

UPDATE OF LAND USE ON THE BASIS OF SURVEYING AND ORTHOPHOTOMAP

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Abstract

The aim of the study is to show the methods of determining the borders of cultivated land and show problems during the update of their status. The current surface of cultivated land is necessary to be known in detail for calculating the exact amount of taxes and subsidies of agricultural land. Discrepancies in the measurements as well as in the use of outdated data can lead to errors in the methods of calculation. The study compared two methods based on differences in determining the land. GPS measurements and the results obtained from orthophotomap were used. The study used agricultural parcels in the possession of the Wrocław University of Environmental and Life Sciences in Lower Silesia. The research has shown differences in the determination of land borders by using different methods and sources of measurement.

Key words: Orthophotomaps, GPS measurement, land use

INTRODUCTION

Land survey issues in Poland are regulated by Act of 17 May 1989 - Geodesic and Cartographic Law. The scope of the Law covers the following matters:

- national system of land information, i.e. spatial databases, concerning specific areas, as well as procedures and techniques used for the systematic data collecting, updating and providing;
- registry of land and buildings (real estate cadastral survey), i.e. a uniform, systematically updated set of data on land, buildings and flats, their owners, as well as other natural or legal persons who manage those properties;
- state surveying and mapping stock, i.e. collections of maps and photogrammetric materials, remote sensing materials, registers, lists, databases, survey data directories and other documents prepared as a result of completed land surveying and mapping operations;
- inventories and lists of utilities, i.e. all types of overground, ground-based and underground ducts and water pipelines, sewers, gas pipeworks, district heat networks,

telecommunications, power engineering and other cabling (with the exclusion of detailed land melioration equipment), as well as registry of underground structures, such as tunnels, underground passes, parking yards, tanks, etc. (Act of 17 May 1989)

Land and Property Register, according to the Polish law, is a unified for the country, regularly updated collection of information about land, buildings and premises, their owners and other natural or legal persons managing the land, buildings or premises. (Regulation, 2015; Regulation, 2001). According to the Law, data included in the Land and Building Register provide a basis for: business planning and spatial planning, as well as public statistics, taxation and benefits, and marking of properties in Land Registers (Surowiec Stanislaw, 1982). The register covers the whole territory of the Republic of Poland, without any areas of the territorial sea. The head of the district leads Land and Property Register and Soil Classification Register.

According to the Polish law the land use is continuous area of land, separated due to a uniform usage. There is eight land use types.

According to the Polish land register, agriculture areas comprise arable land, orchards, grassland, and pastures. Forests and forest land include areas with a minimum surface area of 0.1 ha containing tree stands and areas temporarily devoid of tree stands. Settlement areas are further divided into developed, non-developed, and green areas. Developed settlement areas are then further divided into housing, industrial, and other areas. Other developed settlement areas include land plots with buildings connected with the government, education, health care, services and worship. The non-developed settlement areas encompass the areas that are situated in the settlement investment zone and are not intended for agricultural or forest purposes, but have not been developed (non-developed plots that are not used in any other manner). The green areas include recreational and sports areas, and plots with historic buildings. In Polish Register there is also a category like: wasteland, land under water, ecological areas and other unclassified lands. Every land use has its own symbol, for example: ecological land has "E" as a symbol, wasteland – "N", forestlands – "L". The symbols and classification is defined in Regulation of the Minister of Regional Development and Construction of 29 March 2001 on the registration of land and buildings (Regulation, 2015; Malina Ryszard, Kowalczyk Marian, 2009).

According to the Polish law, the allocation of land to the various land use is determined by:

- 1) the information contained in the documentation of soil classification of land,
- 2) the actual way of using the land determined by the criteria of Annex 6 of Regulation of the Minister of Regional Development and Construction of 29 March 2001 on the registration of land and buildings.
- 3) The findings contained in the existing legislation concerning the internal waters and land use (Regulation 2001; Regulation, 2015).

The aim of the work is to analyze the accuracy of the course of borders of land use, their measurement to determine the new boundaries using GPS measurement and the calculation of the area of new land use and update area accordance with applicable law.

MATERIALS AND METHODS

In order to update the cultivated land boundaries were used: orthophotomaps of selected area, surface data from the Agency for Restructuring and Modernisation of Agriculture ARMA and GPS survey data.

The data, collected from the Agency for Restructuring and Modernisation of Agriculture ARMA, Land and Property Register and Geodesy Documentation Centre, have been analysed and used to calculate the area changes for selected area (parcel number 103/4 in the village Janowice Wielkie, close to Jelenia Gora city, Lower Silesia District – Figure 1). The land use boundary of selected parcel has been calculated two times with data from two sources: orthophotomap date and GPS survey data. The program C-GEO was used to calculate the surface of parcel and land uses.



Figure 1. Topography map of the area (Source: geoportal.gov.pl)



Figure 2. Boundary map of the selected area

RESULTS AND DISCUSSIONS

Update of land use is important for the cadastral system. Data registration fulfill its task only if these data are up to date.

Calculation of taxes or subsidies based on these data. Information contrary to the facts lead to false calculations of charges. Outdated data make difficult any work associated with land development and spatial planning.

According to the "Act of 18 December 2003 on the National Register of Producers, Register of Farms and Register of Applications for Payment", the Agency for Restructuring and Modernisation of Agriculture ARMA, creates and carries out the National Register of Producers, Register of Farms and Register of Applications for Payment. One of the components of the national system is the Land Parcel Identification System LPIS. The Agency for Restructuring and Modernisation of Agriculture provides the cadastral data in a WMS service within the Polish territory with the exception of some larger cities. The shared layer contains information about the approximate boundaries of the parcels. Therefore, they can be used only for the approximate identification and spatial location of the parcel and to estimate its area. Cadastral

data is not the Land and building registration within the meaning of "Regulation of the Minister of Regional Development and Construction of 29 March 2001 on the land and building registration". Register of Applications for Payment is based on data from orthophotomaps. These data are more current than data from the Land and Building Register.



Figure 3. Orthophotomap of the selected area – the parcel 103/4

Table 1. The current state (before the update) for parcel 103/4

	Number of parcel	Surface of parcel [ha]	Type of land use	Soil class	Surface of land use of selected parcel [ha]
1	103/4	40.7597	Ls	III	0.1878
			Ls	IV	4.2948
			Ł	V	0.1609
			Ps	IV	31.4237
			Ps	V	4.6925
					40.7597

Table 2. The new state (after the update) for parcel 103/4

	Number of parcel	Surface of parcel [ha]	Type of land use	Soil class	Surface of land use of selected parcel [ha]
1	103/4	40.7597	Ls	III	0,1610
			Ls	IV	9.6820
			Lz		0.0989
			Ł	V	0.1406
			Ps	IV	26.4764
			Ps	V	4.2008
					40.7597

Ls – forest area

Lz – bushes and wooded area

Ł – meadow/ grassland area

Ps - pasture area

Table 3. Differences between surfaces of annualized area

Number of parcel	Surface of parcel [ha]	Surface of forest areas [ha]	Surface of agricultural area, which are used PU	The area reported to subsidies Pz	Surface from orthophotomaps data PA	The difference Pz - PU	The difference of surface PA - PU
103/4	42,04	9,73	32,31	37,28	32,18	4,97	-0,13

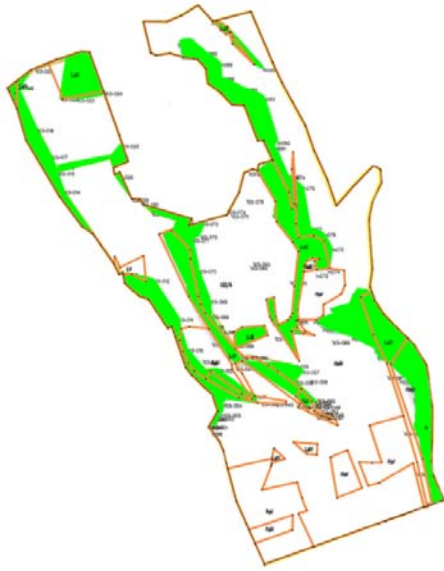


Figure 4. The differences between GPS and orthophotomap measurement on map – parcel 103/4
Green colour – forest land: GPS measurement, orange lines: orthophotomaps measurement
(Source: own work, program C-GEO)

Table 1 and 2 shows the differences between the current state and the new state. GPS Survey showed the changes that have taken place in the parcel. It has changed the amount of land use and their size. It has grown forest area, it has appeared bushes and wooded areas. Agricultural areas (pastures and meadows) accounted for 36.2771 ha (89%) in the parcel and other areas (forests) 4.4826 ha (11%). After measuring, the situation has changed: the new state of the surface of the agricultural land is 30.8178 ha (76%) and the forest area is 9.9419 ha (24%). The area of agricultural land decreased by 13%. The largest decrease was observed in the surface of pastures, class IV and the area decreased by 4.9473 ha (by 16% of the state before measurement). The changes are shown on Figure 4. This situation is caused by bad agricultural procedures and practice. The decrease in agricultural area resulted in a reduction of subsidies for these areas.

Table 3 shows a surface summary. The calculated differences showed surface changes. It showed that the actual surface, which is declared for subsidies, it is about 4.97 ha less than previously declared. Another difference

showed changes between the measurement surface using GPS and orthophoto. The difference is 0.13 ha (0.4%). The most precise measurement technique is a GPS method. However, it is more labor intensive and costly method. Measurement using orthophoto is less accurate, but for the purposes of subsidies, the accuracy is sufficient.

CONCLUSIONS

Orthophotomap is an effective tool for obtaining data on current land use.

Calculated surfaces are close to the measured surface of the orthophotomap. It testifies to the fact that to determine the land area is preferable to retrieve data from aerial and satellite materials than the materials from the land register, because these are not updated for a long time.

Calculations showed a discrepancy between the survey surface of parcel and cadastral surface of parcel.

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