

THE POTENTIAL OF NATURAL CONDITIONS IN JUXTAPOSITION WITH LAND CONSOLIDATION – CASE STUDY OF LUBELSKIE VOIVODSHIP (LUBLIN REGION)

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ABSTRACT

In Poland, land consolidation works are mainly carried out in the southern part of the country. In three administrative regions (voivodships): Lubelskie, Podkarpackie and Małopolskie, in the years 2004–2013, a large number of land consolidation projects were carried out compared to the national average, namely, above 20 thousand hectares in each of the regions. In other three regions (Warmińsko-Mazurskie, Zachodniopomorskie, Kujawsko-Pomorskie) there have been no land consolidation projects, although research shows (Jędrejek et al., 2014) that the need for consolidation works is found in all regions. According to Woch and Głazewski (2014), one of the reasons for this is the difficulty in the implementation of land consolidation projects resulting from the need to preserve the valuable natural qualities of the environment in protected areas. The aim of the article is to analyse and assess the natural potential of individual municipalities, as well as to juxtapose the calculated indices against the area size of the already completed land consolidation works. In the article, we attempt to answer the following questions: Is there a relationship between the natural conditions of the municipalities where the consolidation work on agricultural land was carried out, and the area size of the implemented consolidation projects in the studied area? Is the impact of the natural potential of municipalities positive or negative in relation to the on-going land consolidation projects? What are the environmental conditions of the municipalities in which the consolidation of agricultural land was carried out?

The study involved the query of literature on the subject. Analysis and evaluation of natural conditions was made on the basis of research following a spatial-statistical approach. The potential of the natural environment has been analysed in terms of valorisation of the agricultural production space, analysis of the forest cover (afforestation) index, and the index of protected areas. A synthetic assessment of the natural environment potential index was made, and then Pearson's correlation coefficient was calculated between the calculated environmental potential index, and the area size of the completed consolidation projects. The research area comprised the Lublin region (Lubelskie voivodship). Administrative unit of the municipality served as the primary entity under assessment. The units in which land consolidation projects were carried out in the years 2004-2013 were analysed in detail.

Research has shown that the potential of the natural environment in the majority of municipalities in the Lublin region has been determined on the medium level. It has also been shown that there is correlation dependence between the area size of the completed land consolidation projects and the level of the potential of natural conditions. The quality of the natural environment in rural areas is potentially threatened by the intensification of agricultural production, because economic expansion may affect the disappearance of natural habitats and reduce biodiversity. Therefore, preservation of natural potential is antagonistic to simultaneous actions aimed at improving the conditions of agricultural production. On the other hand, the threat to forms

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of nature protection comes from the lack of modernization of infrastructure in rural areas, including sewage and waste management, which are inseparable activities in the implementation of the land management and agricultural works.

Keywords: plant-agricultural interventions, natural environment, indexation of agricultural production space, forest cover (afforestation), protected areas

INTRODUCTION

Merging or consolidating agricultural land can effectively solve structural problems caused by land fragmentation. The FAO (2008) classifies the impact of land consolidation on three levels. The first is micro level, where land consolidation focuses on changing the structure of agricultural holdings (farms) and their immediate environment, so as to enable the farmers to become more competitive. The second is defined as consolidation at the meso level, in which land consolidation has broader goals regarding the changes extending onto the rural community, among other things, through the improvement of infrastructure (roads, irrigation and drainage systems, etc.); improvement of the natural environment through natural resources management; improvement of the landscape; and ultimately, the impact on the spatial distribution of economic activity. In the third, macro level, the process focuses on changes that can have a positive bearing on various phenomena throughout the country, through, inter alia, reducing disparities between urban and rural areas, ensuring more effective and repeated use of rural space, as well as improving the overall competitiveness of the agricultural and rural areas.

Poland is among many countries in Europe, where there are substantial needs for land management and agricultural works (Janus and Markuszewska, 2017; Pasakarnis and Maliene, 2010; Pödör and Mizsei-Nyiri, 2015; Leń, 2018). The needs for land consolidation in Poland cover the area of approximately 7.1 million hectares (Jędrejek et al., 2014). High degree of land fragmentation is caused by historical and social determinants (Bański, 2017; Baran-Zgłobicka and Zgłobicki, 2012) as well as resulting from the construction of a technical infrastructure network (Bacior, 2016; Bacior, 2017). Unfavourable conditions of agricultural areas result mainly from the fragmented structure of land plots, from lack of access to cultivated fields, and

from considerable distances between agricultural land and human habitats (Harasimowicz et al., 2017, Janus et al., 2018, Gniadek et al., 2017).

After Poland's accession to the European Community (EC), the scope of the land consolidation work has expanded, but its pace has not changed and it still does not exceed 15 thousand hectares per year (Woch, 2014). In total, between 2004 and 2013, 118.2 thousand ha of agricultural land were subjected to consolidation, most of them in 2013, probably due to the fact that the PROW (Rural Development Program) 2007–2013 programming period ended in 2013. The implementation of the Rural Development Program tasks is an opportunity to improve the spatial structure of rural areas, and to promote their rational use, which is of great importance in the context of the production potential of agriculture (Wójcik-Leń et al., 2018a, 2018b).

In three regions (voivodships): Lubelskie, Podkarpackie and Małopolskie, in the years 2004–2013, the largest number of land consolidation projects in Poland were performed – in total, they covered the area of slightly above 20 thousand hectares. In the regions of Podlaskie, Śląskie and Dolnośląskie, substantial areas were subjected to land consolidation, over 10 thousand hectares in each of those regions. In contrast, in Warmińsko-Mazurskie, Zachodniopomorskie and Kujawsko-Pomorskie regions, the smallest scale of consolidation work throughout Poland was observed.

Despite the fact that land consolidation projects have been implemented in Poland on a fairly large area, it should be noted that their area size accounts for only 0.6% of the total area of agricultural land. In the Małopolska region this share is the largest, amounting to 2.26% of the area of agricultural land, whereas in Podkarpacie region it is 2.15%, in Śląskie region it is 1.62%, and in Lublin region, it is 1.56%. In other regions, this share remains below 1% (Dudzińska and

Prus, 2016). Area sizes of the completed consolidation projects are small compared to the needs that had been determined, and at the same time, no correlation between the size of the already completed consolidation projects and the actual needs for the implementation of the land consolidation works has been recorded (Jędrejek et al., 2014) – as indicated, among other things, by correlation coefficient between variables amounting to only 0.194 (Dudzińska and Kotlewski, 2016). According to Woch (2014), one of the reasons for this lies in the difficulties and obstacles to land consolidation projects resulting from the need to preserve the valuable natural qualities of the environment in protected areas.

The thesis is often formulated that Poland is a country possessing a great wealth of natural environment and high biodiversity, especially in rural areas. The issues of rural development also concern actions taken in order to protect the natural environment, and to preserve the value of the production space. Sustainable development should guarantee access to resources of the natural environment for the local community, assuming that this will not pose a threat to either ecosystems or socio-economic systems (Wielewska, 2014). Most of the protected areas have not been completely excluded from economic use, although they are subject to special supervision and to some restrictions. It is thanks to the low-intensity farming that one of the richest biodiversity statuses in Europe is still found in Poland. This situation is favoured by the fragmentation of farms, by the preserved natural rural landscape, by extensive meadows and pastures, by mid-field trees, shrubs, and ponds, as well as low level use of artificial fertilizers (Kociszewski, 2002, Burchard-Dziubińska, 2010).

In the context of natural conditions, the authors point to the importance of three basic elements: the index of valorisation of the agricultural production space, the index of forest cover (afforestation), and the index of protected areas. The valorisation of agricultural space, which is of particular importance for agricultural production, is founded on four basic elements of the natural environment: soil, terrain, water relations, and agro-climatic conditions. The most favourable rating from the agricultural point of view includes the highest point values of the above indicators.

Another analysed factor is the forest cover index. Forests organically perform natural (protective) function as well as social and production functions. According to the Forest Act of 1991 (Journal of Laws of 2017 item 788), forest management should be aimed at preserving forest sustainability, sustainable development, as well as continuity of multilateral use and expanding forest resources. Forest cover is one of the factors determining the natural potential of the environment.

Areas of particular natural value constitute an asset that determines the natural potential of individual municipalities. In the Lubelskie voivodship (i.e. Lublin region), naturally valuable areas occupy 22.7% of the total area. The occurrence of forms of nature protection introduces special conditions that should be considered during the implementation of land consolidation projects. For example, areas of national parks and nature reserves should be excluded from the area of land consolidation, because they are not subject to this process. Natura 2000 areas may be subject to land consolidation, provided that significant restrictions are imposed, making sure that no negative changes are triggered in these protected areas. In the case of other forms of nature protection, the principles imposed when conducting consolidation works are less stringent (Woch, 2014).

The aim of the present article is to analyse and assess the natural potential of individual municipalities, and also to confront the calculated measures with the already completed land consolidation projects within the scope of agricultural land. Authors of the article attempt to answer the following questions: Is there a correlation between the environmental conditions of the particular municipalities where the consolidation of agricultural land was carried out, and the surface (size) of the implemented consolidation projects in the studied area? Is the impact of the natural potential of municipalities positive or negative in relation to the on-going consolidations projects? What are the environmental conditions of the municipalities, in which the consolidation of agricultural land was already performed?

The studies were carried out in the area of the Lublin region, as it was there that the largest number of land consolidation projects among all Polish regions had been implemented.

MATERIAL AND METHODS

As part of the research, the query of the literature on the subject was conducted. The analysis and assessment of natural conditions were made on the basis of studies according to a spatial-statistical approach. The potential of the natural environment was analysed in terms of valorisation of the agricultural production space, the forest cover index, and the index of protected areas. A synthetic assessment of the natural environment potential index was made, and then an analysis was performed of its correlation with the surface of the completed consolidation projects.

The research area covered the municipalities of the Lublin region, where land consolidation projects in agricultural areas (excluding forest land) were implemented in the period of 2004–2013. The research was carried out in three stages, as presented in Figure 1 below.

In the first stage, an analysis was made of the land consolidation projects completed in agricultural areas within the municipalities of the Lublin region, with particular attention to their location and area size.

In the second stage, the assessment of natural conditions in the analysed municipalities of the Lublin re-

gion was carried out (in the year 2013), and analysis was performed of the correlations between the level of potential of natural conditions within the area of the municipality, and the area size of the completed land consolidation projects.

In the final stage, results were summarised, and conclusions were drawn based on the completed research.

Additionally, a synthetic measure of the natural environment potential was used to determine the correlation between the size of the implemented land consolidation works and the potential of natural conditions within the area of the municipality. The values of particular features of the natural environment potential were assigned point scores on a 5-point scale (while simultaneously converting deterrents into stimulants), and following that, a synthetic assessment of the natural potential index for the municipality was carried out. The aforementioned ranking has been determined based on the qualitative assessment of a given feature (from low potential, to medium, to high).

The classification was made due to the type of indices obtained, as well as due to the quality of the data available for analysis. The indices were normalized according to the following algorithm:

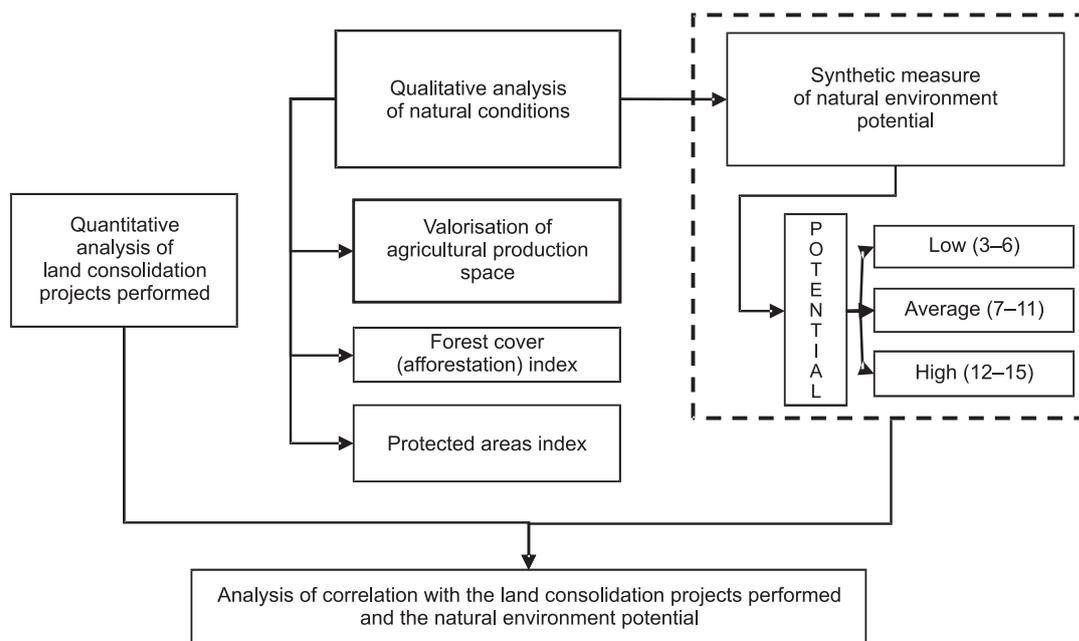


Fig. 1. Diagram of the research methodology applied. Source: authors' own study.

- 1) A numerical series has been ranked for the values of each analysed feature, where: $x_1 = \min. < x_2 < x_3 < \dots < x_n = \max.$
- 2) The length of the class intervals was determined based on the analysis of the subject literature and statistical data, including the statistics of the Local Data Bank and ARiMR data.
- 3) Class intervals were constructed. Threshold values of intervals were calculated from consecutive symbols of the arithmetic series, in which the first symbol (a_1) corresponds to the smallest value of the numerical series ($x_1 = \min.$), and the consecutive symbols of the series are larger than the previous one, by the intervals determined on the basis of literature and expert knowledge, whereas the last symbol is the largest value of the series ($x_n = \max.$);
- 4) The point classification of objects was made. Elements of the numerical series x_j were ranked on the basis of their size to the appropriate classes (intervals) designated by the a_i series, thus each element x_j belonging to the interval $(a_i, a_i + 1)$ takes the point value equal to i , i.e. the value of the rank assigned to this class.

In the point score, a 5-step class interval was assumed for each attribute (partial index), assuming that the most favourable feature value received 5 points, and the least favourable value received 1 point. On the basis of the average value of the point score obtained for three characteristics, municipalities with different potential of natural conditions were distinguished.

RESULTS AND DISCUSSION

Stage 1. Performing land consolidation projects in municipalities of the Lublin region

The Lublin region (*Województwo Lubelskie*) covers an area of 25 115 km² and is the third region (after Mazowieckie and Wielkopolskie) throughout the country in terms of area size. The population size is 2 135.7 thousand, which puts it on the seventh place in the country. Population density is relatively low, and it amounts to approximately 85 people per 1 km². Only four other regions: Warmińsko-Mazurskie (Warmian-Masurian), Podlaskie, Lubuskie and Zachodniopomorskie (West Pomeranian) are characterized by a smaller population density index. The birth rate in

2016 was –1.23. Region's population constitute 5.6% of all inhabitants of Poland (GUS 2018). Rural areas in the Lublin region area cover 24 152 km², and that constitutes 96.1% of the total area of the Eastern Poland region. The rural settlement network consists of 3319 villages, of which 171 are municipal rural centres (Strategia, 2014). The region of Lublin is of great importance for agriculture, with environmental conditions that are much better than the national average, as evidenced by the value index of agricultural production space amounting to 74.1 points (with Poland's average at 66.6 points). Having said that, at the same time is demonstrates a relatively low level of utilizing the production potential of agriculture (Kopiński and Krasowicz, 2013).

In the Lublin region, in the years 2004–2006, consolidation work was carried out on 13 objects, and in the years 2007–2013, on further 39 objects. The areas covered by land consolidation procedures amounted to 7970 ha and 27 502 ha respectively, whereas the consolidation area in the second period increased more than 3.5 times compared to the first period (WB GiTR, 2015). In the first programming period, consolidation projects were carried out in 10 municipalities of the Lublin region, whereas in the second period, 26 municipalities were involved. In total, in the period of 2004–2013, land consolidation projects were carried out in 31 municipalities of the Lublin region (see: Fig. 2 and 3), with a total of 171 rural municipalities and 22 urban-rural municipalities involved (Dudzińska and Prus, 2016).

The largest numbers of objects involved in the consolidation projects were located in the municipalities of Ostrówek, Chełm, Wojsławice and Urszulin (4 objects under consolidations). Also noteworthy is the Łuków municipality, where three objects were subjected to consolidation (see: Fig. 2). Land consolidation projects of various sizes were implemented – on plots with the size between 74 ha (in Łuszczów and Łuszczów Kolonia in the municipality of Uchanie) and 2101 ha in Potok (in the municipality of Potok Górny). Land consolidation of the largest area was conducted in the years 2004–2013 in the municipalities of Potok Górny and Urszulin, comprising 4202 and 3863 ha, respectively.

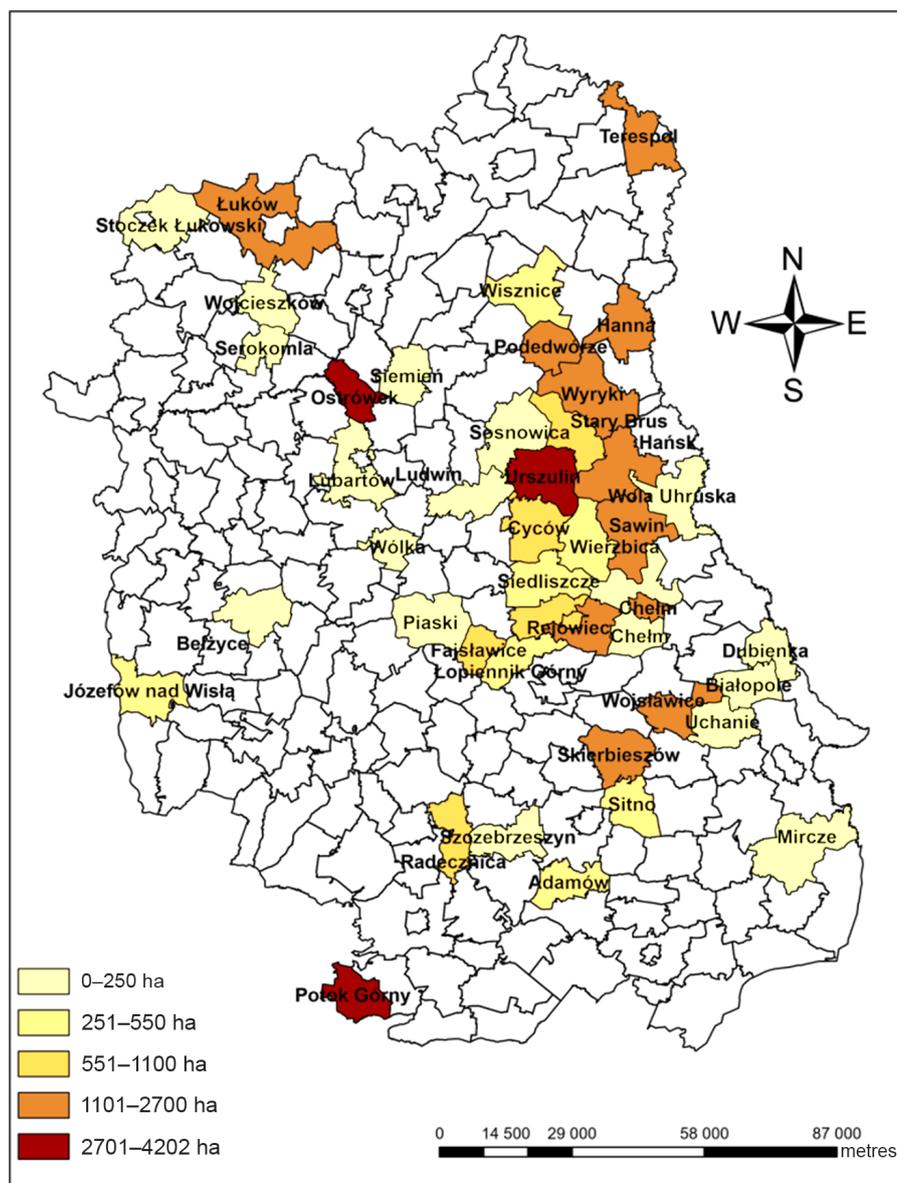


Fig. 2. Land consolidation projects in the Lublin region in the years 2004–2013

Source: own study

Stage 2. Assessment of natural environment potential in the analysed municipalities of the Lublin region

The potential of the natural environment comprises all resources and valuable qualities of that environment, determining the ability of the latter to satisfy broadly understood (physical and psychological) human needs, current and future, and supporting this ability as a re-

sult of the self-regulatory and immune mechanisms in the environment (Kistowski, 1997). All definitions of the potential of the natural environment found in the literature on the subject emphasize the role of man as an agent using environmental resources. Due to methodological difficulties, the determination of the full potential of the environment would be unrealistic, which is why Haase (1978) introduced the concept of

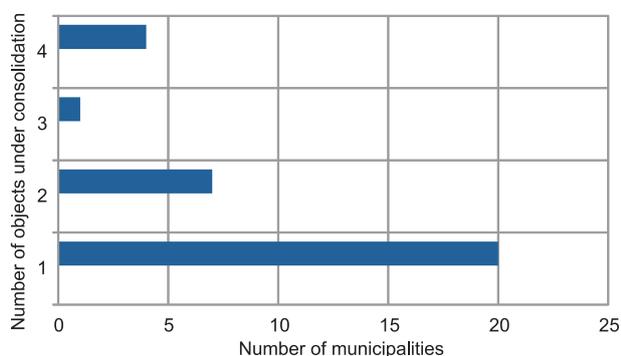


Fig. 3. Number of objects under consolidation in the municipalities of the Lublin region

Source: own study

partial potential. The list of partial potentials of the environment, provided by various authors, is extensive. Przewoźniak introduced one way of systematic categorisation thereof (1991), paying special attention to the intangible nature of some of the resources exploited by man. He introduced the following groups of potentials: self-regulatory-immune, resource-use and perceptual-behavioural (Piętak, 2011). In this analysis, the potential from the resource-use group is assessed.

According to Hopfer et al. (1982) the following factors should be included in the valorisation: land relief, erosion risk, mode of surface water occurrence, soil-water relations, soil suitability to agriculture, existing habitats, climate, microclimate, geological conditions, occurrence of natural resources, aesthetic value of the landscape, accessibility of areas for production and leisure purposes, the occurrence of architectural monuments and natural monuments, as well as the condition, distribution, and the capacity of built-up areas.

The method of valorisation of the agricultural production space developed by the IUNG team in Puławy (Witek and Górski, 1977) consists in assessing four elements of the natural environment that have a major impact on agricultural production. The quality of the soil, climate, terrain, and water conditions are evaluated. Each element is assigned points, and their sum produces the index of valorisation of the agricultural production space. The higher the sum of points assigned to a given area, the higher the quality of agricultural production conditions for this area.

A slightly different way of assessing agricultural potential is proposed by Malinowska (2010). She distinguishes 6 elements (terrain, soil quality class, surface features, agro-climatic conditions, depth of water table, and level of soil degradation) that assess the natural environment, and assigns to each of them, respectively, between 1 and 3 points. In this method, the sum of points leads to assessing the degree of potential in a given area.

Bielska and Krupińska (2016) used the following elements in order to assess the conditions of the natural environment: land relief, availability of land under water, occurrence of forests, current use, and type of bedrock.

The choice of variables in quantitative analyses is usually a product of the availability of data and arbitrary decisions by the researchers, but the basis for the choice should be a strong substantive justification. On the basis of a review of subject literature, coupled with the results of the analyses performed, the index of valorisation of the agricultural production space, forest cover (afforestation index), and the index of protected areas were adopted in order to determine a synthetic measure of the potential of natural conditions.

VALORISATION INDEX OF THE AGRICULTURAL PRODUCTION SPACE

The index of valorisation of the agricultural production space reflects the potential of the area used in agriculture, resulting from the natural conditions of the environment. The main objective of this part of the research was to develop indices allowing for the quantitative and spatial assessment of natural factors determining the potential crop yield at the local level (i.e. level of a municipality) (Ministry of Agriculture and Rural Development, 2007). The index of valorisation (WWRPP) takes into account factors affecting the quality of the habitat, such as: quality and suitability of soils, water conditions, land relief, and agro-climate.

Due to the quality of the agricultural production space, the Lublin region takes third place in the country (Kopiński and Krasowicz, 2013) with the corresponding valorisation index at 74 points. In the analysed area, 37% of municipalities are characterized by a low val-

orisation index of agricultural production space (up to 60 points), while 9% exhibit a high valorisation index (above 93 points). Index of valorisation of agricultural space for municipalities in which land consolidation

works were carried out is lower than the average in the region, and it amounts to 68 points (see: Fig. 4 and 5). It is also lower in relation to municipalities in which no land consolidation works have been carried out.

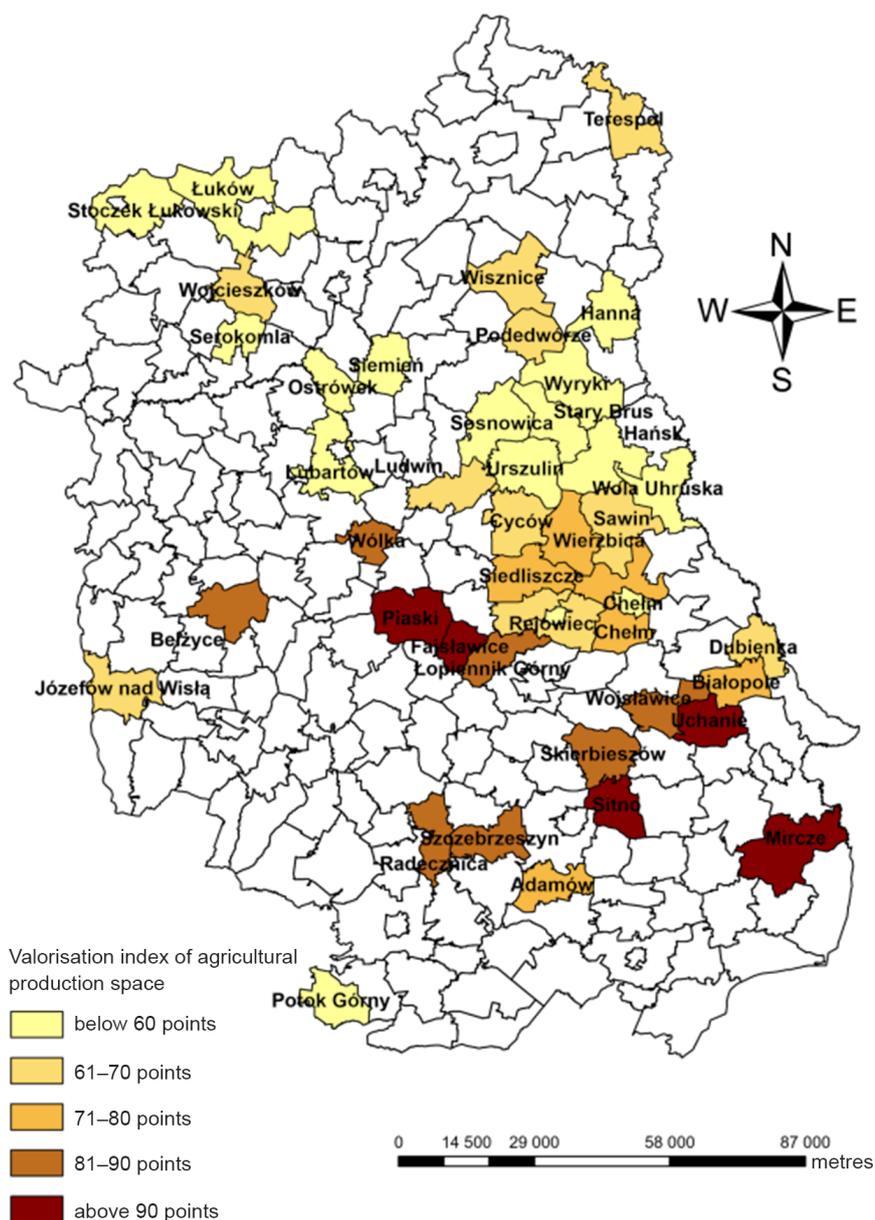


Fig. 4. Valorisation index of agricultural production space juxtaposed against the implementation of land consolidation projects in the Lublin region in the years 2004–2013.

Source: own study

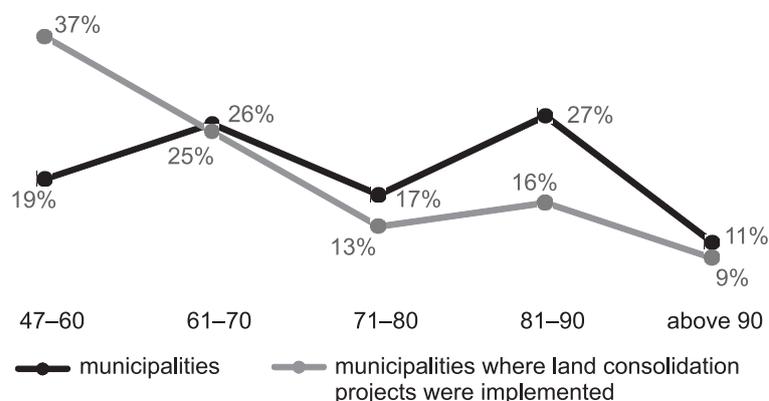


Fig. 5. Comparison of municipalities in the Lublin region, in which land consolidation projects were implemented, and those municipalities where no land consolidation projects were carried out, in terms of the valorisation index of agricultural production space.

Source: own study

FOREST COVER (AFFORESTATION)

Lublin region is characterized by a low degree of afforestation. The forest cover of the region amounts to 23.3% of the total area of that region; to compare, average forest cover in all Poland amounted to 29.5% in 2016. Area of woodland in the Lublin region is 558 643 ha, which is about 6.3% of all forest areas throughout the country. Within this area, 61.23% of forests are owned by the State Treasury (80.4% of all forests of Poland), of which 2.07% belong to national parks. In the age structure of the forests under the management of State Forests, tree stands in the fourth age class (between 61 and 80 years old) dominate, occupying 25.5% of all area and constituting 31.6% of trunk timber resources in the Lublin region (for all Poland, these figures are respectively 19.2% and 25.1%) (Łabocki, 2018; Centrum Informacyjne Lasów Państwowych, 2017).

The largest forest complexes have been preserved on sandy and waterlogged plains of Kotlina Sandomierska (Puszcza Solska, Lasy Janowskie), within the Roztocze region, which is rich in land relief forms (Lasy Zwierzynieckie), and in the Bug River part of the Polesie region (Lasy Sobiborsko-Włodawskie). The most deforested part – due to its good quality soils – is the Lublin Upland. In this area, in many municipalities, forest cover does not even exceed 10% (Strategia..., 2014).

Implementation of land consolidation projects was carried out mainly in municipalities with a fairly low level of afforestation (see: Fig. 6, Fig. 7). As many as 47% of the analysed municipalities have a forest cover rate of 10–20%, and 25% of municipalities have a forest cover index in the range of 20–30%. The research shows that the higher the forest cover in the given municipality, the smaller the number of on-going land consolidation projects.

INDEX OF PROTECTED AREAS

Environmental protection is a civilizational challenge, and it can find its expression in the state constitution, as well as the international law. Environmental protection often requires limitation of ownership right (or its exercise), and on the other hand, it must take into account the rights arising therefrom (Dudzińska and Kocur-Bera, 2014).

According to the Nature Conservation Act (Ustawa, 1995), 10 forms of nature protection can be distinguished in Poland, including national parks, nature reserves, Natura 2000 areas, and landscape parks. Each of these forms requires a different reference to the principles of nature conservation during the implementation of consolidation works. Areas of national parks and nature reserves are excluded from the area of land consolidation projects, that is to say, they are not subject to this process. Natura 2000 areas may be

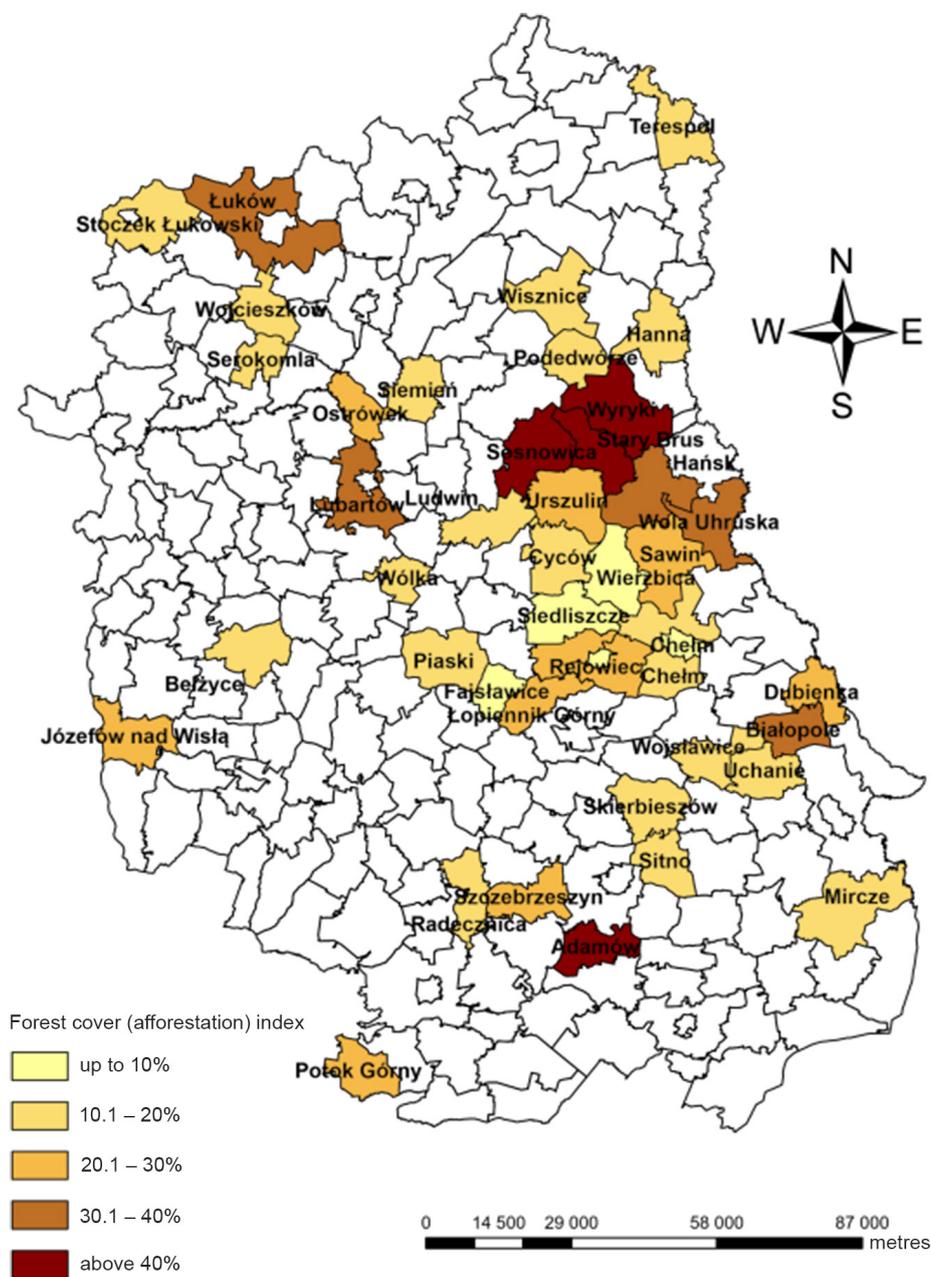


Fig. 6. Forest cover (afforestation) index juxtaposed against the implementation of land consolidation projects in the Lublin region in the years 2004–2013

Source: own study

subject to land consolidation, but only provided that additional requirements are met, so as not to cause negative changes in the protected areas. However, the rules and regulations for the functioning of other areas

are less stringent as regards the conduct of consolidation projects (Woch, 2014).

Legally protected areas account for 22.7% of the total area of the Lublin region, which produces a re-

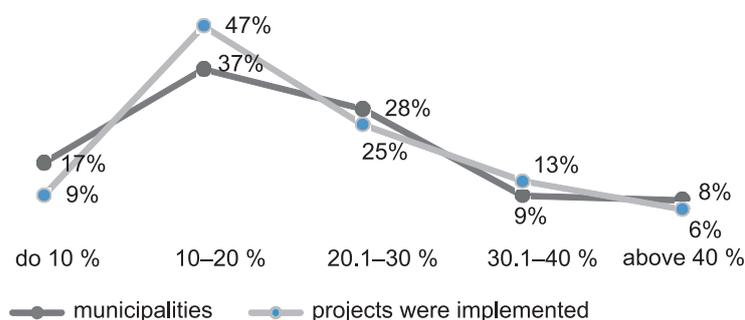


Fig. 7. Comparison of municipalities in the Lublin region, in which land consolidation projects were conducted, and municipalities where no land consolidation projects were carried out, in terms of the forest cover index. Source: own study

sult far below the national average (the latter being 32.5%). In terms of the size of protected areas, the region takes the seventh place in the country. The Nature Conservation Act of 1995 lists 10 forms of nature conservation (see: Table 1).

Currently, the system of protected areas of the Lublin region consists of two national parks: Roztoczański and Poleski, 17 scenic parks, comprising 3 parks including also neighbouring regions, 17 areas of protected scenery, 90 nature reserves (Strategia..., 2014), 107 ecological sites, 2 landscape-nature protected complexes, 5 documentation sites, and 1459 natural monuments (see: Fig. 8).

The analysis determined the index of protected areas, that is, the share in the surface ranges of nature protection areas in the municipality. The said analysis also included Natura 2000 sites.

The analysis included areas covered by both Polish and the European Union nature conservation law.

The largest share in the total area of nature protection areas belongs to areas of protected scenery, which in the Lublin region amounted to 12%, and the second largest belongs to scenic parks, namely 9.5%.

Table 1. List of forms of nature protection in Poland and in the Lublin region

| No. | The form of protection | Number of locations | Number of locations within the Lublin region |
|-----|--------------------------------------|---|--|
| 1. | National parks | 23 | 2 |
| 2. | Nature reserves | 1497 | 90 |
| 3. | Scenic parks | 122 | 17 |
| 4. | Areas of protected scenery | 404 | 17 |
| 5. | Natura 2000 areas | 145 areas of special protection of birds (PLB) 849 areas of special protection of habitats (PLH) | 21 (PLB) 48 (PLH) |
| 6. | Natural monuments | 31111 | 1459 |
| 7. | Documented sites | 177 | 5 |
| 8. | Ecological sites | 7626 | 107 |
| 9. | Landscape-nature protected complexes | 260 | 2 |
| 10. | Species protection | 715 species of plants 322 species of fungi 799 species of animals | |

Source: 1–9. Central Register of Nature Conservation Forms, crfop.gdos.gov.pl (status as of August 2018), 10. General Directorate for Environmental Protection, status as of January 2015

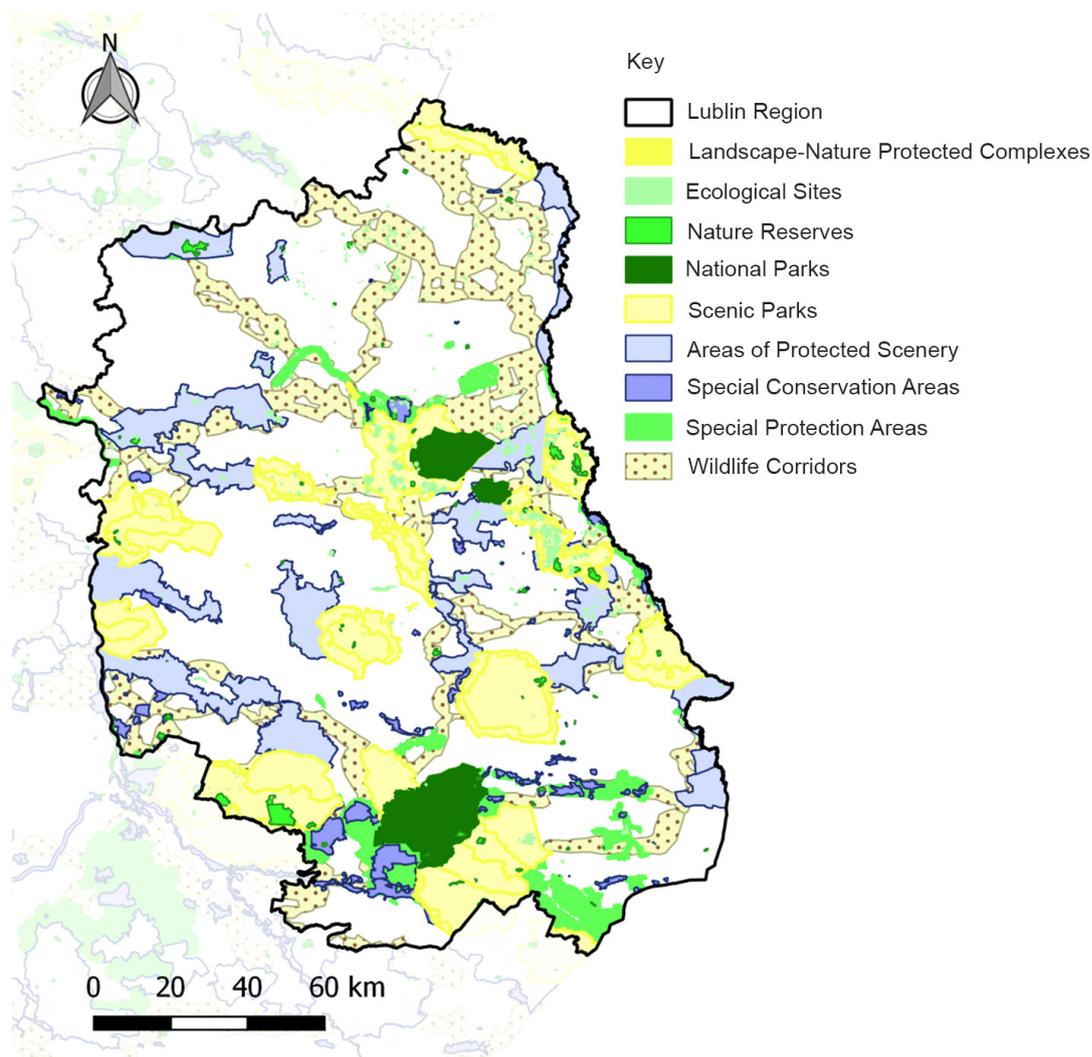


Fig. 8. Areas of special natural value, and Areas of the European Ecological Network NATURA 2000 in the Lublin region. Source: own study based on data provided by the website <https://www.gdos.gov.pl/dane-i-metadane> and <http://www.codgik.gov.pl/index.php/darmowe-dane.html>

Other forms of nature protection have a small share in the total surface of all protected areas. The areas of the Natura 2000 network occupy almost 15.0% of the region's surface. Farmers operating in these areas are obliged to comply with the applicable legal provisions contained in both State and Community legislation. These include varying degrees of restrictive requirements related to environmental protection, whereby the need to comply with these requirements affects the agricultural activities car-

ried out in these protected areas. In addition, these areas represent high natural values, with the occurrence of semi-natural vegetation, and a mosaic of landscapes, containing agricultural land as well as forests, shelters, natural meadows, etc. Farming carried out in protected areas is often of an extensive character (GUS ... 2010).

The conducted analysis demonstrated that the implementation of land consolidation projects was carried out mainly in municipalities with a fairly low

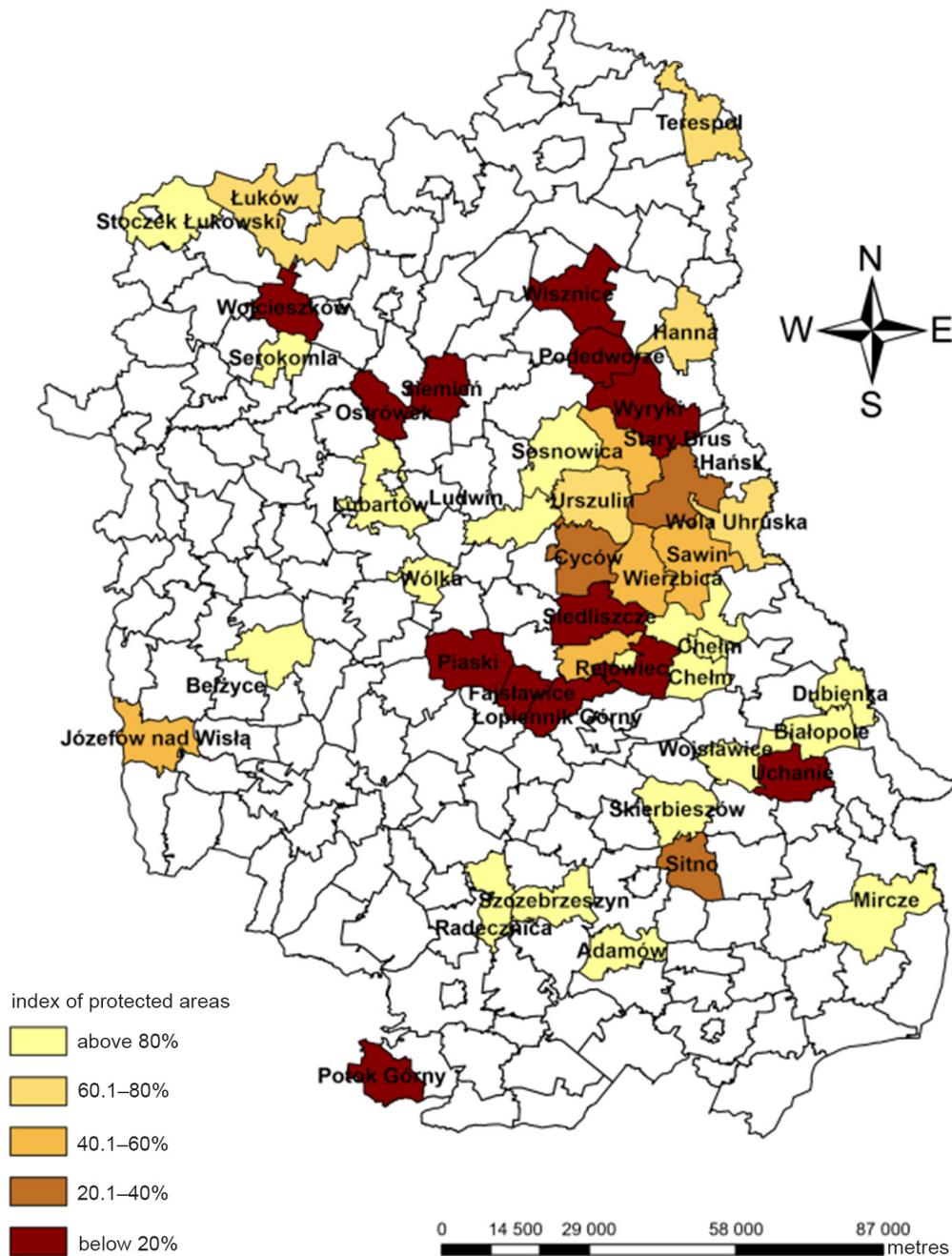


Fig. 9. Areas of special natural value, and Areas of the European Ecological Network NATURA 2000 in the Lublin region. Source: GDOŚ

index of protected areas. 48% of the analysed municipalities show this index at below 20% (see: Fig. 9 and Fig. 10). Only 9% of the analysed municipalities show

the said index in the range above 80%. It is therefore a factor, which constitutes a major barrier to the implementation of land consolidation work.

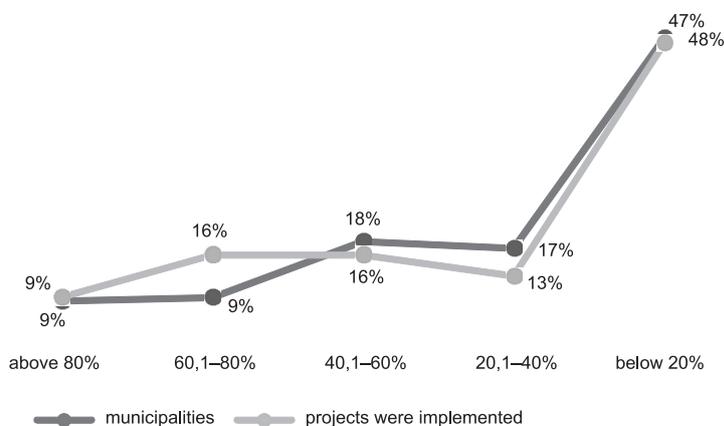


Fig. 10. Comparison of municipalities in the Lublin region, in which land consolidation projects were conducted, and municipalities where no land consolidation work was carried out, in terms of the index of protected areas. Source: own elaboration

INDEX OF ENVIRONMENTAL CONDITIONS POTENTIAL

The synthetic measure in the form of the index of the potential of natural conditions was calculated, taking into account the three indices described above.

In a synthetic approach, the index of the potential of natural conditions was the most advantageous in three municipalities: Piaski, Uchanie and Łopien-

nik Górny (in this area, consolidation works were conducted, covering the area of 166 ha, 74 ha and 533 ha, respectively). The lowest level of the potential of natural conditions was obtained by the Hanna, Urszulin, and Terespol municipalities (in this area, the consolidation works were carried out on the surfaces of 1120 ha, 3863 ha, and 1109 ha, respectively). The remaining municipalities obtained their potential assessment at an average level (see: Table 2).

Table 2. Presentation of synthetic meta-indices, describing the index of the potential of natural conditions in the analysed municipalities

| Municipality | Values of the synthetic meta-index | Development degree | Municipality | Values of the synthetic meta-index | Development degree |
|--------------|------------------------------------|--------------------|--------------------|------------------------------------|--------------------|
| Podedwórze | 9.00 | average | Potok Górny | 9.00 | average |
| Siemień | 8.00 | average | Rejowiec_Fabryczny | 8.00 | average |
| Piaski | 12.00 | high | Wojślawice | 7.00 | average |
| Wola_Uhruska | 7.00 | average | Siedliszcze | 9.00 | average |
| Hańsk | 9.00 | average | Sawin | 7.00 | average |
| Hanna | 5.00 | low | Wierzbica | 7.00 | average |
| Urszulin | 6.00 | low | Rejowiec | 10.00 | average |
| Stary Brus | 9.00 | average | Uchanie | 12.00 | high |
| Wyryki | 11.00 | average | Fajślawice | 10.00 | average |
| Radecznicza | 7.00 | average | Łopiennik Górny | 12.00 | high |
| Skierbieszów | 7.00 | average | Ostrówek | 9.00 | average |
| Sitno | 10.00 | average | Cyców | 8.00 | average |

Table 2. cd.

| Municipality | Values of the synthetic meta-index | Development degree | Municipality | Values of the synthetic meta-index | Development degree |
|--------------|------------------------------------|--------------------|-------------------|------------------------------------|--------------------|
| Adamów | 9.00 | average | Łuków | 7.00 | average |
| Wisznice | 9.00 | average | Wojcieszków | 9.00 | average |
| Terespol | 6.00 | low | Jozefów nad Wisłą | 8.00 | average |

Source: own study

Subsequently, the coefficient of correlation between the level of the potential of natural conditions and the area size of completed consolidation projects was determined. The calculated correlation coefficient between the variables adopted for the analysis amounted to 0.510, which signifies a high correlation according to the Guilford scale.

SUMMARY AND CONCLUSIONS

The quality of the natural environment in rural areas is potentially threatened by the intensification of agricultural production, because economic expansion may affect the disappearance of natural habitats and reduce biodiversity. Therefore, the preservation of natural potential remains antagonistic versus the actions aimed at improving the conditions for agricultural production (for instance, land consolidation projects). On the other hand, a threat to forms of nature's protection lies in the lack of modernization of infrastructure in rural areas, including sewage and waste management, which are inseparable activities in the implementation of the land management and agricultural works. The principles of sustainable development should, therefore, lead to the kind of spatial management that would meet the minimum requirements for agricultural production, while optimally preserving that natural environment's assets.

The following specific conclusions can be drawn from the studies that we have conducted:

1. The studied municipalities of the Lublin region represent diverse levels of the potential of natural conditions – from low to high. About 10% of the analysed municipalities enjoy a high level of the natural potential. Also 10% of the analysed municipalities have a low potential. Other studied units (80%) are characterized by an average potential.

2. In the Lublin region, a larger number of land consolidation projects are carried out in areas with low forest cover.
3. Land consolidation projects in the Lublin region are mainly carried out in areas with lower values of the index valorising the agricultural production space.
4. The occurrence of protected areas reduces the frequency of land consolidation works.

The research that we have conducted confirms the existence of a correlation between the area size of the completed consolidation works on agricultural land (excluding forest land) and the level of potential of natural conditions (the correlation coefficient between the variables was 0.510, which according to the Guilford scale signifies a high correlation). It can be concluded that land consolidation projects in the Lublin region are carried out mainly in municipalities, where the level of potential of natural conditions remains at an average level. In municipalities where the potential of natural conditions was high, smaller land consolidation projects were realized. This confirms, among others, the thesis posited by Woch (2014), who pointed to the need to preserve the precious natural values of the environment as an obstacle to the implementation of land consolidation work.

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POTENCJAŁ UWARUNKOWAŃ PRZYRODNICZYCH A SCALENIE GRUNTÓW ROLNYCH – STUDIUM PRZYPADKÓW W WOJ. LUBELSKIM

ABSTRAKT

W Polsce prace scaleniowe prowadzone są głównie w południowej części kraju. W trzech województwach: lubelskim, podkarpackim i małopolskim zrealizowano w latach 2004–2013 dużą liczbę scaleń, porównując do średniej krajowej – powyżej 20 tys. ha w każdym z województw. W innych trzech województwach nie realizuje się scaleń (warmińsko-mazurskie, zachodniopomorskie, kujawsko-pomorskie), pomimo że z badań wynika (Jędrejek i inni, 2014), iż potrzeby prac scaleniowych występują dla wszystkich województwach. Według Wocha i Głazewskiego (2014) jedną z przyczyn takiego stanu są utrudnienia w realizacji scaleń wynikające z konieczności zachowania cennych przyrodniczo walorów środowiska na obszarach chronionych. Celem artykułu jest analiza i ocena potencjału przyrodniczego poszczególnych gmin, a także konfrontacja obliczonych mierników z powierzchnią zrealizowanych już prac scaleniowych. W artykule podjęto próbę odpowiedzi na pytania – Czy istnieje zależność między uwarunkowaniami przyrodniczymi gmin, w których realizowano scalenia gruntów rolnych, a powierzchnią zrealizowanych scaleń na badanym obszarze? Czy wpływ potencjału przyrodniczego gmin jest pozytywny czy negatywny w odniesieniu do realizowanych scaleń? Jakimi uwarunkowaniami przyrodniczymi charakteryzują się gminy, w których realizowano scalenia gruntów rolnych?

W badaniach przeprowadzono kwerendę literatury przedmiotu. Analiza i ocena uwarunkowań przyrodniczych została wykonana w oparciu o badania z grupy podejść przestrzenno-statystycznych. Potencjał śro-

dowiska przyrodniczego został przeanalizowany pod kątem waloryzacji rolniczej przestrzeni produkcyjnej, analizy wskaźnika lesistości oraz wskaźnika obszarów chronionych. Dokonano syntetycznej oceny miernika potencjału środowiska przyrodniczego, a następnie obliczono współczynnik korelacji Pearsona pomiędzy obliczonym miernikiem potencjału środowiska a powierzchnią zrealizowanych scaleń. Obszar badań obejmował woj. lubelskie. Polem podstawowej oceny była gmina. Szczegółowo przeanalizowano jednostki, na terenie których zrealizowano w latach 2004–2013 scalenia gruntów rolnych.

Badania pokazały, że potencjał środowiska przyrodniczego w większości gmin woj. lubelskiego znajduje się na poziomie średnim. Wykazano również, że istnieje zależność korelacyjna pomiędzy powierzchnią zrealizowanych scaleń a poziomem potencjału uwarunkowań przyrodniczych. Jakość środowiska przyrodniczego na obszarach wiejskich jest potencjalnie zagrożona przez intensyfikację produkcji rolnej, ponieważ ekspansja gospodarcza może wpłynąć na zanik naturalnych siedlisk i ograniczenie bioróżnorodności. Zatem zachowanie potencjału przyrodniczego przy jednoczesnych działaniach zmierzających do poprawy warunków prowadzenia produkcji rolniczej to działania antagonistyczne. Z drugiej strony zagrożenie dla form ochrony przyrody stanowi brak modernizacji infrastruktury na obszarach wiejskich, w tym kanalizacji i gospodarki odpadami, które stanowią nieodłączne działania przy realizacji prac urządzeniowo-rolnych.

Słowa kluczowe: zabiegi urządzeniowo-rolne, środowisko przyrodnicze, wskaźnik waloryzacji rolniczej przestrzeni produkcyjnej, lesistość, obszary chronione