PERSPECTIVES FOR THE DEVELOPMENT OF URBAN AREAS IN THE REPUBLIC OF NORTH MACEDONIA

UDC: 711.4-043.86(497.7)
DOI: https://doi.org/10.37658/MGD24119gp

Aleksandra GAJIĆ PROTIĆ[1], Nikola KRUNIĆ, Danijela SRNIĆ
[1]Institute of Architecture and Urban & Spatial Planning of Serbia,
Bulevar kralja Aleksandra 73 / II 11000 Belgrade, Serbia
e-mail: aleksandra@iaus.ac.rs

ABSTRACT

The growth and development of urban areas became an important topic in recent decades, not only in the field of planning and spatial research, but also in the processes of decision-making and creation of policy and strategy.

This paper analyzes spatial changes and development trends in North Macedonia's four largest urban morphological areas—Skopje-Kumanovo, Bitola, Prilep, and Tetovo-Gostivar—utilizing data from the Urban Atlas provided by the Copernicus Land Monitoring Service. The Urban Atlas contains geospatial data on population size and land use patterns.

The study provides conceptual frameworks to improve territorial development policies and methodology for creating spatial and urban planning documents. By integrating geospatial data with a focus on enhancing strategies for managing territorial development, this research contributes to improvement spatial planning practices and may represent basis for further research in this fields. The aim of the paper is to detect current state and determine main perspectives for sustainable urban and spatial development in North Macedonia.

Keywords: Spatial Changes, North Macedonia, Urban Areas, Urban Atlas, Development Trends

INTRODUCTION

Urbanization is a process that continues intensively into the 21st century, contributing to further polarization between urban and rural areas by increasing the participation of inhabitants in urban areas. This represents the challenges in arranging and organizing settlement networks and their governance in territorial development management (United Nations, 2019; Castells-Quintana & Herrera-Idárraga, 2019).

Despite the increase in urbanization, cities in the Republic of North Macedonia are characterized by a general process of depopulation and demographic aging, strengthening of regional disparities, problems of the development of urban culture and deterioration of the quality of environmental protection, including the unfavorable consequences of climate change. The complexity of settlement networks, urban systems and city planning requires a special approach to directing development trends and activities. Cities in North Macedonia form a heterogeneous system of settlements of different demographic size, economic development and functional capacity, which is a consequence of different development predispositions in the

geographical and socio-historical context (Markoski et al, 2012). Continuing the analysis, this study examines the fundamental spatial characteristics of the four largest cities: Skopje-Kumanovo, Bitola, Prilep, and Tetovo-Gostivar, for which data are available from the Urban Atlas database. Urban Atlas (UA) provides land cover and land use data with the integrated population estimates in 788 Functional Urban Areas (FUA) with more than 50,000 inhabitants in countries that belong European Economic Area (EEA) and the United Kingdom for the 2018 reference year. A FUA consists of a city and its commuting zone. FUA therefore consist of a densely inhabited city and a less densely populated commuting zone whose labor market is highly integrated with the city (Dijkstra et al., 2019).[1]

BASIC CHARACTERISTICS OF URBAN AREAS IN NORTH MACEDONIA

According to the Census data from 2021, the network of settlements in North Macedonia consists of 1,792 settlements with 1,836,713 inhabitants. The largest number of inhabitants (57%) live in large settlements (more than 10,000). On the other hand, 526,502 inhabitants lived in the area of the City of Skopje, which is 29% of the total population of North Macedonia. The disproportion in the demographic size of Skopje and other larger cities is a consequence of the incoherence and asymmetry of the urban system of North Macedonia. Cities in North Macedonia are spatially dispersed and unevenly distributed in terms of population concentration and functions. The dominance of Skopje and its urban area, realizes a strong urban-demographic polarization in the urban system of North Macedonia, which is confirmed by the size of the 10 most numerous urban settlements (Table 1).

Table 1. The ratio of demographic sizes of the ten largest urban settlements in RSM, Census 2021. year

	Urban settlement	Population	Index in relation to Skopje	Index in relation to Previous urban settlement
1.	Skopje[2]	422540	1.000	-
2.	Kumanovo	75051	0.178	0.178
3.	Bitola	69287	0.164	0.923
4.	Prilep	63308	0.150	0.914
5.	Tetovo	63176	0.150	0.998
6.	Štip	42000	0.099	0.665
7.	Veles	40664	0.096	0.968
8.	Ohrid	38818	0.092	0.955
9.	Strumica	33825	0.080	0.871
10.	Gostivar	32814	0.078	0.970

Source: Authors calculation

The analysis of land cover changes in urban settlements is possible for FUAs, i.e., cities with more than 50,000 inhabitants and their gravitational areas. The UA Land Use/Land Cover classification is derived from CORINE Land Cover and is composed of 27 classes distributing among 5 thematic groups: 1. Artificial surfaces 2. Agricultural areas 3. Natural and (semi-) natural areas 4. Wetlands 5. Water. Four hierarchical levels are defined in the nomenclature for

[1] The dataset maps land cover and land use for 17 urban classes with the Minimum Mapping Unit (MMU) of 0.25 ha and for 10 rural classes with the MMU of 1 ha and is available as vector data (https://land.copernicus.eu/en/products/urban-atlas/urban-atlas-2018).
[2] Number of inhabitants only in urban settlements in municipalities which administratively belong to the City of Skopje.

artificial surfaces (class 1) while only two are defined for the non-artificial ones (classes 2-5) (EEA, 2020). Data are available for four cities in the Republic of North Macedonia: FUA Skopje (with Kumanovo in gravitational zone), FUA Tetovo (with Gostivar), FUA Bitola and FUA Prilep (Figure 1 and 2). Land cover data are joined with population data enabling realistic estimates of the population by land use/cover categories and population densities (Гајић & Крунић, 2020).

Thus 893,248 inhabitants in North Macedonia lived in the area covered by FUA, while 840,039 inhabitants lived in the areas classified as artificial (classes 11100-14200)[3], i.e., 46% of the total population of the Republic of North Macedonia was covered with FUA (Table 2).

Table 2. Structure of land cover, population and population density in urban areas (classes 11100-14200)

Code 2018	Class 2018	Total population	%	Area (ha)	%	Mean Population density (inhabitants per ha)
11100	Continuous urban fabric (S.L. : > 80%)	235222	28	2529	6	90
11210	Discontinuous dense urban fabric (S.L. : 50% - 80%)	286571	34	4636	11	59
11220	Discontinuous medium density urban fabric (S.L. : 30% - 50%)	135817	16	3685	9	35
11230	Discontinuous low density urban fabric (S.L. : 10% - 30%)	100713	12	4118	10	22
11240	Discontinuous very low density urban fabric (S.L. : < 10%)	59331	7	7165	18	8
11300	Isolated structures	1847	0	720	2	3
12100	Industrial. commercial. public. military and private units	20054	2	7018	17	2
12210	Fast transit roads and associated land	0	0	582	1	0
12220	Other roads and associated land	0	0	4845	12	0
12230	Railways and associated land	0	0	517	1	0
12400	Airports	0	0	295	1	0
13100	Mineral extraction and dump sites	0	0	1764	4	0
13300	Construction sites	0	0	372	1	0
13400	Land without current use	0	0	970	2	0
14100	Green urban areas	0	0	1049	3	0
14200	Sports and leisure facilities	484	0	491	1	1
Total		840039	100	40757	100	14

Source: Authors calculation

In the structure of artificial surfaces, the highest share is in classes of discontinuous very low density urban fabric (18%) and in industrial, commercial, public, military and private units (17%). Significant contribution to artificial surfaces have classes related to other roads and associated land (12%), discontinuous dense urban fabric (11%) and discontinuous low density urban fabric (10%). Other anthropogenic areas encompass about 32% of total artificial surfaces.

[3] Complete classification is available at https://land.copernicus.eu/en/technical-library/urban_atlas_2012_2018_mapping_guide/@@download/file

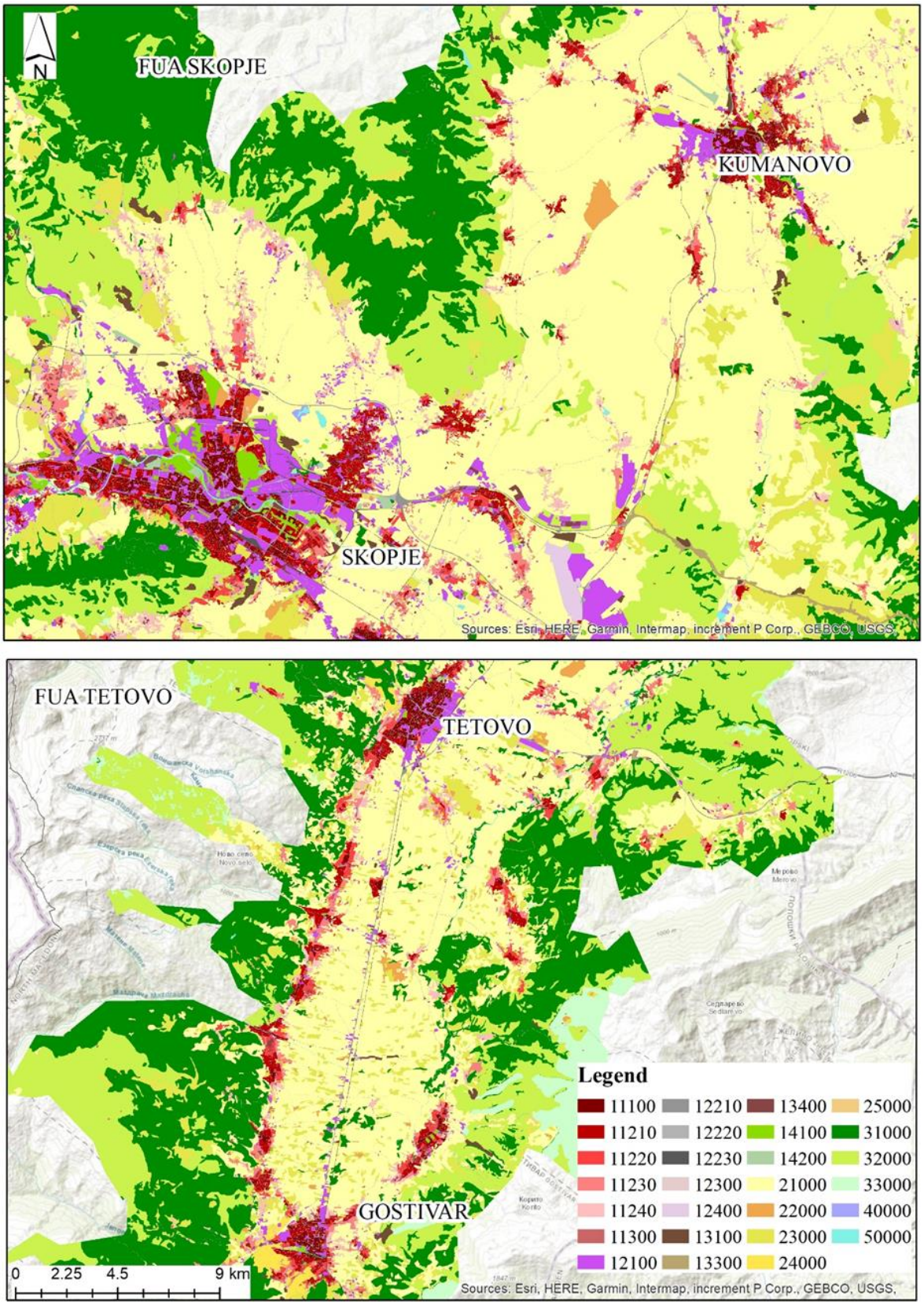

Figure 1. Illustrative example of FUA Skopje and FUA Tetovo land cover

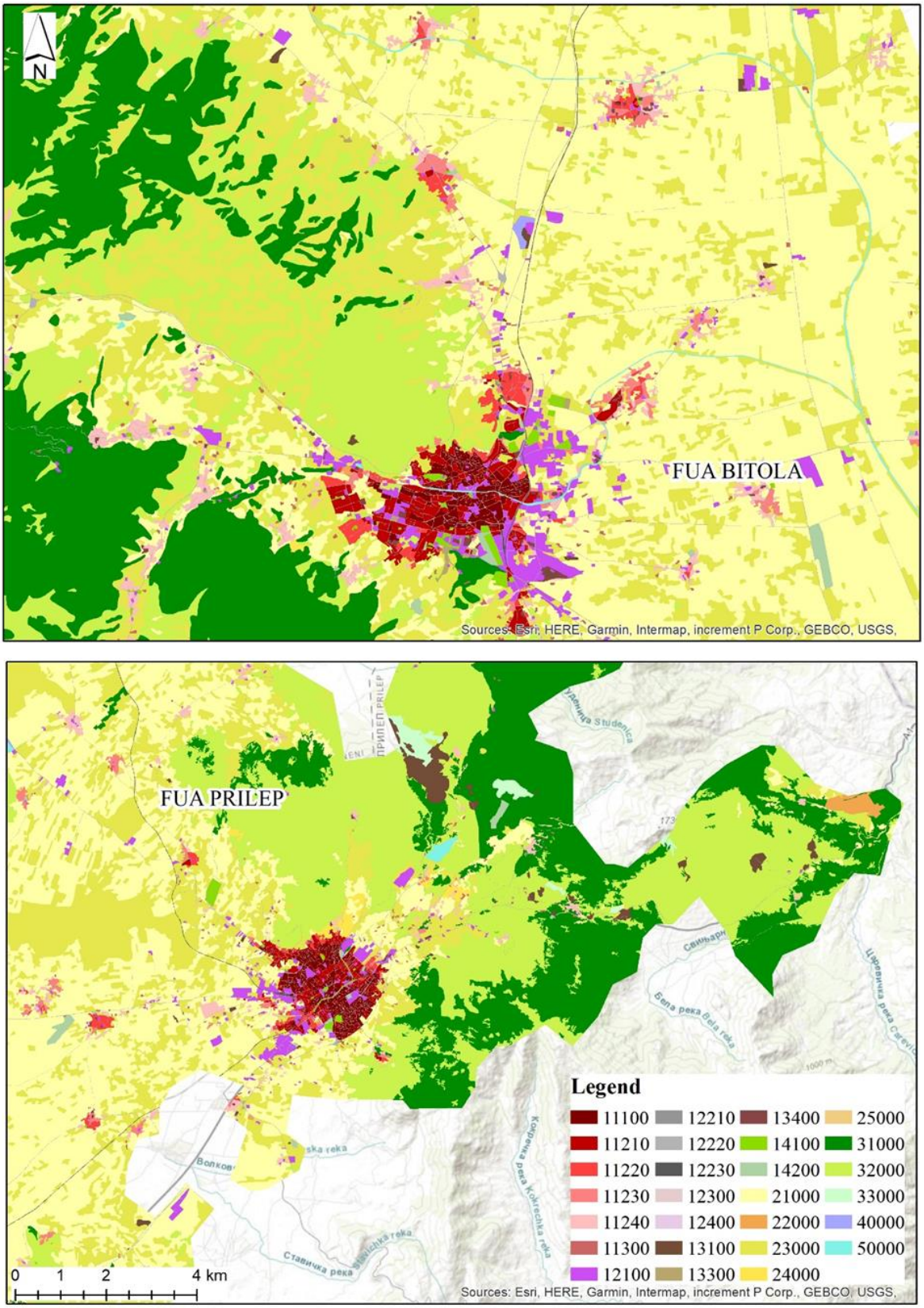

Figure 2. Illustrative example of FUA Bitola and FUA Prilep land cover

Within artificial surfaces the largest number of inhabitants was recorded in discontinuous dense urban fabric (34%) and continuous urban fabric (28%). The rest of the total population is distributed in classes: discontinuous medium density urban fabric (16%), discontinuous low

density urban fabric (12%) and discontinuous very low density urban fabric (7%). The highest population densities are represented in continuously built-up areas where the percentage of built-up is greater than 80%. The average population density in these zones is 90 inhabitants per ha, with the maximum density of 247 inhabitants per ha in FUA Skopje. In discontinuous dense urban fabric areas mean population density ranged from 59 inhabitants per ha (in areas of high built-up density) to 8 inhabitants per ha in areas of very low built-up density. Low population densities are mostly related to isolated areas and other areas where there are almost no inhabitants.

SKOPJE URBAN AREA

According to UA methodology FUA Skopje covered the surface of 1,834 km^2. In FUA Skopje lived 584,603 inhabitants, which is 66% of total population covered with FUA in North Macedonia. In administrative sense FUA Skopje covered parts of territory of the City of Kumanovo (Figure 3).

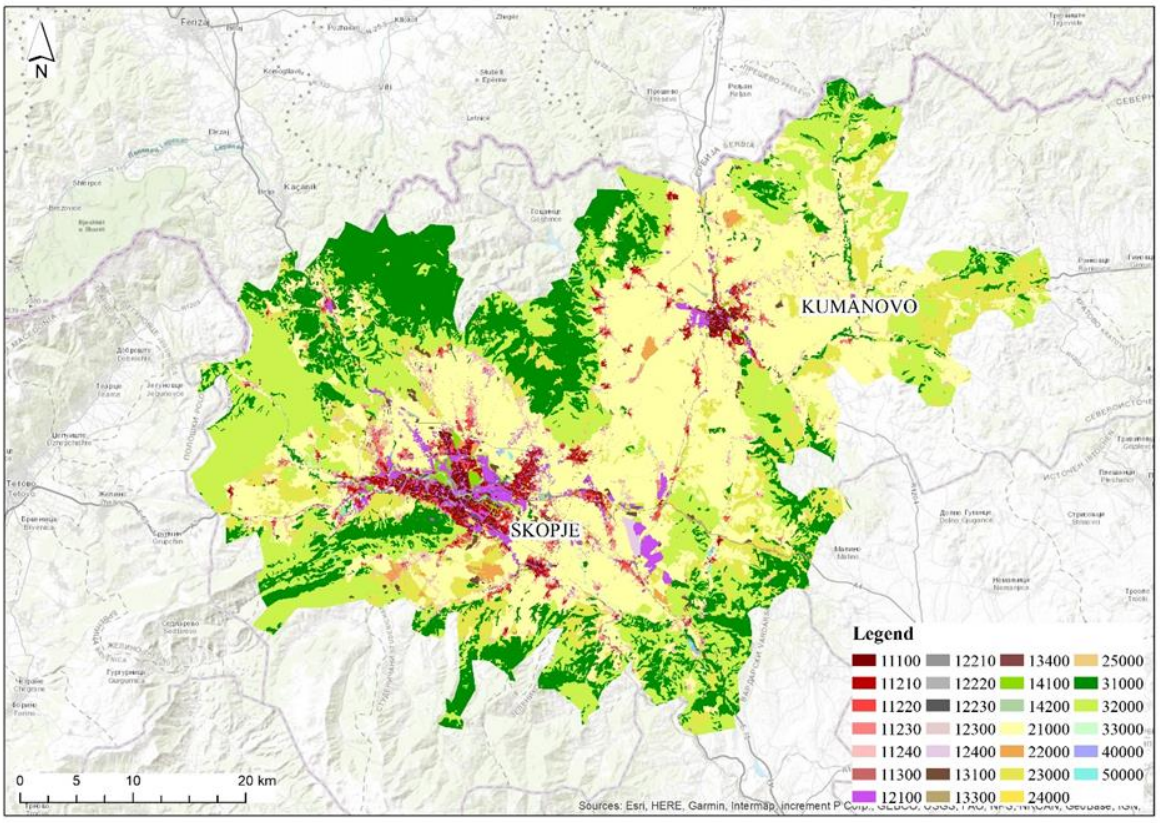

Figure 3. FUA Skopje

Compared to the previous analysis that included all the FUA in Northern Republic of Macedonia the Skopje anthropogenic area has a higher population density of and higher level of built-up areas.

Classes that describe artificial surfaces (classes 11100-14200) occupied about 232 km^2 which is about 10% of the total area of the FUA Skopje. In the structure of artificial classes, the classes that belong industrial commercial public military and private units have the largest share

(20%), discontinuous very low density urban fabric covers 16% of total artificial surfaces, discontinuous dense urban fabric 12%, and roads and associated land around 11%. Significant share in artificial surfaces have classes discontinuous low density urban fabric (9%), Discontinuous medium density urban fabric (8%) and continuous urban fabric with high density (6%), while green urban areas covered (3%) as well as mineral extraction and dump sites (4%). Other classes covered around 11% of total artificial surface (Table 3).

Table 3. Structure of land cover, population and population density in Skopje urban areas.

Code 2018	Class 2018	Total population	%	Area (ha)	%	Mean Population density (inh/ha)
11100	Continuous urban fabric (S.L. : > 80%)	164151	30	1446	6	119
11210	Discontinuous dense urban fabric (S.L. : 50% - 80%)	198438	36	2811	12	71
11220	Discontinuous medium density urban fabric (S.L. : 30% - 50%)	81075	15	1911	8	40
11230	Discontinuous low density urban fabric (S.L. : 10% - 30%)	58709	11	1967	8	25
11240	Discontinuous very low density urban fabric (S.L. : < 10%)	28864	5	3786	16	7
11300	Isolated structures	645	0	259	1	3
12100	Industrial. commercial. public. military and private units	15257	3	4676	20	3
12210	Fast transit roads and associated land	0	0	453	2	0
12220	Other roads and associated land	0	0	2442	11	0
12230	Railways and associated land	0	0	331	1	0
12400	Airports	0	0	276	1	0
13100	Mineral extraction and dump sites	0	0	850	4	0
13300	Construction sites	0	0	274	1	0
13400	Land without current use	0	0	651	3	0
14100	Green urban areas	0	0	741	3	0
14200	Sports and leisure facilities	374	0	277	1	1
Total		547513	100	23152	100	17

Source: Authors calculation

A total of 547,513 inhabitants lived in the areas classified as artificial, i.e. 95% of the total population of the functional urban area of the city of Skopje, i.e. 30% of the total population of the Republic of North Macedonia is included in a functional area. The largest number of inhabitants lived in discontinuous dense urban areas (36%), while in compactly built-up areas lived 30%.

The highest population densities are present in continuously built-up areas 119 (inhabitants per ha), which is significantly high compared to the average value of all four FUAs. Low population densities are mostly related to isolated areas.

THE STARTING POINTS FOR PLANNING AND DEVELOPMENT OF URBAN AREAS

Based on the UA geospatial data, it is possible to determine the basic tendencies of the development of urban systems and areas in the Republic of North Macedonia. The existing system of settlements in the Republic of North Macedonia is the result of the previous develop-

ment of urban systems and its further development will be based on the intensification of spatial and functional relations and links between urban areas. Primarily, this refers to the urban (metropolitan) area of Skopje, which will integrate adjacent rural zones by enhancing its functional capabilities and transportation infrastructure. Additionally, the formation of agglomerations (such as Kumanovo, Tetovo-Gostivar, and Bitola-Prilep) and the fostering of smaller urban areas and urban centers will play integral roles in the spatial development.
The network of urban areas is consisted of:

1. The metropolitan area of Skopje comprises the agglomerations of Skopje, Kumanovo, and Tetovo-Gostivar. Functionally, the development of the Skopje metropolitan area has been driven by the spatial integration of urban centers and their urban areas along the line Kumanovo-Skopje-Tetovo-Gostivar. The metropolitan area of Skopje serves as the primary driver of development in the Republic of North Macedonia and includes about 760,000 inhabitants, which is around 40% of the total population of the country. The core of the metropolis is the agglomeration system of Skopje - a polycentric urban agglomeration of about 590,000 inhabitants.
2. Agglomerations, as complex regional functional-urban systems comprised of multiple settlements have the character of functionally urban regions/areas. The urban centers of Tetovo and Gostivar constitute an agglomeration system within the area of 1060 square km. Bitola-Prilep agglomeration represents an influential zone that encompasses around 140,000 inhabitants. Potentially, these agglomerations could play a pivotal role in achieving a more balanced development for the Republic of North Macedonia.
3. Urban areas consist of city settlements functionally networked with their surroundings. Formed from urban cores with a higher degree of centrality and functionally compatible surrounding settlements.
4. 4.Urban centers in the rural environment appear as smaller urban areas in the rural environment and represent centers of local integration.

CONCLUSION

The paper presents an example of the use of the UA in the area of the Republic of North Macedonia. The research results provide a summary analysis of the land cover of all urban areas covered by the UA methodology. A special analysis included the urban area of the City of Skopje with the aim of a more realistic view of spatial relations considering the dominant role and importance of Skopje in the spatial-functional organization of North Macedonia. Based on the conducted analyses possible directions for the development of urban areas in North Macedonia were proposed. The obtained results can represent inputs in the creation and production of strategies and spatial planning and urban planning documents.

Trough the analysis of land cover and the examination of spatial relationships, the paper presents only one of the possible ways of utilizing UA. Numerous studies indicate the significance of UA data in analyzing population dynamics (Pirowski & Timek, 2018), as auxiliary data

for flood risk assessment (Skilodimou et al., 2021), evaluating the accessibility of green infrastructure (Ruche et al., 2018; Kovács et al., 2019), urban agriculture (Živanović Miljković et al., 2022), etc.

ACKNOWLEDGMENT

The research presented in this paper is supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (No. 451-03-66/2024-03/200006)

REFERENCES

1. Castells-Quintana D., Herrera-Idárraga P. (2019) Cities in the 21st century: A view from the developing world. REGION. Vienna, Austria, 6(2), pp. E1-E6. doi: 10.18335/region.v6i2.260.
2. EEA (2020) Mapping Guide v6.3 for a European Urban Atlas. Available at https://land.copernicus.eu/en/technicallibrary/urban_atlas_2012_2018_mapping_guide/@@download/file
3. Dijkstra, L., Poelman, H. and Veneri, P. (2019) The EU-OECD definition of a functional urban area, OECD Regional Development Working Papers, No. 2019/11, OECD Publishing, Paris, Available at https://doi.org/10.1787/d58cb34d-en.
4. Гајић, А., Крунић, Н. (2020) Примена података „Urban Atlas“ у истраживању и планирању простора: пример Београда. In: Петрић Ј., Вујошевић, М. (eds.) Теоријска, развојна и примењена истраживања просторних процеса за обнову стратешког мишљења и управљања у Србији, (pp. 67-85). Belgrade: Институт за архитектуру и урбанизам Србије.
5. Kovács, K.F., Linares, P.G., Iváncsics, V., Máté, K., Jombach, S., & Valánszki, I. (2019) Challenges and Answers of Urban Development Focusing Green Infrastructure in European Metropolises. Environmental Science, Engineering.
6. Markoski B. Apostolovska-Tosevska B., Dimitrovska O., Milevski I., Gorin S. (2012) Characteristics of the urban settlements network in The Republic of Macedonia, Forum geografic XI, pp. 155-160.
7. Pirowski T., Timek M. (2018) Analysis of land use and land cover maps suitability for modeling population density of urban areas – redistribution to new spatial units based on CLC and UA databases. Geoinformatica Polonica, Vol. 17 (2018), pp. 53-64.
8. Rusche K.; Reimer M.; Stichmann R. (2019) Mapping and Assessing Green Infrastructure Connectivity in European City Regions. Sustainability, 11, 1819. https://doi.org/10.3390/su11061819
9. Skilodimou H.D.; Bathrellos G.D.; Alexakis D.E. (2021) Flood Hazard Assessment Mapping in Burned and Urban Areas. Sustainability, 13, 4455. https://doi.org/10.3390/su13084455
10. United Nations, Department of Economic and Social Affairs, Population Division (2019) World Urbanization Prospects 2018: Highlights (ST/ESA/SER.A/421).
11. URBAN ATLAS 2018, Copernicus Land Monitoring Service DOI: https://doi.org/10.2909/fb4dffa1-6ceb-4cc0-8372-1ed354c285e6
12. Živanović Miljković J.; Popović V.; Gajić A. (2022) Land Take Processes and Challenges for Urban Agriculture: A Spatial Analysis for Novi Sad, Serbia. Land, 11, 769. https://doi.org/10.3390/land11060769