



## EXCLUSION OF LANDS FROM AGRICULTURAL PRODUCTION AND URBAN PRESSURE – CASE STUDY<sup>1</sup>

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### Summary

Though agricultural lands are subject to legal protection limiting their use for non-agricultural purposes, recent research shows that investment areas are becoming larger at the cost of agricultural production areas. The analysis of cases in which lands have been excluded from agricultural production within Ropczyce-Sędziszów district (*powiat*), covering the period of 15 years, confirms that the change of area of particular lands is taking place. The biggest change affected grasslands and arable lands. The lands excluded from agricultural production are transformed into single-family housing, recreational and communication areas. Moreover the research allowed to show similarities in communes (*gminy*) with respect to lands excluded from agricultural production. The communes were singled out that were homogeneous as regards exclusion carried out in years 1999–2014. The choice of a research unit – Ropczyce-Sędziszów district – is determined by accessibility of data regarding exclusions and the fact the district is regarded as a unit with an average outlook for socioeconomic development. Simple statistical methods, quantitative analyses and a method of spatial taxonomy were used in the research.

### Keywords

historical and local changes in land use • urban pressure • original and target use • objects' classification • spatial taxonomy

### 1. Introduction

In recent years there is a consistent increase in demand for investment areas [Sokołowski 1999, Prus 2012, Springer 2013]. Unfortunately, the demand is met at the cost of mainly agricultural lands, which on the one hand are an important biosphere factor component, and on the other – create environment of agricultural production. Agricultural lands have specific qualities, such as spatial permanence, the fact that they cannot be enlarged and they are directly affected by human activity [Czechnowski and Janik 1997]. These qualities have a significant impact on setting directions of development of these lands (their use) and on the way of their protection [Pawlak 1983, Czechowski et al. 1994].

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The environmental protection is based on many premises, among other things on principles of sustainable development [Kauko et al. 2015], and on the economic aspect of space as a good of a specific value, generating income and incurring costs related to its protection [Wańkiewicz 2010, Antczak-Stępnia 2015]. The limitation of space intensifies competitions for it and causes investment pressure, especially in case of lands located in near vicinity of developing rural centres [Domański 2013, Jakóbczyk-Gryszkiewicz 1998, Lisowski 2006]. Inhabitants need private as well as cultural, public or social space. For it is a domicile, a recreational site and – in case of agricultural function – a workplace. The lands used for agricultural production are most likely to be excluded from production, and in consequence fall prey to urban sprawl. It can be seen mainly in transformation of their character from rural to urban [Sokołowski 1999, Gonda-Soroczyńska 2009]. The scale of this processes is a cause for concern among researchers and demands are expressed for thrifty management of space [Szulczewska 2000, Matysiak 2004, Poniży 2008]. Recent studies shows that suburban areas are growing in an uncontrolled and chaotic way [Poniży 2008, Springer 2013]. It is generally believed that from the economic point of view that urbanization has adverse effects due to, for the most part, inefficient use of lands, shrinkage of agriculturally usable spaces, cost increase of building technical infrastructure, as well as rise in traffic congestion [Kamiński 1995]. The development of suburban areas occurs at the cost of rural and natural surroundings [Czochański 2007]. On the other hand a single-family house in a suburban area is a dream cherished by many people who want to improve their living standards, enjoy environmentally friendly leisure, and have more privacy [Domagalski et al. 2008, Parysek 2008]. Indeed though suburbanization is perceived as having negative effects, areas of lands excluded from agricultural production is still growing [Prus 2012, Mroziak and Wiśniewska 2013].

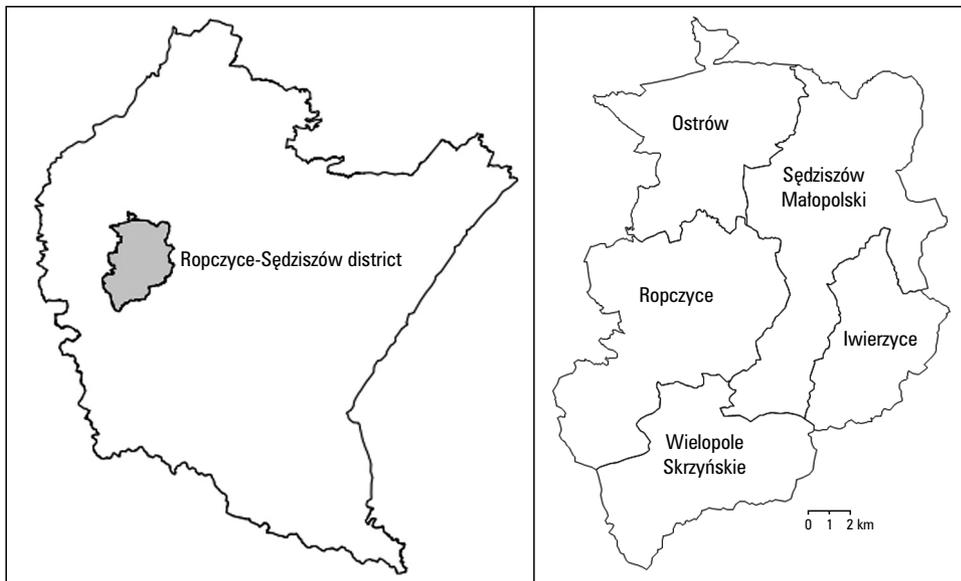
The change of intended land use is introduced in local development plans. But for lands to be actually excluded from agricultural production – according to the Agricultural and Forest Lands Protection Act of 3 February 1995 – their owners have to obtain a permission, in the form of administrative decision, to start non-agricultural activity [Ustawa 1995]. The protection of agricultural lands is thus implemented in two stages. First, it is the process of adopting or changing local development plan (quantitative protection at a commune level). Second: when a decision is issued that allows the exclusion from agricultural production (district level). As specified by the Act, quantitative protection is aimed at limiting the scope of the procedure, as a result of which lands may be used for non-agricultural purposes. On the other hand, qualitative protection is related to owners' obligation to prevent soil erosion and degradation and to carry out land reclamation [Oleszko et al. 1997].

Decision excluding lands from agricultural production must be obtained before obtaining building permit. The decision contains an exclusion permit, the purpose of exclusion, and a list of obligations related to it. A person who obtained such a decision is obliged to make all the necessary payments and annual fees, and if forest lands were excluded from agricultural production – to pay one-time compensation in case premature felling was done. Decision consists also of a precise information on soil quality class and types of agricultural land that are subject to exclusion [Ustawa... 1995].

## 2. Research method

The research was carried out by using a quantitative and descriptive-comparative analyses, as well as a method of spatial taxonomy. The area of research covered Ropczyce-Sędziszów district in the Podkarpackie voivodeship (Figure 1). The field of a basic assessment was a commune. The choice of the research unit was determined by accessibility of data regarding exclusions and by the fact that the district, together with 18 other districts of the voivodeship, is regarded as a unit with an average outlook for socioeconomic development [Gawroński et al. 2014, Bański 2009]. Therefore the study can be considered as reliable (cross-sectional), and the cases of exclusion did not result from specific determinants.

The Ropczyce-Sędziszów district, consisting of 46 village administrations, covers an area of 548.89 km<sup>2</sup>, which is 3.1% of the Podkarpackie voivodeship area. According to data of Central Statistical Office (GUS) in 2014 the districts had 73.5 thousand inhabitants, which is 134 persons per km<sup>2</sup>. It has two towns: Ropczyce and Sędziszów Małopolski, two urban-rural communes: Ropczyce and Sędziszów Małopolski, and three rural communes: Iwierzycze, Ostrów and Wielopole Skrzyńskie (Figure 1).



Source: author's study

**Fig. 1.** Location of the Ropczyce-Sędziszów district in the Podkarpackie voivodeship, and its administrative division

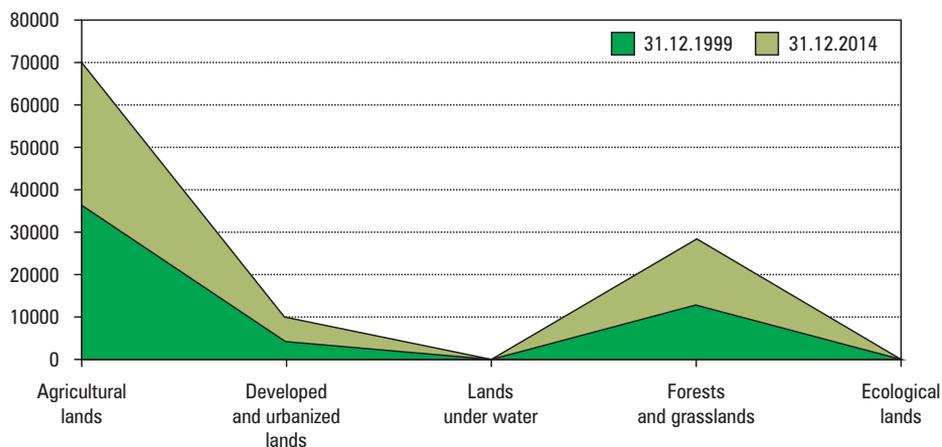
The goal of the study was to analyse administrative decisions to exclude lands from agricultural production with regard to changes in land use. Only permanent exclusions were taken into account. The study was carried out in four stages. In the

first one changes of land use in the Ropczyce-Sędziszów district have been analysed in years 1999–2014. Thus directions of changes in areas of usable lands were determined. Another analysis was carried out to determine changes in the area size in the group of agricultural lands. In the second stage the area of excluded lands was analysed, and a logarithmic trend line was drawn, which indicates a tendency of exclusion size in consecutive years. The structure of exclusions has been established on the basis of target directions of land use, defined in administrative decisions. In the third stage percentage share related to exclusion of arable lands and grasslands from use was calculated, comparative analysis was carried out and communes of the studied district were classified. On the assumptions of numerical taxonomy, a Euclidean distance matrix was chosen as a similarity measure, and then, on the basis of it, objects were classified by a spatial taxonomy method. Percentage share of excluded lands in the area of arable lands, grasslands and agricultural lands was chosen as a criterion of similarity and then of communes' division. In the final, fourth stage, summary of studies was made and conclusions were presented.

### 3. Results and discussion

#### 3.1. Stage one: analysis of changes in land use

The Ropczyce-Sędziszów district is mainly agricultural, what is reflected mainly in the structure of land use, in which agricultural land have the largest share (67% in 1999 and 62 in 2014). In the structure of tillage cereals, sugar beets and potatoes dominate. Decrease in area of agricultural lands during 15 years correspond to 5 percentage points, which is 2.6 thousand ha (Figure 2). In this period developed areas grew larger by about 330 ha and forest lands by about 2340 ha.



Source: author's study based on data from land register

Fig. 2. The change in area of usable lands in the Ropczyce-Sędziszów district in years 1999–2014

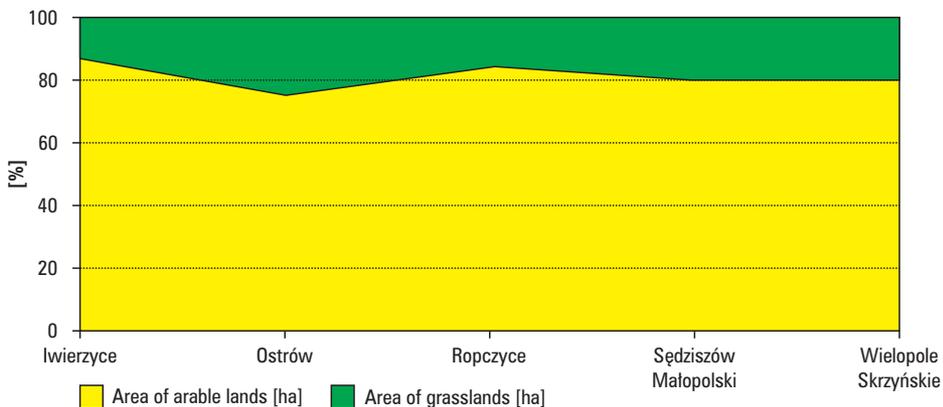
The analysis of agricultural lands (Table 1) in 1999–2014 showed that the greatest change occurred in arable lands – their area shrank by 1723 ha (4.7%). The area of meadows and pastures has also diminished – by 736 ha (2%) in total. And the area of orchards was reduced by 244 ha.

**Table 1.** Types of areas of agricultural lands in the Ropczyce-Sędziszów district in 1999–2014

Type of agricultural land	The area as of 31 December 1999 [ha]	Percentage share in area of agricultural lands as of 31 December 1999	Area of 31 December 2014 [ha]	Percentage share in area of agricultural lands as of 31 December 2014	Change in area in 1999–2014 [ha]	Change in area in 1999–2014 [%]
Arable land	25829	70.4	24106	70.8	-1723	-4.7
Orchard	573	1.6	329	1.0	-244	-0.7
Permanent meadows	4559	12.4	3909	11.5	-650	-1.8
Permanent pastures	5548	15.1	5462	16.0	-86	-0.2
Ditches	179	0.5	245	0.7	-66	0.2
Agricultural lands in total	36688	100	34051	100	-2769	-7.2

Source: author's study on data from land register

In the analysis of decisions to exclude lands from agricultural production information on area in hectares of arable lands and grasslands was important, because it is within those areas that exclusions were made.



Source: author's study

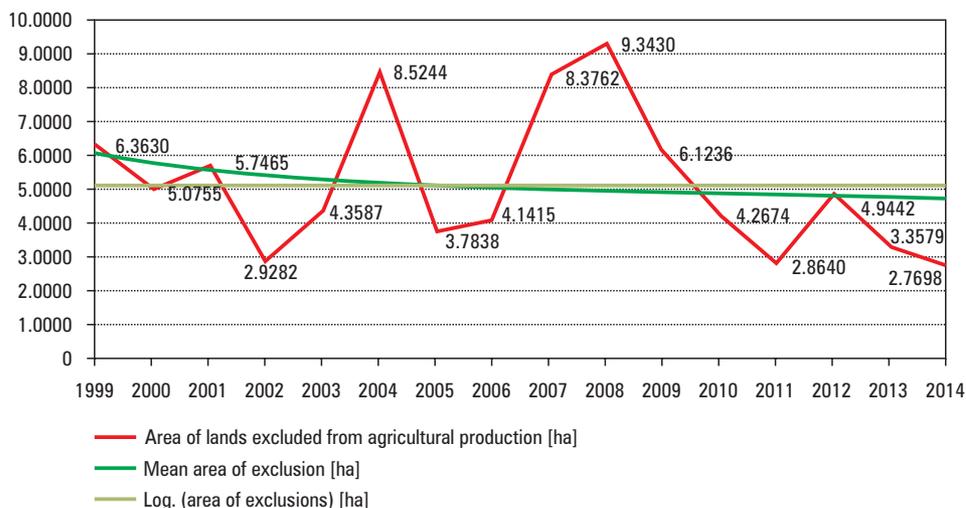
**Fig. 3.** Area of arable lands and grasslands in communes of the Ropczyce-Sędziszów district as of 31 December 2014

In the Ropczyce-Sędziszów district the area of arable lands is four times as large as the area of grasslands (Figure 3).

### 3.2. Stage two: analysis of exclusions of lands from production

In 1999–2014 in the Ropczyce-Sędziszów district there were 1598 request made to exclude lands from agricultural production. The area of agricultural lands (including arable lands and grasslands) that were subjected to exclusion, amounted to 82.9677 ha, which translates into 0.0549 ha for one decision. The largest annual area excluded from production was in 2004 (8.5244 ha), 2007 (8.3762 ha) and 2008 (9.3430 ha), with an average annual area excluded from agricultural production during 15 years of 51.855 ha. The smallest area of agricultural lands was excluded in 2014 (2.7698 ha), 2011 (2.8640 ha) and in 2002 (2.9282 ha).

The chart of logarithmic trend shows that size of lands excluded from agricultural production is diminishing (Figure 4). During 15 years the mean annual area of lands excluded from production has decreased from above 6 ha in the initial phase of the study to less than 5 ha in 2014.



Source: author's study

Fig. 4. The area of lands excluded from agricultural production [ha] in consecutive years in the Ropczyce-Sędziszów district

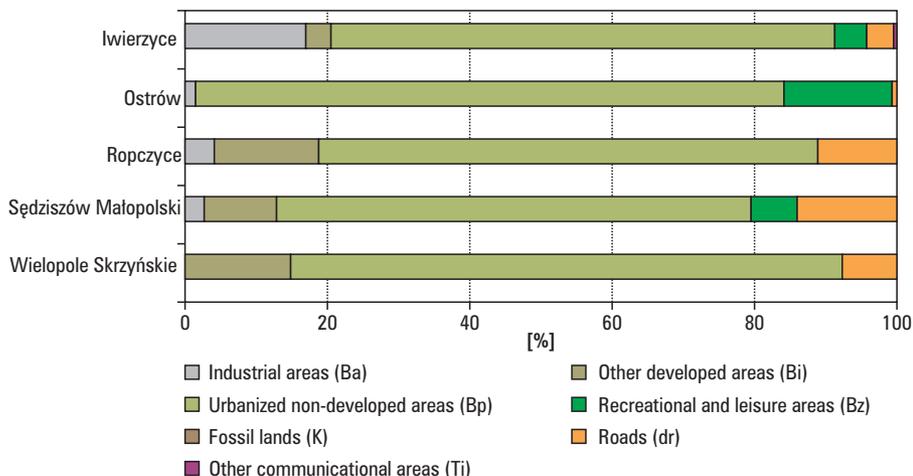
Among administrative decisions taken between 1999 and 2014 those excluding land from agricultural production for single-family housing purposes (Bp) are dominating. Areas intended as urbanized non-developed ones amounted to 67.2% of all lands excluded in the Sędziszów Małopolski commune, and as much as 77.9% of land in the Wielopole Skrzyńskie commune (Table 2).

Table 2. The area of lands excluded from production in communes of the Ropczyce-Sędziszów district according to type of target use

Target use of excluded lands	Wielopole Skrzyńskie	[%]	Sędziszów Małopolski	[%]	Ropczyce	[%]	Ostrów	[%]	Iwierzyce	[%]
Industrial areas <b>Ba</b>	0	0.0	0.8062	2.8	1.3673	4.1	0	0.0	2.5280	17.0
Other developed areas <b>Bi</b>	0.3469	15.0	2.8901	10.0	4.8956	14.8	0.0400	1.1	0.5487	3.7
Urbanized non-developed areas <b>Bp</b>	1.8070	77.9	19.3639	67.2	23.3458	70.5	3.1310	83.5	10.5880	71.2
Recreational and leisure areas <b>Bz</b>	0	0.0	1.8072	6.3	0	0.0	0.5600	14.9	0	0.0
Fossil lands <b>K</b>	0	0.0	0.0828	0.3	0	0.0	0	0.0	0.6800	4.6
Roads <b>dr</b>	0.1659	7.2	3.8427	13.3	3.4944	10.5	0.0200	0.5	0.4748	3.2
Other communication areas <b>Ti</b>	0	0.0	0.0100	0.0	0.0292	0.1	0	0.0	0.0466	0.3
<b>Total</b>	2.3198	100	28.8029	100	33.1323	100	3.7510	100	14.8661	100

Source: author's study

Significant percentage of lands in two communes (Sędziszów Małopolski and Ropczyce) was intended for road investments. In Sędziszów Małopolski and Ostrów communes there were also a few investments related to recreation and leisure facilities (Figure 5).



Source: author's study based on administrative decisions

Fig. 5. Percentage share of types of intended use of lands excluded from agricultural production in the Ropczyce-Sędziszów district in 1999–2014

### 3.3. Stage three: defining similarities between communes, classification

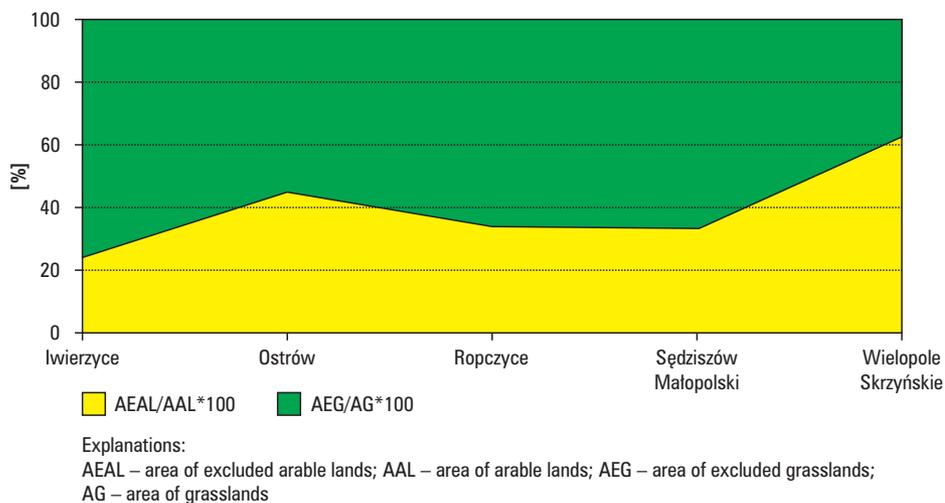
In order to compare the communes of the Ropczyce-Sędziszów district and to indicate communes with similar direction and character of exclusion of lands from agricultural production indices were calculated that show share of excluded areas in the area of usable lands. They were calculated for arable lands, grasslands and altogether for agricultural lands (Table 3). The indices calculated for five communes in case of exclusion of arable lands vary from a minimal value of 0.042 in the Wielopole Skrzyńskie commune to maximal of 0.346 in the Sędziszów Małopolski commune. As to grasslands, a minimal index was calculated in the Wielopole Skrzyńskie commune – 0.026, and maximum one in the Iwierzycze commune – 0.860.

Undoubtedly, grasslands are more often excluded from production than arable lands. This tendency can be found in all communes, with the exception of Wielopole Skrzyńskie (Table 3, Figures 6 and 7). Among communes of the Ropczyce-Sędziszów district, with respect to areas of lands excluded from production, we can observe some regularities. Ostrów and Wielopole Skrzyńskie and Ropczyce and Sędziszów Małopolski communes share some similarities (Figure 7). To define similarities between communes statistically, on the basis of calculated indices of percentage share of areas excluded in the area of total area adequate types of lands, a Euclidean distance matrix was calculated (Table 4).

Table 3. Areas excluded from agricultural production and original use of excluded lands

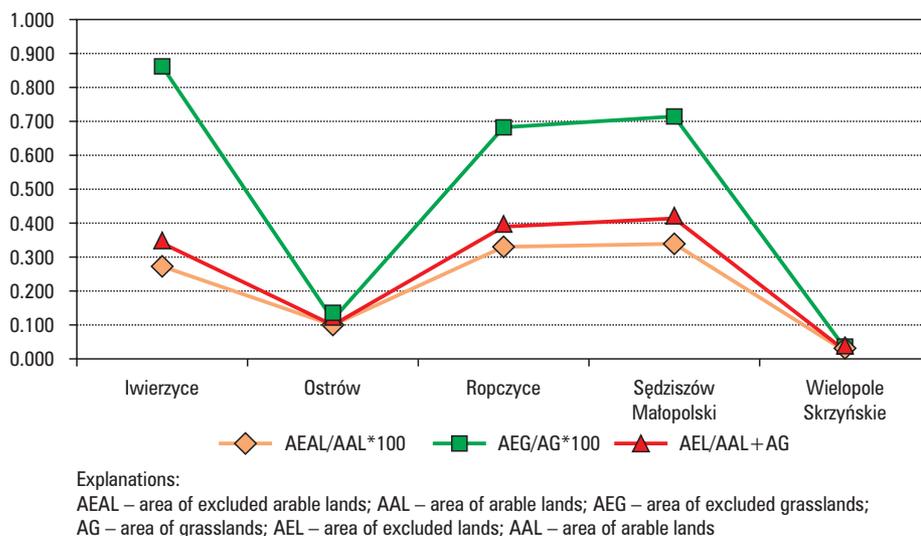
Commune	Area of arable lands [ha]	Area of grasslands [ha]	Area of excluded arable lands [ha]	Area of excluded grasslands [ha]	Area of excluded arable lands/area of arable lands * 100%	Area of excluded grasslands/area of grasslands * 100%	(Area of excluded lands/area of arable lands + area of grasslands) * 100%
Iwierzycze	3661	553	10.1113	4.7551	0.276	0.860	0.353
Ostrów	2841	926	2.6506	1.1001	0.093	0.119	0.100
Ropczyce	7090	1362	23.8658	9.2665	0.337	0.680	0.392
Sędziszów Małopolski	5764	1418	19.9166	10.0568	0.346	0.709	0.417
Wielopole Skrzyńskie	4748	1204	2.0043	0.3155	0.042	0.026	0.039

Source: author's study



Source: author's study

Fig. 6. Percentage share of lands excluded in two categories: arable lands and grasslands in total area of arable lands and grasslands. Graphic interpretation of indices of area of excluded arable lands and area of excluded grasslands



Source: author's study

Fig. 7. Comparison of indices of percentage share of excluded lands in two categories: arable lands and grasslands in total area of arable lands and grasslands. Graphic interpretation of indices of area of excluded arable lands and area of excluded grasslands and of area of excluded lands/area of arable lands + area of grasslands

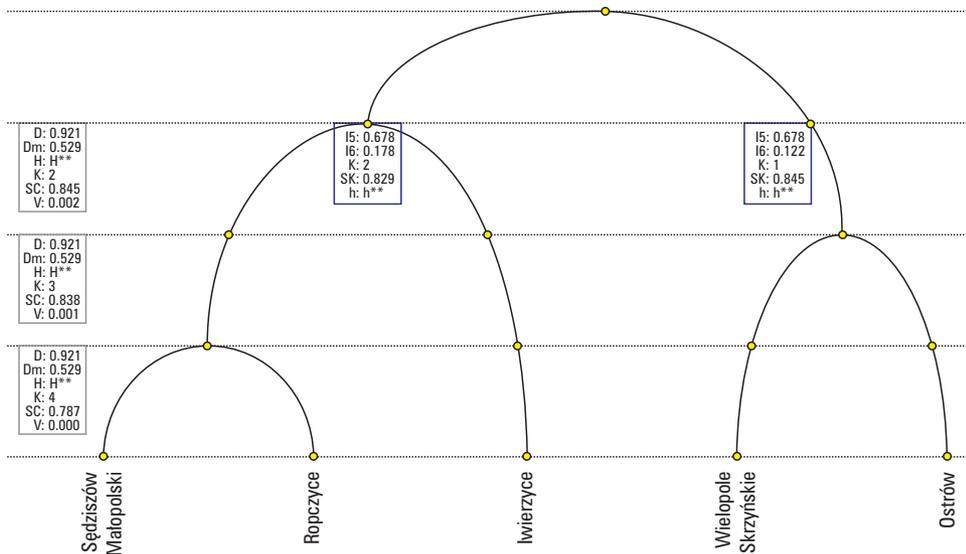
Index calculated for arable lands and grasslands shows minimal value in the Wielopole Skrzyńskie commune, and the maximal in the Sędziszów Małopolski commune.

Table 4. Euclidean distance matrix defining taxonomic similarity of communes

	Iwierzycze	Ostrów	Ropczyce	Sędziszów Małopolski	Wielopole Skrzyńskie
Iwierzycze	0	0.804	0.193	0.178	0.921
Ostrów	0.804	0	0.678	0.716	0.122
Ropczyce	0.193	0.678	0	0.039	0.800
Sędziszów Małopolski	0.178	0.716	0.039	0	0.838
Wielopole Skrzyńskie	0.921	0.122	0.800	0.838	0

Source: author's study

It results from Euclidean metrics that the shorter distance between units (communes), the more similarities between them [Kolenda 2006]. Using spatial taxonomy – hierarchical method of objects classification – similarities between communes in the studied district have been defined.



Source: author's study based on the Numerical taxonomy software

Fig. 8. Graphic interpretation of communes' classification in the Ropczyce-Sędziszów district by spatial taxonomy method

Full structure of objects classification done by a method of spatial taxonomy covered four ranks (Figure 8). In the second rank three types of communes were singled out that were homogeneous as to a direction of exclusion of lands from production. The first group included Sędziszów Małopolski and Ropczyce, the second – Ostrów and Wielopole Skrzyńskie and separately, a third group – the Iwierzycze commune was classified. One degree higher classification rank connected Sędziszów Małopolski, Ropczyce and Iwierzycze communes in one homogeneous group. Measure  $D = 0.921$  indicates taxonomic mean for the whole class of objects and maximal distance in a distance matrix. Index  $D_m = 0.529$  indicates mean value of distances in a distance matrix. Index  $V$  shows mean intragroup variation [Kolenda 2006]. Measure  $H = H^{**}$  demonstrates strong heterogeneity of a group. Whereas, according to Rousseeuw [1987], the value of measure silhouette coefficient  $SC = 0.838$  on the level of second rank and  $SC = 0.845$  on the level of a third rank indicate in both cases a very good division into groups in the classification.

#### 4. Recapitulation and conclusions

Though there are legal limitations imposed on exclusion of lands from agricultural production, the rural areas are subject to ongoing suburbanization and consequently they lose their agricultural function and acquire a non-agricultural one and change their character. This phenomenon is noticeable mainly in high number of administrative decisions on exclusions, and in the form of large area of lands excluded from agricultural production. The Ropczyce-Sędziszów district in the Podkarpackie voivodeship is a good example of such practices. During 15 years almost 1600 such decisions were issued, slightly more than 106.5 per year. Exclusions result especially in structural changes of usable lands. In that period around 55 ha of lands of highest production quality were subject to exclusion (I–III soil quality class). Every year the area of agricultural lands, particularly arable lands, is getting smaller. On a positive note, however, the studies show that in recent years less lands are excluded from production. The maximal value of 9 3430 ha of lands excluded from production was not repeated in the following years. Target functions designated in administrative decisions to exclude lands from productions, taken during 15 years in the Ropczyce-Sędziszów district's communes, were dominated by housing investments, then by recreational and leisure and road investments.

The calculated coefficients, showing the percentage share of arable lands and grasslands excluded from production, point to some similarities between the studied communes. In order to define this similarity the communes were classified by spatial taxonomy method. It allowed to single out group of objects homogeneous as to a pace of growth of lands excluded from production in both types of usable lands (arable lands and grasslands). Three types of communes can be singled out (in the second rank of classification). These are objects, as to which numerous administrative decisions to exclude lands from production are issued. The phenomenon can be explained by the proximity of towns, well developed communication network (there is a national road

E40 nearby and a ring road of Ropczyce), and good quality of roads, which makes suburb residential plots more attractive. The rural commune of Iwierzycze was the only one to be classified in the second group. It is a very characteristic object, because in spite of its rural status, large number of decisions to exclude lands from production were issued there (262 in 15 years). The reason for this can be a close neighbourhood of Sędziszów Małopolski town, as well as to the location of part of the commune that is good for building development. The southern part of the commune is much less frequently chosen as place of living, as these lands are characterized by considerable height differences and classified as a physiographical region averagely favourable for settlement and transportation [Klimek et al. 1969]. The third group is composed of two communes: Wielopole Skrzyńskie and Ostrów. They are also noted for the smallest change in the areas of particular types of agricultural lands. These communes are located in the northern and southern outskirts of the Ropczyce-Sędziszów district, far from main urban centre of this area. They are also communes with substantial height differences, largely forested, and with unfavourable conditions for housing development (sandy soils with low bearing capacity).

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