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The Patchwork of Land as a Problem Restricting the Development of Rural Areas

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Abstract

The patchwork of land is one of the main factors negatively affecting agricultural production. Lands located in the external patchwork can be fully used for agricultural production, but the production costs are higher, and the income from the farm is smaller. The spatial layout of individual land in villages has undergone continuous changes over the centuries, which has led to their defectiveness through the occurrence of fragmentation and scattering of plots, the lack of access or large distances from the farm house. The article presents a detailed study of the spatial layout of the individual land in 29 villages of the commune of Cyców, located in Łęczyński County, Lubelskie Voivodship. The subject of the research was the fragmentation of plots of individual owners, land layout, and scattering of cadastral plots. In this work the index of the external border shape for the analyzed village was also calculated. Regarding the fact that the shape of the village is one of the most difficult properties to measure in the research, the index of shape for each village was calculated by the use of the coefficient of the expansion of borders assuming a square as a model figure. Circumference of the actual village and its area were used for calculations. The sizes of land of local and external non-resident owners of the commune of Cyców were also presented in terms of area and number of plots and the number of owners.

Keywords: land consolidation, patchwork of land, the shape of villages

Introduction

Polish rural areas occupy more than 93% of our country. About 3 million hectares of arable land in our country are situated in the patchwork of land. This is not favorable for the development of agricultural production and the life of rural residents. Since the accession of our country to the European Union the promotion of multi-functional and sustainable rural development has been observed (Sobolewska-Mikulska 2015). Actions that will ensure the development of agriculture, rural areas and environmental protection should be undertaken. These effects should be achieved by performing complex works of consolidation and exchange of land.

The current state of the spatial structure of land is the result of centuries of human activity remaining in close connection with the socio-economic activities of rural residents. The spatial layout of land formed in the historical process in rural areas in southern and south-east Poland has a relatively large defect. Here we can distinguish a large number of plots in the farm, excessive fragmentation, lack of access, unfavorable layout of farms land, irregular shapes or scattering of plots in space (patchwork). In the literature, quite often the statement can be found that the land patchwork adversely affects the organization and level of agricultural production (Dudzińska 2012; Król 2014; Król and Leń 2016; Leń 2009, 2012; Leń and Mika 2016a; Noga 1977, 2001; Noga and Schilbach 1998). The concept of land patchwork was first defined by Kocent-Zielinski (1907). He stated that patchwork is such a layout of land belonging to one village, in which properties of individual owners are not in one joint piece near the farmhouse, but they are fragmented into a large

number of plots, mostly narrow and long, scattered over a large area and separated by plots of other owners. We can distinguish two types of individual land patchwork. Internal patchwork of a village exists when the plots of an individual owner are located in the area of the village in which he lives. The second type is a patchwork between villages, in other words, external, existing when the owner has his own plots outside the village in which he lives. Both the occurrence of the internal and external patchworks adversely affect the development and organization of agricultural production. The concept of the patchwork of land is closely linked to the concept of "non-resident owners" introduced by Rabczuk (1968), which was later clarified by Noga (1977). Non-resident owners are divided into local — that is, the owners who have their land outside the studied village being their place of residence — and external non-resident owners, the owners who have their land in the studied village, and live in other localities. Elimination of internal and external patchwork is the main objective of the comprehensive work of consolidation and exchange of land. This goal stems not only from the improvement of the life and work of farmers but also of environmental protection and preservation of tradition and cultural heritage. It is a comprehensive work to implement a harmonized set of objectives in terms of general public, individual, spatial, environmental and economic good (Leń and Mika 2016b).

Currently, it is advisable to take steps to allow the liquidation of both internal and external patchworks. One of the main procedures of arrangement-agricultural works that enables such actions is the process of consolidation and exchange of land. Rural areas in Poland need deep structural changes related to agricultural production, the size of farms, shaping their land layouts, demographic, spatial and institutional structures (Sobolewska-Mikulska 2009). Consolidation and exchange of land affects not only the improvement of living and working conditions of the farmer but also contributes to the improvement of the environmental quality and cultural values of the village. The arrangement-agricultural works can play an important role in protecting the environment and landscape, development of rural areas and agriculture, and the preservation of traditions and cultural heritage. Both the economic and environmental effects of the arrangement-agricultural works are indisputable.

The aim of this paper thus is to present the impact of the patchwork of land on the development and functioning of agricultural production and an attempt to identify a solution to this problem. The scope of work includes the characteristics of the external patchwork of land in 29 villages of the Cyców Commune based on a database from the register of land and buildings. In this paper a patchwork table method has been used.

1 General characteristics of the studied commune

The study was conducted for 29 villages of the Cyców commune located in the eastern part of the Łęczyński County, Lubelskie Voivodship. This commune lies on the Łęczyńsko-Włodawska plain, along the national road Lublin-Włodawa. The commune consists of 29 precincts (fig. 1 and 2) of the total area 14 800,7991 ha which represents 23,3% area of the Łęczyński County. The Cyców Commune is divided into 12 739 plots 81,8% of which are parcels of individual owners.[1] Fragmentation of individual land understood as the average size of the plot in the commune is relatively small compared to other communes of the Łęczyński County. A major problem is the high percentage of land of local and external non-resident owners in some precincts of the commune. Cyców Commune is the largest commune of the Łęczyński County. Until recently, the commune was part of the former Chełmskie Voivodship.

2 Analysis of the fragmentation of land in the Cyców Commune

Analysis of land fragmentation in the studied commune was carried out for the parcels belonging only to the individual owners. Tests were conducted at 8 size ranges because the average plot

1. [In the journal European practice of number notation is followed — for example, 36 333,33 (European style) = 36 333.33 (Canadian style) = 36,333.33 (US and British style). — Ed.]

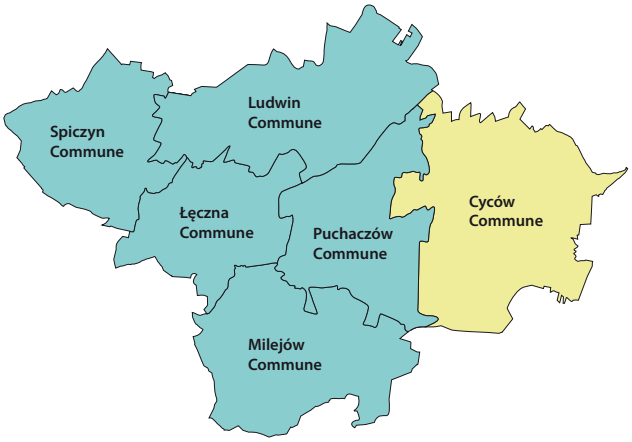

Fig. 1. The spatial arrangement of the communes in the Łęczna County

Fig. 2. The spatial arrangement of the villages in the Cyców Commune

size does not reflect their proper fragmentation in the village. The data in Table 1 illustrate the structure of the fragmentation of plots belonging to individual owners. According to the data in Table 1, individual owners in the Cyców Commune own 12 314,6994 ha area divided into 10 362 cadastral plots with an average area of 1,19 ha. In the first separated range—less than 0,10 ha individual owners have only 979 plots of land which represents 9,4% of the total number and it is mostly building plots. The area occupied by the plots is 58,5865 ha. The average land area in this range is 0,06 ha. A much larger number of plots is observed in the range from 0,11 to 0,30 ha. There are 2 023 parcels, which represents 19,5% of their total number. This fact testifies to the high fragmentation of plots, which already for sale and purchase or inheritance cannot be divided. Another fairly large range in terms of number of plots consists of plots with area from 0,31 to 0,60 ha. Individual owners in this range have 1 190 plots of land, which represent 11,5% of their total number. These plots could not be divided, only larger neighboring plots to 0,30 ha. may be divided. From this range surface, the percentage of the number of plots shows a downward trend from 11,5% to 5,3% in range 1,51–1,80 ha. Only the number of parcels in excess of 1,81 ha has a similar percentage (20,1%) to the small plots up to 0,30 ha. A detailed study of fragmentation in the villages of the Cyców Commune showed that the fragmentation of plots is adequate to the existing systems of land in the villages (Król and Leń 2016).

Compared to other communes in Łęczna County, the Cyców Commune does not show so much fragmentation. The average land area in the studied commune is 1,19 ha, while in the county is 0,65 ha. As can be seen, the average land area in the Cyców Commune is twice as big as the average area of the plot in the county. It can be stated that the fragmentation of land in the commune

Tab. 1. Analysis of the fragmentation of the parcels of individual owners in the accepted size ranges

Size ranges (ha)	Number of plots	Percentage of plots	Area of the plots (ha)	Percentage of plots area	Average plot area (ha)
< 0,11	979	9,4	58,5865	0,5	0,06
0,11–0,30	2 023	19,5	434,0197	3,5	0,21
0,31–0,60	1 905	18,4	847,8815	6,9	0,45
0,61–0,90	1 190	11,5	891,5467	7,2	0,75
0,91–1,20	988	9,5	1 032,5029	8,4	1,05
1,21–1,50	647	6,2	872,3842	7,1	1,35
1,51–1,80	546	5,3	898,3649	7,3	1,65
> 1,80	2 084	20,1	7 279,4130	59,1	3,49
Total	10 362	100,0	12 314,6994	100,0	1,19

Source: Own study based on data from the register of land and buildings

is not nearly as big a problem as the fragmentation of land in the county. Detailed study conducted in 29 villages of the Cyców Commune of the cadastre plots fragmentation revealed that individual land fragmentation understood as the average size of the plot in the commune is relatively small compared to other communes in the Łęczna County (Król and Leń 2016).

3 The study of the patchwork of land

Although fragmentation of the plots of individual owners in the studied commune is not very large, another serious problem has been discovered. Detailed research has shown large faults in the occurrence of the internal and external patchworks. A major problem occurring in the studied commune is a high percentage of land belonging to non-resident owners local and external. Studies of the scattering of individual land parcels were carried out based on patchwork tables including: overall area, the number of plots and their location in the area of the commune, and the number of owners. In this range these values were analyzed for the residents of the village who have land outside their place of residence — local non-resident owners and the owners who do not live in the village, but have here their land — external non-resident owners. The size of land of external non-resident owners in the Cyców Commune is presented in table 2.

As results from data in table 2 the land of external non-resident owners in the commune includes 4 774 plots which represents 46,1% of the plots of individual owners of the commune. The area of land owned by people living outside the analyzed commune is 5 370,6095 hectares, accounting for 43,6% of the studied commune area. The total number of external non-resident owners of land in the Cyców Commune is 2 671 people. Detailed research has shown that more than 40% of the number of plots and the total land area of individual owners is owned by external non-resident owners, which confirms the fact of the existence of the external patchwork in the area.

In the commune, apart from external non-resident owners, also local non-resident owners have their plots. The size of land of local non-resident owners is presented in table 3. The analysis of local non-resident owners in the Cyców Commune was carried out. As indicated by the data in table 3 local non-resident owners living in the Cyców commune possess within its borders 2 157 plots, representing 20,8% of the total number. The area of land own by local non-resident owners amounts to 2 575,4715 hectares, representing 20,9% of the analyzed commune. The number of local non-resident owners in the Cyców Commune is equal to 1 205.

The size of land owned by non-resident owners is the result of inheritance, land turnover or associate marriage. Apart from the land owned by non-resident owners in the area there is also real estate outside the study area (e.g., from major cities). Emigration of residents from the analyzed villages spread throughout the whole country and even abroad. It was noted that a fairly large number of external non-resident owners comes from Lublin, a voivodship capital. Residents of the city own land in every village of the presented commune. Non-resident owners living in the cities left the village in search of better jobs or are heirs of their parents. Another possibility is that

Tab. 2. The size of land of external non-resident owners in the Cyców Commune

	n	%
Area of comunne of Cyców	14 800,7991	–
Area of land belonging to individual owners	12 314,6994	83,2
Area of land belonging to external	5 370,6095	43,6
Number of plots belonging to individual owners	10 362	–
Number of plots belonging to external	4 774	46,1
Number of external	2 671	25,8
Number of villages with plots belonging to external	65	–

Source: Own study based on data from the register of land and buildings

Tab. 3. The size of land of local non-resident owners in the Cyców Commune

	n	%
Area of comunne of Cyców	14 800,7991	–
Area of land belonging to individual owners	12 314,6994	83,2
Area of land belonging to external	2 575,4715	20,9
Number of plots belonging to individual owners	10 362	–
Number of plots belonging to local non-resident owners[a]	2 157	20,8
Number of local non-resident owners	1 205	11,6
Number of villages with plots belonging to local non-resident owners[a]	65	

Source: Own study based on data from the register of land and buildings
[a]only from Cyców Commune

these people own building or recreational plots. A characteristic, regular feature of lands owned by non-resident owners is their concentration around the main village where the municipality office or the church can be found, which proves the existence of cultural and religious ties. It is possible that in the past young people who met in the commune village after marriage also settled there. A large area of land remaining in the hands of external non-resident owners coming from outside of the Łęczna County suggests that the land they possess is not used at all or is leased informally to the residents of these villages.

Detailed studies have confirmed the existence of the external and internal patchwork. It is now necessary to take appropriate measures to eliminate faulty patchworks, which will contribute to the improvement and development of agricultural production and the living and working conditions of farmers. A possible solution to this problem is the exchange of land between local and external non-resident owners. Such a solution may cause changes in the shape of the village depending on the number of parcels to be exchanged.

4 Submission of land exchanged owned in the external patchwork.

The occurrence of defective external patchwork of individually-owned land can be liquidated only in the exchange process, due to the difficulty of covering the entire area of land consolidation in the commune. Therefore, it is proposed to replace the observed defective external patchwork of land in theoretical terms, justified by practical considerations, captured in data table 3. As seen in table 4, the essential element of space in the proposed exchange is the shape of the village. The form determines the spatial distribution of plots in the village that are excessively elongated, misshapen, with no road access. The analyzed border index of each village is based on the method (Kostrubiec 1972), because lands in the commune of the study are diversified along with misshapen boundaries.

The shape of the village according to Kostrubiec (1972) results from the generalization obtained by the perpendicular projection of habitat on the plane. As a result, the area of a polygon that is any flat and finished figure is obtained. Every village creates a figure limited and closed. Its edge or contour is a closed curve or consists of several such curves.

Tab. 4. Proposal to exchange land approximating the land owner to habitat

Name of the village	Area	Index of the shape of the village	Increase of area of land belonging to local non-resident owners[a]		Reduction of area of land belonging to external[b]		The area of the village after changes	Changes in area of villages	
			ha	%	ha	%	ha	ha	%
Zosin	77,1300	17,68	3,6100	4,7	19,7800	25,6	60,9600	−16,1700	−21,0
Malinówka	665,2254	22,34	23,6221	3,6	81,6204	12,3	607,2271	−57,9983	−8,7
Stary Stręczyn	234,4802	22,18	12,1200	5,2	88,5715	37,8	158,0287	−76,4515	−32,6
Stefanów	508,1401	21,79	15,9240	3,1	61,9562	12,2	462,1079	−46,0322	−9,1
Cyców Kolonia Druga	472,5415	22,23	79,3822	16,8	145,7276	30,8	406,1961	−66,3454	−14,0
Garbatówka Kolonia	541,2135	22,49	18,0244	3,3	132,4567	24,5	426,7812	−114,4323	−21,1
Janowica	375,7238	24,53	45,1558	12,0	68,6800	18,3	352,1996	−23,5242	−6,3
Głębokie	463,8498	26,52	96,3648	20,8	77,0686	16,6	483,1460	19,2962	4,2
Szczupak	274,9077	27,61	58,8829	21,4	77,6478	28,2	256,1428	−18,7649	−6,8
Zaróbka	248,4389	26,72	30,0505	12,1	12,0185	4,8	266,4709	18,0320	7,3
Bekiesza	645,6028	29,40	125,7561	19,5	58,4428	9,1	712,9161	67,3133	10,4
Stawek	508,9243	28,84	45,0560	8,9	93,4157	18,4	460,5646	−48,3597	−9,5
Barki	525,4488	33,06	76,7422	14,6	71,3568	13,6	530,8342	5,3854	1,0
Cyców	926,0887	32,81	876,4215	94,6	129,3752	14,0	1 673,1350	747,0463	80,7
Kopina	685,4617	33,12	64,8615	9,5	139,5199	20,4	610,8033	−74,6584	−10,9
Nowy Stręczyn	971,1287	34,14	63,1810	6,5	272,1766	28,0	762,1331	−208,9956	−21,5
Ludwinów	646,7093	35,13	33,0671	5,1	97,1015	15,0	582,6749	−64,0344	−9,9
Adamów	339,9643	35,33	50,0278	14,7	51,0747	15,0	338,9174	−1,0469	−0,3
Ostrówek Podyski	462,5682	35,52	53,2075	11,5	50,8815	11,0	464,8942	2,3260	0,5
Świerszczów	1 577,1502	37,71	134,9571	8,6	277,0757	17,6	1 435,0316	−142,1186	−9,0
Wólka Nadrybska	467,7277	38,41	5,3352	1,1	17,9192	3,8	455,1437	−12,5840	−2,7
Wólka Cycowska	628,9526	40,70	193,5312	30,8	112,7483	17,9	709,7355	80,7829	12,8
Zagórze	609,0922	39,95	57,6461	9,5	107,4192	17,6	559,3191	−49,7731	−8,2
Garbatówka	294,8873	42,87	98,2733	33,3	37,1200	12,6	356,0406	61,1533	20,7
Świerszczów Kolonia	360,9591	44,48	108,3324	30,0	106,4318	29,5	362,8597	1,9006	0,5
Małków	538,1500	48,47	31,3531	5,8	59,7800	11,1	509,7231	−28,4269	−5,3
Podgłębokie	416,8835	54,86	138,2032	33,2	75,1824	18,0	479,9043	63,0208	15,1
Sewerynów	198,5444	54,72	1,6961	0,9	16,3024	8,2	183,9381	−14,6063	−7,4
Biesiadki	134,9044	57,35	34,6864	25,7	36,6205	27,1	132,9703	−1,9341	−1,4

[a]only from Cyców Commune; [b]without residents from cities

In medieval times, when the village was formed in a region where there were no natural boundaries, the area of the village took the shape of a circle. With the development of settlement — circle segments. At the time of the sixteenth century established villages usually took the form of a rectangle. It took a shape from a very elongated to a square one. This shape is considered the most optimal. It could be obtained in the newly established villages or those that were not in the strict arrangement with existing villages (Oliskiewicz-Krzywicka 2012).

In the detailed study the village shape index was calculated. It is important for the exchange of land eliminating the external patchwork. Due to the fact that the shape of the village is one of the most difficult features to measure, in the studies the index of the shape for each village was calculated by applying a coefficient of development of borders by taking the square as a reference figure. An actual circuit of the village and its surface were used for calculations. The index of the shape of the village was calculated using the formula developed by Kostrubiec (1972). It determines the ratio of development of a village's borders assuming a square as a model figure. The index of the shape of the village was calculated, as the ratio of circumference of the actual village raised to the second power and the area of the village. For the square it is equal to 16. The index of the shape was calculated for all the villages in the commune. The results of calculations are shown in table 4. According to the data presented in the table different villages of the Cyców Commune have different shapes. The higher the index of the shape of the village and the ratio of developing of borders the more shapeless the village is. The most optimal shape was noted for the village Zosin. It is also the smallest village in the analyzed commune. An interesting fact is that 86,9% of the land in this village is in the possession of external non-resident owners. People living outside Zosin have 223 cadastral plots in it, which is 84,8% of the total number. Another village with optimal shape is Malinówka.

An attempt to tie the defective shape of the village with a high percentage of non-resident land owners proved ineffective. This does not, however, reject the arrangement-agriculture works as a solution to the above problem. On the contrary, in the studied commune the patchwork of land owned by farmers should be liquidated in the first stage. This should be done through the exchange of land between external non-resident owners and villagers. The result will be bringing closer land outside the place of residence of a farmer to habitat. Proposal of such an operation is presented in table 4. Exchange of land of non-resident owners has been proposed for expenditure of the village surface area. Concurrently land of external non-resident owners has reduced the area of villages. Land of non-resident owners from the cities are not going to be changed. This exchange could lead to change and improvement of the shape of the village. The next step should be to carry out land consolidation. The problem is the presence of land belonging to the external non-resident owners from towns, because if they own developed land or small building plots it may happen that they do not want the replacement or payment for their land. In this case, the land is left in their possession.

The layout of land was presented in figure 3 in the Malinówka village where the external non-resident owners have 320,8961 hectares, which is 53,1% of the total land area of individual owners. One of the worst shapes in the studied commune was noted in the Małków village presented in figure 6. The apparent fault here is the very irregular shape of external borders. In the studied village external non-resident owners have 130 parcels, which represents 42,2% and the surface area equal to 194,5000 ha, representing 41,3% of the total individual land area. In the last place in terms of the shape there is the Biesiadki village. The land of external non-resident owners occupies here the surface of 55,1405 hectares, which constitutes 45,3% of the individual land area. The number of plots owned by people living outside the studied village is 63, which represents 48,8% of the total number of individual owners' plots.

Figures 3 to 6 show various shapes of the villages. Figure 3 presents the Malinówka village shaped almost rectangularly (the most close to optimal), with plot patchwork in strip type and street type compact development. Figure 4 shows the Głębokie village with ladder-strip land patchwork and the shape of a polygon. Figure 5 shows the Kopina village, ladder type patchwork, polygonal shape, street type compact build-up. Figure 6 shows the of Malkow village characterized by faulty shape, irregular-ladder type land patchwork, street type compact build-up.

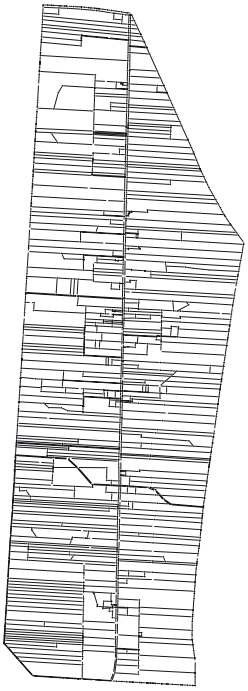

Fig. 3. Malinówka village—strip type land layout

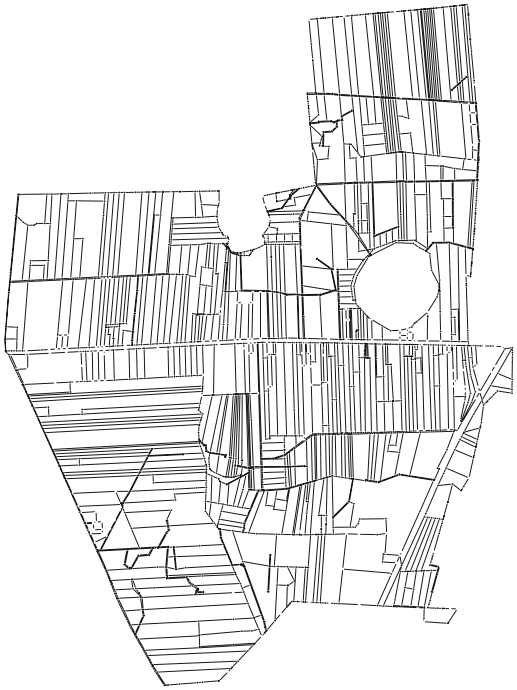

Fig. 4. Głębokie village—ladder-strip land layout

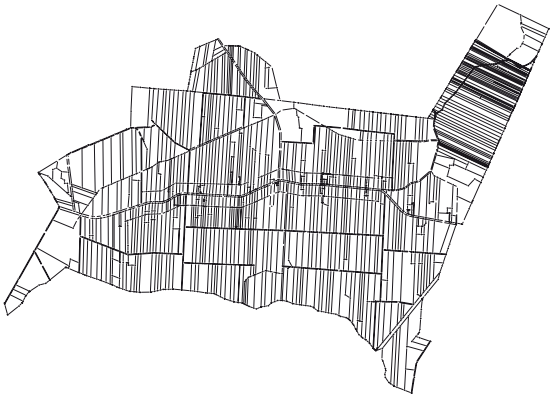

Fig. 5. Kopina village—ladder type land layout

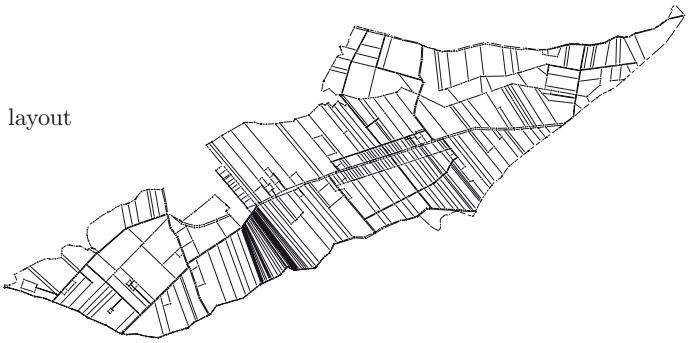

Fig. 6. Małków village—irregular-ladder type land layout

Conclusions

The general study of patchwork of land in the Cyców Commune and detailed study about bringing closer of land outside the place of residence of a farmer to habitat, raise the following observations and conclusions. In order to properly realize land consolidation in areas with such a large external patchwork like that occurring in the villages of the Cyców Commune, you must first exchange land, which could bring closer land outside the place of residence of a farmer to habitat and cause change of the existing village borders. As a result of the exchange of land misshapen village borders may be corrected, in such a way that it could be possible to design new roads, allowing the design of plots during land consolidation. This exchange will make the borders of the village adjust so it can be properly formed in the process of land consolidation. The specified sequence of work will

significantly bring plots closer to the habitat of land owners in the village. The only land which at the moment cannot be brought closer is that owned by urban residents. This fact requires a more detailed analysis and research, and solution. The given proposals for exchange of land before consolidation, although theoretical but mounted on concrete data, requires further study, so it is possible fine-tune the entire exchange and implementation of the land consolidation. Detailed studies in this area are carried out in Łęczyński County.

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