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CHANGES OF LAND USE IN PRAGUE URBAN REGION

I. Bičík, L. Kupková: *Changes of land use in Prague urban region.* – Geografie–Sborník ČGS, 111, 1, pp. 92–114 (2006). – Land use changes in Prague urban region (the capitol - Prague, the Prague-East and the Prague-West districts) are evaluated in the article in the time period of 1845–2000 and that is done on the data basis of the land use structure in the years 1845, 1948, 1990 and 2000. The evaluated time horizons are historical milestones in social development of Czechia, the stress is put on the last ten-year period of transformation. The LUCC Prague methodology was used for the evaluation of land use development. The intensity of occurred changes is analysed through the index of change, the typology of main landscape processes in individual partial phases of the evaluated period is analysed further. The cadastral territory of Čestlice was selected as a case study, in which the comparison of land use structure in the years 1845 (reconstruction from cadastral maps) and 2003 (field mapping itself) was carried out in details.
KEY WORDS: land use – landscape processes – interaction nature and society – Prague urban region – Czechia.

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1. Introduction

Geography studies landscape as a complex of mutual relations between nature and human activities on different levels – from the local to the global one. These relations and their consequences are changing with time and therefore also the landscape changes in its character, structures and its space arrangement.

For a long time, geographic research into landscape developed especially in its individual components, i.e. according to the division of geography into disciplines studying individual components of the landscape. Only little attention was paid to studying of mutual relations of these components and of their impact on the whole, i.e. the landscape in a particular place and at a particular time, as far as it was ever done, it was with little scientific erudition and strong pragmatically (ex. territorial planning) or it had a strongly descriptive character and mainly instructive and informative goals. Haggett (1975) states that geography is situated at the boundary of natural and social sciences, that it is the only science interested to the same extent in natural sphere and living conditions of man, regional contrasts and unequal distribution of living assets and values among people. Geography therefore deals with the structure and interaction of two main systems: ecological connecting man with the environment and spatial connecting one area with other ones through a complicated exchange of flows. At the beginning of the 1970s when new

themes of the state of living/nature environment and of its protection were opened in the scientific and decision-making spheres, geography had a unique opportunity to respond to the newly forming “social order” and to substantially help to its solution. But as in geography at that time a narrow specialization according to individual disciplines clearly prevailed over studying of the whole complex, i.e. landscape, geography remained aside of this new research sphere characteristic for the last quarter of the 20th century. This was the case not only in our country but also in the world and, beside the belated development of geography as a science due to the complexity of its research object (i.e. landscape as a complex and not in its individual components), a significant role was played also by feeble managing background (in Czechia also political one) necessary to go through in this new direction of scientific research.

Johnston (1998, p. 141) divides geographical studies according to four main approaches, the first of which we consider as principal for our research: according to the interest specified by the orientation of individual disciplines studying components in two main semi-complexes – physical and human. Their mutual interconnection is feeble and there are only few themes in which they meet – one of them being environmental problems in a large context of the interaction nature – society. This can be studied on different order levels. Because of very heterogeneous detailed information necessary for such studying, studies in local and microregional character prevail and studies dealing with mezzo- or macroregional levels or even global studies dealing with a large complex of relations nature – society are less frequent (Johnston et al. 2001 ; Haberl et al. 2001, 2002a, 2002b; Douglas, Huggett, Robinson 1999 etc.). More frequent are mainly those aimed at individual components or elements of the landscape system.

During the last 30 years, the interest in studying development and territorial differentiation of the interaction nature – society has increased. It is undoubtedly due to a substantial increase of negative impacts of social-economic sphere development on the landscape not only on local and microregional level, but also on higher order ones. Therefore we consider the evaluation of the interaction nature – society as one of present key problems to which science must respond.

Studying of the above-mentioned interactions must include looking for driving forces involved in individual period of the last two centuries in changes of landscape functions and influencing land use. Land use as reflection of the interaction nature – society is in individual parts of the world in different development stages and a corresponding reaction in “delayed” regions can help to understand processes of interaction development in more advanced regions.

During the last 50 years, land use has been more and more influenced by progressive differentiation of functions of the core and the periphery. Transfer of many activities to centres of higher order level and emergence of new functions of these cores cause greater differences in area structure between cores, their background and other territories. The largest centres, as for instance Prague, have been progressively increasing their territorial framework, in which they influence emergence of new functions. The consequence is a different development of area structure of large cities and of their background in comparison with the other territories of the state. Specific conditions of land use structure development of Prague urban region enable to analyse trends which are progressively emerging or which will emerge in future in other agglomerations. They are mainly a significant increase of

built-up and the other areas in the suburban zone, a decrease of arable and agricultural land both in evidence and sensibly higher in field, formation of specific functions (service areas, suburban family housing, recreation forests, waste sites, etc.) significantly differentiating the land use structure development of core regions from the peripheral ones. Because of the development capacities of Prague the obtained results can be used also as a basis for reflections on land use development in other post-totalitarian countries.

2. Theoretical issues for evaluation the interaction nature – society in the territory of Czechia

Similar land use structures of pre-industrial period (dependent above all on natural conditions) have been changing since the beginning of industrialization under the influence of the modernization of the society. Territorial differentiation has been progressing due to the growing impact of economic, social, political and location factors in industrial and post-industrial society. We presume that the present land use in Czechia corresponds to location in core or peripheral territorial position and to natural conditions of the analysed locality.

Land use has been developing to a deeper territorial differentiation of area structure state and development both in individual localities and in greater territorial units in dependence of functions given to them by the society in a certain period of its development. Self-supplier economy of the pre-industrial society is characterized by a larger extent of agricultural land resources (the maximum was reached in the 1880s, see Jeleček 1985), by the intensity and use of its individual categories, by a strong pressure on forest areas as a source of a further increase of agricultural land resources, by a small extend of built-up and the other areas. The production-market function of landscape in industrial society causes regional differentiation of agricultural effectiveness and therefore also regional differences in specialization and intensity of land use structure development. Multifunctionality and steadily increasing conflicts of functions in the landscape of the post-industrial society with an increasing importance of non-productive functions (water management, ecological, protective, recreation, residential, etc.) are accompanied by an extraordinary increase of built-up and the other areas, but also of areas with different degree of protection with limited possibilities of economic use, or with specific functions with impact on land use structure.

In the case of post-socialist European countries, the effort to reach a high intensity of farming and a maximal self-sufficiency on the state level lead to undesirable impacts on the quality of environment. After the turn of political situation there occurred rapid changes in volume, structure and intensity mainly of farming and naturally also substantial and relatively quick changes in area structure as well as a progressive slowing down of landscape degradation (Bičík, Götz 1998; Bičík, Jančák 2001; Bičík, Jančák 2005). Together with progressive globalization influencing more and more also Czechia, an imbalanced space land use development will be influenced by importations of agricultural products, by promotion of subsidized, i.e. cheaper, EU products at the Czech market with impact on inland producers,

but also by more general processes of urbanization and suburbanization, by restructuring of town agglomerations, etc. which influence, directly or indirectly, also the area structure. Land use development can largely depend on these processes both on global and continental level, but also on the level of state or region. This is due mainly to the fact that in more developed countries rural areas are conceived as “space dimension of collective consumption” (Cater, Jones 1989, p. 219), where the production function is one of many and in many fields it is today a quite insignificant one. It is due to the fact that the prevailing urban population requires in this stage of society development from rural areas many functions needed mainly by urban population (recreation areas, water resources protection, nature protection, military areas and training grounds, dumping grounds, etc.). For the two last centuries, land use in Czechia has been significantly changing both vertically, i.e. with altitude, where especially nature factors prevail in land use structure, and horizontally, where position, i.e. mainly social economical, factors prevail. There occurs a deep regional differentiation of territorial functions and thus land use structure changes. These changes were characterized in many publications as well as in Czech and foreign scientific journals (Bičík et al. 2001; Bičík, Jeleček 2005; Bičík, Kupková 2001 and others); therefore we will concentrate in this paper on trends in land use changes and on their causes in Prague urban region.

3. Aims and methods

Land use represents one of the ways of studying landscape and landscape changes. With regard to the structure of the observed categories of use, land use is a more suitable term. Under our conditions, individual categories of land use represent a different degree of transformation of the original natural environment. On the one hand we differentiate categories (classes) of rather natural character (forest or water areas, permanent grassland), although used to a certain intensity, then categories with a more pronounced degree of transformation of the original natural environment (arable land, permanent cultures: gardens, orchards, vineyards, hop fields) and categories of areas, where the original environment has been totally changed and where it is an artificial or devastated landscape (built-up, the other areas). Certain inaccuracy and generalization are evident. Evident is also a shift of classification of individual areas during the more than 160 years of keeping evidence in Czechia. Other possible imprecise evaluations may be due to the fact that this evidence is based on balance evaluation of decrease and increase of individual categories per partial territory (cadastral territory, municipality, district, region, state) and it does not record a possible change of location within the given territory without a change of its extent. Territorial units are from this perspective a black box and data on land use structure in our evidence do not allow observing this aspect.

Essential is also the fact that we deal with the extent of individual plots according to the evidence kept by geodetical service per cadastral territory and not with the real state in field which is always rather “ahead” the records. While in the past this difference used to be quite small, in the transformation period (after 1990 land was restituted to 3.5 million of owners) differences between records and the real state in field reach, in arable land, about 10 %, differences in other categories are sensibly smaller.

In spite of certain limitations and inaccuracies given by the used statistical evidence of area structure, the similarly aimed research based on area structure database in comparable territorial units is well founded because of three facts:

Data of land use structure represent a certain generalized image of the interaction nature – society on the level of cadastral territory.

The possibility to compose data of individual cadastre, or of comparable territorial units formed out of them, to greater territorial units enables, in a necessary degree of generalization, to evaluate the state and development of the landscape and the driving forces existing on individual regional levels.

This possibility to compose data enables to interconnect the knowledge of the interaction nature – society on all levels from the local to the state or the above-state one, although in a certain generalized form. So oriented research is a link of the research into long-term development of the interaction nature – society from the local to the state and higher regional level.

It follows that research into the dynamics of the interaction nature – society based above all on data on land structure offers the possibility of evaluation applied mostly in regional and above-regional comparisons. It is not suitable for observation of the dynamism of the interaction nature – society on the lowest (i.e. local) level, here is better to use methods using mostly geoeological approaches and detailed map data from different time horizons. They enable to study territorial details and represent an important feedback for our research based on statistical evidence of land use.

In research into land use development we use database established by mapping of the Franciscan cadastre in the years 1826–1843 (dated 1845 when data on the former districts were published) and on land use evidence from the years 1948, 1990 and 2000. It was being compiled in the years 1994–1998 and its concrete output is the database at the Faculty of Science, Charles University (LUCC UK Prague) and several dozens of published articles. The methods are described in detail in many publications (Bičík, Štěpánek 1994; Bičík et al. 1996; Bičík, Jeleček 2005) and it is not the aim of this paper to list them here in detail. We would only like to stress that out of about 13 000 data for cadastral territory some 9 000 basic territorial units (BTUs) were formed, the total area of which is comparable in all four time horizons (the differences do not exceed 1 % of the BTU's area), which enables to compare both changes in area of individual categories and changes in structure of eight basic and three summary comparable categories. Arable land, permanent cultures, meadows and pastures form together agricultural land; forest areas; built-up, water and the remaining areas form together other areas.

Among the most important published papers resulting from these projects are those which closed a certain stage of work and enabled to evaluate the obtained results (Bičík et al. 1996, 2001), or those of methodical character (Bičík 1994, 2005), or contributing to knowledge of certain relationships between area use development in Czechia and selected indices (as altitude, official price of agricultural land, position, etc. – Bičík, Štěpánek 1995; Bičík 2001; Bičík, Kupková 2003; Mareš, Štych 2005 and others). In our geographical literature these methods are based on similar studies on land use structure development of the former North Bohemia region (Pokorný 1970, 1972; Bičík 1988), on historical-geographical analyses of dynamism of agricultural land use by Jeleček (ex. 1985, 1987) and on two papers by Häufler (1955, 1960). It is interesting that a greater attention was paid in Czechia to using of the original database under the form of land use evidence than to classical land use prepared by field mapping (Stamp 1945, 1950;

Kostrowicki 1962, 1965 and others), which was influencing geographical studies in Europe for at least twenty years (also in neighbouring Poland and Slovakia, see Biegajło, Paulov 1966; Biegajło 1972). As the land use structure concerns, we paid attention to Prague and to its background by using statistical data of land use (Bičík 1993, 1994) and data from Earth remote sensing according to the distance and individual segments from the agglomeration core (Kupková 2003). Recently a study combining analyses of area structure development in Prague urban region both based on statistical data and by comparison of detailed land use structure development in three model territories in Prague background (Bičík, Kupková 2006) was published.

The aim of this paper is to show, with the help of GIS instruments, land use structure development according to comparable BTUs in Prague urban region (for simplification we use administrative delimitation: Prague and districts Prague-East and Prague-West) in the years 1845-1948-1990-2000 and to try to explain principal trends and microregional differentiation of landscape changes which occurred in this period.

4. Land use structure development according to BTUs

Situation in land use structure development is documented with the help of the LUCC UK database Prague compiled from data on cadastral territories partly linked to basic territorial units (BTUs) comparable, by their territory, in all observed time horizons. It is evident that in the territory of Prague as well as in other regions of a significant concentration of social-economic activities, it was necessary, to ensure comparability, to link together original cadastres, because territories of an unknown land use structure used to be exchanged among them. Therefore we analyse in Prague urban region on the territory of Prague only 30 BTUs and on the territory of Prague-East and Prague-West districts in total 174 BTUs representing territorially

Table 1 – Land use changes in Prague

Area category	1845		1948		1990		2000	
	ha	%	ha	%	ha	%	ha	%
Arable land	47 251.7	72.4	42 798.7	65.6	26 795.2	41.1	26 360.1	40.4
Permanent cultures	1 802.4	2.8	5 878.9	9.0	5 873.7	9.0	5 867.7	9.0
Meadows	2 787.1	4.3	1 787.7	2.7	716.8	1.1	683.7	1.0
Pastures	4 774.8	7.3	1 646.4	2.5	426.9	0.7	404.1	0.6
Agricultural land	56 616.0	86.8	52 111.7	79.8	33 812.6	51.8	33 315.6	51.1
Forest areas	4 554.1	7.0	4 919.2	7.5	5 889.8	9.0	5 856.3	9.0
Water areas	1 104.9	1.7	889.0	1.4	1 316.6	2.0	1 313.3	2.0
Built-up areas	731.5	1.1	2 924.0	4.5	4 666.1	7.1	5 265.0	8.1
Remaining areas	2 232.2	3.4	4 426.1	6.8	19 576.2	30.0	19 476.6	29.9
Other areas	4 068.6	6.2	8 239.1	12.6	25 558.9	39.2	26 054.9	39.9
Total	65 238.7	100.0	65 270.0	100.0	65 261.3	100.0	65 226.8	100.0

Source: LUCC UK Prague

Note: Delimitation of Prague as in 2000 is based on data from cadastral territories transformed, to ensure comparability, into BTUs. Therefore our database does not always follow frontiers between districts and regions. There is thus a certain difference between the database delimited according to LUCC UK Prague and the evidence of cadastral bureaus.

comparable units, the total area of which differentiated in time by less than 1 %. Because of methods of the database compilation, it was necessary in some cases to link together, when forming BTUs, sometimes even cadastrals belonging to different districts. These differences from the course of external limits of Prague-East and Prague West districts and of Prague itself, by which we delimit the territory of Prague urban region, are visible on cartograms. In our analysis also the limits of Prague and both rural districts slightly differ from official limits of these three territories (as in 2000). Therefore our data rather differ from those given by the Cadastral Office, be it in the total area or in the area of individual categories. Table shows the area structure development in so delimited territory in the years 1845–2000 (bold data represent summary data of summary categories: agricultural land resources, forest, other and total areas), Tab. 1, Fig. 1.

Our database enables to analyse eight basic categories and for all of them it is possible to compile cartograms of the part of the category on the area of the territorial unit or cartograms of development of the category between two of the four observed time horizons. For the whole Czechia, samples of these outputs are given in publications Bičík et al. 2001; Bičík, Kupková 2003 and elsewhere. Here we want to use more complex indices we have already used previously to evaluate land use structure changes.

Index of change is evaluating by one figure the share of areas, on which a change of area of 8 basic categories within the given BTU occurred between two time horizons. Formula for calculation of the index of change is

$$IC = \frac{\sum_{i=1}^n |A_{1i} - A_{2i}|}{2 \times E}$$

The next three cartograms (Fig. 2, 3, 4) evaluate the set of BTUs in the territory of urban region in the periods 1845–1948, 1948–1990 and 1990–2000, which enables to compare the area dynamics of the transformation period with the previous stages of social economic development.

Index of change is in the first more than one hundred year period the highest in the proper core of agglomeration (Fig. 2). In the other part of Prague urban region, the index of change oscillates in the majority of BTUs up to 5, i.e. the level in which the category of use was changed in 5 % (and less) of the area of the given territory. Exceptionally there are BTUs with index of change up to 15. The most important changes in area use are registered in those parts of Prague which used to be freely linked to the historical core and which have undergone a significant transformation because of building of new industrial and storage structures and new residential houses mainly for lower social layers concentrating, in the period 1870-1930, in several waves new immigrants to Prague (Vysočany, Libeň, Holešovice, Žižkov, Vinohrady and others). The maximal index of change, i.e. 55.4, was registered during the more than one hundred year period in the cadastral territory of Bubeneč, where mainly building of more-storied houses in combination of villas with fenced gardens for higher social layers concentrated. These parts of urban region were manifesting a rapid population growth and progressively became administrative parts of Great Prague. A quickly developing transport infrastructure network was

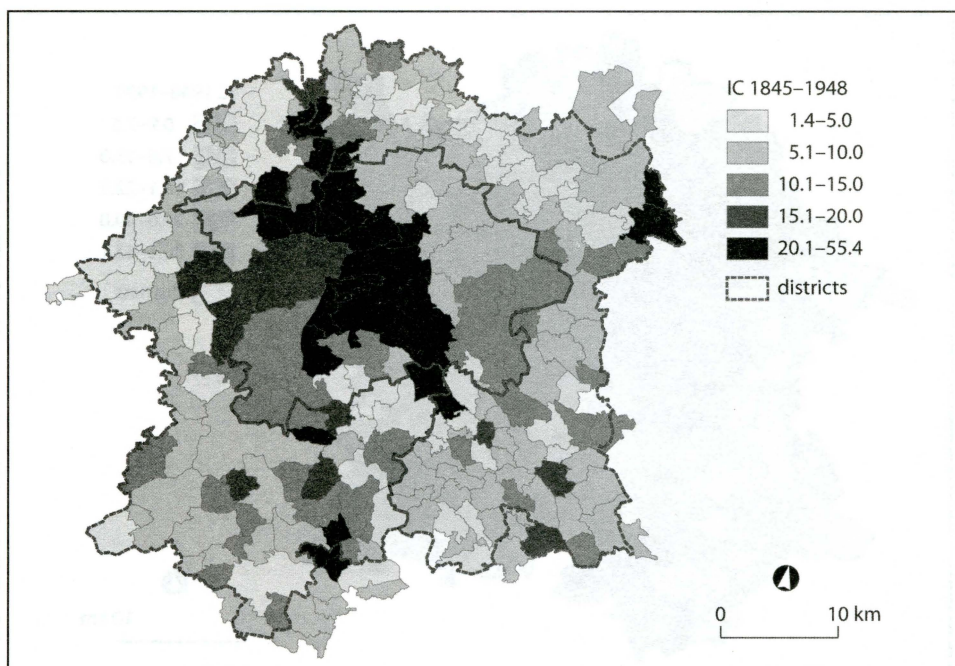


Fig. 2 – Development of index of change in the years 1845–1948 in the territory of Prague urban area (PUA; Prague + districts Prague East, Prague West). Source: LUCC UK Prague.

contributing to intensive changes in area structure. All this was occurring on the detriment of the up to then intensively used agricultural areas which remained in many places of “Great Prague” at least to the World War II.

In the period 1948–1990 (Fig. 3), there is an evident high level of index of change exceeding 22 in the majority of Prague BTUs (maximum: Veleslavín 62.1; minimum: Stránka near Brandýs nad Labem in Prague-East district: 0.94). Because of the length of the period (42 years), which is about 2.5 times shorter than the more than centenary previous period, we can say that the intensity of land use changes in this period (calculated for ten-year period) is about four times higher. It is characteristic that in this period the highest levels of index of change are concentrated in Prague itself. It is undoubtedly due also to the fact that we consider the town limit as in 2000 and therefore such delimited Prague include all territories administratively annexed to the town since 1948. The main reason of high values of index of change in this period is an intensive housing development mainly on greenfield sites, building of new industrial areas and transport infrastructure (D1 highway, addition of a double track on main railways, interconnection of newly built housing estates with town centre, etc.). A significant decrease in area is characteristic for agricultural land resources and mainly for arable land. It can be said that in this period structural changes in land use corresponding to departure from traditional forms of land use to new metropolitan functions of Prague urban region were going on or completed.

In Prague background there are evident significantly higher values of index of change in comparison with the previous period, which is clearly visible in the cartogram. This state results from a more intensive economic use of the background, mainly from a decrease of agriculture land resources

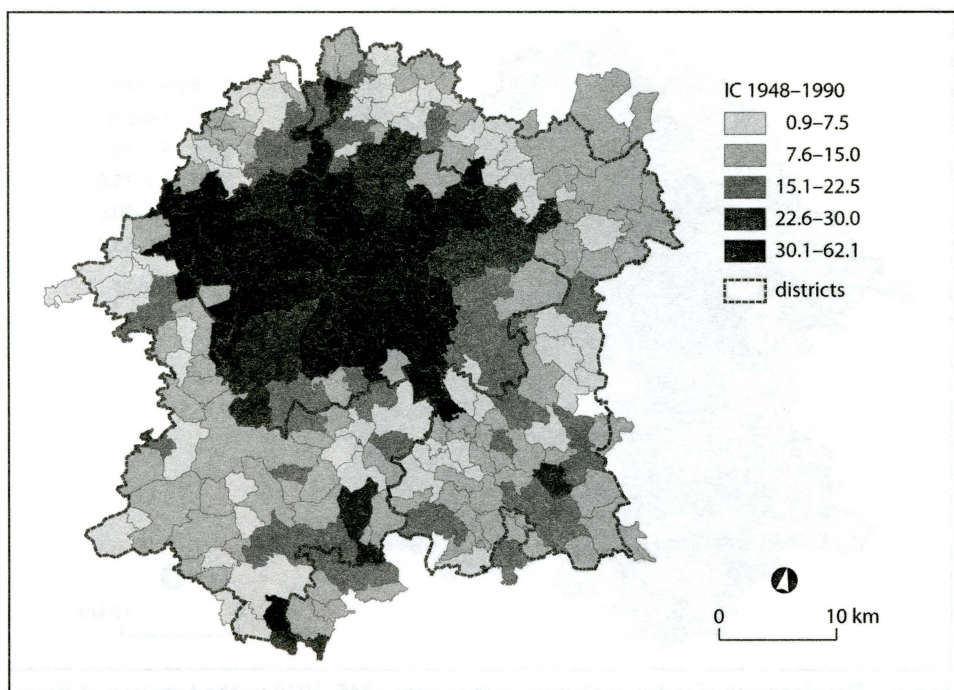


Fig. 3 – Development of index of change in PUA in the years 1948–1990. Source: LUCC UK Prague.

in favour of built-up and remaining areas (development of communication networks, development of industrial, storage and residential functions of some from the transport viewpoint well located settlements). In some BTUs southwards from Prague, there was a rapid increase of second residences which resulted in changes in land use connected with an increase of built-up areas and permanent cultures areas (gardens) on the detriment of forest areas or little fertile and mostly worse accessible agricultural land areas.

The last period 1990–2000 (Fig. 4) is only ten years long and its cartogram manifests the lowest level of changes. The table documents registered levels of index of change in unequally long periods and their standardization for a ten-year period. According to data from selected territorial units, in BTUs localized closer to the centre a high intensity of change was registered mainly in the years 1948–1990, somewhere even in the previous period. On the contrary, “rural” BTUs manifest the highest standardized index of change in the last decade of transformation 1990–2000 (max.: Krňany: 32.0, min.: 0.12: Holubice v Čechách), or in the totalitarian period (1948–1990). The total move in land resources structure in Prague background is higher during the last fifty or ten years. In spite of an increasing difference of evidence and real state of individual categories of land use in the field (mainly in the last period), it is a more general trend of an increasing index of change in Prague urban region.

More significant changes in land use in the years 1990–2000 are characteristic mainly for Prague background. It is undoubtedly both a consequence of suburbanization tendencies with an important building of residential houses of family type (Jesenice, Dolní Břežany, Kolovraty and

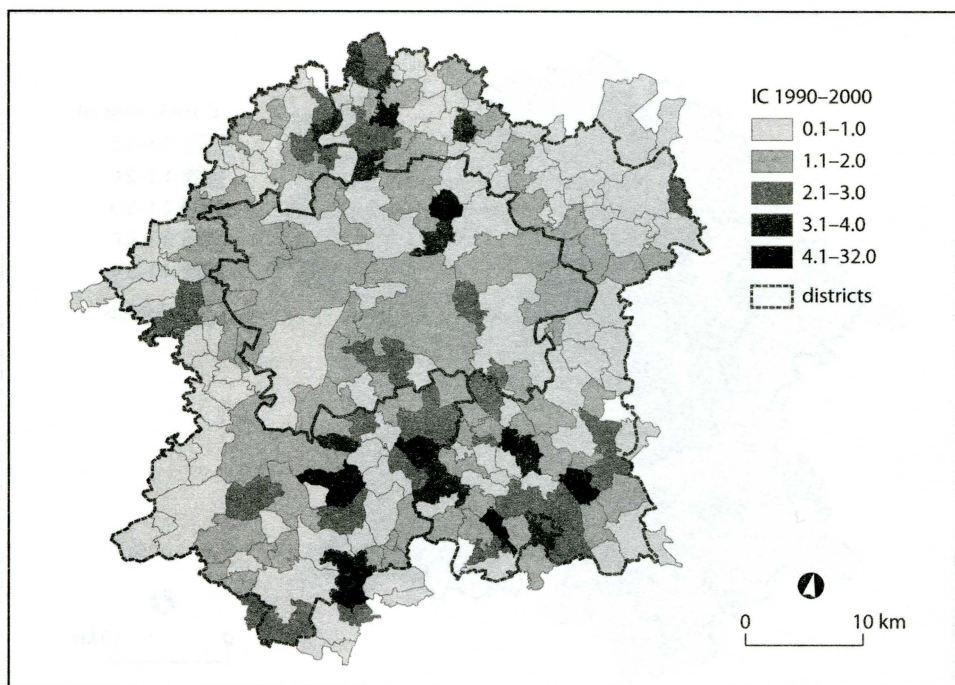


Fig. 4 – Development of index of change in the years 1990–2000 in PUA. Source: LUCC UK Prague.

elsewhere) and a result of construction of service and storage structures in the near proximity of Prague along highways (ex. Čestlice, Nupaky, Rudná and elsewhere). It is also an impact of some other phenomena caused by a significant lowering of the intensity of agricultural use of landscape due to cutting off of subsidies and to bad natural conditions of some BTUs in the southern background of Prague. In the territory of Prague, the move in the total structure of areas is very low. It is probably a consequence of a limitation of larger housing development but also of the fact that in this period the quality of evidence was not maintained and some changes in categories were not reported (mainly arable land transformed into meadows, pastures or laying fallow for more than four years), partly because of higher expectations of owners concerning compensations for confiscated arable land for non-agricultural purposes. There are many similar lands in the territory of Prague (ex. Radotín, Lahovice, Slivenec, Reporyje or some areas in the northern margin of Prague).

The index of change in the three observed periods is further evaluated with the help of typology of these changes. Figure 5 depicts whether the given territorial unit was, by the size of its index, below (0) or above (1) the average value of Prague urban region. Position in the group of three digits characterizes in the first position the oldest period, in the second position the totalitarian period (1948–1990) and in the third position the transformation period (1990–2000). The picture documents the southeastern sector of Prague as the territory with most significant changes from the viewpoint of land use structure (intensity of landscape change) in the whole monitored period of about 155 years. Besides this territory, there are other three lines in which

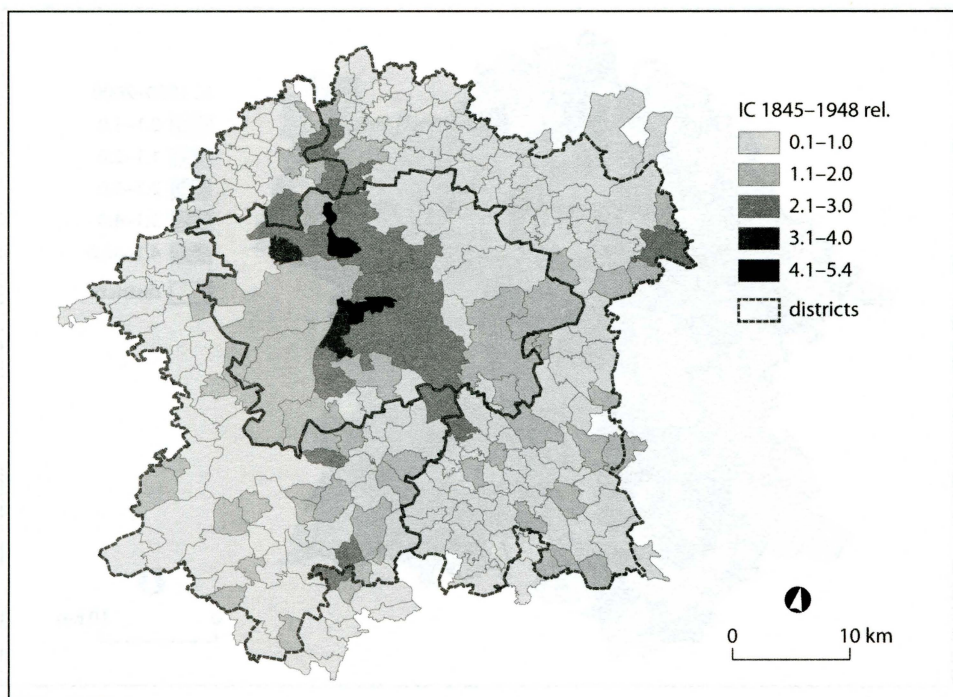


Fig. 6 – Standardized index of change on 10 years in PUA (1845–1948). Source: LUCC UK Prague.

there are always several BTUs with a high intensity of landscape changes. The first ones could be characterized as territories bound to the Vltava course southwards from Prague, the second as areas immediately without Prague border on the north-west along the Vltava course, the third line is south-eastwards from Prague and follows the D1 highway and the road Prague-Ríčany. On the contrary, nearly a half of BTUs in rural districts manifest a state where in none period the intensity of area structure changes was above the average of Prague urban region. From this viewpoint, they are territories where urbanization, or suburbanization pressures were not so strong and had not a more significant impact on area structure changes.

Because of different lengths of individual analysed periods, index of change was standardized for ten-year period (although such simplification may be imprecise, especially for the period 1845–1948 (as it withholds various trends) depicted by the following series of cartograms (Fig. 6, 7, 8) with the same scale classification. These cartograms clearly depict the first period as that where only a small part of historical Prague itself clearly linked to the Vltava course reaches the three highest value of land use structure change. The second, totalitarian period manifests substantially higher standardized values of index of change for a ten-year period, when the proper territory of “Great Prague” reaches in the majority of BTUs two highest values of index of change of the unified scale. Also Prague background manifests substantially higher changes in land use structure than in the previous period, although they are territorially differentiated. A similar image, i.e. more intensive changes in the period 1948–1990, is

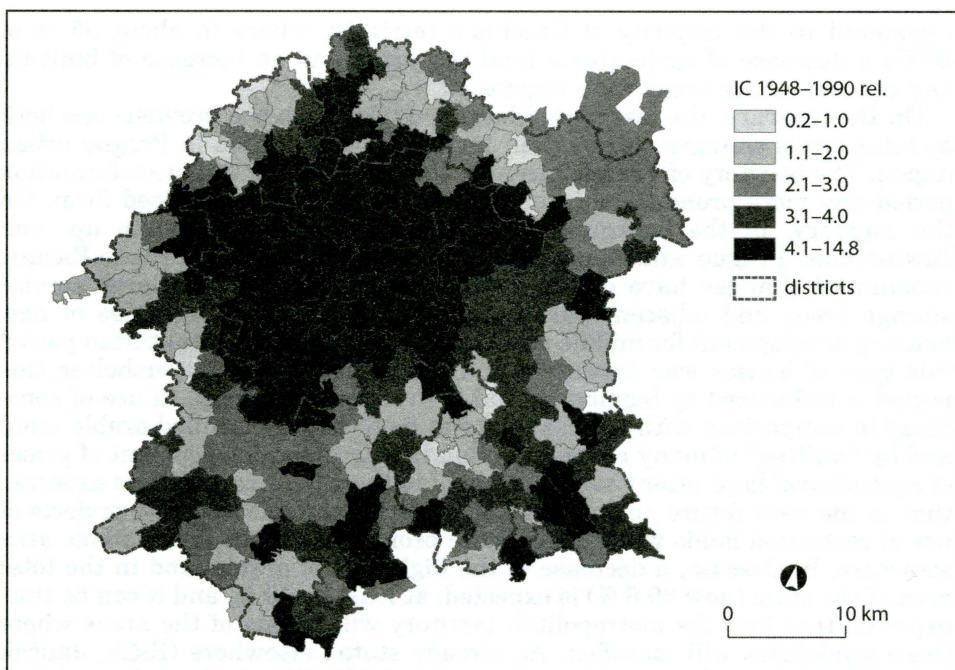


Fig. 7 – Standardized index of change on 10 years in PUA (1948–1990). Source: LUCC UK Prague.

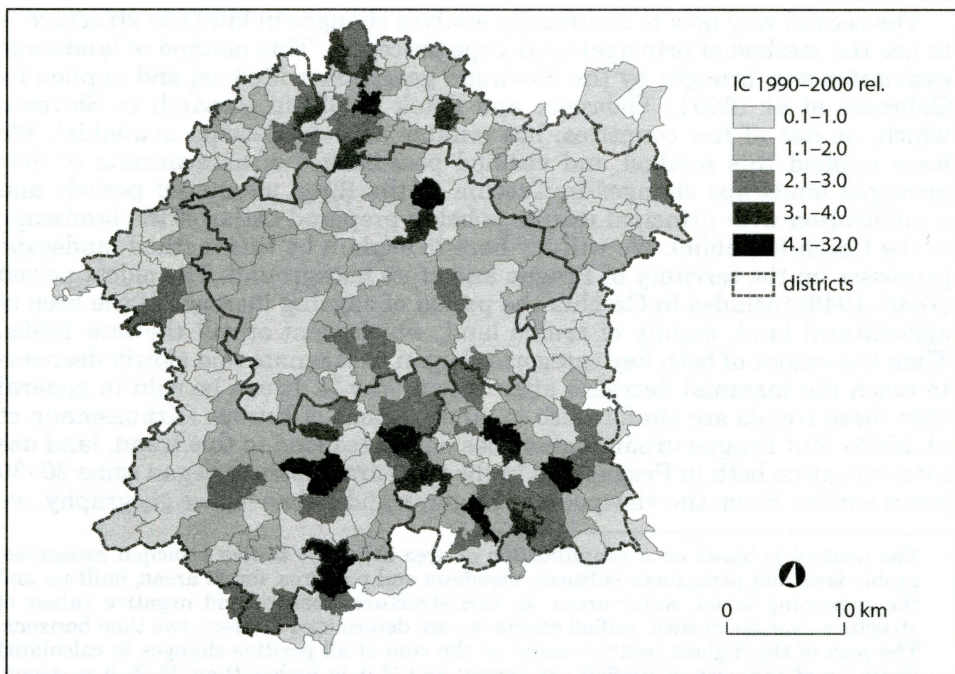


Fig. 8 – Standardized index of change on 10 years in PUA (1990–2000). Source: LUCC UK Prague.

registered in the majority of Czechia's territory, where in about 95 % of BTUs a decrease of agricultural land resources and an increase of built-up and the remaining areas were registered.

On the contrary, the last period largely differs from the previous one both by intensity of changes and by their territorial distribution in Prague urban region. The territory of Prague has not registered during this transformation period any more pronounced intensity of changes in standardized form. On the contrary, in the background, both along the Vltava course up- and downstream Prague and along D1 highway and the road Prague-Ríčany, substantial changes have occurred. There have concentrated large service storage areas and adjacent parking areas and intensive processes of new housing development for middle and higher class, as in the totalitarian period this type of houses was expensive and scarce in Prague. Nevertheless this period is influenced by lagging behind of evidence of changes in use of some areas in comparison with the real state in field (mainly untitled arable land) and by "waiting" of many restituents (land owners) for development of prices of agricultural land after Czechia's entry to the EU. It can be thus expected that in the near future not reported changes in land use and new projects of use of restituted lands will cause a more pronounced move in the whole area structure. In Czechia, a decrease of the high part of arable land in the total area of the state (now 39.8 %) is expected, at least by 10 %, and it can be thus expected that just the metropolitan territory will be one of the areas where these tendencies will manifest. As already stated elsewhere (Bičák, Jančák 2004), a certain stabilization in area structure development can be expected only after foreigners will be allowed to purchase land in Czechia which should be in 2012.

The second way how to summarily analyse changes in land use structure is to use the method of principal landscape processes. This method of landscape evaluation was brought by the Slovenian geographer Medved and applied by Gabrovec et al. (2001), Gabrovec and Petek (2002) in research in Slovenia which, as one of few countries, has similar data as Czechia available¹. We have applied this method and verified possibilities of ascertaining of four principal landscape changes in Czechia in the three monitored periods and a publication with principal results is being prepared (Atlas of the landscape of the Czech Republic). We will try here to explain by this method landscape processes on the territory of Prague and of its background. The oldest period (1845–1948) includes in Czechia the period of ongoing increase of the area of agricultural land, mainly of arable land, which went on till the late 1880s. Then the extent of both key categories began to stagnate and slowly decrease to reach the maximal decrease after World War II. It can be said in general that these trends are similar also in other regions of Europe (Kraussmann et al. 2005). But Prague urban region does not correspond to this trend, land use intensification both in Prague and in the two rural districts began some 20–30 years earlier. From the viewpoint of Hägerstrand's time-space geography, we

¹ The method is based on a simplification of area structure to five principal categories: arable land and permanent cultures, meadows and pastures, forest areas, built-up and the remaining areas, water areas. In this structure, positive and negative values of structure changes of such unified categories are determined between two time horizons. The part of the highest positive value on the sum of all positive changes in calculated (increase of the area of unified categories) and if it is higher than 75 % it is a strong, 50–74.9 % a mean and 25–49.9 % feeble process of intensification of farming, grassing down, forestation or urbanization.

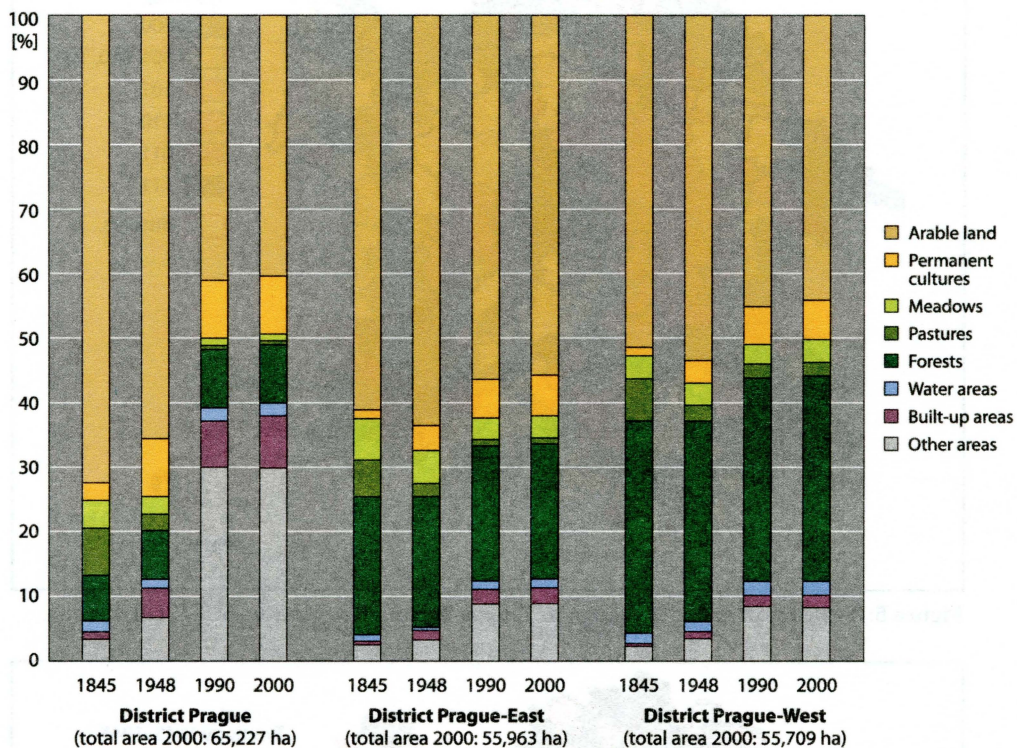


Fig. 1 – State and development of land use structure in Prague and in Prague-East and Prague-West districts in the years 1845 – 1948 – 1990 – 2000. Source: LUCC UK Prague.

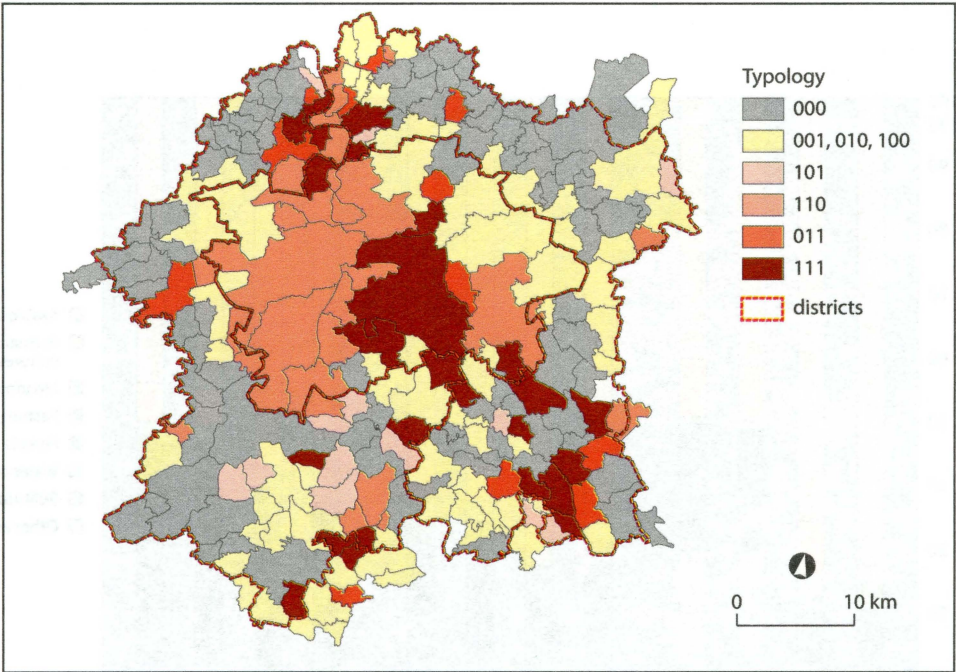


Figure 5: Typology of index of change in Prague urban area. Source: Lucc UK Prague.

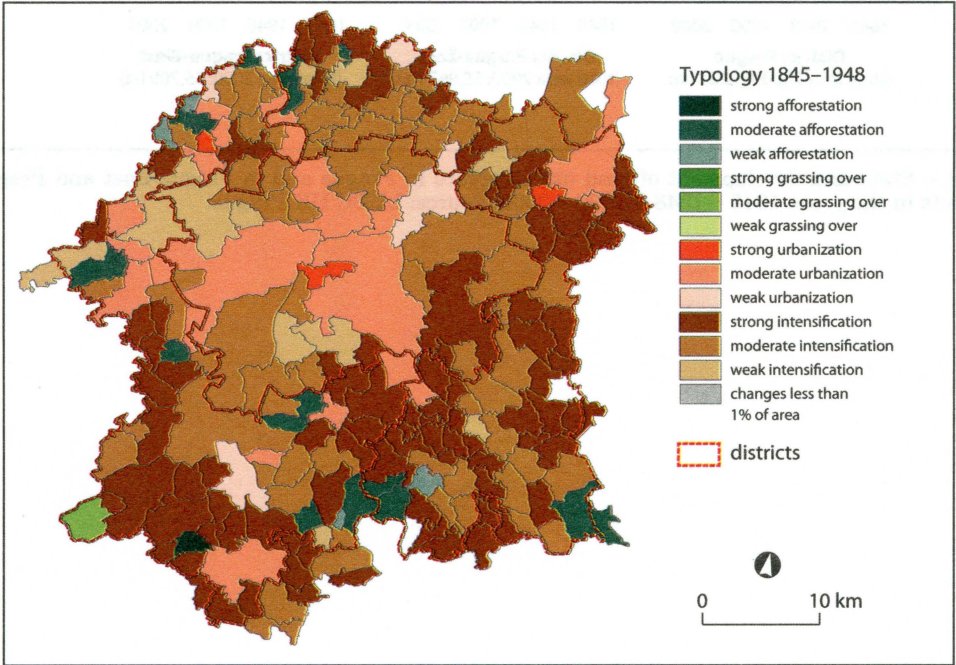


Fig. 9 – Typology of main landscape processes in the years 1845–1948. Source: Lucc UK Prague.

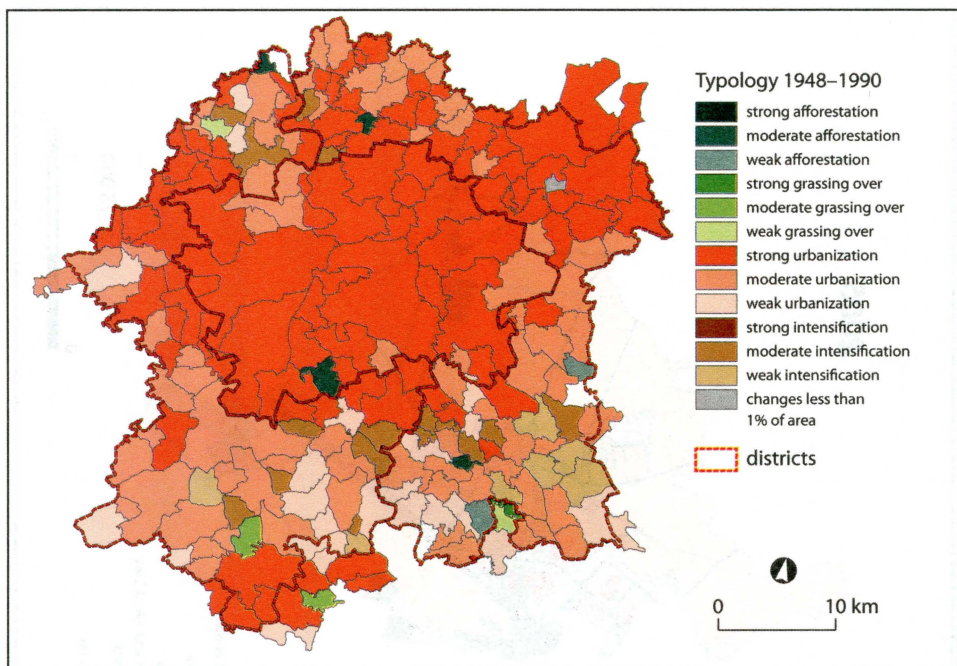


Fig. 10 – Typology of main landscape processes in the years 1948–1990. Source: LUCC UK Prague.

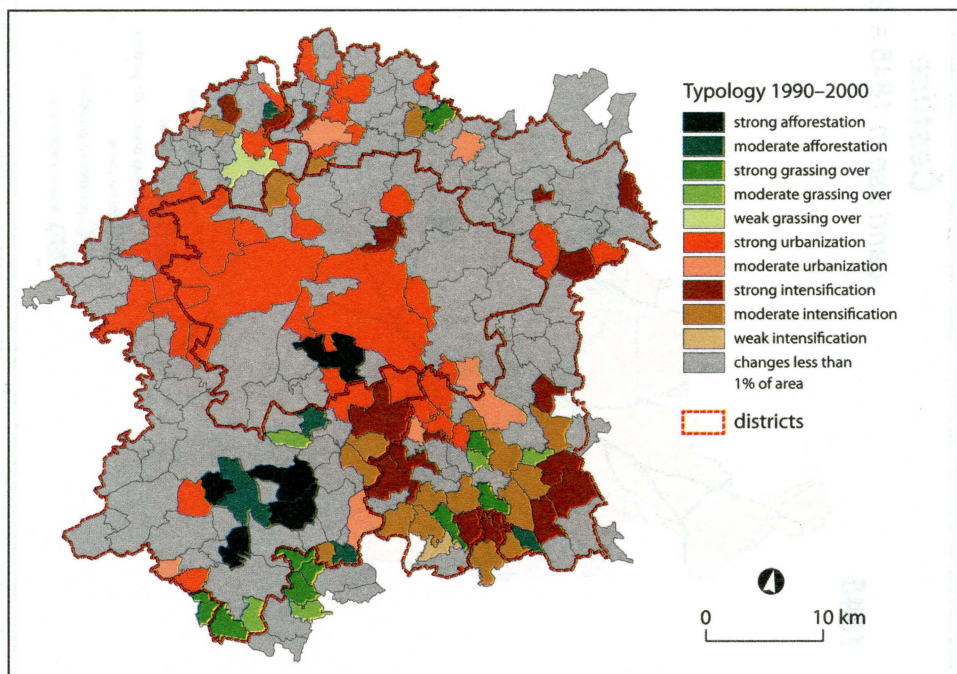


Fig. 11 – Typology of main landscape processes in the years 1990–2000. Source: LUCC UK Prague.

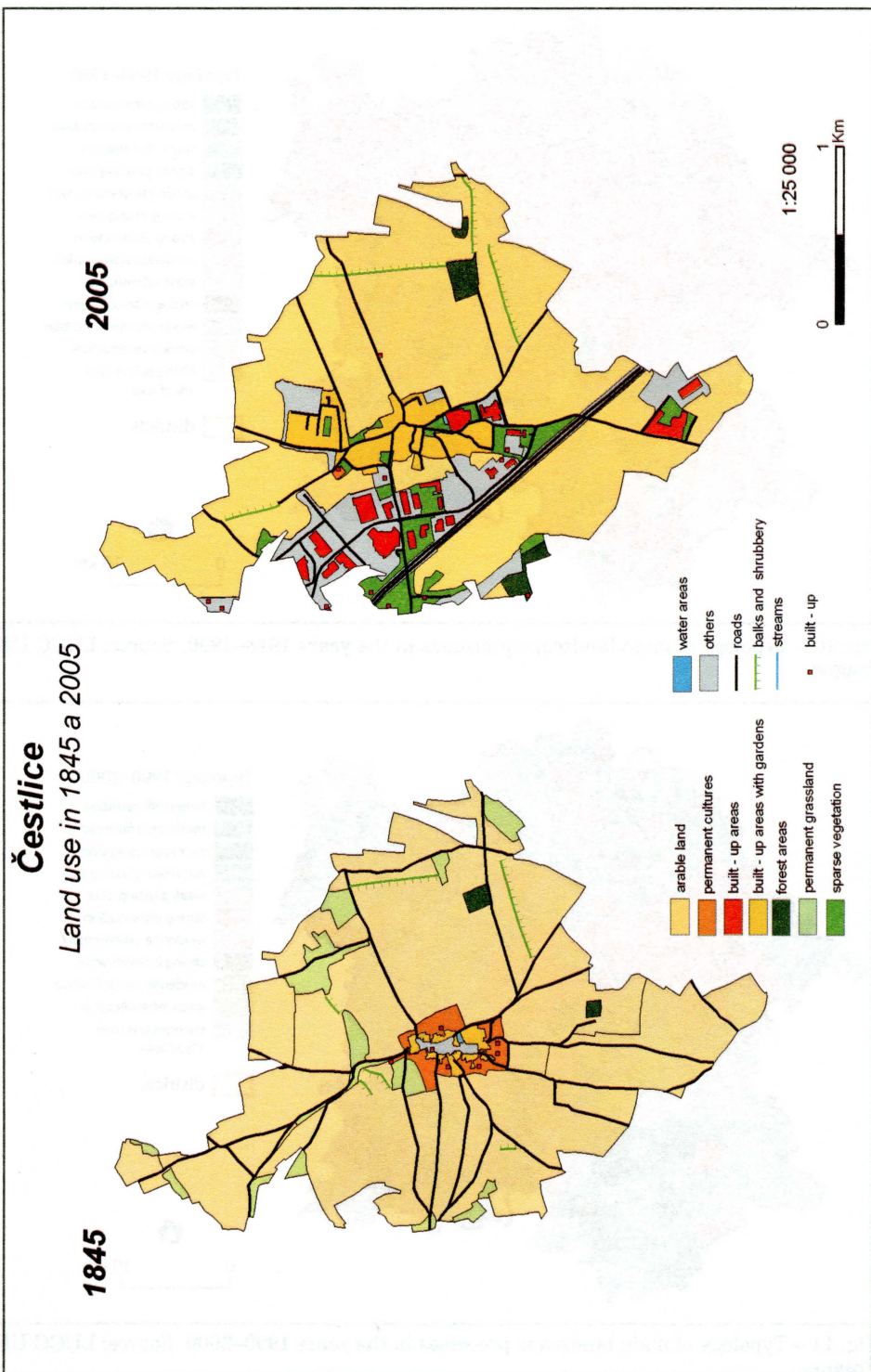


Fig. 12 – Land use structure in Čestlice in 1845 and 2005. Source: LUCC UK Prague.

should evaluate the analysed territory as a core, from which the given innovation (intensification of land use and changes) spread to other regions.

The figure 9 documents this period and shows quite clearly that it is a period of a significant intensification of agricultural land use. In fact, out of the 204 BTUs of Prague urban area only a small part (44) manifests other dominating processes than a strong and mean intensification of farming. This defines the role of background of the proper core of the town in this period as strong production-supply functions of a large consumer centre, Prague. It is interesting that even in this period, there are, within Prague urban region, several BTUs with a mean and feeble development of forested areas.

The second, totalitarian period (1948–1990, see fig. 10) is characterized by a generally clear trend corresponding to what has been ascertained for the territory of the Czech Republic, i.e. dominance of urbanization processes. It is only logical that in the territory of Prague urban region these processes of increase of built-up and the other areas are probably the most intensive; in various intensity, they characterize the move in area structure in more than 85 % of BTUs of Prague agglomeration. We could probably generalize the thesis that in that period the increase of built-up and remaining areas is as dominating as in the first period of intensification of agricultural use of the landscape of Prague agglomeration.

The transformation period (1990–2000, see fig. 11), contrary to both precedent ones, is characterized rather by a variety of main processes of different intensity. Because this period is sensibly shorter, it is not surprising that the general dissimilarity of principal landscape changes is much smaller than in both previous periods. The town core itself manifests rather an urbanization process, i.e. a prevailing increase of built-up and remaining areas. In the background of both rural districts in the NW and SE axes, cartograms display even some rather unexpected trends, undoubtedly influenced by different ideas on restituted land use by their owners in comparison with land users in the totalitarian period. We have in mind rather surprisingly dominant processes of grassing, forestation or intensification of farming in some BTUs. As the process of restitution of land resulted in a substantial fragmentation of land tenants and landowners, use of restituted lands in this period is quite diversified. We suppose that general pressures of development requirements of the town and of its agglomeration will manifest, in the following period, rather by a weakening of surprising tendencies in land use in Prague background from the years 1990–2000.

5. Conclusions

GIS application enabled in this paper to analyse, with the help of the LUCC UK Prague database, long-term trends in land use in Prague and its background. It is a pity we cannot form further time horizons to study still more in detail the trends connected with increasing development and loss of traditional agricultural functions in this exposed areas of Czechia. But still the existing data from these four time horizons can very well document the trend of area changes parting from the core of an agglomeration to its margins. This trend was documented also by analyses of detailed maps of selected model territories (Bičík, Kupková 2006). In general, there is on the one hand an increase of built-up and the other areas in the direction from the centre to progressively more distant margins of agglomeration and on the

other hand other changes in land use structure corresponding to new functions of an agglomeration at the end of the 20th century. It is rather surprising to ascertain that even in the proper core of agglomeration the forest areas have increased by more than one fourth (up to 9 % in Prague today). The same is true for remaining areas which are now more than nine times larger than in 1845. A similar increase area of permanent cultures is connected above all with a more than triple increase of the area of gardens, which however have substantially changed their function during the observed period from productive to recreational and representative one. It is thus logical that spreading of land use structure changes on the outer margin of Prague agglomeration is more than significant. Originally clearly agricultural functions of this area have during 160 years changed to numerous other functions (living mostly in family houses, recreation, storage, productive, ecological and protective functions, etc.) which, together with growing requirements on living, change the original rural landscape and the structure of its areas.

Land use structure development in the observed territory differs, because of its functions, from the majority of the territory of Czechia. This is characterized by a substantial differentiation of area structure development up to the middle of the 20th century. Under worse natural conditions of Czechia, the area of agricultural, and mainly arable land has decreased, under better natural conditions agricultural land resources have stagnated or even increased. In the totalitarian period (1948–1990), there was practically everywhere in Czechia a decrease in agricultural land resources and mainly in arable land and a sensible increase of built-up and remaining areas. This corresponded also to the development in Prague territory. The recent period of transformation is characterized in Czechia mainly by a substantial increase of permanent grassland on the detriment of arable land, to which the area structure development in Prague background corresponded only partially. The development in Prague urban region only in older periods partly corresponded to the area structure development in other parts of Czechia, recently, mainly after 1980, not only the core itself but also the outer territory of the PUA have becoming more and more different. There, especially during the last ten years, a very strong suburbanization process has been going on with an exceptional impact on area structure. Although it is dominated mainly by building of family houses (very reduced during the totalitarian period), impacts on landscape and area structure are extraordinary especially in places of concentrated service/storage development. An example of such territory is for instance Čestlice on the southeastern margin of Prague, where the present state is the result of the development of last ca 12 years (fig. 12).

General trends in area structure indicate that during the monitored 160 years, there occurred in Prague agglomeration a differentiation of the core area of Czechia from the area structure development in other territories as well as territorially differentiated changes within the PUA. Main transport axes of railway and road transports influence intensive changes in land use structure by stronger impacts of suburbanization. This manifests also by a different land use structure development in northern and southern background of Prague. The southern background has better natural conditions both for building of new family houses and for recreation and its changes in area structure are influenced also by changes in agricultural policy. In the past, agricultural enterprises under worse natural conditions

were largely subsidized. This maintained a higher part of arable land in territories, where it is now substituted by permanent grassland and that both officially (with change of category in area evidence) and unofficially (arable land laying fallow for more than four years). Especially the southern margin of Prague agglomeration manifests recently rather surprising changes in area structure as forestation or grassing as dominant landscape processes. Exactly in this territory the possible problems are connected with transformation of many recreation houses to permanent residences, especially in localities near main communications to Prague (as a rule up to 40–50 minutes to the centre). This causes and in future will cause problems in these localities with regard to territorial planning and new residential functions influencing traditional recreation localities (noise, dust, increased traffic, problems with water, wastes, etc.).

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Shrnutí

ZMĚNY VYUŽITÍ PLOCH V PRAŽSKÉ AGLOMERACI

Aplikace GIS umožnila v tomto příspěvku hodnotit pomocí databáze LUCC UK Prague dlouhodobé trendy využití země v Praze a zázemí. Je škoda, že není možné vytvořit další časové horizonty jimiž by mohly být studovány ještě podrobněji trendy spojené s narůstající zástavbou a ztrátou tradičních zemědělských funkcí v tomto exponovaném prostoru Česka. Přesto i na uvedených datech z těchto čtyř časových horizontů je velmi dobře dokumentován trend přeměny ploch z jádra aglomerace směrem k jejím okrajům. Tento trend jsme dokumentovali i analýzami podrobných map vybraných modelových území (Bičík, Kupková 2006, v tisku) a jde v podstatě jednak o nárůst zastavěných a ostatních ploch směrem od centra ke stále vzdálenějším okrajům aglomerace a jednak o další změny struktury ploch odpovídající novým funkcím aglomerace na v konci 20. století. Poněkud překvapivé je zjištění, že i ve vlastním jádru aglomerace vzrostl rozsah lesních ploch o více než čtvrtinu (na dnešních 9 % výměry Prahy), stejně jako nárůst ostatních ploch na více než devítinásobek proti roku 1845. Podobné zvětšení ploch trvalých kultur je spojen především s více než trojnásobným nárůstem ploch zahrad, které ovšem za sledované období podstatným způsobem změnily svoji někdejší funkci produkční na dnešní funkce rekreačně reprezentační. Je proto do značné míry logické, že šíření změny struktury ploch se na vnějším okraji pražské aglomerace jeví jako velmi výrazné. Z někdejší jednoznačně zemědělské funkce se totiž to-muto území po 160 letech přisuzují četné další funkce (bydlení převážně v rodinných domech, rekreační, skladové a výrobní, ekologicko- ochranné atd.), které spolu s rostoucími nároky na bydlení mění původní venkovskou krajinu a její strukturu ploch.

Vývoj struktury ploch se ve zkoumaném území vzhledem k funkcím odlišuje od většiny území Česka. To je charakterizováno značnou diferenciací vývoje struktury ploch až do poloviny 20. století. V horších přírodních podmínkách Česka ubylo zemědělské a zvláště orné půdy, v lepších přírodních oblastech zemědělského půdního fondu stagnuje či se dokonce rozšiřoval. V období totality (1948–1990) prakticky všude v Česku ubylo zemědělského půdního fondu a zvláště orné půdy, a výrazně narostly plochy zastavěné a ostatní. Tomu odpovídal i vývoj na území Prahy. Poslední období transformace charakterizuje v Česku především výrazný nárůst trvalých travních porostů na úkor orné půdy, čemuž jen zčásti odpovídal vývoj struktury ploch v zázemí Prahy. Vývoj v pražském městském regionu tedy jen ve starších obdobích zčásti odpovídá vývoji struktury ploch na ostatním území Česka, v novější době, především po roce 1980 se stále výrazněji odlišuje nejen vlastní jádro, ale i vnější území aglomerace. V něm se především v posledním desetiletí realizuje silný suburbanizační proces s mimořádnými dopady na strukturu ploch. I když mu dominuje především výstavba rodinných domů (za totality silně potlačená) dopady na krajinu a strukturu ploch jsou mimořádné především v místech koncentrované oblužné skladové zástavby. Takovým územím jsou např. na jihovýchodním okraji Čestlice, kde současný stav je výsledkem vývoje posledních 10–12 let.

Celkové trendy ve struktuře ploch naznačují, že v průběhu sledovaných 160 let v pražské aglomeraci dochází jak k odlišení jádrového prostoru Česka od vývoje struktury ploch v ostatním území, tak k územně diferencovaným změnám v rámci aglomerace. Hlavní dopravní osy železniční či silniční dopravy ovlivňují intenzivnější změny využití země silnějšími procesy dopadů suburbanizace. To se projevuje i v odlišném vývoji struktury ploch v severním a jižním zázemí Prahy. Jižní zázemí má lepší přírodní podmínky jak pro výstavbu nových rodinných domků, tak i tradice rekreačních funkcí a jeho změny ve struktuře ploch jsou ovlivněny i změnami zemědělské politiky. V minulosti byly zemědělské podniky v horších přírodních podmínkách výrazně dotovány. To udržovalo vyšší podíl orné půdy v území, která je dnes nahrazována trvalými travními porosty, a to jak oficiálně (se změnou kategorie v evidenci ploch), tak neoficiálně (orná půda ležící ladem déle než čtyři roky). Právě již

ní okraj aglomerace Prahy vykazuje v posledním období změny ve struktuře ploch poněkud překvapivé, jako je zalesňování či zatravňování jako dominantní krajinné procesy. Právě v tomto území jsou i potenciální problémy spojené s přeměnou četných rekreačních chat na objekty trvalého bydlení a to zvláště v lokalitách s dobrou dostupností hlavních komunikačních tahů na Prahu (zpravidla do 40–50 minut do centra). To vyvolává a v budoucnu spíše ještě více vyvolá problémy v těchto lokalitách jak z hlediska požadavků územního plánu, tak z hlediska nových obytných funkcí rušících tradiční rekreační lokality (hluk, prašnost, zvýšená doprava, problémy s vodou a odpady atd.).

- Obr. 1 – Stav a vývoj struktury ploch v Praze a okresech Praha-východ a Praha-západ v letech 1845–1948–1990–2000. Pramen: LUCC UK Prague.
- Obr. 2 – Vývoj indexu změny v letech 1845–1948 na území pražského městského regionu (PMR). Pramen: LUCC UK Prague.
- Obr. 3 – Vývoj indexu změny v PMR mezi lety 1948–1990. Pramen: LUCC UK Prague.
- Obr. 4 – Vývoj indexu změny v PMR mezi lety 1990–2000. Pramen: LUCC UK Prague.
- Obr. 5 – Typologie indexu změny v PMR. Pramen: LUCC UK Prague.
- Obr. 6 – Standardizovaný index změny na 10 let v PMR mezi lety 1845–1948. Pramen: LUCC UK Prague.
- Obr. 7 – Standardizovaný index změny na 10 let v PMR mezi lety 1948–1990. Pramen: LUCC UK Prague.
- Obr. 8 – Standardizovaný index změny na 10 let v PMR mezi lety 1990–2000. Pramen: LUCC UK Prague.
- Obr. 9 – Typologie hlavních krajinných procesů v letech 1845–1948. Pramen: LUCC UK Prague.
- Obr. 10 – Typologie hlavních krajinných procesů v letech 1948–1990. Pramen: LUCC UK Prague.
- Obr. 11 – Typologie hlavních krajinných procesů v letech 1990–2000. Pramen: LUCC UK Prague.
- Obr. 12 – Struktura ploch v Čestlicích v roce 1845 a 2005. Pramen: LUCC UK Prague.

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