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Suburbanization within City Limits in Hungary—A Challenge for Environmental and Social Sustainability

Gábor László Vasárus and József Lennert *

Institute for Regional Studies, Centre for Economic and Regional Studies, 3 Rákóczi út, H-6000 Kecskemét, Hungary; vasarus.gabor@krtk.hu
* Correspondence: lennert.jozsef@krtk.hu; Tel.: +36(30)-478-9455

Abstract: Suburbanization is one of the most prominent processes of post-socialist urban development, leading to the deconcentration of people, capital, as well as productive and non-productive activities within the functional urban area. This phenomenon also has a significant impact on the traditional rural landscape and leads to environmental and social sustainability challenges. Outmigration from the city center to the rural municipalities of the agglomeration ring is already a thoroughly studied topic. However, less attention is given to migration processes not crossing municipal borders. In Hungary, a significant fraction of them is driven by similar motivations as "traditional" suburbanization. Such movements include flows to built-up residential areas that are physically separated from the urban core. Due to their peculiar development path, the inhabited outskirts can also become destinations for within-city migration. This kind of mobility can be considered suburbanization within the city limits. Because of the general lack of data, this phenomenon is seldom researched. However, this study attempts to address this gap. The prevalence of this process in Hungary is explored by analyzing national statistical data sources. Four case studies are selected for detailed examination—Győr, Zalaegerszeg, Kecskemét, and Szeged. GIS methods, field examinations, surveys, and expert interviews are used to get a detailed picture of the demographic and land cover change processes, as well as the distinctions between the destination areas of the case studies. A comparison of the results drawn from the different methods reveals that land use change in the study area is more widespread than what the land cover datasets indicate. The findings indicate that the Corine Land Cover categories describing mixed land use—especially complex cultivation patterns—are not able to capture the drastic function shift caused by intense suburbanization. Different environmental and social sustainability issues are identified depending on the economic status of the outmigrants. This paper also sheds some light on the urban planning considerations of this emerging challenge.

Keywords: suburbanization; post-socialist urbanization; migration within city limits; land cover change; urban sprawl; greenfield development degradation

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1. Introduction

Suburbanization is one of the most prominent spatial processes in the post-socialist countries of Central and Eastern Europe, with fundamental socio-economic consequences. In general, suburbanization can be interpreted as a process in which the productive and non-productive activities, capital, and a portion of the population relocate or concentrate from the urban core to its surroundings. As a result, decentralization occurs in the urban area [1–7].

In recent decades, this phenomenon has been extensively discussed in the geographic, sociological, economic, and urban literature [2,8–13]. However, most studies have only examined migration crossing administrative borders; thus, the phenomenon of suburbanization within the city limits has received less attention. At first, suburbanization within the city limits may sound like a self-contradictory concept. However, looking beyond the plethora of research considering only relocation between municipalities, one can realize

that the essence of suburbanization—deconcentration—can still occur within the city limits. This is especially true if the administrative units and settlements do not match each other [1,6,11,12].

Drawing from the disciplines of settlement geography and urban and rural studies, the term settlement is used in this study for inhabited places that are distinguishable from their surroundings, have a degree of inner cohesion, and have historical antecedence. Settlements with urban functions are considered as towns or cities and settlements without urban functions as villages [14]. This conceptualization is independent of the administrative or legal status of the settlements. Local municipalities, however, are the LAU-2-level administrative and statistical units with defined boundaries and institutes of self-governance. In some cases and certain countries, a local municipality may contain more than one settlement and even a mixture of cities and villages.

The most obvious example is when local municipalities usually cover a large area and include many settlements. Such systems can be found in Poland (gminas), Serbia (opstins), or Bulgaria (obshtins). In these countries, it is typical that some of the suburban villages are in the same administrative unit as the city, especially for middle-sized cities [15–17].

In Hungary, the situation is a bit different. To support the development policies of the state socialist era, many villages were attached to the cities. These settlements are often still physically separated from the cities, and their rural image is preserved [18–20]. In addition to Hungary, this was typical in Poland [15,21,22], the Czech Republic and Slovakia [11,16,23–25], and Bulgaria [17]. As a result, the administrative area of cities undergoing suburbanization may also contain rural settlements, as well as extensive agricultural and forestry areas. However, as the statistics are primarily published for the administrative units, data for population movements within administrative boundaries are limited.

The situation in Hungary is further complicated by the fact that a large number of inhabited outskirts are on the edges of the areas of towns and suburban villages. These are former zones containing holiday cottages, allotment gardens, and vine hills that have become permanently inhabited neighborhoods at the expense of their agricultural function [18,20,26,27]. Even before 1989–1990, these were the target areas for moving out of the city on a small scale. This phenomenon was described in other post-socialist countries too. For example, the Polish osada and ogród działkowy; the Romanian cătune; the dachas and hajaküla of the Baltic states; the Czech and Slovak štále; and in general the allotments, farms, and hamlets of these countries are also going through such a transformation [5,13,28–30].

Another aspect to consider is that earlier research has revealed that suburbanization causes a number of environmental harms, impairing both the sustainability and climate adaptation capacity of cities. The effects of the process, through changes in land use, significantly reduce the quantity and quality of green and blue surfaces, making them unable to perform their ecological functions effectively. Its other effects, such as the increase in vehicle traffic and the growing albedo, are negatively impacting the environment and the quality of life of the population [31–36].

Based on the above, it can be hypothesized that significant portions of the transformations and environmental damage associated with suburban development do not appear in national databases. The main research directions are formulated to prove this hypothesis and to explore its consequences. Accordingly, the present paper has the following three main goals:

- To explore the prevalence of suburbanization within city limits and suburbanization directed to separated inner areas and outskirts in Hungary;
- To draw a detailed picture of the demographic and land-use change processes in four cities selected as case studies (Győr, Zalaegerszeg, Kecskemét, Szeged);
- To explore the micro-level differences between the destination areas of suburbanization within city limits, to draw attention to the diverse social and environmental impacts of the process and highlight the arising sustainability challenges.

2. Materials and Methods

2.1. Methodology

To meet the main goals of the paper, the presented methodology investigates the research problem on three different spatial scales: the scale of Hungary, the scale of the selected case cities, and the scale of the selected destinations of within-city suburbanization. First, a statistical analysis is used to explore the general demographic trends of suburbanization within city limits in Hungary. For the case study areas, besides the statistical analysis, a GIS analysis of the land cover will also help to provide a detailed picture of the process and consequences of suburbanization within city limits. Additionally, for selected destination areas, a field survey of plots and a questionnaire will help to identify micro-level problems and reveal the differences within the spatial categories.

To achieve the main goals and be able to answer the research questions, the municipal areas were divided into the following four spatial categories:

- Core inner areas;
- Separated inner areas;
- Densely populated outskirts;
- Sparsely populated outskirts.

The inner areas and outskirts exist in Hungary as planning delimitations and have distinct planning regulations. These regulations intend to limit urban development to the inner areas, while the outskirts are mainly preserved for agricultural activity and natural vegetation. However, in reality, one can find a mixture of built-up, agricultural, and natural surfaces in both area types. The core inner areas contain the original urban settlement, and these areas were completely incorporated during its enlargement. The separated inner areas are often physically distant from the core inner area, or at least separated by a natural or artificial barrier (e.g., water surface, railway). Most of them were formerly independent villages, attached to the growing towns and cities. The densely populated outskirts are distinct parts of the outskirts (e.g., vine hills, garden zones, scattered farm areas, manors), originally with specialized agricultural and sometimes recreational functions [12,37]. However, due to their later development, they now also provide permanent housing for many inhabitants. The remaining area is considered the sparsely populated outskirts [18].

The base map for the GIS analysis was assembled from multiple sources. The extent of the inner areas of the case studies was based on the ArcMagyarország 2021 database, then the Detailed Gazetter of the HCSO (Hungarian Central Statistical Office) was used to identify the densely populated outskirts. For their spatial delineation, the ArcMagyarország 2021 database, local information, and the satellite view of Google Maps (loaded as an XYZ tile) was used.

Demographic data for the country-level statistical analysis were collected from the Detailed Gazetter of the HCSO. Every populated outskirt and separated inner area that existed between 1990 and 2011 was taken into account. Currently, the Population Census of 2011 is the latest official, comprehensive data source for sub-municipality level demographic statistics. The yearly demographic statistics provided by the HCSO provide no insight about the demographic processes between the censuses below the LAU-2 level. For the four case studies, population data were also derived from the GHS Population Grid [38]. The resident population of the grid was taken from the Population Census of 2011. In the case study of Szeged, the classification of certain areas in the Detailed Gazetter (whether they are separated inner areas or outskirts) differed from the presented categorization and contradicted the logic applied in other cases (as well as the planning regulations). In these cases, only the GHS Population Grid data were used. Apart from this, the data from the Population Grid and the Detailed Gazetter are comparable.

To identify the land cover characteristics and changes, the Copernicus Land Monitoring Service products were used. The CLC 1990 and 2018 datasets and the high-resolution Imperviousness Density layers from 2006 and 2018 were processed in QGIS and ArcGIS to create intersections for each delineated area.

The first step of the field observation consisted of the survey of the properties on the outskirts of the case areas. Altogether 8101 plots were classified based on their function (inhabitancy, recreation, garden, abandoned) and the condition of the buildings (new or renewed, average, poor, in ruins). The infrastructure was also evaluated based on the presence of particular objects (e.g., paved roads, street lights, storm ditches).

In 2014–2016, a questionnaire was conducted in the separated inner areas and outskirts of Győr in a preceding study; in this paper, this database was re-analyzed because it was suitable to assess the environmental impacts of the sprawl [39]. A systematic sampling method was used (every fifth household was visited). Unfortunately, the response rate was rather low; the numbers of responding households were 104 in the separated inner areas and 168 in the outskirts. However, these numbers were still suitable to put the data derived from other sources into context and compare the results with the previous research. The first part of the survey was focused on inhabitancy and migration, the second part placed an emphasis on everyday routines and local communities, followed by an inquiry on household demographics. The survey also contained open questions to collect individual experiences.

The surveys were complemented by expert interviews; local government representatives and employees, social workers, and employees of NGOs shared their experiences about the governance and development issues of the separated inner areas and populated outskirts. In 2021, the survey of plots and the interviews were repeated to place the progress of the sprawl in a temporal context. The interviews collected the experiences of 6 municipal representatives, six officials from municipal offices, three social workers, the employees of five NGOs, and three mayors of villages with a common forest or water surface affected by a problem discovered in the cities.

2.2. Study Area

To answer the research questions, case studies of incorporated villages of different sizes and transformed to varying degrees by suburbanization were needed in different states of the progress of this spatial process. The diversity of densely populated outskirts was also taken into account during the selection. After careful deliberation, the following four cities were selected: Győr, Zalaegerszeg, Kecskemét, and Szeged.

Kecskemét and Győr were selected as two regional centers dynamized by investments in the vehicle manufacturing industry. The choice of Szeged was justified by the transformation of its farms and gardens, while the former vineyards of Zalaegerszeg became neighborhoods. Thus, these four cities were suitable for presenting the characteristics of centers with different degrees of suburbanization and for presenting different types of peripheral areas and villages of different sizes.

The application of the introduced spatial delineation and classification approach revealed that the core inner areas comprise 15% of the total study area, while the separated inner areas reach a share of 5%. The densely populated outskirts cover up to 20% of the study area, while the rest of the area (60%) can be considered sparsely populated outskirts.

The core inner area reaches the highest share of the municipal area in Győr (25%), the separated inner areas cover the most territory in Zalaegerszeg (11%), the densely populated outskirts cover up to 39% of the municipal area in Kecskemét, while around 75% of the Szeged municipal area is covered by sparsely populated outskirts. This process is in line with the settlement development peculiarities of the four municipalities. Győr is a heavily industrialized center, to which villages had previously been attached under socialism in several waves. The municipal area of Zalaegerszeg was enlarged by ten formally independent villages between 1933 and 1981, Kecskemét mostly managed to preserve its vast scattered farm areas that were once typical in the Hungarian Plain, while the extensively scattered farm areas of Szeged were mainly eradicated. For all cities, many allotment gardens and holiday cottage zones were established between 1960 and 1990, which have now become places of permanent residence despite general prohibitions (Figure 1).

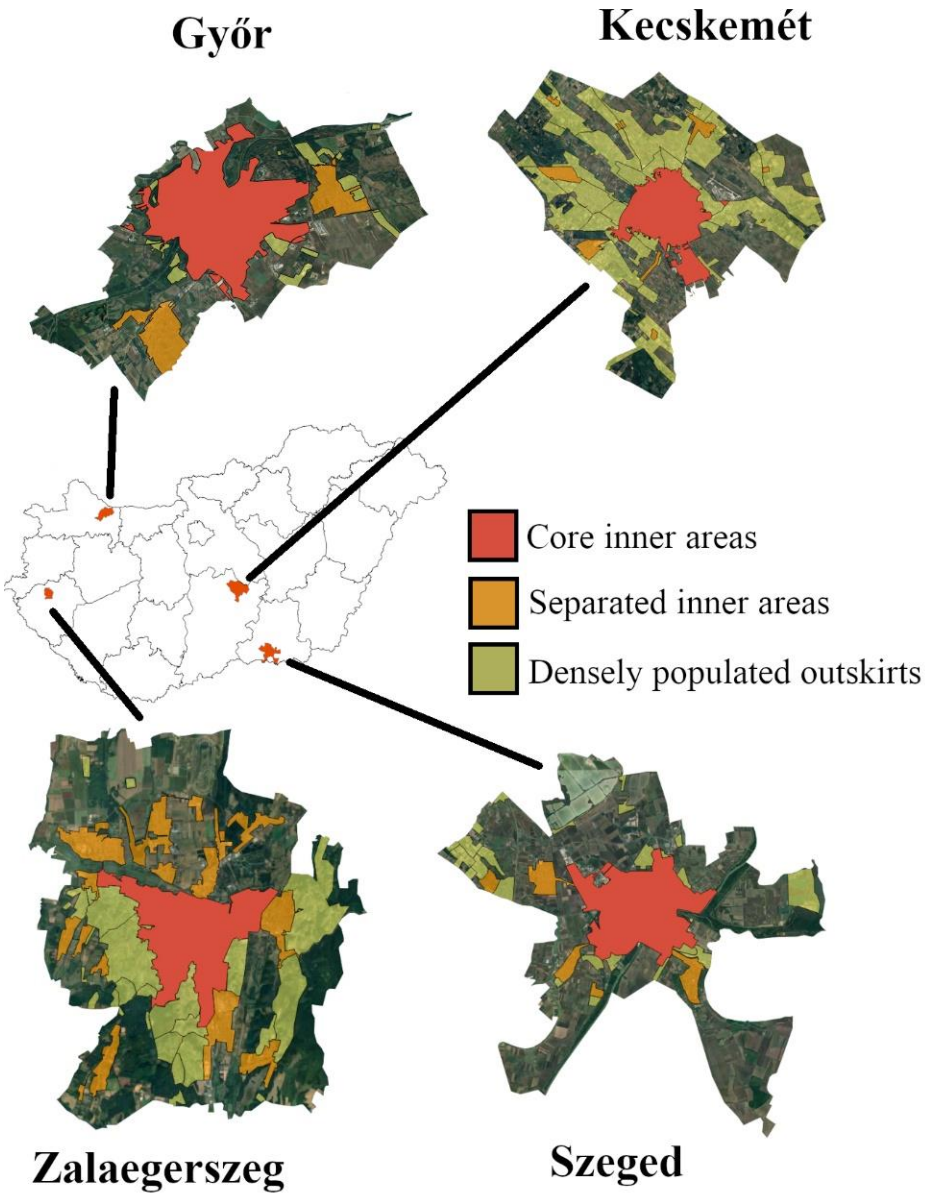

Figure 1. The locations of the case cities, with their inner areas and densely populated outskirts highlighted. Source: Elaborated by the authors.

3. Results

3.1. Suburbanization within City Limits as Population Redistribution

The average population growth rate of the outskirts in the 21 agglomerations of Hungary (without Budapest) was 35.61% between 1990–2011. The separated inner areas showed the most significant increase, and their average growth did not lag behind the administratively independent suburban villages. Between 1990 and 2011, 26.1% of the population growth of the rural suburbs went to separated inner areas of cities and villages in agglomerations, so their role in domestic suburbanization is significant (Table 1). Furthermore, between 1990 and 2011, a large number of outskirts and separated inner areas became attached to central built-up areas, inflating their statistical population by 6828 inhabitants. Taking this into account, the population growth rates of the outskirts and separated inner areas were more dynamic than the growth rates of the central inner areas of the suburban settlements due to their significant population attraction.

Table 1. The roles of outskirts (OUT) and separated inner areas (SIA) in domestic suburban migration.

Spatial Distribution	Population Growth (pers.) 1990–2011	Within Central Cities (%)		Administratively Independent Suburban Settlements (%)		
		OUT	SIA	Village Core	OUT	SIA
All agglomerations in Hungary	484,745	9.0	9.2	66.4	8.5	6.9
Agglomeration of Budapest	296,412	1.3	0.3	80.1	12.0	6.2
Agglomerations other than Budapest	188,333	21.0	23.1	44.9	3.0	8.0

Source: Calculation performed by the authors based on HCSO Detailed Gazetteer.

More than half of the population growth occurred in the outskirts and separated inner areas, especially for the cities with more than 100,000 inhabitants. While the population turnaround in some of the central cities could also indicate re-urbanization, this analysis points out that the population increase could be connected to the outskirts and separated inner areas within the city limits, not to the urban core (except Sopron). Furthermore, it should be emphasized that Hungary can be characterized by population decline; thus, the population growth of these areas is even more significant in light of the national demographic trends (between the population censuses of 1990 and 2011, Hungary lost more than 4 percent of its residents) [18,40–44]. Based on the above, in addition to the prosperous sovereign suburban villages, these municipality parts are among the most dynamic areas of the Hungarian countryside, but due to their nature, the municipality-level statistics conceal this feature.

These processes are also valid for the four case studies; while their separated inner areas and outskirts could be characterized by an influx of inhabitants, the core inner areas of all four cities actually lost inhabitants. For Győr and Kecskemét, the intense growth in the separated inner areas and outskirts even overshadowed the loss of the core, and the municipalities as a whole showed population growth.

Based on the data obtained from the GHS Population Grid, 81% of the inhabitants of the four case cities live in the core inner area, while 12 percent of them dwell in the separated inner areas, 6% of them inhabit the densely populated outskirts, while the sparsely populated outskirts house less than 1 percent of the population. Szeged has the highest percentage of core inner area population, the separated inner areas reach their highest share of the population in Zalaegerszeg, and the highest share of people living in densely populated outskirts can be found in Kecskemét (Table 2).

Table 2. The distribution of the populations of the case studies using the delineated spatial categories.

Case City	Core Inner Areas	Separated Inner Areas	Densely Pop. Outskirts	Sparsely Pop. Outskirts
Győr	106,981	18,349	1316	785
Zalaegerszeg	43,737	10,403	2942	859
Kecskemét	80,755	11,325	15,893	514
Szeged	141,620	16,600	5702	1541

Source: Elaborated by the authors based on data from GHS Population Grid.

This is in line with the differing significance levels of these spatial categories in the case cities, as presented in Section 2.2. Where the populations of the delineated areas according to the Detailed Gazetter and the GHS Population Grid are comparable (see Section 2.1 for exceptions), the population data gained from the two different sources are relatively close to each other. However, the population numbers derived from the GHS Population Grid are somewhat lower, with the most significant difference being observable in the case of the densely populated outskirts.

The population density levels are higher than the national average (107 people per km^2 according to the Census of 2011) in all four municipalities. Since each is a county seat, this is an expected result. In the case of the four examined space categories, there are significant gaps between their respective population densities:

- Core inner areas—2872 people per km^2;
- Separated inner areas—1260 people per km^2;
- Densely populated outskirts—150 people per km^2;
- Sparsely populated outskirts—7 people per km^2.

It is worth noting that even in the densely populated outskirts—in a spatial category originally not designated for housing—the population density is higher than the national average (Figure 2).

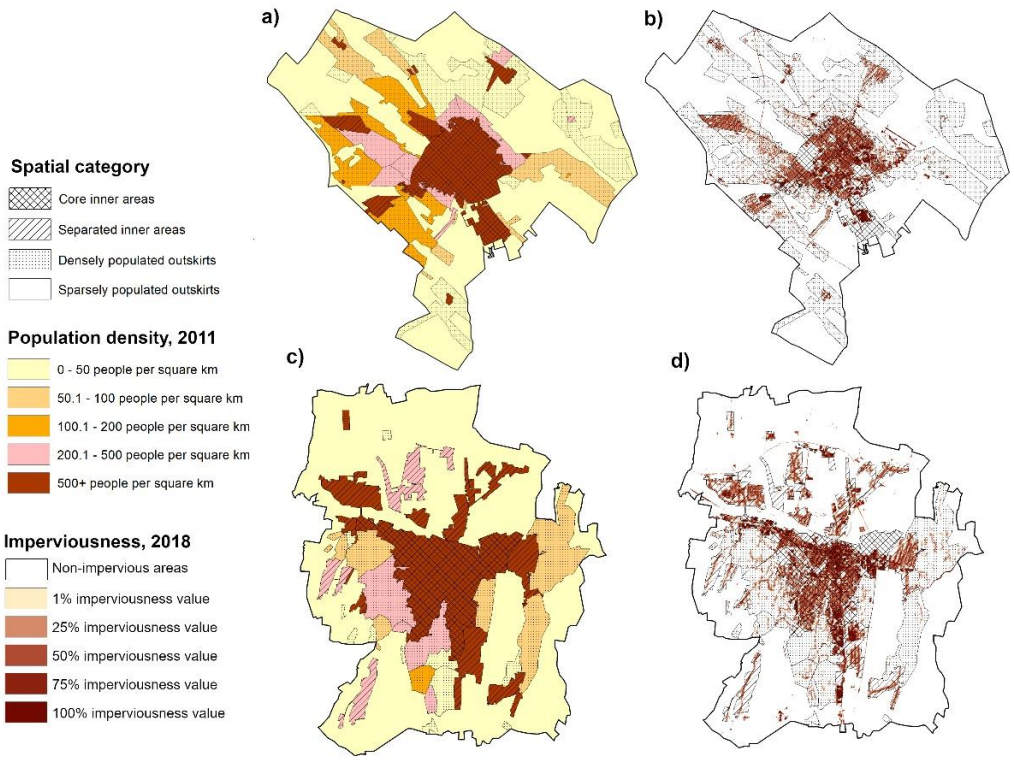

Figure 2. The population density (2011) and imperviousness (2018) of Kecskemét (**a**,**b**) and Zalaegerszeg (**c**,**d**). Source: Elaborated by the authors based on the GHS Population Grid and imperviousness datasets from the Copernicus Land Monitoring Service.

3.2. Suburbanization within City Limits as the Driver of Land Cover Transition

The applied GIS methods mainly focused on uncovering the land cover transitions that followed the migration processes. The results confirm the overarching effects of the within-city population redistribution and also reveal some notable peculiarities. Based on the analysis of the high-resolution Imperviousness Density layers, the soil sealing significantly increased in the case areas between 2006 and 2018. This was true for all four space categories. The highest increase (in percentage points) occurred in the core inner areas, despite the general trend of population decrease. On the other hand, in the case of the sparsely populated outskirts, the percentage of sealed areas almost doubled during the examined period.

In the case of imperviousness, there is a clear division between inner areas and outskirts; while the soil sealing percentage of the core (35% in 2018) and separated inner areas (26% in 2018) are relatively close to each other, there is a huge gap for the densely populated inner areas (4.6% in 2018).

The data obtained from Corine Land Cover reflected this division (Figure 3). Artificial surfaces dominate the land cover of the core and separated inner areas (84% and 76% in 2018), while their presence is limited on the outskirts (8% for the densely populated outskirts and 5% for the sparsely populated outskirts). The share of the urban fabric is the highest in the separated inner areas (almost 90% of the artificial surfaces), which indicates the dominance of

housing. The urban fabric makes up about half of the artificial areas in the core inner areas (indicating more diversity in functions), while it makes up only one-third of the artificial area in the densely populated outskirts and only 12% in the sparsely populated outskirts. Moreover, the latter may also be attributed to the geometric inaccuracy of the CLC polygons.

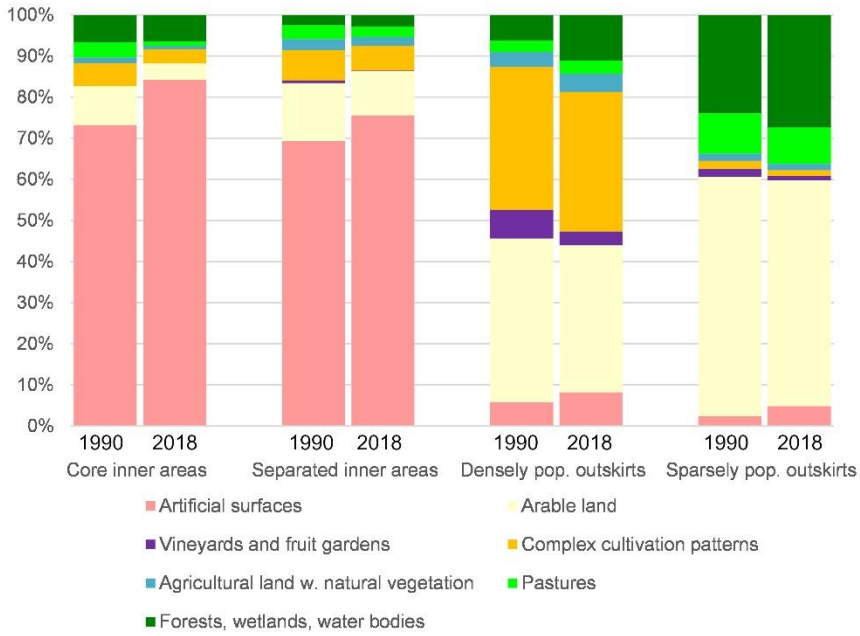

Figure 3. Land cover change trends in the case cities by spatial categories. Source: Elaborated by the authors based on Corine Land Cover data.

In accordance with their functional diversity, industrial and commercial units covered 26% of the core inner areas. While their share is negligible regarding the overall size of the sparsely populated areas, one-third of the artificial surfaces also fall into this land cover category. Agricultural facilities and new greenfield investments both contribute to this category.

Based on the CLC data, the share of artificial surfaces increased in all four spatial categories between 1990 and 2018. While the most significant increase in percentage points occurred in the central inner areas (from 73% to 84%), the share of artificial surfaces almost doubled in the sparsely populated outskirts. The size of the area converted to artificial surfaces in the sparsely populated outskirts was comparable to the new built-up areas in the core inner areas (Figure 4).

The changes in the pastures (CLC 2.3.1) show diverging trends: In the core inner areas, their (not so high) share further decreased, while in the densely populated outskirts, moderate growth is observable.

In line with the general land cover characteristics in Hungary, arable land is the dominant form of land cover in the sparsely populated outskirts. However, the proportion of densely populated outskirts remains significantly lower (55% vs. 36% in 2018). The share of arable land was reduced everywhere between 1990 and 2018, but the highest decline was in the core inner areas (Figure 4). Additionally, in line with the general trends in Hungary, the size of the forest areas is increasing—the primary arenas are the outskirts (Appendix A).

The vineyards and fruit gardens reach their highest share in the densely populated outskirts. This is in accordance with the original function of these areas (wine hills, garden zones). However, between 1990 and 2018, their area was halved (a similar reduction is observable in the sparsely populated outskirts). This rapid decrease contradicts the Thunen model, reducing the chance of short-chain production and working against making the case cities more sustainable. These changes also undermine the participation of peri-urban agriculture to food security and food self-sufficiency. It is also socially significant, especially since crop production is a secondary income for impoverished individuals living in such areas [45–48].

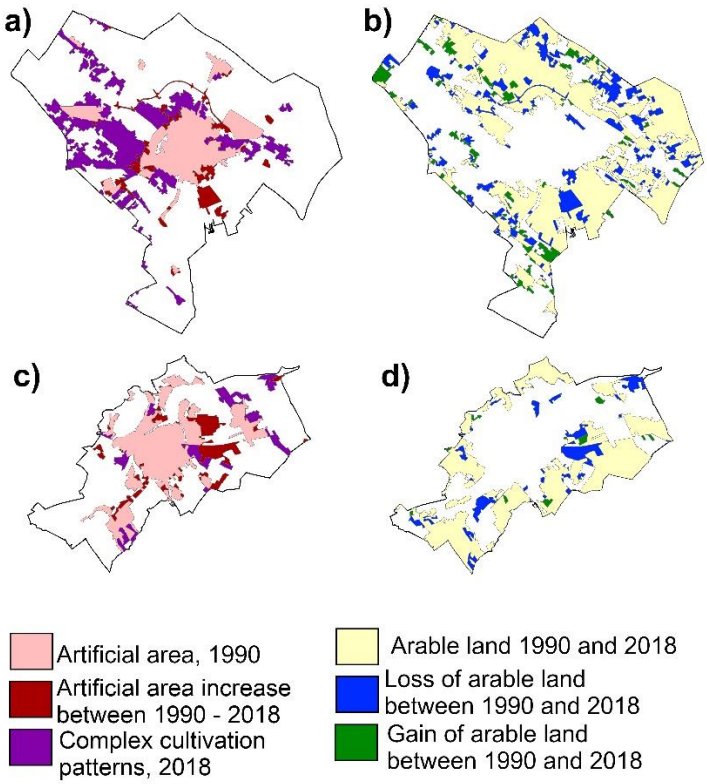

Figure 4. The extension of artificial surfaces in Kecskemét and Győr (**a**,**c**) and the changes in arable land cover in Kecskemét and Győr (**b**,**d**).

In the densely populated areas, the complex cultivation patterns (CLC 2.4.2) have an exceptionally high share (2018: 34%) and are less inclined to reductions compared to other agricultural surfaces. This categorization reflects the diverse nature of the original land use in the area (primarily intensive horticulture in small plots, secondarily recreation), but also hides the drastic shift in its function (toward housing). Thus, the land cover data cannot fully reflect the sustainability challenges in the outskirts.

3.3. Suburbanization within City Limits as a Social and Environmental Sustainability Challenge

The fieldwork and questionnaire helped to better understand the more finely differentiated spatial structure behind the demographic and land cover change processes described above. The wealthiest residents migrate into the most attractive, most accessible parts of the separated inner areas and densely populated outskirts. The price–size ratio of the plots is favorable and there are attractive landscape elements, such as fishponds or wooded hillsides. In these areas, the transformation into a "suburban desert" is typical, similarly to the examples in the western suburbs; thus, the green area is emptied in terms of its content and it deteriorates into a scenery adapted to the discursive image of an idealized countryside setting [49–52].

Areas with inadequate transport facilities but acceptable settlement images are characterized by mixed immigration from disadvantaged households from the peripheries of the country and those excluded from the cities. The vine hills and garden zones proved to be highly vulnerable to both types of migration. They often lie in generally favorable locations at the fringe of the core but have severe infrastructural bottlenecks, thereby attracting a diverse set of migrants. Moreover, the plots here are often cheap but very small, and the newcomers often have additional development needs. Thus, the original vegetation in the former gardens, vineyards, and orchards is often sacrificed in favor of expanding the houses, additional buildings, grassy backyards, and concreted driveways. This process results in a significant loss of biodiversity.

The reduction in the amount and the degradation and significant fragmentation of these landscape elements also impairs their functionality and their role in micro-climate regulation [53–58]. By 2010, these areas had mainly become suburban habitats, with small-scale mixed agriculture and fruit production no longer being typical, with often only abandoned and weedy backyards appearing to be close to nature. Here, 51% of the land use categories in the vineyards and fruit gardens and 80% of the complex cultivation patterns are within the neighborhoods of the densely populated outskirts. Thus, these zones can be interpreted as suffering a partial loss in green areas, and the speed of their transformation into built-up areas is becoming increasing dynamically (Figure 5). This process is also facilitated by the new family support system, which emphasizes the building of family houses and a number of legal acts (XLIV/2015 and CLXXXVII/2016., 156/2016 (government decree)).

Figure 5. The diverse reality behind the land cover category "complex cultivation patterns". Source: Photos taken by the authors.

Within the least attractive outskirts one can observe either a concentration of the least affluent population or rapid depopulation. The latter is often exacerbated by environmental damage caused by industry or irregular routines of agriculture. In addition to segregation with significant social injustice issues, this process also resulted in immediate environmental problems and a decline in the effectiveness of the local agriculture [7,59–64]. The disadvantaged individuals are often forced to save money in ways that are detrimental to nature. These include illegal dumping, heating with municipal solid waste, and illegal logging (Figure 5).

In the least attractive areas, many plots have been abandoned due to selective outward movement and the cessation of small agricultural companies, especially during the post-2007 crisis. These properties have been heavily overgrown by vegetation in recent decades, so they can be seen to represent an increase in forests or zones of agricultural land with natural vegetation. In fact, these areas are similar to abandoned brownfields in many cases, as they contain ruined buildings, sheds, semi-collapsed fences, and other technical objects. In addition to the landscape effects, this phenomenon threatens children living nearby.

The facts presented in this chapter show that this phenomenon has not attracted public attention due to certain spatial features and the attitude of the population; moreover, the land use categories also partially hide the transformations. Therefore, in the next section, the data are interpreted in a broader context.

4. Discussion

As the results indicate, the transition area between the urban core and the countryside is not necessarily a sharp border at the city's administrative boundary. Instead, a unique transitional zone is created between the center and the hinterland, which itself can be further divided [65]. The rural–urban fringe is a complex, highly fragmented spatial structure formed in the meeting zone of the urban and rural spaces through the expansion of urban land use and lifestyle [66,67]. It is characterized by the dynamic transformation of the society, land use, and settlement structures, as well as the economic environment; thus, the processes there significantly reshape the local social hierarchy, networks, and way of life and generate conflicts [68]. Due to its variability and strong fragmentation, it is difficult to delimit the fringe, as its spatial pattern changes extremely rapidly, both towards the city and towards the rural hinterland [5,69]. Thus, at the micro-level, each point in the suburban space at a given geographical distance from the city center can be at a different relative distance from the urban core [65,66].

Much of the transformation of the rural–urban fringe is driven by suburbanization. However, earlier analyses have revealed that many aspects of suburbanization in Central and Eastern Europe differ somewhat from the patterns in "Western" countries. In these countries, the proportions of those who are expelled from the cities and those who came from the peripheries of the country due to the rising cost of living are high. Urbanization and suburbanization, thus, emerged within a short period, along with many other internal migration patterns, which were hampered by socialist settlement policies [9,12,13,53,70,71].

Furthermore, the intensive conversion of the former villages attached to the cities and the transformation of the agricultural areas between the cities and villages are common in these countries [6,30]. Because of their partially hidden nature in the databases, the examined characteristics may be more typical and significant in other post-socialist countries than has been assumed in previous surveys. Therefore, to resolve this issue, a different approach is needed that goes further than the majority of research and also takes migration within municipality borders into account.

The solution to the problem is to identify each "city" with its compact core, along with its integrated urban morphology (core inner areas), while the former villages (separated inner areas) and densely populated outskirts that still retain their rural character should be discussed as village-like settlements. Accordingly, these parts of the settlement can be the target areas for suburbanization, as moving from the urban core involves a change in the quality of life expected during suburban migration [30,49].

Although these settlements are within the city limits, they are located in former agricultural areas or the remaining areas between urban settlement parts. On the other hand, in these areas, the new residential areas also develop similarly to suburban villages, dominated by detached houses or semi-detached houses. As well as most of the migration coming from the city's core, the proportion of relocators from other settlements in the local community will be lower. The process is similar for the Polish and Czech samples [30,72,73], but the former villages attached to the cities are prominent targets for investment instead of greenfield investment filling the intermediate agricultural fields.

The exact number of people affected by this phenomenon is not known due to the illegal construction and missed registration of addresses (shadow economy renting), but according to local governments (Győr, Szeged, Zalaegerszeg) and non-governmental organizations (Szeged), the actual population numbers in the outskirts and some parts of the separated inner areas are about 5–10% higher than the data show in the statistics, but in some cases they can reach 40% more. Surveys in the Czech Republic [74] and Poland [30] also estimate the numbers of relocators not included in the statistics as being 10–20% higher.

Through the uncontrolled development of suburbs, agricultural land, and various green areas, as well as traditional rural land use being reduced, urban land use is penetrating the surrounding areas. The quantitative loss of natural surfaces and their qualitative degradation and fragmentation impairs their functionality and the ability for agriculture to maintain the cultural landscape [5,32,53–56,75]. Moreover, greenfield investments often

take place in the most fertile agricultural land or destroy its natural value. For example, in the case of Győr and Kecskemét, some industrial site developments have been built on the site of a Natura 2000 habitat containing arable land of outstanding quality. Due to the administrative peculiarities and generally weak capacity of NGOs in Hungary, similar cases still occur regularly within the country [19,76,77].

On the other hand, the expectations for future investment may lead to an increase in grassland at the edge of the urban core; as was described in other studies [59,66,78,79], the plot-owners of the dynamically developing urban–rural fringe often abandon agricultural activities and turn their arable land into grassland in the hopes of attracting investment. The conversion to grassland is expected to be a temporary state, but this situation can often persist for years or even decades. However, the landowners have no true intention to properly manage their land as a pasture, and it often deteriorates, being covered by weeds or illegal waste.

According to the results obtained from the CLC, the vineyards and fruit gardens suffered the most significant losses. Moreover, while the CLC data show a relatively stable covering of complex cultivation patterns, other evidence indicates a drastic function shift in this category, sidelining the agricultural activity. Besides the loss of the traditional cultural landscape, this trend goes against environmental sustainability too, making it harder to create short supply lines for fruits and vegetables. Moreover, the secondary recreational role of these areas is also disappearing with the function change.

Positive trends (at least at first sight) could be identified as well; during the examined period, the area of forests increased in the outskirts. This can be considered a favorable development from an environmental point of view, and it could help regulate the microclimate and urban heat island effect [61,75,80,81]. Unfortunately, the increase in volume was accompanied by a decline in the quality of the forests, groves, and rows of trees. Most of the vegetation mixes formed here consist of invasive species. Several such species were present in almost all outskirts, separated inner areas, and even in greenfield investment areas. Ambrosia artemisiifolia, Amorpha fruticosa, Asclepias syriaca, and Parthenocissus vitacea were typical there. Although some of these plants present difficulties "only" due to their allergenic nature, there are several specific types of biological damage. The above phenomena combined with other types of damage, such as garbage-related problems and ruins in the woods, reduce biodiversity. Thus, the flora do not necessarily provide enough food for the local fauna, in some cases adversely affecting the soil [54,82]. Thus, significant parts of the areas appearing as forests in the statistics cannot be considered to be fully functional natural areas, and their capacity to provide ecosystem services is limited [83].

The detailed research involving the four case studies also revealed that the densely populated outskirts offer a wide range of housing options and can attract people from every social stratum. Different groups have differing impacts on their surroundings, leading to different environmental sustainability issues. Well-situated newcomers have more capability to transform the traditional rural landscape into a more bleached peri-urban one. On the other hand, garbage-related issues are typical for people of unfavorable socio-economic status, because they cannot pay utility bills, and some of the less developed outskirts have no waste management services. Unfortunately, according to the respondents, the local community tolerates this and sees it not as pollution but as an inherent part of poverty, so reporting and regulatory actions are sporadic. At the same time, the most impoverished residents carry a considerable amount of hazardous waste here, including literally dozens of car wrecks, batteries, oil barrels, and other substances, to dismantle the spare parts for sale or to burn their combustible parts. This situation can contaminate the air, soil, and groundwater, affecting approximately half of the examined outskirts. It is difficult to determine how common this issue is due to the already mentioned features of the outskirts, and this study certainly did not find all of the hazardous points.

Due to irregularities, these areas are affected by the typical problems of urban sprawl. The increased vehicle and land use, higher household energy consumption, and unlicensed, often unprofessional construction and landfilling all contribute to the quality of the environ-

ment. The increasing traffic load between the hinterland and the city center causes traffic jams and significant air pollution [5,6,23,24,60,84]. Unfortunately, there are no specific data for this, as in Hungary there are basically accredited air quality measurements only for the city centers.

The presented environmental problems counteract the improvement in the quality of life expected from suburbanization. Furthermore, the meeting of very people with different lifestyles is a source of frequent conflicts. The groups of people who moved there from the city and the original residents often split up. The new residents keep the networks of their previous residence. Thus, there is practically no local social network; "I can't even ask for a kilogram of sugar from my neighbor", a resident of Győr expressed. Therefore, local communities are weak, reciprocity does not work, and due to the lack of local cultural and other services, it is common for children to move away as they grow up. The families moving into these areas already have children, so they are not born locally; therefore, no further increase in the number of children is expected [39–43]. Overall, in line with the findings in the literature [12,21,30,39,40], our respondents consider the long-term population retention capacity of these areas to be weak, which is expected to be further weakened by the environmental damage and the effects of climate change in the near future.

The neoliberal urban governance routine exacerbated the processes analyzed in this paper after 1990. Cities have begun to be tailored to the needs of the groups with the most remarkable ability to assert their interests. Thus, the promise of a "good and livable city" has often increased social and territorial injustices [1,22,44,82,85–87]. In doing so, several informal tools and a turn-a-blind-eye-approach have become commonplace in creating the resources needed to develop the city center. Local offices have often made it possible to carry out irregular forms of land use, illegal construction, and polluting investments for tax revenue [5,30,69,84–86,88].

However, this process is also an option for the city. Since 1990, co-operation between settlements has been unfortunately weak in Hungary. On the other hand, the local government in the city can influence the land use and spatial structure through much more direct, targeted interventions within its own borders. Thus, this process can also be interpreted as a reaction of the city to suburbanization processes unfavorable to the city [30,35,72,73,89]. This is especially important because the dynamic residential areas of cities are usually the neighborhoods affected by the sprawl, not the central urban core, which is often losing its population.

5. Conclusions

Suburbanization within the city limits has great importance, but it is partly hidden in national databases by some geographical and statistical features. In this process, both the people moving out of the city and those coming from the fringes of the country choose the separated inner areas and different outskirt areas because the plots are cheaper there and the level of regulation is low due to certain neoliberal routines and the lagging legal environment and urban policies. However, since these areas appear to be integral parts of the administrative areas of the cities, neither the population growth nor specific land use changes appear in the suburbanization databases due to the settlement interconnections of the 1970s.

Garden zones, vineyards, and orchards on the fringes of the cities were the places of intensive and mixed agricultural production supplying the cities, but they have now become areas of suburbanization. In the densely populated outskirts, the rapid immigration and the growth in the built-up area have been accompanied by the abandonment of some gardens, which have become overgrown with woody vegetation and often with invasive species. This transformation can only be partially detected using land cover datasets, because the new neighborhoods often remain within the categories of agricultural land areas, mostly showing complex cultivation patterns. The low level of regulation and lack

of state intervention have accelerated this process, but little information exists about this due to local statistical peculiarities.

The separated inner areas behave precisely like the villages in the suburban ring. However, because they are not legally independent settlements, the amount of data available on their processes, especially their environmental problems, such as air pollution, is limited. This makes it difficult to proactively prevent and mitigate the existing environmental damage.

The changes in other outskirts are similar to the national averages for rural land, except for some extreme cases of environmental damage caused by greenfield development, such as some factories built in Natura 2000 areas.

Environmental degradation at the micro-level is common in separated inner areas and densely populated outskirts, either due to actual "destruction by concrete and lawn bricks", pollution, or even invasive species. Due to the lack of data, in this research we could only explore the most critical problems. The quantitative delimitation of the affected areas and measurements of the intensity of the effects were beyond the scope of the present analysis. In the future, multidisciplinary research is needed for a detailed assessment of this phenomenon, together with biological, pedological, and agronomic analyses and an assessment of the sociological side effects.

As the accredited measurements in the country are mainly carried out in the centers of settlements, there are no comprehensive national data on air pollution, urban heat islands, illegal waste incineration, and other similar processes in separated inner areas or outskirts, and the forests in these areas are less closely monitored. These rural–urban fringes are too rural for urban development and too urban for rural development. Therefore, the lack of attention is accompanied not only by a partial lack of databases but also by the low level of regulation, which is attractive to people who want to move into a suburban house, but at the same time increases the environmental risks of irregular land use.

One of the most significant findings of the research was that the databases are incomplete for the separated inner areas and outskirts, and it is challenging to obtain them compared to the settlement cores. This situation makes it difficult to assess the environmental damage and makes it more difficult for municipalities and national bodies to undertake proactive environmental interventions, as the scale and extent of the problem partly remain hidden.

The rapid growth of the population will ultimately lead to adverse environmental impacts due to the increase in built-up areas, the reduction and degradation of natural vegetation, and the transformation into a monofunctional landscape. Migration to the suburbs causes intensive road traffic, leading to higher air pollution and fossil energy consumption levels, which is also true for areas within the administrative limits of the city. Overall, it makes it more difficult to act against climate change and helps increase the intensity and range of urban heat islands. The unplanned, rapid, and uncontrolled expansion of the suburban area also has many adverse social and economic effects. It brings about significant changes to the economy and the daily lives of the local societies.

This particular case of urban sprawl is not as mature as in Western Europe, but as it receives less attention, Hungary is still missing opportunities for preventive action. Preventing environmental damage is always more effective than treating it afterward. However, the processes that remain within the city limits, even if they are currently chaotic, would be more manageable than those requiring intermunicipal co-operation, given the low level of codified and non-codified co-operation between municipalities in Hungary.

Based on the literature data and geographic similarities, the revealed problems are presumably relevant in the Baltic countries, Russia, and in general in the post-socialist region. The scattered settlements, osadas, dachas, farmsteads, hamlets, and allotments near the cities may have similar features. In the future, we would like to expand our research into an international comparison with cities in Serbia, Slovakia, and Poland.

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Appendix A

Table 1. The different land cover types based on the case city and spatial category.

	Total Area (Hectares)	**Artificial Surfaces, Hectares**		**Arable Land, Hectares**		**Vineyards and Fruit Gardens, Hectares**		**Pastures, Hectares**		**Complex Cultivation Patterns, Hectares**		**Agricultural Land with Natural Vegetation, Hectares**		**Forests, Semi-Natural Areas, Wetlands, Hectares**	
Corine Land Cover categories		CLC 1.1.1–1.4.2		CLC 2.1.1, 2.1.3		CLC 2.2.1, 2.2.2.		CLC 2.3.1		CLC 2.4.2		CLC 2.4.3		CLC 3.1.1–4.1.2	
Year		1990	2018	1990	2018	1990	2018	1990	2018	1990	2018	1990	2018	1990	2018
Győr, core inner areas	4396.95	2750.81	3379.73	374.48	100.64	0.00	0.00	346.27	108.47	193.97	136.20	42.42	16.15	594.11	566.91
Győr, separated inner areas	1299.18	878.49	951.58	233.94	170.98	24.72	0.00	5.95	14.08	137.87	156.65	16.47	4.14	1.75	1.76
Győr, densely populated outskirts	771.13	136.46	221.40	50.69	31.76	124.32	0.03	9.35	5.56	375.37	454.67	51.21	34.75	23.02	22.81
Győr, sparsely populated outskirts	10,989.84	380.83	620.06	6502.18	5903.89	182.39	147.47	934.47	854.05	125.54	207.07	203.66	217.54	2456.44	2838.67
Zalaegerszeg, core inner areas	1151.10	1002.86	1036.44	31.89	29.59	0.00	0.00	55.16	38.64	54.59	40.16	1.01	0.68	5.58	5.58
Zalaegerszeg, separated inner areas	1229.43	680.39	799.19	246.09	218.21	0.00	0.19	76.56	46.20	80.21	35.99	87.13	55.71	22.17	22.07
Zalaegerszeg, densely populated outskirts	1891.94	93.53	100.16	215.70	217.22	11.31	0.00	4.45	4.00	1099.39	1144.63	228.90	156.50	238.63	269.40
Zalaegerszeg, sparsely populated outskirts	5973.93	70.15	491.71	2407.50	2110.82	2.48	92.37	1178.77	935.88	90.68	77.90	241.00	231.75	1977.59	2019.26
Kecskemét, core inner areas	3441.05	2388.75	2894.03	670.35	329.97	0.00	0.00	43.20	0.39	280.91	148.38	12.16	22.59	1.25	1.26
Kecskemét, separated inner areas	896.01	678.04	757.62	83.46	38.44	5.84	2.31	60.96	48.05	67.07	43.15	0.00	5.20	0.63	1.23
Kecskemét, densely populated outskirts	12,512.16	238.18	543.91	5677.84	5074.02	1072.57	582.93	377.45	480.86	4109.72	3783.37	305.28	523.27	731.08	1523.77
Kecskemét, sparsely populated outskirts	15,418.23	452.25	611.27	8577.29	8017.83	838.29	293.70	1358.83	1519.78	592.57	337.17	229.98	189.93	3368.91	4448.43
Szeged, core inner areas	4002.71	3370.08	3629.79	149.36	53.36	0.00	0.00	30.71	0.00	192.65	121.32	125.88	68.71	21.23	16.74
Szeged, separated inner areas	1073.11	882.97	888.51	67.32	60.48	0.00	0.00	6.91	5.48	43.88	36.69	19.03	28.94	31.47	31.48
Szeged, densely populated outs.	2074.09	517.73	546.92	930.99	840.86	0.00	0.51	97.52	64.51	407.16	466.67	32.78	49.48	74.65	91.87
Szeged, sparsely populated outskirts	20,948.94	327.55	853.17	13,615.11	13,234.35	0.00	25.20	1743.14	1421.75	206.88	138.83	272.76	198.41	2597.00	2939.47

Source: Elaborated by the authors based on data from Corine Land Cover.

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