



## **ANALYSIS OF CHANGES IN THE SURFACE AREA OF ECOLOGICAL LAND IN LUBELSKIE VOIVODSHIP IN THE YEARS 2004-2016**

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### ***Abstract***

The aim of this paper was to determine the direction and extent of changes in the size of ecological land use in rural areas in the Lubelskie Voivodeship during the implementation of three Rural Development Programmes (RDPs) in the years 2004–2006, 2007–2013 and 2014–2020 (still in progress) and presentation of the RDP's method of action for nature protection.

The changes in the surface area of ecological land were assessed on the basis of an analysis of aggregate voivodeship lists of the Land and Building register covering the years 2004–2016. Detailed analyses were carried out taking into account changes in the cadastral area of ecological land in rural areas in the Lubelskie Voivodeship. The investigations were carried out for 20 districts located in the Lubelskie Voivodeship, with the exclusion of four urban districts.

The study showed that, in the years 2004–2016, the area of ecological land generally increased by 25% in the Lubelskie Voivodeship. However, the rate of growth was not stable: in the years 2012–2014 there was a 115 ha decrease in the area of this land. The largest changes in the area of ecological land concerned the 1st and 7th land registration groups, i.e. land belonging to the State Treasury, excluding land leased out for perpetual usufruct, and land owned by natural persons. Ecological land in the Lubelskie Voivodeship emerged mainly as a result of conversion of wasteland and various land areas.

**Keywords:** ecological land, Rural Development Plan, sustainable rural areas

## INTRODUCTION

Rural areas currently cover over 90% of the area of Poland (Sajnog and Wójcik 2013) and in the Lubelskie Voivodeship, they cover on average 96% of land (Gabryszak *et al.* 2017). In European Union (EU) we observed the same situation, rural areas cover 90% of the territory (European Communities Commission 2007). One of objective of the EU is to harmonize biodiversity conservation and rural development (European Commission 2011). The realisation of EU governance frameworks are the individual National Rural Development Programmes – NRDP (Mikulcak *et al.* 2013). Since Poland's accession to the European Union, three Rural Development Programmes (RDP) have been implemented, with the last one still being in progress. The first programme spanned the years 2004–2006 (less than half of the EU programme for 2000–2006), the second 2007–2013, and the current programme has been designed for the years 2014–2020. Each of the previous programmes as well as the present one have provided ad hoc measures to support land consolidation processes (Mickiewicz and Mickiewicz 2015) and water and soil conservation activities. Within the framework of the latter objective, the Lubelskie Voivodeship together with the Wielskopolskie and Opolskie Voivodeship were the largest beneficiaries of the RDP for 2007–2013 (Pawlewicz and Bórawski 2013).

The land use structure in the Lubelskie Voivodeship is dominated by agriculture and forestry (Gabryszak *et al.* 2015). Ecological land currently occupy only 0.19% of the Voivodeship. Pursuant to the Act of 16 April 2004 On the Protection of Nature (Act 2004), ecological land represent one of the ten forms of nature conservation in Poland. They are defined in Article 42 of the Act, which describes them as „the remnants of ecosystems important for preserving biodiversity which need to be taken under protection – natural water bodies, field and forest ponds, lumps of trees and shrubs, swamps, peat-bogs, dunes, patches of wastelands, old river beds, outcrops, escarpments, gravel banks, natural habitats and sites of rare or protected species of plants, animals and fungi, their refuges and breeding grounds or seasonal stay grounds”. Ecological land often come into being as a result of the development of marginal land and wasteland, among others in the process of land consolidation, which serves to improve the natural, landscape and ecological merits of these areas both locally and country-wide (Sajnog and Wójcik 2013). They are not used for production, therefore private landowners are not willing to create them on their land. They are mainly located on the land of the State Treasury, and most often forest districts (Koreleski 2005). In the geodetic database of the Land and Buildings Register, these areas are designated as E-Ws, E-Wp, E-Ls, E-Lz, E-N, E-Ps, and E-R, depending on the land use unit they are located on, namely, Ws stands for land under standingsurface waters, Wp – land under running surface waters, Ls – forests, Lz – wooded and

bushy land, N – wasteland, Ps – pastureland, R – arable land (Regulation 2001).

In addition to ecological land in Poland, we distinguish seven groups of lands: agricultural land (R, S, Ł, Ps, B-R, Wsr, W), forests, wooded and bushy land (Ls, Lz), urban and built-up land (B, Ba, Bi, Bp, Bz, K, dr, Tk, Ti, Tp), ecological land (E-Ws, E-Wp, E-Ls, E-Lz, E-N, E-Ps, E-R), waste land (N), land under water (Wm, Wp, Ws) and various land (Tr) (Regulation 2001).

Each of the Rural Development Programs implemented in Poland has been designed to comply with the principles of sustainable development of rural areas, including the protection of the environment. One of the measures of the RDP for the years 2004–2006 was to support the protection of nature in non-protected areas under the „National Agri-environmental Programme” (Mastalska-Cetera 2007). In the years 2007–2013, more attention was paid to the support of sustainable rural development through the shaping of agricultural production in accordance with the requirements of the environment and preservation of landscape features (Staniak 2009). The novelty of the RDP 2014–2020 is that support is given to investments in farm holdings located in *Natura 2000* areas and in „Extremely Affected Areas” (Mickiewicz and Mickiewicz 2015), which often include ecological sites.

The aim of the present study was to determine the direction and extent of changes in the size of ecological land in rural areas of the Lubelskie Voivodeship during the implementation of three Rural Development Programmes (RDPs) for the years 2004–2006, 2007–2013 and 2014–2020 (yet to be completed) and presentation of the RDP’s method of action for nature protection.

## **RESEARCH AREA AND METHODOLOGY**

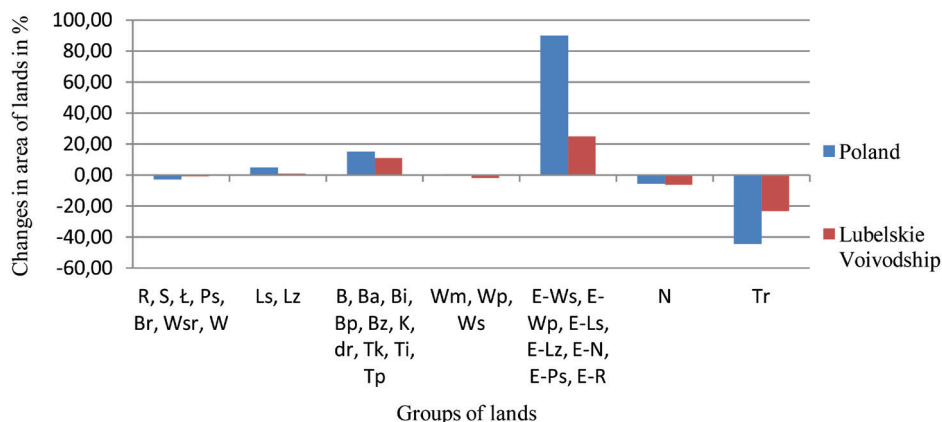
The changes in the surface of ecological land were assessed on the basis of an analysis of aggregate voivodship lists of the Land and Building register covering the years 2004–2016. Detailed analyses took into account the changes in the cadastral area of ecological land in rural areas of the Lubelskie Voivodeship. The investigations were carried out for 20 districts (poviats) located in the Lubelskie Voivodeship, with the exclusion of four urban districts. Calculations were made in the program MS Excel and results were added to attribute table in QGIS software. This programme was used to present the results in cartogram form, as a method for presenting relative data. They were made in the Polish Coordinate System 1992 (EPSG: 2180), which is based on the European Terrestrial Reference System 1989 (ETRS89). QGIS programme offer five options for separating data as: natural breaks, quantiles, equal interval breaks, standard deviation and pretty breaks. The break-down classes presented in the cartograms were generated in the so-called „pretty break” mode and have been modified to

easily compare individual cartograms without a uncomfortable analysis of each of the value classes.

„Pretty break” mode is the statistical algorithms which break down the data into separate classes, based on the statistical package R’s pretty algorithm. It is a bit complex, but the name „pretty” means that it creates class boundaries which are round numbers and the algorithm does not take into account the numbers of chosen classes. The intervals width between data are the same, but they are rounded (Gandhi 2016; Gea 2012; Iwańczak 2013).

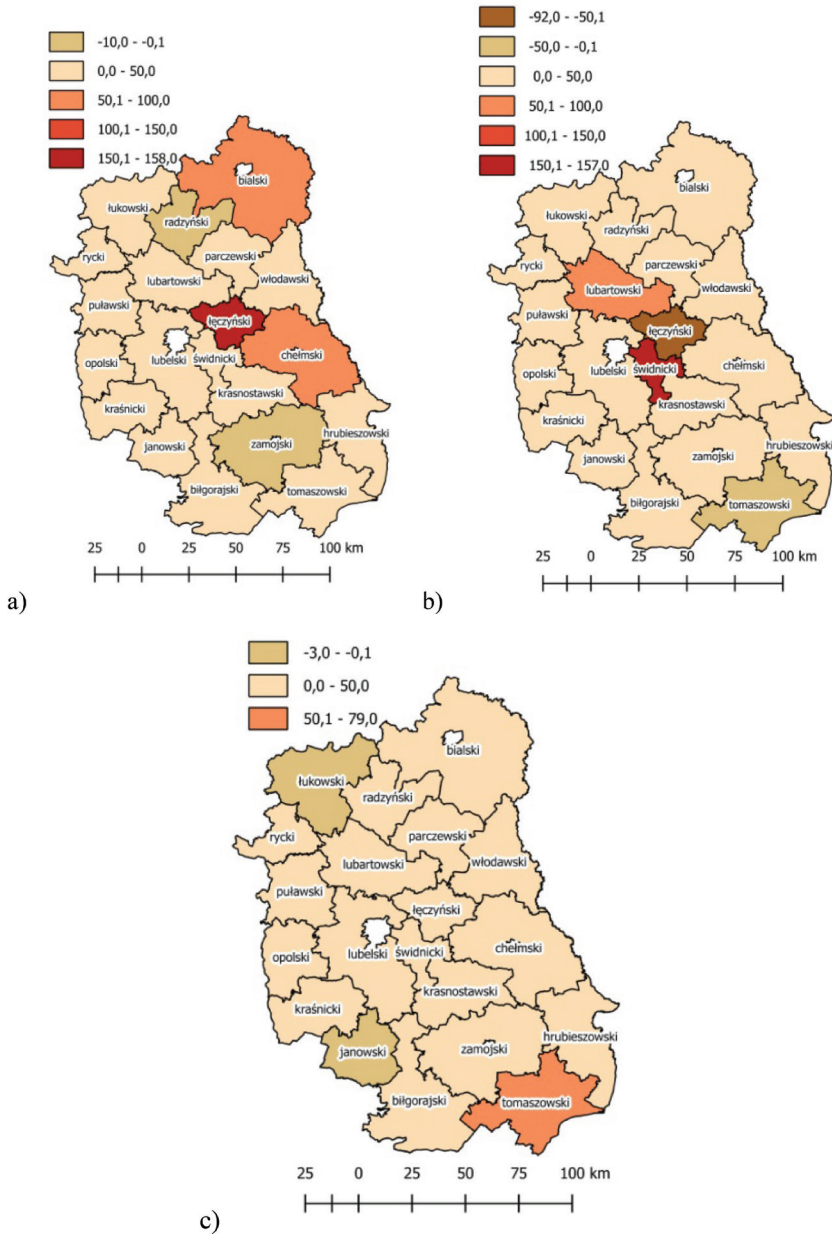
## RESULTS AND DISCUSSION

The land use structure of the Lubelskie Voivodeship has undergone many changes in the period from 2004 to 2016. A considerable increase in size was observed for built-up and urbanized land (an increase of 6935 ha – 11.0%), forests, woodlands and scrub (4237 ha – 0.7%) and ecological land (913 ha – 24.7%). By contrast, the number of hectares occupied by agricultural land decreased (by 16130 ha – 0.9%), and so did the area of various land (616 ha – 23.4%) and wasteland (1474 ha – 6.5%) – Figure 1. Of special interest are ecological land, for which the percentage increase in surface area was the highest in the Polish territory and in the Lubelskie Voivodeship. Figure 2 shows changes in the area of these sites over a period spanning the implementation of the three Rural Development Programmes.



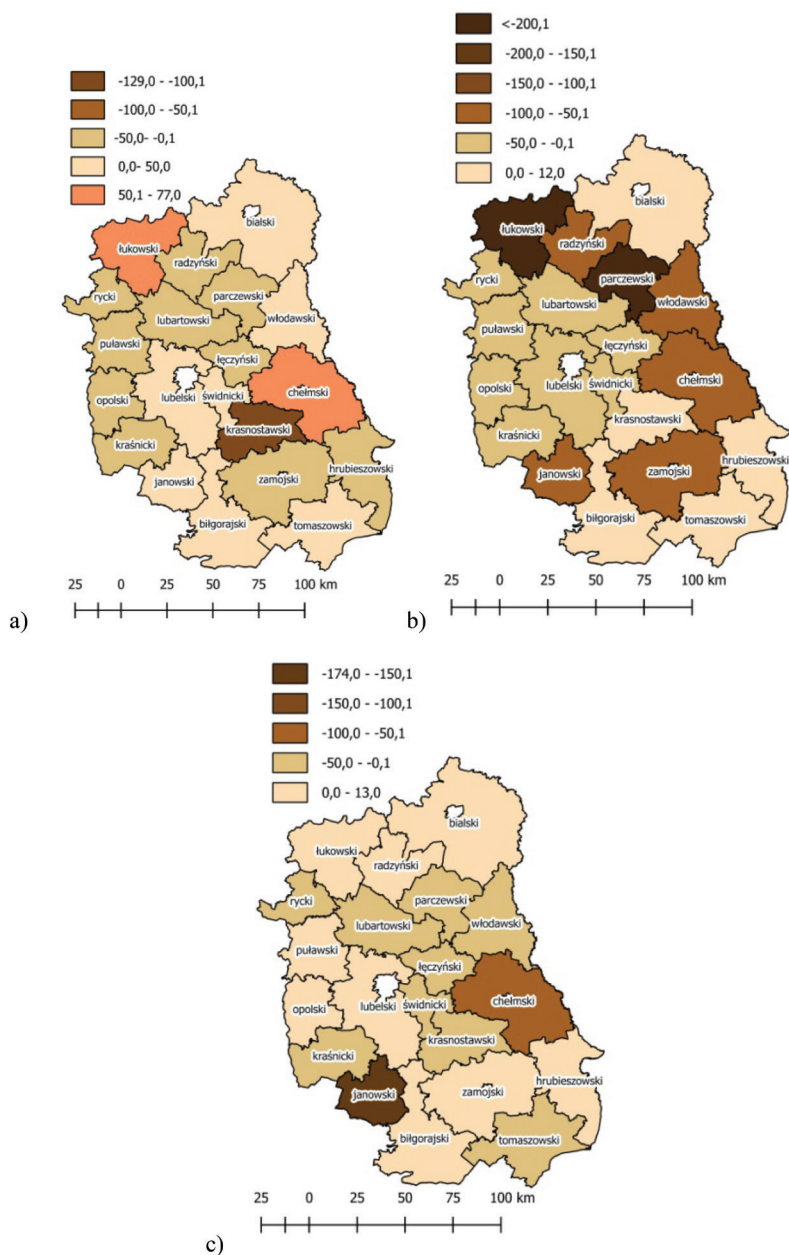
Source: author’s study based on aggregate voivodship lists of the land and building register covering the years 2004 – 2016

**Figure 1.** Changes in land surface in Poland and in Lubelskie Voivodeship during the period 2004–2016



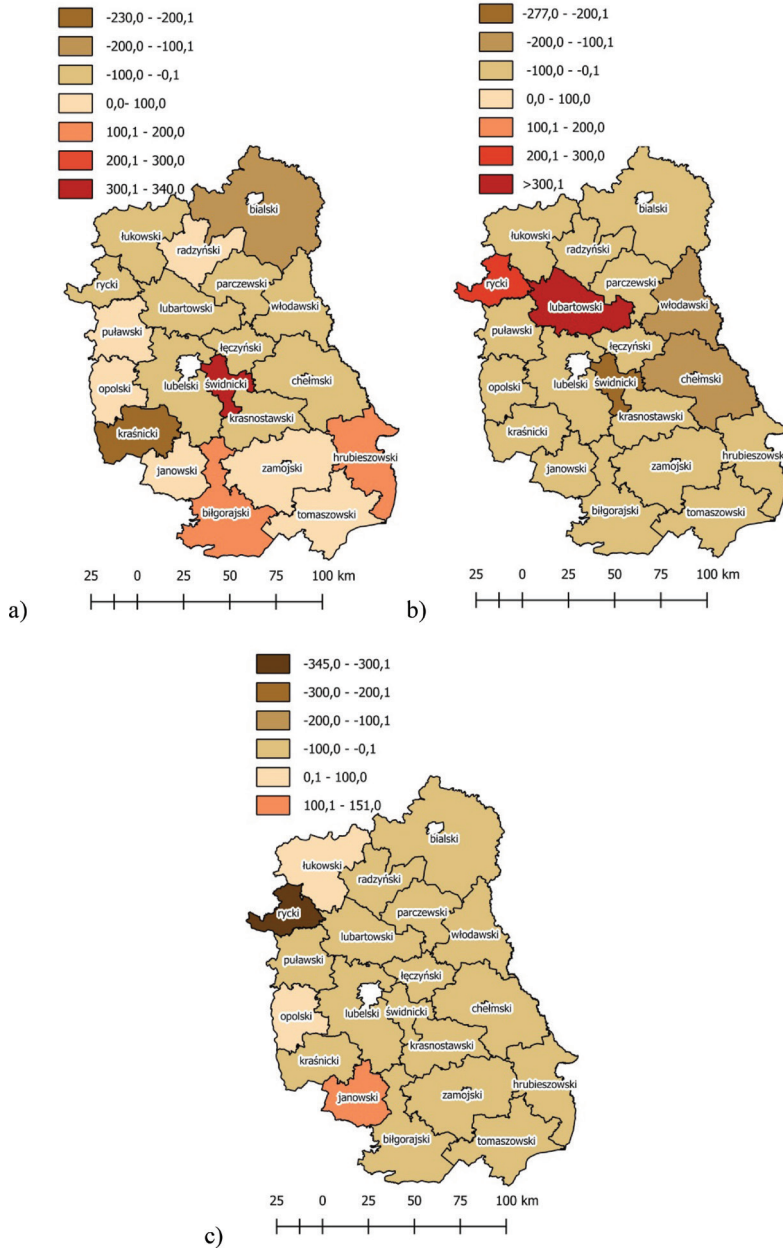
Source: author's study based on aggregate voivodeship lists of the land and building register covering the years 2004 – 2016

**Figure 2.** Changes in the area of ecological land (in ha) in the years a) 2004-2006, b) 2007-2013, c) 2014-2016



Source: author's study based on aggregate voivodship lists of the land and building register covering the years 2004 – 2016

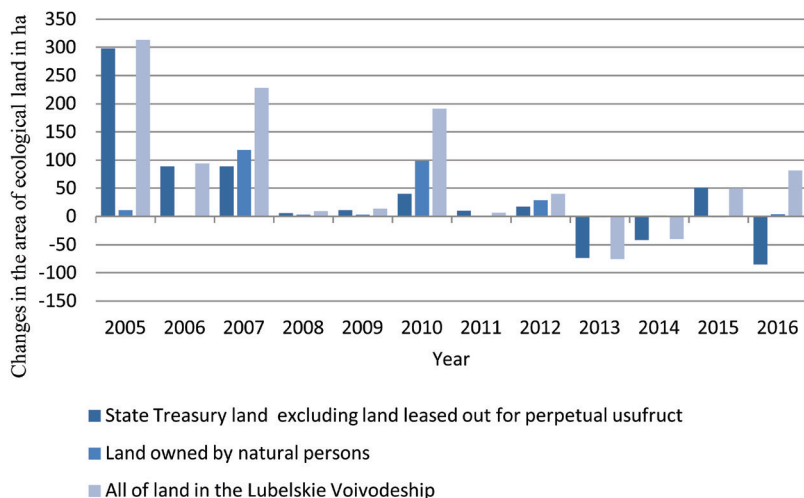
**Figure 3.** Changes in the area of wasteland (in ha) in the years a) 2004–2006, b) 2007–2013, c) 2014–2016



Source: author's study based on aggregate voivodship lists of the land and building register covering the years 2004 – 2016

**Figure 4.** Changes in the area of various land (in ha) in the years a) 2004–2006, b) 2007–2013, c) 2014–2016

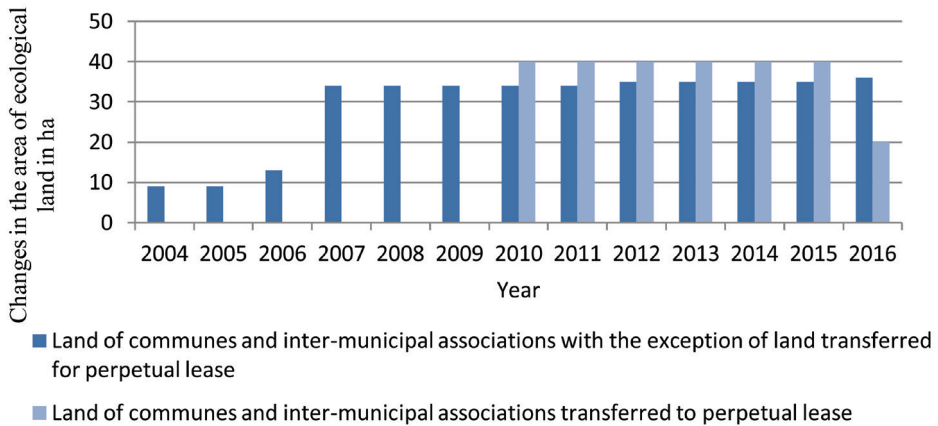
The cartograms (Figure 2) show that the greatest increase in the area of ecological land under the RDP for the years 2004–2006 was recorded in the **łęczyński district** – 23.8% (158 ha), bialski district – 74.6% (94 ha) and chełmski district – 6.7 % (74 ha). Within the framework of the RDP for 2007–2013, new ecological areas appeared in the *świdnicki* district (157 ha) and lubartowski district (54 ha); in the radzyński district, the area occupied by ecological sites increased by 23.1% (33 ha). In 2014–2016, a 13.0% (79 ha) increase in the area of ecological land was observed in the tomaszowski district and a 32.5% (49 ha) increase in the parczewski district. An interesting phenomenon is the 8.8% (92 ha) decrease in the area occupied by ecological sites in the *łęczyński* district. The increase of the area of ecological land in the Świdnicki and Łęczyński district is due to the proximity of the environment of endangered and rare species of animals and plants, as well as the presence of protected natural environment. In Świdnicki district there are such forms of nature protection as Special Area of Protection „Świdnik”, Krzczonowski Landscape Park, Nadwieprzański Landscape Park and Wierchowiska Forest Reservation. In Łęczyński district there are: Poleski National Park, Special Area of Bird Protection „Bagno Bubnów” and „Ostoja Poleska”, Nadwieprzański Landscape Park, Kozłowiecki Landscape Park, „Pojezierze Łęczyńskie” *Landscape Park* and many form of nature reserve.



Source: author’s study based on aggregate voivodship lists of the land and building register covering the years 2004–2016

**Figure 5.** Annual changes in the area of ecological land in the Lubelskie Voivodeship in the years 2004–2016 with distinction of the State Treasury land, excluding land leased out for perpetual usufruct, land owned by natural persons and all of land in Lubelskie Voivodeship





Source: author's study based on aggregate voivodship lists of the land and building register covering the years 2004–2016

**Figure 6.** Annual changes in the area of ecological land in the Lubelskie Voivodship in the years 2004–2016 with distinction of the land of communes and inter-municipal associations with the exception of land transferred for perpetual lease and land of communes and inter-municipal associations transferred to perpetual lease

The data in the cartograms below (Figure 3, Figure 4) indicate that these changes occurred mainly as a result of wasteland and various land being converted into ecological sites (a significant decline in this kind of lands).

Ecological land emerged mainly on land belonging to the 1st and 7th land register groups, i.e. State Treasury land, excluding land leased out for perpetual usufruct, and land owned by natural persons. Figures 5 show changes in the area of these sites for the above mentioned register groups, broken down by the years of the Rural Development Programme.

A smaller but noticeable increase in the area of ecological land was also recorded in the 4th and 5th registration group (Figure 6) i.e. land of communes and inter-municipal associations with the exception of land transferred for perpetual lease and land of communes and inter-municipal associations transferred to perpetual lease. However, the increase in use in the 4th registration group was noticed until 2010.

Despite the decline in the area of ecological land in the two registration groups in the 2016 year, there was a general increase of area in voivodship, caused by obtaining these lands by another register group, among others: commercial companies, political parties and associations.

The rate of growth of the area of ecological land (Figure 5) in the Lubelskie Voivodship varied over the years 2004–2016. The largest increase in the area of ecological land was recorded in the years 2004–2006 – on average 212 ha/year.

Between 2012 and 2014, there was a noticeable decrease in the area of these lands by 75 ha in 2012–2013 and by 40 ha in 2013–2014.

## CONCLUSIONS

- The study showed that, in the years 2004–2016, there was a general, 25% increase in the area of ecological land in the Lubelskie Voivodeship. However, the rate of growth was not stable: in the years 2012–2014 there was a 115 ha decline in the area of this type of land.
- The largest increase in the area of ecological land was recorded in the years 2004–2006 in the districts: łączyński, biański, chełmski. In the years 2007–2013, such an increase was observed for the świdnicki district and in the years 2014–2016 the tomaszowski district.
- The largest changes in the area of ecological land concerned the 1st and 7th land registration groups, i.e. land belonging to the State Treasury, excluding land leased out for perpetual usufruct, and land owned by natural persons.
- Ecological land in the Lubelskie Voivodeship emerged mainly as a result of conversion of wasteland and miscellaneous land areas.
- The largest increase in the area of ecological land in the Lubelskie Voivodeship occurred in 2004–2006, which was caused by the RDP's focus on supporting the protection of valuable natural facilities in unprotected areas; however, two years into the Rural Development Programme for the years 2014–2020, the increase in the area of ecological land is already 71% of the increase observed in the years 2007–2013.
- The increase in the area of ecological land indicates the importance attached to nature protection in rural areas, while supporting the development of agriculture.
- The increase observed in ecological land confirms the effective attempts of taking pro-ecological activities by commune governments and other local entities in the rural areas of the Lubelskie Voivodeship and allows for maintaining of natural environment at least unchange.

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Received: 14.11.2017

Accepted: 29.05.2018