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Spatial, Design, Landscape & Socio-economic Dimensions

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Impact of population dynamics on spatial development of Belgrade urban region

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Abstract

Belgrade urban region, as complex and dynamic system of settlements, is the space of the largest population and functions concentration on the territory of the Republic of Serbia. The starting point of this paper is the importance of this region for the development and integration of Serbian territory, as well as for Serbia's integration into the wider regional surroundings. Spatial expansion of urban areas and the population concentration within this region imposes an important issue of direction and consequences of its recent and future development. In order to observe contemporary development trends in Belgrade urban region relevant demographic and spatial indicators are taken into consideration in the period from 1990 to 2012. Research is focused on the impact of population dynamics, i.e. natural movement of population and migrations, on the expansion of built-up areas and changes in the urban form. The intention of the research is also to examine potential correlation between population dynamics and expansion of built-up areas on the one hand and settlements position and intensity of its functional relations with urban core on the other hand, in order to identify possible directions of planning interventions towards achieving more sustainable urban development in the future.

Keywords: Belgrade; urban region; Serbia; population dynamics; urban form.

1. INTRODUCTION

Population dynamics (particularly migrations) are considered in the paper as factor that is key driver of influence on society's territorial demand on the one hand, and as an indicator in direct correlation with the capabilities of a particular territory to meet the needs of its population on the other. In order to observe contemporary development trends in Belgrade urban region (in the period from 1990 to 2012) the following demographic and spatial indicators are taken into consideration: absolute (total) population, index of population growth/decline, the rate of natural population growth, migration rate, structure of immigrated population by origin, change in ratio between total and urban area of the administrative units and population density (measured via the number of inhabitants per unit of urban area). In addition, structure of daily migrations of the working population by destination, is used as an indicator of the functional links and relations between the settlements within Belgrade urban region. For research purposes and according to available data, spatial framework is defined by the administrative borders of the City of Belgrade (which correspond to the borders of the region at the NUTS 2 level).

1.1 Territorial organization of the City of Belgrade

City of Belgrade (region at the NUTS 2 level) is administratively divided into 17 local administrative units (at the LAU 1 level) i.e. city municipalities (hereinafter referred to as municipalities). The Belgrade settlement (core city) represents the hub for 10 municipalities, whose territories are fully (Stari grad, Vračar, Savski venac, Novi Beograd, Zvezdara, Rakovica) or partially (Palilula, Zemun, Voždovac, Čukarica) encompassed by the core city (see Figure 1). The other 7 municipalities (Grocka, Surčin, Obrenovac, Barajevo, Sopot, Lazarevac, and Mladenovac) have their own municipal centres.

Table 1 - Basic characteristics of the City of Belgrade and its municipalities [1], [2]

Territory	Area km ²	Number of settlements (LAU 2)	Number of inhabitants (2011)
City of Belgrade (NUTS 2)	3234	157	1659440
City municipalities (LAU 1):			
1. Stari grad	5	-	48450
2. Vračar	3	-	56333
3. Savski venac	14	-	39122
4. Novi Beograd	41	-	214506
5. Palilula	451	7	173521
6. Zvezdara	31	-	151808
7. Zemun	150	1	168170
8. Voždovac	148	4	158213
9. Čukarica	157	7	181231
10. Rakovica	30	-	108641
11. Grocka	300	15	83907
12. Surčin ¹	288	7	43819
13. Obrenovac	410	29	72524
14. Barajevo	213	13	27110
15. Sopot	271	17	20367
16. Lazarevac	383	34	58622
17. Mladenovac	339	22	53096

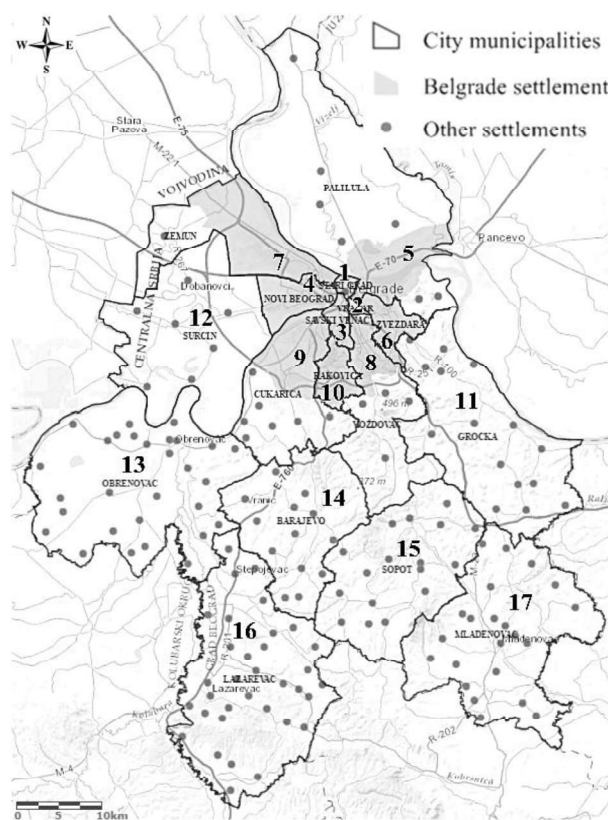


Figure 1: Territorial organization of the City of Belgrade

The Belgrade settlement takes about 11% of the total City of Belgrade (CoB) territory (360 km²) and 70% of the total CoB population (1166763 inhabitants). The remaining 30% of the CoB population lives in 156 settlements (at the LAU 2 level) which are distributed within the territories of 11 municipalities that aren't fully or at all encompassed by the Belgrade settlement. In terms of population size, the largest municipalities are those whose territories (or part of them) are encompassed by the Belgrade settlement, with the exception of the three

¹ Note: City municipality Surčin until 2004 was part of city municipality Zemun, however in this paper Surčin is treated as an independent city municipality during the entire observed period, to allow comparison.

central municipalities (Stari grad, Vračar and Savski venac), which are among those with the smallest population, and also are the smallest in terms of the area scope (see Table 1).

2. POSITION OF BELGRADE IN THE URBAN SYSTEM OF THE REPUBLIC OF SERBIA

From historical perspective, the network of settlements in Serbia has been largely influenced by parallel processes of politically initiated de-agrarisation and emphasised industrialisation after the Second World War. Unlike planned industrialisation, the course of urbanisation was not systematically steered by the former country (SFRY), and the consequence was concentration of population and work places in towns, accompanied by general exodus of rural population. This, however did not result in enhanced policentricity of the network of settlements in Serbia. In contrast, Serbian network of settlements has been featured by functional and other dominance of Belgrade as the capital city. Domination of Belgrade increased even more after the 1990s, when some previously developed urban centres faced depopulation and economic decline largely as the consequence of loss of employment and processes of de-industrialisation [3].

Even though the share of the CoB in the total area of the Republic of Serbia is seemingly small (3.65%) [2], the CoB encompasses 23% of a total population of the Republic of Serbia [1], as well as 33% of the total employed population [4]. According to the most recent available data, the Belgrade region participates with 39.6 percent in GDP of the Republic of Serbia, which stands for 71 percent higher GDP per capita as compared to the Serbian national average¹ [4].

Dominance of Belgrade settlement in the urban network of the Republic of Serbia is illustrated by the fact that it encompasses 27.3% of the urban population of the Republic of Serbia (without Kosovo and Metohija), as well as the fact that Novi Sad as the second largest urban centre in Serbia is 5 times smaller than Belgrade in terms of population size (see Table 2). Demographic size of the 10 largest urban centres in the Republic of Serbia points to the fact that the concept of decentralised urbanization and regionally balanced and polycentric urban system which has been scientifically explained, socially justified and foreseen by the previous Spatial plan of the Republic of Serbia (in 1996) had not been implemented [7].

CoB stands out as the most important system of settlements in the Republic of Serbia, due to the size and influence of Belgrade settlement, latter extending to all other urban systems in Serbia and beyond, on the one hand, and as a key indicator of unbalanced regional development of Serbia on the other. This is largely due to the influx of population in the area of Belgrade, paralleled by the accelerated process of depopulation of the largest part of the territory of Serbia [8].

¹ Until recently Belgrade region was the only one with higher GDP per capita as compared to the national average, but in 2014 Vojvodina region reached GDP per capita which was also higher than the national average [5], [6].

Table 2 - Demographic size of the 10 largest urban centers in the Republic of Serbia¹ [1]

Urban centre	Number of inhabitants (2011)	Ratio compared to Belgrade	Ratio compared to the centre which is at the one position up
Belgrade	1166763	N/A	N/A
Novi Sad	231798	0.199	0.199
Niš	183164	0.157	0.790
Kragujevac	150835	0.129	0.823
Subotica	97910	0.084	0.649
Zrenjanin	76511	0.066	0.781
Pančevo	76203	0.065	0.996
Čačak	73331	0.063	0.962
Novi Pazar	66527	0.057	0.907
Smederevo	64175	0.055	0.965

3. BRIEF OVERVIEW OF THE FACTORS THAT INFLUENCED THE DIRECTION OF DEVELOPMENT OF BELGRADE URBAN REGION

Belgrade urban region, as well as other urban regions in Serbia, is challenged by sprawl, i.e. scattered development of built up area into rural land in the periphery, characterized by lower density, single-family housing, inadequate infrastructure, etc. Although sprawl is not a phenomenon that is unique for Serbian territory, it is largely emphasised here through spontaneously and illegally developed urban outskirts [9]. Initially, the sprawling of Belgrade started as a response to monopolistic and restrictive housing and urban policy during the socialist planning system of former Yugoslavia [10]. Although extensive, state housing production during the socialist regime could not fully meet the overall high demand for housing, due to the structure of housing supply and its failure to adjust to economic conditions of citizens. This opened the way for illegal construction which began at the late 1970s, and led to creation of informal settlements on the peripheral areas of the city. The growth of illegally built areas continued during the 1980s and reached its peak in the 1990s, along with abolition of the state housing system, and the massive inflow of refugees from former Yugoslav republics and internally displaced people from Kosovo and Metohija [9], [11].

4. CONTEMPORARY SPATIAL DEVELOPMENT AND POPULATION DYNAMICS IN BELGRADE URBAN REGION

4.1 Methodology for the applied analysis

Analysis of spatial development and population dynamics in Belgrade urban region in the period 1990–2012 was carried out by using Corine Land Cover (CLC), publicly available dataset of the European Environmental Agency [12], ESRI ArcGIS Basemaps/ESRI ArcGIS OnLine and the official data of the Statistical Office of the Republic of Serbia [1], [14].

¹ Note: Table does not apply to the Autonomous province of Kosovo and Metohija, due to the unavailability of data.

Considering the importance of analysing changes in the “consumption” of the land surrounding cities and the attained rationality with respect to the use of already developed urban land (reflected in the urban population density) for the efficient management of spatial development of cities [13], there has been developed and applied typology of urban development. In order to examine whether growth of urban areas¹ is proportional to the population dynamics, three variables were taken into account (1) change of the ratio of urban area in total settlement area, which can be either increasing (+) or without change (0); (2) change in the number of inhabitants, which can be either increasing (+) or decreasing (-); (3) change in the population density (measured via the number of inhabitants per unit of urban area), which also can be either increasing (+) or decreasing (-). According to possible combination of these three factors, there could be identified 5 types of urban development, varying from 1. Reurbanisation to 5. Shrinking of the city (see Table 3).

Table 3 - Typology of settlements according to direction of urban development

	Change of the ratio of urban area in total settlement area	Change in the number of inhabitants	Change in the population density	Type of urban development
1.	0	+	+	Reurbanisation
	Description of change: Population is growing without occurring of new fragments of urban areas. Consequently, population density is growing.			
2.	+	+	+	Urban growth
	Description of change: Both, urban areas and population are growing. Population density is growing due to the more intense population growth compared to the expanding of urban areas.			
3.	+	+	-	Urban sprawl accompanied by population growth
	Description of change: Both, urban areas and population are growing. Population density declines due to the more intense expanding of urban areas than the population growth.			
4.	+	-	-	Urban sprawl accompanied by population decline
	Description of change: Urban areas are expanding regardless of population decline. Population density declines due to the both, expanding of urban areas and population decline.			
5.	0	-	-	Shrinking of the city
	Description of change: Population is declining without occurring of new fragments of urban areas. Consequently, population density is declining.			

Daily migrations of the working population is used as an indicator of the functional links and relations between the settlements within Belgrade urban region. Structure of daily migrations of the working population by destination indicates the degree of settlements' functional dependence on the local centers, as well as the existence of a certain degree of its functional dependence on other centers within the region or outside of it. In order to differentiate types of settlements based on the direction of daily migration of employed population, there has been developed and applied typology. According to the structure of daily migrants by direction, there could be identified 9 types of settlements, varying from Local (Local in this case refers

¹ Note: Urban area in this case includes following CLC classes: Continuous urban fabric (CLC class 111) and Discontinuous urban fabric (CLC class 112).

to city municipality i.e. LAU 1 level) over Intraregional to Interregional (Region in these cases refers to the NUTS 3 level¹) (see Table 4).

Table 4 - Typology of settlements based on dominant direction of daily migration of employed population

Type of settlement	Criteria
Local	$L > 60\%$
Local-intraregional	$L > \text{IntraR} > \text{InterR}$
Local-interregional	$L > \text{InterR} > \text{IntraR}$
Intraregional	$\text{IntraR} > 60\%$
Intraregional-local	$\text{IntraR} > L > \text{InterR}$
Intraregional-interregional	$\text{IntraR} > \text{InterR} > L$
Interregional	$\text{InterR} > 60\%$
Interregional-local	$\text{InterR} > L > \text{IntraR}$
Interregional-intraregional	$\text{InterR} > \text{IntraR} > L$

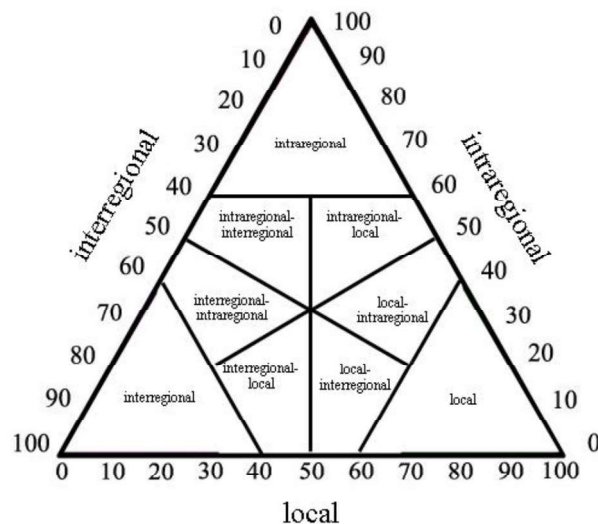


Figure 2 Schematic diagram of the typology criteria

4.2 Results and discussion

Analysis of population dynamics in the CoB indicates significant population growth in the observed period. Population grew due to the positive migration rate, while birth rate was lower than the death rate in this period. In the period 1991-2011, some 283000 people immigrated to CoB. Even 74% of total immigrated population settled in Belgrade settlement. When it comes to the structure of immigrated population by its origin, 56% of immigrated population come from other regions of the Republic of Serbia, while 39% come from the former SFRY republics. This indicates multiplicity of issues that cause development imbalances in this region and in the entire country. Only CoB lost some 52000 people in the period 1991-2011 due to the negative birth rate, and some 124000 people due to the emigration, latter being caused by the political and economic crisis that labels the whole period of a post-socialist transition. In parallel, other regions of the country, also due to the crisis that is even more pronounced in them, have been losing population on the account of Belgrade and further abroad. It is interesting to note that despite intense immigration, the population of Belgrade settlement has not increased significantly, which, among other things, has been a result of settling of population in the periphery. More than two times higher absolute population growth was noted in the periphery in comparison to the Belgrade settlement.

Municipalities Grocka, Čukarica and Surčin are among those with the highest population growth ratio, and the only ones with a positive natural increase of population in this period. Municipalities which are characterized by depopulation are central municipalities: Stari grad,

¹ CoB according to statistics has the status of a region at NUTS 2 and NUTS 3 level at the same time.

Vračar, Savski venac and Novi Beograd and municipality Mladenovac of the periphery. Central municipalities Stari grad, Vračar, Savski venac are also characterized by more intensive emigration than immigration and by the highest aging index. The share of urban area in total municipality area is largest (over 40%) in the municipalities whose territories are fully encompassed by Belgrade settlement. In terms of population density, the most densely populated municipalities are Stari grad, Vračar and Novi Beograd, while the lowest population densities have been in 7 peripheral municipalities. In contrast to municipalities: Grocka, Čukarica and Surčin, the population densities in all other municipalities decreased. In central municipalities, population density decreased due to the loss of the respective population, while in other municipalities it was that the increase of urban areas exceeded population increase. On the entire territory of the CoB, population density decreased by 22% in the observed period (see Table 5).

Table 5 - Indicators of population dynamics and urban area growth [1], [12], [14]

Territory	% of urban area in total area (2012)	Population ratio (2011/1991)	Urban area ratio 2012/1990	Population density (inhabitants/km ² of urban area) (2011)	Population density ratio (2011/1991)	Natural increase rate (per 1000 inhabitants) (1991-2011)	Net migration rate (per 1000 inhabitants) (1991-2011)	Ratio of immigration compared to emigration (1991-2011)	Aging index 2011
City of Belgrade	11	107	137	4842	78	-1.6	4.9	2.3	117
Belgrade settlement	33	103	132	9147	78	-1.7	3.2	1.5	126
Periphery	8	118	139	2290	84	-1.4	9.5	-	98
City municipalities:									
Barajevo	7	130	294	1764	44	-4.8	17.9	18.2	125
Voždovac	19	101	130	5465	78	-2.6	3.2	1.5	133
Vračar	100	84	100	19341	84	-7.9	-1.0	0.9	180
Grocka	11	128	114	2506	112	0.7	11.4	4.8	87
Zvezdara	51	112	115	9585	97	-1.1	6.7	3.0	111
Zemun	22	119	173	5088	69	-0.3	8.9	3.7	104
Lazarevac	5	101	199	2821	51	-1.0	1.6	1.3	96
Mladenovac	8	97	132	1900	74	-3.2	1.9	1.4	119
Novi Beograd	43	98	150	12321	65	-1.1	0.1	1.0	137
Obrenovac	7	107	121	2707	88	-1.7	5.2	2.3	106
Palilula	7	116	185	5593	62	-0.8	8.0	2.8	101
Rakovica	42	113	151	8620	75	0.0	6.0	2.6	119
Savski venac	60	85	107	4615	79	-6.4	-1.6	0.8	156
Sopot	5	102	108	1455	95	-6.7	7.6	3.3	149
Stari grad	53	71	100	16967	71	-8.0	-9.2	0.4	196
Surčin	8	127	115	1922	110	3.1	8.8	2.6	85
Čukarica	18	121	116	6380	104	0.4	9.0	4.3	106

Analysis on the settlement level has shown that population decline has been present in 93 settlements. Population growth was noted mostly in settlements in the surroundings of the Belgrade settlement, which are all well connected with it (within the 45 minutes isochrone). Beside that, population growth is noted in peripheral municipality centres, as well as in their surroundings (see Figure 3).

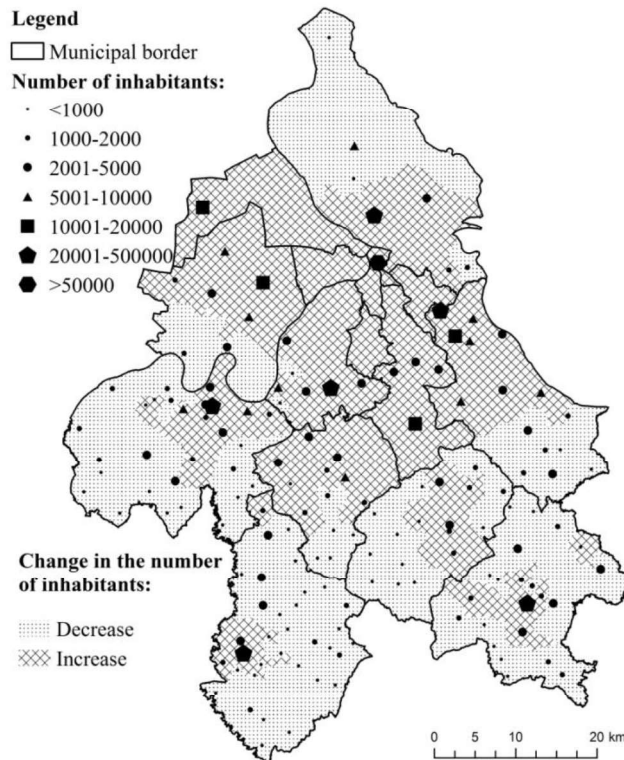


Figure 3
Population size of settlements (2011)
and population dynamics (1991-2011)

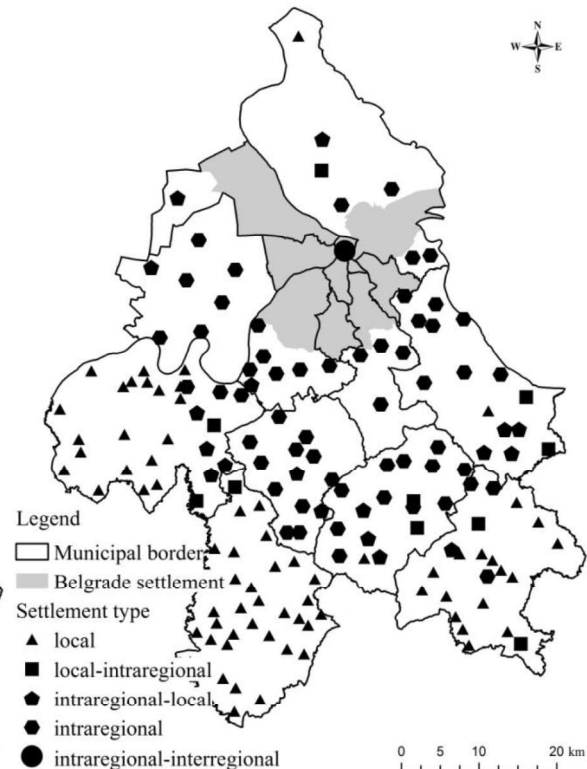


Figure 4
Typology of settlements of the CoB
based on dominant direction of daily
migration of employed population
(2011)

Daily migrations of the working population as an indicator of the functional links and relations between the settlements within the CoB pointed to the stronger functional links in the inner periphery of the CoB, with concentration of the settlements with intraregional orientation of daily migration. In some peripheral municipalities, e.g. Barajevo and Sopot, a higher functional dependence on other centers within the CoB is noted due to the lower functional capacity of these municipalities' respective centres. However, higher degree of functional dependence on the local centers is noted in the most remote municipalities from the core city, due to the higher distance and in case of the municipalities Obrenovac and Lazarevac due to the slightly higher functional capacity of their centers (see Figure 4).

Expansion of urban area was most intensive at the territory of Belgrade settlement and along the main roads intersecting the territory of CoB (see Figure 5). Typology of settlements according to direction of urban development in the period from 1990-2012 indicates that urban sprawl, which was present in 73 analysed settlements of the CoB, was the most frequent type of urban development. Even 42 settlements were characterized by urban sprawl

accompanied by population decline, which is the least sustainable type of urban development. Remaining settlements were characterized by urban growth (30 settlements) (see Figure 6). When comparing the two sub-periods (1990-2000 and 2000-2012), the number of settlements which were characterized by urban sprawl accompanied by population decline decreased from 44 to 29 settlements. Based on that, the number of settlements characterized by urban sprawl accompanied by population growth increased from 16 to 30 settlements. The most represented type of urban development in the period from 2000-2012 was urban growth (43 settlements). This analysis did not include 53 settlements distributed on the territories of periphery municipalities because their territories did not encompass urban areas (CLC classes 111 and 112), and the settlement Sakulja which ceased to exist because of the expansion of the coal mine. It is interesting to note that from these 53 only 4 settlements were characterized by population growth in the period from 1990-2012.



Figure 5
Urban areas on the territory of the CoB

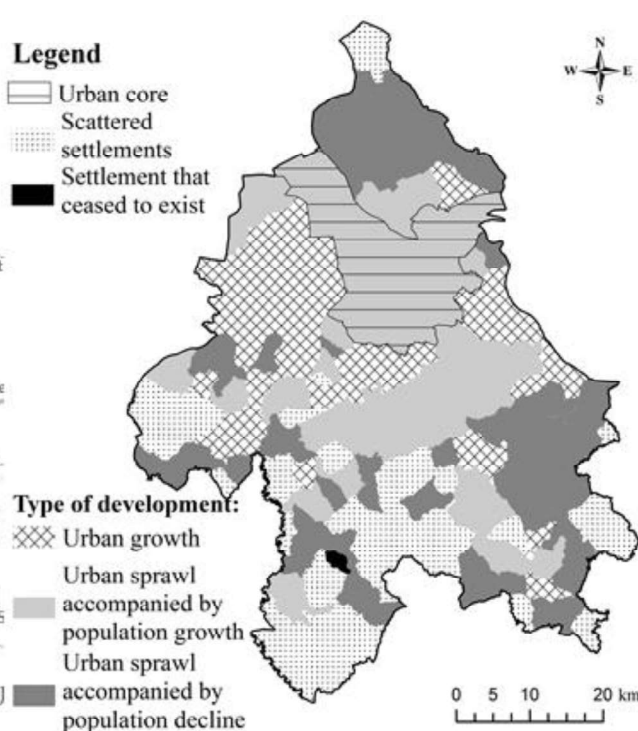


Figure 6
Typology of settlements of the CoB according to direction of urban development (1990-2012)

5. CONCLUDING REMARKS

Back in 1989, Radovanović [15] criticized the negligence of essential importance of human migrations in the former Yugoslav socio-political practice. The consequence was deagrarianisation, influencing depopulation of the entire regions, neglect of valuable agricultural potential, increased pressure on employment, and intensification of pressure on social, residential and public utilities in urban settlements. Today, despite the advocating of the concept of polycentric and regionally balanced spatial development as stipulated in the Spatial

plan of the Republic of Serbia from 1996 [16], as well as by the latest Spatial plan of the Republic of Serbia from 2010 [17], these problems are even more pronounced and fostered by the process of de-industrialization, that have resulted in weakening of functional capacity of the majority of urban centres and growing polarization effects on the territory of the Republic of Serbia.

Extremely emphasized polarization between the Belgrade settlement and the secondary urban centres, e.g. Obrenovac, Lazarevac and Mladenovac (each one of them being almost 45 times smaller than Belgrade settlement in terms of respective population size) had an impact on population changes and functional relationships between settlements in CoB. Consequently, urban growth and intensive functional links between settlements were spatially concentrated at the immediate periphery of urban core. Population migrations towards Belgrade urban region, caused by economic and social development imbalances in the urban network of the Republic of Serbia, contributed to increasing of the gap between the CoB and other regions. However, at the same time intense emigration was noted, which will become even more effective in the future period since the intensity of immigration weakens.

Applied typology of urban development has showed that expansion of urban areas in the observed period mostly was not proportional to the population dynamics. Physical expansion of urban areas either exceeded the population growth or urban areas expanded regardless the population decline. Urban sprawl of the majority of the settlements within the CoB pointed to the negative effect of growing “consumption” of mostly agricultural land in the periphery of most of the settlements within CoB.

Considering all previously mentioned, it is certain that for the future development of the Belgrade urban region, as well as for the development of the entire Republic of Serbia, radical and long-term planning measures are more than necessary. Much needed economic strengthening of the secondary urban regions in the Republic of Serbia, as one of the measures, will require initiation of the process of reindustrialisation in these secondary urban regions, as well as greater incentives for revitalising of agricultural activity in the surroundings of urban centres for improving residents’ quality of life and preserving high quality of agricultural land. Although this kind of planning measures are very difficult to implement under the conditions of prolonged crisis, it is the only way towards achieving more sustainable urban development in the future.

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