and flooding in the downstream part; all natural processes but accelerated by human interference in the study area.

The main cause of the soil erosion is the large scale deforestation in the upper part of the basin. The local tribes of the area still depend on jhoom particularly in the upstream areas, and with increasing population pressure the previous 6/7 years jhoom cycle has come down to 3/4 years i.e. a plot of hill land used for shifting cultivation left fallow for 6 to 7 years for restoration of natural soil quality is now being used with a gap of only 3 to 4 years. The impact of these fragile hillslopes is accelerated topsoil erosion and deterioration of the soil quality.

River flooding is not a problem of the Umtrew River Basin, but the area is often affected by flash floods caused by heavy rainfall. Standing crops,

dwellings, household properties, cattle etc. are damaged by such flash floods. More damage has taken place in recent years due to the increasing siltation of the river bed and also in downstream areas where wetlands suffer encroachment by the brick industries. As many as 15 brick factories have been established in the lower part of the Umtrew River Basin since 1990 to 2003 and their impacts are expanding. From the primary survey conducted in the study area revealed that more than 30 to 40 percent of agricultural land was sold to the brick kilns during that period.

Burning of coal in the brick kilns release particulates like ash, dust and smoke and gaseous pollutants like carbon dioxide, carbon monoxide, sulphur dioxide, nitrogen oxide etc. The brick kilns of lower Umtrew River Basin operates for 6 to 7 months in a year. During this period, total amount of coal burned for making brick is about 1200–1400 tons.

The magnitude of atmospheric pollution being resulted by the brick kiln can be gauged form the fact that burning of 1 kg of coal releases about 3 to 4 kg of harmful and toxic gases like carbon dioxide, sulphur dioxide. Presence of 3 to 5 percent organic sulphur in Assam coal release more sulphur dioxide resulting itching eyes and skin of the residents in neighbouring villages.

The demand for bricks continuously increases in Guwahati city, only 10–15 km away. This is the commercial heart of the entire Northeast India where large scale constructions are going on. In addition, the great demand of coarse sand for brick making as well as building constructions means sand quarries are being created on the sites near the bank of Umtrew River. As a result, the course regime of the river is changing.

With the growth of brick industries and sand quarries, the traditional human occupation has changed. As the people living in this part are economically poor, they have been selling their croplands to brick industries to meet their immediate need of money.

As soon as money goes to their hands they usually spend more in buying consumer goods rather than the essentials. As the money comes once only they suffer as it gets exhausted. As a consequence they have to work as daily labourers either in the brick industries or in sand extraction works under the contractors at a very low wage. Such change in their occupation makes them poorer and brings about drastic changes in social life.

The possibilities of micro climate change due to alteration in land use and other associated activities cannot be ignored. It has been reported that the rainfall in Cherrapunjee–Mousinram, the wettest part of the earth, which is only 50 to 60 km away from the study area, has declined substantially (22,987 mm in 1860–1861 and 11,931 mm in 1973–2006 average). As such the study area needs more afforestation including social forestry programmes to restore the previous conditions.

Conclusions

Remote sensing and GIS techniques are important tools for measuring land use/land cover change (Sharma, P.K. *et al.* 2008) The study made in a mid-altitudinal watershed in Northeast India shows the dynamics of the land use and land cover. Since 1977, there has been an increase in areas under mixed built-up land, barren land and other associated land use patterns. The increase of scrub area and barren land in the study area is the result of deforestation and industrial growth. The downstream part of the Umtrew Basin has been worst effected by deforestation and other anthropogenic activities with far-reaching consequences. There is an urgent need to take protective measures, particularly in the lower part of the Umtrew Basin, to maintain the environmental quality, restrict the possibilities of change in microclimate and to maintain the age old socio-economic traditions of its people. It is hoped that the methodology adopted for this study could be extended towards more across the region.

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REVIEW

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Rural geography in Russia, Ukraine and in Belarus – a literature review[1]

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Abstract

The article is an overview of the literature on rural geography published in the Commonwealth of Independent States during the two decades that passed since the break-up of the Soviet Union. First, a brief review of the Soviet period is presented. A description of the current methodological approach and of the main sources follows. Finally, the studies devoted to rural areas of Russia, Ukraine and Belarus are introduced. The sources of the analysis mainly include works in English, German, Russian and Ukrainian. The literature review covers rural geography of Russia, Ukraine, and Belarus, and in the case of Russia it is focused on its European section.

Keywords: rural areas, rural geography, Russia, Ukraine, Belarus, CIS.

Introduction

This article is an attempt to provide a review of the rural geography literature published in the countries of the CIS. Our review is far from comprehensive as our goal has been to summarize the English-language sources in the first place and only to some extent sources in Russian and Ukrainian. The most abundant literature in western languages is available on Russia's rural areas.

Only a small portion of the reviewed writings is considered rural geographical by their authors, but some topics were chosen deliberately for their association with rural spaces. The novelty of our efforts for the international audience boils down to systematization of various sources and to introducing them to the Hungarian experts. During the 1990s Hungarian geography, with

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few exceptions, stood away from the realities of the CIS Consequently, this review purports to fill this gap.

Soviet geography and rural areas

East European (i.e. *Soviet-Russian*) *geography* developed along a pathway different from the Western as well as from the Hungarian trends (Probáld, F. 1999 p. 251). Though clearly manifested in academic theories, this difference stemmed from the divergent social processes. . In the first half of 20th century, rural areas in Eastern Europe experienced a stormy and tragic history with far-reaching consequences. The elimination of their backwardness remained merely an ideological slogan. What had really been accomplished proved to be a step backwards relative to the previous periods and caused a serious break in economic development of rural places and in social consciousness of rural people. One example of a cataclysm the Soviet countryside experienced – a cataclysm with a death toll of 6–8 million people – was the great famine (Holodomor) in the early 1930s.

The Soviet *dualist approach to geography*, different from the western treatment of the subject, sharply distinguished between physical and human (i.e. economic) geography (Bulla, B. 1953 p. 49; Probáld, F. 1995 p. 38, 1999 p. 252). However, human geography was effectively reduced, in the Soviet Union, to economic geography (industrial geography, analysis of location factors and production forces). Such genuine subjects of human geography as population and settlement were studied mostly as important factors of production (Probáld, F. 1999 p. 253). According to Mészáros, R. (1979 p. 401), population geography and geography of settlements were the youngest spheres within Soviet economic geography.

All the three factors, i.e. a specific path of social and academic development, a definitive dualist stance, and a preponderance of economic geography (within human geography's scope) provided that in contrast to Western geography a concept of rurality did not emerge as a synthesizing concept. According to Probáld, F. (1995 p. 38): "at any rate, dichotomy of nature and society hindered the development of regional geography of a synthesizing trend". A specific approach to rural spaces or their neglect in Soviet geography in comparison with the western (including Hungarian) counterparts is captured in *Table 1*.

In spite of the above limitations the Soviet economic geography yielded considerable results in the sphere of *agricultural regionalization* (e.g. Mukomel, I.F. 1954; Rakitnikov, A.N. 1961, 1973), based on diversity of natural landscape. According to Bernát, T. (1967 p. 152), the evaluation of natural components has played an eminent role in geographical approach to Soviet agriculture.

Table 1. Concepts of and studies on the rural spaces in the 20th century in the West, in the East and in Hungary

Years	Western Europe	Hungary	Soviet Union (and successor states)
1920–1950	– Tönnies (Gemeinschaft) urban-rural dichotomy, – Rural areas preserve the past (conservativism, the genuine nation: England), urban settlements are depositories of modernity, of the future	– Sociographies, studies on the backwardness of rural Hungary, feudal residues within the rural society – Repartition of land as the fundamental issue of land reform – Repartition of land carried out in 1945 and its consequences	– From the 1920s: laying foundations for the Soviet concept of geography, Baranskiy's activities – 1930s years: „Stalinist" transformation, social "shock" (the three great demographic disasters, Civil War+Holodomor+Great Patriotic War) – In these circumstances (grain expropriation, collectivization, *obeskulachivanie*, deportations) no investigations of rural areas might be carried out (in a lack of data and conditions)
1950–1980s	– Pahl modernization, urban-rural continuum, – Penetration of capitalism into agriculture – Smallholders' holdings are changed by family farms, peasant farms are taken over by agricultural workers	– Early 1960s: collectivization – sectoral and regional studies on the economic background of agriculture in the support of development and planning – Expansion of quantitative methods, options for a complex investigation of rural areas – From the 1970s a turn towards the society: research of rural transformation	– Demand on the research of rapid industrialization – Development of the consolidated extensive Soviet economy starting with the second half of 1950s: studies on the agricultural rayons for the purposes of economic progress (the Khrushchev era): virgin land, cotton, maize programmes – Recognition of population and settlement as the factors of economic production, initiation of investigations into rural areas in the frame of economic geography
1980–1990s	– Postmodern agriculture: rural areas "after" farming – searching for new research trends – social problems, social geographic groups – rural is the area residents of which declare themselves rural (behavioural geography)	– 1990s years: decline of the agricultural sector: studies on the related socio-economic problems and on the new spatial structure of farming – A complex approach to rurality (after the western pattern) – A growth of the significance of farming (with the decay of subsidiaries as part of structural reorganization)	– Survival of the concept: rural=agricultural – Research of depressive (rural) regions, of those with heavy population loss – Looking back upon the rural conditions during the period of "classical" capitalism (Vitte and, Stolypin, late 19th early 20th century; NEP era; Ukraine: independence between 1917 and 1922) – Connection of agricultural issues to demographic ones (Ioffe's works), outset of the complex rural geography

Enyedi, Gy. (Bernát, T. and Enyedi, Gy. 1977 p. 16) called attention to Soviet agroecological regionalization schemes which he tended to label as natural landscape assessments from the viewpoint of farming. A similarly large-scale work on regionalization was devoted to the delimitation of agrarian zones in Ukraine (Mukomel, I.F. 1954).

Some outstanding achievements of *rural geography* were aptly summarized by Mészáros, R. (1979). In the 1960s, scholars from the Institute of Geography Academy of Sciences of the USSR (IGAN) carried out extensive agricultural regionalization of the Lower Volga (Astrakhan oblast') as reported by Laszisz, J.B. (1959) and Rakitnikov, A.N. (1961).

In Hungary, the *geographical literature of the Soviet period was* thoroughly studied by Wallner, E. (1953); Beluszky, P. (1965); Bernát, T. and Enyedi, Gy. (1977); Mészáros, R. (1979); by Radó, S. (1957, 1960: with a strong Marxist-Leninist ideological approach by the latter author). Besides, periodicals such as *Földrajzi Értesítő/Geographical Bulletin* (e.g. Pomusz, M.I. 1952) and *Földrajzi Közlemények/Geographical Review* (e.g. Anucsin, V.A. 1966) published materials of scientific discussions and theses in Hungarian translation, and some articles from the journal *Voprosy Geografii* were printed as well. For the most part these reviews covered publications authored by scholars from Moscow State University/MGU and at IGAN. Relatively little attention was paid to the works produced at the universities of the Soviet republics other than Russia (e.g. Ukraine). The latter, however, were of lower quality compared to research conducted in the academic centres in Moscow.

Current approach to rural areas of the CIS and the principal literary sources

In many respects, "rural spaces" in the East European literature are synonymous with the agricultural sector. In Soviet books and articles published at the end of the 1980s, the adjective "rural" was applied to depressive regions afflicted with massive population decline. The objective of researchers was to reveal the reasons for this decline and other problems of these areas (Khomra, A.U. 1989; Zayončkovskaya, Z.A. 1986; Dolenina, O.E. 2005).

In the early 1990s, privatization of agriculture and its political and economic background was the focus of the studies primarily pursued by economists. Besides, several contemporary publications compared the rural spaces prior to the Russian revolution (1917) with the processes during the 1990s (e.g. Ioffe, G., Nefedova, T. 1997a; Nefedova, T. *et al.* 2001). A *radical transformation* of the peasant society and *rural regions* were the topics for the historians (Subtelny, O. 2000; Heller, M. 2000; Heller, M. and Nyekrics, A. 2003), and for the experts on economic policy (Van Zon, H., Batako, A. and Kleslavska, A. 1998; Van Zon, H. 2001).

The third important case at issue was investigations into a nexus of the above mentioned problems that constitute rural geography in a broader sense. There are only few specialists involved in the study of rural regions in Eastern Europe because the attention of geographers is rather focused on urban centres as the engines of socio-economic transformation (Wegren, K.S. 2000 p. 237). A "discovery" of rural spaces was accomplished by the late 1990s when privatization was basically over, and its consequences, as well as the unsolved problems gained importance. Rural geography as a complex approach appeared on the scene, relating farming production to demographic depression. That was the focus of the works of Ioffe, G. and Nefedova, T. However, only a narrow circle of contemporary researchers from Eastern Europe deals with the rural issues. At present Nahirna, V.P. in Ukraine, and Antipova, E.A. in Belarus are the leading personalities in rural geography.

Out of geographical periodicals in the West, the most valuable source of information about East European countryside is *Eurasian Geography and Economics* (the successor to *Soviet Geography*). Founded by Theodore Shabad (Harris, C.D. 1998), author of the first monograph on the economic geography of the Soviet Union (Shabad, T. 1951), this periodical has since 1960 dealt with geography of countries of the Eastern Bloc. Publishing the writings by several Soviet economic geographers, it provided a deeper insight into studies going on in the eastern part of Europe. With the time passing, the appearance and contents of the journal changed several times, and it has become predominantly economic in profile. In the early 1990s, it was renamed *Post-Soviet Geography and Economics*, its current title was obtained at a later date. This change in the title was necessary, because the study area extended spatially. Since the early 1990s, the growing number of articles was devoted to China, so instead of the former Soviet space the emphasis was put upon human geography of post-socialist countries.

Another important source available in the English-speaking world is *Europe-Asia Studies* published by the University of Glasgow. The title suggests a less geographic and more general (area studies) orientation of the contents. Besides the regional studies, micro-level sociological surveys and articles on economics prevail, the latter with the emphasis on economic and social policy.

There are some research institutes specializing on East Europe (Osteuropa Institut, Berlin, Österreichisches Ost- und Südosteuropa Institut, Vienna, Institut für Länderkunde, Leipzig, Institut für Agrarentwicklung Mittel und Osteuropas, Halle), and their areas of inquiry are divided between the Balkans, Central and Eastern Europe (European countries of CIS). Of the periodicals in German, *Osteuropa* rather publishes multidisciplinary essays ranging from economics and history to literature and political science. Its kindred journal is *Osteuropa Wirtschaft* which focuses on the economy. Of

the geographic periodicals, the most important is *Europa Regional. Its study areas are* the Balkans, Central Europe, and CIS countries. There are journals (*Geographische Rundschau, Geoforum, GeoJournal, Annals AAG* etc.) that deal with the East European region either only occasionally or in thematic issues; they offer a scope to publications by both native and western experts.

A critical comment about Western publications on Russia is contained in Ioffe, G. and Nefedova, T. (2001a p. 398). Specifically, they point out that the approach of western authors to contemporary Russia is marked by a "breaking news" mentality, i.e., it centers on elections, Kremlin leadership, oligarchs or the drastic decline of the economy but barely takes the long-term processes into account.

Rural geography in Russia

This area of inquiry has developed mainly in Russia during the past two decades indicating a high scholarly level reached by the academic institutions and far-reaching international links. Since the emergence of the CIS, the attention of the international academic audience has increasingly focused on the Russian Federation. There are several reasons for this. Firstly, political and economic power and therefore importance of Russia in the eyes of social scientists outweighs those of the rest of the successor states of the USSR considerably, thus the experts keep a close eye on that country. Secondly, in Soviet times Moscow dominated international relations whereas the universities of the other (than Russia) republics almost exclusively maintained professional ties with the academic establishments within the Soviet Union. After the breakup of the union, Moscow inherited the international connections of the Soviets; therefore, Russian researchers have a better chance to publish in western periodicals than specialists from the Near Abroad. Thirdly, after the collapse of the USSR, part of the leading scholars (mainly from Moscow) with command of foreign languages emigrated to the West where they were welcomed. These researchers established further contacts and created publishing opportunities for the geographers from the homeland.

There are two kinds of articles about rural Russia. The first group deals with the relatively densely populated core area, i.e., with rural regions of the black-earth and of the non-black-earth areas of *European Russia*. The other group is devoted to *geography of the peripheral regions,* that is, sparsely populated areas and ethnic republics. Besides Siberia, the European North belongs in this group as well as ethnically diverse Caucasus.

In most of the articles on European Russia, no regional aspects are tackled at all; rather, they deal in general with processes of shorter duration that have taken place in rural Russia and in agriculture, especially privatiza-

tion or with a historical perspective on the society and economy. Some of these writings are economic treatises considering Russia as a homogeneous entity, describing the privatization process and the rural areas affected by it in a spatially undifferentiated manner. Other articles are micro-level sociological analyses which view general trends from the perspective of local experiences learned through in-depth interviews. Yet one more group of articles are writings emphasizing regional specifications of general trends and applying methodologies from economics and sociology to a continuum of spatial scales from regions down to settlements and individuals.

In sights into the historical geography of the processes that took place in rural Russia of the 19th century and were thus *historical antecedents* of the agricultural privatization of the 1990s is mainly associated with the work of Ioffe, G. and Nefedova, T. (especially Ioffe, G. and Nefedova, T. 1997a). The authors provide an overview of the developments in rural areas, that is, of the forerunners of the present-day transformation,. These developments range from overpopulation of the rural regions to their fragmentation and from the decay of obschina to the vanishing of the collective sector. The major thread of the work in question is the comparative analysis of the transformations of Russia's rural spaces after the emancipation of serfs (1861) – the transformations preceding and following the Stolypin land reform (that undercut obschina) and of the post-Soviet transition. Dolenina, V.P. (2005) presented an overview of demographic processes in rural spaces in the 20th century. Devoted to the investigations of historical dimensions, is an outstanding book by Nefedova, T., Polian, P. and Treivish, A. (2001) entitled *Town and village in European Russia – Changes of one hundred years*. This is one of the most detailed analyses of European Russia. Its antecedent was the eponymous 1910 book by P.P. Semenov Tian-Shanskiy. It was the first detailed description of European Russia, including its rural areas. Fundamental structures of East European collective agriculture – obschina under the czars and the collective farm under the Soviets – were the subject of writings by several authors (Skyner, L. 2003; Lindner, P. and Nikulin, A. 2004).

Most articles on *agricultural privatization* were published in the first half of 1990s; predominantly in the context of politics and economics and of the ongoing transformation. Along with the economist Lerman, Z. it was Van Atta, D. and Wegren, K.S. who studied these issues thoroughly. Below only those authors will be mentioned who have been steadily publishing on the subject. The first contributions by Wegren, K.S. (1994a, 1997) were devoted to agricultural privatization, putting the political background and land reform in the focus. Barnes, A. (1998) highlighted the differences between the methods of privatization in industry and farming.

In the early 1990s, the majority of the authors dealt with private *(farmer)* holdings at that time considered potentially viable, but by the

mid-1990s they had shrunk and the dominance of large-scale collective sector and the subsistent household plots became evident. Later, large-scale production units had come to the fore and due to difficulties in data acquisition for several million dwarf holdings (Ioffe, G. 2005) the subsistence or household farms were involved in the analyses only after the turn of the millennium. Skyner, L. (2003) inquired into the issue of collective and private land ownership. Brooks, K. and Lerman, Z. (1994), Wegren, S.K. (1994c), Rodionova, G. and Ovčinceva, L. (2000), Lindner, P. (2003) analysed a model reorganization of production units in *Nizhny Novgorod oblast'* and its outcomes. This, in fact, was a model suggested by the World Bank and first introduced in five territorial units; subsequently the methods spread from here to the entire country. Accordingly, land shares were distributed among collective farm members. The contingents of the individual members were determined on the basis of time they worked on the farm. Real estates and other non-land property and agricultural machines were auctioned. Members were encouraged to join into groups in order to form new farms and to participate in tenders, bidding for machinery, buildings, and animals. From one collective farm 5–15 new farms with different specialization used to emerge.

In his two latest articles, Lindner, P. (2003, 2007) sought for reasons for the disintegration of Russian agriculture at the farm level. He emphasized that due to the weakness of the central state power in the course of the transformation of collective farms – a multitude of subjective human factors proved to have played a critical part in the destiny of the newly emerged farms and their economic success or failure. This led to rapid differentiation of the farms. Moreover, Soviet collective farms used to assume functions beyond just farming, as they provide infrastructure, services for the settlements, economic background and support for the household farms so bidding farewell to collective farms was not an easy case. Consequently, reorganization of collective farms was often nominal and it has not brought about new structures.

Wegren has lately provided an assessment of the agricultural policy of the Putin era (Wegren, K.S. 2004, 2005) coupled with the description of *socio-economic outcomes of reform* (Wegren, K.S. 2000; Wegren, K.S. *et al.* 2003), such as rural unemployment and the lack of agrarian elite. A similar sociological treatise published by Shubin, S. (2007) on rural poverty is based on network analysis.

Besides macro processes, several authors studied their *regional specifications* that showed up during agrarian reform. The first writings of this kind appeared in 1994, with the termination of the initial step of transition when collective and state farms acquired new organizational forms pattern (even if only formally) and most agricultural land was withheld from state property. Craumer, P.R. (1994) carried out an analysis of the spatial consequences of the transformation of farming at the oblast level for the entire country, in-

cluding the socio-economic circumstances and natural conditions. Craumer, P.R. applied many variables of a broad spectrum (qualification, employment, population, ethnic relations, productivity and profitability in agriculture, urban–rural interrelationships, private farms, political relations, incomes and land use). He made an attempt to process variables by multi-various methods (correlation and cluster analyses) but due to a multitude of variables and the unknown pattern of their interrelationships no statistically significant results were arrived at, and so the treatise revealed nothing much by way of description. Craumer, P.R. also provided a long list of references from the first half of 1990s. Typologies relating to rural Russia on the oblast level and based on agriculture and consumption were produced by Kuhn, A. and Wehrheim, P. (1999) for European Russia, South Siberia and Far East.

Using comparative analyses of different regions Wegren, K.S. (1992 1994b,) established spatial effects of agricultural reform and for the first time among the foreign experts he examined these processes at the rayon level in the Kostroma and Rostov oblasts. These studies focused on the transformation of agricultural enterprises and on appearance of peasant holdings and emphasized the relevance of the cultural-ethnic dimension to the collectivise tradition.

Ioffe, G. and Nefedova, T. (2001a) presented an overview of the entire agro-food system (food production and processing) and its regional distribution. In another article (Ioffe, G. and Nefedova, T. 2001b) they closely examined the processes of transformation using the example of Moscow and Ryazan oblasts, with a special reference to the spatial aspects. The study uses local examples for the description of territorial links between agriculture and food processing. The authors' conclusion was that there would be five factors instrumental in the regional position of food economy: a core–periphery relation, productivity of the agricultural sector, human capital, economic situation of food processing, and spatial polarization with land abandonment in the periphery. Another article by Ioffe, G. (2005) treated the critical issues of agriculture such as its unimportance from the viewpoint of the investors and human resources whereas a work by Nefedova, T.G. (2009) was an attempt to provide a summary report about the period since 1990 and a prediction of the long-term retreat of the sector due to extreme rural population decline up to 2050.

There were studies focusing on *household plots* and private farms. The forerunner of these studies was an article in the special issue of *Geographische Rundschau* which dealt with the USSR (Giese, E. 1983) and attached importance to household plots operating along with collective and state farms not merely as subsidiaries. Even though the dwarf household plots provided a significant part of produce they barely appeared as research topics. This is primarily because the reliable statistical data had been merger about this type of farming

operations which could only be investigated through painstaking field work. This topic surfaced in several works that for the most part explored the changing legal and economic background (Prosterman, R.L. *et al.* 1997; Wegren, S.K. 2004). The latter article identified the differences between the household plots and registered private farms, especially from a legal perspective. An article by Amelina, M. (2000) sought an answer to the question, why the peasantry prefers to remain within the collective sector, why it is more attractive and where the household plots are positioned in the contemporary structures. The empirical investigations carried out in the Leningrad and Saratov oblasts included survey of nearly two hundred households associated with the collective sector and an analysis of the local agricultural policy allegedly responsible for the divergent options, such as self-organization on the market (household plots) versus dependency on the collective sector. The East European collective agriculture (obschina of the tsarist regime or the collective farm of the Soviet period) as a basic structure of the rural spaces appeared in Lindner, P. and Nikulin, A. (2004). The study by Ioffe, G. and Nefedova, T. (1997b) is similar in its content.

A significant breakthrough was the investigation by Nefedova, T. and Pallot, J. (2003, 2006) reported in a volume published by the Oxford University Press and entitled *Russia's Unknown Agriculture: Household Production in Post-Soviet Russia*. The book pursues a spatial approach to household plots i.e. it is a purely rural geographical volume. This is an extended version of an article published by the same authors in *Eurasian Geography and Economics* and based on surveys in contrasting regions of Russia: Stavropol' krai, Volga and Ural regions, and Arkhangel'sk and Moscow oblasts. Factors differentiating among household plots (accessibility of markets, physical environment, competitiveness of the different produce) have a close relationship with the ethnic dimension.

One of the latest contributions of Wegren, K.S. *et al.* (2008) was an attempt to apply linear regression to outcomes of a sociological survey and reveal implications of geographical location. In that survey over 1,000 households were analysed on the basis of their distance from the rayon centre in more than 30 villages from 9 regions. Correlation was found between location and economic performance both on rayon and settlement (micro) levels.

A complex spatial perspective on rural space, *Russian rural geography* has grown out of studies on geography of agriculture and those on rural demographic processes (as the labour force background of the sector). The outstanding works belonging to this trend: Ioffe, G. 1991; Ioffe, G. and Nefedova, T. 2004; Ioffe, G., Nefedova, T. and Zaslavsky, I. 2004; Ioffe, G. 2005; Nefjodova, T. 2008a,b. The first crucial point in the case was made by an article by Ioffe, G. V. (1991) showing linkage of demographic processes taking place in the rural areas to the situation in agriculture, based on the state of affairs in the Soviet

era. The reforms of the 1990s produced a mess in the spatial distribution, but rural structures that had crystallized by the end of the decade by and large remained the same as before; the reforms even intensified the spatial contrasts. Beginning from the second half of the 1990s, the authors tried to display the historical continuity of the new structures. The first fundamental work on this subject, entitled *Continuity and Change in Rural Russia* (Ioffe, G. and Nefedova, T. 1997a), was written in the midst of the transformation. This volume dealt chiefly with the changes prior to the 1990s, taking into account the Soviet period as a whole, but it extended into the years after the change of the political regime. The book was pioneering in a sense that it was fully dedicated to the Russian countryside and the concepts of rural geography were applied to inter-urban spaces. The authors revealed the factors instrumental in the structure of the agriculture prior to 1990, including the change of population distribution and socio-economic impacts of transformation. They were the first to write about spatial polarization and fragmentation of rural activities. Some regions, e.g. Belgorod oblast' within the black earth zone and Yaroslavl oblast' within non-black-earth zone were studied in more detail. In a monograph published at the turn of the millennium (Nefedova, T. *et al.* 2001), special attention was paid to rural typology and changes in European Russia.

A prominent volume by Nefedova, T. (2003), entitled *Rural Russia at the Crossroads* dealt with rural circumstances that emerged following the transformation of agriculture. A particular attention was paid to urban–rural relationships, including the impact of the *dacha*, a typically Russian phenomenon of weekend cottages combining urban and rural functions (in a sense that urbanities settled in the countryside and thus affected its demographic and socio-economic processes). Many people who own *dacha*s engage in subsistence farming activities. The author also subjected the transformation of Russia's agriculture to an international comparison focusing on the mode of food production (e.g. collective sector, household plots, and registered private farms). The measures of agriculture's success are influenced by the farm's location especially under extreme environmental and accessibility conditions. The book ends up with a 10 unit regional typology that combines two aspects – accessibility and natural conditions.

A publication by Ioffe, G., Nefedova, T. and Zaslavsky, I. (2004) represents the most concise and thorough account of the fragmentation of Russian rural spaces. A more detailed version of this account was later released as a book, "*The End of Peasantry?*" by Ioffe, G., Nefedova, T. and Zaslavsky, I. (2006). The same issues were raised by Ioffe, G. and Nefedova, T. (2004) in their article in *Eurasian Geography and Economics* seeking for the drivers of spatial differentiation, such as physical environment and accessibility, in European Russia. This volume has a lot in common with the one of 1997 but presents a picture that emerged after the market reform induced transforma-

tion. The book focuses on spatial disintegration of rural Russia applying a key idea: *Geography is Destiny*. The once continuous social space of rural Russia has been converging into an archipelago consisting of multiple oases of farming immersed in a socio-demographic desert. Internet inspired the idea of the "death of distance" but it is not valid in each case as electronic communication is not available everywhere and for everyone. In the book the proponents of environmental determinism (Andrey Parshev, Fiona Hill, Clifford Gaddy) are set against scholars who studied relations of cause and effect between Russian environment and socio-economic development (geographers Piotr Semyonov Tian-Shanskiy, Piotr Savitskiy and historians Sergey Solovyov and Vasiliy Klyuchevskiy).

The book enlarged upon specific Russian features such as the dichotomy of Westerners and Slavophiles, Russian collectivism (sobornost'), peasant community (obshchina), collectivization, delayed capitalist development and urbanization. The general dimensions fundamental for the situation of farming were described: west–east socicultural gradient in Europe, distance from urban centres (i.e., a core-periphery relation), frontier character of the conquest of rural space, expansion typical of the previous times, marginal location due to considerable distances and environmental extremes. The volume provided an overview of rural population, situation in farming, and regionalization of European Russia. Some specific regions were characterized in more detail, such as Novgorod and Moscow oblasts, Stavropol' krai, and Chuvash Republic. The book may be considered a comprehensive summary of the authors' previous investigations.

In the course of their quantitative studies G. Ioffe, and T. Nefedova have come to the conclusion that whereas the differentiation of rural spaces during the czarist regime depended on natural conditions, it became predominantly the function of urban impact by the end of the Soviet era. As Nefedova, T. (2006) put it, the urban centres had become the main drivers (organizing forces) of the spatial structures of rural Russia.

In an article written in Russian Nefedova, T. G. (2007) discussed theoretical foundations and roots of rural studies (in fact human geography approach to agriculture) in Russian geography, while Kryuchkov, V.G. (2002) wrote about agrarian geographical investigations carried out at Moscow State University. In Russian literature several regional reports appeared such as the Ugory project conducted and published jointly by sociologists and geographers (Nefjodova, T.G. 2008c; Nefedova, T.G. 2010). Ugory village council (sel'skiy soviet) is located in Manturovo rayon of Kostroma oblast', ca 600 km north-east of Moscow. This is a typical segment of an internal periphery where a low population density, dwarf villages, ageing and outmigration have become a serious problem. It is virtually a process of degradation of a frontier area.

Leafing through the periodical *Regionalnie Issledovaniya,* one can get an insight into the situation of rural geography in Russia. Another inner peripheral rayon in Kostroma oblast' was the subject of an article by Baburin, V. L. (2007). In effect it is an exploration and description of complex socio-economic problems within a smaller region. Typologies of simpler (one-dimensional) kind are represented by Kazmin, M.A. and Černisheva, E.A. (2007) who dealt with the settlement network of rural areas in European Russia. European oblasts were classed into 11 types of rural settlement network by the size of villages (small, medium and large) and the temporal change of the oblasts' position (1979, 1989 and 2002) was traced as well. Levčenkov, A.V. (2007) described the historical transformation of a rural settlement pattern of Kaliningrad oblast' since the pre-Soviet period.

Research of rural areas in Ukraine and in Belarus

The geographical literature associated with rural areas of Ukraine, especially the one based on empirical studies, is much scantier than its counterpart about Russia and it is hardly represented internationally. One of the most curious papers was published by Khomra, A.U. (1989) who analyzed population decline in rural regions of the Ukrainian S.S.R. in the 1970s and 80s. Its greatest merit among the foreign language publications on Ukraine is high spatial resolution of research (conducted at the rayon level).

Most of geographical studies about rural Ukraine in foreign languages have dealt with agricultural endowments. The issue of a contradiction between a high *agrarian potential* and a disastrous performance of the farming sector and the issue of *privatization in agriculture* were examined predominantly by the economists.[3] Several studies were published under the aegis of the World Bank (1994a, 1994b), such as the treatises by Csáki, Cs. and Lerman, Z. (1997, 2000). The World Bank and OECD issued several works about the Ukrainian agricultural sector (OECD 2003, 2004). The latter (OECD 2004) is a detailed analysis focused on the agricultural potential of the country (agrarian policy, privatization, living conditions in rural areas).

Clement, H. (1994) examined Ukrainian agriculture in the mirror of agriculture and heavy industry as the major sectors of the economy. The notion of "*Kornkammer*"[4] (granary or breadbasket) referring to Ukraine occurs in the articles repeatedly. Balabanov, G.V. and Friedlein, G. (1995) reveal the significance of "Kornkammer" in relation to environmental and economic con-

[3] E.g. Gudowski, J. 1997; Lissitsa, A. and Odening, M. 2001; Onegina, V.M. 2001; Nijnik, M. 2001; Lissitsa, A. 2002; Kravchuk, R.S. 2002; Zorya, S.I. 2003; Johnson, T.G. *et al.* 2005.

[4] In Diercke Weltatlas (2000 p. 153) published in Germany the concept of "Kornraum" was used.

ditions. A similar approach is deployed also by Brebuda, J. (1971), Penkaitis, N. (1994), Pospelowa, G. (1995) and Schubert, W. (1997). In the 1940s and 50s, agroecological studies appeared in the Anglo-Saxon literature comparing the North American prairie and the Ukrainian steppe (e.g. Nuttonson, M.Y. 1947).

The issue of *household microfarms* is discussed in the paper of Nedoborovskyy, A. (2004) reporting on the case study conducted in three rayons of Zhitomir oblast'. Transformation of the Ukrainian rural areas was tackled by Allina-Pisano, J. (2007).

On agriculture and its transformation many studies of non-geographic character were published relating to *regions that once used to be part of Central Europe* such as Sub-Carpathia (Almásy, S. 2004; Almásy, S. and Káli, T. 2004; Réti, L. and Molnár, J. 1999; Vlakh, M. 1997); Galicia (Bosch, B. and Endlicher, W. 2001) or Kaliningrad oblast' (Kornejewez, W.S. and Knappe, E. 1996). Rural areas of the Carpathian Euroregion figured in the writing of Süli-Zakar, I. (2000) with a detailed description of such regions in Sub-Carpathia and Galicia. The study presents the results of a survey devoted to subsistent farms within agriculture.

An overview of contemporary literary sources published in Ukrainian has led to more findings in empirical and quantitative analyses, but not in spatial typologies. Apparently the main hindrance on the way to a typology was a lack of uniform data about small territorial units. As a result, spatial analysis is performed at the oblast level, which is conducive to only a generalized picture of the emerging spatial patterns.

In Ukraine, one of the most prominent sources is the periodical issued by a research institute for regional studies under the aegis of the University of Lviv, *Regionalna Ekonomika* and *Ekonomika Ukraina.* From the reviewed literature it became clear that a strong regional economic approach and a GIS-based environmental-ecological analysis are the key aspects of research published by that periodical.

This is a fundamental and rapidly evolving trend within Ukrainian geography. A widely accepted and practised method to measure spatial disparities is to sum up various socio-economic indicators and to establish a ranking order of oblasts. Cluster and factor analyses are also frequently applied. However, when relatively few spatial units (the oblasts of the country or the rayons of an oblast') are described by numerous indicators, a statistical significance of the results appears to be questionable.

A textbook for higher education published in Lviv and dealing with human geography of Ukraine (Shablij, O.I. 1994) contains only a brief description of rural issues (e.g.: settlement patterns pp. 210–213). The population as a source of workforce for agriculture captures some attention in the introduction to a discussion of the agri-food production complex (285 p). After a brief

analysis of sectoral complexes the spatial structure of agricultural production is displayed (pp. 307–310).

In relation to transformation processes in the rural areas and to the agricultural sector, several surveys were conducted at the oblast' level by Nahirna, V.P. (1998, 2003, 2006) resulting in types of rural spaces within the individual oblasts. The associates of the Institute of Geography in Kyiv (Balabanov, G.V. *et al.* 2003) published a work on the spatial aspects of transformation of several sectors, including the agri-food production complex at the level of oblasts.

Besides, this work presents a complex description of the nine regional economies in the country. The drawback of the analysis is that it sticks to vast administrative units, i.e., oblasts or to large economic regions so the picture derived is too generalized. The research of rural areas in this sense means the study of depressive (agrarian) regions (Zastavniy, F. 2005; Baranovskiy, M.O. 2007).

The first lengthy *monograph that might be considered rural geographic* was published by Baranovskiy, M.O. in 2009. The work is centered on a typology of depressive areas at the rayon level supported methodologically with a factor analysis encompassing 19 indicators. The book has a lot to offer and contains proposals for the regional policy especially in relation to Chernikhiv region based on a detailed case study.

As far as rural geography of Belarus is concerned, the work of Antipova, E.A. (*et al.* 2007, 2008) has to be mentioned. She has been involved in the investigations of demographic issues and rural settlement network of Belarus. In her first lengthy coauthored volume published under the auspices of the United Nations, the demographic situation and labour market potential were measured. In her later writing, she used the concept of rural geography (sel'skaya geografiya). Describing the demography of rural areas, Antipova compiled a rayon-level typology. Dwarf villages present the most acute problem throughout the country; therefore in the frame of regional development policy a network of agrarian towns was planned as central places of the lowest level.

The author examined the demographic trends of these central settlements. A rayon-level cluster analysis of Belarus's demographic situation and its settlement network, resulted in a typology of the rural areas in Belarus. Similarly to Baranovskiy, Antipova tackled the related problems of regional policy and made recommendations.

In the international literature on geography, the agriculture of Belarus was dealt with by Knappe, E. *et al.* (2002, 2004). Putting emphasis on the postponement of structural reforms in agriculture and on change of the level and standards of production in farming, she also touched upon the problems of the rural settlement network.

Conclusion

The emergence of rural geography in all the three CIS countries can be attributed to a few of researchers. Consequently, rurality as a complex notion has not been accepted and appears only marginally in the literature. Russian rural geography has developed in the wake of research activities and publications of Nefedova and Ioffe, its Ukrainian counterpart emerged with the works by Nahirna and Baranovskiy, while in Belarus Antipova was the explorer of the subject. All of them should be deemed pioneers of rural geography in the respective countries.

Rural geography has grown out of the interrelationship between the issues of demography and agriculture and of the studies on rural areas as depressive regions in these countries. Studies of rural areas, however, are still lagging behind the studies of urban spaces as the key engines of the economy. International and foreign language literature mainly deals with rural Russia and to a considerably smaller degree with Ukraine, whereas Belarus is largely neglected. Rural Russia attracts the attention of foreign scholars because of its enormity and of the role it plays in society as well as because of a general interest in privatization. As for Ukraine, the apparent contradiction between its large agrarian potential and low productivity of agriculture has engaged attention of the scholars.

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AVAILABLE!

Ukraine in Maps

Edited by

Kocsis, K.–Rudenko, L. and Schweitzer, F.

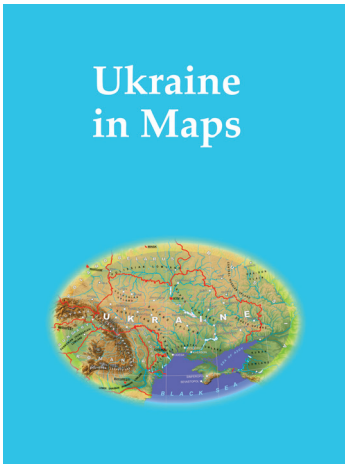
Institute of Geography National Academy of Sciences of Ukraine

Geographical Research Institute Hungarian Academy of Sciences. Budapest, 148 p.

Kyiv–Budapest, 2008

Since the disintegration of the USSR, the Western world has shown an ever-growing interest in Ukraine, its people and its economy. As the second-largest country in Europe, Ukraine has a strategic geographical position at the crossroads between Europe and Asia. It is a key country for the transit of energy resources from Russia and Central Asia to the European Union, which is one reason why Ukraine has become a priority partner in the neighbourhood policy of the EU. Ukraine has pursued a path towards the democratic consolidation of statehood, which encompasses vigorous economic changes, the development of institutions and integration into European and global political and economic structures. In a complex and controversial world, Ukraine is building collaboration with other countries upon the principles of mutual understanding and trust, and is establishing initiatives aimed at the creation of a system that bestows international security.

This recognition has prompted the Institute of Geography of the National Academy of Sciences of Ukraine (Kyiv) and the Geographical Research Institute of the Hungarian Academy of Sciences (Budapest) to initiate cooperation, and the volume entitled "Ukraine in Maps" is the outcome of their joint effort. The intention of this publication is to make available the results of research conducted by Ukrainian and Hungarian geographers, to the English-speaking public. This atlas follows in the footsteps of previous publications from the Geographical Research Institute of the Hungarian Academy of Sciences.



Similar to the work entitled South Eastern Europe in Maps (2005, 2007), it includes 64 maps, dozens of figures and tables accompanied by an explanatory text, written in a popular, scientific manner. The book is an attempt to outline the geographical setting and geopolitical context of Ukraine, as well as its history, natural environment, population, settlements and economy. The authors greatly hope that this joint venture will bring Ukraine closer to the reader and make this neighbouring country to the European Union more familiar, and consequently, more appealing.

Price: EUR 35.00
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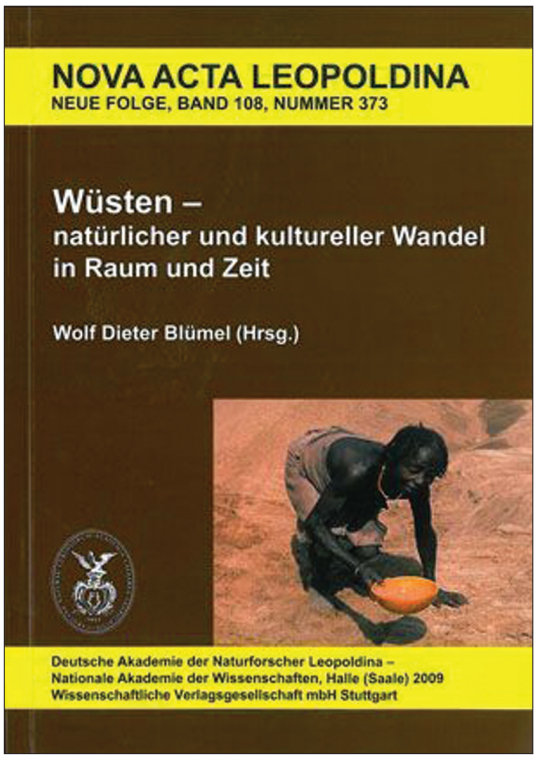
Hungarian Geographical Bulletin 60 (1) (2011) pp. 101–104.

Blümel, W.D. (Hrsg.): Wüsten – natürlicher und kultureller Wandel in Raum und Zeit *(Deserts – natural and cultural change in space and time).* Nova Acta Leopoldina, Neue Folge, Band 108, Nummer 373. Deutsche Akademie der Naturforscher Leopoldina in Zusammenarbeit mit der Gesellschaft für Erd- und Völkerkunde zu Stuttgart e. V. Stuttgart, 2009. 259 p.

Volume 108, No. 373 of the series „Nova Acta Leopoldina" contains 259 pages and includes 12 papers preceded by an introduction and welcome speach. The topic is up-to-date and important, for deserts belong to the most problematic regions of the Earth. The papers published in this volume were presented at the Leopoldina Meeting, 2–3 May 2008 in Stuttgart, organized by the German Academy of Natural Scientists Leopoldina in cooperation with the Geographical Society, Stuttgart.



The introduction by Blümel, W.D. gives a concise summary of the topic. The main issue is whether climate change and its consequences will further complicate the problems of the deserts putting more and more pressure on the poorest regions of the world.

The first introductory paper by Bolle, H.G. characterizes arid regions as risk areas and it focuses on the question how people and social groups handle risks. The second contribution by Giese, E. and Sehring, J. presents an analysis of environmental changes in Central Asia from the aspect of potential conflicts.

The authors distinguish anthropogenic reasons of environmental change from global climate change. Nevertheless, they seem to forget that climate change is also due to anthropogenic reasons. The importance of the interactions between environmental changes and socio-economic disparities is emphasized in the paper.

Succov, M. and Thevs, N. take the example of the Taklamakan to present a paper on the danger of extinction of the Tugai vegetation which has been characteristic for winter cold deserts and semi deserts, the author say "formerly". This is a statement pointing to the fact that Tugai is a vegetation of former times already. Climate change, land use change, desertification and salinization are mentioned in relation to the processes having endangered Tugai vegetation.

High mountain deserts of Central Asia are the subject of the paper by Kreutzmann, H. As in most of the publications in this volume, the importance of the activities of human society is emphasized both in this article as well as the next one by Mächtle, B. and Eitel, B.

The Namib Desert is one of the most attractive areas of Southern Africa. The paper of Blümel, W.D., Eberle, J., Hüsel, K. and Eitel, B. discusses climate and land use changes in the Holocene era. ^{14}C-datings allow for the reconstruction of climatic fluctuations in the Middle Ages (1000–1350 A. D.) and in the Little Ice Age (1500–1850 A. D.). According to these datings the period between 1000–1250 A. D. was so humid that parts of the desert were transformed into a savanna-like ecosystem, while during the Little Ice Age hyperarid conditions prevailed. These changing climatic conditions triggered landscape changes, especially along the desert margins.

The topic of Claussen's, M. contribution is similar to the previous one. The author investigates the dynamics of the Sahara during the Middle and Late Holocene times. Focusing on the Sudanese Desert Kröpelin, S. reports on the reconstruction of the environment and on the cultural history of the Sahara.

The following paper by Breuer, I. and Gertel, J. leads the reader to the field of social problems at the edge of the Sahara, i. e. in Morocco. There is a switch from the social problems to the highly current activity in the region, to tourism in the deserts of Northern Africa. These areas are easily accessible, especially in Morocco and Tunisia. The appearance of tourists requires newly established infrastructure. The construction of an asphalt road leading directly to the Erg led to serious damages so that this kind of development can not be considered sustainable.

Talking about deserts one should not forget about the highly developed parts of the world. Schmid, H. gives an interesting paper on Dubai and Las Vegas. The success attained by these centres can not make us forget the negative effects on the environment.

The last paper of Radtke, U., Hilgers, A., Hülle, D., Lomax, J. and Rittner, S. is more or less a synthesis of the reconstruction of landscape history of drylands. The method of Optically Stimulated Luminescence (OSL) is mentioned as a tool for paleoenvironmental reconstruction. The authors propose to apply this method for the assessment of the sedimentation history of the whole Quaternary period.

The volume of Nova Acta Leopoldina is an intriguing work providing a huge amount of information about deserts and their development. It is very remarkable that environmental change of the deserts is presented not only as a natural process but also as a socio-economic one. The contributions deal with the deserts in a global dimension so that the reader can get a very good overview of contemporary research on the drylands of the World.

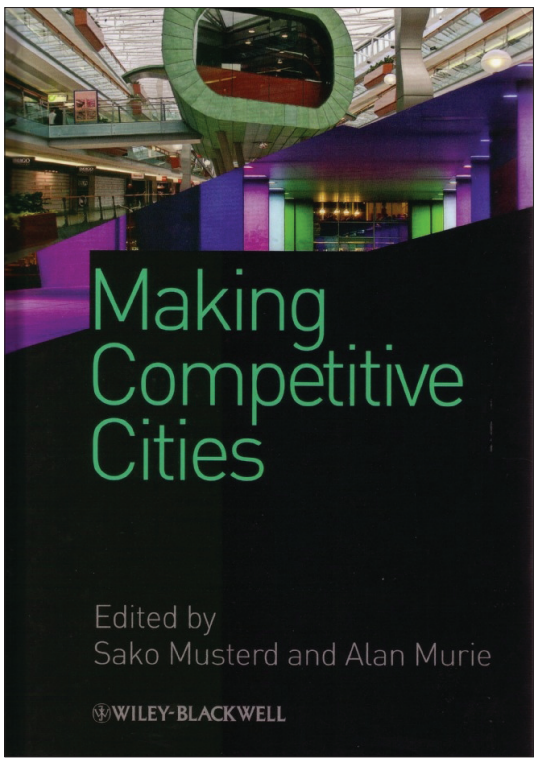
Ádám Kertész

Musterd, S. and Murie, A. (eds.): Making Competitive Cities. 2010. Wiley – Blackwell 360 p.

The book investigates how creative industries contribute to the competitiveness of cities. It epitomizes the results of a four year long project called ACRE. In the framework of the project participants from 13 European cities carried out a comprehensive research about the role and possible development of creative and knowledge intensive industries.

The papers of the first section of the book entitled "Pathways" deal with the developing paths of the investigated cities: their socio-economic structure, position in the international urban network in terms of competitiveness, and the role they fulfill in their native country. In most cases, the general description of cities means an overview of the history during the last few hundred years (e.g. Milan from the 15th or Amsterdam from the 16th century) but the focus is put on the relevant events which have been responsible for the present conditions of their economic performance. These chapters show that the economic success and problems are rooted not only in the last decades but sometimes they can be related to the past centuries.

Peripheral European cities like Helsinki and Dublin are good examples for rapid development in recent years because as capital cities they played a central role in the national economic development and modernization and they could rapidly change their economic profile due to massive foreign investments. Toulouse represents another way of development, as it was the beneficiary of the French decentralization policy and especially the national high-tech and R&D strategies.



There is a strong difference between the western and eastern European cities, the latter still lagging behind their western counterparts in many respects. For example, the share of low-paid creative workers is much higher in the post-socialist countries as Burdack, J., Egedy, T. and Stryjakiewicz, T. pointed out through the examples of Budapest, Leipzig, Poznań, Riga, and Sofia.

The studies of the next section of the book under the title of "Actors" discuss the most intriguing question concerning the creative class: how the theory of Richard Florida fits to European cities. The results of the international survey carried out in ACRE project reveal that the main difference between the European and the American creative workers lies in their mobility. The lower level of mobility of the European creatives has several reasons e.g. the local embeddedness of creative workers (mostly

those who run a business) due to cultural (e.g. language), family and social factors (e.g. pension funds).

The same survey showed that the role of soft factors in the decisions of creative workers to move to a particular city is much weaker in Europe than in the United States. In Europe the central functions of cities and the personal contacts seem to be more important than the social atmosphere or the level of tolerance. On the other hand, albeit soft factors can not attract new creative workforce to a city they can keep those already working there. The language problems and cultural attractiveness are also important. For instance even culturally attractive cities like Barcelona have the problem that the everyday use of English is not common, which discourages international workers.

The life of creative workers is proved to be partly different from the stereotypes of progressive lifestyle. Gender inequalities exist both in working and in private life despite all expectations. Young employees have many difficulties in their job career; one of them is being the temporary contracts they are often employed on and what they consider as a source of insecurity, and not flexibility. At the same time, some other features fit to the stereotypes: people working in the knowledge intensive and creative industries appreciate professional stimulation and are ready to work overtime.

The last part of the book headed by "Policies" intends to give a direct answer to the major question: how cities can be made competitive? There are examples of policies based on bottom-up approach (e.g. Milan where it has a long tradition), and also of top-down interventionist strategies (e.g. Dublin). While analyzing the development strategies and plans of Toulouse, Milan and Dublin, Mugnano, S., Murphy, E. and Martin-Brelot, H. drew different conclusions. In Toulouse, soft factors can be considered as key elements of the development strategy. In Milan, the city should build intense relations with its metropolitan area. In Dublin, where the private actors have played a dominant role for the last decades, they should be involved in the planning process.

The connection between clusters and the creative economy is highlighted by the cases of Helsinki, Birmingham and Poznań. The first has a long experience in the evolution of clusters. According to the authors, it can be explained by the strong tradition of cooperation between these sectors developed during the nation building process in the 19th century. In West-Midlands it is the regional policy that strengthened the formation of clusters, whereas in Poznań the universities and the scientific institutions have strong connections with the clusters, business companies hardly have them.

A major question is analyzed by Kovács, Z., Pethe, H. and Miosga, M.: whether the soft or the hard factors are more important in attracting the creative industry and creative workforce. The local and national development plans they have examined reveal the higher importance of hard factors, namely of the infrastructure (e.g. science parks, universities).

One of the main merits of the book is in an innovative approach: its focus on the topic of creative city and creative class in Europe. It identifies the similarities and differences of the creative industries in the European cities and their difference from the American experience. Besides the excellent papers included in the volume, a rich bibliography offers the readers the opportunity to follow up numerous issues: conceptual, theoretical and practical ones. The book can be equally useful for researchers and urban planners.

Balázs Szabó

CHRONICLE

Hungarian Geographical Bulletin 60 (1) (2011) pp. 105–107.

Report on the Association of American Geographers Annual Meeting

Washington D.C., April 14–18. 2010

Although the Association of American Geographers is a US-based organization, its activities are of worldwide reach. The annual meetings of AAG are one of the greatest and most colorful events among the geographical conferences with thousands of presenters from all over the World. The 2010 Meeting was held in Washington D.C. The relative closeness of the venue to Europe had attracted a lot of researchers from Europe. More than 5,000 participants attended the event, which took place in the Marriott Wardman Park and Omni Shoreham hotels.

Partly because of the great number of the participants, the meeting was very diverse thematically and a wide range of approaches were present – which provoked interesting discussions and debates. The majority of presentations were from the field of human geography, although some sessions dealt with topics related to anthropologic geomorphology or to the climate change, too.

Conference break at Marriot Wardman Hotel

A number of sessions concentrated on the theoretical questions and main concepts of geography. For example, three sessions were focusing on space and spatiality with wide range of approaches. The last of them was a concluding one where some of the most prominent theorists (e.g. Yi-Fu Tuan, Nigel Thrift) exchanged their interpretations of space. These presentations – and the debates about the ontological and epistemological issues related to space – demonstrated the far-reaching philosophical roots of geographical knowledge.

Several sessions dealt with the causes and the consequences of the global economic crisis. One of the most anticipated lectures was about the crisis, too: David Harvey (City University of New York) interpreted the crisis as the logical consequence of the practices of the late capitalism – which he calls as "merchant capitalism". In his Marxian analysis he emphasized the role of the "accumulation by dispossession" – a term which he developed and used in his later works. According to Harvey the solution to the inevitable crises is to change the capitalism itself – although Harvey himself admits that it is a utopian idea.

The number of sessions dealing with China and India reflected the growing economic and political role of these countries. For example the developing green turn of the Chinese economy was presented through the case of the automotive industry, in which the government invests heavily to develop new, more ecologically friendly engines and vehicles. The problems of rapid urbanization of China were also discussed in a separate session.

The "Geographies of postfordism" sessions have dealt with some theoretical questions of geography regarding the current crisis and spatial processes. For example, one of these sessions dealt with the relevance of the Marxian categories in the analysis of the crisis and usability of the concept of class. Richard Peet and Neil Smith both emphasized that there is still a class society and the lower classes are the main losers of the economic downfall. Similar to David Harvey the participants of these sessions agreed that a change is necessary in the capitalism. In another session the panelists discussed how the social construction/production of scale is changing in the postfordist era.

The Nobel Prize recipient economist, Paul Krugman spoke about the "new economic geography", and how it has influenced the economists' approach. In his opinion the main result was that economists started to use the concepts of space and scale in their research. However, as the discussant of Krugman's lecture, Michael Storper from London School of Economics pointed out that it is not always the case: a lot of analysis from the mainstream economy uses a simplified view of the space, e.g. seeing the countries as a homogeneous entity rather than a spatially differentiated unit.

The Lefebvrian idea of "Right to the city" emerged in a lot of papers: presenters from various parts of the world analyzed the spatial exclusion in the cities and the transformations of urban governance. E.g. the "Diversity of neoliberal urbanization" sessions demonstrated that despite the economic crisis the neoliberal urban governance is still in its bloom – moreover, in some places it was intensified because of the growing competition for investments and jobs.

The problems and specific development path of the post-socialist countries were also often mentioned topics. The "Critical geographies of post-communist cities" sessions were focusing on the changing housing conditions in and around the Eastern European cities, e.g. how the gated communities were formed in Bulgaria, how the former socialist summer homes were transformed in Estonia or what kinds of conflicts related to urban rehabilitation have emerged in Budapest.

The „Author meets critics" sessions were memorable parts of the conference: in these events the writer of a recent book and a few critics/reviewers discussed that volume.

Conference break in the park of Omni Shoreham Hotel

At one of these occasions the book in question was Edward Soja's "Seeking spatial justice", which was criticized for example because of the normative nature of the term "justice" or because of the author's alleged "Los Angeles exceptionalism" i.e. that the processes and phenomena he addresses only apply to Los Angeles. At the same time the contestants underlined that Soja's book is a valuable contribution to the philosophical/sociological debates related to justice and points out the role of geography in these debates.

The scientific programme of the conference was extended by a book exhibition and numerous guided tours in Washington and its surroundings and social events like the International Reception or the meetings of various specialty groups. As a highlight of the conference, Jane Goodall was awarded with the AAG Atlas Award for her work for environment and humanity.

At the end of the conference nature demonstrated its power and the relevance of geography regarding the globalized transportation and communication systems: because of the eruption of Iceland's Eyjafjallajökull volcano and the cancellation of flights, several European attendees of the AAG meeting faced difficulties to get back to Europe. The next Meeting will take place in Seattle (WA) in 2011. Hopefully the more distant location will not affect negatively the number of European participants and it will be a colorful and exciting conference as well – and hopefully without travelling difficulties.

Lajos Boros

GEOGRAPHICAL RESEARCH INSTITUTE
Hungarian Academy of Sciences
Scientific Activity Report'10

I. Main tasks of the Institute

The Geographical Research Institute Hungarian Academy of Sciences (GRI HAS) continued to pursue research activities as a member of the Association of Institutes in Geosciences of the HAS in 2010. The most important tasks included the investigations into the short- and long term changes in natural environment anticipated and into transformation processes of socio-economic spatial structure. These activities formed part of international research projects launched previously (SefoNe, SOWAP, EU-6 BORASSUS, ACRE etc.), and of projects announced by domestic research centres and by academic and governmental organizations (National Scientific Research Fund: OTKA, etc.). A major task was to publish the second, revised and updated version of the "Inventory of Natural Microregions of Hungary" and, as part of the preparatory work of the National Atlas of Hungary, to compile the Hungarian version of the thematic atlas, Hungary in Maps, first published in 2009 in English.

The main tasks in the physical geographical domain were the continuation of the projects in progress and presentation of the results at Hungarian and international forums. In the Department of Physical Geography the following topics were elaborated either independently or in collaboration: "The role of gully erosion in the present-day relief development of Hungary (OTKA),"Effect of landscape pattern on macro and micro element budgets of wetlands, "The Environmental and Socio-Economic Contribution of Palm Geotextiles to Sustainable Development and Soil Conservation" (BORASSUS), "Comparison of the impact of different Best Management Practices on runoff from a maize field treated with an early post-emergence herbicide product" (MARGIN), "Water budget investigations of soils under Conventional and Conservation tillage". The colleagues from the physical geographical domain also took part in preparations of the IV. Hungarian Landscape Ecology Conference held in Kerekegyháza between 13th and 15th May.

Research activities in sample areas to facilitate deposition and safe storage of radioactive wastes of low and intermediary activity as by-products of nuclear energy generation continued to be a complex scientific operation. In 2010 comprehensive studies focused on environmental monitoring, hydrogeographical and soil erosion measurements in the surroundings of Radioactive Waste Treatment Disposal Facilities at Püspökszilágy and of the National Radioactive Waste Repository at Bátaapáti.

The *Department of Geomorphology and Quaternary Research* carried out research in three main topics. The members of the Department conducted geomorphological and neotectonical research for the proposed enlargement of the Paks Nuclear Power Plant. During this research the landforms and geomorphic surfaces in the wider environs of the power plant and the floodplain along the Danube (NNE of the power plant) were studied from the perspective of neotectonics. The relationship between the earthquakes and the environmental geomorphologic processes were also studied. The department also carried out a geomorphological strategic research after the red sludge spill accident at the alumina works of Ajka. The chairman of the Hungarian Academy of Sciences commissioned the GRI

to work out a scientific project to eliminate the damages. The results and proposals of this work and the environmental geographic conditions of the Hungarian red sludge reservoirs were presented in a scientific study entitled "Channel regulation of Torna stream to improve environmental conditions in the vicinity of red sludge reservoirs at Ajka, Hungary". The floods and waterlogging in 2010 attracted the attention of public to the fact that the management of the active and low floodplains must be built in a new complex national water management system. To attain this objective the department co-operated with other research institutes to work out a strategy to combat floods and waterlogging.

In the *Department of Human Geography* two EU FP6 projects terminated in 2010: ACRE („Accommodating Creative Knowledge: competitiveness of European metropolitan regions within the enlarged Union") and SeFoNe ("Searching for Neighbours: dynamics of physical and mental borders in the New Europe"). "Revitalisierung von gründerzeitlichen Altbauwohnquartieren in Budapest – Prozesse, Strategien, Perspektiven" was financed jointly by HAS-DFG (German Research Foundation). Another project entitled „Zwischen Gentrification und Abwärtsspirale" was supported by the DFG. On behalf of the Presidium of HAS a thematic atlas in English entitled „Hungary in Maps" was published in 2009; in 2010 the preparation of the Hungarian version was one of the main tasks, including revision of the manuscripts, thematic checking and preparation of insert maps. Another major venture was to publish the second edition of „Inventory of Natural Microregions of Hungary" in 876 pages (236 maps included), which became a great success both in professional circles and among general public.

II. Outstanding research and other results

One of the main tasks was the geomorphological and neotectonical research for the proposed enlargement of the Paks Nuclear Power Plant. During this research the landforms and surfaces in the wider environs of the power plant and the floodplain along the Danube (NNE of the power plant) were mapped and investigated from the aspect of neotectonics. During the geomorphological and neotectonical research, field studies were made to explore and evaluate the proposed location of the expansion.

The most important geomorphological strategic research was the exploratory and analyzing work of the red sludge accident at Ajka alumina factory. The news on the catastrophe spread quickly around the world and had drawn the attention to the geographical factors which contribute to the development of industrial and natural disasters and to the importance of the responsible thinking, prevention and safety. The institute took a coordinator role in the elaboration of an environmental strategy to prevent further catastrophes in the future. Geomorphological survey of the hazard posed by similar reservoirs in Hungary has also been performed.

As a result of the project "The long-term strategy of the flood-protection and safety", it was established that the supposed climate change during the last 10–15 years and the anthropogenic interventions altogether caused record high water stages and flood events of increasing frequency. The geomorphologists in the institute proposed that the low floodplains should be reoccupied by river in some places to create proper conditions for the traditional water management and storage. That could be a favourable solution as there are limited possibilities to raise the embankments due to the siltation on the floodplains. Hungary is in need of a long-term (50–100 years) hydrologic strategy.

In the frame of „OTKA 76434" project: "The role of gully erosion in the present-day geomorphic processes in Hungary" the small scale mapping of gullies is being converted into digital form for the whole country. By the end of the last year 105,000 linear erosion features evolved in the hills had been digitized. The total length of the digitized features is more than 21,000,000 km. The land use and the soil characteristics of the surrounding areas of the gullies are also represented on the maps.

The most important scientific development of BORASSUS project was the demonstration of the effects of geotextiles on soil moisture and showing the differences in soil moisture dynamics depending on the geographical location and the types of geotextile fabric on the various sample plots. The sample plots are situated in areas under different climates. Brazilian, Chinese, Hungarian, Lithuanian, Thai and Vietnamese measurement data were evaluated. The measurements in the soil erosion plots were made by applying the gravimetric method. The favourable effects of the geotextiles show up in case the annual precipitation is more than 700 mm and the annual temperature variation is less than 28º Celsius. The highest values of soil moisture variation can be detected in the moderate climate zone, while the highest soil moisture surplus is typical under an udic soil moisture regime.

The main purpose of the research supported by OTKA called "Spatial structural impacts of industrial investments and their transport connections" was to analyze the transport geographical locations and transport accessibility of industrial parks. Based on a survey carried out in industrial parks they were classified into 7 major groups and 13 subgroups. Elements of transport network were established those having played an important role in the location choice. It could be realized that the quality of transport connections and the development of transport network had exerted a major impact on the development of industrial parks. The research and its basic results have been reported at two international conferences.

OTKA project "Health tourism and quality of life in Hungary" summarized the relationship between tourism and quality of life in Hungary in a book published by GRI. This volume provides the theoretical basis of the dimension of health tourism. With the help of a questionnaire (n=500) the local population's opinion of Orosháza town about and attitudes towards the nearby spa opened in 2004 were investigated; in addition the contribution of the new spa to the tourism industry and its other external effects were described. Using internet sources content analysis was made about health services in Hungary for revealing the attitudes towards and feelings about tourism. As a result a map was constructed about the medical tourism in Hungary.

ACRE project covered the time span between October 2006 and September 2010. This was an Integrated Project, financed by the European Commission within the FP6 with a total budget of 4.5 M Euro. The project aimed to assess the impact of the emerging 'creative class' and 'creative industries' on the competitiveness of EU metropolitan regions. The focal question studied was: what are the conditions for creating or stimulating 'creative knowledge regions' in the context of the enlarged European Union? The project analyzed and compared recent socio-economic development trends, strategies and policies in 13 metropolitan regions across Europe (Amsterdam, Barcelona, Birmingham, Budapest, Dublin, Helsinki, Leipzig, Milan, Munich, Poznań, Riga, Sofia and Toulouse) to get more insight about the extent to which creativity, innovation and knowledge are connected and serve as keys to a successful long-term economic development. According to the outcomes of the project the consortium formulated many targeted messages and recommendations to policy makers to enhance the importance of creative industries and to develop the competitiveness of metropolitan regions investigated.

In the frame of „Zwischen Gentrification und Abwärtsspirale" (DFG) project interviews were carried out with experts and inhabitants from a gated community, in Budapest. The research shed light on the circumstances of the investments, the evolved conflicts it made, and the relationships among the inhabitants and their opinion about the local government. The results synthesize the inner differentiation of post-socialist cities, including Budapest, and its improving or deteriorating quarters. The results can directly be used in the urban development strategy of Budapest.

The departments of the institute were involved in several researches addressing not just the academic community but the society as well. The public was informed through the media such as articles and news broadcasting.

III. International relations

In the near future the institute is aiming to put special focus on its international relations. The institute made efforts to maintain and enlarge its multilateral international relationships. In order to fulfil this aim participated in several EU and other international projects, making use of the researchers international contacts. A part of them is related to education: one researcher is employed in J. Selye University (Komárno, Slovakia), another in Babeş-Bolyai University (Cluj, Romania). Another chain is the numerous position in scientific societies and editorial boards. Among the colleagues three participate in the work of international committees for a long time, nine of them are involved in editorial boards of international journals. Of the scientific advisors one is vice president at ESSC (European Society for Soil Conservation).

In 2010 numerous conferences, workshops were organized or co-organized by colleagues from GRI (e.g. Creaticity conference at Budapest, HUNGEO 2010 and. X. Worldwide meeting of Hungarian Geoscientists in Szombathely, Hungary).

Among international scientific conferences researchers from the institute participated in the following: GEOMED 2010 The 2nd International Geography Symposium – Mediterranean Environment (Kemer-Antalya, Turkey); UNESCO Chair on Eremology: Workshop and 3rd Conference on Desertification and Land Degradation (Gent, Belgium); "Soil solutions for a changing world" – 19th World Congress of Soil Science (Brisbane, Australia); IGU Globality Commission Meeting (University of Haifa, Israel); X. Seminario Internazionale di Geografia Medica (Roma, Italy); Association of American Geographers, Annual Meeting (Washington D.C., USA).

The bilateral relations were especially close with the geographical units of the Romanian, Ukrainian, Croatian and Slovak academies, with the Institut für Länderkunde (Leipzig), Shevchenko University (Kyiv), Akademie für Raumordnung und Landesplanung (Hannover), with the universities of Zagreb, Leipzig, Cluj, Bern, Berlin, Novi Sad, and the college in Berehove (Ukraine).

These relations are also connected to special research programmes, research projects or bilateral research agreements (EU FP6, SNSF, DFG, joint research programmes financed by the HAS, etc.). In 2010 a special attention was paid on the formerly strong Eastern relations of the GRI, which were neglected following the transition in 1990. On November a delegation travelled to Moscow from GRI to discuss the ways of possible future collaboration, while in December a delegation arrived from the National Academy of Sciences of Belarus.

Ágnes Erőss

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