



THE HISTORICAL ANALYSIS OF THE SPATIAL LAND LAYOUT OF MŚCIWOJÓW VILLAGE IN THE MŚCIWOJÓW MUNICIPALITY

Karol Noga, Jarosław Taszakowski

Summary

This paper presents the analysis of cartographic materials formed on the basis of the former Prussia cadastre, modern cadastral maps and digital orthophotomaps. The maps from the various periods of time allow for the land layout analysis and changes in land use from the first colonists settlement to the present. Studies have shown that during the last 70 years in the (analyzed) village in this study, more than half of the arable land was transformed to the grassland. In the analyzed period of time the number of plots increased by 112%, and their average size has been reduced by more than a half.

Keywords

land use • spatial structure of land • land layout

1. Introduction

The spatial image of today's village is a result of multidirectional human activity, which stays in close connection with the prevailing socio-economic relations and natural conditions [Noga 1979]. Human beings in pursuing their livelihoods, secured and changed the natural landscape to prepare it for their own needs. The original settlement has had a decisive influence on the present state of the landscape. As a result, there has been a division of settled space, in accordance to the accepted rules [Podkański 1906, Lenczowski 1957, Solecki 1977]. The area of land obtained by the first settlers was primarily used for agricultural lands, building and for communication routes. As a result, the demographic, economical rural community development, of the original layouts (also landscaping) underwent a perpetual metamorphosis [Noga 1988, 1993].

The spatial image of the agricultural land, buildings, roads, railways and water boundaries as represented on the maps from the various periods of time, is a great source of information for modern cartographic studies. The manner of parcels or plots numbering allows for inference to the original land layout reproduction which

the first settlers received. The location on the village's map as historically recorded for settlers areas, provides a possibility for an analysis of further proprietary land division, based on descriptive data from the cadastre. These maps are a valuable source of information for analysis of landscape spatial structure changing. Based on this information, it is possible to analyze land use transformation which are affected by the anthropogenic impact on the environment as well as the progressive environmental restoration. The spatial structure changing analysis may refer to the urban landscape in particular, the changes and development on road networks. Moreover, based on these maps, we can analyze the spatial evolution of water networks, regression and progression of water reservoirs, their shape and course changed and irrigation and drainage construction concentration [Wolski 2000].

The purpose of the work is the historical analysis of the land spatial layout of Mściwojów village in Mściwojów municipality, Jawor county, Lower Silesia Province.

The scope of work includes analysis of descriptive and cartographic materials formed on the basis of the former Prussia cadastre, modern cadastral maps and digital orthophotomaps. These maps allow for the land layout development and changes in land use during many years.

2. The land layout concept

The land layout concept refers to the spatial land allocation for particular farms. It is a result of human activities. The spatial land allocation has always been done according to a specific scheme. It means that the same specific scheme was used for many villages [Fedorowski et al. 1970]. Therefore, one can observe a kind of regularity which correspond to the approved scheme. This regularity can be used in the land layout classifications type and all the rules that govern them. The basis for land layout classifications is the amount and the shape of the compact part of the land, which were divided from one farm.

The detailed analyses of developed ownership and economic structures of land division, allows for the definition of an important features in this structure, which are noticeable in different villages. It is possible to define two significant stages of layouts. The first is the original moment of forming layouts and then their further development.

The new construction framework and regulations governing land division were made at the original land layouts forming time. They took place within a short period of time. Usually first during the larger areas dividing, or at the time of land structure reconstruction which were shown during land consolidation in villages [Fedorowski et al. 1970]. In this case, the spatial land location were designed according to the specified rules, established by the designer managing land division. Therefore, a created land layout undergoes the changes due to population growth on part analyzed area.

The second phase of the land layouts formation is nothing other than to further their development and transformation, connected with land fragmentation.

With the regards to the shape of the land plots, we can distinguish two forms:

- the band – specifies the plot of land in the shape of strip, with a large extend area, which runs through the entire width of the village, it is half or through the significant width of other parts,
- block – specifies a plot of land with a compact form, usually a rectangle with a small extend area.

With the regards to the number of plots belonging originally to a single farm, we can also distinguish two forms:

- a single plot of land – provides compact farm area,
- many plots of land – belonging to a single farm, situated in different parts of a village, mostly varied with the regards to soil evaluation.

A combination of forms and the amount of plots allows for distinguishing four typical models of land layouts, which were the base of villages arrangement. Those are single-striped type, multi-striped type, single-blocked type, multi-blocked type of land layouts.

3. The fragmentation of holdings concept

The fragmentation of holdings concept was introduced in 1907 by Koncent-Zieliński. He described the fragmentation of holdings, as a land area which belongs to one village but the property of single owner is not located in the same place near the house. And they are fragmentized into greater amount of plots, mostly narrow and long, separated by other owners properties [Koncent-Zieliński 1907]. At the time of the introduction of the fragmentation of holdings concept, he had no idea about owners fragmentation of holdings, which was dominated in mountain areas. It was characterized by short and small plots.

In addition, Hopfer [1987] described the fragmentation of agricultural lands and soil evaluation classes. This kind of fragmentation of holdings shares are due to administrative boundaries. We can distinguish an internal and external fragmentation of holdings. One of them is located inside of the village and the other outside the village. The external fragmentation of holdings can arise between villages, municipalities, counties, provinces or countries. As an example, we can see fragmentation of holdings between Poland and Slovakia, Poland and the Czech Republic, which appeared during the partitions time, when there were no boundaries in Galicia. The owners, who had land in that type of fragmentation of holdings, were named by Rabczuk [1968] as “non-resident owners”. This concept was developed and more specified by Noga [1977], who created a method of analysis and established the following separation:

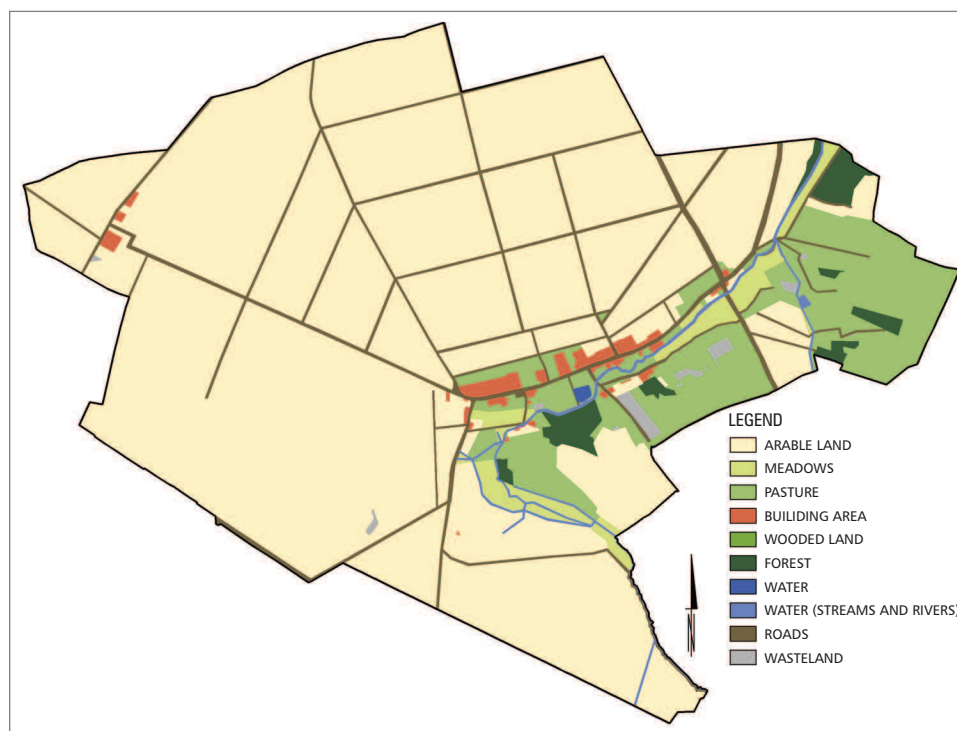
- Out-of village owners – those are owners who have their lands in the analyzed the village, but they live outside.
- Local non-resident owners – those are owners who have their lands outside the village in which they live.

Based on an extensive review of the literature, three basic types of fragmentation of holdings are clear: ladder type, band type and irregular type. In relation to these specifications, as a combination of mentioned basic types, some fragmentation of holdings' subtypes were divided into: ladder-band subtype, ladder-irregular subtype, band-ladder subtype, band-irregular subtype, irregular-band subtype, irregular-ladder subtype [Noga and Schilbach 1990].

In the case of classifying villages due to fragmentation of holdings' type, first of all, we define the dominant type (50%) and next, the supplemental type (30%).

4. The method of analysis

The changes in land use in the Mściwojów village can be analyzed by making a comparison of maps from the various period of time. That comparisons was possible by overlapping maps in digital form in an unified spatial reference system. Moreover, the comparison with state from digital orthophotomaps allows for the examination of the current land structure metamorphosis.



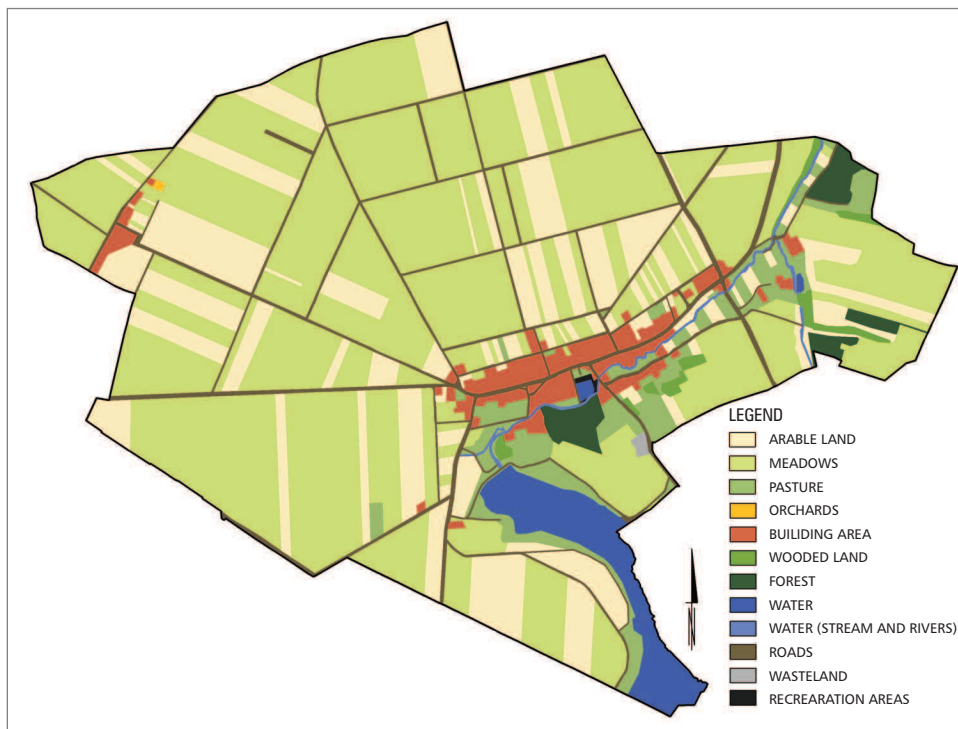
Source: authors' study

Fig. 1. Land use study based on cadastral map of 1964

The cartographic comparison of agricultural land boundary changes is a method which, in various periods of time, allows for the review as to directions and trends of changes that took place in the analyzed space. This supplement information is a tabular and descriptive cadastral documentation thanks to which one can specify the size changes in analyzed space and period of time.

The cadastral map of 1964 and digital orthophotomap were used for a comparative analysis, in this study. The cadastral map of 1964 was made based on a regulatory surveys in 1958 which documented the state of land legal assignment for colonists in 1948. Digital orthophotomaps of 2009 shows the current state of each agricultural land spatial arrangement.

Agricultural land structure plan due to the state of 1964 was made with the color technique, as shown on Figure 1. Agricultural land structure due to state from digital orthophotomaps 2009 is shown on Figure 2.



Source: authors' study

Fig. 2. Land use study based on orthophotomap of 2009

5. The characteristic of the spatial land use metamorphosis in the Mściwojów village

As a result of socio-economic and demographics development, agricultural land boundaries have been permanently changing. The accepted term for this studies (45 years), allows to define the directions and the size of changes which took place in the space in the Mściwojów village. It is presented in detail in Table 1. The size and directions of those changes in the analyzed period show various trends. The state of spatial agricultural land changes in the term this studies period was marked with color and cartographic technique, which is shown in Figure 3.

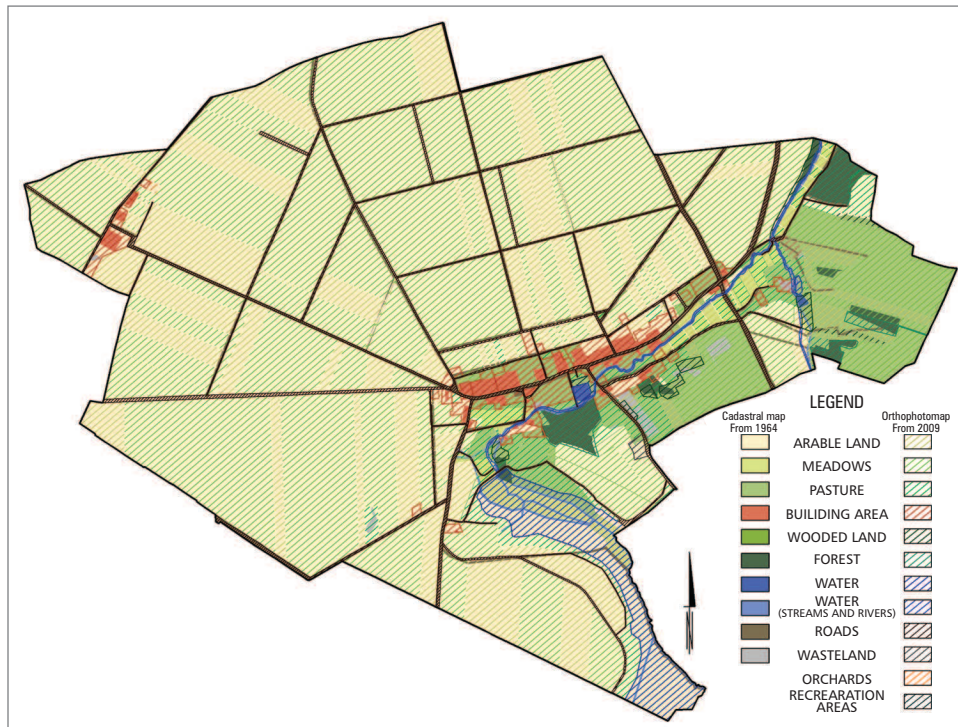
Table 1. Changes in land use in Mściwojów village in 1964–2009

The name of village	Land use	State in 1964 based on cadastral map		State in 2010 based on orthophotomap		Difference in hectares	Percentage changes indicator
		Land use area		Land use area			
		[ha]	[%]	[ha]	[%]		
Mściwojów	arable land	662.4406	78.8	170.4837	20.3	-491.9569	-74.3
	grassland	116.6356	13.9	552.9412	65.8	436.3056	374.1
	orchards	0	0.0	0.2960	0.0	0.2960	100.0
	forest	15.5524	1.9	13.2414	1.6	-2.311	-14.9
	wooded land	0	0.0	6.5317	0.8	6.5317	100.0
	roads	26.3474	3.1	31.9568	3.8	5.6094	21.3
	building areas	10.4638	1.2	31.8001	3.8	21.3363	203.9
	water	4.5163	0.5	32.1500	3.8	27.6337	611.9
	recreation areas	0	0.0	0.5276	0.1	0.5276	100.0
	wasteland	4.6543	0.6	0.6819	0.1	-3.9724	-85.3
Total	840.6104	100.0	840.6104	100.0	0	0.0	

Source: authors' study

As a result of the analysis during this 45 years period, we can state that the biggest changes in land use were found in arable land, grassland, building grounds and waters. As researches have shown, the arable land area decreased of 75% in relation to the state from 1964. On the other hand, the grassland area increased almost 380%. It is clear that there has been a major transformation of arable land to grassland. It is clear change in the direction of agricultural production from cultivation to cattle breeding.

A natural phenomenon, confirmed by analysis, are increasing of building and roads areas. The roads, widened, many times changed their routs. The new roads section were created, which conditioned increased of buildings areas. Because of water reservoir building, water area increased of over 600% in relation to the state in 1964.



Source: authors' study

Fig. 3. Spatial arrangement in land use changes based on cadastral map of 1964 and orthophotomap of 2009

6. The characteristics of the spatial land layouts metamorphosis in the Mściwojów village

The spatial land location analyzed in the Mściwojów village is illustrated in Figure 4. The map of 1964 was based on a regulatory surveys in 1958, which documented the state of legal land assignment for colonists in 1948. In accordance with the colonization, low in the area of the Western Lands [Dekret 1946], the lands were requisitioned by the States, and then divided into plots for settlers. Ten percent (10%) of total area remained the State's ownership. This rule was also realized in the analyzed village, which is shown in Figure 4, in the south-eastern part of the village, below the building where the state farm was located. The rest of the village was divided among the settlers. A very significant feature in the village is the location along the building of small parcels which serve as home gardens for each settler. In the building zone one notices the park and palace complex. The settlers arable land areas are characterized by a dense network of agricultural transport roads. The road's layout is almost equilaterally spaced.

The spatial arrangement of the plots in the complexes determined by roads (Figure 4) is a ladder-irregular fragmentation of holdings subtype, with a differential width, length and surface of plots. Especially clear, the small area plot complexes in the building zone are exposed, also those are bigger in the rest of the area.

As a result of the passage of time until 1964, the private owner's plots have been divided, which is shown in Figure 5 and the State lands remained unchanged.

In the more or less 60-year period plots divisions have been observed, regardless of the legal relationship to land. The current status of the plots is shown in Figure 6. The compilation of those three states is shown in Figure 7.

On the basis of the analyzed maps from the three different periods, the plot's number synchronization has been done using those three maps – Table 2 shows it as an example. The result of this synchronization is presented in Table 3, which contains quantitative sizes of changes in spatial land layout in the analyzed village.

Table 2. The plot's number synchronization in 1948–2011 (example)

Plots from the regulatory surveys map	Plots from the cadastral map of 1964	Plots from the cadastral map of 2011	Plots from the regulatory surveys map	Plots from the cadastral map of 1964	Plots from the cadastral map of 2011
1	2	3	1	2	3
2	2	2/1	49	49/1	49/1
		2/2		49/2	49/2
13	13	13/1		49/3	49/16
		13/2		49/4	49/17
		13/3			49/4
16	16/1	16/1		49/5	49/5
	16/3	16/3		49/6	49/6
	16/2	16/4		49/8	49/8
		16/5		49/7	49/12
	156	156/1		156/1	49/9
156/2	156/2	49/9		49/9	
156/3	156/3	49/10		49/14	
156/4	156/4			49/15	
156/5	156/5	156/6		49/11	49/11
		156/7			

Source: authors' study

Table 3. The sizes of changes in plots quantity in 1948–2001

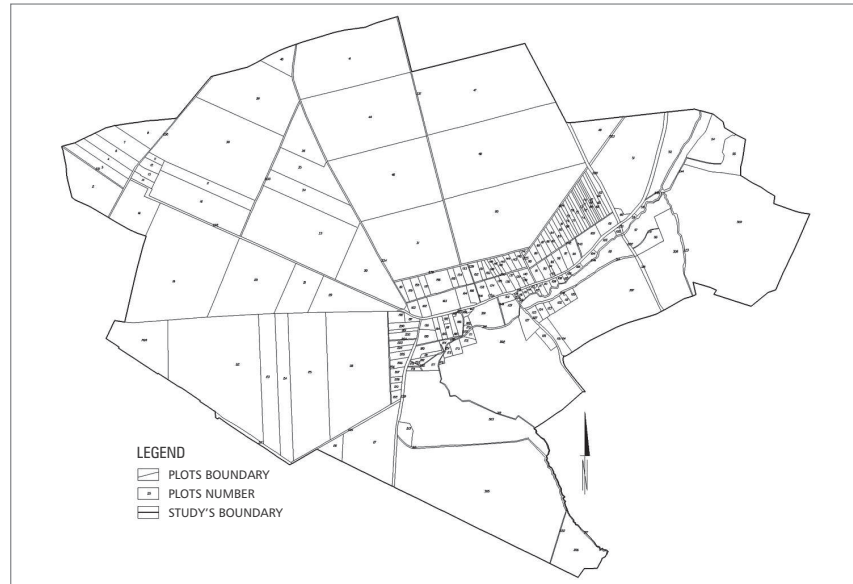
The kind of map	State by year	The plots quantity	The average plot size [ha]	Percentage changes indicator in the plots quantity		
				1948–1964	1964–2011	1948–2011
Map based on a regulatory surveys	1948	322	2.62	+46.9	+44.2	+111.8
Cadastral map	1964	473	1.78			
Cadastral map	2011	682	1.23			

Source: authors' study

The largest increase in the plots quantity (151 plots) was found in the years of 1948–1964, this represents 46.9% of the original quantity of plots. A smaller increase in the plots quantity (109 plots) was noticed in the years 1964–2011. However, this occurred in period almost 5 times longer (47 years). Due to this, it was followed by a systematic decrease in the average plot size (from 2.62 ha in 1948 to 1.23 ha in 2011). With time the new plots were not only reduce their surface but were very adversely extended. In the most current plots, the extension indicator exceeds the optimal value (1 : 5), and whereas a standard plot can contain two different cultivated fields, this indicator disproportionately deteriorates. The result of these adverse changes in plots extension is not elongated but crosswise division in order to reduce the extension of plots. We can observe the tendency of increasing the quantity of plots which is associated with getting their smaller areas. Largely, it is connected with dual inheritance.

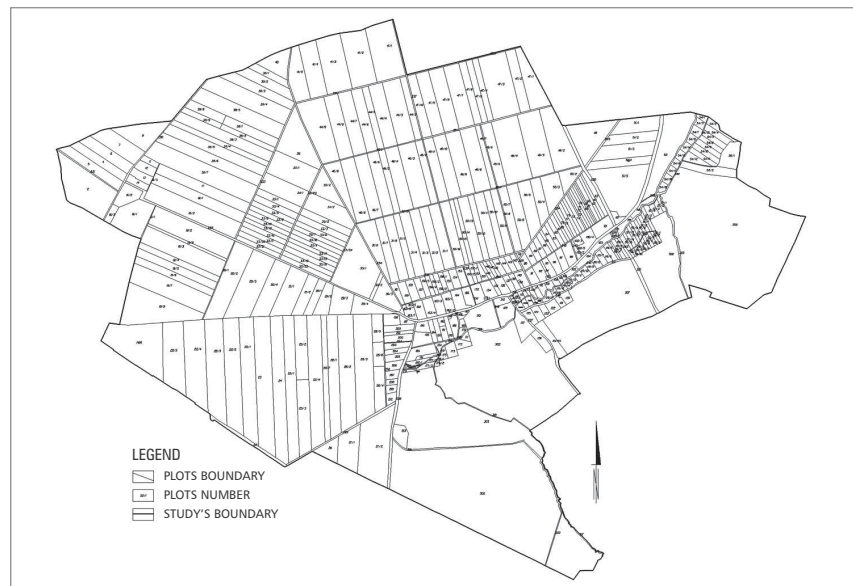
Moreover, analyzed village, which is the seat of the municipality, is equipped with fairly good services this constitute the workplace. It is the main location of people who have a small land areas which do not constitute farms.

In connection with the small widths of the country road network system and their unpaved surface, this makes difficult the mechanization of field work, large plots fragmentation and their small widths. The analyzed village took up an implementation of comprehensive land consolidation with an expected completion in 2013. Land consolidation will eliminate the fragmentation of holdings and allows the correct road access to designed new plots.



Source: authors' study

Fig. 4. Spatial arrangement in land layouts given to the first settlers in 1948



Source: authors' study

Fig. 5. Spatial arrangement in land layouts based on cadastral map of 1964



Source: authors' study

Fig. 6. Spatial arrangement in land layouts based on cadastral map of 2011



Source: authors' study

Fig. 7. The comparison of changes in land layouts arrangement

7. Conclusions

As presented in this paper, the development of land layout boundaries and arable lands (this is based on cartographic data originating in the maps from the various periods of time) is necessary information for rural areas spatial order planning. The cartographic presentation of land layout boundaries development based on existing maps is particularly important. The analyses of land layout spatial metamorphosis and changing land use were possible because of computer tool developments which were needed to unify the spatial reference system. The unified spatial reference system allowed for computer comparisons and digital analysis.

Studies have shown, that during the last 70 years in the analyzed village, more than half of the arable land was transformed on to grassland. In the analyzed period, the number of plots increased by 112%, and their average size has been reduced by more than a half. It has become necessary to implement land consolidation which is now in the final stage.

The spatial metamorphosis of land layouts and land use have yielded variety of directions and size changes. This not only has cognitive but also practical significance. Descriptions of rural areas metamorphosis will prevent or eliminate observed defectiveness in agricultural and forestry production space.

References

- Dekret z dnia 6 września 1946 r.** o ustroju rolnym i osadnictwie na obszarze Ziemi Odzyskanych i byłego Wolnego Miasta Gdańska (Dz.U. Nr 49, poz. 279 z późn. zm.).
- Fedorowski W., Frelek M., Nowosielski E.** 1970. Geodezja Rolna. Państwowe Przedsiębiorstwo Wydawnictw Kartograficznych, Warszawa.
- Hopper A.** 1987. Zasady prowadzenia oceny terenu na potrzeby jego urządzania. Nowe tendencje w teorii i praktyce urządzania obszarów wiejskich, ser. Geodezja i Urządzenia Rolne. ART, Olsztyn.
- Lenczowski F.** 1957. Materiały do dziejów miasta Żywca od XV do XVIII wieku. Kraków.
- Koncent-Zieliński E.** 1907. Jak usuwać szachownicę i przeprowadzać kolonizację gruntów. Warszawa.
- Noga K.** 1977. Analiza międzywioskowej szachownicy gruntów na przykładzie wsi położonych w górnym dorzeczu Soły. Zesz. Nauk, AR w Krakowie.
- Noga K.** 1979. Badanie zależności struktury przestrzennej użytków gruntowych w terenach górskich od wybranych czynników. Część I. Analiza występujących zależności między strukturą użytków gruntowych a przyjętymi cechami. Część II. Charakterystyka przyjętych czynników i sposobów określenia ich wpływu na strukturę użytków gruntowych. Zesz. Nauk. AR w Krakowie, ser. Geodezja, 6.
- Noga K.** 1988. Zmiany w strukturze użytków gruntowych w beskidzkiej zlewni Soły w ostatnim osiemdziesięcioleciu. Zesz. Nauk. AR w Krakowie, 21.
- Noga K., Schilbach J.** 1990. Opracowanie metodyki kompleksowego urządzania obszarów wiejskich w warunkach wsi karpaccich. Syntetyczne opracowanie pięcioletniego okresu badań.
- Noga K.** 1993. Przeobrażenie krajobrazu wsi górskich. Zesz. Nauk. AR w Krakowie, 39.
- Podkański K.** 1906. Studia nad średniowieczem Polski. Rozmieszczenie osad na obszarze małopolski. Spraw. AU w Krakowie.

Rabczuk I. 1968. Problem różniczan w pow. proszowickim, woj. krakowskie.

Solecki A. 1977. Osadnictwo na Podhalu. Geneza i rozwój ukształtowania przestrzennego. Zesz. Nauk. AR w Krakowie, 56.

Wolski J. 2000. Austriacki kataster podatku gruntowego na ziemiach polskich oraz jego wykorzystanie w pracach urzędzeniowych i badaniach naukowych. Pol. Prz. Kartogr., 3.

Prof. dr hab. inż. Karol Noga
Uniwersytet Rolniczy w Krakowie
Katedra Geodezji Rolnej, Katastru i Fotogrametrii
30–198 Kraków, ul. Balicka 253 a
e-mail: rmknoga@cyf-kr.edu.pl

Dr inż. Jarosław Taszakowski
Uniwersytet Rolniczy w Krakowie
Katedra Geodezji Rolnej, Katastru i Fotogrametrii
30–198 Kraków, ul. Balicka 253 a
e-mail: j.taszakowski@ur.krakow.pl