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# CHARACTERISTICS OF POST SOCIALIST SPATIAL DEVELOPMENT OF THE FUNCTIONAL URBAN AREA OF VESZPRÉM, HUNGARY

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**Abstract**

The post-socialist era resulted remarkable changes in urban landscape in Eastern Europe and in Hungary. The special circumstances caused moderate level of urbanisation and special patterns of urban sprawl, traceable in land use changes. The urban sprawl and suburbanisation became an important trend around smaller Hungarian cities as well. Regulators are eager to rule the evolution of spaces, however, it is hard to control all aspects of land use. The research presented in this paper shows the dynamics of new artificial areas with the help of land use changes from the Corine Database for the functional urban area around Veszprém and attempts to find the most important policy responses to the growing artificial surfaces after transition. The research questions are: What are the most important trends in changing in-built areas in a small city after the transition? What kind of new artificial areas appeared and where are they situated? Were the land use plans and nature protection effective tools for manage urban sprawl? With the help of Corine land use changes between 1990-2018 the most important spatial changes are shown, and the different peri-urban areas are compared around the core town. Attention is drawn to the importance of regulation for sustainable land use and protection of resources. It also highlights the importance of the regulatory power of municipalities. Changes in the environment of Veszprém may give inspiration for the rethinking the relationship of urban-rural, and catchment area and core town.

**Keywords:** land use analyses, urban sprawl, Veszprém, post-socialist urban development, regulation

## INTRODUCTION

One of the commonly mentioned challenges of the future is urban sprawl (EEA, 2016) and land use as the essential factor of it (ESPON, 2006; EEA, 2007). There is also a growing body of literature that recognizes the importance of the most influenced territories: role of the central city and its settlement network, the periphery, edge, peri urban territories (Meeus and Gulinck, 2008; Csemez, 2008; Piorr et al., 2011; Szirmai, 2011; Woltjer, 2014; Oueslati, 2015). The spatial context of urban sprawl is also highlighted and researched by international bodies like OECD and the EU and the definitions of functional urban area (FUA) (OECD, 2012) or settlement group municipalities (KSH, 2014) are integrated into the international and national statistical systems as well. Studies also attempt to find regulatory or other assets to control or manage the growth of urban areas (Allen, 2003; Ros-Tonen, 2015; Geneletti et al., 2017) and suggests sustainable development, the management of urban sprawl and its consequences and also foster the densification of artificial surfaces (Artmann et al., 2019).

The special aspects of urban development in Eastern Europe – the semi-peripheral situation, the slow transition of society based on agricultural to industrial production, the changing regulatory system after socialism, postponed urbanisation process during socialism, and despite of intensive suburbanization after 1990, a moderate level of urbanisation (Enyedi, 1988; Beluszky and Győri, 2005; Enyedi, 2012;) – give additional motivation to researchers and planners to highlight the causes and the possibilities to cope with urban sprawl. Several studies focus on the importance of land use changes of cities and towns as well in post socialist countries (for example Lincaru et al., 2016; Grigorescu and Kucsicsa, 2017 in Romania; Roose et al., 2013 in Estonia; Slaev and Kovachev, 2014 in Bulgaria; Zivanovic-Miljkovic et al., 2012 in Serbia) and most of them urges the importance of regulatory tools to manage land use changes in peri-urban areas.

Hungary is also affected by increase of artificial areas, however in several regions the population of urban fabric decreases (Hennig et al., 2015). Several researches showed the tendencies and differences within Hungary (for example Ladányi and Szelényi, 1997; Bajmócy, 2001; Timár, 2005) as well as in small cities like Győr, Pécs, Miskolc (Lux, 2014, Hardi, 2012; Somlyódyné Pfeil, 2012), Szeged (Mucsi, 2011), Kecskemét (Ricz et al., 2009), Nyíregyháza (Kókai, 2006), most of all focus on socio-economic changes and consequences, but not land use changes. Although the trends are well known, the Hungarian spatial planning could not find satisfactory answer to manage urban sprawl and negative tendencies of increasing land consumption.

In our research we explore the trends of spatial growth of a smaller Hungarian town, Veszprém and its functional urban area. In spite of the fact that the importance of agglomeration is highlighted in towns with more then 100 000 inhabitants in literature, the agglomerational potential of the town is underlined. With its almost 60 000 inhabitants it has regional importance in the Transdanubian

region of Hungary (Koós, 2010; Hardi, 2015), but no such case study focusing on Veszprém and its surroundings has been published yet. Our research area was delineated into 3 characteristic parts: an outer fringe, an inner fringe and the core town according to the international and also broader delineation of catchment settlements - FUA, and the national, more focused agglomeration arena - settlement groups. Land use changes were analysed based on Corine Database between 1990 and 2018, in 4 periods. Results were also compared to the former land use management plans on country and on municipality level (in the case of Veszprém).

## STUDY AREA

The area at the Central-Transdanubian region in Hungary (Fig. 1), along the Lake Balaton highlands and Bakony mountain has diverse natural and landscape features: topography, natural environment is characteristic and protected. The temperate climate is mild, becomes warmer closer to the Lake Balaton (Balaton-Riviera). The annual precipitation varies between 500-800 mm. Sedimentary and volcanic aquifers are both found in the fragmented landscape. In addition to the diverse natural values of the area it is also an important cultural landscape. In addition to management based on landscape characteristics (vineyards or cultivation of herbs) its ethnological values are unique (Dövényi, 2010). The land use patterns are also diverse here. Several settlements have agricultural or forestry tradition (Szentgál, Zirc) however, industrialisation also caused significant changes (Balatonfűzfő, Papkeszi). In addition, a military training field is also located here, with regular international exercises. As the area partly belongs to the preferred holiday destination and is a popular target of investments in recent years, it's natural values and landscape management are threatened. Therefore, developments are particularly important in accordance with the outstanding landscape system and values.

The centre of the study area is Veszprém town, which is approx. 12 690 ha and a specific topographic location thanks to the vicinity of lake Balaton, foot of Bakony mountain and Séd creek. It is the pole town of its surrounding FUA (131 310 ha) and also its settlement group (53 932 ha). The town's former administrative and educational character has changed. New technical university was founded, and several industrial sites were opened, the population grew from about 20 500 (1949) to about 63 000 (1990) during the socialist era. Now Veszprém has almost 60 000 (2018) inhabitants (teir.hu). The transition brought a less intensive development, but today Veszprém is an economical focus point of Western Hungary thanks to several companies, which have chosen Veszprém as new location.

## METHODS

In our study the administrative area of Veszprém and its surrounding – the settlement group (defined by KSH, 2014) and functional urban area (FUA) (based on the Urban Atlas 2012) were analysed (Fig.1). Using the Corine land use maps (CLC changes layer) from 1990-2000, 2000-2006, 2006-2012 and 2012-2018 the land use changes have been calculated and visualized for the study area in Geographical Information Systems (GIS) – ArcMap software 10.2.2. The categories defined on the basis of Corine nomenclature (Table 1) show the trend of the change. If the changes stayed within the category of three main land use pattern (artificial, agricultural and natural) it was identified as unchanged and was not highlighted during the analyses. However, the scale of the Urban Atlas would mean a better basis for analyses, it is

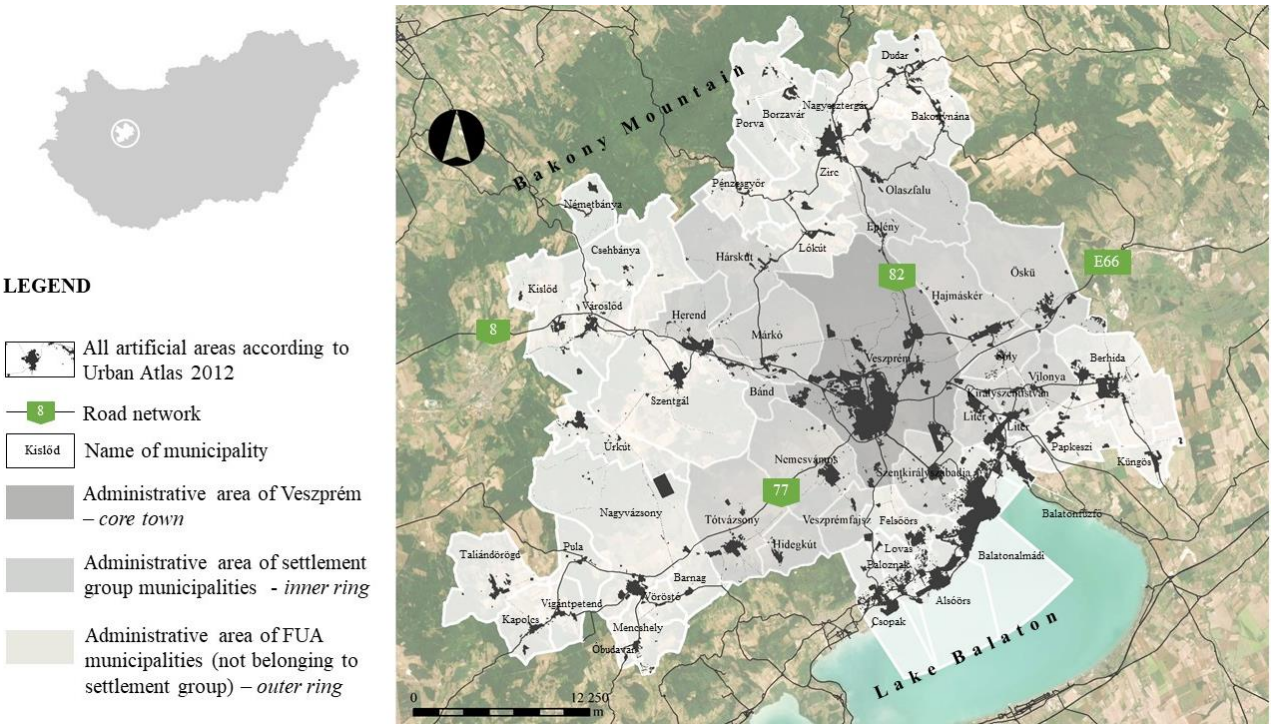


*Fig.1* Analysed areas: Veszprém – core town, Settlement group– inner fringe and FUA fringe– outer fringe on Google Earth view

*Table 1* The applied land use categories of the analyses, based on Corine nomenclature

| Code | Corine nomenclature | | | Simplification and terms in the research | |
|---|---|---|---|---|---|
| | **Class 1** | **Class 2** | **Class 3 (relevant within Artificial surfaces)** | **Main categories** | **Further categories** |
| 1.1.1 | Artificial surfaces | Urban fabric | Continuous urban fabric | Artificial surfaces | Urban fabric |
| 1.1.2 | | | Discontinuous urban fabric | | |
| 1.2.1 | | Industrial, commercial and Transport units | Industrial and commercial units | | Industrial and commercial units |
| 1.2.2 | | | Road and rail network and associated lands | | Transport units |
| 1.2.3 | | | Port areas | | |
| 1.2.4 | | | Airports | | |
| 1.3.1 | | Mine, dump and construction sites | Mineral extraction sites | | Mine, dump and construction sites (abbr. mine sites) |
| 1.3.2 | | | Dump sites | | |
| 1.3.3 | | | Construction sites | | |
| 1.4.1 | | Artificial, non-agricultural vegetated area | Green urban areas | | Artificial, non-agricultural vegetated area (abbr. urban green areas) |
| 1.4.2 | | | Sport and leisure facilities | | |
| 2.1 | Agricultural areas | Arable land | … | Agricultural areas | |
| 2.2 | | Permanent corps | … | | |
| 2.3 | | Pastures | … | | |
| 2.4 | | Heterogenous agricultural areas | … | | |
| 3.1 | Forest and semi natural areas | Forests | … | Natural, semi natural areas (abbr. natural areas) | |
| 3.2 | | Scrubs and/or herbaceous vegetation associations | … | | |
| 3.3 | | Open spaces with little or no vegetation | … | | |
| 4.1 | Wetlands | Inland wetlands | … | | |
| 4.2 | | Maritime wetlands | … | | |
| 5.1 | Water bodies | Inland waters | … | | |
| 5.2 | | Maritime waters | … | | |

available only for the year of 2012. That is why the Urban Atlas was used for visualisation of artificial surfaces (Code begins with 1). The extent (in ha) was calculated with the help of ArcMap software. Excel software was used for further calculation of the ratio of the changed areas. To evaluate the relation of the land use changes and regulatory maps manual comparison was used, because the regulatory maps were in raster dataset available. Furthermore, after manual check of each change of artificial land use in Google Earth and in actual land use maps of municipalities some corrections were needed because of the marked construction sites. For example, the polygon EU-176485 marked a construction site in the year of 2000 transformed to urban fabric for 2018. During the analyses the current or planned (in land use maps) state was taken into account.

According to these categories the spatial distribution of the land use system (area of the municipalities of functional urban area, FUA; settlement group municipalities and central town) was analysed and the most important tendencies between 1990 and 2018 were identified. With the use of this method the urban sprawl around Veszprém was shown.

## RESULTS

In present study the land use changes were analysed for the area of FUA, settlement group of Veszprém and administrative area of Veszprém. Changes of FUA (outer) fringe (FUA without settlement group area) and settlement group (inner) fringe (settlement group without the core town, Veszprém) were also described.

*The ratio of different land use categories*

Most significant changes described between 1990 and 2000, with about 5500 ha in FUA and 785 ha in Veszprém, but more than 90% of all changes stayed within the land use category, defined as unchanged. During this period the tendencies show similarity in the core town and its broader neighbourhood. The increase of natural and artificial areas is almost balanced, the new areas occupied former agricultural areas in the FUA. In parallel in the fringe of the settlement group the artificial surfaces show higher increase. Important fact is, that without the core town there were no change in natural areas within the settlement group (inner fringe), however in the outer fringe there were 167 ha

new natural plots shown, representing 90% of all new natural areas. In Veszprém the artificial areas have remarkable increase with more than 15% of all changes within its administrative border; agricultural areas did not change (Fig. 2, Table 2).

Between 2000 and 2006 the changes are modest; however, the ratio of unchanged areas is the lowest during the examined period – the lowest in the settlement group with about 75%. Remarkable, that during this period no new natural and agricultural area were detected, only the ratio of new artificial areas grew. Only at broader surrounding of Veszprém were new natural and agricultural areas identified – at FUA fringe more agricultural, at the settlement group fringe more natural ones.

The period of 2006-2012 can be described by intensive increase of artificial areas. Not only in Veszprém (41.7 ha) but at the settlement group fringe (35.9 ha) and FUA fringe (52.2 ha) significant changes are seen. In addition to this only at FUA fringe were new agricultural areas detected. There were no new agricultural and natural areas at inner fringe and core town.

In the last 6 years, between 2012 and 2018, the area of new artificial surfaces has grown further – altogether 136 ha concentrated in the surrounding of Veszprém, and the quantity of new natural surfaces also increased: in Veszprém 97.5 ha, in settlement group fringe 33.3 ha and in FUA fringe 55.3 ha was identified.

According to our analyses focusing on new artificial areas the tendency of changes is different in the examined zones. The most intensive increase of artificial surfaces is identified in the settlement group fringe, in the direct neighbourhood of Veszprém (Table 3, Fig. 3). The trend shows intensive boom of new artificial areas after 2000, between 2000 and 2018 with a growth of 111 ha in FUA fringe, 185 ha in settlement group fringe and 135 ha in Veszprém. The changes show different tendencies, the settlement group fringe shows increase in the last 6 years, however in Veszprém a modest increase and in FUA fringe decrease is experienced. In the last period the structure of the artificial areas also differs from each other: the highest ratio of new areas is urban green in FUA fringe, urban fabric in settlement group fringe and industrial in Veszprém after 2012.

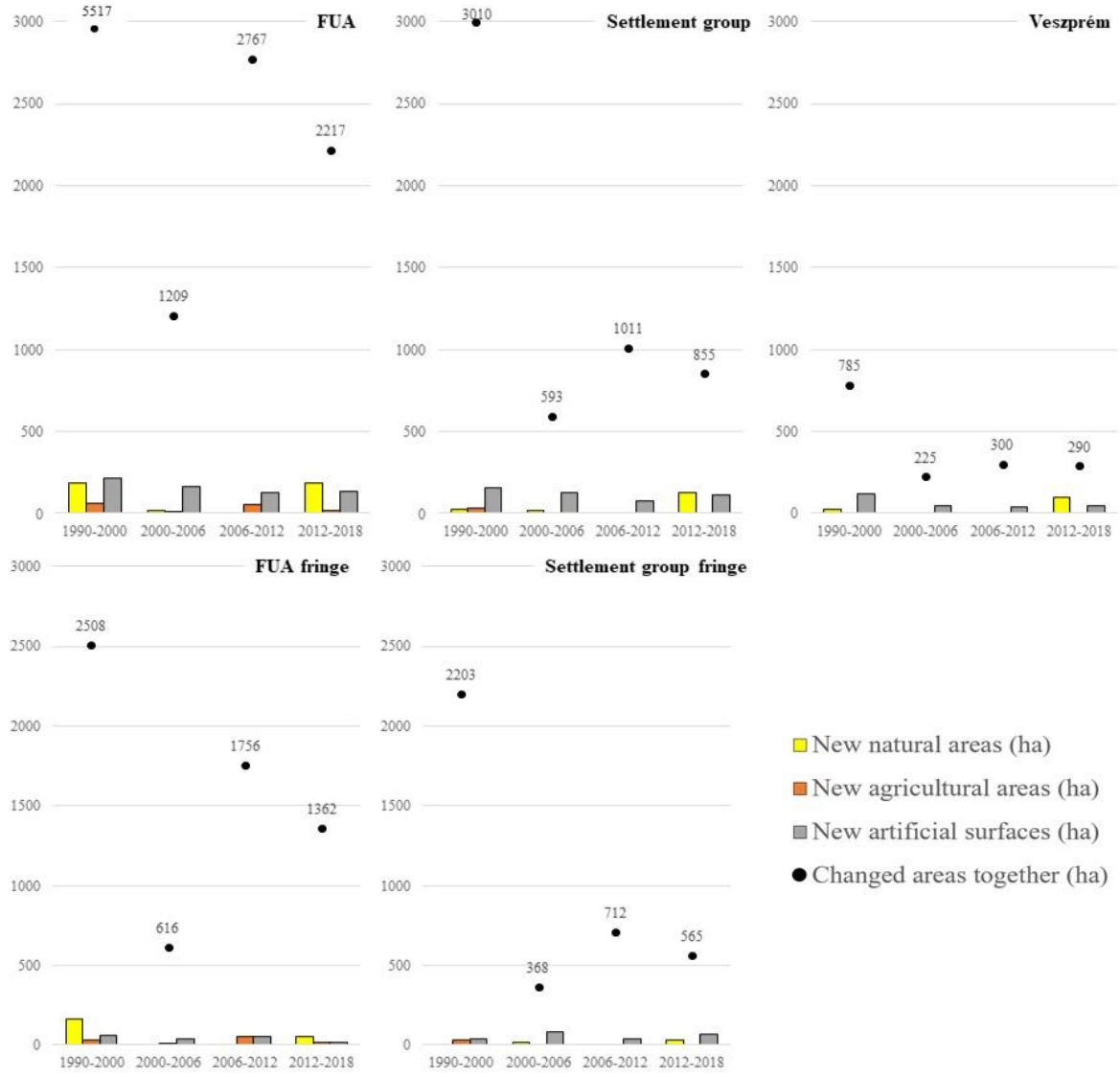


*Fig.2* Land use changes focusing on new natural, agricultural and artificial areas at Veszprém and its surrounding between 1990 and 2018 (Data source: Corine, Google Earth)

*Table 2* Land use changes in different agglomeration zones according to main categories expressed in ha and ratio of the whole area of the agglomeration zone (Data source: Corine, Google Earth)

| | 1990-2000 | 2000-2006 | 2006-2012 | 2012-2018 |
|---|---|---|---|---|
| **Core town** | | | | |
| New natural areas | 21.85 ha / 0.172% | 0.0 ha / 0.000% | 0.0 ha / 0.000% | 97.5 ha / 0.768% |
| New agricultural areas | 0 ha / 0.000% | 0.0 ha / 0.000% | 0.0 ha / 0.000% | 0.0 ha / 0.000% |
| New artificial surfaces | 119.4 ha / 0.941% | 46.4 ha / 0.366% | 41.7 ha / 0.328% | 47.3 ha / 0.373% |
| Unchanged | 665.8 ha / 5.245% | 178.3 ha / 1.405% | 257.8 ha / 2.031% | 144.9 ha / 1.142% |
| Changed areas together | 807.0 ha / 6.358% | 224.7 ha / 1.771% | 299.5 ha / 2.360% | 289.7 ha / 2.283% |
| **Inner ring** | | | | |
| New natural areas | 0.0 ha / 0.000% | 18.8 ha / 0.045% | 0.0 ha / 0.000% | 33.3 ha / 0.081% |
| New agricultural areas | 29.6 ha / 0.072% | 0.0 ha / 0.000% | 0.0 ha / 0.000% | 0.0 ha / 0.000% |
| New artificial surfaces | 37.0 ha / 0.090% | 79.9 ha / 0.194% | 35.9 ha / 0.087% | 69.0 ha / 0.167% |
| Unchanged | 2136.1 ha / 5.180% | 269.5 ha / 0.653% | 675.8 ha / 1.639% | 463.0 ha / 1.123% |
| Changed areas together | 2202.7 ha / 5.341% | 368.1 ha / 0.893% | 711.7 ha / 1.726% | 565.3 ha / 1.371% |
| **Outer ring** | | | | |
| New natural areas | 167.2 ha / 0.216% | 0.0 ha / 0.000% | 0.0 ha / 0.000% | 55.3 ha / 0.072% |
| New agricultural areas | 33.6 ha / 0.043% | 4.2 ha / 0.005% | 53.1 ha / 0.069% | 20.1 ha / 0.026% |
| New artificial surfaces | 59.9 ha / 0.077% | 39.3 ha / 0.051% | 52.2 ha / 0.068% | 19.7 ha / 0.025% |
| Unchanged | 2247.1 ha / 2.904% | 572.6 ha / 0.740% | 1651.0 ha / 2.134% | 1266.9 ha / 1.637% |
| Changed areas together | 2507.9 ha / 3.241% | 616.1 ha / 0.796% | 1756.3 ha / 2.270% | 1362.1 ha / 1.760% |

*Table 3* Land use changes in different agglomeration zones according to categories of artificial surfaces expressed in ha and ratio of new artificial surface in Table 2. (Data source: Corine, Google Earth)

| | 1990-2000 | 2000-2006 | 2006-2012 | 2012-2018 |
|---|---|---|---|---|
| **Core town** | | | | |
| New industrial, commercial units | 107.8 ha / 90.3% | 31.5 ha / 67.9% | 6.7 ha / 16.0% | 24.0 ha / 50.8% |
| New urban green areas | 0.0 ha / 0.0% | 0.0 ha / 0.0% | 0.0 ha / 0.0% | 1.9 ha / 4.0% |
| New transport units | 0.0 ha / 0.0% | 0.0 ha / 0.0% | 23.7 ha / 56.9% | 0.0 ha / 0.0% |
| New mine sites | 5.9 ha / 4.9% | 0.0 ha / 0.0% | 11.3 ha / 27.2% | 6.0 ha / 12.6% |
| New urban fabric | 5.7 ha / 4.7% | 14.9 ha / 32.1% | 0.0 ha / 0.0% | 15.4 ha / 32.5% |
| **Inner ring** | | | | |
| New industrial, commercial units | 8.2 ha / 22.2% | 10.4 ha / 13.1% | 6.0 ha / 16.8% | 0.0 ha / 0.0% |
| New urban green areas | 28.6 ha / 77.2% | 1.6 ha / 2.0% | 0.0 ha / 0.0% | 6.0 ha / 8.6% |
| New transport units | 0.0 ha / 0.0% | 0.0 ha / 0.0% | 16.2 ha / 45.1% | 0.0 ha / 0.0% |
| New mine sites | 0.2 ha / 0.5% | 5.1 ha / 6.4% | 13.7 ha / 38.1% | 32.9 ha / 47.7% |
| New urban fabric | 0.0 ha / 0.0% | 62.7 ha / 78.5% | 0.0 ha / 0.0% | 30.2 ha / 43.7% |
| **Outer ring** | | | | |
| New industrial, commercial units | 0.0 ha / 0.0% | 6.3 ha / 16.0% | 5.3 ha / 10.1% | 0.0 ha / 0.0% |
| New urban green areas | 16.0 ha / 26.7% | 0.1 ha / 0.4% | 46.9 ha / 89.9% | 15.5 ha / 78.7% |
| New transport units | 0.0 ha / 0.0% | 0.0 ha / 0.0% | 0.0 ha / 0.0% | 0.0 ha / 0.0% |
| New mine sites | 12.9 ha / 21.5% | 14.7 ha / 37.5% | 0.0 ha / 0.0% | 4.2 ha / 21.3% |
| New urban fabric | 31.0 ha / 51.8% | 18.1 ha / 46.1% | 0.0 ha / 0.0% | 0.0 ha / 0.0% |

It is also worth noting, that the new industrial areas are dominant (more than 50% of new artificial areas) in Veszprém, except the period of 2006-2012, when transport units represent the 57% (24 ha) of all new artificial areas. The ratio and the extent of new industrial areas are marginal at the settlement group fringe and FUA fringe, this fact highlights the strong economic concentration in the examined area.

The expansion of urban fabric is typical at FUA fringe between 1990-2006, but after there is no new plot for this purpose until now. At settlement group fringe urban fabric expansion is experienced between 2000-2006 and 2012-2018, just the same as in Veszprém. During the period of the economic crisis, between 2006-2012 there were no new urban fabric plots at all.

It is also interesting, that urban green (new areas for urban green, sport and leisure facilities) is relevant at FUA fringe areas. During the years of the economic crisis 90% of new plots (47 ha) fall within this category. These plots– for example golf clubs, tracks – are usually located further from the in-built area of the municipalities. However, the same tendency is visible at the settlement group fringe between 1990 and 2000 (77%, 28.6 ha). In Veszprém the new urban green is negligible in all examined periods.

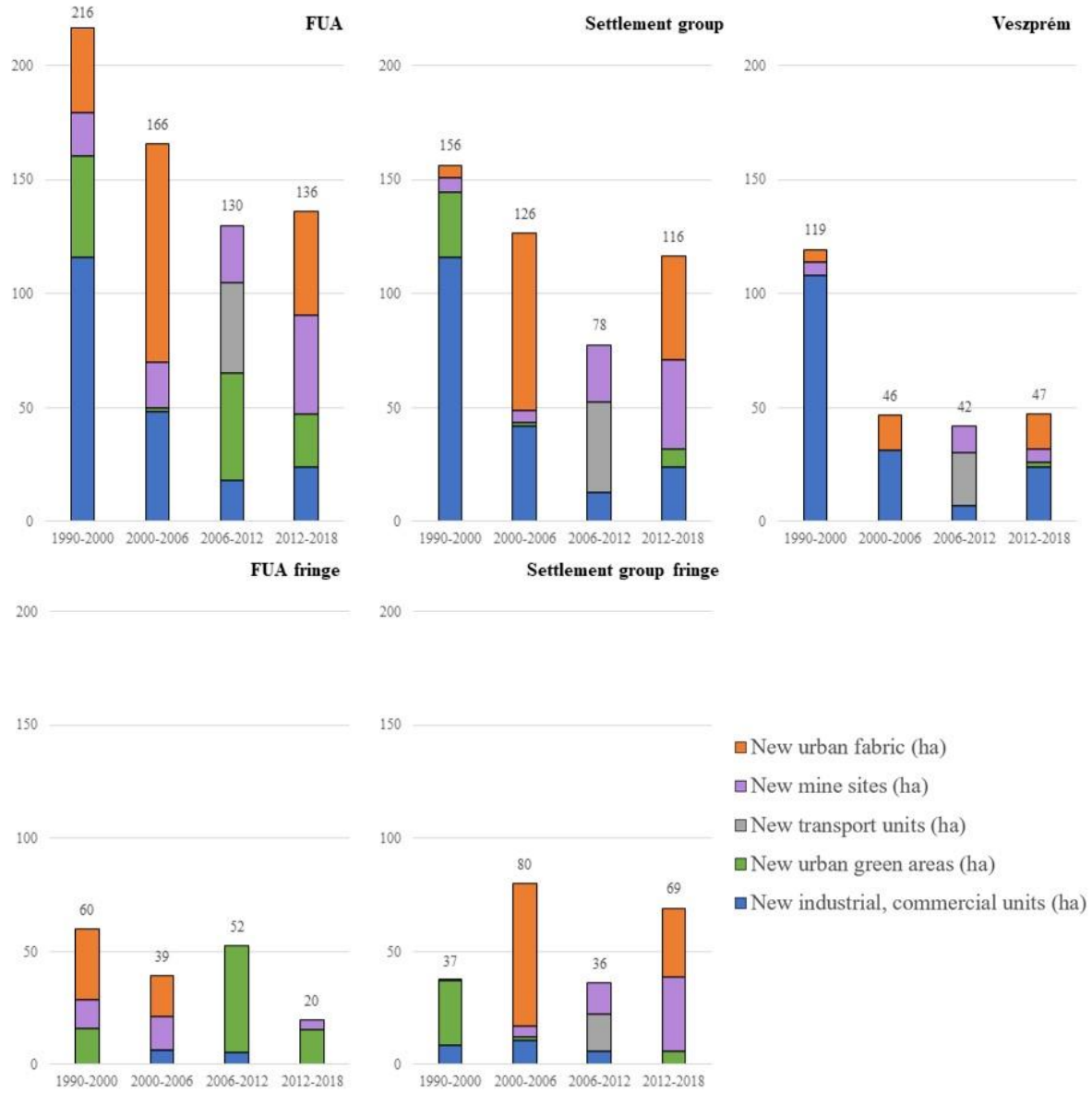


*Fig. 3* Land use changes focusing on new artificial areas: industrial, commercial units, urban green areas, transport units, mine sites and urban fabric at Veszprém and its surrounding between 1990 and 2018 (Data source: Corine, Google Earth)

*The spatial pattern of the changes*

As the map shows (Fig. 4, 5) new artificial areas are situated around the in-built areas of municipalities. Exceptions are found, especially from the period of 2006-2012 and 2012-2018. It is also remarkable, that the density of the new artificial areas is higher on the edge of the in-built areas of Veszprém, at the coast line of Balaton and the main roads of Nr. 8 (to Körmend), E66 (to Székesfehérvár and Budapest) and 77 (to Nagyvázsony). At the Northern part of the study area, Németbánya, Zirc and Dudar have new artificial areas from 1990, among which Zirc seems to have continuous development.

Analysing the distribution of these areas (Fig. 5), it can be stated, that new industrial and urban fabric areas are strongly connected to existing built in areas of municipalities, and former existing industrial sites from the socialism. At outer ring new industrial and commercial areas appeared only in municipalities, that has industrial tradition (Balatonfűzfő, Nagyvázsony). In addition to this, new mining and transport sites are so called 'green field' development – set on agricultural or natural areas. Important fact, that urban green areas are also situated far from the core in built areas, and dense urban fabric, also transformed from non-artificial surfaces.

*Policy responses for sustainable land use management*

There are several tools to control urban sprawl in Hungary. The most important on country level is the renewed Act on Land Use Framework Plan of Hungary and Priority Areas (Act Nr. CXXXIX. 2018), that tries to guide the settlements developing according to the compact settlement structure. This act aggregates the interest of different fields, like nature conservation, agriculture, forestry etc. In our comparison analysis, the Act, adopted in 2003 was used, to be able to follow the effectiveness of regulation (Act XXVI on Land Use Framework Plan of Hungary from 2003).

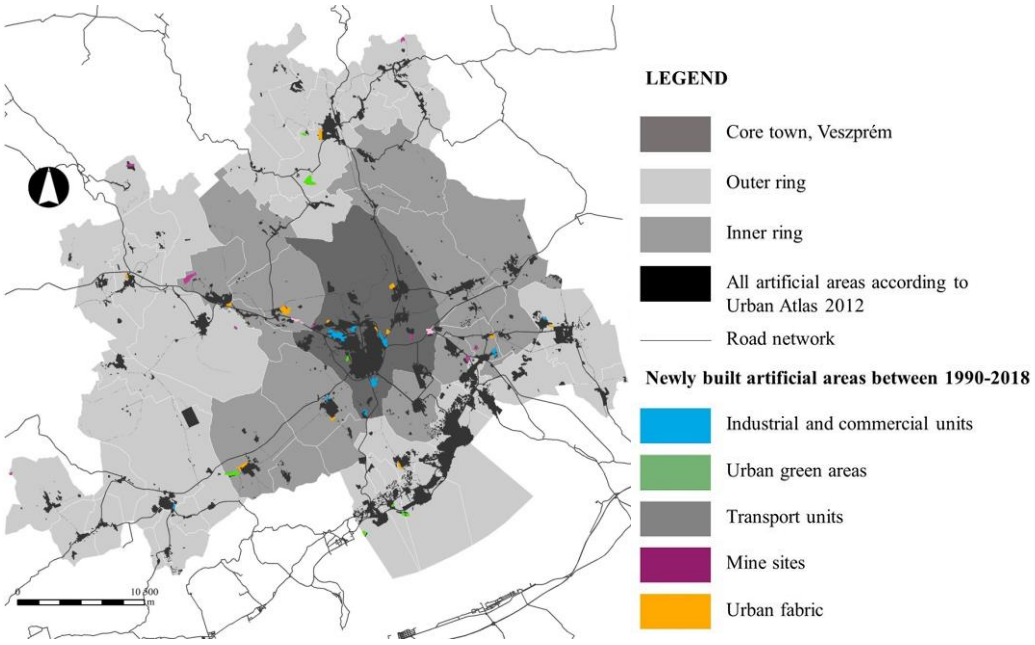


*Fig.4* Categories of newly built artificial areas between 1990-2018 in core town, inner ring and outer ring, illustrated with all artificial surface based on Urban Atlas 2012 (Data source: CLC changes layers 1990-2018, Urban Atlas 2012)

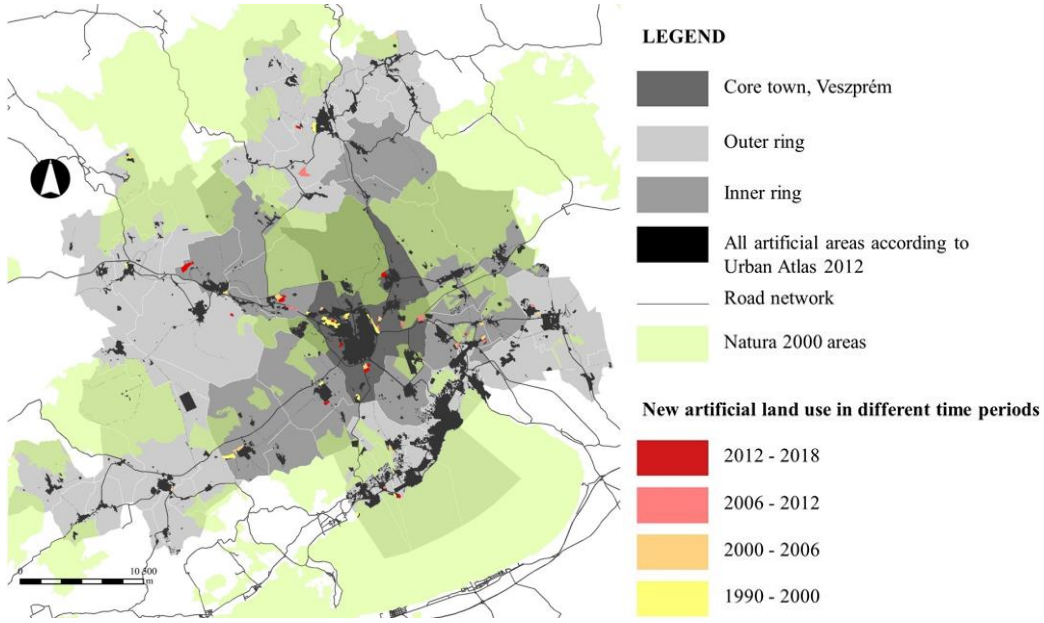


*Fig. 5* Newly built artificial surfaces in different time periods, in core town, inner ring and outer ring and Natura 2000 areas, illustrated with all artificial surface based on Urban Atlas 2012 (Data source: CLC changes layers 1990-2018, Urban Atlas 2012, termeszetvedelem.hu)

The municipalities have to follow the regulations of the national spatial plan. Although the frame is given, the municipalities have a considerable freedom in management of the land use system in their administrative area by elaborating urban management plans (urban development plan, land use plan and building plan). The land use changes were also compared with the land use plan of Veszprém from 2005.

The Natura 2000 network initiated by the European Union's Habitats Directive, 92/43/EEC, and Birds Directive 2009/147/EC was defined on national level. In Hungary some activities require authorisation from competent nature protection authority and require habitat management plans. Certain activities (like hunting, fishing, tourism or mining) are possible if it is compatible with the protection. At our examined area (Fig. 5) only some new mining and transport plot falls on the area under Natura 2000 protection.

The National Ecological Network Zone (Fig.6) – that contains inter alia all the Natura 2000 areas – permits land use that are compatible with the preservation of natural values, however different regulations are applied for the core areas, buffer zones and ecologic corridors. After 2000 several land use changes fall on these areas, urban fabric, transport areas, mining units, even industrial and commercial sites.

The Land Use Framework Plan of Hungary, 2003 appointed zones for forests and arable land of exceptional quality (Fig.7). The High-Quality Forests Zone prohibits construction, the High-Quality Arable Zone allows exceptional building with permission of authority. After 2000 no new artificial areas appeared within these zones. However, at the examined area not a great extent of high quality arable can be found.

A new tool of Land Use Framework Plan of Hungary, 2003 was the opportunity for common planning (Fig. 8) for agglomerations and settlement groups defined by the Hungarian Statistical Office. In Hungary there are not really good examples and practice for a such strong common planning activity among municipalities. Maybe that is the cause, that no one had chosen this opportunity, nor Veszprém. The National Land Use Plan (Fig. 9) marked the new main road (E66) without exact path and supplementary infrastructure.

Veszprém's land use plan was adopted in 2005 in accordance with the National Land Use Plan. That is why the presented study focused on the period between 2006 and 2018. During these years altogether 87 ha area was turned to artificial according to the authors' evaluation. Most of these changes (81%) followed the spatial structure of the land use plan. Specific sites turned to mining and transport areas between 2006-2012 from semi natural areas do not fit into the foreseen spatial structure of the masterplan. It is also considerable, that these plots were formerly Natura 2000 areas. Another example is the new area of Veszprém Zoo, that was turned to urban green area from forest for recreational purposes. Despite of the negative examples the new artificial areas are directly connected to the morphological urban area and urban sprawl is controlled, as it was foreseeable in the land use plan from 2005 (Fig. 9).

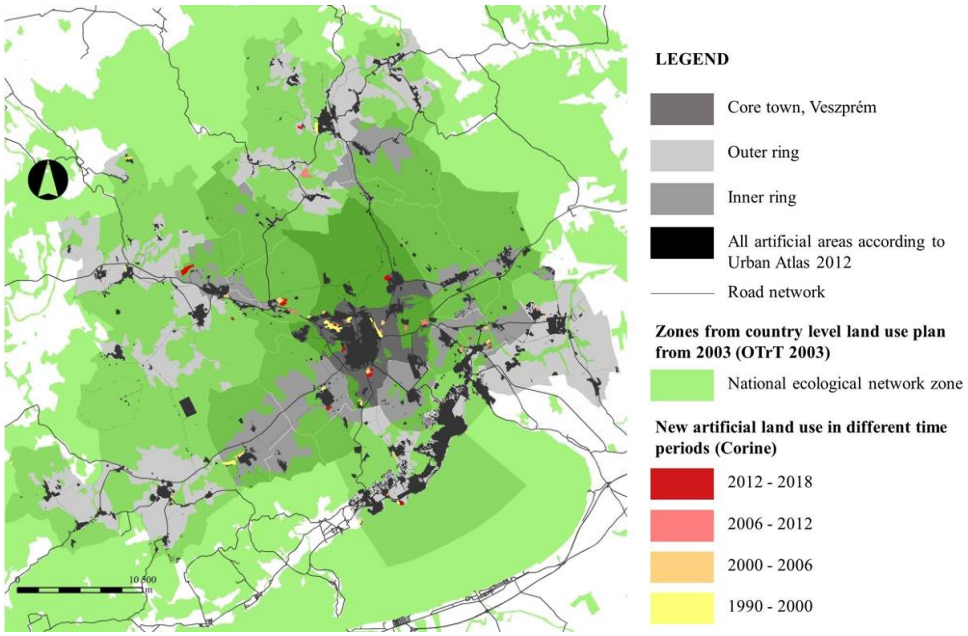


*Fig.6* National Ecological Network Zone from National Land Use Plan 2003 and new artificial surfaces in the study area

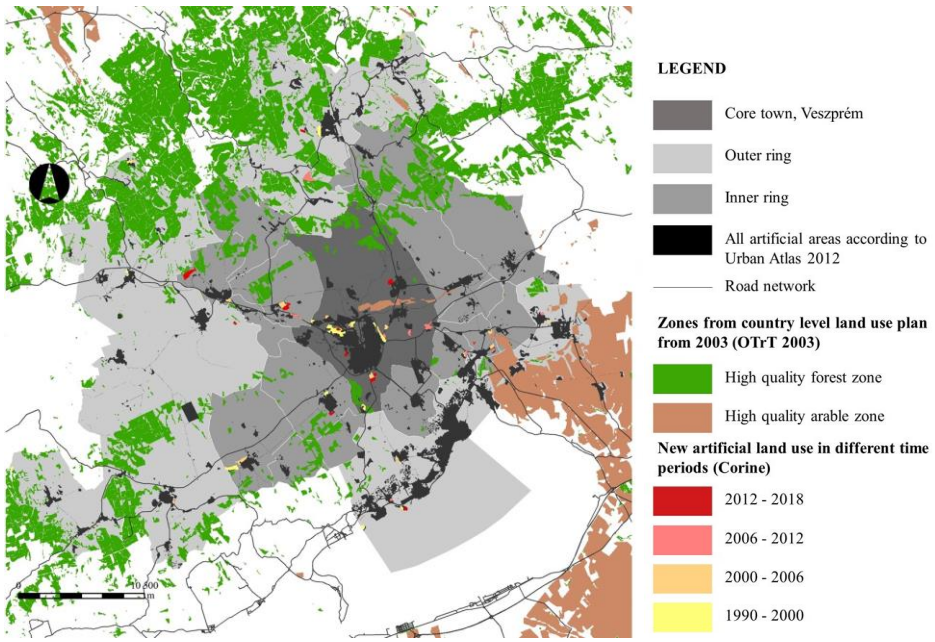


*Fig.7* High Quality Forests and Arable Land from National Land Use Plan 2003 and new artificial surfaces in the study area

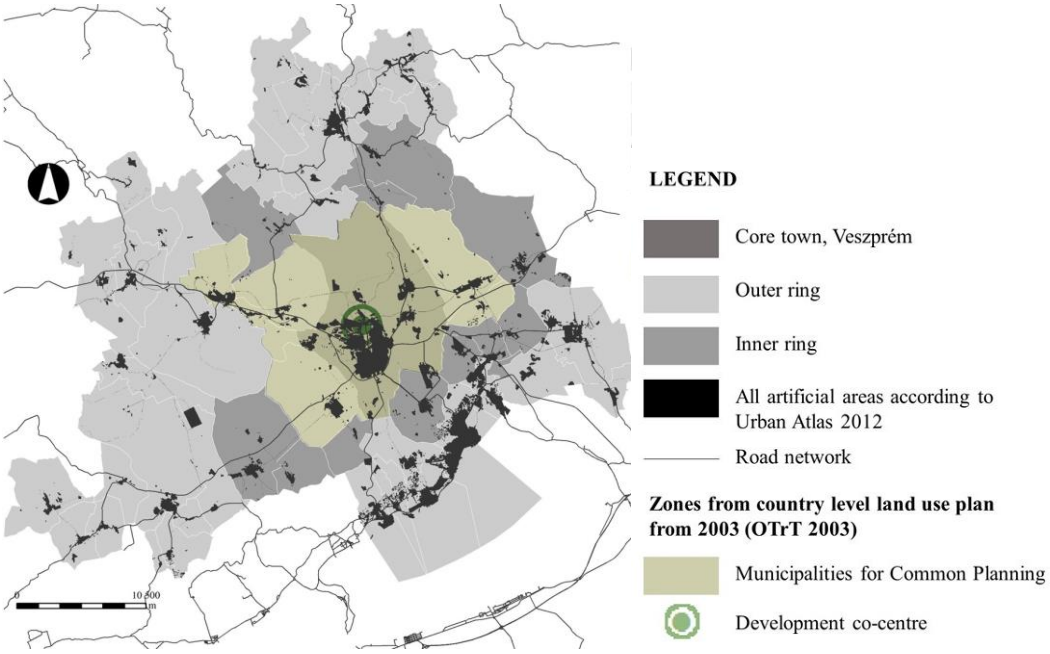


*Fig.8* Zone for Region for Common Planning from National Land Use Plan 2003 in the study area

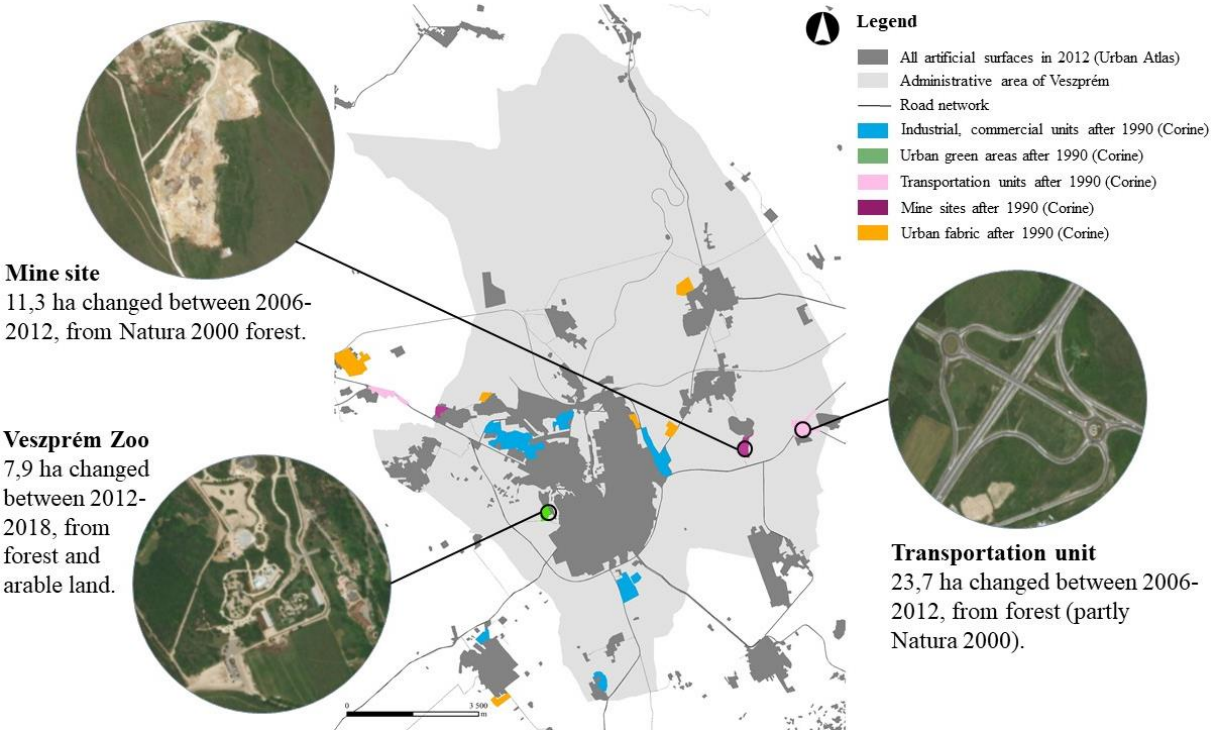


*Fig. 9* Artificial land use changes are not fit into the Veszprém land use plan from 2005

## DISCUSSION AND CONCLUSION

In the presented research the urban sprawl around Veszprém is detected with the help of land use changes from Corine database, visualised with Urban Atlas map from 2012. The artificial surface is larger in Veszprém, than at inner fringe, the lowest in outer fringe, mostly with the loss of agricultural and natural surfaces.

The most intensive period is the restructuring after socialism, between 1990 and 2000. Important changes are detected during the economic crises, between 2006 and 2012, when the land use moved to the direction of artificial surfaces, especially at the core town and inner fringe. We can state that the crises consumed the agricultural areas – 95 ha agricultural and 35 ha natural area was turned to artificial. In the last six years the growth of artificial surfaces continued, however new natural areas appeared in Veszprém and in the outer fringe. Agricultural areas are the losers of land use changes, and this finding fits to the European and Hungarian trends (ESPON 1.1.2. 2006; Ricz et al., 2009).

The period of 1990-2000 is the age of reorganisation and industrial renewal, that meant a surface intensive growth in and around Veszprém. In European level the changes are not outstanding (ESPON EU-LUPA, 2014; Grigorescu and Kucsicsa, 2017) and in Budapest similar

trend is detected (Szilassi, 2017). Because of the rural characteristic of the outer fringe, the new natural areas are dominant (more than 78% of new artificial areas after 2006), however artificial and agricultural areas can be also detected. In the inner fringe the characteristic moved to agricultural and artificial surfaces, in Veszprém more to the direction of artificial surfaces. After 2000 the inner fringe gained several new artificial plots, and we found the patterns of a municipality driven housing in the core town. After 2006, the new artificial areas showed different quality. No new housing plots appeared, even in the core town, however new transport and mining units were characteristic, also some urban green and recreational areas at fringe. These changes can be explained by the effects of economic crises, and the dominance of EU Funds, from these were the transport investments financed presumably. In the last six year, in parallel with the continuous and balanced growth of core town, in the inner fringe new artificial surfaces became remarkable again (70 ha), however, the urban development of outer fringe seems to slow down.

If the distribution of new artificial spaces is examined, different tendencies are experienced at outer, inner fringe and core town. The industrial development – according to our data – is concentrated in the core town, that is the pole of the examined region.

The most intensive period of this concentration – due to the inherited socialist sites and central driven development – is between 1990 and 2000 in Veszprém. The inner fringe can be described as the place for living, also has some industrial development, but not dominant. The outer fringe started to be favourable for living purposes, however lagging behind the core and inner areas, only few plots were transformed to industrial. At the time of industrial reorganisation of the capitalism and during the last 6 years no new industrial sites appeared. The recreational function strengthened in these areas thanks to several new artificial green areas for recreation.

An interesting tendency is the change of new sites for urban green, sport and leisure facilities. These are not situated in the in-built areas – the scale of Corine database even not suitable to detect such minor changes – but are found on natural areas, further from morphological urban area. In Veszprém only between 2012 and 2018 is dedicated a plot to this purpose, for the above-mentioned Zoo. In the inner fringe significant period is between 1990 and 2000, after 2000 only minor plots were turned to urban green. At FUA fringe the tendency is almost opposite; between 2006 and 2012 a boom is seen. This artificial land use category is dominant also after 2012, but the extent of changed areas dropped. Some of these areas were turned to golf club, camping sites, or track for horse racing.

Transport development dominated during the crises, mostly financed by EU. In addition, these developments also concentrate more to the core town, than inner fringe. The new plots for mining are scattered during the periods and in the fringe of agglomeration. It is not surprising, that most of the new sites for mining appeared between 2012 and 2018, because for this region the typical natural resource is raw material used in constructions.

The development of urban fringe also mirrors the tendencies of economic changes. During the period of crisis, no new plots were opened for urban fabric. During the period of 1990 and 2000 the outer ring seems to be preferred, 31 ha new urban fabric appeared. This has almost halved for the next period, and no new urban fabric was detected during the crises. In the last 6 years it did not became popular, but some new areas were dedicated for living. At inner ring the suburbanisation and thanks to this new plot came up during 2000-2006 and 2012-2018. In Veszprém – not to count the years of crises, the quantity of new areas for urban fabric was continuously growing. The intensive growth between 2000 and 2006 of urban fabric was the result of municipality policy. The well-known national policies for family support after 2012– for example CSOK support (financial aid for buying flat/house for families) – do not have any effect on the outer fringe, but in inner fringe and core town is visible through land use changes.

Not surprising the spatial pattern of developments. The new industrial and residential areas are strongly connected to the morphological urban area and main roads. Furthermore, the location of new industrial sites follows the socialist heritage and are mostly opened in the neighbourhood of former industrial units. This can be explained with the importance of transport and logistic facilities nearby, as an economic incentive at other Hungarian towns, Miskolc and Győr as well (Lux, 2014).

The transport units, mining sites and urban green areas are scattered in the rural areas. According to the result, the most vulnerable areas of urban sprawl are at catchment area of main roads outside the town in urban fringe.

Effectiveness of tools of land use control were also analysed, however several soft solutions also exist outside the well-known land use plans and nature protection areas. In the future it would be worth to make a deep analysis of the different land use plans and their modifications. In present study emphasis was put on the most important zones from 2003 and the core town from 2005. According to this the High-Quality Forests Zone had the strictest regulations that was successful, because no new artificial surface appeared. The High-Quality Arable Zone was not so strict, and not dominant at the examined area, however, was successful because these valuable areas did not turn to artificial. Almost the same regulation was at the case of Ecological Network Zone – except the buffer zone where building-in is allowed. This might be the reason for several plots turned to artificial on these areas. Typically mining sites and transport units appeared at the Natura 2000 protection areas. The Zone for Region for Common Planning did not reach its aim at all. At the case of Veszprém the land use plan was able to hold new development close to the morphological urban area, however two unplanned construction sites were opened: the E66 road construction and a new mining site near to the main road. However, special regulation for peri-urban areas do not exist, the framework of land use control can be effective, not to mention some special cases. In this term the regulatory possibility in Hungary are better than in Estonia, where planning control is

missing (Roose et al. 2013) or in Poland where only 30% of municipalities have land use plans (Filepné et al. 2018).

Beside the land use plans and regulations economic changes have also great effect on land use changes. For the future it would also be necessary to prove our assumptions with statistical data, exploring correlation between the land use changes and economic development or social trends. The research was focused on the FUA of Veszprém, but a comparison analyses could have new results. Based on Veszprém's unique development and geographical situation assumptions could not be made to the whole country – the neighbourhood of Balaton agglomeration with one of the strongest regulation for nature protection and land use or the relatively large military area at the Northern part also affect the land use trends.

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