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Analysis of Changes in Agricultural Use of Land After Poland's Accession to the EU

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Abstract:

Purpose: *The paper presents an analysis of changes in the management and use of agricultural land. The comparative study dealt with the state before Poland's accession to the EU (ex ante) and the state after nearly two decades (ex post).*
Design/Methodology/Approach: *A statistical analysis demonstrated changes in the methods of land use, which was shown in graphs. A comparative analysis of two objects on a micro-scale was performed in north-eastern Poland. Fifteen features were analysed for each state ex post and ex ante of a plot under analysis. These features applied both to land covered by EU subsidies and to land not eligible for such subsidies. The data used in the analysis included cadastral data and LPIS data.*
Findings: *The findings show that the changes in the land-use methods are not identical in each area. Currently, owing to modern methods of data acquisition, users can demonstrate different methods of land use with greater precision. Owing to regular measurements, databases on agricultural land reflect the state in the field as close to reality as possible.*
Practical implications: *The use of databases on agricultural land allows a precise evaluation of the changes. Local strategies preventing the excessive transformation of land for non-agricultural purposes can be prevented owing to permanent monitoring on a micro-scale.*
Originality/value: *The study shows changes in land use in agricultural areas after Poland accessed the European Union. The analysis performed on a micro-scale shows the actual situation in the field, which can provide the basis for implementing a strategy of land management adapted to the local conditions.*

Keywords: *Land use, agriculture land, non-productive land use, accession to the EU.*

JEL Classification: *R52, Q15, Q18.*

Research type: *Research paper.*

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1. Introduction

Variability of space in time is its permanent feature (Ellis, 2015). Changes take place in the natural environment (Degorski, 2009) and, in consequence, in the methods of land use (Statuto *et al.*, 2017). The issues associated with research of changes in land use are present in the scientific discourse, especially with respect to changes in the environment (Fan *et al.*, 2017), ecosystems (Foley *et al.*, 2005; Verburg *et al.*, 2009; Falcucci *et al.*, 2009; Leppers *et al.*, 2005), the landscape (Sallay and Jombach, 2011; Bogoliubova and Tymków, 2014), and their contribution to climate changes (Kazak, 2018; Kocur-Bera, 2018). These changes are caused by such factors as demography (Gavrilidis *et al.*, 2015), human activities (Affek, 2016; Bański, 2017) and natural and socio-economic phenomena (Boori and Voženilek, 2014; Kocur-Bera, and Dawidowicz, 2019).

Land use/cover change is a multi-disciplinary issue that needs to be considered comprehensively (Arnold *et al.*, 2020; Hao *et al.*, 2021; Mansour *et al.*, 2020). Studies on changes in land use focus on modelling space-time land transformations and on seeking causes and consequences of such changes (Garcia-Ruiz *et al.*, 1996; Lambin *et al.*, 2003; Dezso *et al.*, 2005; Pelorosso *et al.*, 2009; Harkot *et al.*, 2011; Sleeter *et al.*, 2012; Dobos *et al.*, 2014; Prus, 2019). They often regard land use as the equivalent of land cover, because the latter is a consequence of the method of the land use (Karimi *et al.*, 2017). An analysis of changes of the land cover is also a tool used to evaluate transformations of the natural environment and ecosystems – on the local, regional and global scale (Tong *et al.*, 2012, Muchova and Tarnikova, 2018). Human activity is the prime cause of global environmental changes and it exerts the greatest impact on it (Cegielska *et al.*, 2018).

Many countries, including Poland, implement procedures and legal regulations which impose an obligation to monitor and manage changes in land use (Regulation, 2013; Law, 2001). According to experts, the land cover provides the best information on environment resistance or susceptibility to changes (EC, 2000).

An interdisciplinary definition of the land cover includes the observed geo-bio-physic cover of the Earth surface, with vegetation (natural and grown) and artificial structures (buildings, roads, etc.), which cover the Earth surface making up unique compositions (Sims, 1995). The form of the cover is a consequence of anthropogenic activity and natural processes, as well as the local climate (Kocur-Bera, 2018), land physiographic features (Zajączkowski, 2016), forms of the natural and cultural landscape (Richling and Lechnio, 2005), expansions of agriculture, deforestation and urbanisation (Lambin and Geist, 2006; Ostapowicz and Sitko, 2009). There is a strong relationship between land use and its cover, as the land use is a consequence of a combination of the land cover and its utilisation (Lambin *et al.*, 2000).

The authors who make assessments of changes in land use/land cover employ multiple research methods. There are spatial and non-spatial models (Irwin and

Geoghegan, 2001), dynamic and static, descriptive, deductive and inductive models (Lesschen *et al.,* 2005; Lambin and Geist, 2006), based on the agent-based method (Giełda-Pinas, 2015), cellular automatons (Sante *et al.,* 2010; Halmy *et al.,* 2015), Markov's models (Guan *et al.,* 2011; Subedi *et al.,* 2013), economic, mechanical, linear and non-linear models (Aspinall, 2004) as well as simulation and hybrid models (Riitters *et al.*, 2007; Yirsaw *et al.,* 2017). This great diversity of directions and methods of researching changes in land use shows that the subject is very important for humanity (Prus, 2019) and the methodology is not clearly defined.

An assessment of the phenomenon is also affected by the sources of data used in the analyses. This information can be obtained, for example, from the Global Terrestrial Observing System (Sims, 1995), Land Use and Land Cover Changes or Corine Land Cover (CLC). However, these sources are so general that observation of changes in land use/cover on a micro-scale (e.g., on a plot) is impossible. Therefore, data from the Land Parcel Identification System (LPIS), which give the assumed precision, were used in the analysis performed.

LPIS is part of the Integrated Administration and Control System (IACS), developed to enable agricultural producers to obtain EU subsidies. The need to develop the IACS arose from art. 70 of Regulation (EU) No. 1306/2013 (EU 1306/2013) and art. 5 of Regulation (EU) No. 640/2014 (EU 640/2014) of the European Union. The database comprises several components, for example (a) LPIS (Land Parcel Identification System); (b) GSA (geo-spatial application) and animal-based application system; (c) Area monitoring system; (d) System for identification of beneficiaries; (e) control and penalties system; (f) where applicable, a system for the I&R of payment entitlements; (g) where applicable, a system for I&R of animals (EU, 2020).

LPIS is a very important component of the IACS, as it shows a spatial representation of land used by agricultural farms (EU, 2021). The LPIS database in Poland was founded on cadastral data (CD) as part of projects executed by two bodies, the Agency for Restructuring and Modernisation of Agriculture and the Head Office of Geodesy and Cartography. Cadastral data (CD) is part of the LAS (Land Administration System) and contains data used mainly for fiscal purposes, those related to spatial planning, identifying real estate in perpetual registers, public statistics, real estate management, etc. Orthophotomaps are prepared for the LPIS database. They are often used by other land managing entities, e.g. the State Forestry Service. They are also applied for environmental-climate purposes in accordance with INSPIRE and for statistical purposes (EU, 2020).

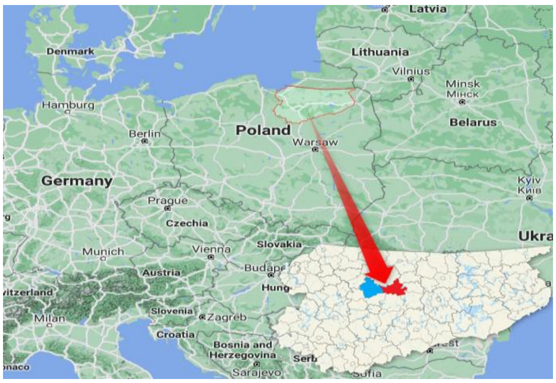
An ARMA unit is obliged to keep up-to-date LPIS reference databases and to use on a regular basis all the available source materials based on which the LPIS reference data are modified (Regulation No. 640/2014). Sources of changes in the LPIS reference data include (a) new orthophotomaps showing changes in land use; (b) information from inspection on-site by the field inspection method and the FOTO control; (c) information on changes in the method of land use, provided by the farmer on the graphic material appended to the personalised application; (d) changes that took place in cadastral data, arising from the administrative and legal proceedings (land consolidation, plot division, modernisation) (MR, 2019). Currently, there are 44 national or regional LPIS systems in the 28 member states, covering over 135 million reference plots (Kocur-Bera, 2019).

The aim of this paper is to analyse changes in the methods of agricultural land use (on a micro-scale). Changes taking place in the smallest spatial units (cadastral plot) were used for this purpose. Two states of use were compared: that of 2003, which was the last year before Poland accessed the European Union and 2019 (the time when the analysis was performed). Two databases, LPIS and CD were used, because of their assumed level of detail. Many programmes and projects (e.g., Corine Land Cover and others) offer ready-to-use imaging and qualifications of the methods of use, but the level of data generalisation and the scale of development do not allow an assessment of changes in land use/land cover, taking place within a cadastral plot.

2. Methods of Research

An analysis was performed of changes in land use for agricultural purposes which have taken place in the area under analysis during the past two decades. The land states for comparison were not chosen at random. They take into account the state before Poland's accession to the EU (ex ante) and the state after nearly two decades (*ex post*). The first phase of the analyses covered data from public statistics, whereas the second phase covered detailed comparative analyses within the cadastral plot. The comparisons were made for four villages situated in two rural communes: Dobre Miasto and Jeziorany, the Warmińsko-Mazurskie Voivodeship, the north-east of Poland. The comparison revealed the commune where the range of changes was wider. Figure 1 shows the location of the area of research.

Figure 1. *Area of research*



Source: *Own study on www.google.com.*

Approx. 10% of plots used for agriculture were chosen at random in each of the villages. For each plot, parameters were described that determine the features related to a change of range and method of use of agricultural land and land not used for agricultural production, but situated within a cadastral plot (15 features for each state). *Ex ante* 2003 data (before Poland's accession to the EU) were adopted as the primary state of data. At the same time, it was the basic source of data for the LPIS database. The *ex ante* data were obtained from the Starost's Office in Olsztyn (data management agency). They included: vector borders of a cadastral plot and agricultural land, descriptive data with identifiers and the area of cadastral plots with the type and area of agricultural land. The *ex post* data came from 2019 and were collected by the ARMA, for the purpose of redistribution of EU subsidies. They covered methods of land use according to LPIS data layers (vector reference borders, identifiers and areas of reference plots, maximum eligible areas and vector borders of fields of management). Correlations between a description of corresponding methods of use are presented in Table 1.

The data for the analysis were implemented and listed in the licensed ArcGIS software. The comparative study could be performed because in Poland (like in Italy, Spain and in Cyprus) the reference parcel was equated with the cadastral plot (ECA, 2016). A cadastral plot is a spatial object isolated under formal-legal or utilitarian conditions, associated with exercising a specific right assigned to the land, rather than strictly natural features. Therefore, the course of the cadastral plot border as shown in the cadastral data reflects the legal status established in the field (Felcenloben, 2010). A cadastral plot is then an unambiguously identifiable spatial object, whose borders provide a universal basis for determining an area when calculating and granting area-based payments and, for this reason, data from this system were used in the construction of the LPIS system, e.g., position of the cadastral plot, the area, the numerical description of the plot boundaries, the site and soil quality class (the type of land and area within the plot boundary) (Hanus, 2005).

The features under analysis compared for the *ex post* and *ex ante* state included (D1) differences between the plot area *ex ante* (cadastral plot) and *ex post* (reference parcel), within an accuracy of 0.01 ha (provided for in declarations on area in applications for EU subsidies); (D2) differences between the area non-eligible for payments in the *ex ante* and *ex post* plot state, taking into account the ARMIR guidelines (ARMiR, 2018); (D3) identification of the database, in which the plot area differences is greater; (D4) identification of the database in which the areas within a plot that are non-eligible for payments is larger; (D5) the frequency of occurrence of differences in the spatial position of the corresponding points of the turn of plot borders in the *ex post* and *ex ante* states; (D6) the frequency of occurrence of differences of more than 0.1 m (which characterises the accuracy of the border point position in the *ex ante* state); (D7) the mean distance between all the points within a plot, the mean distance between those points within the plot which are shifted by more than 0.1 m relative to each other and the largest distance between those points; (D8) mean distance between the points within a plot which are shifted by more than 0.1 m (in the set under analysis); (D9) the largest distance between points within a plot in the analysed set [m]; (D10) the consistence in the method of agricultural land use in the *ex post* and *ex ante* state; (D11) the spatial shift of the corresponding methods of agricultural land use in the *ex post* and *ex ante* state; (D12) the frequency of occurrence of such non-agricultural land in the *ex post* state which were not present in the *ex ante* state; (D13) the frequency of occurrence of such non-agricultural methods of land use in the *ex* ante state which were not present in the *ex post* state; (D14) the frequency of occurrence of agricultural methods of land use in the *ex post* state which were not present in the *ex ante* state; (D15) the frequency of occurrence of agricultural methods of land use in the *ex ante* state which were not present in the *ex post* state;

According to the ARMA guidelines (https://www.gov.pl/web/arimr/jednolita-platnosc-obszarowa-jpo-21), areas eligible for payments include: (a) all the agricultural land within a farm, including those areas which were not maintained in good agricultural culture on 30 June 2003; (b) any area which ensured the farmer's entitlement to uniform area-related payment in 2008 and which does not meet the eligibility criteria because the area is covered by protection under the directives (on natural habitat protection, framework water directive, directive of wild bird protection and/or afforestation of the area under PROW 2007-2013 or PROW 2014-2020 (afforestation from autumn 2008 - except afforestation on non-agricultural land), (c) eligible areas, owned by the farmer on 31 May of the year in which the farmer files an application, (d) eligible areas with agricultural activities conducted throughout the calendar year except in cases of force majeure or extraordinary circumstances, (e) agricultural areas (including land no longer used for production), maintained in good agricultural culture in line with environment protection, (f) approved areas, i.e. those that will comprise the area with respect to which all the eligibility criteria for aid and other obligation have been met, (g) area used for cultivation of hemp, if the cultivars grown contain not more than 0.2% tetrahydrocannabinol (THC) per dry weight, with the eligibility of the area used for hemp cultivation depending on the use of the seeds of cultivars mentioned in the common catalogue or agricultural plant species on 15 March of the year for which the payment has been granted, and published in the Official Journal of the European Union, (h) areas occupied by landscape elements, situated within land declared for payments (i.e., ditches of not more than 2 m wide, trees – monuments of nature, ponds of a total area not exceeding 100 m^2 and landscape elements, areas occupied by dirt roads, afforested strips, hedges, terrace walls, whose width does not exceed 2 m, arable land and permanent grassland with individual trees, unless their density per a qualifiable hectare does not exceed 100 trees and agricultural activities in the land is conducted in the same way as in land with no trees).

The other land is classified as non-eligible; the non-eligibility for payments also includes the area of a farm smaller than 1 ha and agricultural plots smaller than 0.1 ha.

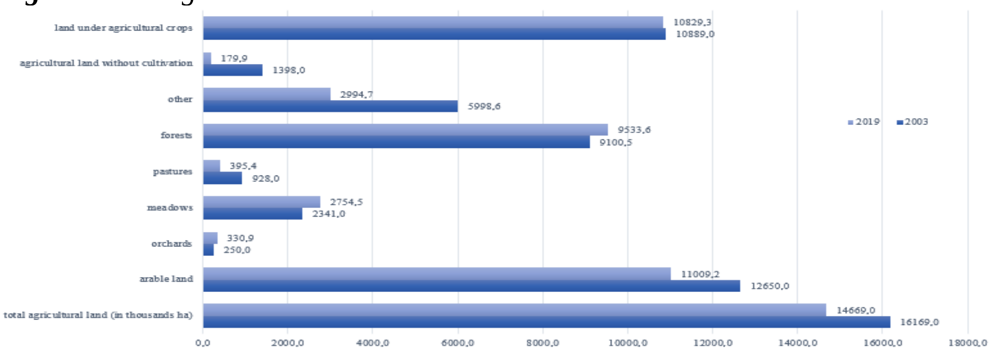
3. Results and Discussion

In 2017, Poland occupied the 61st place worldwide in terms 43 of the area of agricultural land and the 5th place among the countries of the European Union (in 2018). Agricultural land covered at the time 14.5 million ha (35.6% of total area), in Denmark – 2.6 million ha (60%), in Germany – 16.7 million ha (33.8%), France – 28.7 million ha (33.8%), Romania – 13.4 (37.0%), in Ukraine – 41.5 million ha (56,6%), in Hungary – 5.3 million ha (47.3%), in Italy – 12.8 million ha (22.8%), in India 179.7 million ha (52.6%), etc., and worldwide in total - 4827.8 million ha (10.7% of total area) (GUS, 2020).

Changes in the methods of use in rural areas following Poland's accession to the European Union are noticeable. According to the findings of comparative analyses (see figure 2), the area of land used for agricultural purposes is approx. 1,500 thousand ha larger than in 2003. The area of arable land used for growing cereals increased by 1641 thousand ha, those used for pastures – by 532.6 thousand ha, fallowed agricultural land – by 1218.1 thousand ha. The area of the other agricultural land also increased. It was at the expense of other methods of use. Among the decreased areas were forests and afforested land (by 433.1 thousand ha), meadows (by 413.5 thousand ha) and orchards (by 80.9 thousand ha). An increase in the area of the other agricultural land gave a cause for concern. It is a group of areas which is still classified as agricultural land because of the absence of local plans for them.

However, it is highly probable that in future (after an administrative decision on a change of the method of use is obtained), the land will be used for non-agricultural purposes, mainly for investment and construction. It gives a reason for concern, as its area increased during the nearly two decades by 1218.1 thousand ha. Concluding the first stage of analyses arising from the public statistics, it is difficult to accept the assumption of an increase in the area of agricultural land, as this surplus will probably be allotted for non-agricultural purposes in the nearest future.

Figure 2. *Changes in land use in 2003 and 2019.*



Source: *GUS, 2003; 2020.*

The changes in the methods of use presented in the macro scale are reflected for individual cadastral plots (the micro-scale). The second part of the analyses performed for the communes of Jeziorany and Dobre Miasto indicates (Table 2) that the frequencies of occurrence of differences in the plot area between the *ex post* (2019) and *ex ante* (2003) state is greater in Jeziorany (70%) than in Dobre Miasto (53%) (feature D3). The greatest difference in the area between the *ex post* and *ex ante* state was observed in Dobre Miasto – 0.48 ha (feature D1). There are also noticeable differences in the objects concerning the areas non-eligible for payments (feature D4). The maximum observed difference in the non-eligible areas is 2.58 ha (feature D2). An analysis of indicators (feature D1-D4) shows that the area differences in Dobre Miasto are generally greater (max. 0.48 ha for plots and 2.58 ha for the methods of use), but they are observed in a smaller number of plots than in Jeziorany (53% for the eligible areas and 12% for the areas non-eligible for payments). The area difference in Jeziorany are observed more frequently (in 70% of the eligible areas and 23% of the non-eligible ones), but they are smaller than in the other objects under analysis (0.28 ha for a plot and 0.51 ha for a method of use).

A group of features covering differences in the position of the points of turn on plot borders (Table 3) includes another six features (feature D5-D9). In both objects, the borders of all (Dobre Miasto) or nearly all (Jeziorany) plots under analysis were shifted in the *ex post* state compared to the *ex ante* state. It was observed that some differences were of a centimetre range and, in fact, they could be negligible (feature D5). In 70% of the plots under study in Dobre Miasto, a shift of the plot border in the *ex post* state compared to the *ex ante* state exceeded 10 cm (this is a consequence of the accuracy of the border point position imposed by the law). This proportion in Jeziorany was 95% of the border points under study (feature D6). The mean shift for all the points within a plot (feature D7) was 2.20 m in Jeziorany and only 0.69 m in Dobre Miasto. A similar trend was observed for the mean distance between the border points shifted by more than 0.1 m (feature D8). If a point in Jeziorany is shifted, the mean shift is 3.59 m, and if in Dobre Miasto – 2.16 m. The largest observed linear difference between the position of points in a plot in the *ex post* state relative to the *ex ante* state in Jeziorany was 27.83 m (feature D9). To summarise this part of the analyses, the D5-D9 features are generally larger in Jeziorany, as with the D1-D4 features.

The last group of features included the parameters associated with the absence of uniformity of the methods of use (Table 3) in the two states of a plot. Differences were observed in 20-23% of the plots between the *ex post* and *ex ante* state for the plots (feature D10). In general, higher consistency was observed in Jeziorany, but the borders of uniform methods of use did not always coincide and were shifted relative to each other (feature D11) (Figure 3). For example, Figure 3 shows the same method of use, but it is shifted and with a different range. The greatest discrepancies between the *ex post* and *ex ante* states were observed in non-agricultural land. The *ex ante* state was that from the year before Poland's accession to the EU. Due to the political and technological conditions, as well as a low level of motivation of the bodies maintaining agricultural land registers, and agricultural producers, the land use area borders were not identified with sufficient precision.

Figure 3. *A border shift for the same method of use.*

Source: *Own study on Geoportal2, 2021.*

Nowadays, when farmers want to obtain subsidies for their agricultural land (the *ex post* state), they have to demonstrate precisely which land is used for agricultural purposes and how, and which land is not. Sanctions and penalties, and even revoking decisions to grant EU subsidies (Kocur-Bera, 2020) for providing incorrect areas of various methods of land use, is very harsh on agricultural producers. For this reason, they indicate precisely the position of all the eligible and non-eligible land on current orthophotomaps in annual applications for subsidies. Figure 4 shows the methods of use demonstrated in the *ex ante* state (in 2003), but non-existent in the *ex post* state (in 2019). Furthermore, Figure 5 shows the reverse situation – in 2003 (the *ex ante* state), there are no methods of use on the plot, which appeared in the *ex post* plot state in 2019.

Figure 4. *Feature D12 - land use which did not exist in the ex post state.*

Source: *Own study.*

Figure 5. *Feature D13 – object (land use) which did not exist in the ex ante state.*

Source: *Own study*

In general, the frequency of occurrence of discrepancies in various methods of land use between the *ex post* and *ex ante* plot state is higher in Jeziorany than in Dobre Miasto (Table 4).

4. Discussion

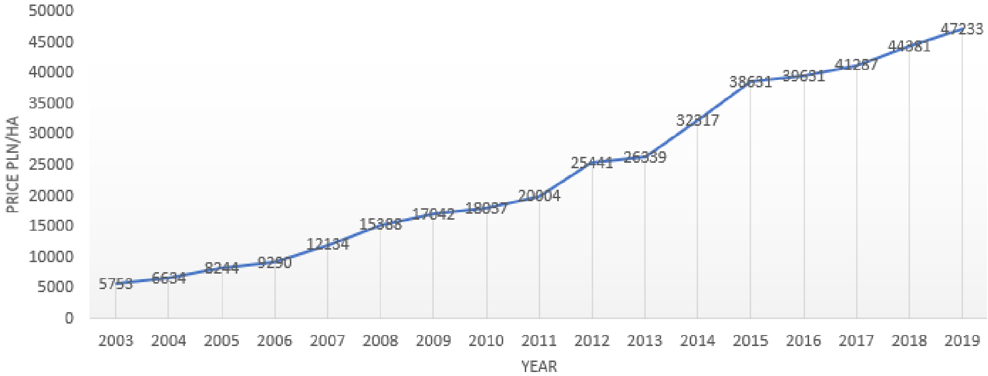
Changes in agricultural land are noticeable every day, which is why they are monitored and analysed. Such changes can be noticed by monitoring the available data on the state of land on geoportals or published as part of executed projects. Some of them, e.g., CLC (Corine Land Cover), are generalised and do not allow for a detailed evaluation of changes on the micro-scale (Kocur-Bera and Dawidowicz, 2019). The aim of this study was to evaluate changes in methods of land use in the cadastral plot scale, which is the smallest spatial unit, registered with respect to land occupation. Fifteen features were analysed for the *ex post* and *ex ante* states of the plots under analysis. The analysis revealed the area where changes in land use took place on a larger scale.

In general, the causes of the changes can be divided into two groups: exogenous and endogenous. Exogenous changes in land use, arising from external, global factors, take into account the system changes that took place after 1989 (Prus, 2019), together with Poland's accession to the EU. The system transformation in Poland involved changes in the country's political system along with economic and social changes. They were supported by changes in the law. Regarding agricultural areas, producers were given an opportunity to use programmes supporting production development.

However, they could benefit from them provided they adapted to the requirements, which resulted in a thorough analysis of each agricultural plot and the areas adjacent to it with respect to the crop cultivation opportunities. The state of plots in the first year of the analysis (2003), defined as ex ante, did not take into account many requirements, which were important in 2019 with respect to payment of EU subsidies. Since agricultural producers did not receive subsidies supporting agricultural production in 2003, they did not feel obliged to report changes in their farms to the relevant authority. They were motivated to do so by the threat of being deprived of EU subsidies.

More precise analyses of various possible methods of land use on each plot were also caused by an increased interest in agricultural land from investors. The price of 1 ha of agricultural land increased nearly tenfold during the two decades, from 5,753 PLN/ha (GUS, 2003) in 2003 to 47,233 PLN/ha (GUS, 2020) (Figure 6). Land buyers invest capital and perform analyses of profitability, taking into account income and costs. Up-to-date and precise data on agricultural land provide valuable information in the whole process and have an impact on investment decisions.

Figure 6. *Changes of arable land prices between 2003 and 2019.*



Source: *Own study on www.stat.gov.pl.*

The climate change is also a cause of changes to the borders of various methods of land use. Climate-related scenarios suggest that climate change will result in a decrease in the water balance, which decreases the areas of high surface evaporation and small retention (Serba *et al.*, 2009; Mirkowska, 2009; DePaula, 2020; Malhi 2021). It also results in an increased presence of secondary pests (insects and fungi), fire hazards, expansion of natural vegetation in agricultural land and desertification of land. Expansion of natural vegetation is a consequence of climate change. It is observed in 40% of cases in the land under study (feature D13), which contributed to an increase in the size of non-agricultural area.

Changes in land use can also be referred to the quality of data under analysis. The ex ante plot state included 2003 cadastral data. It may have had many quality anomalies. Cadastral maps in the geodesic resources were initially created by rasterisation, which impairs the quality and shape of the object being mapped (Liao *et al.*, 2012; Tomlinson *et al.*, 2018). The measurement techniques employed now ensure much better quality than those applied nearly two decades ago. Modernisation of all cadastral resources is a long-term and costly process (Noszczyk and Hernik, 2017) and although it is rather satisfactory, it has not been completed in Poland.

Real estate owners also contribute to the noticeable change in the methods of land use. Before 2003, they often neglected their duty to report changes taking place in cadastral plots to the relevant authority (Stojek, 2010; Kocur-Bera and Stachelek, 2019; Kocur-Bera and Frąszczak, 2021), as a result of which the changes were not revealed on cadastral maps, which may have affected the differences.

Anomalies in the *ex post* plot state should also be taken into account. The data were obtained from the LPIS system. Their quality is an effect of both technological solutions and human activity. One should accept the fact that the data may have been updated based on inaccurate orthophotographs, orthorectification performed incorrectly by photointerpreters without the necessary experience (Montaghiego *et al.*, 2013; Kocur-Bera, 2019; Ozcelik and Nisanci, 2016). The complicated shape of objects in the space surrounded by irregular landscape elements may have been one of the causes of noticeable differences in registering methods of land use.

5. Conclusions

The space is changing continuously and monitoring and registering those changes has been the object of research conducted by many authors because of their impact on humanity and the environment. Land cover is a consequence of land use. Society, natural phenomena and climate are among the main drivers of change in agricultural areas. Accessing unions of states, such as the European Union, also contributes to changes in the methods of land use. The analysis on the micro-scale allowed for assessment of the scale and direction of the changes. Accurate analyses on the micro-scale allow one to identify the problem areas, with possible spatial conflicts (e.g., protected areas where changes of the land cover take place). They also help to determine the direction of future actions suited to the local needs.

Modern technologies of obtaining information about land help to monitor changes in land use as they enable one to get quickly up-to-date information on land.

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