

SPATIAL CONSTRAINTS OF SLOVENIAN FARMS: WHAT DOES URBANIZATION HAVE TO DO WITH IT?

Nika Razpotnik Visković¹



¹ Dr. Nika Razpotnik Visković, Research Center of the Slovenian Academy of the Sciences and Arts, Anton Melik Geographical Institute, Novi trg 2, Ljubljana, Slovenia, e-mail: nika.razpotnik@zrc-sazu.si

Abstract: The spatial constraints of farms in Slovenia have never been systematically studied before; however, this is an important developmental aspect of agriculture, as stated by experts in spatial planning, agricultural economics, and geography. This article presents the concept of farms' spatial constraints within settlements and their effect on farms' development potential, proposes a methodological framework for measuring them, and reveals the relation between farms' spatial constraints and urbanization.

Key words: spatial constraints of farms, urbanization, development potential of farms, spatial planning, geography, Slovenia

Povzetek: Prostorska utesnjenost kmetij v Sloveniji še ni bila sistematično preučena, čeprav gre za pomemben razvojni vidik v kmetijstvu. Na to opozarjajo strokovnjaki s področij prostorskega načrtovanja, agrarne ekonomije in geografije. Prispevek predstavlja koncept prostorske utesnjenosti znotraj naselij, metodološki okvir za njeno merjenje ter razkriva povezanost med prostorsko utesnjenostjo kmetij ter urbanizacijo.

Ključne besede: prostorska utesnjenost kmetij, urbanizacija, razvojni potencial kmetij, prostorsko načrtovanje, geografija, Slovenia

1. Introduction

This article focuses on the spatial constraints of farms within settlements, which arise when, due to the urbanization of rural areas and lack of building land, farms cannot expand their outbuildings. Farms' spatial constraints are an overlooked aspect of spatial limitations in farm development, even though they affect development in several ways: they impede expansion of production activities, make agricultural land less accessible, create social tensions in rural and urban settlements, change the identity of the rural landscape – even the rural idyll (Pospěch et al., 2015; Neumeier and Pollermann, 2014), and reduce young people's interest in farming.

The case of Slovenia illustrates that changes in the social and political attitude towards agricultural activity and the simultaneous diversification of rural areas have contributed to farms often being treated as intruders within urbanizing settlements, and their activities being perceived as disruptive for the local population. Nevertheless, this topic has not yet been systematically researched. The time dynamics as well as the factors that have influenced or stimulated this process are not well known. These factors could be either external (deriving from physical geographical and broader social, economic, and political circumstances; e.g., slopes, rivers, infrastructure, and spatial planning documents) or internal (deriving from socioeconomic changes to individual farm households and individual decisions by their members). The uncertain development of farms, which also burdens their successors and the growing dissatisfaction of the non-agricultural population, calls for greater attention by researchers, expert services, and local governments to this challenge. It is clear that insufficient knowledge about farms' spatial constraints can lead to implementing inefficient measures requiring considerable financial input and organizational effort. The solutions adopted are often based on examples and practices from abroad, not taking into consideration the specific local historical, social, and political characteristics that shaped the existing spatial situation and farms' socioeconomic structure.

The problem of farms' spatial constraints appears to be more characteristic for urbanized areas in connection with suburbanization and land consumption due to the expansion of built-up areas (Ravbar, 1997), although it is not clear whether farms also face spatial constraints in rural settlements, where the pressure of urbanization is not as strong and functions are less diversified.

The aim of the research presented in this article is to empirically determine whether the problem of farm constraints exists in different settlement types according to the level of urbanization (urban, suburban, urbanized rural, and rural). In doing so, it improves the understanding of complex spatial and social processes in both rural and urbanized areas, it encourages further discussion of the spatial conditions of Slovenian family farms and the transformation of their situation in the middle of built-up areas, and it contributes to existing and potential adjustment strategies for further development.

It also contributes new findings on how urbanization has been transforming the European rural landscape, in addition to already existing studies, which tried to highlight different sociocultural, economic, ecological and aesthetic issues related to this process (Grazuleviciute-Vileniske et al., 2015), but mostly focusing on land-use changes and land abandonment (Price et al., 2015; Hauser et al., 2016; Serra et al., 2014; Hersperger et al., 2014).

2. Spatial constraints of farms: concept and research relevance

Providing global food security has become the worldwide priority task of agricultural development and an important political and social question. This is also true for Slovenia, where the level of agricultural self-sufficiency is alarmingly low, especially for vegetables: namely, only 33% (SURS, 2014). Increasing this is a strategic national challenge stated in the Resolution on Strategic Objectives of the Slovenian Agriculture and Food Industry in 2020, but the resolution mainly focuses on preserving cultivated agricultural land, whereas the role of family farms and spatial constraints on farmsteads is not recognized as a remedy for this challenge.

Not only at the Slovenian level, but at the European level as well, family farms are fundamental form of agricultural holding. The predictions of agricultural experts that the competitive global market economy will lead to industrial farming replacing traditional family farming have not come true (Potter and Tilzer, 2005). Quite the contrary: the transformation of farming from productivism, which is based on commercialization, concentration, and industrialization, towards post-productivism, which is based on diversification, dispersion, and extensification (Ilbery and Bowler, 1998; Almstedt et al., 2014), led to strengthening the importance of family farming. Slovene family farms, with an average size of 6.4 ha of agricultural land (SURS, 2012), are half the average European size. Their farmland is fragmented into several plots, predominantly with unfavorable conditions for farming. The productivity of farms is therefore low because almost 60% of all farms produce food primarily for their own consumption.

The spatial constraints of farms are one of the main spatial issues in agriculture. This issue arises when farms cannot make good (i.e., profitable, productive) use of their current location for expanding outbuildings needed for farm expansion and modernization. Farmers are also limited in expanding and reorganizing the working areas needed for using modern machinery (Perpar and Kovačič, 2006). Farms may be spatially limited due to physical factors (relief, water, buildings, roads, and other types of infrastructure) or due to regulations and protective measures in spatial planning documents. Opportunities to expand production are also limited due to the fact that agricultural activities are considered disturbing, especially in densely populated and protected areas (Henderson, 2005).

Spatial constraints also affect farms' succession status and decisions because the willingness of the younger generation to preserve family farming depends on the expansion possibilities of inherited farms (Kerbler, 2008; Knific and Bojnec, 2015). Namely, the option of increasing farm production is one of the most influential factors in successful succession on farms (Blanc and Perrier-Cornet, 1993).

Farms' spatial constraints are therefore one of the aspects considered in evaluating the development potential of farms in the methodology implemented by Razpotnik Visković (2015), which analyses and evaluates farm characteristics that indicate their development potential and future tendencies: a) stability and vitality of farms; b) expansion potential and conflict potential (including farm constraints); c) the quality and structure of agricultural land; and d) the effects of spatial planning and environmental protection measures.

The decline of the economic significance of agriculture is especially evident in areas close to urban centers. At the same time, agricultural land-use interests collide with other increasingly expanding and diverse interests stemming from the urbanization of lifestyles in these areas. With changes in the population structure in rural areas, the diverse interests of various social groups and social tensions among them are rising (Henderson, 2005; Lewis, 1998). The reasons for tensions between farm and non-farm residents are mostly connected to the effects of agricultural production (odors, noise from farm machinery, and road pollution), land ownership disputes, trespassing, and vandalism (Lisansky et al., 1988). Some national or federal and local authorities have already recognized the unfavorable consequences of such conflicts and have started to reduce them, either through stricter regulations concerning farming activity (Henderson, 2005) or with a protective attitude towards farming (Lisansky et al., 1988).

Over the past decades, studies on the spatial development of agriculture have mainly focused on the urban fringe (Berry and Plaut, 1978; Lawrence, 1988; Bryant, 1992; Bryant and Johnston, 1992; Daniels, 1999; Errington, 1994; Kladnik and Petek, 2007) because, due to increased land pressure, farming in the direct vicinity of cities is more vulnerable than farming in traditional rural areas. However, due to the proximity of cities, such farms have better opportunities to gain additional income, from either on-farm or off-farm employment. These farms are more flexible from the perspective of both agricultural activities (e.g., specialization in horticulture, horse breeding, organic farming, or supplementary activities) and the labor force (e.g., part-time farming; Kladnik, 2003; Zasada et al. 2011).

The issue of farms' spatial constraints is closely related to land consolidation processes. In the case of simple land consolidation, in which land protection concerning floods, erosion, drainage, irrigation, and agrotechnical amelioration is taken into consideration, the main goal is to increase productivity (Vitikainen, 2004; Markuszewska, 2013; Podhrazska et al., 2015). With the revaluation of rural areas and new demands of agricultural activity, most European countries have moved toward a more comprehensive approach to land consolidation. This is employed not only by consolidating farmland but also through complex village renewal (van Dijk, 2007). Experiences of western European countries with longer traditions in land consolidation have shown that promising but spatially limited farms cannot be relocated if the entire settlements are not part of integrated planning (Markuszewska, 2013).

As pointed out by Perpar and Kovačič (2006), spatial constraints of farms in settlement areas have not yet been systematically researched. The importance of this research topic is substantiated by their findings that spatial constraints of farms generate social tensions within settlements, change the identity of the rural landscape, and reduce young people's interest in farming. The authors fault past spatial-planning practices for not doing enough to prevent increasing land-use conflict between agricultural and non-agricultural land-use in built-up areas. This was also confirmed by Razpotnik Visković (2011), who analyzed the spatial constraints of farms in the case of a suburban settlement in central Slovenia. In this study, the farms' constraints were determined by using public spatial data and GIS at the micro level. The analysis also used the municipal spatial plans in force for the settlement, which allowed the author to evaluate farms' future development potential.

3. Urbanization in Slovenia

Like the majority of European countries, Slovenia has witnessed a continuous increase in built-up areas for decades, resulting from a decrease in other, primarily arable land categories. At present, it is not cities that display the greatest dynamics, but suburban and rural settlements, which subsequently have to deal with functional and social stratification in relation to living, work, and leisure activities. The key features of settlement development are connected with the effects of globalization, economic progress, altered lifestyle habits, and the subsequent increase in the active population's mobility (Bole et al., 2007).

Another feature of the contemporary spatial transformation of settlements is connected with predominantly dispersed construction in the form of mainly single-family detached homes with appertaining (business, production) facilities, which goes against the long-standing preferences for having residential areas concentrated within settlements (SPRS, 2004).

A comparison of ratios between the shares of inhabitants, number of settlements, and areas with a positive migration balance shows that the share of areas and settlements with a positive migration balance is increasing (Bole et al., 2007). Housing is growing due to the increasing number of households, which is primarily the result of a decrease in the average number of household members (this has been decreasing for fifty years now). All of this confirms that, due to the transformation of economic and social structures in Slovenia, the period of urban demographic growth is coming to an end and a period of “urban development without growth” has begun (Ravbar, 2004).

Suburbanization has been taking place in Slovenia for over two decades now. The analyses of Ravbar (2002, 2005) show that by studying the geographical features manifested one can distinguish between at least two development stages: the residential/demographic suburbanization and production/industrial suburbanization. Early suburbanization was characterized by demographic growth in suburbs and dispersed urbanization along main roads with favorable access and low-density structures on the urban fringes next to existing rural settlements. The collapse of the communist economic system was followed by an expansion of development sites for production, retail, and service activities, or industrial suburbanization (Bole et al., 2007).

Residential suburbanization increased alongside the individual demand for additional residential land, both in terms of its purchase and inheriting undeveloped land. The demand for residential land in areas 30 minutes away from the most important employment center is even greater than in nearby suburbs (Bergmann and Dosch, 2004), which is also reflected in increased pressure on the traffic flows from remote rural areas towards the urban centers.

Early suburbanization of production and retail activities was already heralded during the 1970s by remote units of factories, which moved part of their production to rural areas, whereas today suburbanization primarily appears in the form of residential areas formed by individual craftsmen that moved there together with their workshops (Bole et al., 2007).

The extension of the external borders of settlements, dispersed construction of land, and increased demand for building land are factors that contribute significantly to farms’ spatial constraints. Hence, this article explores the extent to which the level of a farm’s spatial constraints depends on the urbanization level of the area where the farm is located.

4. Methodological approach

4.1 Level of urbanization

The analysis of farms’ spatial constraints in relation to the level of urbanization was carried out for all Slovenian settlements. The urbanization level was assigned using a Ravbar’s typology of settlements according to the level of urbanization (Ravbar, 1997), later updated by Cigale (2005). The typology is based on four groups of criteria: socio-geographic, structural, morphological, and functional.

The criteria describing socio-geographic changes in settlements included settlement size, population changes and density, the share of people moving to the area or the migration balance, and the share of rural population.

Changes in the economic structure of the population were described in terms of employment structure, commuting, traffic flow, and the share of rural population.

Morphological changes were described in terms of residential construction dynamics, the share of detached houses, the number of stories, and the share of apartment buildings.

The last, functional criterion for describing “burdening” of the landscape caused by urbanization was expressed by the sum of the population and the number of jobs/km² (for a detailed description of this typology, see Ravbar, 1997). For the purpose of this analysis, settlement types were generalized: the eight original types of settlements were merged into four categories: urban, suburban, urbanized rural, and rural.

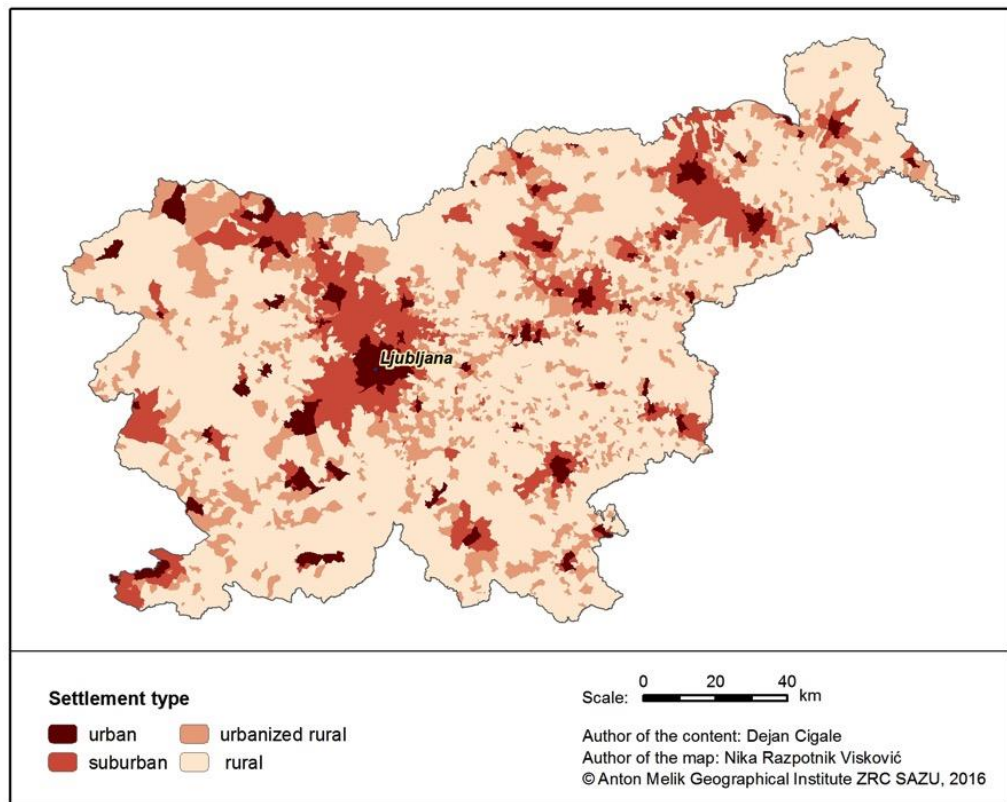


Fig 1. Urban, suburban, urbanized rural, and rural settlements in Slovenia.

4.2 Measuring the spatial constraints of farms

Measuring the spatial constraints of farms in settlements that permit mutual comparison presented the greatest methodological challenge. During the first step, the potential area of expansion was determined, whereby expansion was not perceived as the purchase or rental of additional farmland, but as expansion or reorganization of farm buildings within the individual farmstead. A buffer zone fifty meters from the centroid of the farm's seat was identified (centroid of residential building or centroid of the parcel where the farm's seat is located). Thus, the area of potential expansion of every farm measured 7,850 m², except in the case of any physical obstacles to the farm's expansion, such as the water bodies (rivers, streams, lakes), a major road, or a relief inclination exceeding 30% (which is the upper limit for building structures with appropriate adjustments).

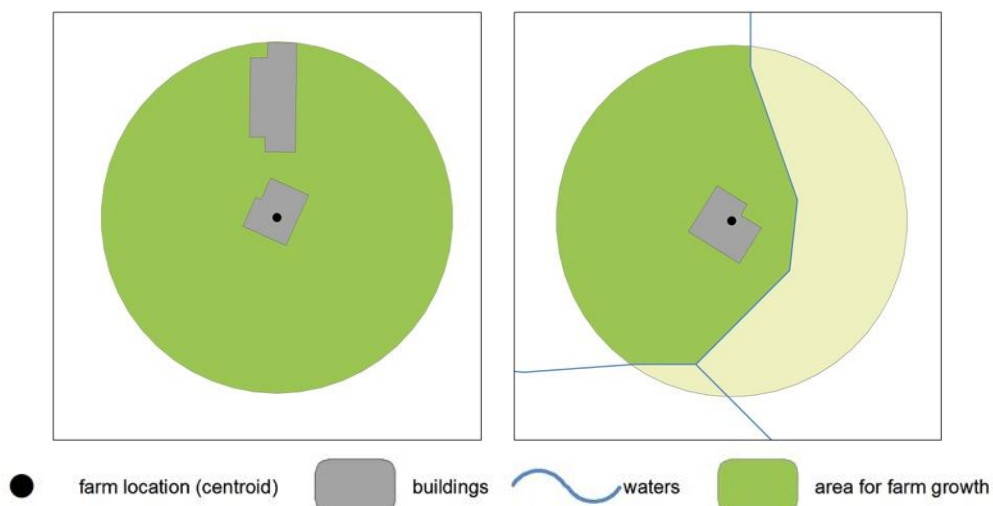


Fig 2. Area of potential farm expansion.

The next step involved calculating the share of built-up area of an individual buffer, which at the same time served as the criterion of farms' spatial constraints. A higher percentage of the built-up area naturally meant poorer opportunities for spatial expansion of outbuildings on farmsteads and in their vicinity. When calculating the share of the built-up area, only buildings with a more permanent character were taken into account, whereas those with a temporary character, such as free-standing roofs and sheds, were ignored.

Based on the shares of built-up areas of each farm, the average level of the farm's spatial constraints was calculated at the level of the settlement. The spatial constraint analysis was carried out using GIS tools.

4.3 Correlation between farms' spatial constraints and level of urbanization

The statistical correlation between the level of farms' spatial constraints and the level of urbanization was established in two stages. First, the potential presence of a statistically significant difference between the average values of farms' spatial constraint level was explored by individual settlement type. The correlation between the nominal variable (settlement type according to the level of urbanization, hereinafter: settlement type) and the numerical variable (farm spatial constraint level) was determined.

A one-way analysis of variance (ANOVA) was performed; it included one variable (the farm spatial constraint level) in several groups defined by a single factor (settlement type). The analysis showed statistically significant differences between the arithmetic means of farm spatial constraint levels by settlement type, but the same result can already be achieved if statistically significant differences are established between the values of only one group (e.g., only in urban areas). Therefore, in the next step additional ad-hoc tests were used to establish whether the differences were statistically significant between all pairs of settlement types. Two tests were used: the conservative Tamhane's T2 test and the liberal Games–Howell test.

Although the assumptions about the same size and normal distribution were not supported, the additional tests concerning the significance of distribution and the sample sizes permitted us to carry out the statistical analyses. To do so, we used SPSS software.

5. Results and discussion

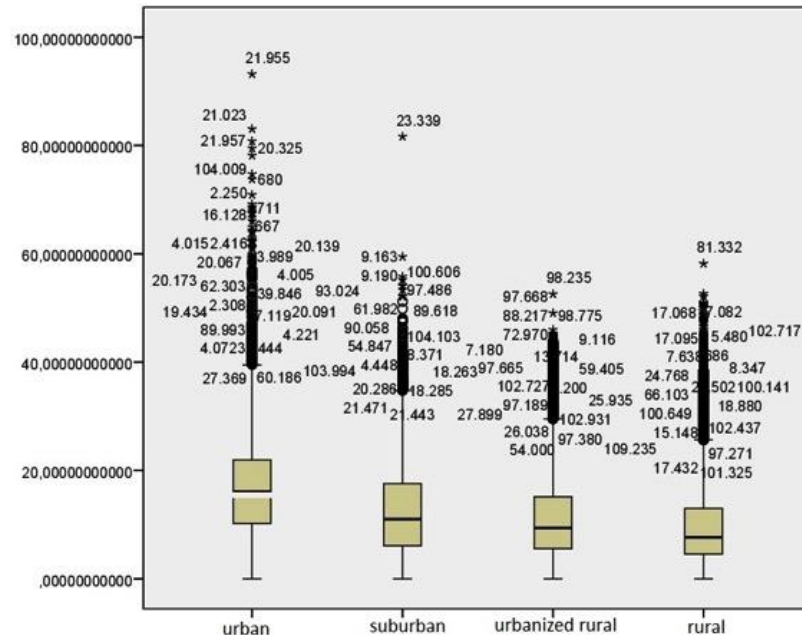
The empirical measurements of the farms' spatial constraints in Slovenia show a wide range of values. On one hand, there are farms that can expand without limits; their surrounding area has not been built up yet, and their expansion is not hindered by roads, water bodies or excessive inclination. These are mostly isolated mountain farms, farms in dispersed settlements, and farms on the edges of compact settlements. On the other hand, some (rare) farms face such a high degree of built-up areas in their surroundings (50% or more) that they can no longer expand on their existing location in any way at all.

Spatial constraints (share of built-up areas in the farm's surroundings)	Number of farms	Share of farms
Up to 5%	26,441	24.19%
5 to 10%	34,437	31.51%
10 to 20%	34,316	31.40%
20 to 30%	11,447	10.47%
30 to 40%	2,196	2.01%
40 to 50%	353	0.32%
50 to 60%	72	0.07%
Over 60%	29	0.03%

Tab 1. Spatial constraint level of farms.

Using a box plot, which displays variables within groups and their five key statistics (maximum, third quartile, median, first quartile, and minimum), the first piece of information on the differences between groups was obtained.

The diagram shows that the average values between groups already differ at first glance (the value range was the greatest with urban settlements), but their statistical significance was confirmed by ANOVA, Welch's t-test (used because the number of units in individual group varied), and the post-hoc Tamhane's T2 and Games–Howell tests; the latter showed that the differences were statistically significant in each group pair (between urban and suburban settlements, between urban and rural settlements, and so on).



Test	Type	Type	Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tamhane	urban	suburban	4,51	0,13	0	4,16	4,86
		urbanized rural	6,00	0,13	0	5,66	6,34
		urbanized rural	7,43	0,12	0	7,10	7,75
	suburban	urban	-4,51	0,13	0	-4,86	-4,16
		urbanized rural	1,49	0,08	0	1,29	1,69
		urbanized rural	2,92	0,06	0	2,75	3,09
	urbanized rural	urban	-6,00	0,13	0	-6,34	-5,66
		suburban	-1,49	0,08	0	-1,69	-1,29
		urbanized rural	1,43	0,06	0	1,28	1,58
	urbanized rural	urban	-7,43	0,12	0	-7,75	-7,10
		suburban	-2,92	0,06	0	-3,09	-2,75
		urbanized rural	-1,43	0,06	0	-1,58	-1,28
Games-Howell	urban	suburban	4,51	0,13	0	4,17	4,85
		urbanized rural	6,00	0,13	0	5,67	6,33
		urbanized rural	7,43	0,12	0	7,11	7,75
	suburban	urban	-4,51	0,13	0	-4,85	-4,17
		urbanized rural	1,49	0,08	0	1,29	1,68
		urbanized rural	2,92	0,06	0	2,75	3,08
	urbanized rural	urban	-6,00	0,13	0	-6,33	-5,67
		suburban	-1,49	0,08	0	-1,68	-1,29
		urbanized rural	1,43	0,06	0	1,28	1,57
	urbanized rural	urban	-7,43	0,12	0	-7,75	-7,11
		suburban	-2,92	0,06	0	-3,08	-2,75
		urbanized rural	-1,43	0,06	0	-1,57	-1,28

Fig 3. Statistical analysis results (SPSS printout).

Tab 2. Spatial constraints of farms according to the level of settlement urbanization.

Settlement type	Farms (n)	Average level of spatial constraint (%)
Urban	6,888	17.6
Suburban	19,643	11.6
Urbanized rural	22,591	10.0
Rural	60,169	9.6

The results of the statistical analysis of the farms' spatial constraints show that spatial constraints increase with the level of urbanization. This is an expected result, which, however, should be examined more closely:

– The spatial constraints of farms are the greatest in cities, which is not surprising considering that the built-up factor in urban areas is among the highest. Compared to other areas, the farms here are less common, their survival in the future is less certain, and because of their activity and lack of space they often find themselves in conflict situations with the surrounding residents or even the city administration. Nonetheless, urban farms can play a special role in the life of the urban community because some of them allow visits by preschool children, primary school students, and other urban residents, thus improving the understanding of farming, food production and the preservation of cultural landscape among people that are not in daily contact with any of these. For the majority of farms that face spatial constraint problems, moving to a more suitable location is the only development prospect, and, especially in the case of cities, this usually does not imply moving to a nearby location, but to a remote location outside the areas where the city is envisaged to expand. Another problem is that legislation and government assistance in economical and efficient search for substitute farm locations is not systemically handled, this is why these processes usually take several years.

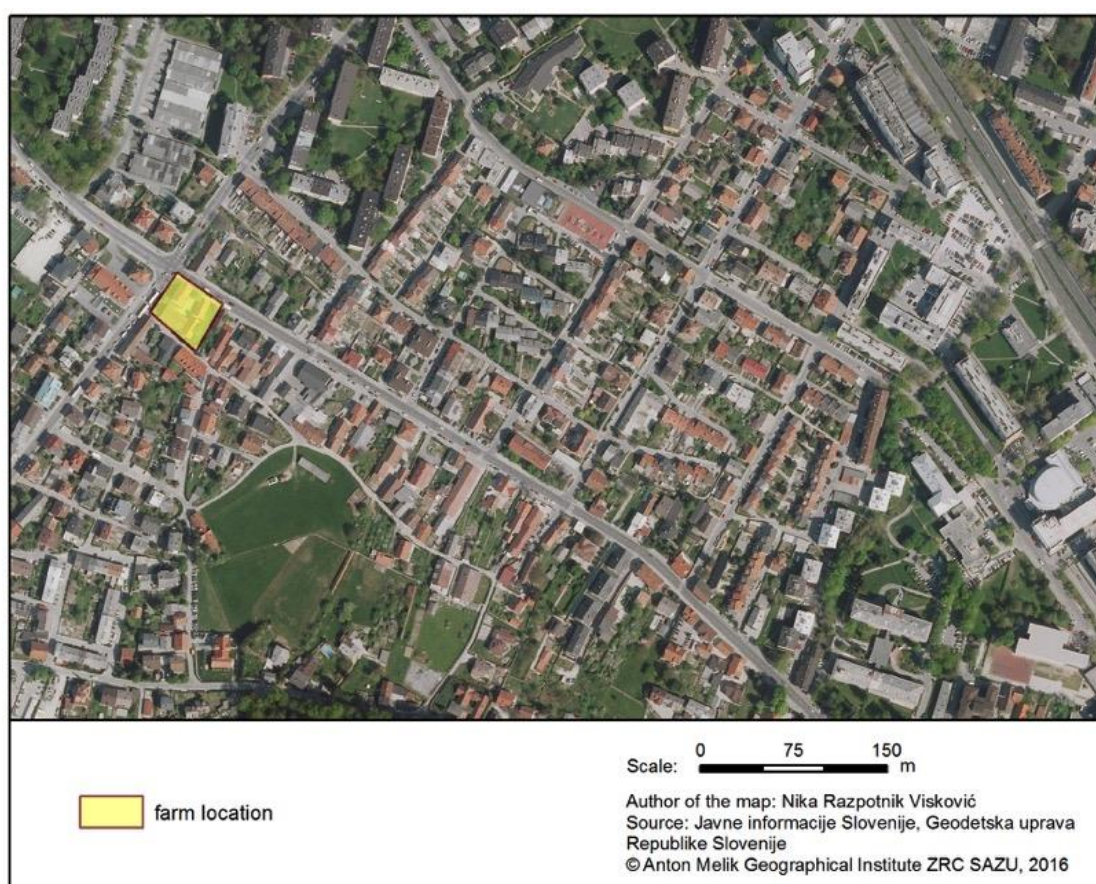


Fig 4. Example of spatially limited farm in Ljubljana.

– On the other hand, the minimal differences in the spatial constraint level of farms in other settlement types come as less expected; this can be linked to the findings on the characteristics

of suburbanization in Slovenia (described in the Section 3) and the fact that pressure on building land is typical not only for areas close to cities, but also remote rural areas. At the same time, it can be observed that, in some suburban settlements, new residential buildings are no longer built inside the settlements, but in the form of compact residential neighborhoods on the edges of settlements; hence, this type of construction has a less notable impact on the spatial situation of the farms within the settlements.

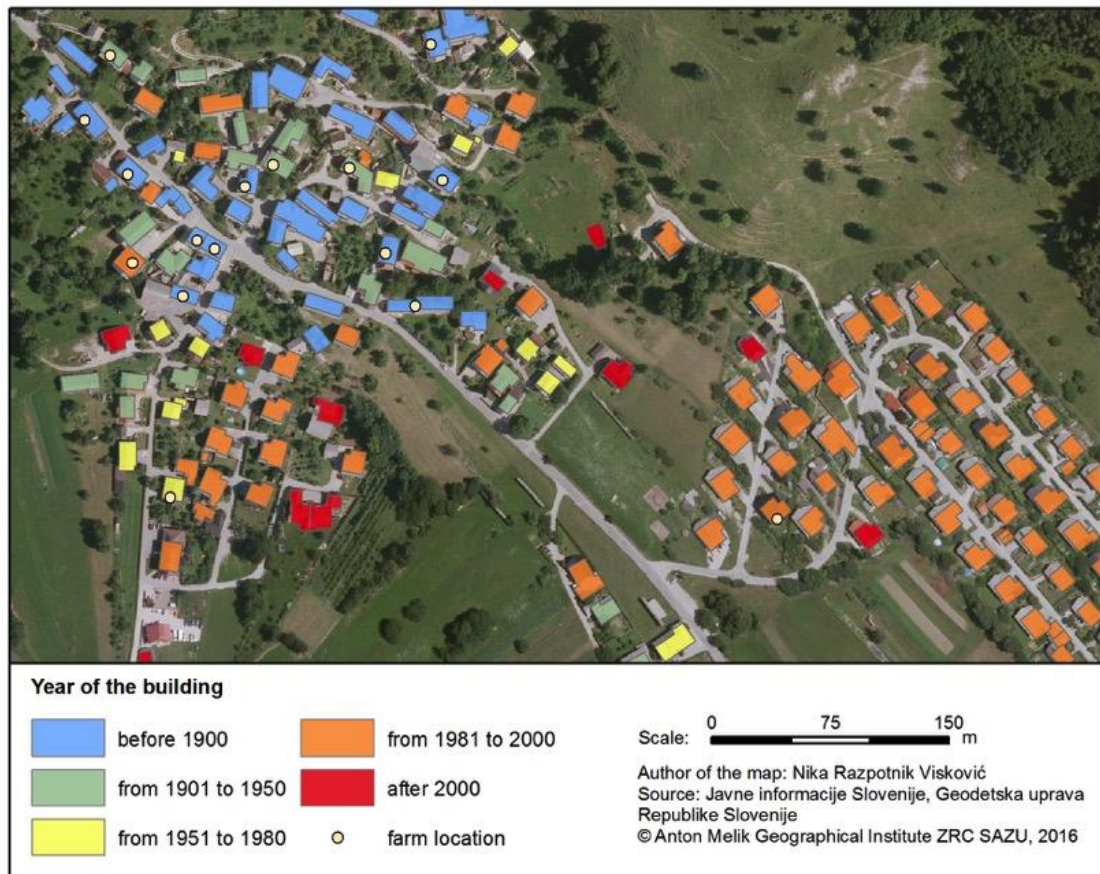


Fig 5. Example of a new residential neighborhood on the edge of a settlement.

The results of the analysis performed show the spatial constraints of farms – or, in other words, their expansion potential – but based on at least the following two assumptions related to the methodology used:

- Unencumbered real-estate trading in settlements (reality can show a different situation);
- Spatial planning documents allow the farm's expansion within the settlement.

The spatial constraints of farms raise important spatial planning questions for the future, especially in connection with how to direct the future development of farms, how to resolve the issues of those that can no longer expand, and how to manage the spatial conflicts arising from this.

The farmers' perceptions of the urbanization pressure and spatial constraints are shown by a study conducted by Lampič (2008) in Ljubljana. There the farmers believe their farmland will sooner or later be transformed into residential, trade, retail, or industrial use because, in their opinion, spatial development is characterized by such rapid and major changes that they are unsure what to expect in the future. The current situation in spatial planning leaves a large portion of farmers uncertain and the exceptionally dynamic changes prevent individuals from making long-term strategic plans regarding their farms' organization, use of farmland, and their farming orientation in general.

This article focuses on the “physical” aspect of farms’ spatial constraints, but further analyses should consider the “normative” aspect as well; namely, local spatial development strategies or municipal spatial plans (OPN – občinski prostorski načrt) and detailed municipal spatial plans (OPPN – občinski podrobni prostorski načrt).

Such an approach would offer additional insight into the complex relationship between urbanization and agricultural activity, which until now has been reduced solely to the role of urbanization in the decline of agricultural land and the transformation of the socio-economic structure of farms.

6. Conclusion

The spatial constraints of farms in Slovenia have never been systematically studied before; however, this is an important developmental aspect of agriculture, as stated by experts in spatial planning, agricultural economics, and geography. This article presents the concept of farms’ spatial constraints, proposes a methodological framework for measuring it, and reveals the relation between farms’ spatial constraints and urbanization.

It mainly aims to encourage further discussion about the spatial situation of Slovene family farms, the transformation of their role within settlements, and existing and potential adjustment strategies for their survival in order to alert spatial planners to the problem of farms’ constraints and steer them towards greater responsibility in deciding on the future development of settlements and the role of agriculture within them.

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