

Issues related to creation of borders of the agricultural production space in land consolidation processes in Poland with consideration of soil, water and agricultural landscape protection

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Abstract

The idea of rural area development in the European Union has been implemented according to sustainable development rules. This approach is also valid with regard to Polish rural areas, in particular when the arrangement of borders of the agricultural production space is considered. Changes in density and sizes of farms in Poland exposed and intensified the situation when agricultural production resources are not utilised, as well as degradation of the natural environment. From the perspective of the agricultural policy, it has been estimated that in Poland the process of land concentration should be combined with the process of reduction in the number of farms. This process was carried out under Polish conditions in the form of surveying works — in particular, as land consolidation operations. The necessity to follow the sustainable development rules proved that land consolidation works cover a very narrow scope of conventional solutions. This process should not ignore ecological and environmental aspects, as well as other aspects related to spatial arrangement and landscape. This paper will discuss solutions of conventional land consolidation works carried out in Poland, their scopes and estimation of demands. The land consolidation process is most important in the transformation of the agricultural production space, where the basic objective is to improve the farm organisational space with consideration of environmental protection and landscape arrangements. This paper will also present and characterise the possibilities of solutions in the field of soil, water and agricultural landscape protection from the perspective of land consolidation works carried out in Poland.

Keywords: Land consolidation, agricultural production space, borders.

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1. Introduction

According to the Organisation for Economic Cooperation and Development index, rural areas in Poland occupy 91.7% of the entire country [Główny Urząd Statystyczny (GUS), 2014]. They are highly diversified in terms of the level of agricultural development. The forests areas, which are included in rural areas, occupy 30.9% [Główny Urząd Statystyczny (GUS), 2013a, Agriculture]. The remaining areas – about 60% of Poland – are covered by agricultural production [Główny Urząd Statystyczny (GUS), 2013a, Agriculture]. In Poland, 1,391,000 individual farms exist [Główny Urząd Statystyczny (GUS), 2013a, Agriculture], equalling 99.7% of all farms. According to the assumptions of the state policy related to rural areas, this number should be reduced to 900,000 individual farms. This process should be combined with intensive land consolidation works that will improve the spatial structure of farms; it should be implemented with consideration of sustainable development rules, which was implemented by document Agenda 21 (Agenda 21).

The history of land consolidation works, as surveying operations carried out in rural areas in Poland, has very long traditions. Three periods of land consolidation works, carried out after the Second World War, are mentioned as follows:

1. The after war period, until 1968, when land consolidation works started before the war and were completed. Operations of surveying services were focused on improving the farming conditions for the needs of Agricultural Production Cooperatives.
2. The period 1968–1981, when the basic objective of land consolidation works was to concentrate state and cooperative arable lands; on this occasion, the spatial structure of individual farms was also improved.
3. The period since 1982 till present. Resolution of the act on land consolidation and exchange of 1982 have been in force. Although this act modernised the criteria of implementation of land consolidation works, it still has been focused on improving the spatial structure of individual farms, on rational farm expanse in those farms and on adaptation of borders to water melioration systems, roads and the terrain relief. Thus, although many corrections, this act does not allow for the full implementation of sustainable development rules in Polish rural areas.

Recently, after the Polish accession to the European Union in 2006, the scope of land consolidation works has been systematically widened, aiming at the complex social and economic development of rural areas. Besides issues related to the agricultural production, it also considers forest production and recreational functions and all possible and justifiable ways of land use, with consideration of environmental protection and landscape arrangement rules (Figure 1). The development of rural areas assumes the development of values resulting from those functions of rural areas, which are related to cultural, folklore and landscape identity (Mostefai, Miloud & Miloudi, 2019).



Figure 1. Examples of landscape of rural areas in Poland. Source: the author's original photograph.

2. Methods

The research method aims to investigate the scope of design solutions adopted in land consolidation projects. For this study, 16 land consolidation objects were selected, which are located in the southeastern part of Poland, where the highest demands for implementation of land consolidation works occur (Figure 2). This research is based on cadastral data and land consolidation project maps. This study aims to analyse design solutions adopted in land consolidation projects in Poland, in particular design solutions related to water, soil and landscape protection in rural areas.

3. Findings and results

3.1. The scope and objective of land consolidation works in Poland – test sites research

The accession of Poland to the European Union structure resulted in the commencement of a wide process of restructuring rural areas; this was mainly connected with the intensification of land consolidation works. One of the parameters which points to the necessity to carry out land consolidation works and assess their efficiency is the, so-called, 'farm expanse'. Publications which discuss land consolidation works mention the following features of farm expanse (Moszczenski, 1927; Woch, 2001):

- Size of a farm,
- Number of parcels in a farm,
- Acreage of parcels in a farm,
- Distance of parcels from households (the farm economic centre),
- Shape of a parcel.

Statistical data [Główny Urząd Statystyczny (GUS), 2013a, Agriculture] concerning Poland in relation to three parameters mentioned above are as follows:

- The average size of an individual farm equals to 10.22 hectares [Główny Urząd Statystyczny (GUS), 2013b, Characteristics of farms],
- The average number of parcels in an individual farm in Poland equals to 6.78 [Główny Urząd Statystyczny (GUS), 2013b, Characteristics of farms],
- The average acreage of parcels in an individual farm in Poland equals to 0.89 hectares [Główny Urząd Statystyczny (GUS), 2013b, Characteristics of farms].

Analysis of only three parameters mentioned above points out that the intensity of land consolidation works must be considerably increased in order to allow agricultural farms to achieve satisfactory economic results. At presents, demands for implementation of land consolidation works in Poland are diversified in particular municipalities (Figure 2). The highest demands occur in the central, southern and southeastern parts of Poland.

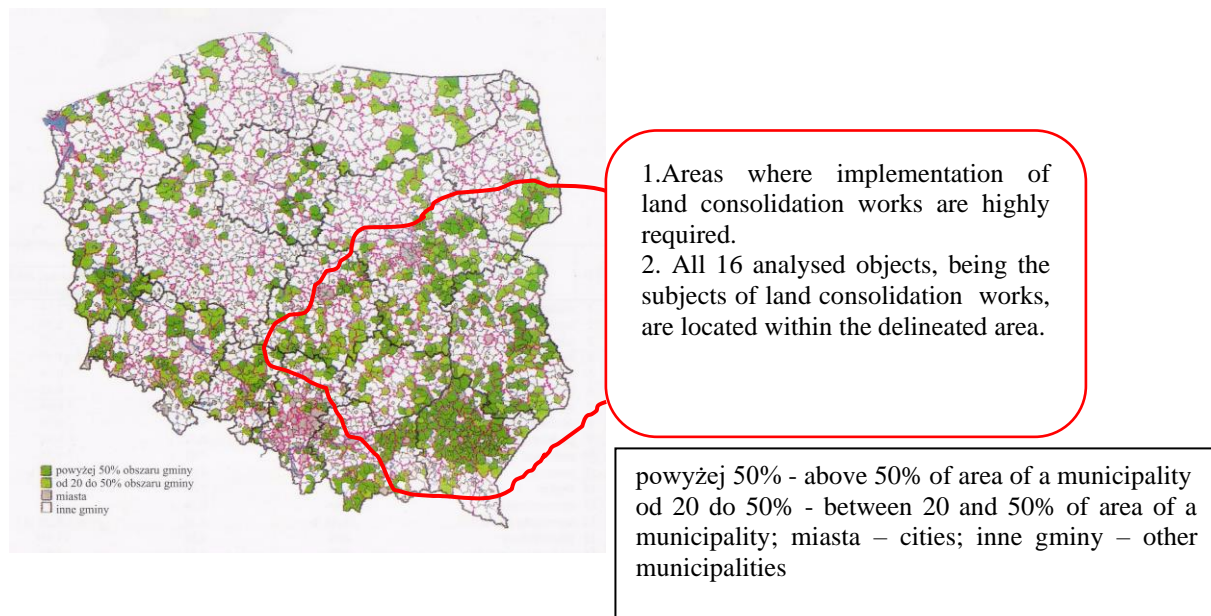


Figure 2. Demands for land consolidation works in Polish municipalities.
Adapted from Ministry of Agriculture and Rural Development (2014).
– the original research work.

The act on land consolidation and exchange of 1982 binding in Poland in its Article 2 states that ‘the objective of land consolidation is to create more advantageous farming conditions through improvements of area structure of farms, rational arrangements of the farm expanse, adaptation of property borders to water melioration installations, roads and the terrain relief.’ In practice, the reason to commence land consolidation works is mainly due to the incorrect farm expanse and the basic result of those works is its improvement – this is presented below. Figures 3 and 4 show the object of land consolidation works of the Latyczyn village before and after completion of this process. Before land consolidation, the characteristics of numerous parcels which belong to one farm (marked in separate colours) may be noted; they are elongated and located far from households. After consolidation, the same farms have lesser parcels of advantageous sizes and shapes.

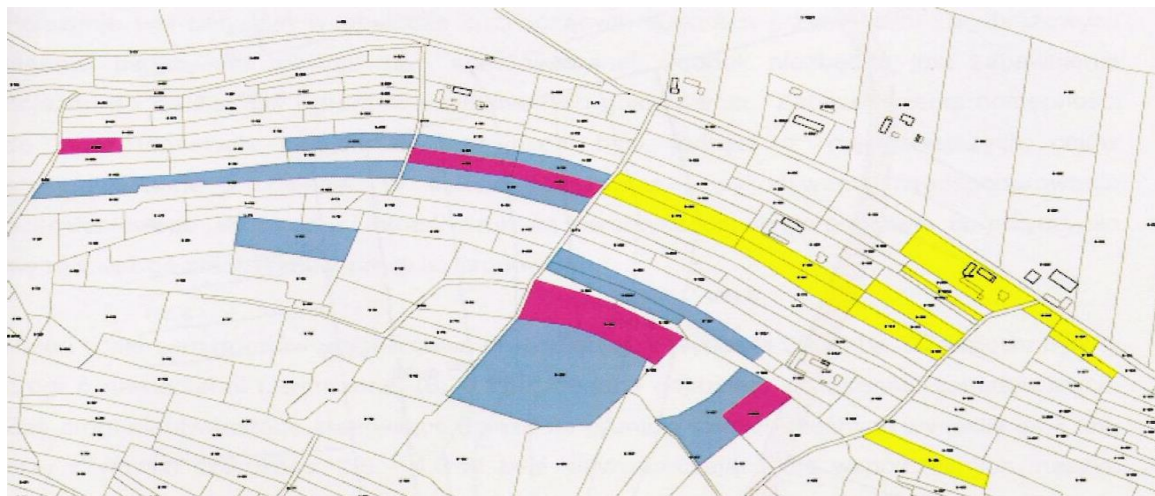


Figure 3. The system of land parcels before consolidation – a fragment of Latyczyn village (no. 2) – the original work. Documentation of the land consolidation project: Latyczyn object.

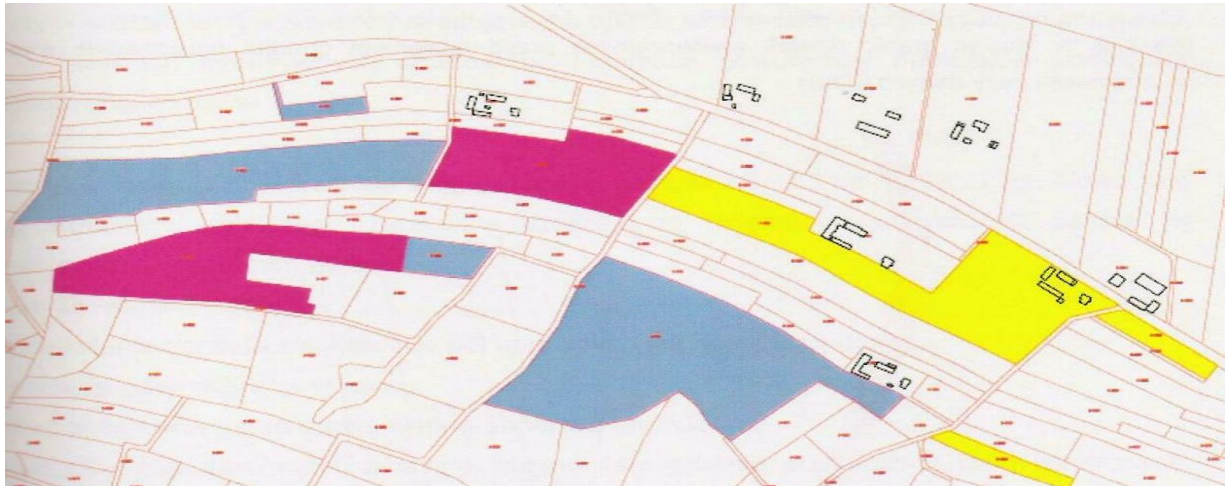


Figure 4. The system of land parcels after consolidation – a fragment of Latyczyn village (no.2) – original work. Documentation of the land consolidation project: Latyczyn object.

The authors have carried out research and analytical works of sites where land consolidation works were carried out with consideration of sustainable development with respect to the following:

- Designing borders of the agricultural and forest production space,
- Creating borders of the agricultural production space considering aspects of protection of soils and waters in rural areas,
- Creating borders of the agricultural production space considering aspects of environmental protection and development of rural landscapes.

All analysed land consolidation projects concerned the areas located in accordance with the need to perform such works, with the highest necessity to perform land consolidation works in order to create satisfactory farming conditions (Figure 2).

The analysis of designing documentation, for both descriptive and graphical visualisation on maps for the discussed areas, points out that the basic reason to commence land consolidation works was fully economic. Participants of land consolidation works – the farmers – expected improvements of agricultural farming conditions through the improvements of all the above parameters which influence farm expanse. The synthetic evaluation of results of land consolidation, in terms of creating borders for the agricultural and forest production space for analysed sites, is presented in Table 1 (Berkin, 2017).

The analysis of land consolidation documentation for aspects presented in Table 1 proves the possible high difficulties of farmers who maintain production in many parcels of disadvantageous shapes and located far from households (Figure 3).

As it turns out from the presented analyses, environmental and landscape incentives were not the reason for any of the analysed objects. Designing solutions always improved farming conditions (economic aspects) and, in some cases, partial solutions appeared, which protected waters and soils. Such solutions include the small retention design – objects 2, 9 and 13 – in the form of designed ‘water features’; land consolidation projects for objects 2, 4, 6, 11 and 16 assumed protection against erosion in the form of buffer zones. For all objects, for which afforestation works were assumed in municipal planning documents, they were transformed as obligatory to land consolidation projects. Also, it should be stressed that biological stabilisation of watercourses, their meandering nature, vegetation on banks and balks between fields, as well as forests, trees and bushes, are biological

structures which mostly create the landscapes of rural areas. Therefore, it is an additional factor for which the above elements should be considered in land consolidation projects.

Table 1. Synthetic list of results of efficiency analysis of land consolidation with respect to the creation of borders of the agricultural and forest production space for investigated sites.

Object No./name	Assessment of improvements of farm expanse parameters				Protection of waters and soils		
	Reduction in the number of parcels in a farm (+/-)	Improvements of parcel shapes (+/-)	Improvements of parcels acreages (+/-)	Reduction in distances from parcels to households (+/-)	Buffer zones, protection against erosion Before consolidation (+/-); After consolidation (+/-)	Water retention, Before consolidation (+/-); After consolidation (+/-)	Forests, trees, bushes Before consolidation (+/-); After consolidation (+/-)
1/Dabrowka	+	+	+	+	-/-	+/-	+/+
2/Latyczyn	+	+	+	+	-/+	+/+	+/-
3/Olchowka	+	+	+	+	-/-	+/-	+/-
4/Klimki	+	+	+	+	-/+	-/-	+/+
5/Wisznice	+	+	+	+	-/-	-/-	+/-
6/Drewniki	+	+	+	+	-/+	+/-	+/+
7/Rydnik	+	+	+	+	-/-	+/-	+/+
8/Piaszczyce	+	+	+	+	+/-	+/-	+/-
9/Seroki	+	+	+	+	-/-	+/+	+/+
10/Nurzec	+	+	+	+	+/-	+/-	+/-
11/Niwkowo	+	+	+	+	-/+	-/-	+/+
12/Tymianka	+	+	+	+	+/-	+/-	+/+
13/Ilowiec	+	+	+	+	+/-	+/+	+/-
14/Palecznica	+	+	+	+	-/-	+/-	+/-
15/Zarzecze	+	+	+	+	+/-	+/-	+/+
16/Grabal	+	+	+	+	-/+	-/-	+/-

Source: Original works based on the surveying documentation of land consolidation projects.

3.2. Issues related to soil and water protection in rural areas

In Poland, surface waters are highly polluted. The basic sources of biogenic agents resulting in water pollution are arable lands. Protection of waters against pollution and disadvantageous changes of bank zones of watercourses and reservoirs should be carried out in the entire river basin, as well as at the level of individual farms. The basic water protecting activities in rural areas include the following:

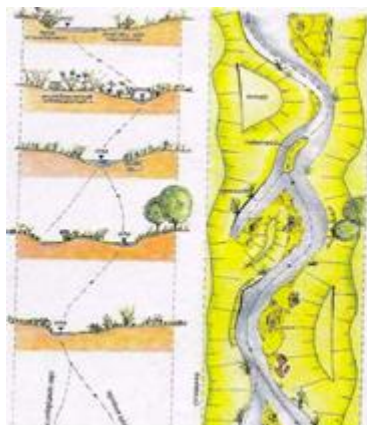
- Prohibition to dispose water pollutants and sewages from agricultural farms to water melioration systems and natural watercourses,
- Creation and maintenance of at least 5-m wide, turfed, free from fertilisers buffer protecting zone along each natural and artificial watercourse and water reservoir,
- Maintenance of vegetation, particular trees and bushes along watercourses and around water reservoirs,
- Limitation of access of livestock from pastures to lakes, rivers and water features, which will result in the maintenance of bank escarpments,
- Creation of conditions for storing natural fertilisers in farms.

Protection of waters cannot be explicitly distinguished from protection of soils in rural areas. Obviously, chemical and biological conditions are different for waters and soils; however, some aspects are the same within the projects of land consolidation works. They include the location plans for the, so-called, 'buffer zones'. For the Polish rural areas, these solutions were based on German solutions, originated mainly from Bavaria. Examples of buffer zones which protect waters and soils against erosion are shown in Figure 5.



Figure 5. Examples of buffer zones between arable fields which protect soils against intense erosion. Source: The authors' original photograph – an example of buffer zones in the form of trees and bushes in areas hazarded by erosion in rural areas in Poland.

A fragment of project, as shown in Figure 6, shows the designing solutions for rural areas covered by land consolidation works, aiming at protection of waters, increase of retention in rural areas and development of artificial anti-flow depressions; this has already been implemented in Germany.



A detailed project of introducing vegetation in particular sections, close to a watercourse, as one of water protection forms – a fragment of the project for an area covered by land consolidation works

Figure 6. Designed depressions for retention of outflow waters in rural areas. Source: A fragment of a project of depressions for water retention in areas covered by land consolidation works. Stappebbach – Germany, Bamberg, 1991.

According to the National Environmental and Agricultural Programme approved for Poland for the period 2007–2013 (National Agricultural-and-Environmental Programme, 2007–2013), which has been implemented, buffer (protection) zones are elongated belts of vegetation developed in order to limit water pollution or to act against erosion, in order to increase biodiversity of arable lands. The width of the zones has been determined as 2.5 or 5 m and the basic objective of their designing is to create a natural border between arable lands and the edge of a ditch, an escarpment, a watercourse and other valuable landscapes and spatial structures. This area should be seeded with species of crops which are specific for natural local conditions. Introduction of buffer zones in the form of turfing is an efficient way of protecting water against pollutants in the agricultural space. Introduction of such solutions is particularly important along water melioration ditches and small rivers, hazarded by landslides caused by grazed animals or as a result of erosion, which results in the silting of streams.

Buffer zones should be designed and introduced in Polish conditions similar to German solutions as buffer zones inside arable fields, in particular when diversified terrain relief occurs, another factor which increases the erosion hazard (Figure 5). In the case of groups of arable fields, the buffer zones should have the form of bulks between fields. The length of an introduced zone should not be smaller than 50 m; they should be localised as borders of fields greater than 20 hectares. Since solutions of land consolidation projects are arranged by the borders of properties, the discussed elements should be considered as pro-ecological solutions.

3.3. Final remarks and conclusion

Considering the above discussions and analyses for solutions included in land consolidation projects implemented in Poland, it may be stated that the idea of sustainable development has not been fully taken into account in any case. Land consolidation is carried out as a form of improvement of the area structure of farms and no possibility to protect waters and soils, which are components of the natural environment. Although the analysis included in the table presents some solutions in this field, these are only partial and temporal solutions. For the need of transformation of Polish rural areas, it is necessary to intensify land consolidation works, and also to consider ecological and environmental aspects, as a method of implementation of the sustainable development of rural areas.

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