Acta Universitatis Palackianae Olomucensis
Facultas Rerum Naturalium

Geographica 40 | 2

Palacký University Olomouc
Olomouc 2009

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Published by Palacký University Press
Křížkovského 8, 771 47 Olomouc
IČO 619 89 592
1st edition
Olomouc 2009

Published since 1960
Frequency: two volumes in a year
Current volume: 40/2

Printed by Papírtisk s.r.o.
Chválkovická 223/5, 779 00 Olomouc

ISSN 1212-2157
MK ČR E 18 956

Contents

CHANGES IN FARMING IN THE LANDSCAPE OF EASTERN SUDETES AS A FACTOR INFLUENCING THE DYNAMIC OF FLUVIAL PROCESSES

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Abstract
The paper deals with relationship between the landscape patterns establishing after medieval colonization in Hrubý Jeseník foothills and fluvial dynamics in catchments of small-scales. The dissected landscape of Zlatohorská vrchovina Uplands has retained features of landscape structure, created by stripes of fields diverging to both sides of valleys. The way of farming and cultivating individual fields within the band structure appears – from present point of view – as very thrifty, stabilizing itself after beginning unsteady period of deforestation. Remarkable channel erosion (depth and mainly lateral), cut banks in meander belt with marks of downstream meander progression, widening of active channel and gravel bars accumulation were found in the Kobylí potok Brook near village Jelení in Zlatohorská vrchovina Upland. These features confirm activity of flood and high water flow. On the top of it, implication of cattle grazing and tramping of banks were discovered. In paper are discussed following questions: Are these features accordant with natural development? Can be these changes linked with dynamic equilibrium disruption between sediment transport and velocity of flow as a result of changes in farming, grassing of land and natural erosion reduction?

Key words: Zlatohorská vrchovina Upland, human impacts, landscape structure, grassing, sediment deficient water, lateral erosion

INTRODUCTION

The aim of this paper is to contribute to understanding of variability in channel dynamics and lateral erosion in small catchments in piedmont landscape of the Eastern Sudetes in relation to human activity and land-use since the beginning of settlement, especially after the Second World War. This study is based on the analysis of colonization history and the landscape structure of Eastern Sudetes (on the example of extinct village Jelení/Hirschberg in the Kobylí potok Brook valley), using aerial photographs interpretation and field surveys.

STUDY AREA

The study area is situated in Zlatohorská vrchovina Upland, at the watershed among the Opavice River in the north and the Opava River in the south, in the upper reach of the Kobylí potok Brook. The Zlatohorská vrchovina Upland lies in the area with relatively cold, humid summer and long winter. The snow cover lies on the average 102 days in year. Mean annual total amount of precipitation reaches up to 900-1,200 mm. The most amount of precipitation, in a long-term mean of years 1901 to 1950, in spring and summer months had the peak in July (135 mm, weather-station Heřmanovice). The area consists mainly of flyschoidal layers of "Andělská Hora formation" of Upper Devonian up to Lower Carboniferous age with prevalence of greywackes or slates. The region with mean altitude 680 m a. s. l. can be characterized as Hrubý Jeseník Foothills (Fig. 1).

The Kobylí potok Brook with the catchment area of 23.2 km^2 is 7.7 km long, the mean discharge at the mouth to Opava is 0.22 m^3/s. In respect of

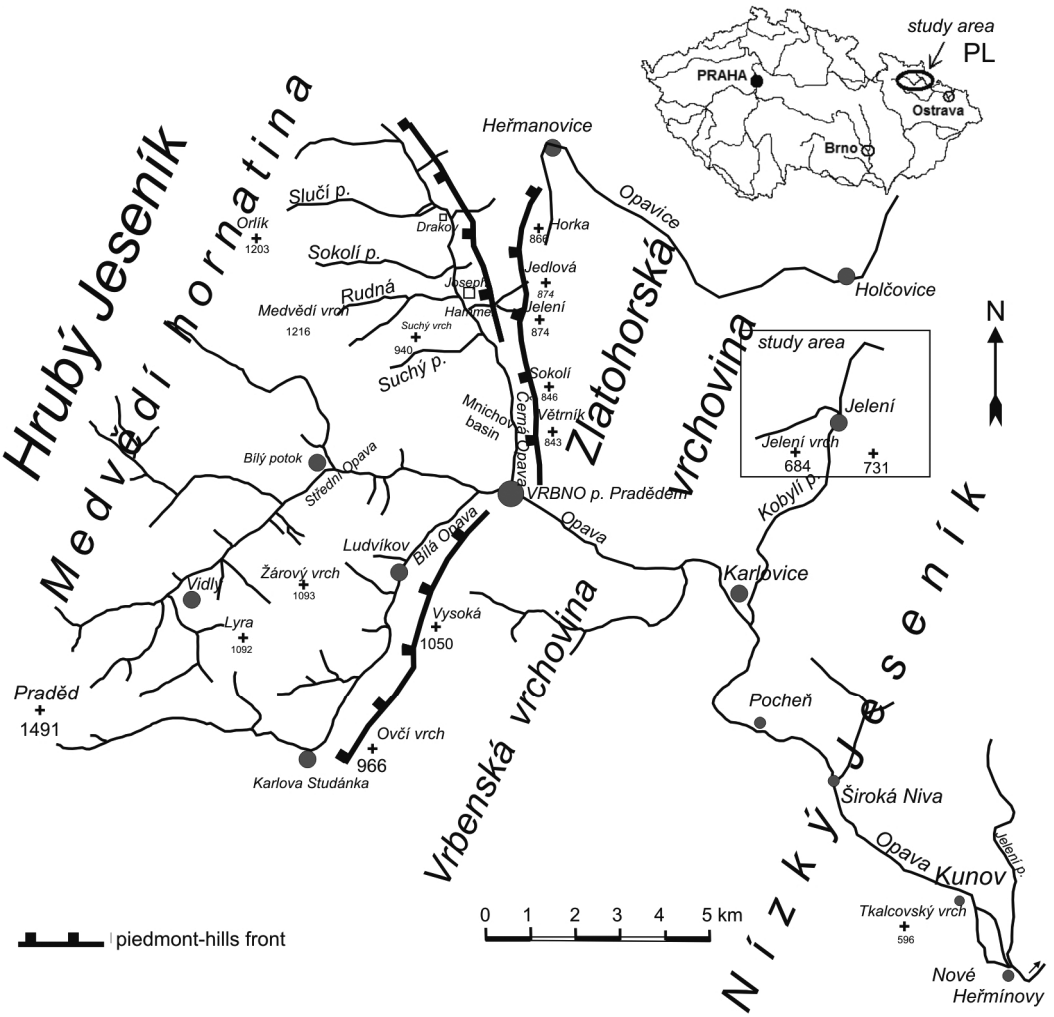


Figure 1 The study area.
Source: www.mapy.cz.

snowmelt, the highest water-level stage occurs during spring months, whereas the autumn months are typical with the low-flow stages. There are mainly two reasons why the valley of mentioned brook is greatly suitable for evaluation of impact of variations in farming and land-use on geomorphological processes: firstly, phases of expansion of the land register from establishment to present state are precisely known here, secondly, the erosion processes and dynamic equilibrium disruption are still in progress in the stream channel.

The Zlatohorská vrchovina Upland was repeatedly affected by number of disastrous floods in former times, catastrophically affected were villages lying along the Opavice and Opava River. In 1605 the catastrophic flood caused property damages (houses, mills, meadow, fields, corn, cattle). The flood on August 26, 1813 destroyed 13 houses and all the bridges in near village Holčovice, in village Hejnov 16 houses were destroyed and 30 houses were damaged. In accordance to historical records, the water in evangelistic church gained upon height 30 cm in 1829 on June the 10 after several-

-day rainfalls. The other floods took place in years 1847, 1880, 1883, 1920 and 1940. One of the most devastating flood occured in 1903 in July the 10, when Opavice River flowed catastrophically over the banks after five-day heavy rainfalls. The total day amount of precipitation of 184.7 mm was recorded on weather-station in Heřmanovice. This natural disaster washed down or destroyed number of buildings, bridges, reads, a new school building, brew-house and several factories. Other extreme flood took place in July 1997.

RESEARCH METHODS

Field research, measurement of basic parameters of river channel (bend radius, meander belt width, wavelength, sinuosity) and analysis of aerial photographs acquired in years 1937, 1955, 1979 and 2006 (obtained from Office of Military Geography and Hydrometeorology in Dobruška) were the main methods used to investigate changes in farming and subsequent impacts on fluvial dynamics. The approximate type of land-use was determined, as well as the particular field product. Patterns of grey-coloured tones (from light to dark) in aerial photography in 1937 indicates larger scale of crops growing in the fields in various maturity – winter and spring corn, potatoes, grass herbage etc. After 1945, the uniform gray shade dominates indicating the prevalence of permanent grass vegetation (light colour with symbol in Fig. 2). Moreover, the eastern part of the Kobylí potok valley was covered with this grey colour already in 1937, which implies the use of colder slope for pasture as so-called "winterhalde". Furthermore, the sinuosity of the channel bed in individual aerial photographs was compared.

HISTORICAL DEVELOPMENT OF LANDSCAPE LAND-USE

The acquaintances of landscape historical development from first settlement and land-use methods were used in land-use changes evaluation. The area of Zlatohorská vrchovina Upland was colonized in the course of several periods, which are perceptible in its structure. The mining colonization relating to gold-mining was the oldest one. Gold-washing took place from early middle ages (Večeřa, Večeřová 2001). Main valleys of Opava River and Opavice Rivers were settled by so-called large colonization in 13th and 14th century. During this period the first colonies were established. The exact establishment time of the villages during the large colonization is not known, the first mentions are dated considerably later – e.g. the villages Heřmanovice (Hermannstadt) in 1339 or Holčovice (Hillersdorf) in Opavice Valley first mentioned even in 1478. These villages originated as long forest lane villages, so-called *"Waldhufenflur"* (in German) with typical field arrangement in long strips getting from each farmstead in valley up to the hills, approximately perpendicular to the valley axis. *"Flur"* means entire farmland cultivated in three-field crop rotation including pastures with a third of land kept waste every year. English language has no nomenclature for this type of fields setting (in Czech *"plužina"*) on account of different historical development. Therefore it is logical to use German terminology, where the type of organization is possible to describe as *"flur mit langstreifen besitzparzellen"*. In English as a system of open fields which does not describe the subject matter. This belt system created the main feature of landscape structure in colonized valleys and is evident nowadays mainly due to long dry stone walls and balks.

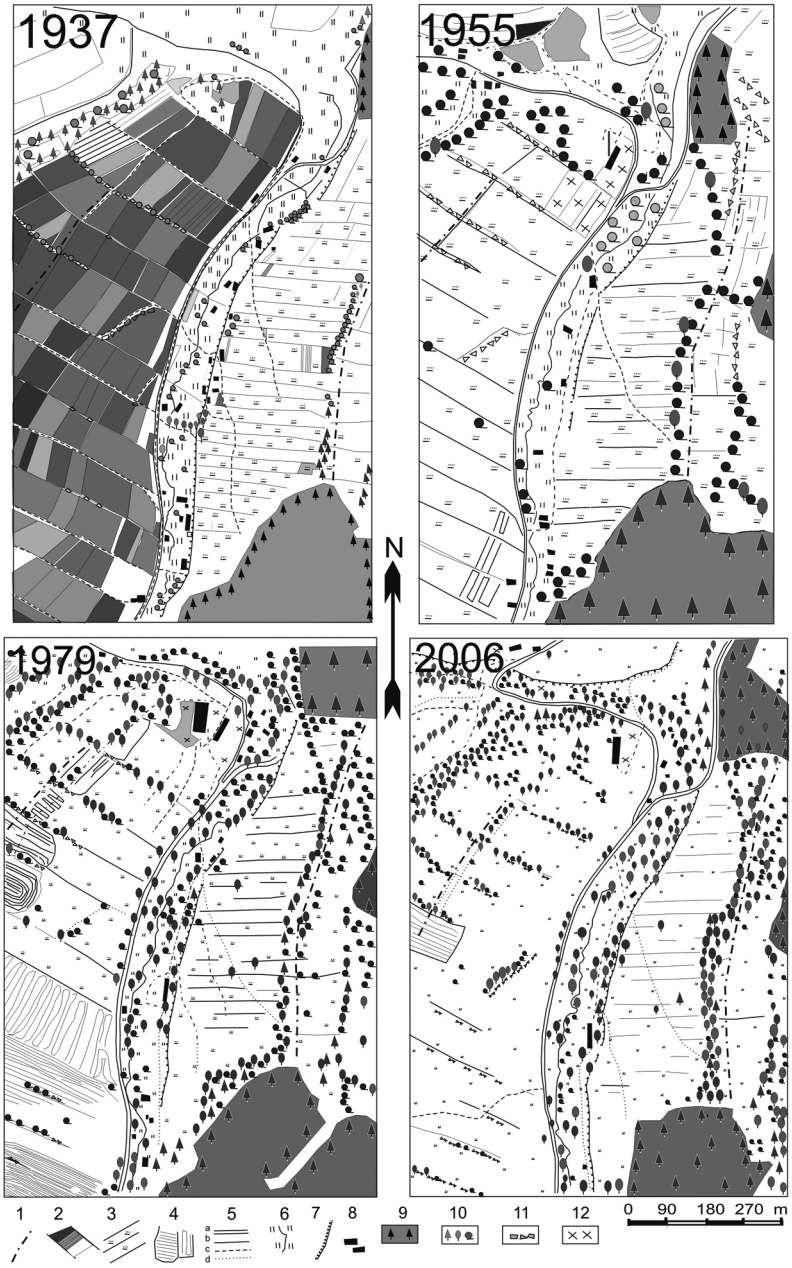
In the same time as a large colonization the river alluvium were scoured and washed which led to belts of placer hill formation, which were later either removed (e.g. on Opavice River – *"Gold Oppa"*) or were preserved, e.g. in valley of Opava River where its massive distribution caused considerable local constriction of floodplain area (Hrádek 2008). In 18th century and after the Thirty Years War, the second period of colonization took place. During this colonization the less opportune places were populated, the highest locations were colonized at the very latest e.g. Rejvíz (Reihwiesen) 770 m a.s.l. in the second half of 18th century). The hamlet Jelení originated on August 29, 1666 south of Holčovice village in place called *"im oberen Hirschgrundt"*. This small village had 20 colonists. Each of them received a piece of land, 108 rods long and 15 rods wide (one rod = 3.79 m). Rye, oat, barley, flix, pulses, potatoes and fodder crops were grown in stony fields. New created village during second colonization had also features of

"waldhufenflur" as that arisen in the course of the first period; however the build-up area was opener.

Most part of upland landscape was cultivated. The long-term using of a three-field crop rotation was very environmentally friendly to the landscape. In 1900, 44% of Holčovice's land register was covered by forests. Land-use data for Jelení village have been known since 1905. At that time 459 citizens lived in Hirschberg (Jelení) in 80 houses, situated in the Kobylí potok Brook valley. Generally, 288 ha of ground were used as arable land (204 ha), meadows (29 ha), gardens (2.09 ha), grasslands (5.46 ha) and forests (35 ha). The arable land was dominated. Another development of land-use is well noticeable in aerial photograph taken in 1937 (Fig. 2). Strips of *"flur"* divided in individual rectangular or square plots and situated up hill are noticeable in the photograph. The varied mosaic of fields is evident, individual plots were ploughed across a slope (contour plowing). Meadows were situated mainly in valleys along water courses but the little fields were also situated in floodplain of the Kobylí potok Brook. The well developed road network is apparent, following the stripes of *"flur"* and boundaries of fields. After the displacement of German inhabitants in 1945, the population decreased dramatically and has never reached even third of its pre-war state. Many houses and fields stayed abandoned. In 1945, a mountain pasture cooperative was established in Jelení. Deserted buildings were demolished and the village Jelení practically died away. More about land-use in Jelení is apparent from aerial photographs taken in 1955 and in 1979. In the photograph from 1955 (Fig. 2) is evident that the major part of land register of former Jelení was not cultivated at all. Only marginal parts adjacent to neighbouring villages (mainly to Holčovice) were cultivated. The old mosaic structure of *"flur"* stripes dividing in individual plots was already not kept. The amount of old roads was reduced, new ones originated. In the aerial photograph from 1979 (Fig. 2) about one third of parcels were cultivated in the entire length, the rest of land lied waste, the amount or roads kept on decreasing, the forested area started to increase. Since 1993, private company has been farming round village Jelení. Pastures take up major part of landscape according to the aerial photography from 2006 (Fig. 2). The structure of landscape, marked out by belts of land strips, stayed well-established, even though not functional. The area of overgrowing former grazing lands and fields by trees and shrubs also increases. The main difference in land-use is the extension of grasslands at the expense of arable land. The amount and length of used roads decreased with changes in farming.

HUMAN IMPACTS ON FLUVIAL SYSTEM

Fluvial systems in small catchments are well responded to impacts of changes in land-use and farming. The small catchments reply more immediately and with greater intensity to processes linked with precipitation run-off and they also more reflect changes in surrounding landscape than large basins (Hrádek 1989). The agriculture system kept by human appears, under the special terms, may be quite steady. The belt system of fields in steep land gradually gained these properties. Whereas in beginning period in medieval times, the processes of erosion were considerable after forest clearing (Hrádek 1980, 1989, Klimek et al. 2002), especially when coincide with the beginning of LIA (Hrádek 2007), after establishing the three-field crop rotation and contour plowing the situation steadied and field system came to equilibrium state even though intensive land-use activity. The post-war period in 20th century brought changes in land-use. Investigation in Eastern Sudetes brought new evidence on erosion processes in small catchments. Klimek and Malik (2005) studied effects of deforestation and processes of erosion in small tributary of Černá Opava River near Drakov in land register Heřmanovice in western part of Zlatohorská vrchovina Upland. As dendro-chronological methods suggest, the origin of erosion is associated with lateral channel migration mainly during large floods. The start of erosion processes is dated to the last 30 years. According to the authors, the main reasons are the excess of energy and a lack of transported material. Latocha (2005, 2006) closely analyzed the Luty potok Brook in Polish side of Rychlebské hory Mts. and confirmed the recent age of fluvial sediments in floodplain in consonance with former knowledge Teisseyre (1985). The beginning of the channel erosion is referred to changes in population



1 – rounded ridge; 2 – band structure of fields and plots; 3 – band structure of perennial grassland which primarily arisen under the thumb of exposition on cold valley side; 4 – marks of land cultivation after the year 1946; 5a – local roads, 5b – main path, 5c – other path, 5d – inactive path; 6 – meadows in Jelení potok Brook; 7 – edge between valley side slope and floodplain; 8 – farmsteads and other buildings; 9 – forest; 10 – coniferous and broad-leaf trees and bushes out of forest; 11 – dry stone walls; 12 – degraded ground.

Figure 2 Variations in farming in southern part of village Jelení's land register.
Source: own research.

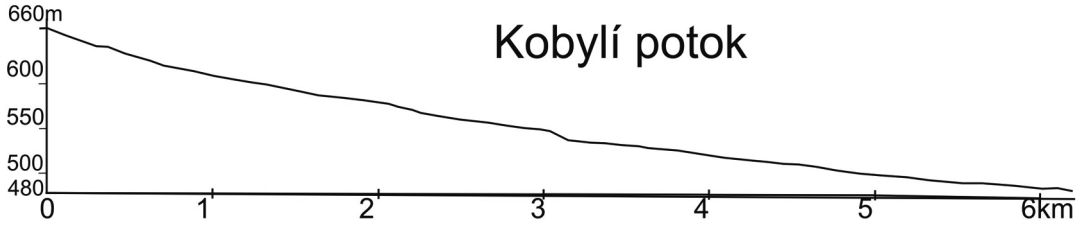


Figure 3 Longitudinal profile of the Kobylí potok Brook with the maximal slope (and meander sequence) in the middle section.
Source: topographic data from the map.

density and overgrowing of former fields with herbal, shrubby and forest vegetation in years 1930-1950. The author also refers to other forms of erosion associated with e.g. cattle grazing.

Changes in the Kobylí potok Brook valley

The Kobylí potok Brook can be considered as an example of small-scale catchment. Field survey in 2005 found marks of lateral erosion, meander progression and shallow channel incision into the floodplain (from 0.7 to 1.5 m). The analysis of aerial photographs taken in 1937 up to 2005 revealed distinct meandering patterns of the Kobylí potok Brook namely in 2005. Especially the meander situated in the lower part of former village became greatly remarkable in the photography taken in 2005. During field investigations the following problems were discussed: is the lateral and deep erosion a part of a natural development of channel or should be considered as a feature of instability as a result of variations in land-use? Data describing characteristic dimensions of meanders sequence is listed in table 1.

Table 1 Parameters documenting the meander sequence in mentioned reach on the Kobylí potok Brook.

Bend radius	10 – 12 m
Meander belt width	20 m
Wavelength	24 m
Sinuosity	1,35

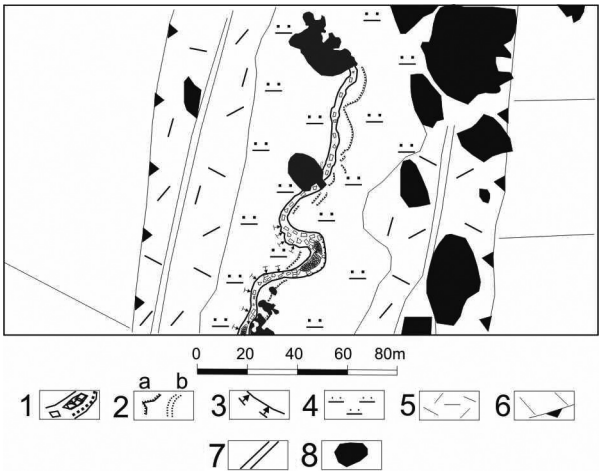
Investigated meander sequence is situated in the middle section of stream in lower part of former village, towards the mouth to the Opava River, where the channel slope is changing from 20 m/km to 27 m/km (Fig. 3).

On the left side of channel in upper part of meander belt the scars of left banks as low steep slopes (up to 0.5 m high) were kept, with typical feature of shifting – so called cusp, indicating meander progression (Fig. 4 and 5). The channel width varies; it is relatively narrow above the meander belt, (generally approximately 1 m width) and it extends in meander belt up to 5 m. The concave meander bank is affected by lateral erosion and the structure of floodplain is striped on the wall of cut banks. Poorly sorted clastic silty sand deposits of small thickness (0.25-0.4 m) form the upper part of cross profile lying above coarse tabular and angular gravel and cobble with prevalence of greywackes. Investigated structure of floodplain and lateral erosion point to immature of floodplain associated with redeposition of weathered Pleistocene greywackes deposited at the base of steep slopes (15-20°). The small thickness of fine-grained overbank flow deposits proves the low transportation rate of fine-grained material with lower content of suspended load and thereby lower erosion in the catchment. The right side of channel bed is affected by several types of geotechnical failures – partly cantilever failures attacking turf layer, partly caused by cattle grazing and tramping, as a negative implication of predominant grazing. Sandy gravel horizon part of banks lying below the turf is affected by freeze/thaw processes and dry granular flow. As a result of lateral erosion and banks instability, the

Figure 4 View on the floodplain of the Kobylí potok Brook with meander belt. Photo: Mojmír Hrádek, 2006.

water course is supplied with abundant material, namely with coarse gravel; the channel has typical features of gravel bed channel. Thorne (1998) defines present status of channel whether or not the channel width is adjusted to the present flow and the sediment regime. The adjusted channels have *"stable widths over time, although they may still be laterally active if they erode one bank and deposit sediment at the other to migrate in 'dynamic equilibrium' "*. The present state of the Kobylí potok Brook indicates that the width of channel bed is not adjusted to present flow with low water content and even not to the sequence of one eroded bank and deposit sediment at the other. In the course of the year, the stream channel is more watery in spring and low-flow in autumn. During low water stages, the gravel bars are covered with vegetation. A big width of channel bed in the first outstanding meander with mid-channel bar and imbricated tabular gravel corresponds to high-energy processes such as flood in July 1997, flood in August 2002 and strong snowmelt in 2006. Erosion of cut banks, the channel widening and creating of mid-channel bars are concerned with effects of meandering thalweg during the overbank flow (Levin 1976, Schumm et al. 1987) which were also found on other rivers (Hrádek 2005, 2006). According to Baker (1987), in a meandering alluvial stream with a floodplain, the rising stages of flood flow yield sequences of adjustments within the channel. At the beginning width does not markedly increase as depth increases rapidly up to bankfull stage. The stream erodes sediments from its bed to keep pace with an increasing equilibrium rate. If the sediment concentration increases faster than the equilibrium rate, the overbank flow deposits the excess sediment as natural leveé, thereby restoring equilibrium (Maddock 1976). If sediment transport does not keep pace the equilibrium rate, the flow will attack the banks, widening the channel. Equilibrium is thereby restored since sediment is added to the flow, and the enlarged channel reduces velocity for given discharge thereby producing a lower transport rate. The absence of leveé indicates no greater excess of sediment material on the Kobylí potok Brook. On the contrary, the processes of meander formation, channel deepening and channel widening are apparent.

The destructive effects of flood in 1997 became evident also on channelized lower reach of the Kobylí potok Brook, where the stone revetment was destroyed during channel widening. A lack of erosion and transported sediment material on middle and upper reach of the Kobylí potok Brook is probably associated with increasing of areas with meadows and pastures as indicates analyzing of aerial photographs from years 1955 and 1979. The overgrowing of inactive roads increases, causing



1 – widened reach of channel with mid channel bar and left cut bank; 2a – scars of left bends as a testimony of meander progression, 2b – abandoned channel; 3 – right channel bank affected by gravity cantilever failures and dry granular flow; 4 – floodplain; 5 – accumulations of colluvial deposits at foot of steep valley sides; 6 – lower slope egde; 7 – road; 8 – woody vegetation.

Figure 5 Channel of the Kobylí potok Brook with meander sequence in lower part of Jelení. Source: own research.

decrease in road erosion, as pointed out by Latocha (2005). According to field measurements of Rychnovská (1985), the perennial herbage stand is able to reduce erosion about hundred times. The decreasing amount of bed load and suspended load in river channel of grassing upland landscape is highly actual, leading to sediment deficient water stage. To keep the dynamic equilibrium, the stream creates meanders and erodes its own channel to supply the bed load. Even very little depth of fine-grained overbank flow deposits in floodplain points to reduced rate of natural erosion. Erosion consequences of changes in land-use were discovered also at other places in Sudetes. Remarkable meanders were found for instance in case of small tributary of Černá Opava River near Drakov in upper part of the stream at the point of channel slope increasing (Klimek, Malik 2005) as well as on larger water courses such as Luty potok Brook near Lutynia in Klodzko basin (Latocha 2005, 2006). The above mentioned streams differ in a sum of kinetic energy of longitudinal profiles, stream order, local lithology and features of landscape structure. The main reason for channel erosion is probably similar in all cases – the dynamic equilibrium disruption between sediment transport and kinetic energy in consequence of the long-term grassing of farmland.

CONCLUSION

The band structure of of Zlatohorská vrchovina Upland landscape was established on the beginning of stable settlement in the Middle Ages. In response to landscape deforestation and field system setting the erosion reaction and soil loss occured. It is apparent, that after stabilizing, the new system managed to keep in equilibrium the processes of run-off and material transport in channels of small catchments in the course of intensive farming activity. After the Second World War, the steady state was disturbed by one-way grazing technique of farming. The channel erosion can express as deep or lateral erosion and on the Kobylí potok Stream proceeds during high-energy stages of floods through meandering thalweg, meander progression and channel widening with channel bars formation. Also cattle grazing and tramping contributes to river bank erosion. The landscape near extinct village Jelení, which is situated at water divide between Opava River and Opavice River, was colonized relatively late. The landscape structure formation was influenced by organization of belt open field system. The prevalence of greywackes of "Andělská Hora formation", the three-field crop rotation and the contour plowing created relatively steady system,

which was locally only disturbed by occasional floods. The deep and lateral erosion (pursuant to the meander belt), increasing in sinuosity, meander progression, channel widening and gravel bars formation were investigated ten years after flood in July 1997 in middle reach of the Kobylí potok Brook. All these processes were identified as a result of meandering thalweg channel operation during flood in 1997, and slowly progressing in the next years. This type of widening of unstable channels has been known in the Czech Republic on the larger altered streams as the Bečva River. The instability on the Kobylí potok Brook is related to disproportion between sediment transport and flood flow velocity induced by long-term changes in farming near water divide between Opava River and Opavice River, mainly by grassing and grazing land-use. The effects of permanent herbage cover which prevents from erosion were experimentally demonstrated and they were also confirmed from other parts of Eastern Sudetes.

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Résumé

Změny v hospodaření v krajině Východních Sudet jako faktor ovlivňující dynamiku fluviálních procesů

Fluviální systémy v povodích malých měřítek velmi dobře odrážejí vliv změn v hospodaření a využívání krajiny. Tato povodí s větší intenzitou reagují na procesy spojené se srážko-odtokovým procesem a také více reflektují změny v okolní krajině na rozdíl od povodí větších měřítek.

Cílem studie je objasnit příčiny ve změnách fluviální dynamiky vodních toků v povodích malých měřítek podhorské krajiny Východních Sudet. Zjištěné skutečnosti jsou analyzovány v souvislosti se změnami v hospodaření v krajině od počátků osídlení, zejména pak se změnami vyvolanými hospodařením v období po druhé světové válce. Modelovým územím je horní část povodí vodního toku Kobylí potok situovaná v oblasti Zlatohorské vrchoviny poblíž zaniklé obce Jelení (Hirschberg). Tato oblast představuje území vhodné k hodnocení dopadu změn v hospodaření a využití krajiny na dynamiku fluviálních procesů zejména ze dvou důvodů: i) záznamy o vývoji hospodaření v katastru obce se vyskytují souvisle od dob jejího založení až po současnost a ii) v korytě místního vodního toku dochází k porušování dynamické rovnováhy. Studie srovnává vliv několika posledních etap vývoje hospodaření na fluviální dynamiku systému na základě hodnocení série leteckých snímků, terénních výzkumů, historické analýzy kolonizace v oblasti a rozboru vzniklé krajinné struktury.

Krajina Zlatohorské vrchoviny byla osidlována v několika kolonizačních vlnách. Nejstarší byla kolonizace hornická, spojená s vyhledáváním ložisek zlata, která probíhala od raného středověku. Hlavní údolí v oblasti byla osidlována v průběhu tzv. velké kolonizace ve 13. a 14. století, během níž byly zakládány jednotlivé osady. Tyto obce vznikaly jako dlouhé lesní údolní vsi (něm. tzv. *waldhufenflur*), jejichž typickým rysem bylo uspořádání polí v dlouhých pásech probíhající od každé usedlosti či dvora zhruba kolmo na osu údolí v pásech vzhůru do svahů. Pásová struktura krajiny založená již v počátcích trvalého osídlení krajiny Zlatohorské vrchoviny dokázala při intenzivním hospodářském využívání krajiny udržovat v rovnováze procesy odtoku a transportu materiálu v korytech toků v malých povodích. Zjištěné skutečnosti ukazují se, že zemědělský systém založený člověkem může dosahovat poměrně stabilního stavu. Ustálenou podobu získal ve svažitém terénu postupně i pásový systém polí. Zatímco v počátečním období po vymýcení lesa v období středověku obvykle docházelo k intenzivní erozi (Hrádek 1981, 1989, Klimek et al. 2005), zejména pokud se tato doba shodovala s nástupem malé doby ledové (Hrádek 2007), později po zavedení trojpolního systému a obdělávání podél vrstevnic se situace ustálila a polní systém se dostal do poměrně rovnovážného stavu i přes intenzivní využívání půdy. Změny v charakteru hospodaření přineslo poválečné období v minulém století. Při jednostranném pastevním způsobu využívání krajiny v období druhé poloviny dvacátého století začalo postupně docházet k diskrepancím v rovnovážném stavu fluviálně-dynamického systému.

Korytová eroze, nabývající podoby hloubkové i boční eroze, se v současné době na Kobylím potoce vyskytuje během vysokoenergetických stavů (povodní) a projevuje se zejména meandrováním proudnice, posunem zákrut, rozšiřováním řečiště a vytvářením štěrkových lavic. Menší měrou k erozi přispívá k erozním procesům i pastva dobytka a sešlapování břehů. Příčinou korytové eroze je v tomto případě porušení dynamické rovnováhy mezi transportem a kinetickou energií toků způsobené dlouhodobým zatravněním pozemků. Zjištěné závěry odpovídají výsledkům výzkumů prováděných dalšími autory v oblasti Východních Sudet.

TOPOLOGY, NODALITY AND SPACE OF INTERNET FLOWS

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Abstract

The Internet, despite being hailed as the end of geography, created its own geography of nodes and nets. On its basis, the space of flows is created, which is the result of interactions between the Internet users. The net users form its tissue; they are the nervous system of the Internet space. However, the Internet still seems to be a phenomenon which is the subject of psychological and sociological study. The locationlessness of the Internet is only apparent. Knowing that the phenomena occurring in the Internet space are characterized both by concentration and deconcentration, the question arises whether they actually lead to the creation of new territorial configurations. Is the statement formulated by M. Castells (2003) in *The Internet Galaxy* in 2001 still valid? The answer to the above-posed question was formulated based on three internet data sources.

After the dominance of the Internet space by users from the United States of America, which lasted till 2000, this space is currently being shaped by inhabitants of the USA, China, India and Japan. The former geographical approach to this issue has been changed. The dominance is being taken over by the Asian, and not European and American Internet users. The shape and internal structure of global space of flows is determined by North American and Western European nodes. The Asian space of flows is less visible. It constitutes its additional rather than crucial element. Africa and Latin America are *'the worse pole'* of dichotomous digital division of the world. In the topology of the Polish Internet one can see an analogy to *'the American star'* mentioned by K.N. Cukier (1999 after Castells, 2003). On the local scale, cyberspace coexists with geographical space.

It seems that the Internet, the net space, does not lead to the creation of new or not rationally explainable territorial configurations. To a larger extent, we are dealing here with a phenomenon of transferring *'accents'* in *'cyber-geographical'* space. It results in some deviations *in plus* or *in minus* from *'traditional'* perception of the diversity of the world, in the context of social, geographical and civilizational development.

Key words: Internet, space of flows, net connections, global and local scale, digital divide, Poland

INTRODUCTION, OUTLINE OF THE PROBLEM AND SOURCES OF DATA

The Internet Era was hailed as the end of geography. However, it has its own geography – topology – geography of networks and nodes (Castells 2003). As a result of mutual interactions between the web as a unit and nodes, a new form of space, characteristic of the information era, is being created. It's by no means a placeless space of flows. Non-spatial perception of the Internet, and resulting from it *"lack and unwillingness"* to undertake its examination in the field of geography is the result of subconscious comparison of *"the real space"* with *"the virtual space"*. They are, for no apparent reason, perceived separately. Such perception emphasizes the privileged position of the physical space. Through *"being a part of the network"* we occupy a particular place, we communicate with other places and it depends solely on us whether we choose to perceive them and ourselves only through the keys we press, the

screen of the monitor, i.e. placelessly, or aware of their relationships – acknowledge their variety and richness. We are more than just passive observers of the e-reality, we constitute its tissue and nerve. We manage and create the e-economy, a new geography of development (see Castells 2003).

The Internet, in its geographical aspect, may be examined on three levels, i.e: (1) its technical development, that is Internet technical infrastructure; (2) spatial distribution of the Internet users; (3) *"production"* of solutions connected with the development of the global network and, probably most importantly, providers of its content (Castells 2003). From the geographical point of view, the last two aspects are the most significant. It needs to be stressed, however, that it's not only about spatial distribution of the Internet users, but also about interactions between them, and thus, about space created through these contacts. Only then we can talk about nodity and hierarchy of places and in consequence answer the question whether phenomena of concentration and deconcentration occurring simultaneously in the space of the Internet lead to the creation of new territorial configurations. Despite the global reach of the Internet, it's territorially diverse. This concerns all the aspects of the geographical approach to the analysis of the Internet. The biggest territorial imbalance concerns production and consumption of the network's content. It is sometimes called an asymmetry (Castells 2003). Among causative factors there are: wealth in the broad sense, development – technical advancement and connected with it technical infrastructure, access to education, influence of the state. Therefore, in the context of the above-mentioned question, we can ask whether the Internet creates its own space, or tends to *"imitate"* socio-economic diversity not only on a global scale, but also at lower territorial levels.

The analysis of the Internet as well as the elements connected with it can be divided into three areas: spatial, technical and sociological (Torrens 2008). However, the Internet as a medium is more often studied in sociological and technical terms. The geographical analysis of the Internet covers mostly its infrastructural aspect, which is extended by spatial diversity of the origin of the Internet users (Castells 2003). The problem with the geographical approach to the phenomenon of the Internet consists in the lack of data describing it. This concerns in particular the data characterizing flows in the broad sense and formed on their basis relationships between geographically defined places. The development of geographical field of research is possible and necessary for three reasons (Kitchin 1998). Firstly, there is an uneven access to the Internet space (*digital divide*). Secondly, despite the fact that information in the Internet does not have geographical location, their *"usage"* is connected with a particular place in the geographical space. Ultimately, the functioning of the Internet is dependent on the elements of the infrastructure localized in the real, geographical space. Works of the following authors represent geographical approach to research: Townsed (2001), Grubesic (2002) and Zook (2005). They raise the issues connected with spatial distribution of Internet domains which are complemented by analyses of Internet firms and Internet providers (see: Zook 2005). Invariably, they revolve around the analysis of the Internet infrastructure (Gorman and Malecki 2000, Malecki 2002). More and more frequently the fact of using the Internet by its users is related to their socio-economic status (Warf 2001). Thus, these works enrich the *"simple"* analysis of the origin and spatial diversity of the Internet users. Much less frequently we can encounter studies concerning flows of information and their relationships – connections – in the Web (Dodge and Kitchin 2001). The present study makes explicit reference and *"situates itself"* in the research of this element of the Internet reality[1].

Identification of the above-stated problem will be done on the basis of three Internet sources of data.

The first of them is statistical data collected by International Telecommunication Union (ITU) (www.itu.int). It covers four groups of issues. These are: (1) basic indicators concerning the size of the population, GDP and telephone subscribers; (2) the number of the main telephone lines; (3) the number of telephone subscribers

[1] So far the geographical approach to the study of the Internet has been hardly represented in the Polish subject matter literature. These studies are: Ilnicki (2002, 2003, 2004), Ilnicki and Janc (2008), Micek (2008), Retkiewicz (2008 a, b).

Table 1 Fraction of the number of the Internet users and its relation to the population potential in total

Continent	2000	2001	2002	2003	2004	2005	2006	2007
	% Internet users							
Asia	28.3	30.7	**34.2**	**35.9**	**37.5**	**39.0**	**41.7**	**46.9**
Europe	28.1	27.9	26.9	28.3	27.8	26.6	25.5	22.8
North America	**36.5**	**33.5**	30.0	26.5	25.1	23.6	21.1	18.5
Latin America	3.9	4.7	5.4	5.8	5.8	6.6	7.1	7.2
Africa	1.2	1.3	1.6	1.9	2.3	2.9	3.5	3.6
Australia & Oceania	2.1	2.0	1.8	1.7	1.4	1.3	1.2	1.0
	% Internet users – % population potential							
North America	29.7	26.8	23.3	19.8	18.4	16.8	14.3	11.8
Europe	15.0	15.1	14.2	15.7	15.4	14.4	13.2	10.7
Australia & Oceania	1.6	1.5	1.3	1.1	0.9	0.7	0.7	0.5
Latin America	−3.1	−2.3	−1.5	−1.2	−1.2	−0.4	0.0	0.3
Africa	−11.8	−11.8	−11.6	−11.5	−11.2	−10.9	−10.6	−10.9
Asia	−31.4	−29.1	−25.6	−23.9	−22.3	−20.7	−17.7	−12.5

Source: own study based on www.itu.int.

(users) of mobile phones; (4) information technology indicators covering: the number of the Internet users – the Internet subscribers using leased and modem lines as well as subscribers with broadband access.

The next two sources of data do not have *"complex character"*. They describe a part of the Internet reality. However, due to their mass character, they seem quite reliable. The first source is data made available within the framework of the research project DIMES (www.netdimes.org) concerning topology and structure of the Internet, collected with the help of the Internet community. Among the data published, there is information concerning the occurrence of connections (edges) between geographically defined places. The Polish source of data, however, taken from the Internet website www.opengeo.pl is a compromise between the number of Internet users and places (sources) of traffic generation. In a sense, it represents the number of subscribers – the Internet users. Thus, this data can be interpreted as reflecting the number of the Internet terminals, or places where one can *"access"* the Internet. In the accessible database, apart from the IP number, there is geographical information referring to administrative-territorial division, covering the name of the town, poviat and voivodship.

GLOBAL CONTEXT

At present, the number of Internet users in the world, as for the year 2007, is estimated at nearly 1.5 billion people. This is just over 1/5 of the world's total population (22%). Although, at first glance, this number may seem disappointing, it needs to be remembered that in the year 2000 it was only a little over 6%. The average annual growth of the fraction of the Internet users was about 2%. In the last two years, this number grew by about 1/3 of the present number. The present, dynamic growth in the number of the Internet users still cannot be identified with common access to the Internet. The first proof of this phenomenon is its *"continental"* diversification of the proportion – fraction – of the Internet users. Basing on *"the division of the world"* proposed by the ITU[2], we can observe a dichotomous division into the rich north and the poor south (see Ilnicki 2003) (Table 1).

After the first two-year period of the greatest concentration of the Internet users in North America, in 2002 Asia took the lead. In the next year, the North American continent lost its second

[2] Americas (North, Latin, South), Africa, Australia and Oceania, Asia, Europe.

position to Europe. At the moment, half of the Internet community is made up of the inhabitants of the Asian continent. Since 2002, the dominance of the United States in this respect ceased to be indisputable. The remaining three continents complete the consumers' space.

This state of affairs is obviously the consequence of diversity in population potential. Comparison of the fraction of the Internet users with the size of population in general shows that these numbers correspond with each other only in the case of Latin America, Australia and Oceania (see Table 1). North America and Europe with their overconcentration are polar opposites of Africa and Asia with their *"scarcity"* of the Internet users compared to their population potential. Such approach favours North America. Europe, with its higher fraction of the Internet users, makes *"the old continent"* an equal partner in the shaping of a network society. A very good illustration of these statements and generalizations is a map showing spatial diversity and the change in the number of the Internet users in the first and last years of the researched period as well as the indicator of their concentration per 100 inhabitants in 2007 (Figure 1). After initial dominance of the United States of America, at present, the space of Internet consumers is made up of the inhabitants of the USA, China, India and Japan. Since 2000, the share of these 4 countries has been at an average level of 57%. The former pattern of geographical perception of this phenomenon has been changed. In the world, the Asian Internet users are beginning to outnumber the American and European ones. It needs to be stressed, however, that Brazil, Germany, Great Britain, South Korea, Italy, France and Russia also have a significant participation in the number of the Internet users. In the case of the remaining three continents, with particular focus on Africa, slight changes in the number of the Internet users are observed. Africa cannot any more be perceived only in terms of a *"digital abyss"* separating if from the world. Its homogenous and stable character singles it out from the remaining continents. Africa is an element of *"the periphery of the Castellan galaxy of the Internet"*. *"The common access"* to the Internet is characteristic only of Europe and North America (see Figure 1).

The above-presented and described aspect of the functioning of the Internet space in fact talks only about the distribution of *"Internet terminals"*. There is, however, no interaction between them. Space of flows is dependent on the Internet technical infrastructure. K.N. Cukier (1999, after Castells, p. 235) called topology of the Internet *"…a star with the United States in the middle"*. It was hard to reject such an expression at the moment it was coined. It seems, though, that the North American star is starting to *"fade"*. We are witnessing the rise of *"the European star"* (Figure 2).

In the examined period 1.7 million edges were identified in the world. Among them, there occurred over 13.3 million connections. In total, nearly 80% of edges and connections constitute *"the inner"* space of flows, which was called *"own potential"* (see Figure 2). Space of the Internet, despite its global openness is *"closed"* regionally and locally.

The United States of America have the biggest own potential (see Figure 2). Their share is 56% of the world's inner flows. In the following places (in declining order of share) are: China (6.8%), Germany (4.6%), Great Britain (4.1%), Canada (3.1%) and Japan (2.8%). The inner space of flows may be interpreted as concerning nodity, i.e. attractiveness of the Internet space. It may also form the basis for classification of the places and their position in the hierarchy. We can identify three main nodes of the Internet space: North American, Western European and Asian. The Asian node, in contrast to the European one, has *"dispersed"* character. These three nodes of space of flows defined in this way refer to the large cities: New York, London and Tokyo.

When we incorporate external flows in the space of internal flows we will see that its shape and inner structure is determined by North American and Western European nodes. The Asian space of flows, although distinct, is noticeable to a lesser degree. Moreover, there is no clearly visible *"closing"* of the space of flows between the Western European and Asian nodes. Africa and Latin America, with the exclusion of the Republic of South Africa and Brazil respectively, once again remain on the periphery of the space of flows.

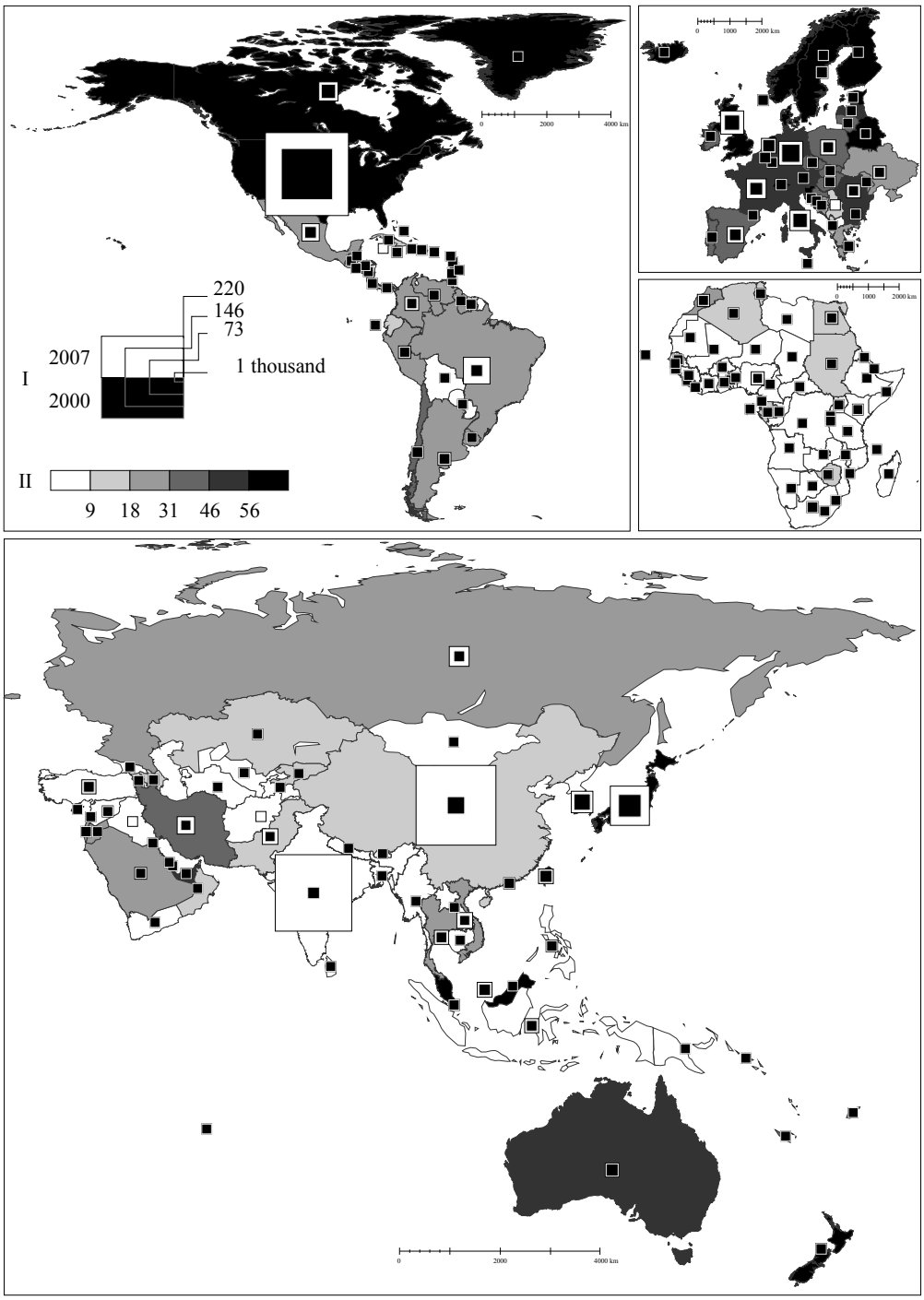

Figure 1 Spatial diversity and the change in the number of the Internet users between 2000–2007 (I) and the index of the number of the Internet users per 100 inhabitants in 2007 (II).
Source: own study based on www.itu.int.

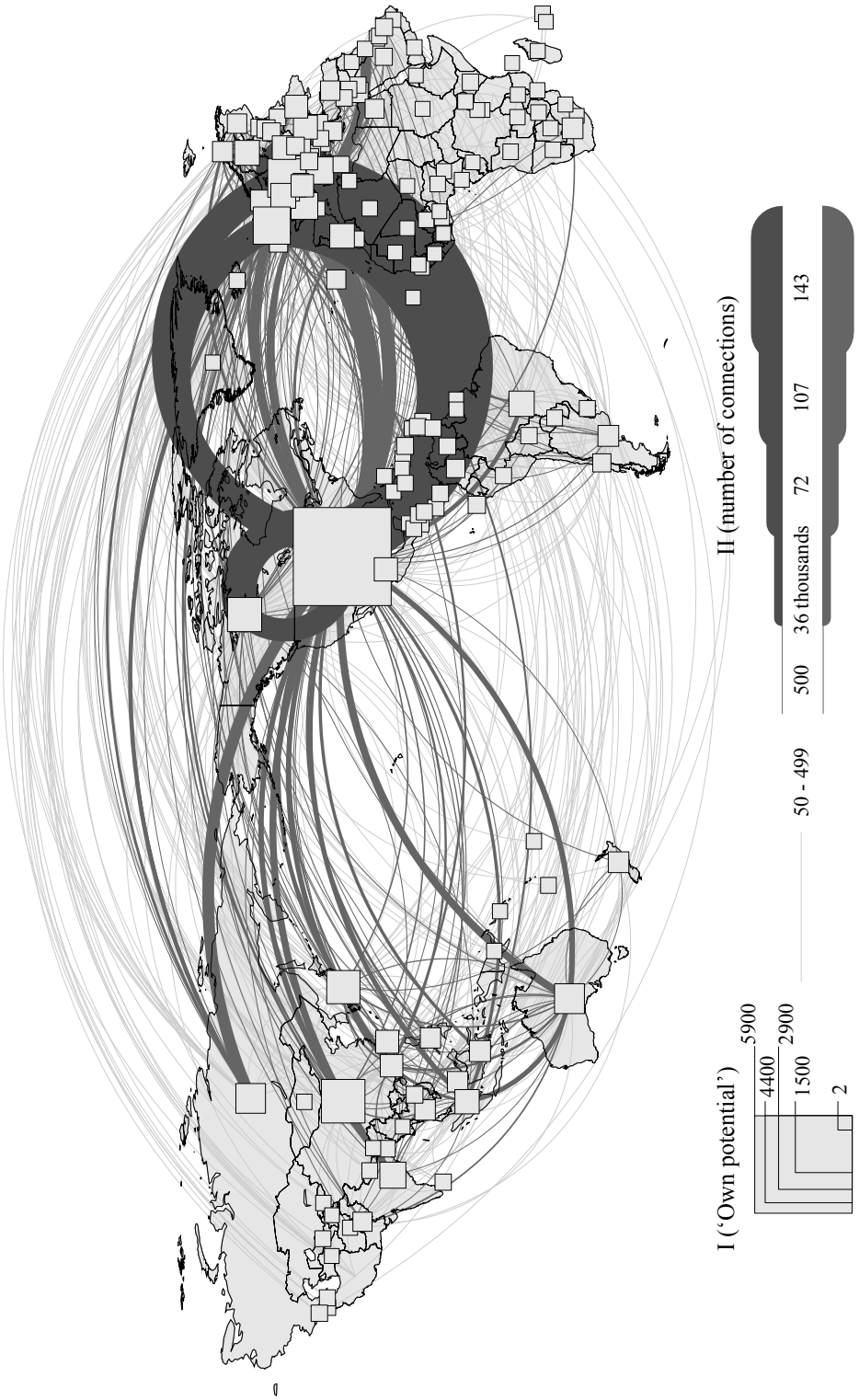

Figure 2 'Own potential' of the flows – within each country – (I) and the space of flows – connections–among the countries of the world for the streams of at least 50 connections (II) in the period of 14 months (January 2007 – February 2008)
Source: own study based on www.netdimes.org.

They are *"the worse pole"* of the dichotomous, digital division of the world[3]. This division is a kind of carbon copy of the wealthy north and poor south, at the basis of which lies wealth in the broad sense, measured by GDP per capita.

In generating the space of flows, the most visible is the USA–Western Europe system. The other components of the space of flows are *"interactions"* generated between: the USA, Great Britain and Canada; Great Britain and the USA; Canada, Germany and the USA. In the next 30 positions in terms of the number of connections, as the source feature USA (16 times) and European countries, among which the most frequently appear: Great Britain, Holland and Germany. There is a clear dominance of European countries. The African continent turned out to be *"outside the space of flows"*. In terms of the number of incoming and outcoming connections between the USA and the countries with which they *"exchange the most information"*, we are facing a situation in which inhabitants of the USA connect more with the world than the world with them (see Figure 3). The average ratio is: two incoming connections to three outcoming ones from the USA[4].

The space of the Internet does not seem to lead to creating new, or rationally inexplicable, territorial configurations. This is more about shifting *"accents"* in *"cyber-geographical"* space. This consists in deviation *in plus* or *minus* from *"traditional"* perception of the diversity of the world, in the context of social, economic and civilizational development in the broad sense. Therefore, the space of the Internet remains in feedback with the level of *"average wealth"*, which, similarly to the space of flows, divides the world into *"the better north and the worse south"*. At the same time it shows a new geography of development – self-stimulating system of North America–Europe, with Asia *"overshadowed"* by the main stream of flows.

LOCAL CONTEXT

When narrowing the scope of the analysis of the Internet space from global to the local one, it's reasonable to assume lack of spatial egalitarianism both as regards the distribution of the Internet users (IP numbers) and the space of flows. With this assumption, the question remains whether distribution of *"network terminals"* corresponds with the existing territorial configurations. If so, then to what extent?

At present, in Poland, the number of registered and functioning IP numbers can be estimated at around 12 million. This number indirectly indicates the number of active Internet users. Their unambiguous location is known in 35% of cases. Spatial distribution of Internet access points (IP) corresponds with the significance of particular towns and their place in the hierarchy of the settlement network. Warsaw concentrates 28% of 4.2 million IP numbers. For the remaining large cities the concentration of the Internet users is as follows: Kraków (8.4%), Poznań (7.5%), Katowice (6.0%), Łódź (5.1%), Wrocław (5.1%) (Figure 3). A relatively large concentration is also found in Gdańsk, Lublin, Gliwice, Szczecin, Olsztyn (2-5%). In the case of this group of locations there is also a close correspondence between the number of terminals and their population potential.

Compared to June 2008, spatial distribution in the following month was changed – there occurred a kind of *"filling of the space"* (see Figure 3A and B). The change concerned both *"the mass"* of IP numbers, which grew by nearly 500,000, as well as locations. The increase in number of locations was four and a half times, from 511 to 2,327 locations. 53% of the increase in the number of IP addresses occurred in 14 previous locations. This concerned the biggest urban centres. Medium-sized and small towns began to be more noticeable. This change is not only connected with an increase in the number of *"network terminals"*, but it is also a consequence of an increase in the popularity of the openGeo project.

When viewed in the light of network terminals, the space of the Polish Internet reflects the spatial dimension of socio-economic diversity of Poland. This refers to social diversity resulting form the

[3] So far the expression *"digital division"* referred to the diversity of the Internet access in terms of various demographic, cultural, social and economic categories. This expression also appears in the context of *"digital exclusion"*.

[4] A comparison of flows was also made between the United States of America and: Australia, Holland, Canada, Germany, Great Britain.

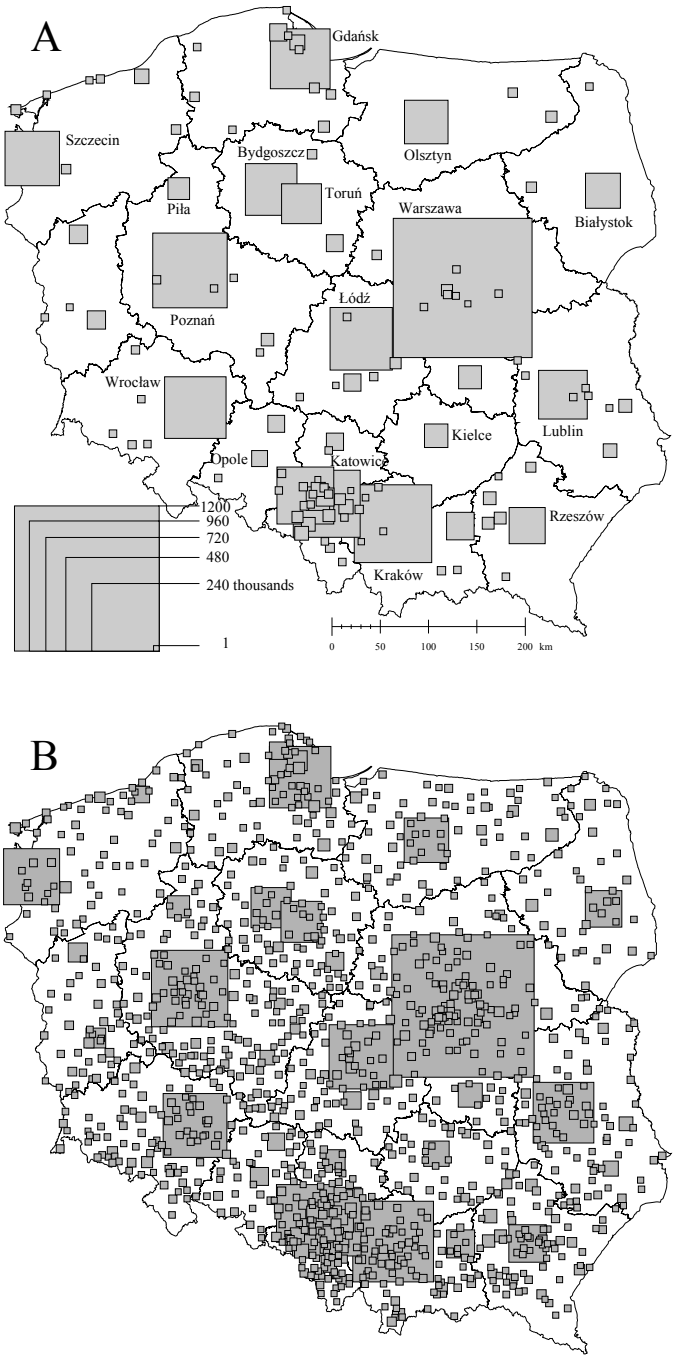

Figure 3 Geographical distribution of IP numbers for June 2008 (A) and July 2008 (B), excluding locations with up to 20 numbers.
Source: own study based on www.opengeo.pl.

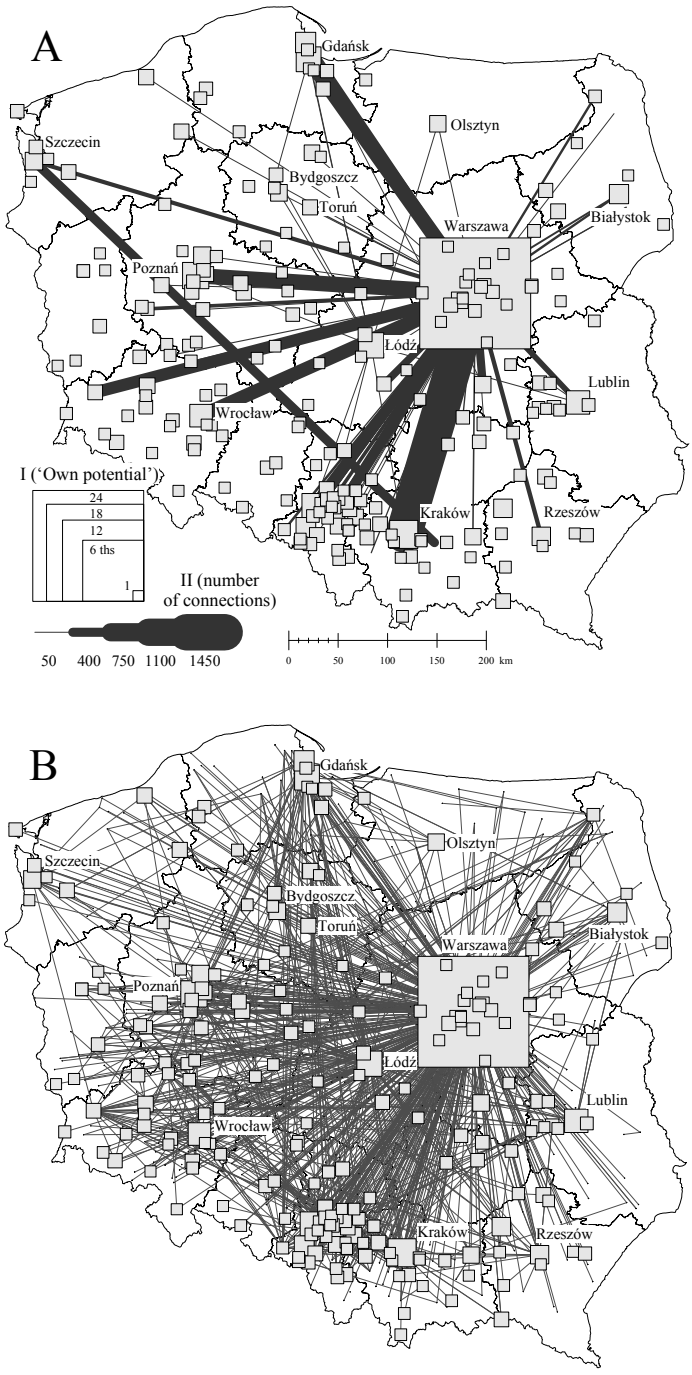

Figure 4 The space of flows – connections – for the locations of particular towns for connections above (A) and up to 50 connections (B) in the period of 14 months (January 2007 to February 2008)
Source: own study based on www.netdimes.org.

character of the place of residence. The level of education, age and other factors[5] influence the need to use the Internet. They constitute a significant *"regulator"* of the existing picture of the Polish space of the Internet users. On the basis of the above, we can tell that we are dealing with a duplication of the real space by the cyberspace.

The dominance of Warsaw in the space of the Internet gains clarity when we take a look at the shape and structure of the space of flows (Figure 4). Warsaw's *"own potential"* is several times bigger than that of the city in the second position. The advantage over Kraków, which is in the second place, is 35 times bigger. Thus, we can talk about an escalation of disproportions existing in the real economy. This disproportion is big enough to treat the other locations as peripheral ones in the space of flows. The following nodes in the hierarchy are: Kraków, Poznań, Łódź, Trójmiasto (with the leading role of Gdańsk) – the Upper Silesian Conurbations with Gliwice, Wroclaw and Lublin. The regions in the north and east of Poland do not exhibit any nodity.

Polish space of flows represents nearly 94 thousand connections, among which nearly 72% are generated by the inner traffic. When considering streams of flows between particular locations we can say that Warsaw is the main force responsible for generating the space of flows. It forms the central point in the Polish space of the Internet and generates 60% of the traffic between the locations. Warsaw is both the source and the destination (10%) of the vast majority of interactions between the Internet users[6]. The lack of significant flows between the other large cities is surprising. There are scarcely any edges whose source or destination is other than Warsaw. Locations in the east of Poland, which are the least socially and economically developed, are definitely less active. Regions located to the north and north-east of *"the Warsaw node"* constitute Polish periphery of the Internet space.

To complete the picture of flows in the Internet, one should have a look at the small-size streams of flows – below fifty connections (see Figure 4B). Also in this case Warsaw forms the main node of flows. However, the traffic is largely bidirectional (from and to Warsaw).

The topology of the Polish Internet is somehow analogous to *"the American star"* of K.N. Cukier, resulting from the global approach to the analysis of the Internet. In the case of Poland it needs to be emphasized that this *"star"* is characterized by a lack of significant connections between the biggest locations. They do not form the meeting place for a few edges – they are rather their destinations or the starting point of the stream directed towards and from Warsaw. Such a picture of the Polish space of flows stems from the fact that it is still undergoing the process of formation. The shaping structures of the network allow specifying its main regularities. However, the shaping of this phenomenon still requires constant monitoring.

Conclusions resulting from the analysis of global topology of the Internet largely translate into the local context. What is most important, on the local scale the cyberspace co-exists with the geographical space creating a new layer of spatial diversity. Interestingly, as in the case of the global aspect where the division into *"the rich north"* and *"the poor south"* is duplicated – in the case of Poland the shape and structure of the network are reflected in the traditional division of the real space into a well-developed, richer west and poorly developed, poorer east.

CONCLUSIONS

When we consider the Internet in terms of its time frame, we can say that is has always existed. Only when we realize that it didn't start to develop dynamically until the end of the last decade of the 20th century, we begin to notice that it is just starting to gain momentum. However, the examination of the Internet space of flows can be

[5] Time budget that is available to a particular unit; mental resources (knowledge, social and technical skills); social resources (social networks and relationships – in the place of residence and the workplace), cultural resources (Selwyn and Facer 2007:36).

[6] This is obvious if we take into account the existence of central institutions, cultural resources, company offices and organizations in the capital. Their quicker „connection to the network" in comparison with the other potential tenants of the virtual house generates the present space of flow.

dated to the beginning of the 21st century (Castells, 2003, 2007). However, there are still more questions than answers. For this reason, examinations of the Internet in the broad sense should be intensified and more widely incorporated into the current of geographical examinations.

The Internet, despite its futuristic vision of common digital egalitarianism, presents more and more clearly contrasts resulting from the diversity of the level of development. When describing the development of the Internet in the light of its users and the traffic they generate, territorial division into the privileged north and the weaker south becomes even more apparent. African countries are drifting on peripheries of the Internet galaxy. *"The reality of the Internet"*, its shape and structure are created by the users from North America and Western Europe. The Internet users from Asia play complementary role. The space of inner flows, described as own potential, allowed identifying three nodes: North American, Western European and Asian. Despite a clear concentration of the volume of flows as well as their territorial origin, it's hard to state categorically that in the space of the Internet takes place the creation of new territorial configurations. It's rather *"the old systems"* that become more visible. This statement is also true when the analysis of the Internet space is limited to a particular country (Poland). Firstly, the relationship between territorial distribution of the Internet users and spatial diversity of the level of development becomes visible. Secondly, in the shaping of the space of flows, the leading role and nodity of Warsaw with a marked preference for the west of the country become noticeable. This corresponds with the division into Poland A and Poland B. It seems that the Internet tends more to *"imitate"* socio-economic diversity not only on a global scale, but also at lower territorial levels, rather than create its own space.

The geography of the Internet is a promising research area. It requires, however, at least an interdisciplinary approach, if not a research team. Geographers do not understand *"the language of the Internet"* completely (if at all), whereas IT specialists, Internet administrators, concentrating on its proper functioning do not realize what kind of data concerning the Internet they can provide. This does not have to be a sequence of zeros and ones or a virtual creation, but a picture – a map – which will be understood without words.

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Résumé

Topologie, nodalita a prostor internetových toků

Ačkoliv byl internet kdysi označen jako konec geografie, vytvořil vlastní geografii uzlů a sítí. Na jeho základě se tvoří prostor toků, které jsou výsledkem interakcí mezi uživateli internetu. Uživatelé sítě tvoří jeho tkáň, představují nerv prostoru internetu. Stále však se internet jakožto postmoderní médium ukazuje jako jev, jež se více hodí pro psychologický a sociologický výzkum. Určitá bezejmennost internetu je ovšem jenom zdánlivá. Při vědomí, že jevy probíhající v prostoru internetu charakterizují paralelní koncentrace a dekoncentrace, vyvstává otázka: Vedou tyto jevy fakticky ke vzniku nových teritoriálních konfigurací? Nebo je konstatování M. Castellse (2003) použité v práci The Internet Galaxy (2001) i nadále pravdivé?

Úvodní dominance internautů ze Spojených států amerických v prostoru internetu (do roku 2000) polevila, dnešní prostor uživatelů internetu tvoří jak lidé z USA, tak také z Číny, Indie a Japonska. Podíl těchto čtyř zemí se pohybuje průměrně na úrovni 57 % (2000–2007). Dřívější model geografického uspořádání internetového prostoru se změnil. Postupně začínají ve světovém měřítku převládat asijští, nikoliv evropští nebo američtí internauté. Tvar a vnitřní strukturu globálního prostoru internetových toků determinují severoamerický a západoevropský uzel. Asijský prostor internetových toků je viditelný v menší míře. Současně chybí „uzamčení" prostoru toků mezi západoevropským a asijským uzlem. V podstatě představuje tento prostor doplnění prostoru internetových toků, jehož je důležitým prvkem. Afrika a Latinská Amerika jsou oním „horším pólem" dichotomické číslicové struktury světa. V topologii polského internetu shledáváme jistou analogii „americké hvězdy" (K. N. Cukier, 1999, cit. Castells, 2003). Na lokální úrovni kyberprostor koexistuje s geografickým prostorem.

Zdá se, že internet jako prostor sítí neumožňuje vytvořit nové, nebo jinak racionálně vysvětlitelné teritoriální konfigurace. Ve větší míře se setkáváme s jevem přenosu „akcentů" v „kybergeografickém" prostoru. Jeho podstatou jsou vzdálenosti *in plus* nebo *minus* vůči „tradičně" vnímanému světu, a to v kontextu široce definovaného socioekonomického civilizačního rozvoje.

URBAN DEVELOPMENT IN SELECTED CZECH AND AUSTRIAN CITY REGIONS

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Abstract

Conceptually, this paper is based upon the CURB model of city region development set out by Van Den Berg et al. in 1982. Using a very simple and formal typology of population changes within cores and rings of functional urban regions (FURs), it was originally applied to a sample of 189 FURs in 14 countries across Europe, for the years between 1950 and 1975. Empirically, our paper tries to expand the original study in both time and space. In time, we are updating developments to the population register data from 2007, but we also go back in urban history to the first modern census held in the Habsburg Empire (1869). In terms of geographical coverage, we are adding data on the three largest mononuclear city regions in the Czech Republic, i.e. Prague, Brno and Plzeň, to the three largest city regions in Austria, i.e. Vienna, Graz and Linz (these had already been included in the original CURB study). By using a unitary delimitation of urban cores, urban rings and urban regions across the Czech-Austrian border, this paper tries to create a harmonized data basis for interpretation and debate.

Key words: Prague, Vienna, CURB model, urban development

INTRODUCTION

The impetus to compare city regions in Central Europe stems from our experience of the last two decades, when fundamental political change led to a complete overhaul of the regional economy in the area. In the Czech and Slovak Republics, the transformation to pluralistic democracies and market economies took place under the conditions of an increasingly global competition for labour, goods and services. EU membership, in 2004, can be considered a keystone of these developments. The transformation of Austria, from a regulated and protectionist national market into a minor regional player itself, has taken place in parallel, joining the EU at an earlier stage, in 1995.

In all countries considered, regional structures have changed, and large city-regions have become more important, as centres of investment, knowledge and innovation. In both the Czech and the Slovak Republic, as well as in Austria, the capital regions of Prague, Bratislava and Vienna are those with the highest regional income, exceeding by far the national averages. Booming urban labour markets have attracted migrants into the cities and city regions, making urban decline an episode of the past, a phenomenon of the 1970s (and the interwar period) in the case of Vienna, a phenomenon of the 1990s in the three Czech city regions included in this study (with Brno trailing behind).

THE CONCEPT

As one of the earliest projects of comparative urban research in Europe, the CURB project assembled economists, geographers and planners from 14 countries in what used to be a continent divided into market and planned economies. From the mid-1970s, a small team chaired by Roy Drewett (1936-1994) developed a "theory of urban development" which hypothesized a general sequence of urban growth, then suburban growth, to be followed by urban decline. These stages of urban development were claimed to be found on both sides of the systems divide between capitalism and socialism. The theoretical concept was broader, but empirical testing focused on the few reliable data that have been available for small spatial areas, across nation-states, and for a longer period of time: these were simple population data, but spatially re-assembled in a specific way, by urban cores, surrounded by urban rings, the two basic building blocks of functional urban regions (FURs).

In 1982, concept and findings of several years of research were published in a book named "Urban Europe, vol. 1: A Study of Growth and Decline". For the period 1950-1975, and with data for 189 FURs, the sequence and direction of change from centralisation to decentralisation, or urbanisation to suburbanisation to disurbanisation, was proved to be true in most cases. Cities under socialism were more stubborn to resist, and tended to remain compact cities, but even here there were early deviants from that rule, such as cities in Poland (Van Den Berg et al. 1982:88).

Functional urban regions, urban cores and urban rings

As said, the data used are simple population data on the number of inhabitants, but spatial units on urban cores and urban rings are not simple to delimit. Large European cities with at least 200,000 inhabitants in 1970 were chosen as urban cores for the surrounding city region. The functional urban regions around them were delimited by travel-to-work areas. The cut-off point was a commuting rate of at least 15 per cent – a much lower threshold than would be used today. From all 189 FURs, a large number (43) was found in Great Britain, followed by Western Germany (28) and France (22). Austrian urban regions were also analysed in "Urban Europe", 7 FURS in total, including those of Vienna, Linz and Graz, but data from Czechoslovakia were missing. To add and refine these data was one of the starting points of this paper.

For the Austrian city regions, an official delimitation has been performed with data for 1971, 1981 and 1991 (Fuchs 1997). It follows the principle of travel-to-work areas, but it deviates from the CURB model in two respects: (a) the core area is not equated with the administrative area of the central city, but it is redefined as the contiguous built up (CBU) area in and around a central city, (b) commuting fields are related to the CBU area, and the thresholds are set at higher levels, climbing up from 20% (for 1971) to 25% (in 1981) and 30% (in 1991). With the census data for 2001, no official recalculation has been performed. As a compromise, all analyses for Austrian FURs will be based upon the 1991 urban regions of Vienna, Graz and Linz, and these will be used as spatial units for all periods backwards and forward in time. In Vienna, the core area comprises the city of Vienna plus 38 municipalities morphologically attached to it, surrounded by a ring of 145 municipalities related by flows of more than 30% of the resident workforce commuting into the core area. In Graz, the core area is made up of the administrative city plus 17 municipalities, and the ring area extends to further 65 municipalities related to the core by commuter flows. In Linz, the core area covers the city itself plus 8 adjacent municipalities next to it, surrounded by a ring of 56 municipalities related by travel-to-work flows. In all these Austrian cities, city boundaries could not be changed in the democratic, afterwar era.

In the Czech Republic, urban regions have not been defined officially for a long time.[1] For this reason, comparable units had to be delimited with census data. Again, the goal is to define core areas surrounded by a commuters' ring. Due to the wide

[1] In 1921, however, the Statistical Office of the Czechoslovak Republic had defined one of the first residential agglomerations worldwide („sidelní aglomerace", cf. Kostelecký and Čermák 2005:353).

administrative limits of our cities, the core area could be equated with the city area in Prague, Brno, as well as in Plzeň.[2] In each case, a ring of municipalities has been defined on the basis of a commuter flow, in 2001, of more than 30% into the central city. Around Prague, 208 such municipalities are captured by that definition, around Brno, there are 132 such municipalities, and around Plzeň 73 municipalities. The greater number of municipalities within the largest Czech city regions, with a smaller average number of inhabitants than in Austria, gives an impression of the amount of administrative fragmentation in Czech suburbia.

To investigate political divisions in Czech city regions, Kostelecký and Čermák (2005) have undertaken a similar analysis for the four largest cities in the Czech Republic, i.e. Prague, Brno, Ostrava and Plzeň, delineating an "inner suburban zone" with a threshold of 40% daily commuters and an "outer suburban zone" with 30% daily commuters. They also stress how easily the communist administration could extend city boundaries whenever a planning need did arise.[3] In Prague, city limits have been pushed outwards in 1960, 1968, and 1974; in Brno, extensions have occurred in 1960, 1971, and 1980; in the 1970s, a number of municipalities were added to the city of Plzeň, and two further municipalities in 2003. In an earlier article, the same observation could be made about Bratislava, where the administrative area had been pushed out into the countryside in 1972, far beyond any medium term need (Matznetter 2004:68). The findings of Kostelecký and Čermák come very close to our calculations, with a slightly smaller suburban zone total of 194 municipalities around Prague, an identical suburban zone of an 132 municipalities around Brno, and a slightly greater number of 81 municipalities around Pilsen (2005:363).

For the purpose of comparative and retrospective analysis, both urban cores and urban rings have been defined with contemporary data and thresholds, for 1991 in the case of the official city regions in Austria, for 2001 in the case of Czech city regions. In the original CURB study, cores and rings have also been defined for one point in time, and not been adjusted from census to census. Due to the time period observed, from 1950-1975, this was not even considered a topic for debate. In our case, with a time span of 138 years, ranging from the boom years of industrialisation and urbanisation across decades of isolationist nation-states to the most recent period of European integration and globalisation, such an erratic definition has to be justified and defended.

We think the basic argument is that any historical analysis of spatial patterns cannot avoid some stable definition of its observation units, either at the beginning of the observation period, or at the end, or somewhere in the middle. Depending on commuting data, as in our case, only more recent delimitations were possible. We took the most recent available, hinging upon contemporary built-up and travel-to-work areas. The effects upon our analyses can be hypothesized as follows: the more historical data will be for an over-sized urban core as well as for an over-sized urban ring. For both units, growth rates would have been higher if we could have redefined the areas according to historical thresholds. Both core and ring values are diluted by data from areas that had not been developed at the time, and/or not within reach of transport facilities of the time. The important observation is that growth differentials between core and ring are adequately mirrored in these historical data. Our working assumption is that this is the case, even for the earliest periods included in the analysis. In the late 19th century, urban core growth clearly dominated, but even then there have been early outposts of suburbanization, mainly along railway lines. For the city region of Vienna, Hassinger (1910) has produced one of the earliest maps on such lines of equal accessibility. He also described patterns of temporary, summertime suburbanisation, as a forerunner of permanent suburbanisation. Fin-de-siècle buildings within today's commuter ring are a testimony to these early beginnings.

[2] Only in Brno, there is a place where the contiguous built-up area stretches across city limits: recent commercial development along the Vienna road has attached the municipality of Modřice to the urban fabric of Brno. To facilitate calculations, the core area of Brno has not been redefined, but equated with the administrative area.

[3] As Sýkora and Ouředníček (2007:213) succinctly observe: „Czech cities are overbounded".

Choice of cities and observation period

Once the spatial units have been defined, data analysis with the CURB model is fairly straightforward. For each functional urban region and its two constituent parts, an urban core and an urban ring, population data have to be assembled for the time period to be investigated. In the original CURB study, the observation period was 1950-1975, or the decades of reconstruction and political division of Europe. Follow-up studies have been performed by Cheshire (1995), with data for 1981 and 1991, or, in different ways, by Reckien and Karecha (2007), with data for 1991 and 2001. In all these studies, Czech and Slovak city regions are missing, and Austrian city regions are not always included.[4]

In an earlier study, the largest Slovak urban region, with the capital city of Bratislava has been analysed with the CURB method, for the time period 1950-2001, and compared with the urban development of the neighbouring urban region of Vienna (Matznetter 2004). Due to its observation period stretching across 1989, its findings contribute to the debate about the specificities of the "socialist city" and its post-socialist transformation. For Van Den Berg et al. (1982), there is a strong drive from urbanisation to suburbanisation and desurbanisation all across Europe, and across political systems, with Eastern Europe lagging behind due to an inherited lag in development. Communism and the planned economy are rarely mentioned as reasons for protracted urbanisation, even if these city regions come out clearly and are mentioned in their empirical findings (e.g. table 7.4., pp.84f.). Theirs is a convergence perspective on urban development; trying to downplay differences and overstate casual evidence pointing to the fact that suburbanisation had finally arrived in some socialist cities. There were still some years to go, until this stage of development became true in the transformation period. In this respect, Bratislava was almost an ideal-typical case of a planned and compact socialist city, switching from full urbanisation to desurbanisation in the 1990s.

In this paper, the authors make an attempt to generalise (or to put into its place) the results of the Vienna-Bratislava case study, by looking into other cities of the former Czechoslovak Republic (1918-1939/1945-1992), and other cities in the Republic of Austria (1918-1938/1945ff.). Not one city was used for comparison in both Austria and the Czech Republic, but three urban regions were chosen in each of the two countries. In principle, these should have been the largest urban regions in each country, Vienna followed by Graz and Linz, and Prague followed by Brno, then Ostrava. For all these urban regions, urban cores and urban rings have been defined, by taking official definitions in Austria, and by analysing commuter flows in the Czech Republic. Due to its polynuclear structure, with overlapping travel-to-work areas, the (industrial) urban region of Ostrava could not be defined in a way that satisfies the intention of the CURB model, i.e. a clear division between a densely populated built-up area surrounded by a low--density commuter belt on all sides. This was the reason to drop Ostrava from the analysis and replace it with the fourth-largest Czech city region, that of Plzeň (Pilsen), much smaller in size.

Once the urban cores and urban rings had been defined, historical data for municipalities, within their current boundaries, could be easily assembled in both countries. Until now, CURB-oriented studies had been carried out with post-war data, but this was probably due to the times when historical data had to be typed into the spreadsheets available. Today, much of this work has been done, and historical data are available in digital form. This paper is making use of such data, originating in the Czechoslovak censuses of 1930 and 1921, the Nazi-German census of 1939 (for Austria after annexation), the Austrian censuses of 1934 and 1923, and five censuses from the Habsburg era, for 1910, 1900, 1890, 1880, and 1869. Such historical data-mining summarizes population development for six cities which had been at the apex of the Austro-Hungarian city hierarchy from early industrial times, and makes them comparable: under Habsburg rule, Vienna and Prague, the largest cities, had the highest growth, at about identical levels, to be followed by Brno, Graz and Linz, in that order; the only exception is Plzeň, growing faster than any other

[4] Only the EU-12 countries of 1991 are included in Cheshire's re-analysis (1995), same as in his earlier book (1989, together with Hay).

Table 1 Four stages of development in a Functional Urban Region (FUR). Eight sub-stages or "classification types" are named according to whether there is "absolute" (A) or "relative" (R) "Centralisation" (C) or "Decentralisation" (D).

Stage of development	Type	Core	Ring	FUR
I Urbanisation	1 AC	+ +	−	+
I Urbanisation	2 RC	+ +	+	+ + +
II Suburbanisation	3 RD	+	+ +	+ + +
II Suburbanisation	4 AD	−	+ +	+
III Desurbanisation	5 AD	− −	+	−
III Desurbanisation	6 RD	− −	−	− − −
IV Reurbanisation	7 RC	−	− −	− − −
IV Reurbanisation	8 AC	+	− −	−

Source: Van Den Berg et al. 1982:36.

city in the whole data-set, especially before 1900. In the interwar period, Czech cities were prospering, with Prague ahead of the smaller cities, and early signs of suburbanisation. Austrian cities, by contrast, went through a period of permanent crisis, culminating in a series of population losses of Vienna, due to emigration, genocide, and war. After WWII, modest urbanisation started again, both under Communist rule as well as in Austria's social market economy.

Stages of urban development

At this point, a precise definition of the four stages of urban development according to the curb model is long overdue. To make city regions comparable, no absolute data are used, but only relative data are ranked between three observation units: urban cores, urban rings and functional urban regions (FURs). Based on the direction and strength of population change during observation periods, four stages of development and eight sub-stages have been defined in the CURB model (table 1).

The basic assumption of the CURB model is that there is a general tendency for population change to develop along this sequence, starting from a stage of urbanisation, continuing into a stage of suburbanisation, later into a stage of desurbanisation, and possibly a return to growth in the urban core, i.e. reurbanisation. For the time period observed, 1950-1975, there was massive empirical evidence for such developments to take place, at least amongst the 10 capitalist countries observed, with the socialist countries trailing behind (Van Den Berg et al. 1982:91). For the 1980s, Cheshire (1995) confirmed an ongoing trend towards the more advanced stages of urban development in Western Europe. So far, post-socialist cities have not been systematically re-analysed and updated within the CURB framework, with the exception of case studies of Prague and Brno (Sýkora et al. 2000, 2007), or Bratislava (in comparison with Vienna: Matznetter 2004) or Ljubljana (Pichler and Milanovic 2005).

For the 1960s, Van Den Berg et al. (1982:90) have added a map on the regional distribution of Types 1 AC to 6 RD across the 14 countries included in their study, which clearly shows that all city regions in the socialist countries of the time were in the phase of urbanisation (absolute centralisation or relative centralisation). All city regions of Poland, all city regions of Hungary, all city regions of Yugoslavia, all city regions of Bulgaria were in this stage of development. In the market economy countries, suburbanisation dominated as early as in the 1960s, at least in Western Europe, when urbanising city regions could still be found in the capitalist semi-periphery of Southern and Northern Europe. Other socialist countries of the time, such as the former GDR, Czechoslovakia, Romania, Albania and the Soviet Union, have not

Table 2 Stages of development in the Functional Urban Region (FUR) of Prague, own calculations for population change in percent (%) per 10 years, for typical periods.

Stage of development	Type	Core	Ring	FUR	Typical period
I Urbanisation	1 AC	+3.6	−1.0	+3.0	1970-1980
I Urbanisation	2 RC	+6.5	+4.5	+6.2	1950-1961
I Urbanisation	2 RC	+24.1	+5.6	+19.3	1869-1910
I Urbanisation	2 RC	+33.6	+23.4	+31.8	1921-1930
II Suburbanisation	3 RD	+1.1	+31.2	+5.2	2001-2007
II Suburbanisation	4 AD	−	+ +	+	
III Desurbanisation	5 AD	−3.7	+8.6	−2.2	1991-2001
III Desurbanisation	6 RD	− −	−	− − −	
IV Reurbanisation	7 RC	−	− −	− − −	
IV Reurbanisation	8 AC	+	− −	−	

Source: Van Den Berg et al. 1982:36.

been included in the original CURB study, but there is abundant, but scattered evidence that urbanisation has been an integrative feature of the "socialist city" in Europe. This particular aspect was to remain until the very end of the planned economy, in or after 1989. This paper wants to add evidence on that secular change from centralising to decentralising, and transitionally declining urban regions in today's Czech Republic and Austria, as two countries that had been separated by the divide between socialism and capitalism from 1948 to 1989 – almost a laboratory situation.

Urban development since 1869: Prague and Vienna compared

The contrast in urban development under a socialist and a market regime comes out clearly when the largest and capital cities are compared, Prague and Vienna. The system changes of 1989 and after had an immediate effect on city development: in the 1990s, the city of Prague lost 3,7% of its population, a loss that could not be compensated by the immediate onset of suburban growth (+8,6% in the suburban ring), the balance of which made the whole urban region go into decline – i.e. "desurbanisation" within the CURB taxonomy. In Vienna, a similar decade of decline, although for different reasons, had occurred in the 1970s, but in general "suburbanisation" had been dominant since the 1960s – as classified and depicted by Van Den Berg et al. (1982).

The basis for this classification is the relative population change within the three observation units (cores, rings, FURs) and per observation period, usually the decade between censuses. For Czech and Austrian cities, this was true for the 1880s, 1890s and 1900s, as well as for the 1990s, when census years coincide. For all other censuses, years do not coincide, and the inter-census periods are shorter or longer than a decade. To make data comparable, percentage change has been recalculated per 10 years period. In tables 2 and 3, representative periods have been selected for both Vienna and Prague, and inserted into the classification matrix of table 1.

At a glance, a very long period of shared urban history comes to the fore: from the first modern census in the Habsburg Empire, in 1869, to the last common census in 1910, urban development in Vienna and Prague seems to have been very similar, both regarding growth rates as well as regarding stability. We entered the average population growth per decade for the whole period of 41 years because variation was much smaller than in any period after, not exceeding 3% in the 19th century, and slowing down in both cities in the first decade of the 20th century. Despite of

Table 3 Stages of development in the Functional Urban Region (FUR) of Vienna, own calculations for population change in percent (%) per 10 years, for typical periods.

Stage of development	Type	Core	Ring	FUR	Typical period
I Urbanisation	1 AC	+0.7	−3.6	+0.2	1951-1961
I Urbanisation	2 RC	+11.8	+9.5	+11.5	2001-2007
I Urbanisation	2 RC	+21.9	+7.5	+19.7	1869-1910
II Suburbanisation	3 RD	+1.6	+10.0	+2.8	1981-2001
II Suburbanisation	3 RD	+0.9	+3.2	+1.2	1961-1971
II Suburbanisation	4 AD	−	+ +	+	
III Desurbanisation	5 AD	−3.8	+1.5	−3.1	1971-1981
III Desurbanisation	5 AD	−14.6	+2.2	−12.5	1934-1939
III Desurbanisation	6 RD	− −	−	− − −	
IV Reurbanisation	7 RC	−	− −	− − −	
IV Reurbanisation	8 AC	+	− −	−	

Source: Van Den Berg et al. 1982:36.

their difference in size, the first and the second city of Cisleithania[5] have been growing in similar ways and at similar speed, with smaller cities lagging behind, such as Brno, Graz, and Linz – with Plzeň being the exceptional boom town of the early stage of urbanisation.

In the 1920s, the fate of the two cities could not have been more different: undoubtedly, Prague, now the capital of Czechoslovakia, was booming, reaching the highest population growth in its history, and an early wave of suburban growth, to be repeated only in the most recent years of the 21st century. Vienna, now the oversized capital of the Republic of Austria, had lost some 5% of its population after the war, many of them Czechs, and was not faring much better in the 1920s and 1930s. The worst exodus was still to come, with 7% of the Vienna population exiled and deported within a year after annexation, in March 1938, when the number of those remaining was meticulously reported by the Nazi-German census of May 1939. During the war, further persecutions, killings and casualties took another 8% of the population. Of course, such exceptional times cannot be handled with an urban development model, but the data increase the visibility of local specificities that deviate from general patterns. In Prague, the demographic scars of occupation and war are less visible, but this is due to the lack of any census reports between 1930 and 1950.

In the 1950s, both cities seem to be back on the same track, centralised, but modest growth, i.e. urbanisation in the CURB language. There is a difference, however. During the 41 years of Communist rule, the city of Prague has been growing much faster then capitalist Vienna, where much of the growth was diverted the suburban ring. Around Prague, by contrast, today's suburban ring continued to be depleted of its population since the 1960s, until the velvet revolution turned things upside down, and suburbanisation took over.

The most recent period, including the years 2001 to 2007, is very different again from the decade before, the 1990s, when Prague was transformed into a post-socialist city. The onset of suburbanisation was immediate, but it was accompanied by a sudden drop in the urban core population, pushing the whole urban region into decline. This stage of "desurbanisation" is now over, and both the city of Prague and its urban region are growing again. Surprisingly enough, Vienna has also changed, leaving behind 40 years of predominantly suburban

[5] Explain division of powers due to 1867 Austro-Hungarian „Ausgleich".

Table 4 Austrian FURs of Linz, Graz, and Vienna: relative population change between census rounds 1869-2001, and between population register data 2001-2007*, per cent (%) standardised by 10-year period.

	Linz			Graz			Vienna		
	Core	Ring	FUR	Core	Ring	FUR	Core	Ring	FUR
2007*	5.5	6.3	5.8	15.6	6.1	13.1	11.8	9.5	11.5
2001	−5.6	12.2	0.5	−1.1	8.7	1.4	1.7	10.5	3.0
1991	3.8	12.1	6.5	0.2	9.1	2.3	1.6	9.5	2.6
1981	2.2	10.5	4.7	−0.5	5.0	0.7	−3.8	1.5	−3.1
1971	10.0	16.1	11.8	7.2	7.8	7.3	0.9	3.2	1.2
1961	11.6	4.5	9.4	6.4	0.8	5.1	0.7	−3.6	0.2
1951	38.2	5.6	25.8	8.0	4.5	7.2	−7.1	−5.1	−6.8
1939	22.1	2.3	14.1	−1.9	−3.4	−2.3	−14.6	2.2	−12.5
1934	7.1	2.6	5.2	5.6	2.6	4.8	1.3	0.4	1.2
1923	6.8	−2.1	2.9	2.6	0.6	2.1	−5.6	0.7	−4.8
1910	16.0	2.4	9.6	14.5	3.3	11.5	17.8	9.3	16.8
1900	25.1	0.9	12.3	22.4	−1.0	14.9	23.6	8.7	21.6
1890	15.2	0.2	6.7	15.7	2.3	11.1	23.0	5.7	20.3
1880	11.9	1.9	6.0	15.9	3.2	11.1	25.5	7.0	22.2
1869									

Source: own compilations and calculations.

growth, and embarking upon a period of renewed city growth, at levels that have not been recorded since 100 years. In both Prague and Vienna, these data are derived from the new population registers that are going to replace the traditional census rounds. This implies that absolute figures are not strictly comparable with earlier census data, but comparison between relative growth in both cores and rings – the crucial feature of the CURB model – should be correct.

This is only a first summary of what a long-term analysis of population development in two functional urban regions has to offer. More detailed analysis, on more than two cities, is to follow below. One general remark can be made at this point, however: cities and their city regions are travelling across the stages of the CURB classification, but they are not travelling in the sequence and numbering set out in the original study. Urbanisation is not necessarily followed by suburbanisation, but may be interrupted by desurbanisation and decline during exceptional periods, and there may be (and there is) direct return from suburbanisation to urbanisation, without going through the various stages of decline.

STAGES OF URBANISATION IN THE CZECH AND AUSTRIAN LANDS

In Austria, the original CURB study included seven functional urban regions, those of Vienna, Linz, Graz, Salzburg, Innsbruck, Klagenfurt and Bregenz – with the latter two falling below the targeted threshold of 200,000 inhabitants. In the 1950s, five of them were in the stage of suburbanisation, and two in urbanisation; in the 1960s, one more had moved into suburbanisation, leaving one FUR in urbanisation; by the early 1970s, this distribution remained, except for one FUR (Vienna) that had moved into desurbanisation (Van Den Berg et al. 1982:86ff.). For Austria and the time period observed, the sequence suggested by the stage model was followed through in every detail, including the following: "Most capital cities and larger industrial cities are in a later stage of development than lower-order centres within the same national system. For example, …, Vienna, … all 'lead' in their respective nation states" (ibid:85). For the three largest urban regions in Austria, Vienna (FUR population of 2,314,000 in 2007), Graz (FUR population 424,000 in 2007), and Linz (FUR population 454,000 in 2007), we extended the

Table 5 Czech FURs of Prague, Brno, and Plzeň: relative population change between census rounds 1869-2001, and between population register data 2001-2007*, per cent (%) standardised by 10-year period.

	Prague			Brno			Plzeň		
	Core	Ring	FUR	Core	Ring	FUR	Core	Ring	FUR
2007*	1.1	31.1	5.2	−5.7	10.9	−1.2	−3.9	11.3	0.1
2001	−3.7	8.6	−2.2	−3.1	2.4	−1.7	−4.4	2.6	−2.7
1991	2.5	−4.3	1.6	4.1	−4.7	1.6	1.2	−2.8	0.1
1980	3.6	−1.0	3.0	7.9	1.6	6.0	11.8	−1.2	8.1
1970	0.8	−5.0	−0.1	6.9	−1.6	4.2	10.6	−5.5	5.6
1961	6.5	4.5	6.2	7.6	6.3	7.2	9.0	6.7	8.3
1950	5.6	−1.3	4.5	2.7	−1.3	1.3	−2.5	−9.1	−4.8
1930	33.6	23.4	31.8	21.7	10.8	17.8	10.8	13.9	11.9
1921	8.5	0.8	7.0	8.8	3.3	6.8	8.4	3.5	6.7
1910	19.3	6.5	16.7	22.7	9.2	17.4	22.6	10.8	18.1
1900	27.9	4.4	22.3	21.2	5.8	14.7	42.4	6.5	26.2
1890	25.1	5.2	19.7	21.4	6.6	14.6	31.4	10.2	20.9
1880	26.6	6.9	20.5	13.1	5.7	9.6	50.3	10.3	27.2
1869									

Source: own compilations and calculations.

database from 1975 to 2007, and from 1951 back into the 19th century, to find further evidence for this observation and hypothesis.

Czech and Slovak cities were missing from the original CURB study, as well as from related comparative urban studies of the time, such as Hall and Hay (1980), as well as from follow-up studies (Cheshire and Hay 1989, Drewett et al. 1991, Cheshire 1995). It is one of the goals of this paper to include at least some of the largest cities of today's Czech Republic into a CURB-type analysis. Another goal is to extend the observation period forward to the most recent data available and backwards to the most distant, but reliable data available, i.e. the census of 1869. With such data, growth differentials between city regions of different size can discovered and compared with the original findings. Based on the criterion of 200,000 inhabitants for the FUR, the following cities would have qualified: Prague, Brno, Ostrava, and Plzeň. Due to its polynuclear structure, we did not include Ostrava (FUR population of 399,000 in 2007), but we delineated the functional urban regions of Prague (1,409,000 in 2007), Brno (518,000 in 2007), and Plzeň (or Pilsen, 227,000 in 2007).

For each of the 6 city regions, 3 in Austria (AT), and 3 in the Czech Republic (CZ), population data were collected for 3 territorial units: the urban core area (AT: "Kernraum" as defined 1991, administrative city area in CZ), the urban ring (AT: "Aussenzone", CZ: own calculations based upon 2001 census) – and for each of the 13-14 census rounds between 1869 and 2001, plus population register data for the years 2001 to 2007. Table 4 summarizes the results for the Austrian cities; table 5 does the same for the Czech cities.

To improve readability, the stage of urban development according to the CURB typology is indicated in type and colour of writing for each FUR and each census period: normal (and black) for urbanisation, underlined (and black) for suburbanisation, normal (and white) for desurbanisation, and underlined (and white) for re-urbanisation. The broad picture across the urban history of Central Europe is that there has been a century of urbanisation, if not some more, lasting until the 1950s in the Austrian city regions, and continuing until 1989 in the Czech city regions. Urbanisation has been particularly stable and ongoing in the second half of the 19th century, when industrialisation peaked in all Western cities of the Habsburg

Empire. Growth rates of larger cities and their urban regions typically exceed those of smaller cities, but dynamic centres of industry are able to bypass that pattern – with Plzeň (and later Ostrava) being an example from the Czech cities, and the war-industry induced growth of Linz being an Austrian example. Urbanisation is only interrupted under very specific circumstances, when nation-states are re-organised in the 1920s, or as a consequence of Nazi atrocities, war-time destruction and post-war population displacements. Urbanisation ends when incomes allow greater mobility and suburban house building is conceded. This happened in all Austrian cities from the 1960s and in all Czech cities from the 1990s. The planned housing economy of Communist regimes had actually kept cities compact and oriented towards public transport.[6]

Not only in Austria, but in most city regions of capitalist Western Europe suburbanisation dominated urban development since the 1960s. As a minority programme, it had started much earlier, and suburban villas haven been built along railway lines before WWI. In wealthy Czechoslovakia, suburbanisation gained momentum in the 1920s, and garden cities were built around Prague[7]; around Plzeň, population growth was so strong that it qualifies as the very first stage of suburbanisation according to the CURB model in our study, 40 years before the phenomenon returns to capitalist Central Europe. In Southern Europe and Northern Europe suburbanisation arrived at a later stage (cf. Cheshire 1995), partially hidden behind the widespread occurrence of second homes.

As soon as the market economy was introduced in the Czechoslovak, then the Czech and Slovak Republics, a number of demographic processes also changed. The beginnings of suburbanisation were accompanied by a dramatic fall in birth rates, below European average, and a strong surge in emigration, both temporary and permanent. For about a decade, the 1990s, all regions of the Czech Republic experienced population decline, including the urban regions, and despite the onset of suburban growth. Within the CURB typology, such a combination of suburbanisation and city region decline is called "desurbanisation". In the 2000s, the decade of transformation seems to bed over: one by one, Czech cities started to grow again, Prague from 2002, Plzeň from 2005 (?), and Brno from 2007. In table 5, Brno is still classified as desurbanising, due to its late turnaround, but Prague and Plzeň are to be classified as suburbanising.

On the Austrian side, the 2000s have also brought remarkable changes in urban development. For 30 to 40 years, the core population of Vienna, Graz and Linz has been stagnating, sometimes growing, sometimes declining. Over the last couple of years, growth rates have climbed to historical heights in Vienna, but also in Graz, comparable to fin-de-siècle values, and exceeding suburban growth. In the CURB typology, this implies a return to traditional urbanisation. In Linz, core development is more modest, and suburbanisation still dominates.

THE GEOGRAPHY OF LARGE CITY REGIONS IN AUSTRIA AND THE CZECH REPUBLIC

Vienna and Prague

Over the last decades under Habsburg's rule, the largest and the third largest city of the empire grew at similar speed, more than doubling in size from 1869 to 1910. Due to urbanisation, core growth was much stronger than suburban growth, six times higher in Greater Prague[8], and almost four times higher in Vienna. Within the area of today's functional urban region, the population increased from 1.20 million to 2.55 million in and around Vienna, and from 0.39 million to 0.82 million in and around Prague. Concerning their FURs, the proportion in size between Vienna and Prague remained the same, concerning their morphological cores, Prague was even growing faster.

[6] Hampl and Kühnl (1993) have called that process „kontrametropolizace" (according to Ouředníček and Posová 2006:97).

[7] Ouředníček and Posová (2006) and Sýkora and Ouředníček (2007) are quoting Ullrich et al. (1938) and Král (1946) as contemporary reports on Prague's inter-war suburbanisation.

[8] Not Imperial Prague which was not allowed to expand its city limits, in contrast to Vienna, the "Reichshaupt- und Residenzstadt" (formal wording used at the time).

Figure 1 gives an overview of population dynamics within the urban region of Vienna between 1869 and 1910. Growth is concentrated in the "Vororte" (the outer districts incorporated in 1890), and within areas that have been incorporated later, plus several ribbons of municipalities that have remained independent to the present day. All these fingers of faster growth are related to railway lines bringing towns like Baden and Klosterneuburg within reach of the capital. In the inner-most districts I, VI and VII, the early formation of a CBD contributed to population losses as early as the late 19th century.

In smaller Prague, growth was even more concentrated within today's administrative area (figure 2). Despite urban core growth, the innermost districts of Prague started to lose population after 1870 – similar to Vienna. If some suburban municipalities have been growing faster, development is also related to railway lines.

After WWI and the foundation of nation-states, the Czechoslovak Republic and the Republic of Austria, the fates of the two cities diverged, for almost 70 years. Between the last common census of 1910 and the first censuses after WWII, Vienna FUR lost almost 20% of its population, whilst Prague FUR has been growing by more than 50%, boosted by the most dynamic growth in its history, in the 1920s and early 30s. In 1950/1951, city sizes had come closer, with 2.09 million in the Vienna FUR versus 1.24 million in Prague FUR. Since the Communist take-over in Czechoslovakia, in 1948, however, contacts and even information flows between the two cities were drying up.

In and around Prague, a first wave of suburbanisation accommodated part of the growing population. In 1922, the city limits could finally be expanded, to include cities like Žižkov, Královské Vinohrady, Smíchov, Karlín and others, 37 municipalities in total that had functionally been parts of the urban region of Prague since long. New, often modernist suburbs and garden cities were set up within and beyond the boundaries of Greater Prague (Strahov, Vinohrady, Strašnice, Kobylisy, Košíře, Břevnov) (cf. Láník 1993).

In inter-war, pre-war, war-time and post-war Vienna, population losses were frequent and widespread. Nevertheless, emigration and expulsion had its geography. In figure 3, population changes are accumulated for the time between the censuses of 1910 and 1951, for the functional region of Vienna. The heaviest losses are in some of the inner districts of Vienna, notably the 2nd district Leopoldstadt which had been depleted of its Jewish population, and the 1st district, where CBD formation continued, despite of repeated economic crises. But even in these decades of depletion and decay, some areas of modest increase come out. These include today's 22nd district where garden cities and colonies had been built by the Vienna settlers' movement, and some municipalities outside where modest cottages offered some relief from the pressures of the time.

The 1950s have been a period of modest, but centralised growth in both city regions, with more dynamics in Communist Prague than in capitalist, but peripheral Vienna. During this period, Prague's urban ring grew for the last time, before falling into neglect and depopulation for the remainder of the socialist era. In Vienna's suburban ring, depletion was a reality in these years, and if there was growth, it took place in the outskirts, but within the city limits of Vienna.

Between the censuses of 1950 and 1961, the number of inhabitants increased both in Prague core and in Prague ring. The spatial differences are shown in fig. 6; in the central parts the number of inhabitants increased in the urban district Praha 1 and on the contrary decreased in the urban district Praha 2.

Between the censuses of 1961 and 1970, the number of inhabitants increased in Prague core but decreased in Prague ring. The spatial differences are shown in fig. 8; in the central parts the number of inhabitants decreased and on the contrary the population increased in the urban districts with construction of the housing estates (especially prefabricated houses). In the smaller municipalities the number of inhabitants was usually decreasing because of state policy (almost no investments to infrastructure, schools etc.).

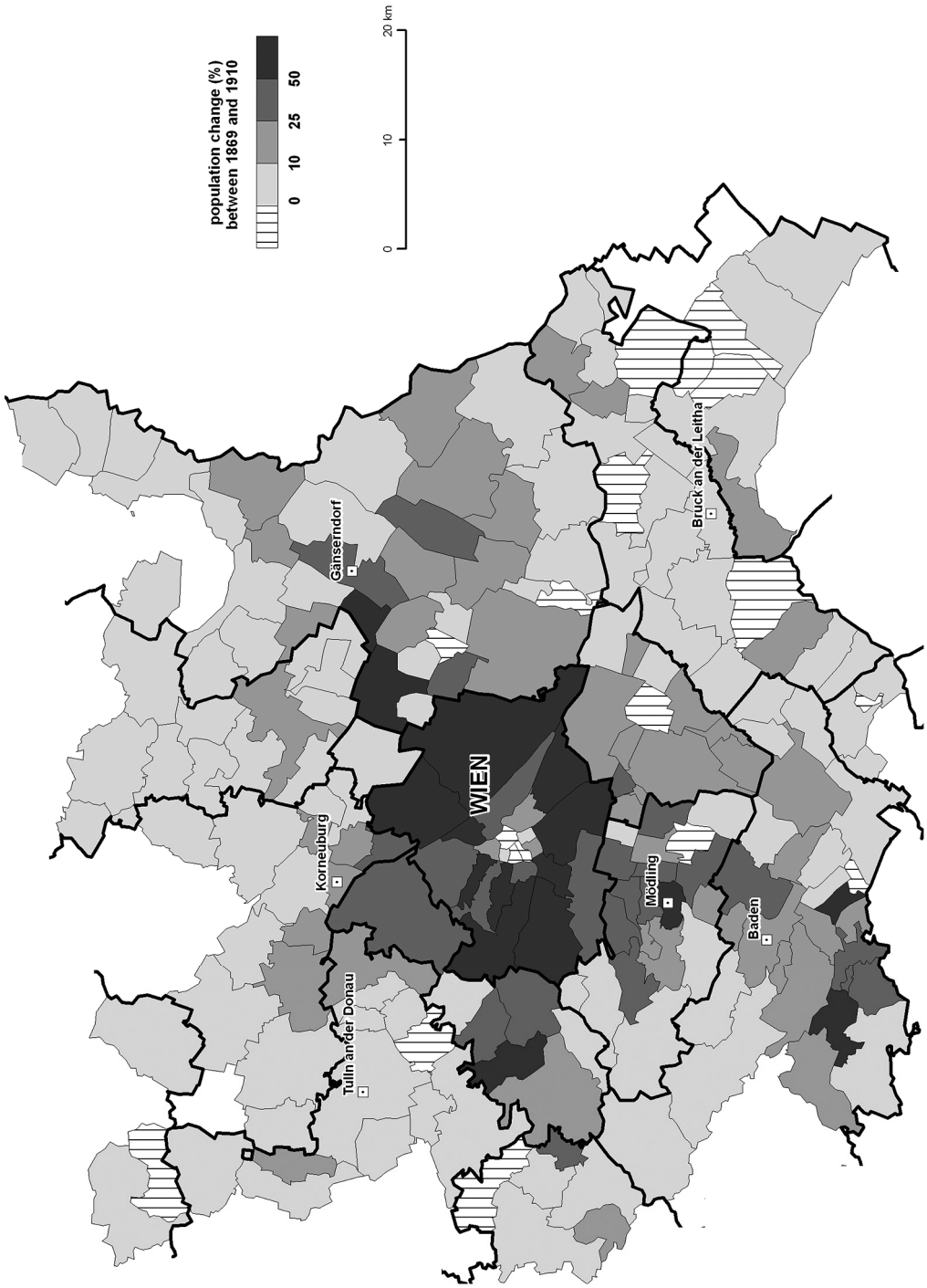

Figure 1 FUR Vienna, population development 1869-1910, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation.

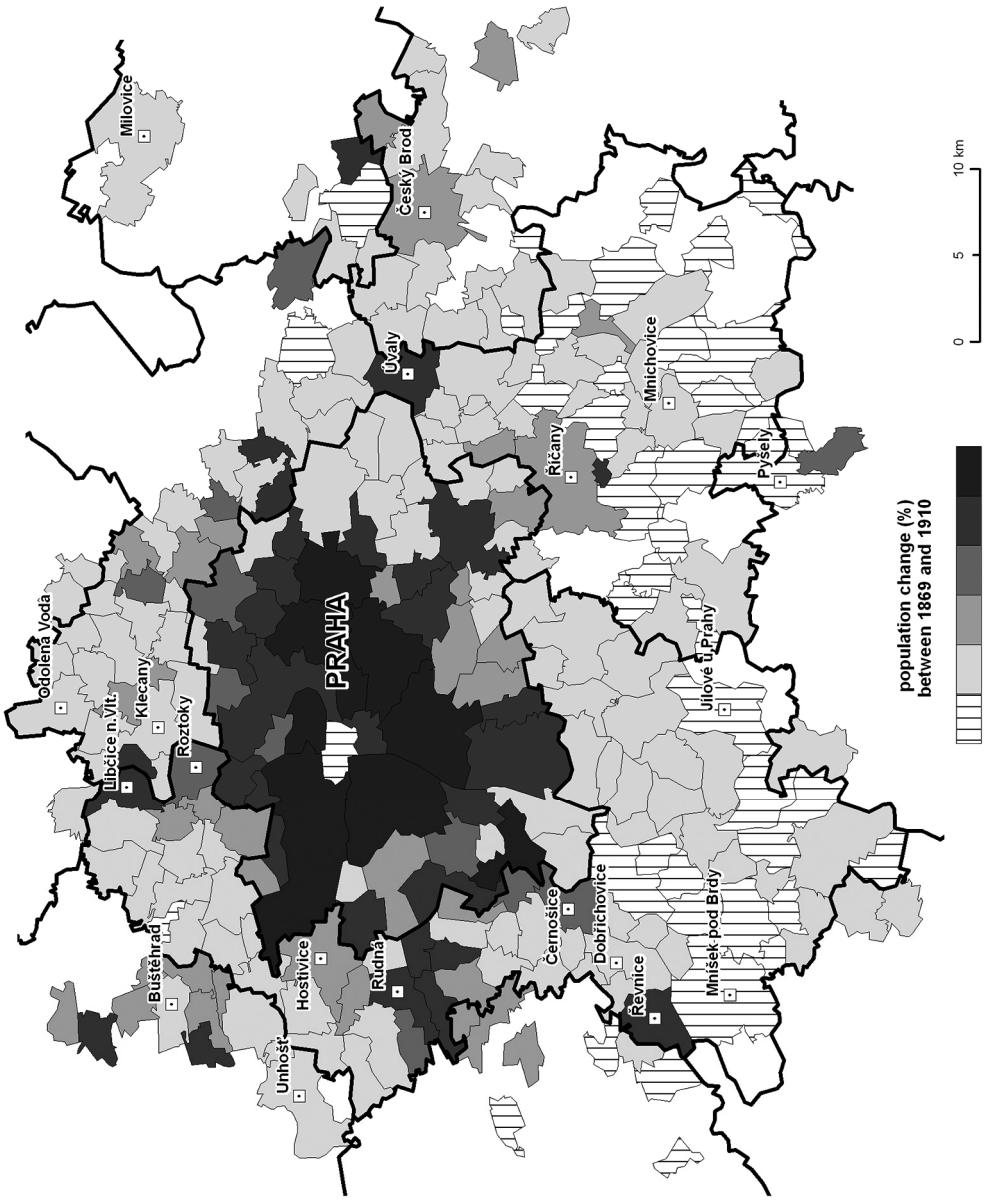

Figure 2 FUR Prague, population development 1869-1910, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation from CZSO 2004.

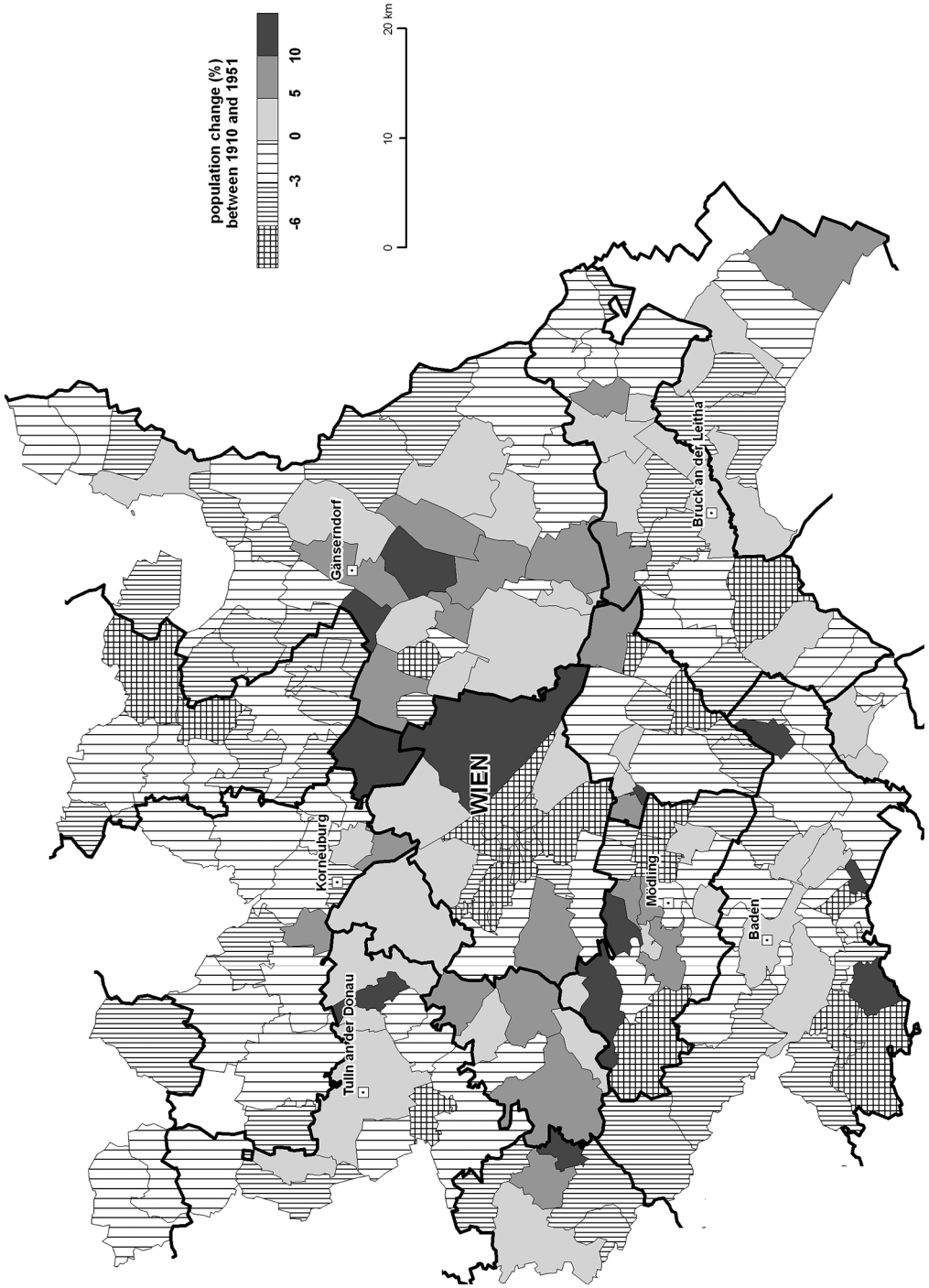

Figure 3 FUR Vienna, population development 1910-1951, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation.

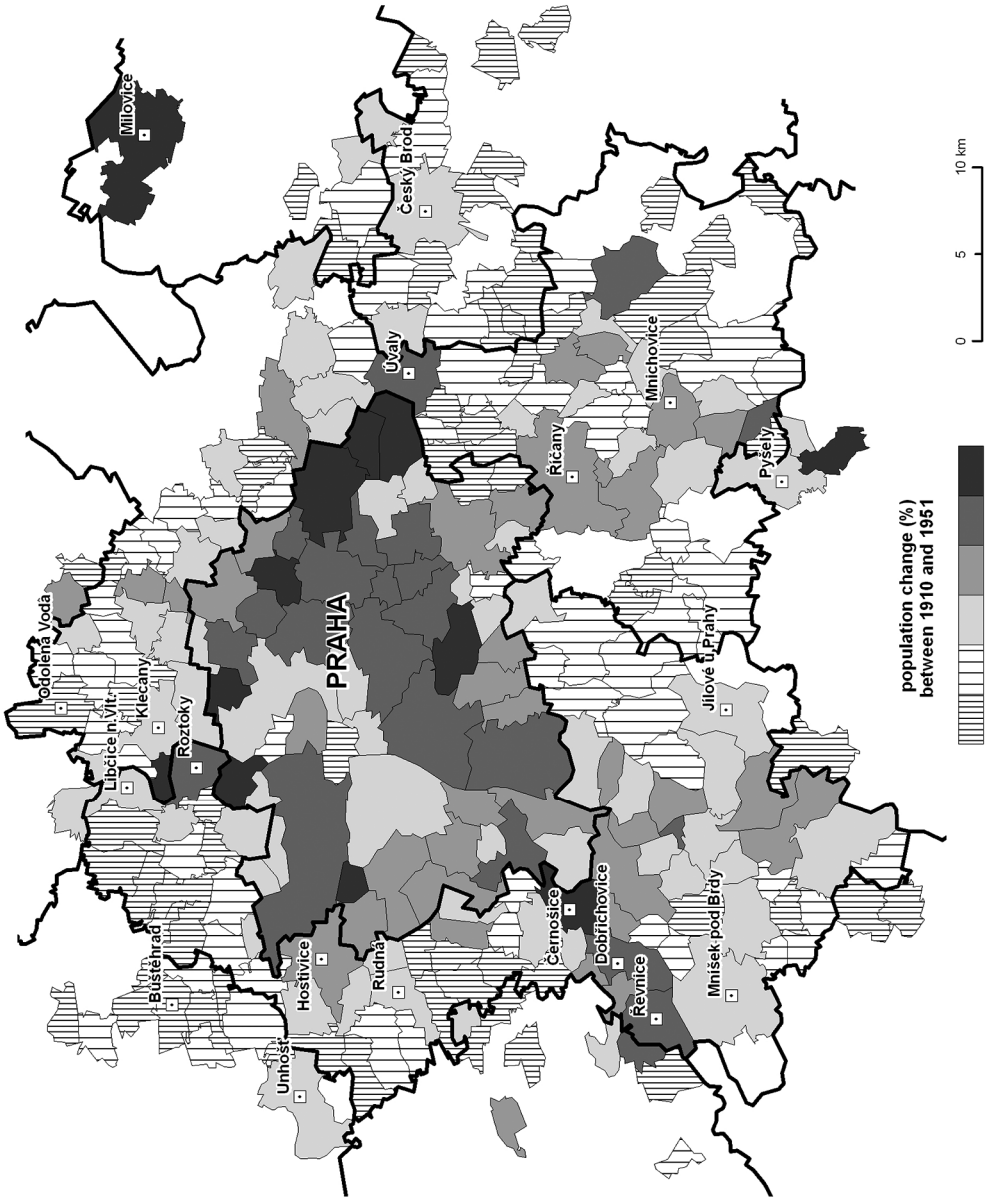

Figure 4 FUR Prague, population development 1910-1950, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation from CZSO 2004.

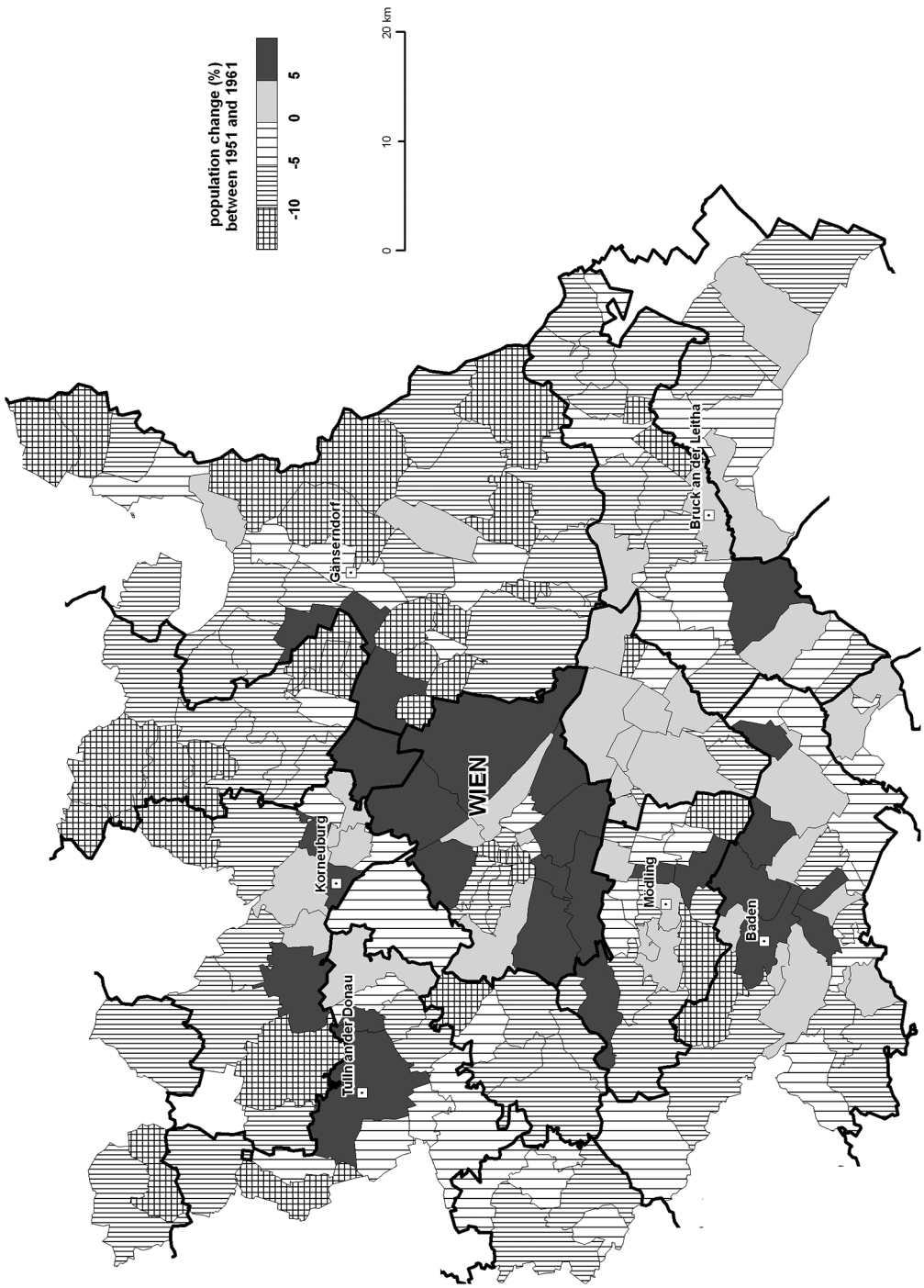

Figure 5 FUR Vienna, population development 1951-1961, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation.

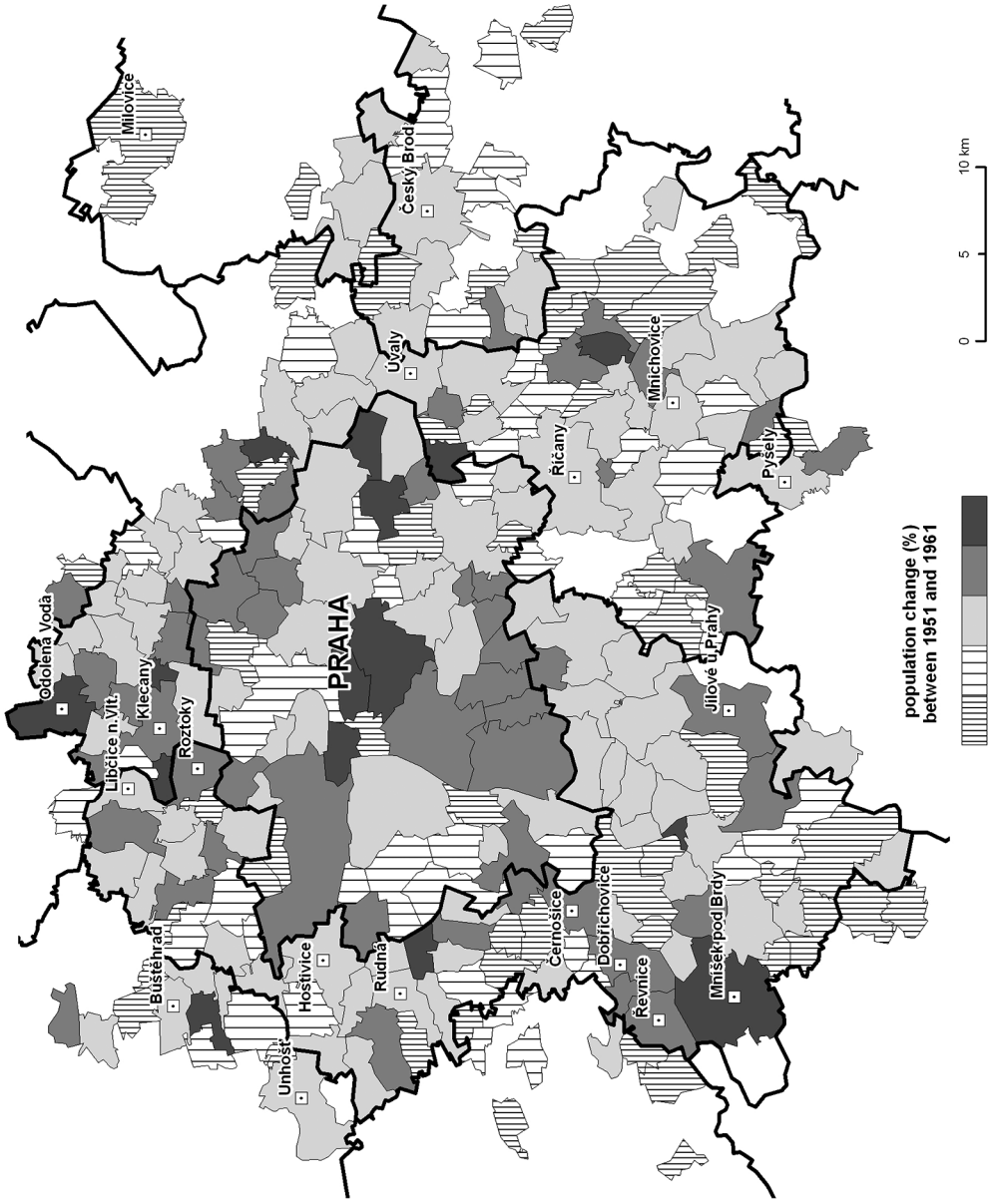

Figure 6 FUR Prague, population development 1950-1961, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation from CZSO 2004.

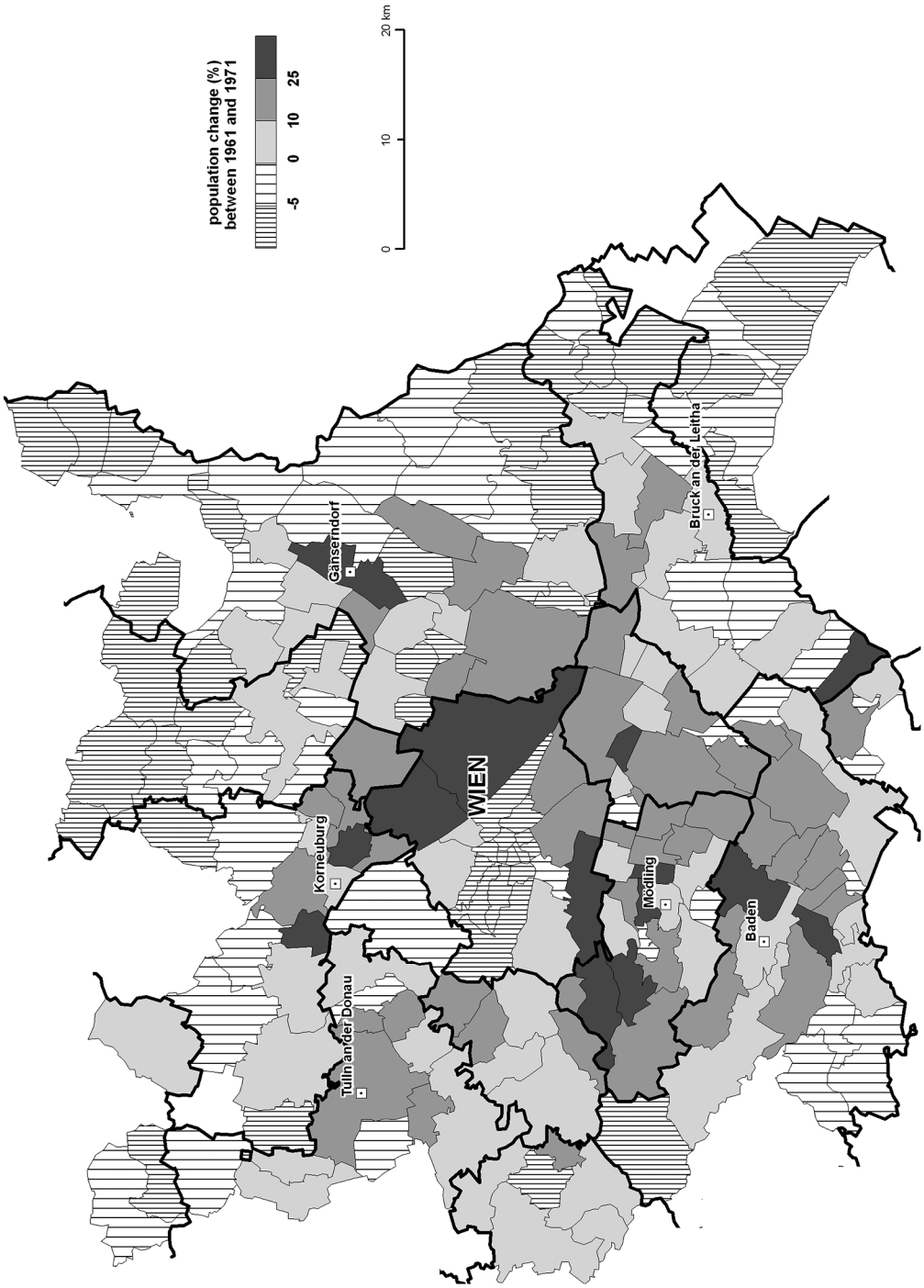

Figure 7 FUR Vienna, population development 1961-1971, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation.

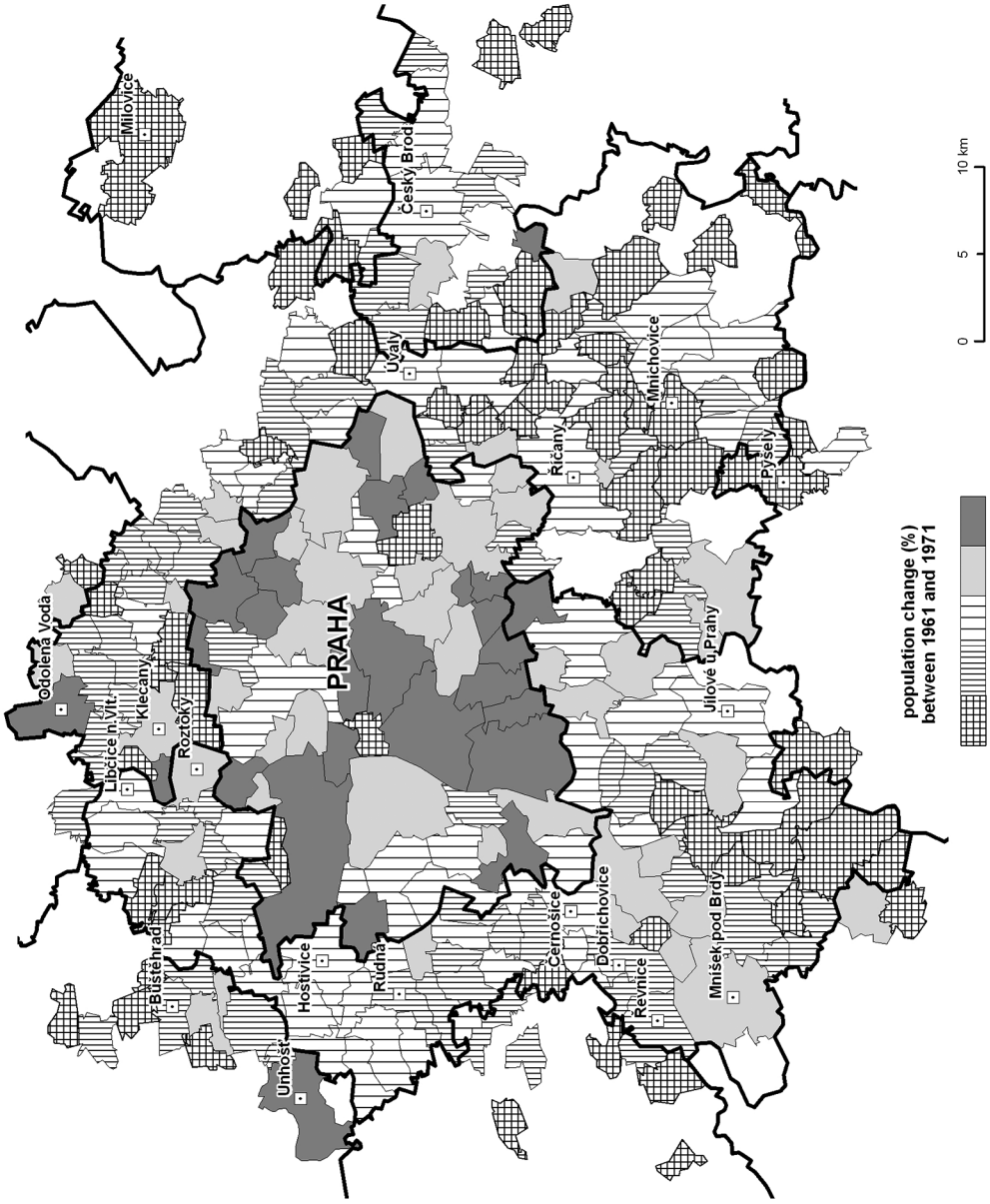

Figure 8 FUR Prague, population development 1961-1970, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation from CZSO 2004.

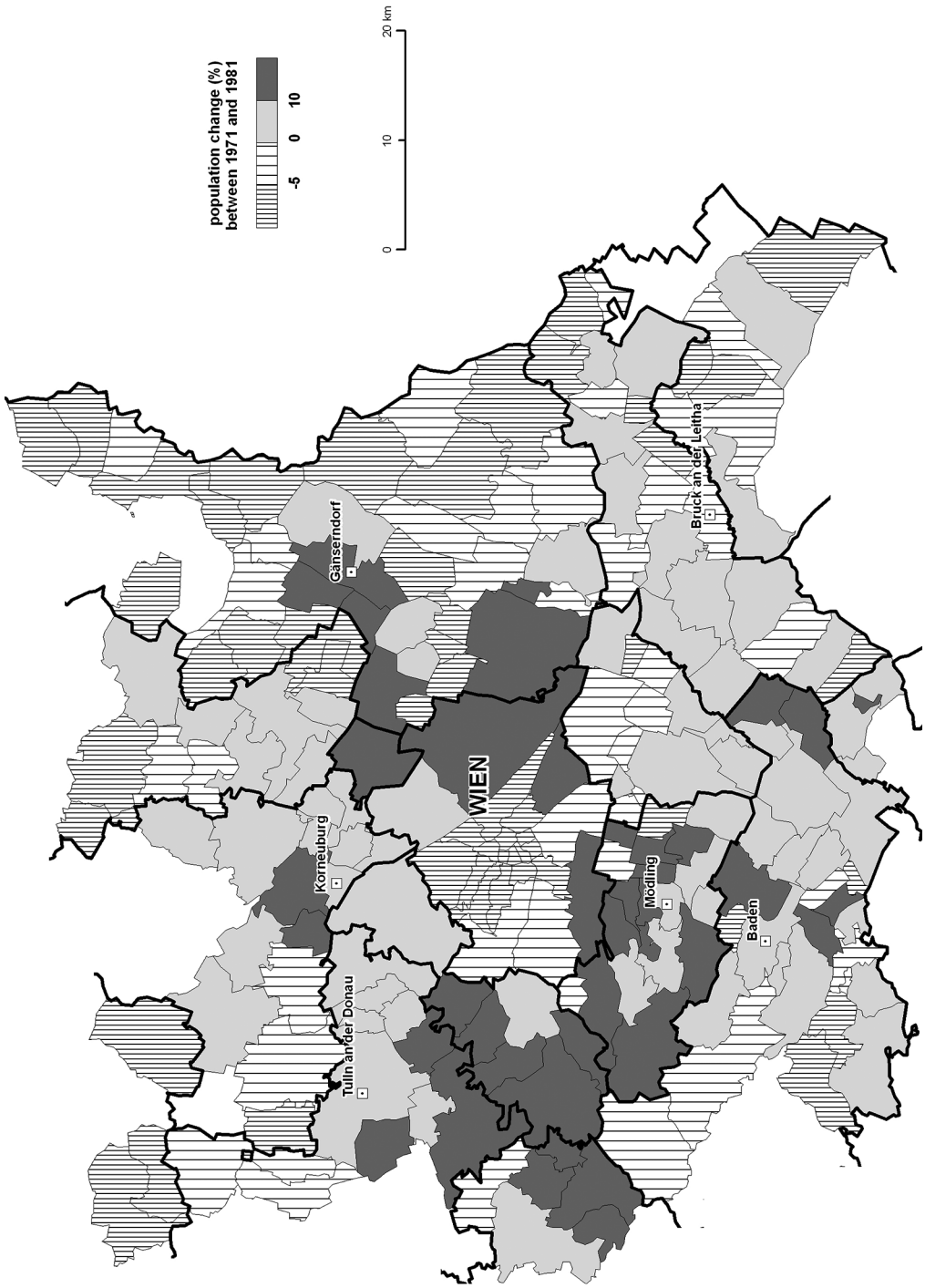

Figure 9 FUR Vienna, population development 1971-1981, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation.

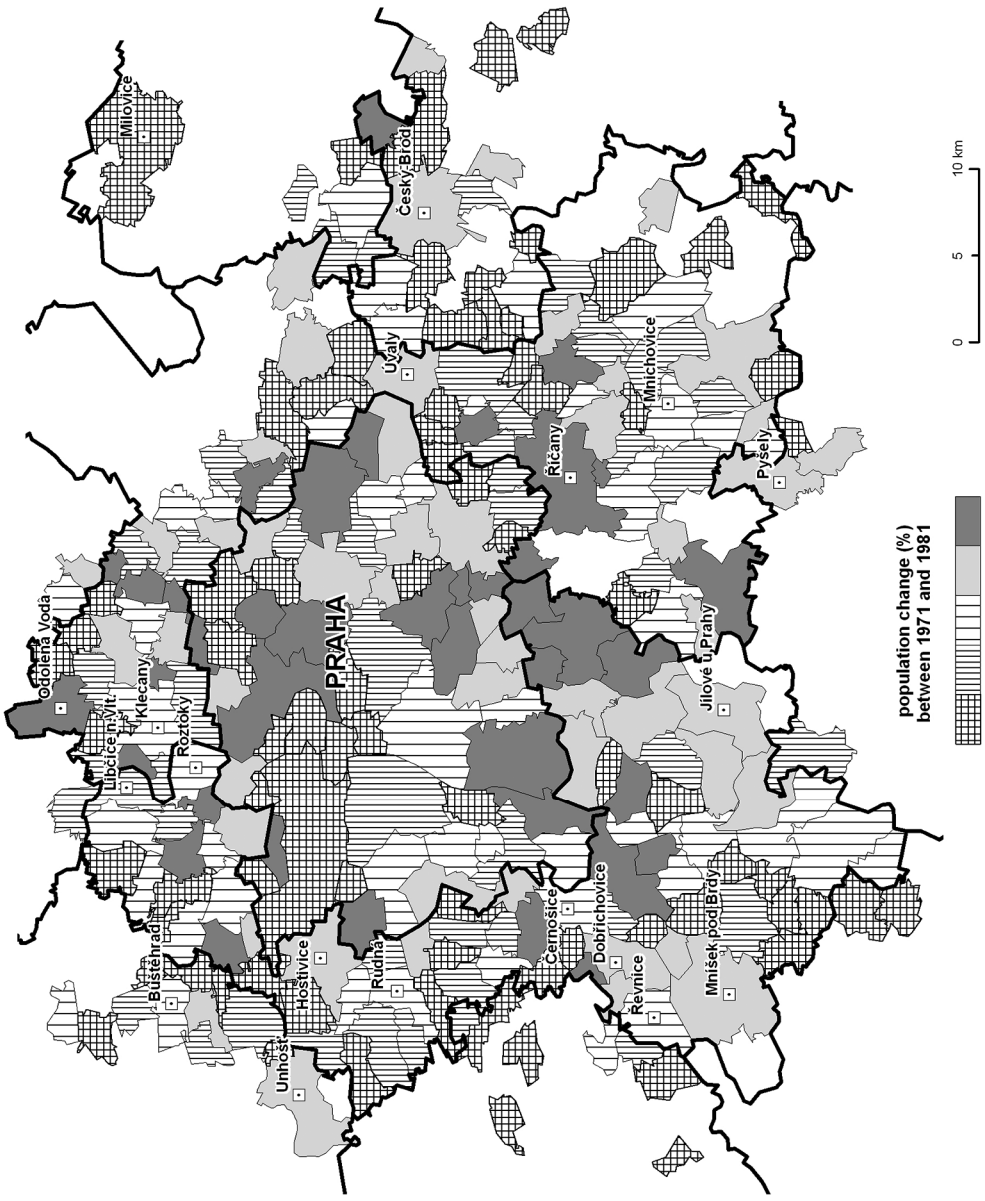

Figure 10 FUR Prague, population development 1970-1980, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation from CZSO 2004.

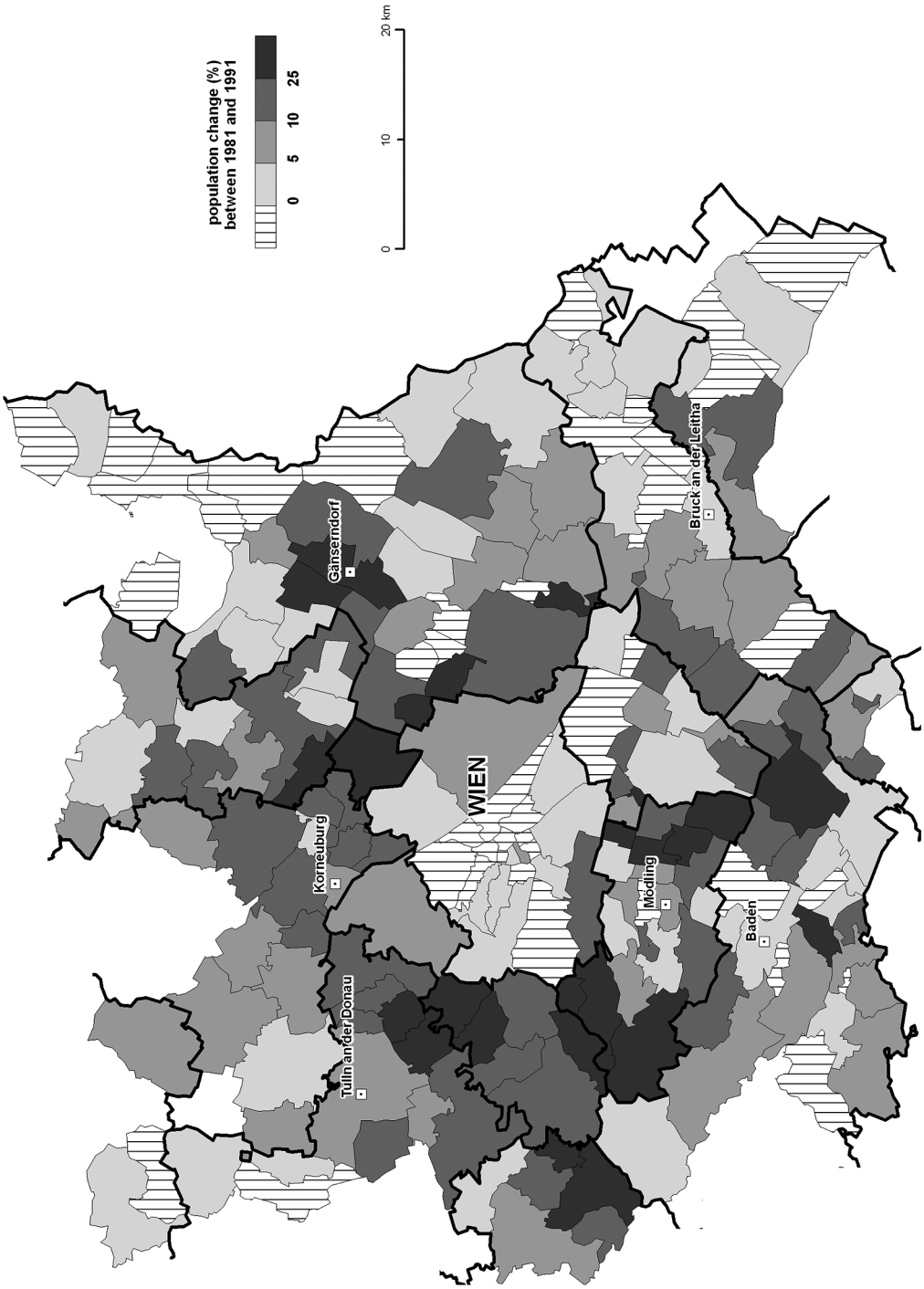

Figure 11 FUR Vienna, population development 1981-1991, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation.

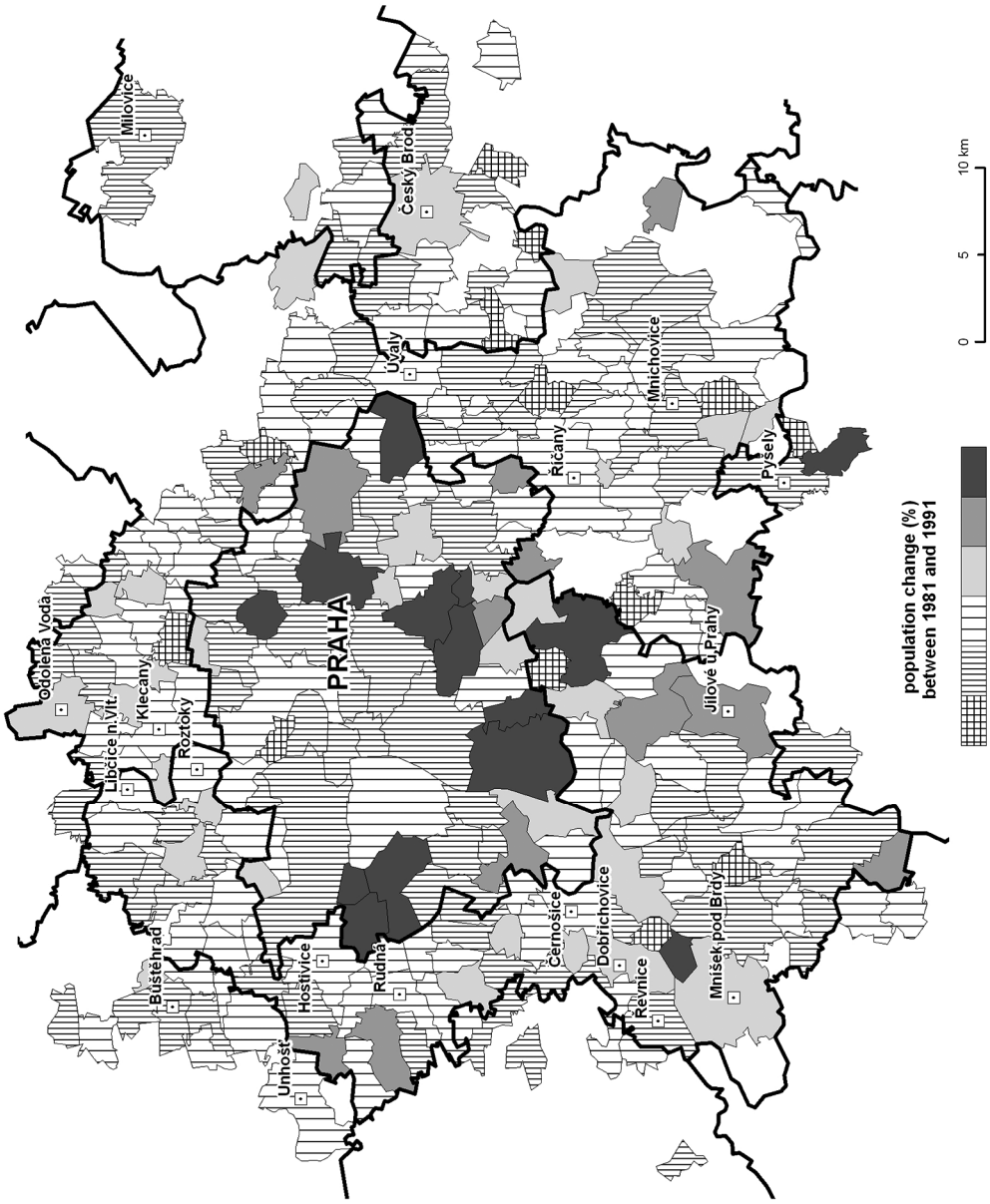

Figure 12 FUR Prague, population development 1980-1991, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation from CZSO 2004.

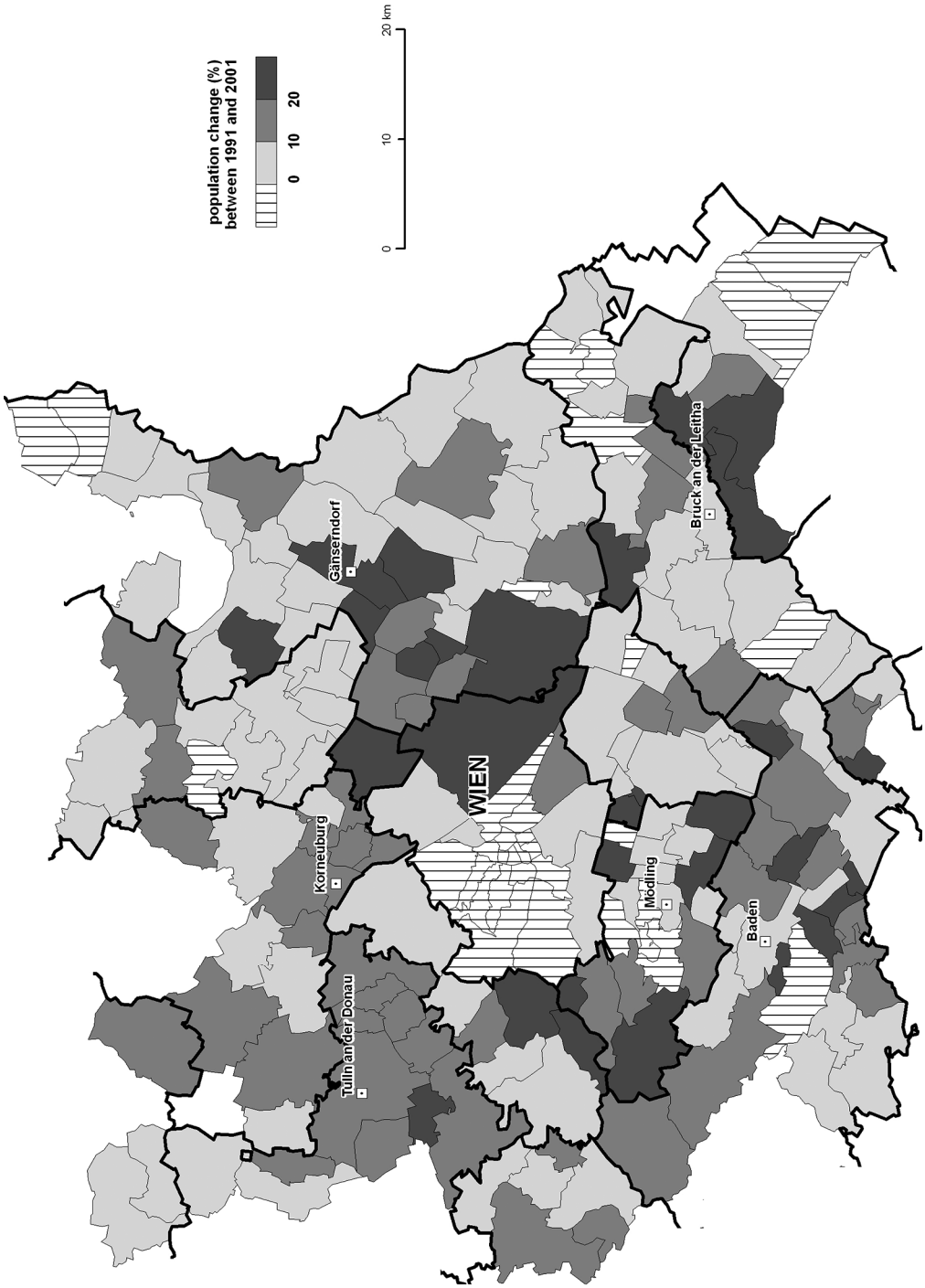

Figure 13 FUR Vienna, population development 1991-2001, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation.

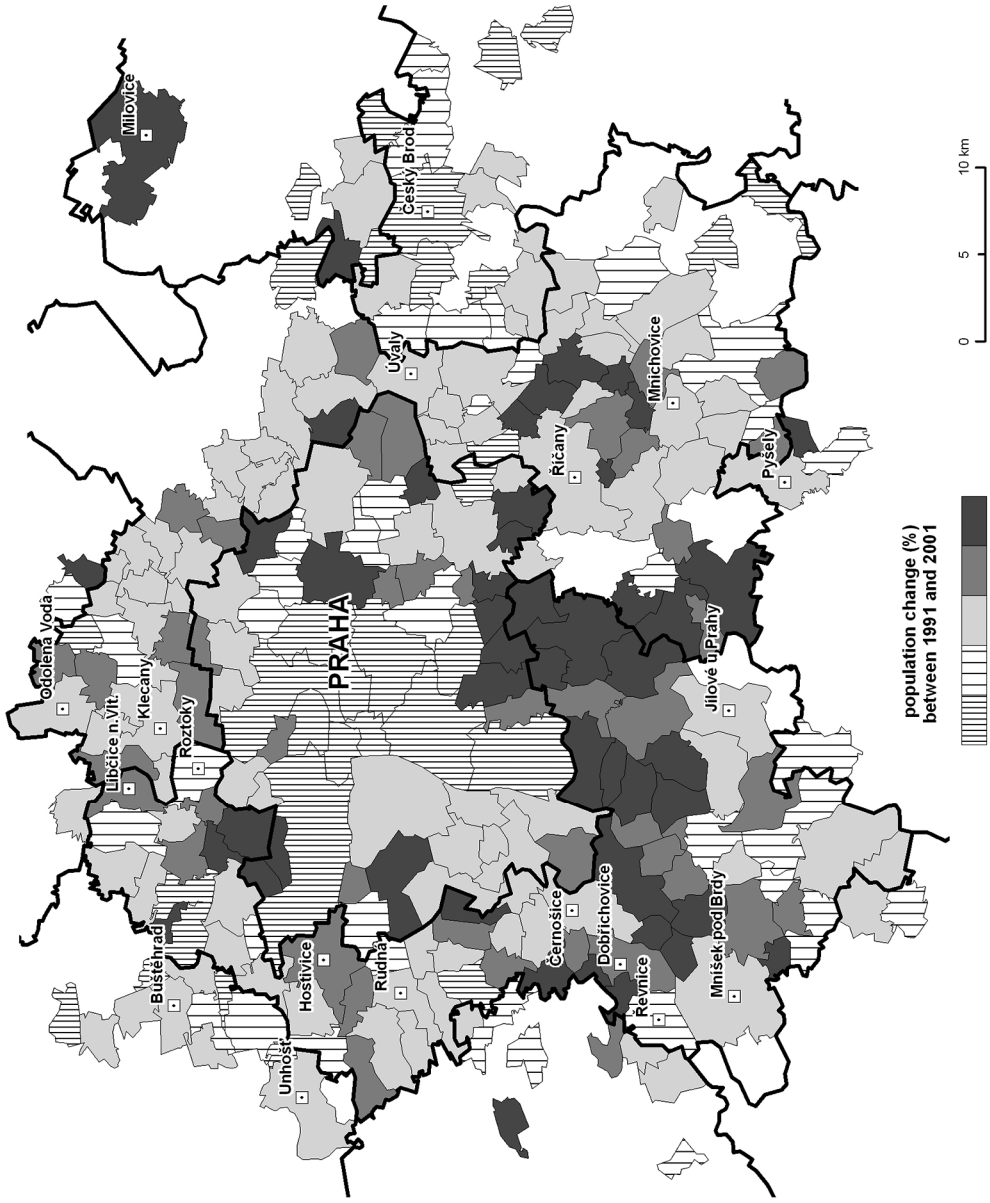

Figure 14 FUR Prague, population development 1991-2001, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation from CZSO 2004.

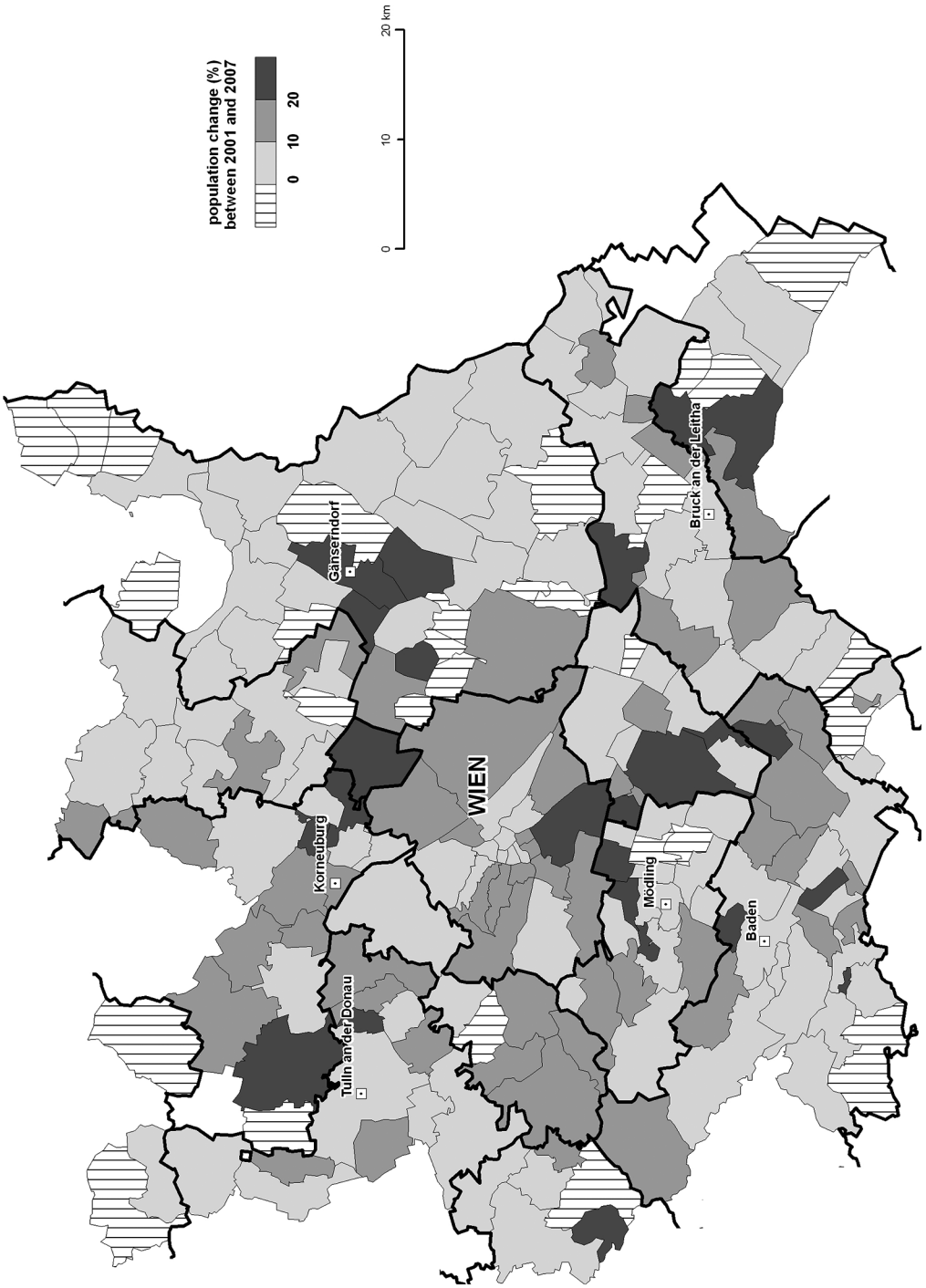

Figure 15 FUR Vienna, population development 2001-2007, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation.

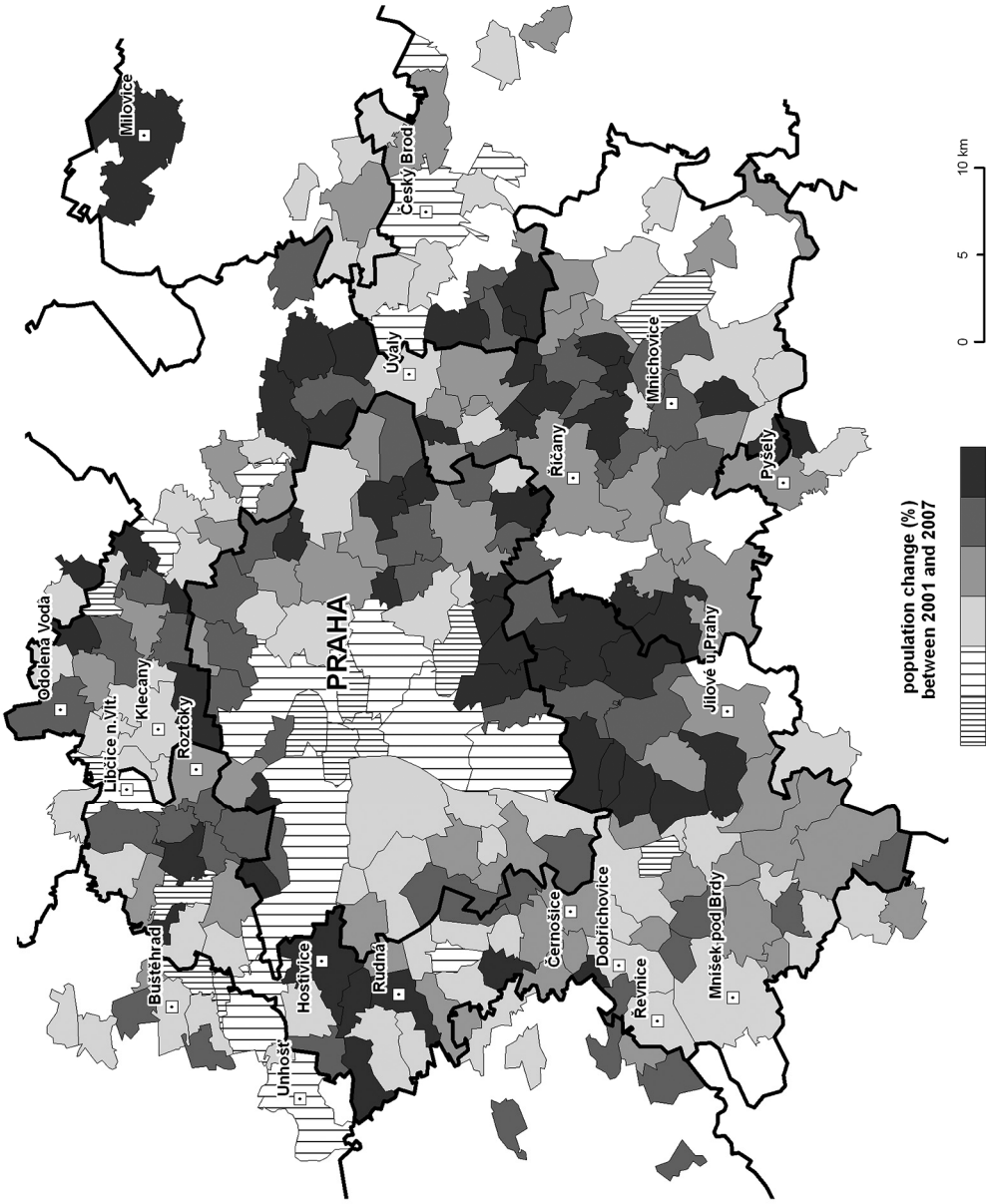

Figure 16 FUR Prague, population development 2001-2007, by municipality or (municipal) district, percent per 10-year average.
Source: own compilation and calculation from CZSO 2004.

Between the censuses of 1970 and 1980, the number of inhabitants increased in Prague core but decreased in Prague ring. The spatial differences are shown in figure 10; the population increased in the urban districts with construction of the housing estates (prefabricated houses). In the smaller municipalities the number of inhabitants continued to decrease because of state policy (almost no investments).

Figure 14 shows that the number of inhabitants between the censuses of 1991 and 2001 decreased in the central part of Prague while the population increased in the some peripheral parts of the core (with the new housing construction) and in municipalities in Prague ring. According to Ouředníček and Posová (2006), for the first part of the transition decade (1990-1994) small projects of suburbanisation were typical and also the completion of prefabricated houses that had been started earlier (e.g. Jihozápadní Město and Černý Most). The end of the period (1998-2001) could be described as expansion of the suburbanisation type of housing in the Prague hinterland. The spread of the family houses influenced the rural landscape in Prague ring (see for example Perlín 2002). The suburbanisation was supported by the state by different economic instruments – for example the state policy of support of housing for young people up to the age of 36 years (Sunega 2005). The process of suburbanisation was analysed in many studies – for example Sýkora (2003) or Sýkora and Posová (2007) or Sýkora et al. (2000).

Figure 16 shows that the number of inhabitants between January 1, 2001 and January 1, 2007 increased not only in Prague ring but in Prague core as well. The population of Prague has started to grow again since 2002 due to positive net migration (and in 2007 even thanks to small positive natural increase!). According to Ouředníček and Posová (2006) the population increase was caused by an increase of housing construction in this period both within the administrative area of Prague as well as in the Prague hinterland in particular. This housing boom was naturally influenced by the fact that mortgage credits started to be available for larger groups of the Czech society than in the previous period. The processes are stronger in Prague than in Brno or Plzeň because the Prague is not only the richest region of the Czech Republic but Prague even belongs to the most prosperous NUTS II regions in Europe.

Suburbanisation was not based on family houses alone, but developers have started to build multi-dwelling houses – especially in the larger municipalities (e.g. Suchdol, Průhonice) in the surroundings of Prague core (Ouředníček and Posová 2006:102). According to Vobecká (2008) the trend of population decrease in the central part of Prague was continuing, while the strongest increase of population was achieved in the peripheral urban districts and in suburbanisation zones because some inhabitants moved to the peripheral parts of Prague or to the municipalities surrounding Prague (suburbanisation) or to the urban districts with new housing construction. The size of newly constructed flats could be influenced by the fact that Prague is the city with highest share of one-person households in the Czech Republic (Andrle 2003).

CONCLUSIONS

Some 30 years ago, an international team chaired by Roy Drewett has developed a concept of stages of urban development. As one of the first empirically based projects of comparative urban research, they applied it to almost 200 city regions of the time, the 1950s to mid-1970s, in both Northern and Southern, Western and Eastern Europe, in both market economies and planned economies of the time.

Our own comparative project started on the assumption that the old CURB model can still be used and applied to other periods and urban regions than those it was originally applied to. For reasons that should be investigated, Czechoslovak cities had not been included in the CURB study. This had been the starting point of an earlier study by the Austrian contributors on Vienna and Bratislava, for the years 1950 to 2001 (published in English by Matznetter 2004). The results on the effects of the systems divide between a social market economy on the one side, and a planned housing economy on the other side, and their immediate disappearance after the Velvet Revolution, were impressive. The contrasts

between Vienna and Bratislava seemed to be too clear-cut and ideal to be generalised to all city regions of former Czechoslovakia, and all socialist cities beyond.

Prague, now the capital of the Czech Republic, was certainly worth a comparative case study with Vienna, all the more because these cities had rarely been compared before, even in the distant and shared past. It took some years and conferences to find colleagues from the Czech Republic who would have the means and the time for such a project. Two geographers from Brno and Ostrava spontaneously agreed to co-operate, under the condition that their cities would be included. This coincided with the interest of the Austrian partners to bring the CURB model down the own national city hierarchy, to control the idiosyncrasies of Vienna, and get hold of city size effects. This is why and how Brno, Graz and Linz got included. In the process, we decided to replace Ostrava, the multinuclear industrial pole boosted in the Communist era, by the mono-nuclear and oldindustrialised city of Plzeň, the fourth-largest city in the country. Obviously, it is not easy to delimit urban regions in the case of two or more morphological centres, something that should be taken into account in CURB-type analyses.

Consequently, data were assembled on the six cities, starting with the after-war period. On our way, we discovered that both the Czech and the Austrian statistical offices had adapted and standardised historical population data to present municipality boundaries, for all censuses back to 1869. We took up the challenge to explore urbanisation "avant la lettre" (at least in the CURB definition). We think our findings should be of great interest to urban historians who will find a consolidated data basis and cartography to which more scattered evidence can be related.

From the more recent periods, the decades since the original CURB study has been completed, one result emerges that is in conflict with the concept of stages of urban development itself. In the 1960s and early 1970s, evidence for a progressive change from urbanisation to suburbanisation and some desurbanisation was so overwhelming that the sequence was thought of as irreversible and continuing into a stage of re-urbanisation under decline (although there are caveats in the 1982 book publication). Nowhere in our sample, and possibly nowhere else in Europe, did such a sequence of the 4 stages come true. If there is decline, then the city core is more affected than the suburban ring in most cases. Suburban depletion during core city growth or less depletion than in the ring is a rare phenomenon that occurs under exceptional circumstances.

There is a return to urbanisation recently, in Vienna and in Graz, but it is plain urbanisation according to the CURB typology. The compact city is growing again, under market conditions, and not because it is contained by a planned housing economy from which there was no escape. The reason is international migration, often from within the EU, and the data are from the permanent population registers that have been built up in many countries, in Austria as well as in the Czech Republic.

After the turbulent years of transformation, Czech cities seem to be following the highway towards suburbanisation, at the same time that their city cores have stopped their decline. At least for the largest Czech cities, the decade of shrinkage seems to be over, in Prague and Plzeň, and Brno to follow.

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Résumé

Urbánní rozvoj ve vybraných českých a rakouských městských regionech

V konceptuální rovině je článek založen na aplikaci modelu, jenž byl vytvořen v rámci projektu CURB (*The Costs of Urban Growth*) (Van Den Berg et al. 1982). S využitím velmi jednoduché a formální typologie, zaměřené na zkoumání populačních změn na území městských jader a jejich zázemí v rámci funkčních městských regionů (*Functional Urban Regions*), byla tato metoda původně využita pro 189 funkčních městských regionů ve čtrnácti evropských zemích, a to pro analýzu vývoje pro období mezi léty 1950–1975. Jedno z nejdůležitějších zjištění tehdejšího výzkumu bylo, že stále větší množství městských regionů přechází v průběhu poválečných desetiletí z fáze urbanizace do fáze suburbanizace, případně se v některých případech prosazují i tendence k desurbanizaci. Uvedené změny se projevovaly nejvýrazněji zejména v kapitalistických zemích s tržními ekonomikami, ale nebyly příliš patrné v několika socialistických zemích (Bulharsko, Maďarsko, Polsko, Jugoslávie), které byly do CURB výzkumu rovněž zahrnuty. Většina z jejich městských regionů totiž pokračovala v procesu urbanizace a to často až do konce plánovitého hospodářství.

Na empirické úrovni se článek snaží o rozšíření původní studie, a to jak ve smyslu časovém, tak i prostorovém. Z časového hlediska bylo provedeno rozšíření zkoumání směrem nejen k novějším údajům (populační data Českého statistického úřadu a z rakouské statistiky za rok 2007), ale pozornost se dále zaměřila i na starší údaje, které začínají již prvním moderním censem na území habsburské monarchie (1869). Z hlediska geografického prostoru se pozornost soustředila na hodnocení tří největších monocentrických městských regionů na území České republiky (konkrétně se jedná o městské regiony Prahy, Brna a Plzně) a tří největších městských regionů v Rakousku (regiony Vídně, Štýrského Hradce a Lince).

Předchozí dílčí studie (Matznetter 2004), která byla zaměřená na Bratislavu a Vídeň, ukázala, že dopady proměny systému v roce 1989 byly velmi významné. V období devadesátých let se suburbanizace v případě Bratislavy stala dominantní fází urbánního rozvoje. Naproti tomu v případě Vídně začala obdobná etapa o třicet let dříve, přičemž tento dlouhodobější trend k suburbanizaci zahrnul i jistý druh intermezza v podobě desurbanizační fáze v období sedmdesátých let 20. století.

Tento výrazný zlom v trendech urbánního rozvoje, který se vztahuje ke konci období socialismu, byl v nedávné době zkoumán na příkladu mnohých městských regionů (podrobněji např. Ott 2001, Sýkora a Ouředníček 2007). S pomocí využití jednotného vymezení městských jader, městských zázemí a celých městských regionů se článek snaží vytvořit vyváženou informační základnu, sloužící jako východisko k dalším interpretacím a diskuzím. Lze ho tedy možné například využít ke srovnání urbánních a suburbánních vzestupů a poklesů v průběhu času, a to i pro období meziválečné, či dokonce pro období před první světovou válkou, kdy proces urbanizace byl dominantní ve všech městských regionech tehdejší monarchie – i když se zde přirozeně odehrával s rozdílnou intenzitou.

V devadesátých letech byla dřívější diference mezi suburbanizačními tendencemi kapitalistických městských regionů na území Rakouska a urbanizací v podmínkách tehdejšího socialistického Československa nahrazena rozdílností mezi jednotlivými rostoucími a klesajícími městskými regiony (viz Turok a Mykhnenko 2007). V období po roce 2000 začala městská jádra na území Rakouska opět růst (podle modelu CURB dochází k obnově fáze urbanizace), zatímco městské regiony v České republice ukončily klesající tendence v nedávné době a to zejména díky růstu v jejich zázemích (model CURB klasifikuje tuto fázi jako suburbanizační).

Příspěvek byl vytvořen v rámci projektu *„Populační trendy a rozvoj bydlení v městských regionech České republiky a Rakouska: Srovnávací studie Prahy, Vídně, Brna, Štýrského Hradce, Lince a Plzně“* (MEB 060907, rozhodnutí č. 4454/2009-32).

THE EUROPEAN METROPOLITAN REGION NUREMBERG IN GERMANY – HISTORY OF ORIGINS, TASKS AND ACTIVITIES

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Abstract
For about ten years now, European metropolitan regions have been regarded as new strategy of regional planning. These regions are geared to the principle "strengthening the strong regions" so that they then become driving forces for the rural areas. In the present contribution the history of origins of metropolitan regions as well as their assets and drawbacks will be presented and discussed. Furthermore, a detailed examination of the case study Nuremberg, which has been approved as European Metropolitan Region only in 2005, will follow.

Key words: European Metropolitan Regions, Nuremberg, function of universities, future prospects

INTRODUCTION

On 25 April 2005, the Ministerial Conference on Spatial Planning officially approved Nuremberg as a European Metropolitan Region. Since, it forms one of 11 European metropolitan regions in Germany (Jurczek 2008a). The superordinate objective is to strengthen the urban centres of the country in order to establish them as driving forces and enabling them to compete with other regions in Europe and the world. However, these national strategies are based on international activities that, on a regional level, extend in principle the concept of the Global Cities.

Since the turn of the century a new concept of regional planning has evolved in Europe which is closely linked to the long-term development of metropolitan areas in post-industrial countries (DATAR 2003). Although the conceptual debate about such regions started rather late in the Federal Republic of Germany, it has meanwhile become a constant in spatial planning and research. While in the past areas of metropolitan character were described as 'city regions' or 'agglomerations', the term 'European Metropolitan Regions' first came up at the end of the 1990s. In the legal framework on regional planning of the German state they are defined as 'motors of the societal, economic, social and cultural development' that ought to preserve the achievement potential and competitiveness of Germany and Europe and contribute to the acceleration of the European integration process (BMBau 1995).

On the basis of this superordinate objective, the Ministerial Conference on Spatial Planning (MKRO) assigned seven European Metropolitan Regions (Berlin/Brandenburg, Hamburg, Munich, Rhine-Ruhr, Rhine-Main, Stuttgart and Halle/ /Leipzig-Saxon Triangle) which were complemented in 2005 by four more regions: Nuremberg (including further cooperation partners in Franconia), Hanover (including Brunswick and Göttingen), Bremen (with Oldenburg) and the Rhine-Neckar Triangle (fig. 1).

DEFINITIONS, BACKGROUNDS, OBJECTIVES

The term "metropolis" had been widely-used for a long time. It refers to a prominent major or capital city that represents a political, economic and societal centre within a country. On the other hand, the term 'metropolitan region' refers to a metropolis (in some cases to more than one) and its respective hinterland. It thus describes a 'region', or in other words, an area of medium spatial dimension within a larger territory, characterized by particular features, functional interdependence or a specific perception.

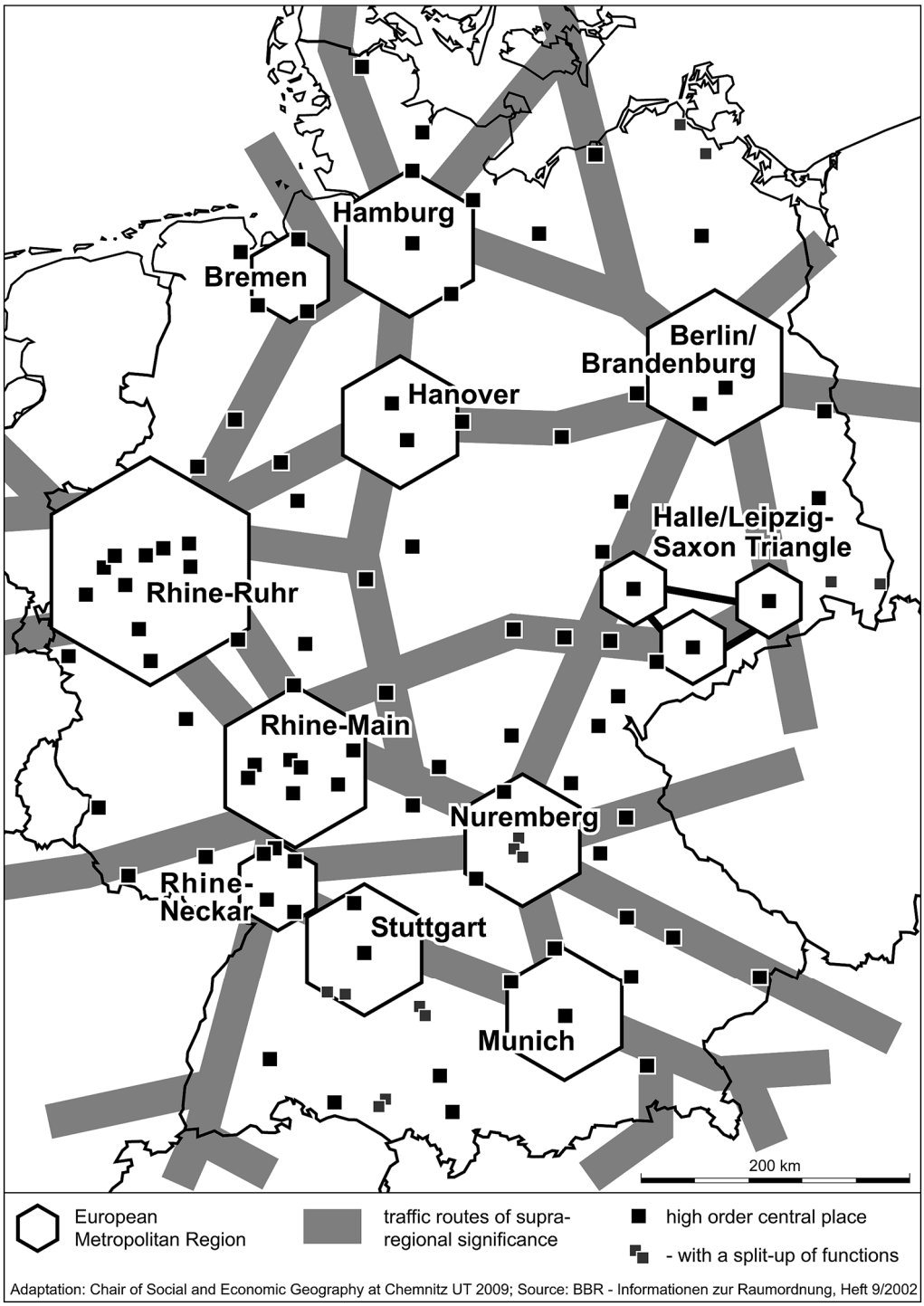

Figure 1 European Metropolitan Regions in Germany.

Similarly to other conceptual innovations, the term 'metropolitan region' had various forerunners; most of them are of Anglo-American origin. In this context, concepts such as 'World City' or 'Global City' were established that are synonyms for modern locations integrated into the network of the global economy. Both terms reflect a new understanding of the function of higher-ranking cities in the global urban system. The focus is now on the specific function of metropolises as outstanding locations for the international flow of trade and as nodes for financial and information transfers.

It can thus be stated that the economic function of metropolitan regions takes the centre in the current debate, both on the part of spatial research and practical planning. This becomes especially obvious in Kujath's definition. He points out the three following node functions determining such a region (Kujath 2005:20f):

- High-tech production location

Export quota, gross value added (in relation to the size of the labour force), and ranking order of economic sectors (size and proportion of labour force) (…). Within this first function, the branch structure, especially the significance of the second economic sector, economic power and the role the respective region plays as a (high-tech) export location for goods is of importance.

- Node of metropolitan services

Number of company headquarters, employees in company-related services (…). The indicators of the second node function represent the distribution of the power of decision-making and controlling expressed by the allocation of centres of decision-making as well as high-grade financial and company services (instrumentality and decision-making function).

- Communication and traffic node

Number of trade fairs (foreign exhibitors and visitors), air traffic (number of flights and passengers), air cargo (…). The nationally and internationally oriented infrastructure is the third function that represents the significance of a region as node of passenger and freight traffic as well as of communication and information exchange (…).

What are the reasons for and why has the debate about metropolitan regions in Germany received such a noticeable boost since the 1990s? Certainly, one of the reasons can be found in the vigorous discussions on the European level resulting in specific concepts. Those were initially inspired by worldwide considerations on the systematization and configuration of regions of metropolitan character. This, however, also implies that the moving power of this debate is not only an intra-European competition, but also an intercontinental one which influences the principles of regional planning and, above all, aims at a permanent strengthening of further economic developments. Against this background, it becomes apparent why at the turn of the century it was an absolute necessity that also Germany had to pay more attention to the concept of metropolitan regions and, moreover, to try to rapidly implement it.

CHARACTERISTICS, FUNCTIONS, FORMS OF ORGANISATION, NETWORK FORMATION

As already mentioned in the introductory chapter, the Ministerial Conference on Spatial Planning in Germany has assigned 11 metropolitan regions so far: Berlin/Brandenburg, Hamburg, Munich, Rhine-Ruhr, Rhine-Main, Stuttgart and Halle/ /Leipzig-Saxon Triangle, Bremen, Hanover, Nuremberg and the Rhine-Neckar Triangle. Among those, there are larger as well as smaller metropolitan regions. With regard to spatial dimensions, the metropolitan region of Hamburg is the largest one, followed by the metropolitan regions Rhine-Main and Halle/Leipzig-Saxon Triangle. In contrast to this, the Rhine-Ruhr region is by far the largest one in terms of population with a number of 10 million inhabitants. Partly highly varying figures can also be found with respect to other population indicators.

As far as economic power is concerned, the metropolitan region of Munich has the highest gross domestic product, followed by the metropolitan regions Rhine-Main and Stuttgart. Compared to this, the Halle/Leipzig-Saxon Triangle performs less well with rates that are 50% below those of the above named regions. In general, it has to be stated that the data of the

economic indicators show higher variations than those of the population indicators.

Beyond certain basic structures concerning population and economy, metropolitan regions have to fulfil specific functions which are listed in the latest Report on Regional Planning (BBR 2005:177ff.):

- The decision-making and control function refers to the spatial concentration of political and economic centres, in which financial and information flows are being controlled.
- With regard to their innovation and competition function it can be stated that metropolitan regions are innovation centres as a rule.
- As far as the gateway function is concerned, 'good accessibility from international locations and multiple options for 'face-to-face contacts' (…) are essential factors for the exchange of knowledge and information (…)'.

Altogether, 17 indicators have been included into the analysis on the international level. Due to the better data records for national comparisons, further indicators were complementarily examined (currently 24 indicators). Apart from that, it can be expected that the research on the methodology for the definition and classification of metropolitan regions will be further pushed forward in the future on both the national and international level. Other significant characteristics refer to the form of organisation and assignment of tasks of metropolitan regions. Here, the most important principles are as follows (BBR 2005: 188f.):

- Metropolitan regions need a strong regional self-government: 'A political, legal and organisational re-arrangement of local and regional tasks and responsibilities is one of the essential elements of a metropolitan regional planning policy (…)
- Metropolitan regions can be understood as regional alliances with common responsibilities (…)
- Metropolitan regions require specific regional location policies (…).'

Another aspect is the cooperation between metropolitan regions. On the national level, they joined in the initiative 'European Metropolitan Regions Germany' to represent their common interests, coordinate their activities, learn from each other etc. Lively communication processes also exist on the European level; in some areas cross-border alliances have been established or cooperation projects motivated by the aim of being able to compete with the growing number of globally significant metropolitan regions (with more than 10 million inhabitants) developed. This was also the background for the foundation of the METREX network, in which European Metropolitan Regions have become organised (www.eurometrex.org).

THE CASE OF NUREMBERG – A EUROPEAN METROPOLITAN REGION

On 28 April 2005, the Nuremberg Metropolitan Region with currently about 3.5 million inhabitants has been approved as a European Metropolitan Region by the Ministerial Conference on Spatial Planning (MKRO). This decision was preceded by intensive preparations and negotiations. With regard to the required structural features and functional aspects they are highly complied (European Metropolitan Region Nuremberg 2006 a). These aspects are compared with each other by Liebel (2005:147) in a Strength-Weakness-Analysis. Concerning the decision-making and control function the existence of branches of some renowned enterprises belongs definitely to the regional strengths and potentials.

According to empirical surveys, there are altogether about 150.000 companies in the whole research area whose export quota is about 40% and they have a GDP (2004) of about 103 billion Euros. These enterprises "are characterised by their wide diversity of industries and orientation to small to medium size. One fifth of all companies, with nearly 40% employees subject to social insurance contributions, belong to the producing sector. More than one third of these are active in the commercial, transport and gastronomy fields. 44% belong to the service sector, where ca. 1.1 million persons are employed." (www.em-n.eu)

The following technological core competences are especially important: Medicine and health care, Information and communications, Energy and environment, Transportation and logistics, new materials, Automation and production engineering, Automotive engineering. These core competences are complemented by the following inter-disciplinary technologies: Mechatronics, Power electronics, Optics, Lasers and Photonics, Nanotechnology, Biotechnology, Biomedicine.

Nevertheless, Liebel (2005:147) names also several location weaknesses that might be impeding for the further development. These include the following aspects: "weak private sector with headquarters of global enterprises, only few important national and federal governmental organisations (ministries, agencies or authorities), lacking supranational organisations (EU, UN, NGOs)."

In contrast to this the innovativeness and competitiveness of the European Metropolitan Region Nuremberg is mainly positive according to the investigations by Liebel (2005: ibid). He identified the following strengths:

- "wide-ranging research landscape within the university and higher education sector,
- leading positions of knowledge-based services in certain areas,
- numerous inter-communal cooperation and networks,
- active foundation scene and high technological efficiency,
- highest engineer-density in the FRG,
- rich cultural equipment in the historic-cultural as well as in the modern field,
- location of significant events"

In contrast to this, he only identifies two weaknesses or obstacles: "networks and cooperation structures are partly insufficiently linked to the peripheral regions; relatively weak equipment of state R&D institutions in the extramural sector."

Concerning the gateway function the following strengths turn out:

- "gateway function to the CEECS and to China,
- excellent connection to the European rail, road, and water network,
- international airport,
- most important hub for logistics in the South of Germany,
- international top 10 location for the modern exhibition centre (Nürnberger Messe)"

Rather impeding might be the following weaknesses: "Numerous transport routes are still under construction; partly discussions concerning financing; plan of deviating some transport connections via other metropolitan regions are under consideration; wanting consideration in programmes and plans due to the lacking designation as a metropolitan region."

Even when regarding atmospheric conditions many things speak in favour of the international positioning of Nuremberg and three other cities in Middle Franconia – together with the neighbouring districts and independent cities (Beck 2004) – so that there is broad consent concerning the approval of being a European metropolitan region. This region comprises territorially the axis of the cities Nuremberg-Fuerth-Erlangen-Schwabach, four districts of the industrial region Middle Franconia (Erlangen-Höchstadt, Fuerth, Nuremberger Land and Roth), four districts of the Western part of Middle Franconia (city of Ansbach and the districts of Ansbach, Neustadt/Aisch-BadWindsheim, Weißenburg-Gunzenhausen), the two districts Forchheim and Neumarkt in the Upper Palatinate that are strongly interlaced with the metropolitan area, six districts partially interlaced with the metropolitan area (cities of Amberg, Bamberg and of Bayreuth, districts of Amberg-Sulzbach, Bamberg and of Bayreuth) as well as 13 cooperating partners (cities of Coburg, Hof, Würzburg and of Weiden in the Upper Palatinate, districts of Coburg, Haßberge, Kitzingen, Kronach, Kulmbach, Lichtenfels, Neustadt a.d. W., Tirschenreuth and Wunsiedel i. F.).

Concerning the territorial delimitation of the Nuremberg Metropolitan Region (see fig. 2) there are controversial opinions. Sceptics challenge among others the stretch of the territory which, in

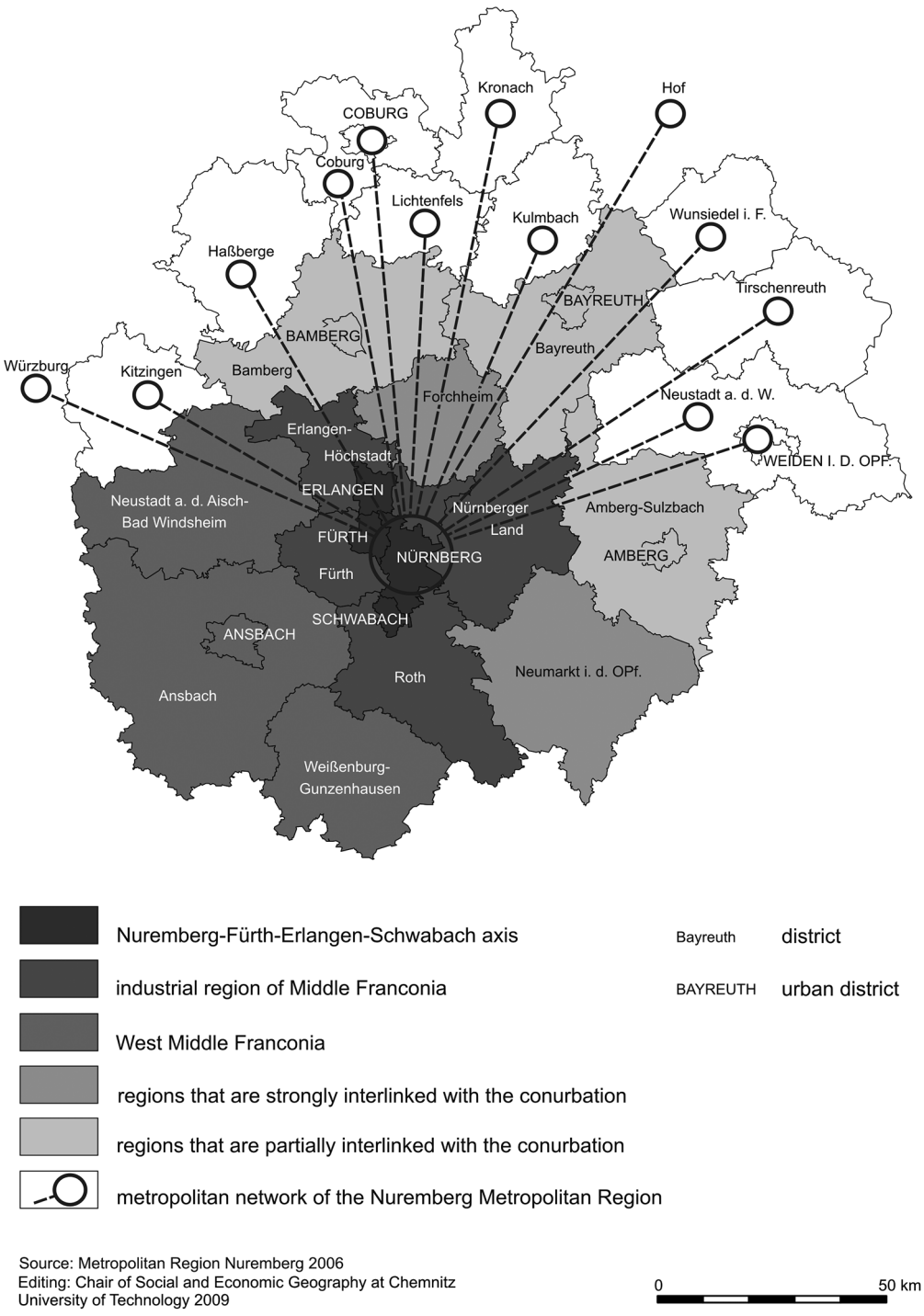

Figure 2 European Metropolitan Region Nuremberg.

their opinion, is too large and this may lead to confusion and inefficiency. Furthermore, unpopular measures – such as considering fusions, i.e. reducing higher education institutions – would become more feasible. In contrast to this backers argue that it is a voluntary and thus intended cooperation which needs to be accepted. Further, there is not only an above-average high economic power but also a high variety of 'soft' location factors that are contributing to a high quality of life (Region Nürnberg e.V. o.J): Infrastructure, Exhibitions and Trade Fairs, Research and Development, Education, Culture, Music and Festivals, Lifestyle and Events, Family.

On the basis of these positive location factors, the form of organisation and further work stages were eventually realised. The base for this is the "Charter of the Nuremberg Metropolitan Region", which was submitted on 12 May 2005 in Erlangen and adopted by municipal decision-makers. In the preamble of the Charter of the Nuremberg Metropolitan Region (2005) "the actors aim at a sustainable development and increasing prosperity in this region. The Nuremberg Metropolitan Region acts according to the European model of polycentrality. Based on the spatial, structural, historical and geographical features this region disposes of outstanding preconditions. For the establishment of a Regional Governance it can draw on a successful tradition of regional cooperation."

By the way, a complex form of organisation, which meets the complex structure of the European Metropolitan Region Nuremberg, has been established: "The organisation of the EMN is viewed as an innovative example of self-governing within a metropolitan region, in modern linguistic terms metropolitan governance. The core idea is that representatives from different social areas – industry, politics, administration, culture and sport – assume joint responsibility for the region. The council forms the democratic legitimating core of the Nuremberg Metropolitan Region, in which 54 lord mayors, mayors and rural administrators work together. Also included, as co-opted members, are two members of the Bavarian state government with residence in Franconia as well as one president each as representative of the four rural district parliaments and administrative districts concerned. A board of directors is assigned to each forum, comprising a political speaker, a speaker for specialised areas, and a general manager. In the management group of the metropolitan region, the boards of directors of the forums prepare strategic recommendations for the council, together with the council chairman, coordinate projects, and discuss current topics." (www.em-n.eu)

Parallel to activities in the fields of local politics and functional planning runs an intensive dealing within the tertiary sector. Supporting document is, for instance, the dissertation by Liebel (2005) whose research results concerning the Nuremberg Metropolitan Region were published. Further research work dealing with metropolitan regions is carried out at different national and international universities. Furthermore, the findings of this relatively new approach of spatial planning are entering university teachings and they are discussed in the frame of knowledge transfers (Institut für Entwicklungsforschung im Ländlichen Raum Ober- und Mittelfrankens e.V.). In 2005, there was introduced a corresponding masters programme at the Freie Universität Berlin labelled "Metropolitan Studies". Although this is of great interest because of topicality, this research approach ought not to be overestimated. Detailed analyses of this topic seem to be desirable but they should not take inflationary dimensions.

It is a fact that there are altogether 18 universities (European Metropolitan Region Nuremberg 2006b): the universities Erlangen-Nuremberg, Bayreuth and Bamberg as well as ten colleges, one Protestant university (in Bayreuth), the College of Fine Arts (in Nuremberg) as well as two Schools of Music (Nuremberg-Augsburg, Würzburg). About 100.000 students are registered in these universities. In addition to that numerous research institutions proposing a wide range of core competences have to be mentioned. Besides, the higher education area is characterised by the following subject-specific focuses (www.em-n.eu):

- "Internationalisation,
- technological core competence and interdisciplinary technologies with functioning organisational structures and associated research institutions,

- high regional development potential thanks to outstanding educational opportunities for the next generation of scientists and engineers,
- spin-offs from universities,
- and events" (e.g. Long Nights of Sciences).

Not least, the high significance of scientific research and teaching can be easily seen when looking at the realisation of already two Days of Sciences (2007 in Nuremberg and 2008 in Bayreuth).

An interesting example for a so called "best-practice-project" in sciences forms the "Summer School for managers of today and tomorrow" which was organised by the Forum Zukunft Oberfranken e.V. und der Commerzbank AG with the topic "Franconia 2010 – High Potentials in the Nuremberg Metropolitan Region" (see www.summerschool-zeitsprung.de). To this project the author of this article contributed actively, amongst others by organising an excursion to Prague. The aim of the organisers was to "give another important impetus to safeguard the future of the region". The 25 students mainly coming from Franconian universities had the opportunity to live and work together for nine days. Here, presentations, discussions and excursions were to the fore. Contentwise, a wide range of topics were touched – for instance Franconia as location for science, economy, culture and media as well as for families; the latter was treated under the headline "work-life-balance". As an ostensible result a journal called "Zeitsprung" was designed and distributed in and outside Franconia. In this way the level of awareness of the Nuremberg Metropolitan Region – especially of the Upper Franconia region – is increased on the one hand. On the other hand, students being future multipliers may identify more with their referential region and may be more intensively committed – for instance in their working lives – as it would have been the case without such a motivating Summer School.

Additional activities include different projects where the efforts to effectively integrate rural areas present an important concern. There has been organised a symposium dealing with the topic "strengthening the strengths" focussing on rural areas (European Metropolitan Region Nuremberg 2007). In the frame of the "Demonstration Projects of Spatial Planning" (MORO) should be displayed "how rural areas may profit from cooperating within the network of metropolitan regions. With the MORO project European metropolitan regions precise projects in the following fields of action: 'regional circular flows', 'clusters in rural areas' and 'border-crossing cooperation'; these projects are touched and realised" (www.em-n.eu). The latter means that border-crossing activities with Czech partners (preferably of the sectors higher education or health care) are intended. Similar considerations are taken in the Saxon-Bohemian borderlands where it is thought about the significance of metropolitan regions and its European or national effects (Jurczek 2008b).

Eventually, the Marketing Association that supports the work of the actors in the European Metropolitan Region Nuremberg in financial and non-material ways has to be pointed out. The concerns of this Marketing Association pursued since about ten years now are the following (www.region.nuernberg.de): "The Marketing Association of the Nuremberg Metropolitan Region has the function of communicating the strong points of the region in both a national and an international context, of portraying the attractiveness of the economic area and of emphasising the unique quality of life in the region (…). Local authorities as well as hundreds of companies and private individuals are involved in the forward-looking marketing of the metropolitan region. Chambers of Industry and Commerce, associations and local trade unions also participate in this task." At the same time there are three main tasks to the fore: "Taking Action in a Regional and International Arena", "A Network of Advertising" and "Shaping the Region Together".

FUTURE PROSPECTS

Recent evaluations suggest that the significance of metropolises and metropolitan regions is most probably going to increase in the future. Against this background Blotevogel (2001:164f.) raises the question whether it would be more efficient for Germany to have one single prominent but world-

wide operating metropolis like France (Paris), Great Britain (London) or Japan (Tokyo) instead of having a larger number of maybe less influential metropolitan regions. On the other hand, this would be in contradiction to the federal structure of the state – even though the principle of equivalent living conditions enshrined in the Regional Planning Act has lately been more and more challenged. However, in the light of the trend towards globalisation, the development function of the European metropolitan regions is continuously gaining priority in the regional planning policy in Germany.

In any case, it is of great importance to precisely identify both the advantages and the disadvantages of the metropolis approach and to compare them. Thus, a number of essential advantages that determine the way decision-makers of German metropolitan regions think and act are listed below:

- voluntary participation and cooperative collaboration,
- involvement of a large number of participants,
- involvement of the private sector, particularly large enterprises,
- introduction of fresh accents and new stimuli,
- intensification of the commitment of the decision-makers,
- extension and promotion of the innovative power,
- chance for tying together existing endogenous potentials,
- improvement of the co-operation ability,
- basis for the formulation of a strategic development concept on a national and, moreover, an international scale,
- ideal starting point for the formulation of a professional mission statement as basis for future-oriented provisions for continuity,
- improvement of the supra-regional degree of popularity as well as the inner and, more importantly, the outer image,
- good prerequisites for the setup and extension of a modern infrastructure,
- opportunity for the reduction of the disparities between cities and surrounding areas.

In contrast to this, there are also numerous disadvantages that can influence activities in the metropolitan regions negatively. The most significant ones are as follows:

- complex, complicated and thus poorly working organisational structures,
- danger of an only temporary instead of a permanent commitment of the participants,
- often no employment of additional staff for the management of the metropolitan region,
- potential overlapping of competences (e.g. business development, urban and regional planning),
- possible distraction from actual problems (e.g. remote location, insufficient transport connections, unfavourable economic development),
- a mere imitation of (inter-)national role models,
- partly only national importance with few chances of gaining international significance,
- often high pressure of competition between the metropolitan regions,
- danger of overrating their functions and effects,
- high expenditures for achieving the status as metropolitan region,
- no state subsidies as they are not (yet) granted for these purposes,
- permanent pressure for modernisation,
- possible predominance of one or more metropolises at the expense of suburban areas and/or rurally structured parts of the region.

In this respect, the ability of German metropolises and metropolitan regions to integrate into a correspondent European network is increasingly gaining significance. Nevertheless, it is widely agreed upon the fact that there is no notion as 'Global Cities' in Germany. Blotevogel (2002) regards the metropolitan regions Berlin, Hamburg, Munich, Rhine-Main and Rhine-Ruhr as less significant within Europe than London, Paris, Brussels or Randstad/Netherlands (now called 'Delta-Metropolis'). DATAR, the office for regional development in France (2003), even ranks the metropolises Berlin and Hamburg in the third and Cologne/Düsseldorf and Frankfurt upon Main in the fourth category within Europe.

Other research questions focus on the problem whether metropolitan regions should, or even have to cooperate in order to be successful in the long run. This cannot be answered clearly since active cooperation can produce synergy effects, but it does not have to be an automatism. In certain fields metropolitan regions will remain competitors because one of their primary aims is the consolidation or improvement of their own position in competition.

Some issues, however, have not yet received sufficient attention, such as the role suburban and rural parts of the metropolitan regions play. Do they gain significance by participating in those regions or do they lose their specific character and endogenous potential? It is similarly difficult to say whether the proclamation of metropolises and metropolitan regions leads to more 'glory' or more 'misery' on the part of the citizens affected (Kaltenbrunner 2001). Long-established ways of life, such as urban life or urbanity with all their advantages are in danger of being restricted or might even vanish. These problems are also in the centre of the sceptics' critical debate on the currently (inter-)nationally propagated metropolitan regions. Time will show which spatial structures are able to prevail in the long term and how regional planning and policy will deal with them.

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Résumé

Již deset let jsou evropské metropolitní regiony považovány za novou strategii regionálního plánování. Tyto regiony sledují princip „posílení silných regionů" tak, aby se staly hnacími silami pro venkovské oblasti. Článek představuje a diskutuje historii původu metropolitních regionů včetně jejich výhod a nevýhod. Teoretické části jsou dokumentovány na podrobném výzkumu Norimberka, který byl schválen jako metropolitní region teprve v roce 2005.

REPORTS

The International Scientific Conference 50 Years of Geography at the Faculty of Science, Palacký University in Olomouc

On 10th and 11th June 2009 the Department of Geography at the Faculty of Science, Palacký University in Olomouc arranged the international scientific conference on the 50th anniversary of its founding. The programme of the relatively broad-based celebration included the meeting of geography graduates of Palacký University (27th June 2009), attended by 150 former students, and publishing the "History of the Department of Geography at the Faculty of Science, Palacký University in Olomouc" presenting the most important stages of the Department development to a wide geographic public.

The UP geographical department was founded by prof. Vitásek shortly after its renewal in 1946. Prof. Vitásek led the department a few years and till the mid 1950s it changed its organizational form several times. Initially it had the status of a separate geographic institute which was later included into a broader system of all the science-oriented departments of the Faculty of Education. After its later split this workplace was part of the Department of Biology, Geography and Geology, and later the Department of Geology and Geography. Even within the existence of "broader" departments, the geographical work-place preserved its administrative and especially research autonomy. After the implementation of the university reform in 1953 the university was reorganised. Geography was transferred to the Faculty of Natural Sciences of the newly established University of Education and after the next reorganization in September 1958 it returned at the Faculty of Science of Palacký University.

The independent Department of Geography was established on 1st May 1959. The main objective of the Department, as well as the whole Faculty, was the education of secondary-school teachers of geography. After 1989 the Department changed its specialization. It gradually abandoned its one-sided orientation and started to develop Geoinformatics (studies opened in 1997), International Development Studies (2003) and the study of Regional Geography (since 2006). In the period after 1989 the Department has noticed a significant increase in scientific research activities and intensification of its contacts with partners, especially abroad.

The conference on the 50th anniversary of the Department was held under the auspices of the Rector prof. Lubomír Dvořák, Dean of the Faculty prof. Juraj Ševčík and mid-Moravian branch of the Czech Geographical Society and it took place in the premises of the Art Center UP (Konvikt). At the opening ceremony of the conference, commemorative medals were awarded to emeritus members of the Department in recognition of lifelong contribution to the Department reputation. These awards were presented also to the members of the "founding" generation such as doc. Stanislava Šprincová, the main representative of Czech geography of tourism and recreation, and in memoriam doc. Vladimír Panoš, a significant carsologist and speleologist. Neither the contribution of the "second" generation of geographers in Olomouc was forgotten. The medals were awarded to the prominent Czech geomorphologist prof. Jaromír Demek, who led the Department in Olomouc from 1988 to 1995, and also doc. Miroslav Pluskal and dr. Ivan Lepka. The next group of awarded people included representatives of Czech and Slovak geographical departments and institutes, as well as cooperating departments from Slovenia and Poland.

Not only the social but also the professional programme of the conference was really rich. More than one hundred geographers from five countries came to Olomouc to actively participate in the conference, among them all Czech and Slovak geographical departments, including the presidents of the Czech Geographical Society and the Slovak Geographical Society – doc. Siwek and prof. Matlovič.

In the plenary session three key note speeches were given: Physical geography - a vision of Czech science for the 21st Century (Karel Kirchner, Jaromír Kolejka), Behavioral geography as a part

of geography with evident and productive approaches (Vladimír Ira) and Spatial analysis of the birthplaces of geography professors in the Czech Republic (Tadeusz Siwek). Discussions were subsequently divided into three sections: physical geography (17 contributions); social and economic geography (61 contributions); geographic education, cartography and GIS (18 contributions).

The physical geography section debates focused thematically on the geoecology and landscaping, less discussed topics represented lectures on hydrology, climatology, geomorphology and pedology. The section of social and economic geography traditionally contained the highest amount of contributions. Delivered speeches included all the basic disciplines of the field, the regional disparities research, integration processes, regional policy enjoying greater interest, and a separate group was formed by contributions dedicated to the rural area. Regarding the geographic education, cartography and GIS section six papers were presented on the issue of geographic education; the remaining eleven contributions were concerned with cartography and GIS. In a separate poster section 21 research results were presented. The conference itself was naturally an opportunity for informal meetings, exchange of experience and preparation for further cooperation between the representatives of presented geographic departments.

On the occasion of this conference realization, the university published the abstracts proceeding and the conference proceedings with full texts of presented contributions will be available in autumn 2009.

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Miloš Fňukal

Current Research in Human Geography at the Department of Geography, Palacký University Olomouc

The Department of Geography of the Palacký University Olomouc participates since the beginning of 2009 in three projects granted by either of the two Czech grant institutions. All projects are concerned with various aspects of the spatial organization of the geographical environment.

Significant social, economic and cultural transformations have occurred in the Czech Republic since 1990 and these transformations are reflected in the lives of the Czech population. The complexity of the spatial behaviour dynamics is enhanced by individual motivations and interests, personal social-demographic characteristics and cultural, political, economic and technological factors at the macro level. The principal objective of the Czech Science Foundation project (no. 403/09/0885) ***"Spatial models of behaviour in a transforming urban environment: a time geographical approach"*** is to verify whether new phenomena appearing in the inner city structure after 1990 influence the spatio-temporal models of human behaviour and whether these models can contribute to municipal planning. The analysis pursues preferably the phenomena (i.e. "innovations" spreading in space and time) with a high leisure time potential, typically the shopping malls or leisure centres, and population segments with a high amount of leisure time, high level of adaptability to the innovations and also relatively higher degree of social and economic dependence (students, women on maternity leave, and seniors). The project is essentially based on the theoretical assumptions and methods of the time geographical school, particularly the use of space time activity budgets recording the daily trajectories of the individuals and the identification of their constraints. Phenomenological context and in-depth analyses of the human behaviour are surveyed as well. The research is carried out in four cities (Brno, Ostrava, Olomouc and České Budějovice) and four other institutions are involved (Department of Regional Economics and Administration, Masaryk University Brno, Institute of Geonics AS CR, Brno branch, Department of Geography and Regional Development, University of Ostrava, and

Department of Geography, University of South Bohemia, České Budějovice). As the Czech social sciences currently lack a complex research of the spatio-temporal human behaviour we expect, apart from completing particular case studies, also the formulation of generalised theoretical-methodological background that could be used in other similar researches.

Daily urban systems as a special case of a functional region are analysed within The Grant Agency of the Academy of Sciences of the CR project (no. IAA301670901) ***"Spatio-temporal organisation of daily urban systems: an analysis and assessment of selected processes"***. Interactions between a core and a periphery of a region organising a daily urban system must occur on a daily basis (i.e. a daily trajectory of an individual or a group of individuals) and exceed a minimum intensity. The project has two main intentions: 1) to use the interaction based on retail services commuting (either real or modelled) for delimitation of daily urban systems and 2) to analyse the internal structure of these areas on the basis of daily trajectories or cycle of individuals. Such a pursuit of internal structuration of a daily urban system has not been very frequent in geography but it has its internal logic since the time span (i.e. one day) is usual both in the studies delimiting daily urban systems and in many studies, especially time geographical, on daily activities of individuals. The full research is carried out in two regions organised by the cities of Brno and Olomouc. However, the delimitation of the daily urban systems is going to concern the whole territory of the Czech Republic. In this project the Department of Geography cooperates with the Department of Regional Economics and Administration, Masaryk University Brno. The expected research results could provide the general insight into spatial expression and reflection of the social and economic transformation processes that have shaped our country since the end of the 1980s and could make a contribution to the regional planning.

The Grant Agency of the Academy of Sciences of the CR project (no. KJB300860901) ***"Quantitative methods and synthesizing graphic methods in approximation, projection and modelling of geographical phenomena"*** is concerned with more theoretical and methodological issues of a spatial organisation, though it provides the examples of the application of selected methods. Basically the project involves the discussion and application of the spatial interaction models and the question of graphical expression of the results. Methods leading to fulfilment of the objective are diversified. They can be divided into two basic spheres – quantitative methods in approximation, projection and modelling of geographical phenomena and synthesizing graphical methods in approximation, projection and modelling of geographical phenomena. Partial objectives of the project, both methodological and application, include for instance the regional of the Czech Republic and identification of nodal regions based on the labour commuting and confrontation of this regionalization with existing socio-economic geographical regionalizations, the application of the spatial interaction models on the national level and their use in geographical differentiation of space, the assessment of influence of barrier effect of borders and environmental line components on the organization of socio-geographical space in selected model regions, the construction of synthetic graphical expression of spatial organization of model regions by adequate graphical tools, or the verification of possibilities of alternative definitions of masses and distances in the spatial interaction models and their calibrations. The project is solved in cooperation with the Brno branch of the Institute of Geonics of the Academy of Sciences of the Czech Republic. The project has wide opportunities of practical use for planning and revision of partial components of the geographical organisation of the society (e.g. the correction and optimization of the administrative division, planning and optimization of communication network at the national and regional level etc.). Stress on the natural spatial interaction can contribute to more precise and effective proposals of the strategies of regional development.

Pavel Klapka

Physical and Environmental Geography at the Department of Geography, Palacký University

Last several years saw the favourable scientific development in the field of physical and environmental geography at the branch of physical geography of the Department of Geography of the Palacký University in Olomouc. The fact that young workers, who also gained their PhD's for their work, considerably participated in this research is very promising to the future.

Environmental historic issues related to the surface runoff were solved by Pavelková Chmelová (2006) in her work, published as a Ph.D. thesis, on **environmental and historical analysis of land use changes and their effect on surface runoff in the catchment**. Parts of the thesis were also published in journal and conference proceedings (Chmelová, Šarapatka 2002, Chmelová, Šarapatka, Pavka 2006, Chmelová et al. 2006). Extensive land exploitation by over-intensified agriculture in the past has decreased natural retention and accumulation capacities of catchments areas in the Czech Republic. Many natural barriers to surface runoff have been removed; inappropriate land use, namely incorrect agricultural and forestry practices such as monoculture cropping in both fields and forests, along with the effects of heavy machine induced soil compaction have significantly decreased infiltration capacities (Kovář et al., 2002).

During the evaluation of serious flood events which have taken place in the Czech Republic in recent years, one of the proposed, and much disputed reasons for the severity of the floods, is that of a decreased retention and accumulation function in the of landscape. The effect of „flash floods" affect smaller areas, either at the catchment or subcatchment scale. The point is that appropriate measures taken in land use might be able to moderate flood severity and thus, the subsequent consequence both to the built environment on which humans are directly dependent and the environment in general. The destructive effects of „flash floods" tend to impact agricultural catchments, especially those with insufficient land cover that has had intensive runoff generation and where there are insufficient soil infiltration capacities.

Land use changes that have occurred during the last eight decades in the subcatchment of the Krupá river basin were analyzed. The analysis of both aerial photographs and databases from archival data containing cadastral units, cadastral maps and old forestry maps was the first step. The second step was to estimate, through simulation, how the runoff processes in the Krupá river catchment have been influenced by land use changes. The historical development in this period was described in two parts beginning with the displacement of the German inhabitants after the Second World War and ending with a description of post-1989 agriculture.

The DesQ hydrological model and the CN method were used to simulate the effects of these land use changes on the runoff processes. The DesQ hydrological model is used to calculate the maximum water flow in unobserved small watersheds. These small watersheds are those where there is insufficient number of hydrologic stations. The parameters we can change in DesQ model are various, but we have chosen to focus on differing rainfall and land use patterns. CN (curve number) values are in a range between 0 to 100, higher CNs are associated with higher runoff potential watershed. The CN is usually estimated from handbook tables that list land use, hydrological soil group and the antecedent moisture condition. The Krupá river catchment (left tributary of Morava river) serves as the general study area. The Krupá river has a total drainage area of 112 km^2 and its length is 23 km.

Runoff conditions in the catchment can be assessed by CN. The CN was calculated for the upper reaches of the Krupá river in 1930 and 2002. Runoff conditions were significantly changed due to land use changes in those years. In 1930 forest areas covered only 2.619 ha compared to 4.393 ha in 2000. Changes of age structure and species composition of forest are reflected in the CN. Generally speaking, arable land and pine monoculture areas have a higher CN. In regard to runoff conditions some agriculture areas in 1930 transformed to forest in 2002 indicate worse hydrological conditions. These examples show us that the surface runoff can be influenced by land use changes. The CN formulation was used for

further hydrologic calculation e.g. HO surface runoff (mm) and A potential maximum retention (mm).

The environmental issue of the air quality is being solved by Martin Jurek. His long term interest and research in this field resulted in the dissertation on the **air quality in the district of Olomouc and trends in atmospheric pollution in 1981-1990 and 1991-2000 as a response to structural changes in industry (with the utilisation of GIS tools)** (Jurek 2007b). The aim of his research was to analyse the development in air pollution levels bound to the background of industrial sources. The timeframe of this study was equally divided between the late period of a centrally-planned economy in the socialist Czechoslovakia and the early years of an emerging market economy. The Czech emissions inventory records for the large sources of air pollution as well as air pollution levels from two monitoring stations were examined to detect and assess the hypothetical trends. Three-year moving averages and the Mann-Kendall non-parametric test were applied to air pollution levels averaged over a period of one year as well as over two distinct seasons: warm (April to September) and cold (October to March). All the large sources of air pollution as recorded in the national emissions inventory were spatially identified and sorted into seven functional groups according to the frequency of occurrence in the district of Olomouc and considering the prevailing technology with an effect to air pollution (heating plants, smelting of metals, manufacturing of machinery, food processing, extraction and processing of raw materials, agricultural production, other types of manufacturing). The emissions inventory was analysed with respect to the seven functional groups to find out the trends in emission levels for the distinct groups of sources. Using GIS tools the emissions were spatially encoded to a 2 km × 2 km grid overlay of the district of Olomouc, this way being visually presented to demonstrate the changing intensity and distribution of emissions within the district.

The main findings of the study are the following: the air pollution levels of suspended particulate matter as well as of sulphur dioxide decreased over time, while no general trend was detected for nitrogen oxides. The group 'heating plants' was recognized as responsible for the major part of total emissions from the large air pollution sources, especially the central heating plant in the city of Olomouc was detected as a source capable to overrun all other changes within the structure of annual emission totals. Three more groups were assessed as significant: 'smelting of metals', 'manufacturing of machinery', and 'food processing'. Generally decreasing trends in annual emission totals over the period 1981-2000 were detected. With the 'heating plants' a general upgrade in technology and partly in the fuels used was interpreted as the major cause of the observed reduction. For the other three significant groups a synergic combination of investment into technology and reducing the production due to its obsolescence or lack of competitive strength was identified. The emissions were spatially distributed into five stable clusters of grid-cells, representing the city of Olomouc, the towns of Litovel, Uničov, Šternberk, and the municipality of Hlubočky. The overall values of emission densities were identified as decreasing over the studied period.

Partial results of the Ph.D. thesis were published in scientific journals and conference proceedings (Vysoudil, Jurek 2004, Jurek 2004, 2006, 2007a).

Research in fluvial geomorphology and biogeomorphology is a domain Blanka Loučková. Her Ph.D. thesis (Šaňková 2008) deals with **bottomland vegetation in relation to fluvial geomorphic landforms in near-natural river reaches in Hrubý and Nízký Jeseník Mountains**. Field surveys were conducted in permanent plots located along transects perpendicular to a stream channel in five reaches of the Opava, Černá Opava and Branná rivers. In each of plot, the following characteristics were collected: the percent canopy cover of each vascular plant species present (using Zlatník's scale), landform type (alluvial gravel bar, vegetated island, riverbank, floodplain, terrace), height above channel, distance to channel, sediment-size characteristics, slope, aspect and width of floodplain. In twenty-one plots also soil pH, soil enzymatic activity and dry matter content were measured.

At first, vegetation data collected in 2007 (relevés from 71 study plots) were statistically analyzed using ordination methods to search for a pattern in species composition and to determine which of the measured variables are the main factors influencing the woody and herbaceous vegetation. The binary discriminant analysis was used to reveal significant association of species with specific type of fluvial landforms. The results of both direct and indirect gradient analyses suggest that the key environmental determinants of riparian vegetation variation are the fluvial-geomorphic surface, width of the floodplain, distance to the river channel and altitude. In case of herbaceous vegetation (woody and herbaceous vegetation were treated separately) also the difference in elevation above the channel bed has a significant influence on vegetation composition. The binary discriminant analysis revealed that numerous species can be associated with specific type of fluvial landforms. Herbaceous and woody plants identified along study reaches were classified into four groups according to their bottomland occurrence based on performed analysis and field investigation. The vegetation composition on dominant geomorphic surfaces (bar, island, bank, floodplain, terrace) was described.

The investigation of the species richness of riparian vegetation in relation to fluvial landforms revealed clear trends in diversity along the studied reaches - species richness per site (number of species for each fluvial landform) was generally highest on the floodplain and decreased gradually to the channel bed and to the terrace. The comprehensive three-year monitoring (2005-2007) of vegetation dynamics in 49 permanent plots on three transects on the Opava river (147 relevés) is presented in second research chapter. For more detailed survey, individual habitat types were distinguished on fluvial geomorphic surfaces. The year-to-year changes in woody and herbaceous cover and in number of species on different habitat types were closely evaluated and displayed in sets of graphs. The final chapter focuses on vegetation recolonization on different habitat types after major flood disturbance (July 1997) in the course of ten years on the Branná river. In three repeat sets (2000, 2005, 2007) were obtained 21 relevés, the vegetation has been described and the successional changes were analysed. Various spatial and temporal patterns of recolonization were determined by the analysis of vegetation reestablishment on adjacent quadrats located along transects.

Partial results of the research on biogeomorphology and fluvial geomorphology were also published in journals and conference proceedings (Hrádek, Loučková 2009, Šaňková 2007, 2008).

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Pavel Klapka

REVIEWS

Těžba nerostných surovin na území ČR a její geografické aspekty [Extraction of mineral resources in the Czech Republic and its geographical aspects]
by Irena Smolová.
Olomouc: Univerzita Palackého v Olomouci, 2008.

This publication has been so far missing at our book market. It was partially caused by the fact that the issue of spatial changes in the extraction of mineral resources after 1989 was not a subject of research interest of the Czech geography. In geographical literature only partial themes were solved, complex approach being presented just in the reviewed monograph. Chosen methodological approach of the author, associate professor at the Department of Geography, Palacký University, is very successful. In the introduction to the study she deals with a resource potential of the Czech Republic, then she draws attention to historical aspects of the extraction of the mineral resources, takes into account the legislation of the extraction and then discusses the transformation of the mining industry after 1989 and the development of the extraction of individual resources in 1990-2006. Inclusion of the chapters on contemporary situation of the Czech Republic and the extraction of mineral resources in the world and on economic effect of the extraction of the mineral resources on the regional development is also very favourable. The author in the monograph proves that she is an erudite specialist in this issue, which is confirmed also by a number of published articles or communications both at domestic and international conferences. Particularly her emphasis on the revealing of the causes of the present state can be positively assessed. The monograph pays special attention to the role of the foreign direct investments in privatization and later transformation of the mining companies.

We can agree with the author's statement that the Czech Republic possesses despite its small area relatively rich resource base. The history of their extraction witnesses that the mining has been widespread in the Czech lands and reached very good level. In the past gold, silver and other ores were mined. The Czech production was by its extent at peak European levels. Variety and richness of some mineral resource deposits significantly affected later industrialization of the Czech lands. Thanks to wide resource basis and sufficiency of energetic resources the Czech lands belonged at a time among the most industrialized regions in Europe.

The development in 1948-1989 was influenced by the centrally planned economy, which was logically reflected in the whole economy of Czechoslovakia. The economy was oriented at heavy industry (metallurgy, machinery, metal working), which demanded strongly for a large amount of mineral resources. Not only the extraction was enormous, but in many cases it was at the very level of economic rentability or even under that level (particularly ores and hard coal). In many places of the Czech Republic the extraction had an extensive and exploitative character. Central bodies did not care about the effects on landscape. As late as in the 1980s and particularly after 1989 the slump programme was fulfilled in case of ores, coal and a number of other mineral resources, which under new economic conditions were not competitive.

As the author notes, the total extraction dropped significantly with the most of the resources. For instance in comparison with 1989 the hard and brown coal extraction decreased in 2006 by 50-60%, the extraction of the uranium dropped even to 7%. In the Czech Republic the extraction of the polymetalic ores was finished in 1993. Adequately to the extraction development also the area and number of mining spaces dropped significantly. Extraction of practically all mineral resources follows today the rules of the market economy, which is being significantly helped by the presence of international companies, which export the resources to the international markets. The monograph pays attention also to this issue.

I suppose that the publication of Irena Smolová can interest a number of specialists dealing completely or partially with the issue of the mineral resources. The publication has for university students, particularly regional geographers, even

the character of the textbook. The students can use the acquired knowledge in a number of partial geographical disciplines, such as for instance the geography of industry, geomorphology etc.

Václav Toušek

Notes for contributors

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The articles and reports are published in English (preferably UK version), the articles being accompanied by the Czech résumé. The articles are submitted to referees anonymously. The manuscript consists of (1) title page, (2) abstract, (3) text, (4) references, (5) résumé, (6) tables, and (7) figures (each part submitted separately). Articles should not normally be longer than 8,000 words, excluding abstract, references, tables, and résumé. The minimum length is 4,000 words. Reports should not exceed 2,000 words.

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Demek, J. 1996: Catastrophic implications of global climatic change in the cold regions of Euroasia. *GeoJournal* 38 (3), 141-250.

Theses:
Halás, M. 2002: *Cezhraničené vázby, cezhraničná spolupráca*. PhD thesis, Department of Human Geography and Demogeography, Comenius University.

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KRNAP 2004: *Plán péče o Krkonošský národní park a jeho ochranné pásmo*. (http://www.krnap.cz/), accessed 2005-06-23.

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Geographica 40 | 2

ISSN 1212-2157