

ALEKSANDRAS STULGINSKIS UNIVERSITY (Lithuania)

LATVIA UNIVERSITY OF AGRICULTURE



**Aleksandras  
Stulginskis  
University**



# **BALTIC SURVEYING**

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## FOREWORD

BALTIC SURVEYING (ISSN 2255 – 999X) is international scientific journal. The periodicity of the journal is 1 or 2 volume per year.

Universities from Latvia and Lithuania joined their efforts to publish international scientific journal BALTIC SURVEYING. It is jointly issued by:

- Department of Land Management and Geodesy of Latvia University of Agriculture
- Institute of Land Use Planning and Geomatics of Aleksandras Stulginskis University (Lithuania).

In the 3<sup>rd</sup> volume of the journal are included original articles on land administration, land management, real property cadastre, land use, rural development, geodesy and cartography, remote sensing, geoinformatics, other related fields, as well as education in land management and geodesy throughout the Baltic countries, Western and Eastern Europe and elsewhere. The journal is the first one in the Baltic countries dealing with the issues mentioned above.

This scientific journal contains peer reviewed papers. For academic quality each paper has been reviewed by two independent anonymous academic reviewers having Doctors of science degree. Editorial Board has made the final decision on the acceptance for publication. Each author is responsible for high quality and correct information of his/ her article.

We believe that in the future scientists from other foreign countries will become authors of research articles, and the topics of articles will range widely.

We believe that journal will disseminate the latest scientific findings, theoretical and experimental research and will be extremely useful for young scientists

Scientific journal BALTIC SURVEYING already is indexed in Agris database. Published scientific papers will be submitted to CAB Abstracts and EBSCO Academic Search Complete databases. The data bases select the articles from the proceedings for including them in their data bases after individual qualitative and thematic examination.

Volume 3 is compiled by Department of Land Management and Geodesy of Latvia University of Agriculture. Address: Akademijas iela 19, Jelgava, LV-3001, phone +37163026152, e-mail: [lifzige@llu.lv](mailto:lifzige@llu.lv)

Editorial board

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# PROBLEMS OF RURAL AREAS MANAGEMENT IN LITHUANIA

**Audrius Aleknavičius, Marius Aleknavičius**

Aleksandras Stulginskis University, Lithuania

## **Abstract**

The article analyses the changes of agricultural production development and the demand of rural planning in the post-reform period. The main aim of the research is to identify the problems of land use and the formation of farms as the territorial-production structures in Lithuania as well as to analyse the possibilities of finding solutions to them. Tendencies of the decrease of the number of rural residents and farms were determined, the regulation of which is possible by improving working and living conditions in rural areas by means of public support measures. In order to form land holdings of rational farms, to coordinate the residential construction, farmlands and the local road network, to preserve efficient agricultural land, it is suggested preparing the documents of land management planning. The implementation of these documents is associated with the regulation of the land use provided for by legislation, formation of cultural landscape, as well as with the EU and public support for the development of production of viable farms and environmental protection. It is recommended to supplement the rules of the preparation of documents of land management planning with methodological requirements for the arrangement of land parcels and for their conversion into other agricultural areas.

**Keywords:** rural residential area, cultural landscape, lands, land holding of farm, documents of land management planning.

## **Introduction**

After the Restoration of an Independent State of Lithuania in 1990, the reorganisation (return of private land, reorganisation of large agricultural companies, etc.) which started at that time had a great impact particularly on the territories used for agricultural activities. The management of these territories is associated with the development of farms which can function according to the conditions of market economy. However, due to various reasons the transition into the new structure of farms was not successful, as favourable conditions for efficient farming do not prevail everywhere. The main factor which is considered to halt the development of the sector of competitive agriculture is fragmented structure of farms, which is characterised by small farms and fragmented one-farm land parcels, as well as the lack of co-operation and the ageing of farmers (Nacionaline..., 2016). In order to support agriculture until accession to the European Union (hereinafter referred to as the EU), Lithuania was given support according to the Special Accession Programme for Agriculture and Rural Development (SAPARD). Later on, when Lithuania became a member of the EU, the opportunity to use the EU funds from the European Agricultural Guarantee Fund (EAGF) was created. The given funds were used purposefully according to the set priority directions. The majority of funds was designated for the funding of measures related to the competitiveness of agricultural products and forestry sectors, environmental protection and the preservation of biodiversity. The activity fulfilling these directions is also supported respectively during the funding period from 2014 to 2020. The EU Common Agricultural Policy provides the support according to the national programmes, which set out the following priorities for the strengthening of farm economy and management of rural areas: “to increase the viability and competitiveness of agriculture of all types...; to restore, preserve and improve ecosystems related to agriculture and forestry; to promote the efficient use of resources and support the transition to climate-resilient low-carbon economy of technologies in agricultural, food and forestry sectors... ” (Zemes ..., 2016).

Scholars who analyse problems of agricultural development and territorial land management stress out the positive influence of the EU and public financial support on the strengthening of farm economy and environmental protection. It is stated that direct payments constitute the greatest support to farms, though a greater flexibility is needed for their criteria of distribution (Jurkenaite, 2011). It is important to analyse the factors which have an influence on the economic viability of farms (currently it is mainly funded with public support), which is suitable for the use of land designated for agricultural purposes (Savickiene et al., 2012). Research conclusions suggest improving the spatial planning in the territories of municipalities indicating that these activities would create opportunities to improve the protection of biodiversity, also suggest ensuring the stability of landscape, applying the principles of sustainable development (Arimaviciute, 2011). The measures of the rural development programme to the multifunctional agricultural development, improvement of infrastructure, promotion of activities of communities and other measures can improve the image of rural areas, make them attractive to live in,

work and invest into (Atkociuniene et al., 2011). Furthermore, when it was found out that this farming method is relatively more effective in livestock farms, the policy of agriculture support was suggested to improve the attractiveness of livestock farming (Balezentis et al., 2014). It is noted that the equalisation of competitive conditions to all countries of the EU in the field of agriculture would allow to restore the previous livestock farming potential as well as to improve the farming culture, and the agrarian landscape in Lithuania (Pranckietis et al., 2010). However, some researches focus on the search of criteria of development of forest areas and other ecologically important areas rather than the investigation of possibilities to apply agrarian theories to intensive agricultural activities, or the analysis of problems of preservation and improvement of agricultural land. It is particularly relevant to the regions of infertile land. It is stated that in the most unproductive lands where the number of rural residents decreases rapidly, the traditional agricultural activity is not promising (Ribokas, 2013). It is recommended to prepare the documents of territory planning with regard to landscape reorganisation, in order to achieve such proportion of areas of lands so that natural lands would relatively constitute 60% of the territory of Lithuania, and anthropogenised land would constitute 40% (Kavaliauskas, 2014), even though this would reduce intensively used areas of arable land to a greater extent.

The majority of legislative requirements and scientific recommendations to the rational use of land designated for agricultural purposes can be introduced by preparing the rural development projects of land management to reorganise the land holdings of a farm (Aleknavicius et al., 2016). In order to set the most important tasks and conditions of the planning, a more detailed analysis of the problems to be solved is necessary.

*The aim of the research* is to set the problems of the formation of the territorial-production structures of agriculture and the use of land in Lithuania and to analyse possibilities of finding solutions to them. Research tasks:

- to analyse the development of land holdings of farms and the demand of their stabilisation;
- to investigate the structure of rural residential areas and present proposals for the planning of new homesteads as well as the arrangement of road network;
- to establish the changes of the structure of lands and prepare suggestions to the planning of their rational arrangement by preparing the documents of land management planning.

*Research methods.* Carrying out the research, the analysis and synthesis of documents as well as mathematical statistical methods were used. The legislation of the Republic of Lithuania, the sources of scientific literature as well as the data published by Statistics Lithuania, National Land Service under the Ministry of Agriculture of the Republic of Lithuania (hereinafter referred to as NLS), State Enterprise “Agricultural Information and Rural Business Centre”, State Enterprise “Centre of Registers”, State Enterprise “State Land Fund” were used in the research.

## **Results and discussion**

### **1. Stabilisation of land holdings of farms**

One of the aims of the reconstruction of land relations initiated in 1991 and the restructuring of agricultural companies was the creation of the system of competitive farms functioning according to the market economy conditions. However, the area of privatised (returned) land for one farm of a natural person, who starts an individual activity under a business certificate, was approximately only 6 ha, and other manufacturing facilities were constituted mostly of a small part of privatised property of agriculture companies (buildings or agricultural machinery). The economic situation being difficult and the public support being limited, a lot of persons, who started farming, terminated their activity. This process is also related to the decrease of the number of rural residents (the migration of working-age people to cities and other states), as well as with the policy of the public support to the agriculture, which supports large farms, implementing an intensive agricultural production to a greater extent. For example, implementing the programme of Lithuanian rural development for 2007–2013 till the end of 2015 123.56 thousand persons received payments for the retirement (139.9 million Euros). However, this decrease in the number of families, participating in agricultural activity, had a particularly great impact on dairying: the number of cows in Lithuania decreased by 99.3 thousand (24.9%) in the period from 2007 to 2016.

Supporting the modernisation of agricultural production by the public and EU funds, the opportunities for farms to cultivate larger areas of lands are created in the country, however, some small farms become uncompetitive. As it can be seen in Table 1, during the period from 2007 to 2016, the number of farms



using up to 10 ha of agricultural land decreased in Lithuania by 57.5 thousand (37.6%), and the number of farms using more than 50 ha of agricultural land increased by 3.4 thousand (45.3%).

**Table 1**

**Agricultural land in farms of natural persons and legal persons in Lithuania**

Indicators	Declared area of agricultural land, ha						Total
	up to 3.0 ha	3.01–10.0 ha	10.01–50.0 ha	50.01–200.0 ha	200.01–500 ha	> 500 ha	
Number of farms, thousand: Year 2007 Year 2016	68.7	83.9	37.6	6.1	1.0	0.4	197.7
	42.0	53.1	31.0	8.7	1.7	0.5	137.0
Declared area in 2016: thousand ha percent for one farm, ha	86.8	301.7	639.8	828.0	515.1	525.6	2897.0
	3.0	10.4	22.1	28.6	17.8	18.1	100.0
	2.1	5.7	20.6	95.1	297.6	1070.6	21.2

*Source: Agricultural Information and Rural Business Centre*

From the data of Table 1 it can be stated that farms of unequal size will further exist in Lithuania, thus causing the diversity of specialisations of production and economic relations. From the perspective of these territorial-production structures as the formation of long-term economic units it is important to achieve the stability of land holdings of farms while preserving lively rural societies and activity of people living in villages. According to statistics, the number of rural residents in Lithuania approximately decreased per year as follows: during the period from 1989 to 2011 – by 14.6 thousand residents (1,2%), during the period from 2011 to 2016 by 13.4 thousand residents (1,2%). Under these tendencies of changes, there will be less than 900 thousand rural residents in Lithuania in the short term and up to 120–130 thousand farms of various size.

In order to solve the problems of the decrease of the number of rural residents and farms, it is suggested improving the laws in such a way that the support for the agricultural and rural development could be associated with the documents of land management planning. It is appropriate to support the economic activity of families living in a village by public economic and legal measures so that a sufficient amount of income would be ensured to promote co-operation. It is also necessary to control the development of land holdings of large farms as transport costs and the prime cost of production increase by using land parcels which are remote from the economic centres, and small farmers living in this area do not often have an opportunity to increase their land holdings. To optimise the land holdings of farms, it is appropriate to prepare land management schemes which would provide for the perspective boundaries of land holdings, and to specify the laws, regulating the provisions of land acquisition of agricultural land: according to those provisions, agricultural activity subjects would have the priority to purchase land parcels only in the perspective boundaries of land holdings of their farms.

**2. Residential construction in rural areas**

Reforms carried out by the government, i.e. the Vokok Reform (16<sup>th</sup> century), the division of countries into granges in the first half of the 20<sup>th</sup> century, and the reconstruction of agrarian areas in the period from 1950 to 1989 (collectivisation of farms, large-scale complex land reclamation, the destruction of granges and the construction of settlements of large agricultural companies) were of the greatest influence on the structure of rural residential areas in Lithuania, Due to this reason, the complex system of the arrangement of homesteads is developed in village – from large towns to compact settlements of various sizes, grange-villages and granges, existing in former land holdings. According to the research data (Aleknavicius et al., 2014), in settlements having more than 100 residents there were 73.2 % rural residents and in smaller settlements and in grange-villages there were 26.8 % rural residents in 2011 (Table 2).

**Table 2**

## Arrangement of rural residential areas in Lithuania

The classification of residential areas	The number of residential areas (villages, towns)	The number of residents		The average size of residential area (the number of residents)
		Year 2011 thousand residents	The changes during the period of 1989–2011 per cent	
Suburban rural settlements (up to 2-3 km from city or municipality centres)	378	174.2	+18.7	461
Towns and nearby large villages	682	287.8	-15,9	422
Other separately located large villages - former central or auxiliary farm settlements > 100 residents	1447	279.9	-12.2	193
Small countries and hutors	14300	271.9	-28.5	19
<b>In total:</b>	<b>16707</b>	<b>1013.8</b>	<b>-14.7</b>	<b>61</b>

Sources: *Statistics Lithuania, Aleknavicius et al., 2014.*

The construction of new residential buildings has an influence on the stabilisation of the decrease of the number of rural residents. Persons, whose own land parcels are located in the territories designated for the urban development, have an opportunity to build homesteads in a rural area. They are planned by preparing general plans; mostly they are territories designated for the development of cities and large rural settlements and for the increase of the compactness of building of residential places, having an attraction of residents. Furthermore, for this aim the users of agricultural land designated for agricultural purposes, i.e. farmers can build residential buildings and agricultural factory buildings in the chosen locations according to land management projects of rural development. The residential construction, regulated by these documents of territories planning is based on the following arguments:

- the settlement of families in a rural area may retard the decrease of the number of rural residents and restore disappearing villages and granges;
- during construction, a part of the capital accumulated in cities will be used for the needs of rural residents, i.e. the improvement of roads, the increase of employment of residents of these areas;
- with more residents in village participating in agricultural activity, the intensity of the use of land would increase, more focus would be drawn on the improvement of economic characteristics of land;
- with more educated and initiative people and young families settling in, the rural societies would be strengthened.

The need to build homesteads in land designated for agricultural purposes situated in rural areas is illustrated by the fact that in the period from 2008 to 2015 there were approximately 1170 rural development projects of land management prepared per year in the country. The problems of the process which are needed to be solved: 1) the majority of homesteads are built not for permanent residency but for seasonal free time spending; 2) some new homesteads are arranged not coordinating them with other landscape components as they are planned only according to the arrangement of land parcels possessed by land owners. In some places, particularly in recreational areas, the concentration of homesteads may be very high; 3) rural development projects of land management are prepared in order to choose the place of farmer's homestead only for one land parcel, in which only a construction site and access road are provide for without analysing the questions of the development of production of the whole farm and the management of its territory.

From the perspective of the formation of cultural agrarian landscape (it is considered as a rural landscape, having the features of agricultural activity, the management of which is affected by human economic activity and measures of land improvement), the establishment of new residential homesteads should be solved by coordinating all long-term territorial elements: the network of roads and drainage systems, other engineering communications, territories which could be urbanised or used for agricultural or forestry purposes (arable land, forest and natural land). The problem would be solved if the arrangement of farmers' homesteads were envisaged during the preparation of documents of land management planning, in which all the most important questions regarding the coordination of territorial elements would be tackled in a comprehensive manner: by preparing the land management schemes of

municipalities or territories of their elderates as well as the rural development projects of land management to a land holding of a large farm or the territory of the whole village.

### **3. The improvement of road network**

The length of road network in Lithuania was determined by dense arrangement of residential areas and the significant differentiation of lands. Until the land reform, the total length of all roads falling into 100 ha lands constituted 2.6–2.7 km in areas of plains, 3.1–4.6 km in hilly areas, approximately 3.5 km in lands designated for agricultural purposes. Out of them, public roads constituted 17%, local roads with a roadbed and road surface 28%, dirt roads 55%. The network of local roads was considerably changed by complex land reclamation performed in the period of 1950–1989, during which approximately 2.5 million ha of waterlogged lands were drained, 17.5 thousand km of intensively used local roads with a roadbed and a firm surface were improved or rebuilt. The density of these roads was planned to increase more as according to the data of projects of internal land management of farms, the length of intensively used roads should reach approximately 1.5 km in 100 ha of the total area. After analysing the land management schemes of the arrangement of local public road network of territories of municipalities, which were prepared in the period from 2006 to 2016, it was determined that in Lithuania approximately 8 km of local roads fall into 1000 ha of total area, however approximately 1/3 of these roads is dirt roads. There are only 5–25 per cent of roads in good condition. According to the solutions of schemes, administrations of municipalities are responsible for the management of roads of general use which are assigned to them. However, other local roads that are in need to be improved are not provided for in these schemes.

After the return of land when the private land ownership prevail, the total length of roads in agrarian territories should increase more due to accesses not only to residential areas but also to every separate land parcel (till the end of 2016 there were 1.3 million land parcels designated for agricultural purposes and 0.2 million designated for forestry purposes registered in the Register of Real Property). The majority of roads, particularly accesses to residential homesteads have to be appropriate to access in every season, and their duration of use should not be shorter than the duration of use of buildings or parcels of arable land, for which the roads are designated to serve. The precise planning of the arrangement of these local roads is necessary to separate public and local roads (including those assigned to municipalities) of the general use, which have to be in public land (it cannot be privatised or privatised stretches of road are redeemed from owners) and private roads, as well as to set easements necessary for the use of roads, which are in a private land.

The arrangement of local roads network planned in land management projects of land reform is not precise yet, there are a lot of litigations regarding the conditions of accessibility and land easements. In order to solve the problem, it is suggested designing the road network necessary for the activity of owners and users of real property objects in the land management schemes of the parts of territories of municipalities (elderates, cadastral areas) or in rural development projects of land management prepared to the reorganization of land holdings of large farms. Carrying out the analysis of the current state, public roads should be marked according to their categories in these planning documents, as well as roads of municipalities, other public roads which are in public lands, other roads which are necessary to access residential homesteads and economic objects, other roads necessary to access the areas of arable land, forests, meadows etc. only during the time of seasonal works. Out of them, to the intensively used stretches of road, the width of a road and roadbed as well as the necessary measurements of management should be indicated in the main drawings of plans. It should be necessary to guide by these documents of land management planning in all cases preparing projects of land holdings which envisage the formation of new land parcels as well as the division and amalgamation of existing land parcels.

### **4. Rational arrangement of agricultural land**

Besides buildings, roads and hydrographical network, lands used for different purposes prevail in rural agrarian landscape, i.e. arable land areas, meadows, forests, trees and shrubs, marshes and other. The reorganisation of their arrangement depends on human economic activity and conditions of the land use regulated by a state. It is sought to form areas of arable land by conditions of an intensive agricultural production in such a way that they would be better adapted to mechanised agricultural works by their area and form. Furthermore, it is necessary to preserve parcels of natural or relatively natural lands important to soil, water and environmental protection in these territories. These parcels have to be protected by users of land as ecologically important elements of the landscape. After declaring that an appropriate use of land is the public interest and land designated for agricultural purposes is a limited

natural resource of an exceptional value (Lietuvos..., 2005; Lietuvos..., 2006a; Lietuvos..., 2006b), restrictions of the use of land which are imposed to private land owners also acquire a legal basis. In special conditions for land and forest use approved by the resolution of the Government of the Republic of Lithuania, it is established that it is forbidden 1) to drain and transform into agricultural lands and water: bogs and mires as well as their swamp areas; fens, whose area is more than 0.5 ha and the depth of peat is higher than 1 m, and their swamp areas; 2) to drain and plough up flooded or arid meadows and pastures if they have not been ploughed for at least 25 years and natural meadows prevail there (Lietuvos..., 1992). These and other restrictions as well as requirements not to reduce the area of efficient lands are legislated in the Republic of Lithuania Law on Land of (Lietuvos..., 2004b). According to Article 21 of the Law, land owners and other users must: “1) use land according to its proper purpose of use; 2) comply with the special conditions of land use established for the land plot, with requirements set in documents of territory planning or projects of land holding; 3) use the land rationally and preserve agricultural and recreational land, forest, water bodies, mineral resources and other natural resources the exploitation of which has been permitted as well as the landscape properties; 4) implement measures as provided by law and subordinate legislation for the protection of land, forest and water bodies from pollution, for the protection of soil of farming land from erosion and exhaustion, for environmental protection so as to put a stop to the deterioration of the ecological situation.” Article 22 of the Law states that “the areas of lands consisting of ecologically valuable forests as well as trees and shrubs having the protective value of soil and water, also marshes, stony land, natural meadows and pastures which are marked in territory planning documents or land holding project have to be used with respect to the requirements of the formation of the landscape and environmental protection.”

These provisions are practically implemented only when cartographical material with exact arrangement of lands and boundaries of land parcels used for various purposes are obtained. Cadastral data, in which the conditions of the use of special land and forest are entered, are prepared according to the documents of land management planning. During the formation of land parcels, land management projects of land reform were considered to be the documents of planning; during the reconstruction of private land parcels, plans of land holdings are prepared, and when the conditions of the land use and the composition of lands (their contours, type or the use) are changed, land management schemes and rural development projects of land management are prepared. It is most reasonable to prepare these projects not for a land parcel but for the whole land holding of farm as the territorial-production unit. Then the following questions listed in Article 39 of the Law on Land could be answered to this territory: the measures of landscape formation; the measures of the protection and improvement of agricultural land soil; the arrangement of the main inland roads which are necessary for agricultural activity; the construction, reconstruction and renovation of reclamation buildings; land areas which are appropriate to afforest; the formation of arable land parcels (agro-economic parcels) containing similar characteristics and the establishment of their recommended use. Law on Territorial Planning of the Republic of Lithuania (Lietuvos..., 2004a) regulates that land management documents of the special planning of territories are mandatory to owners and users of land parcels as well as to other persons (Article 22 of the Law).

Since these special plans/planning documents of land management have not been prepared so far, the unregulated change of the composition of lands is possible, which fails to meet the requirements of the protection of valuable agricultural land and the formation of cultural landscape. The analysis of the change of the structure of country's lands disclosed that the areas of meadows and natural pastures decreased and the areas of cultivated agricultural lands increased in the pre-reform period due to the great extent of reclamation works. In later period, the areas of agricultural lands decreased due to the lack of the necessary amount of funds for the reconstruction and new construction of drainage systems. Due to the afforestation of land designated for agricultural purposes promoted by the state (e.g. in the period from 2006 to 2014 the area of annually afforested areas of private land owners constituted approximately 2.7 thousand ha each) and due to the conversion of lands naturally overgrown with trees into forests, the area of forests approximately increases by 7.8 thousand ha per year (Table 3).

Table 3

Changes of lands in Lithuania in the period from 1947 to 2016

Lands	Area, thousand ha			Changes, approximately per year			
	1947 11 01	1985 11 01	2016 01 01	thousand ha		per cent	
				Year 1947–1985	Year 1985–2016	Year 1947–1985	Year 1985–2016
Meadows and natural pastures	1262.2	560.0	320.1	-18.5	-7.7	-1.46	-1.38
Arable land, gardens and other agricultural land	2757.4	3113.3	2983.2	+9.4	-4.2	+3.4	-1.35
Forests	1234.1	1955.4	2198.5	+19.0	+7.8	+1.54	+0.40
Trees and shrubs, marshes	338.1	222.9	229.5	-3.0	+0.2	-0.90	+0.01
Roads and built-up areas	287.1	272.0	342.5	-0.4	+2.3	-0.01	+0.84
Other land and water	591.1	406.5	413.8	-4.9	+0.2	-0.82	+0.01
<b>In total</b>	6470.0	6530.1	6528.6	x	x	x	x

Sources: National Land Service under the Ministry of Agriculture of the Republic of Lithuania; State Enterprise "State Land Fund", Land Cadastre 1989

The problem of management of agrarian landscape consists of the possible further decrease of the agricultural land area in territories necessary for the development of farm production, increasing the areas of forests respectively. According to the data of the declaration of agricultural lands and crops, in 2016 land to be used (i.e. excluding meadows and perennial pastures > 5 years) constituted 2190 thousand ha out of the declared area of 2897 thousand ha for corn, rapeseeds and other crops of annual plants, and this is even less than the area of forests in Lithuania established according to the land accounting. This further disproportionate change of the structure of land areas used for the activity of two main production branches, i.e. agriculture and forestry, has to be controlled by legal measures, i.e. by preparing documents of land management planning and by achieving solutions only on their basis regarding the permission for agricultural activity in a suitable area for afforestation or regarding the permission to transform other lands into arable land as well as into cultivated meadows. These planning documents are appropriate to be prepared for all administrative areas of the country; furthermore, one of the planning solutions in documents have to be the formation of boundaries (contours) of parcels of lands. The rules of the preparation of planning documents or other legislation have to be supplemented by methodical provisions, i.e. by requirements for the formation of cultural agrarian landscape.

Taking various conditions for the rational use of land provided by laws and scientific advice (Pauliukevicius, 1982; Pauliukevicius et al. 1995) into account, it is suggested adding the following requirements for the design of lands into the rules of the preparation of land management schemes and rural development projects of land management:

1. Meadows and natural pastures should be in areas of agriculture land if they have been natural meadows and pastures at least for 20–25 years or if they were situated in areas of drained land, the soil of which consists of peat or turf which tends to mould, or in areas of hilly lands, the soil of which is eroded averagely or heavily, and the inclination of slope is  $\geq 7^\circ$ .
2. Marshes as well as trees and shrubs are designed to remain according to the current state excluding the areas of these lands in drained land, in which the reconstruction of drainage systems is appropriate by restoring former agricultural lands.
3. Forests which naturally grew in former arable land or in former cultivated meadows as well as pastures formed in this land or in other agricultural land with drainage systems are designed to be transformed into arable land or cultivated meadows.
3. New forests are designed:
  - 4.1. in an unused land, areas occupied with trees and shrubs and abandoned agricultural land, except for land areas with fertile soil which are envisaged to be used in order to establish arable land or cultivated meadows;

4.2. in other agricultural land if it is considered to be appropriate in terms of the formation of cultural rural landscape. Forest plantations are arranged in forest zones (of the width of 7–15 m) in land areas of flat and wavy terrain, and in groves of the area of 0.3–4.0 ha in land areas of hilly terrain as well as in river and creek valleys. When new forest land areas (forest zones and groves) are designed in other non-forest areas, it is necessary to ensure that the distance from the designed forest till the nearest existing (remaining) forests, trees and shrubs, marshes overgrown with shrubs and homesteads planted with trees would be: in hilly terrain at least 300 m and no more than 500 m, in sandy and sandy loam-based plains at least 800 m and no more than 800 m, in loamy plains at least 800 m and no more than 1000 m. The design of land parcels to be dedicated for the afforestation is coordinated with the arrangement of existing forests, trees and shrubs, marshes, meadows and natural pastures, waters as well as with the design of new meadows. Forests shall not be designed in land parcels suitable for agricultural crops and mechanised cultivation with average productivity score higher than 29–32.

## Conclusions

1. In Lithuania, the number of rural residents and farms participating in agricultural activity decreases gradually. The negative consequences of this process can be avoided by preparing documents of land management planning providing for the formation of rational holdings of farms and by expediently regulating public economic support to ensure viability of farms.
2. The system of rural residential areas of Lithuania consists of compactly built-up settlements of various size, villages and granges. Due to unequal conditions of social service, suburban and other large settlements, in the development areas of which new constructions are planned, are the most stable. However, from the perspective of the formation of efficient economic structures and the rational use of land, the construction of separate grange-homesteads in areas provided by territory planning documents is tolerated coordinating it together with other questions of territory management.
3. The main network of local roads with firm surface was formed in rural areas during reclamation works in the period from 1950 to 1989, currently their maintenance is carried out by municipalities. The road network is supplemented by necessary accesses to homesteads and land parcels when the land is privatised. While preparing documents of land management planning it is foremost necessary to solve the arrangement of structures as stable infrastructure objects, including all roads of general use as well as roads which are to be used by easement, and to determine the of the improvement of separate road stretches.
4. The conditions of the land use as provided for by legislation are specified by preparing special plans as well as plans of land holdings. Documents of land management planning should form long-term elements of cultural rural landscape, not to reduce the area of efficient agricultural land, identify ecologically valuable and protectable or relatively natural agricultural land parcels. Therefore, it is expedient to supplement the instructions of the preparation of documents of land management with methodical requirements to the planning of the arrangement of parcels of lands and their conversion into other agricultural areas.

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# ANALYSIS OF THE 20<sup>TH</sup> CENTURY VILLAGES IN NEMUNAS DELTA REGIONAL PARK

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## Abstract

Nemunas Delta Regional Park and its surroundings is the land of heritage of Lithuania Minor with its special history, unique scenery, original ethnoculture, and valuable cultural heritage. Villages and homesteads of Lithuania Minor were of greater variety than in Lithuania Propria as there were no forced rural restructuring which had a great impact on the establishment and development of villages, thus ancient villages had been preserved in Nemunas Delta Regional Park until the post-war period. These villages may be grouped not only by location, and names, but also by lifestyle peculiarities of villagers. Peculiar natural conditions of the coastal and lagoon areas had a continuous influence on the inhabitants of that area. Coasts were covered with the sands and wetlands, which were poorly suitable for conventional agricultural activities that people living in dry areas were engaged in. Therefore, homesteads and villages typical for farmers were not formed in these areas. The main aim of this article is to provide the analysis of the conditions of village emergence and development in the territory of Nemunas Delta Regional Park on the basis of historical written sources. The research showed that the villages located in the territory of Nemunas Delta Regional Park are disappearing, the number of rural residents and homes is decreasing. One of the defunct villages that should be mentioned is the village of Skirvytėlė located in the territory of Nemunas Delta Regional Park. It is presupposed that the names and boundaries of other villages may become extinct in the future as well. Therefore, it is important to assess the extent of the vanishing of villages and to develop a legal system to preserve the names and boundaries of vanishing villages for future generations so that the villages would not only be seen in historical maps. Also, in order to preserve the Prussian ethnocultural heritage of Lithuania Minor and Samogitian ethnocultural heritage of Lithuania Propria and the uniqueness of their landscape, it is expedient to make use of these advantages in developing an attractive image of a touristic region.

**Keywords:** Lithuania Minor, village, colony, bog, heritage.

## Introduction

The peculiarities of Lithuania Minor villages and traditional ways of life prevailing there were usually determined by unique natural conditions of the region and its separate parts. For instance, in low and boggy Nemunas delta there stretched large raised bogs and wet low bogs. There, since ancient times people learned to live by the bogs and make use of bog products, i.e. thick grass, peat, berry plantations, fertile soil, hunted birds and animals. Dryer land by the bogs was settled by people, villages, homesteads were established there, own traditions and customs formed (Purvinas, 2006).

By its natural conditions, the Nemunas delta is one of the most original landscapes not only in Lithuania, but also in other Baltic states. One of distinguishing features of the Nemunas delta is the preserved variety of natural conditions, which is a rarity in Western European deltas (Povilanskas et al., 2003). According to Skablauskaitė (2011), “Prussian Lithuanians lived where the local people had spent their most beautiful days. Where they brought up their children, welcomed guests, where they celebrated weddings, christenings, bid farewell to the deceased.”

The architecture of Prussian Lithuanians was determined by the old Prussian heritage, intersection of cultures, economic activity. There was no randomness in Lithuania Minor, the order prevailed here all the time, even residential buildings, homesteads were built with regard to the trades prevailing in those areas. Thus, Prussian Lithuanians resided in the buildings of peasants (lith. *laukininkai*), as well as in the buildings of the so-called dune people (lith. *kopininkai*), bog people (lith. *pelkininkai*), grassland villagers (lith. *pievininkai*), or fishermen (lith. *žuvininkai*).

Local people realised that the flood waters naturally shape the landscape, gradually rising flooded parts of the holm with sediments, fertilise fields after winter revives nature, and sometimes even drift timber. People have adapted to living in the rhythms of the river, and the water supplied goods has become a source of livelihood. Specific natural conditions had led to a peculiar indigenous lifestyle, customs, trades and farming traditions in the Nemunas Delta. Eventually, there formed communities of fishermen, grassland villagers, peasants and bog people. Near the water lived people involved in fishery, in marsh fringes there lived bog people, forests were inhabited by rangers. Pamarys people cutting reeds in winter cut the reeds necessary for the roof covering. The Nemunas floods have long hampered the development of conventional farming. Powerful jets of water washed ploughed lowland soils or sanded them, so only in the higher yielding Nemunas delta areas protected from the threat of flooding, the birth of gardeners,



growing vegetables and potatoes, occurred. The soils rich with nutrients were suitable for grassy vegetation, therefore flooded meadows have long attracted animal breeders – grassland villagers. Their farmsteads or entire villages (Rupkalviai, Pietiniai Girininkai, etc.) were settled in higher places, rescuing people from flood waters. The writings of Teutonic and Livonian Orders made the unique and rich nature of the Nemunas delta famous around the world.

Peasants lived in stack settlements in hilly areas of the region. Homesteads seemed to be scattered, hiding amongst the greenery. Most often peasants built wooden houses, covered roofs with reeds, less often with straws, thus protecting themselves from the rain. Wooden shacks had wide garrets intended for equipment of granaries to store thresh grain stocks. Besides traditional residential buildings, bathhouses were found here until the 17<sup>th</sup> century. Later on they were prohibited due to the abundance of fires, and the most importance place was designated for farm buildings. In the 19<sup>th</sup> century, the residents of the fields started building red-bricked cattle-sheds. Wooden barns (lith. *skūnios*) were built instead of threshing barns (lith. *jaujos*). Peasants were one of the first to build more modern, complex, variously decorated residential buildings, which had previously only been characteristic of towns.

Bog people were settled down at the outskirts of the bogs in correctly-shaped and densely arranged small homesteads that were situated in drier elevations. In this area, it was important to adjust the location for farm buildings, as bog people were engaged in cultivation of potatoes and vegetables. Colonists, who were residing in this area, built small wooden houses. If they had enough funds, they decorated them with carved wooden decorations and verandahs. At the beginning of the 20<sup>th</sup> century, the buildings of bog people were already painted, shutters thoroughly decorated.

Villages and homesteads of Lithuania Minor were much more diverse than the ones in Lithuania Propria. The architecture of Prussian Lithuanians was extremely varied, with modern masonry buildings being built alongside ancient houses; some of them had decorated attics and verandahs. The houses of large-scale farmers particularly stood out because of the abundance of building materials that were used. Both wood and red bricks were used here, as well as painted walls were planked, roofs were decorated, doors and shutters were painted with beautiful patterns (Skablauskaitė, 2011).

After restoration of independence, the objectives of land reform were predominated by the desire to return the land to the applicants of former land owners of 1940s, without taking into consideration the land that at a time was supplied with restructuring economic structures (Aleknavičius, 2012).

As Lithuania Minor avoided the major land reforms, some villages of the older epochs could have remained in different parts of the region. The history of Lithuania Minor was much more diverse than the history of Lithuania Propria. The historical development phases of villages of adjacent regions also vary. For instance, in the 19<sup>th</sup> century the villages of Prussia and later German Empire were rapidly developing as a result of increasing economy of the region. At the same time in Lithuania Propria, which at that time was controlled by Czarist Russia, villages and the whole region in general experienced a period of stagnation (Skurvydas, 2008).

The differences of villages of Lithuania Propria and Lithuania Minor substantially affected the economic and legal relations of both states. Different procedures have prevailed in Lithuania Minor – the lands and homesteads were not divided between the successors as in Lithuania Propria, but rather remained to one of the heirs. For this reason, large and medium scale farms remained throughout the centuries. Likewise, the homesteads were not diminishing; more often the landlord would expand and decorate the buildings. Within a few centuries, a very striking difference between the poor villages with small homesteads of Lithuanian Propria and relatively large and medium scale farms of Lithuania Minor has emerged (Purvinas et al., 1999). The gap between adjacent regions was progressively increasing, with the difference in economic development, standard of living and architectural features, in the form of villages, homesteads and buildings.

**The aim of research** is to provide an analysis of the conditions of village emergence and development in the territory of Nemunas Delta Regional Park on the basis of historical written sources.

**Main objectives of research:**

1. To distinguish peculiarities of Nemunas Delta Regional Park.
2. To describe the different living zones in the analysed area.

**Methodology of research and materials**

Scientific, historical literature analysis, inventory methods were used for the preparation of the article. The object of research – villages situated in Nemunas Delta Regional Park.

The study is theoretical in nature, occurrence conditions of bog people, peasants, grassland villages, the natural environment and Lithuania Minor traditions and customs were analysed during the research. The

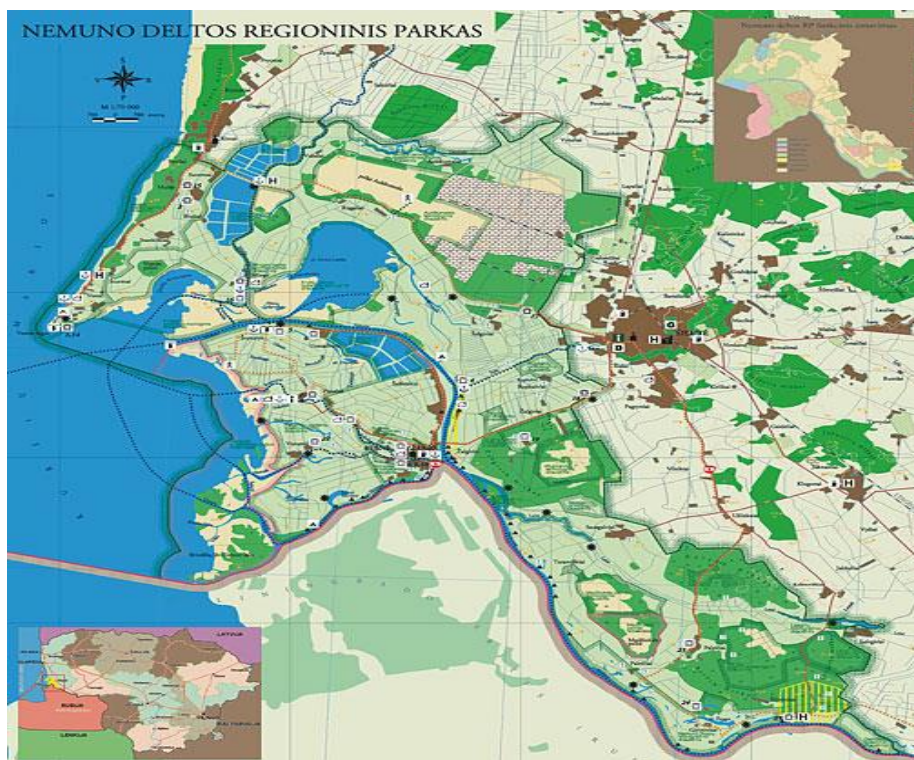
study reviews the broad historical period. Due to economic – historical conditions many documents fell into German archives. During the decades of Soviet occupation Lithuania Minor was doomed to destruction and oblivion.

Nemunas Delta Regional Park is the exclusive territory of Lithuania, preservation of which has a great historical, natural, ethno-cultural significance.

The paper distinguished the colonial villages of bog people, i.e. Aukštumala, Žalgiriai, Rūgaliai and others, the emergence of which was conditioned by the great bogs. In areas where flooding could not wash away the fertile layer of ploughed areas the birth of peasant villages (Šturmai, Muižė, Stankišķiai, Suvernai, etc.) took place. Flooded meadows had long attracted animal breeders – grassland villagers. Their farmsteads or entire villages (Rupkalviai, Pietiniai Girininkai, etc.) were created on hilly places, which rescued them from flood waters. Difficult living conditions formed bog people as a unique small Lithuanian agricultural group, in which social media specific skills, customs, traditions and lifestyle were going on.

### Discussion and results

The Nemunas Delta is a flat, the lowest elevated seaside lowland part averaging 0.6-1.2 m above the sea level. In the East it begins 48 kilometers above the Nemunas estuary, where the river diverges into Rusnė and Gilija. The wide river floodplain (part of the valley flooded during floods) in the west gradually moves to the flat lowlands. The Nemunas Delta in the past 6 000 years formed deposits (sand and silt particles), also known as alluvium and brought by the Nemunas, Minija and other rivers. Due to the continuously recruiting alluvial deposits the delta gradually grew and expanded towards the lagoon (Fig. 1).



**Fig. 1.** Nemunas Delta Regional Park (Hnit – Baltic, 2013)

Eventually constantly accumulating deposit clogged some river branches. It formed old riverbeds and small closed lakes called „grasshoppers“. Such alluvial deposits from the Nemunas River separated a part of the Curonian Lagoon, which became the only lake of marine origin in Lithuania - Krokų Lanka (Basalykas, 1965).

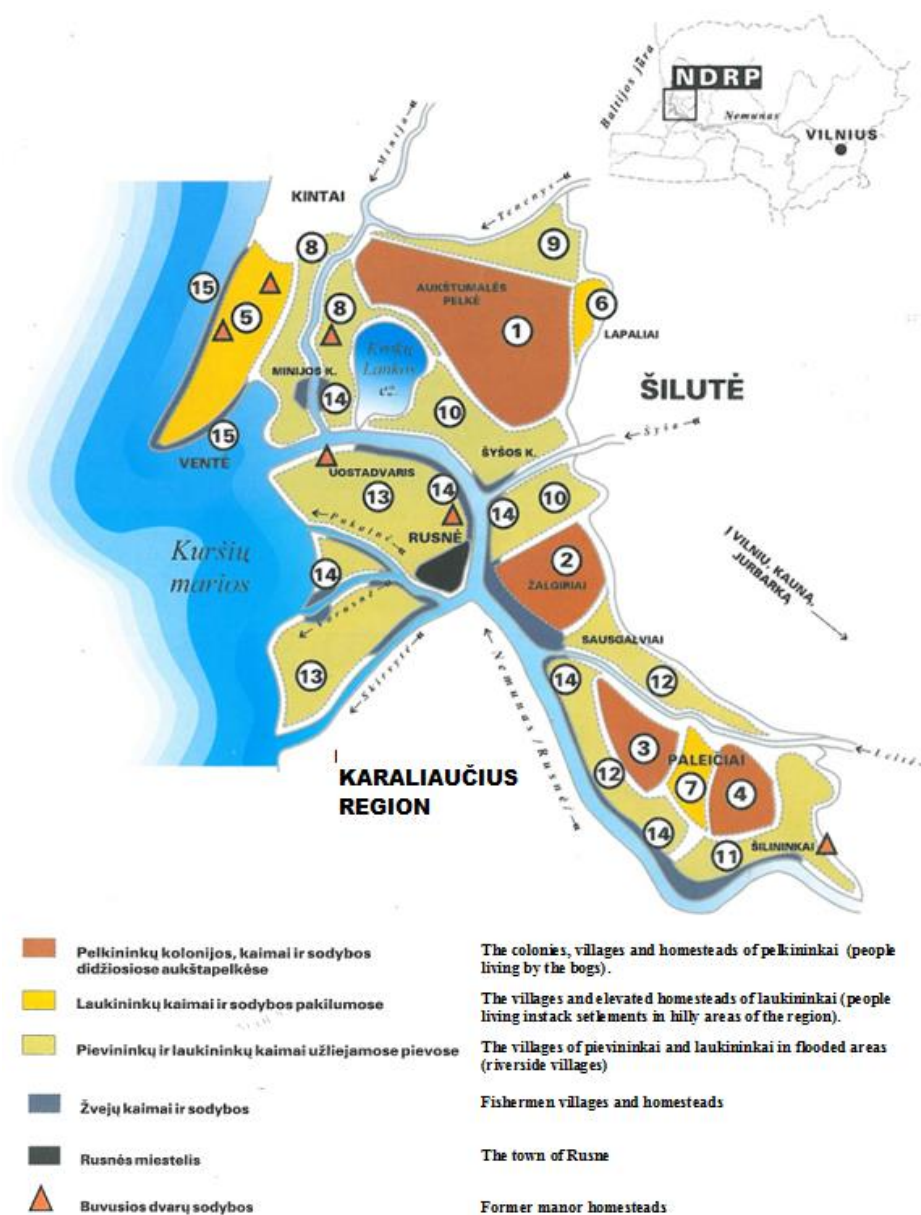
The Nemunas delta is one of the few places in Europe where fairly large river floods take place every year. Melting snow suddenly rises water level in the lower reaches of the river Nemunas and water floods the large area (approximately 400 km<sup>2</sup>) of the delta.

Only in this region can be seen the vast areas of flooded grasslands and unique in Lithuania deltoid type raised bogs (Aukštumala, Medžioklė, Bėgšai, Leitgiriai bogs). One of them – Aukštumala raised bog – scientists researching bogs around the world recognise it as the locus classicus (from the Latin - a classic place, a classic example) and jealousy call it the cradle of wetland science (Weber: in 2016).

In 1992, Nemunas Delta Regional Park was established for the preservation of the Nemunas Delta landscape, ecosystems and cultural heritage. In 1993, the Nemunas Delta was recorded in the list of wet areas of international significance (Ramsar Convention), in 1998, it was legalized as the Baltic Marine Environment Protection Commission (HELCOM) Area and in 2004 it was incorporated into the network of protected areas of European importance NATURA 2000.

In the order of the Minister of the Environment of the Republic of Lithuania “On the approval of the Nemunas Delta Regional Park Management Plan” the following most important environmental regional park’s objectives were raised: 1) to preserve valuable natural complexes and objects; 2) to maintain the Nemunas Delta natural ecosystem stability; 3) to restore damaged natural landscape complexes and objects; 4) to regulate the use of grasslands and land reclamation systems (Lietuvos, 2014).

On the basis of the map of Nemunas Delta Regional Park, the villages of bog people and flooded area fall in the territory of this regional park (Fig. 2).



**Fig. 2.** Different living areas in the territory of Nemunas Delta Regional Park (Purvinas, 1999)

The territory of Nemunas Delta Regional Park is divided in areas based on the nature of territorial lifestyle and architectural-urban heritage:

*The colonies, villages and homesteads of bog people in large raised bogs:*

- Aukštumalė bog array (former villages – colonies of Aukštumala, Vabalai, Naujieji Rūgaliai, parts of Šyšgiriai and Lapaliai village homesteads);
- Žalgiriai - Rupkalviai bog array (former villages – colonies of Žalgiriai, Juodkrantė);
- Medžioklė bog array (former villages – colonies of Medžioklė);
- Berštininkai bog array (part of Paleičiai, Andruliai and Šilininkai village homesteads).

*The villages and elevated homesteads of peasants:*

- Ventė – Kintai ridge (villages and homesteads of Ventė, Šturmai, Stankiškiei, Bložiai, Suvernai, Povilai);
- Lapaliai – Traksėdžiai elevation (part of Lapaliai village homestead);
- Paleičiai height (part of Paleičiai village homestead);

*The villages of grassland villagers and peasants in flooded areas:*

- Miniņa river valley (part of Miniņa, Vabalai, Rugaliai village homesteads);
- Alka and areas of adjacent villages alongside the river Tenenys (emptied after 1944);
- Coastal areas of the river Atmata and river Šyša (villages of Šyšgiriai, Rupkalviai, Atmata, Šlažai and partly Šyša);
- Rusnė (Nemunas) and Leitė riverside floodplains (Sausgalviai, Tatamiškiai, part of Barzdėnai, Šakūnėliai, Paleičiai, Leitgiriai, Andruliai and Bėgšai village homesteads);
- Wooded riversides of the river Rusnė (Nemunas) (villages of Girininkai and Šilininkai, village homesteads of Bėgšai, Leitgiriai and part of Andruliai);
- Rusnė island – archipelago (part of Šyškrantė, Pakalnė, Vorusnė and Skirvytėlė village homesteads);

*Fishermen villages and homesteads:*

- The Nemunas branches and coastal tributaries;
- The coast of the Curonian Lagoon (Purvinas, 1999).

Aukštumala is a bog situated in the current Šilutė district, 6 km to the North West from Šilutė, among Krokų Lanka, Tenenys and lower reaches of the river Miniņa. The area of this bog is approximately 30 km<sup>2</sup>. Aukštumala is a typical raised bog of Nemunas delta region (Mažosios..., 2000).

The bog is situated in a large flatland of marine structures emerging 1 metre above the sea level. The area surrounding the bog is full of wet alluvial soil which in majority of places covers peat (Zaromskis, 2013).

From early on bog and marsh people (lith. *pelkininkai pabaliai*) formed granges and villages with distinct traditions and customs in drylands near low bogs. Until World War I, these colonies were managed in terms of state management system, had a process of selling the produced agricultural goods (a lot of potatoes harvested in peats were shipped to the West), an agricultural system (fertilisers and minerals needed to culture the peat were brought from the West), the development of the colonies was funded. At the beginning of 1923, when Klaipėda region was separated from Germany and annexed to the Republic of Lithuania, the former maintenance system of bog people colony went through crisis. The colonies of the region were not expanded, they existed as the shadows of past. The distinct lifestyle of bog people, their traditions and skills of contemporary activities were determined by their existence in extreme conditions, i.e. damp environment, the use of damp soil scarcely suitable for traditional agriculture, experience of tides and water level fluctuations in various seasons. The oldest businesses of bog people (hunting, collecting of bog foods) were gradually supplemented by a unique type of agriculture. The low bogs were easier to cultivate (usually, draining them was sufficient), while the use of raised bogs was for a long time obstructed by their specific acidic soil. Germany used specific fertilisers for liming and fertilising peatlands. These means transformed wetlands into highly fertile areas of land (Purvinas, 2006).

Since 1863 when villages of bog people were stated to establish till the beginning of the 20<sup>th</sup> century, villages increased five times.

Since 1888, the colony started to lay broad gravel roads and dig 12 m width and 4 m depth canals into the Šyša and Tenenys rivers, where small ships could travel. The edges of the canals were divided into parcels, where the colonists started to settle. The drained, limed, fertilised peatlands were sown with crops and clover. Smaller drainage (1 m width) used to direct water to main canals were dug. The peats dug from the canals and trenches were taken to the peat factory. Meadows were culturalised in places

of exported peat. The life of bog people was improved by the Šilutė – Šyšgiriai – Ruguliai – Kintai road laid by the southern boarded of Aukštumala bog. Each colonist rented a 3 ha parcel of land with a new building. It was calculated that after 66 years of farming, the parcel with its buildings would become the property of the colonist's successor. Later on, the administration changed these conditions, and the colonists had to construct the buildings themselves. In 1905, 58 people (29 of which were men) were living in Aukštumala bog. The colony consisted of 10 residential buildings and 10 lodgings. The colony administered 2816.6 ha of land and paid a preferential property tax, i.e. only 0.42 marke a hectare.

In 1925, Aukštumala colony of bog people (Aukštumala) was not separately recorded. During the Inventory of Klaipėda Region Residents, the Aukštumala bog state manor including Aukštumala, Jociškiai, Kiliškiai, Senieji and Naujieji Ruguliai were recorded. Here the volost and school were founded. The manor administered 4881 ha of land, 766 people lived in the aforementioned settlements. During the decades of Soviet occupation Aukštumala settlement was destroyed (Purvinas, 2006).

Up until 1900, agricultural crops were exclusively grown, by using raised bog peat, on the slopes of raised bog. Potatoes were the main crop, in some places winter rye and oats were grown, less often hulled six-row barley.

By 1905, 1691 people (781 of which were men) were living in Bismarkas (Rupkalviai bogs) colony. The colony had 357 residential buildings with 405 accommodations. It predominantly consisted of Prussian Lithuanians and newcomers from Lithuania Propria (in addition to numerous descendants of mixed families or people of Lithuanian origin who had no knowledge of Lithuanian language). During the Soviet occupation period, Žalgiriai village (Bismarkas colony) was devastated. Many of the wooden buildings were disassembled for firewood. In 1995, only a few old homesteads and their remnants were recorded, as since 1944, about 97 per cent of buildings and homesteads in the colony were destroyed, cemetery were vandalised and former public buildings were demolished (Purvinas, 2006).

Peasants were settling on larger elevations, working the land in places where floods could not wash away fertile layer of ploughed areas. In some convenient areas for farming, such as Kintai – Ventė moraine ridge, villages of peasants (Šturmai, Muižė, Stankišķiai, Suvernai, Povilai, etc.) stretched in a continuous circuit. South of the town of Šilutė, by the right riverbank of the Nemunas river, for dozens of kilometres stretches historically famous riverside meadows – areas that are flooded annually. Nemunas valley is often severely flooded in autumn. To make matters worse, in spring, avalanche of debacle would slide down through the wide valley, sweeping everything in its path (Purvinas, 2011).

In order to avoid the constant threat of debacle, the unique engineering objects of today's heritage were formed in Nemunas lowlands, called the embankment system of the Nemunas Delta (Svazas and other, 2009).

In 1785, Sausgalviai was described as a rather large village with 17 homesteads, in 1871, the total population of 319 inhabitants (145 male and 174 female) was registered in the village, of which 178 were born in the village and other came from different locations. The traditional life was lost in the autumn of 1944, when the inhabitants of the Sausgalviai had to retreat to the West. Unoccupied village was diligently demolished. During the Soviet period floodplains had to supply the major livestock complexes with feed. The cattle farms were also built in Sausgalviai hillock, near the old cemetery. The construction of polders and major drainage channels had begun, relying on cheap energy resources of that time. In times of change, rigid Soviet farm system had collapsed. Out of 60 former homesteads with several hundred decent buildings, only the fragments of 8 old homesteads are left today (Purvinas, 2011). The old Šyšgiriai can conditionally be called the village of the riverside. Šyšgiriai tried to recede from the whimsical Šyša and threatening Atmata, through which the devastating avalanche of debacle from time to time would reach the village. It was much more convenient to live on elevations, even though it was less romantic. Life itself was not stable and ensured, in some cases ice hummocks could reach buildings that stood on elevated surfaces. In 1905, it was counted that 430 people were living in the village, this means that the population doubled over the last thirty-four years. The village was dominated by women (with 203 men). Out of 412 Evangelical Lutheran only 84 could speak German, which leaves 318 Lithuanian speakers. All of 18 Catholics of Šyšgiriai could speak Lithuanian. The economy of Šyšgiriai had also improved. They had already owned 760 acres of land, which means that over the past half of a century the area of land belonging to the village had increased five times. It was calculated that the village had 73 homesteads with 94 apartments. Although settlers would usually settle in rather poor houses, they would still feel like at home. In 1912, 406 people were registered in Šyšgiriai (the rapid growth of the village was already stagnant). World War 1 affected Šyšgiriai less than post-war turmoil. Many young men who were mobilised had fallen or been mutilated in various fronts. It was disastrous for the families of bog people. With the loss of breadwinners it was nearly impossible to perform the



majority of hard work in the peat bogs. Some of them pulled out in search for a better life. By 1925, 357 people were still living in the village of Šyšgiriai, where they still owned 763 acres of land. The traditional life had ended in the autumn of 1944, when the inhabitants of Šyšgiriai had to retreat from the approaching front. The ones who stayed or returned had experienced oppressions and repressions of the occupational Soviet regime. During the De-Stalinisation period, as the opportunity occurred, they would immediately retreat to the West. Some of the old homesteads of Šyšgiriai were preserved for longer periods by more serious newcomers. Unfortunately, during the Soviet period most of homesteads and old buildings were used and later liquidated, picturesque cemetery of the village was vandalised. The second Šyšgiriai was destroyed and dozens of homesteads of bog people were demolished. Their hard-worked land has overgrown with bushes, as it was unnecessary for Soviet economy (Purvinas, 2011).

Difficult living conditions, unique natural environment, traditions, customs have formed exclusive habitable territories in the Nemunas Delta, thus it is very important that the measures provided by the state or private individuals would help to maintain these territories.

### Conclusions and proposals

1. Nemunas Delta Regional Park, the exclusive territory of Lithuania, where you can see large areas of flooded meadows and unique deltoid type bogs, spectacular landscapes, natural complexes and objects of cultural values and distinctive heritage.
2. In the 19<sup>th</sup> century, the programme for bog people colony creation was initiated. One major programme, concerning the colonies, was provided for the Nemunas Delta, where lie the large wetlands. With the state-funded construction of roads, the development of such colonies has increased significantly. During this period, Aukštumala, Žalgiriai colonies were established. By 1925, there were 766 inhabitants in the village of Aukštumala, while in 2011 the number of inhabitants was only 3. In 1959, there were 132 inhabitants in the village of Žalgiriai, while in 2001 the number of inhabitants was 86. The village of Skirvytėlė is mentioned among the villages that went extinct in the territory of Nemunas Delta Regional Park.
3. The greatest negative influence was caused by the socialist and peasant economical collectivisation land reform, since it abolished the peasants' rights to the private property and forcibly seized the lands. Individual villages were reorganised by assigning them to the large settlements. The start of large scale land reclamation works meant further destruction of the villages. The ones that were preventing the formation of vast arrays of farmlands were immediately exterminated.
4. In order to preserve the ethnocultural legacy and the uniqueness of the landscape of Prussian Lithuania Minor and Samogitian Lithuania Propria it is expedient to use the advantages of creating an attractive image of tourist region.

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# ANALYSIS OF DATA ACCURACY OF LITHUANIAN SPATIAL INFORMATION PORTAL TOOL “SET ALTITUDE OF POINT ON LOCATION”

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## Abstract

Geoportal.lt is a Lithuanian state information system whose scope is to allow all data users to freely access geographic data, maps and e-services. The portal also allows drawing relief altitude profile and set the altitude of point on location. It is performed by applying the tool “Set altitude of point on location”. It is one of the newest tools of geoportal.lt website, whose accuracy has not been analysed, and which, according to the information provided by GIS Centre, complies with the requirements set for 1:50000 scale maps. This tool is selected as an object of research, while the aim of the research is to analyse the accuracy of data provided by Lithuanian spatial information portal tool “Set altitude of point on location” in case of different land covers. The following methods of investigation have been employed: literary analysis; the analysis of cartographic material; field measurements and data processing; comparative analysis of data. The data is processed using Geomap and Microsoft Excel programmes. After the analysis has been carried out, it was established that the most common errors in all types of land covers are from 0.5 m to 1.5 m. Such errors comprise 70 per cent in forest areas, 35 per cent in built-up territory, and 53 per cent in thin land cover. Taking into consideration that the website geoportal.lt operates on the basis of orthographic map whose accuracy is 1 meter and the discussed tool shows the altitude of the nearest known point, it can be stated that the obtained presumptions are permissible. To summarise the obtained data, the tool is reliable. The reliability of the data is 91 per cent in thin land cover, 86 per cent in forest area, 75 per cent in built-up area. To compare it with topographic maps of analogous format, where the errors of altitudes may reach up to 10 meters, the tool is reliable even in case of major errors.

**Keywords:** *Lithuanian spatial information portal (geoportal.lt), laser scanning (LIDAR), altitudes*

## Introduction

Two main methods based on central and orthogonal projection are used for cartography. In the majority of cases, both of these methods are joined and the location cartography is performed by using the combined method (Balevicius, Gudritiene, 2014). Each method has its advantages and disadvantages. Mostly, the size of objects and their spatial position is determined by performing the distant (photogrammetric) measurements. Laser scanning (LIDAR), which has been discovered recently and is already being used in Lithuania, allows collecting information not only on natural, but also on man-made surface objects as well as heights of land surface (altitudes). In Lithuania, the data of distant cartography is publicly accessible to the users on Lithuanian spatial information portal (Geoportal.lt). This website presents to the users the simplified tools, which allow carrying out the analysis of spatial object without the use of complex software (Papisiene, 2014). One of such tools is “Set altitude of point on location”. The tool is created by using LIDAR data. The Lithuanian Orthographic map (ORT10LT) is used as a spatial basis. According to the specialists of GIS centre, this tool complies with the requirements set for the 1:50000 scale maps. A lot of Lithuanian authors analyse the accuracy and application of available LIDAR data, however, the functions of the product created on the basis of such data have not been thoroughly analysed, therefore this investigation has been carried out.

The main motif for applying the LIDAR method is its capacity to obtain a lot of information on land surface objects in a short period of time. The data gathered by LIDAR includes not only information on geodesic heights of land surface, but also natural and man-made objects (Kalantaite et.al., 2010). However all measurement methods and systems have errors. A lot of scholars have been investigating the accuracy of this method; in his article Zachary argues that the accuracy of LIDAR data ranges from 1 to 2 meters, and the mean squared error – from 15 to 20 centimetres (Zachary et.al., 2007). According to Zalnierius, the LIDAR laser beam measures the distance to solid surface with 1-3 cm accuracy, while the real accuracy of height scanning reaches 10-15 cm in urban territories. Ruzgiene claims that the accuracy of measurement is mostly dependent on the flight altitude. According to her, the accuracy of LIDAR data is approximately 15 cm. Kraus provides the conclusions of his research, stating that the vertical accuracy in forests is 0.50 m and 10-15 cm in streets (Kraus, 2008). According to A. Zalnierius, the accuracy of the location scanning depends not only on the flight altitude, but also on the features of the scanner, the width of the scanned sector, errors of scanner positioning on GPS and orientation, the frequency of laser beams and their dispersion, atmosphere conditions and especially the



features of the reflective surface and other factors, therefore the accuracy of the data varies (Zalnieriukas et.al., 2009, Kraus 2008, Zachary 2007).

In Lithuania, LIDAR technology has been applied twice. In 2007, the photos of the centres of ten biggest Lithuanian cities have been ordered by the National Land Service under the Ministry of Agriculture. The density of points on location is 3–4 points/m<sup>2</sup>, the average distance among points is 0.5 m, vertical accuracy is ± 15 cm and horizontal accuracy is ± 30 cm. Another surface scanning has been made in 2009–2010. These measurements scanned the whole territory of Lithuania, thus forming a digital spatial model of land surface. The density of points in this scanning is no rarer than 1 point in 2 m<sup>2</sup>, when the vertical accuracy is not greater than 30 cm and horizontal is not greater than 60 cm. When processing the data, the reflections with blurry signal, reduced by thick vegetation, have been removed. Therefore, the layer of points may vary in different Lithuanian territories (Zalnieriukas et.al., 2009).

To check the accuracy, the geodesic measurements, being the most accurate method of setting coordinates, have been employed.

**The aim of research** – to analyse the accuracy of the data provided by the Lithuanian spatial information portal (Geoportal.lt) tool “Set point on location altitude” in case of different land cover.

To reach this aim, the following objectives have been set out:


- To set the altitude of points by employing two different methods of GPS receiver and tool provided by geoportal.lt;
- To set the errors of data and the dispersion of the obtained errors in case of different land cover.

### **Methodology of research and materials**

**The object of research** – Lithuanian spatial information portal (Geoportal.lt) tool “Set altitude of point on location”.

When performing the analysis, the following methods have been applied:

- literary analysis;
- analysis of cartographic material;
- field measurements and data processing;
- comparative analysis of data.

When carrying out the literary analysis, the results of the data of analyses carried out by other authors as well as the accuracy of available laser scanning data in Lithuania have been discussed. During the analysis of cartographic material, the topographic plans, which have been drawn by the co-author during the production work, have been selected. The measurements have been performed by using GPS receivers (TopCon GMS and Trimble R10). The altitudes of the points measured by GPS devices were compared to the altitude set by the geoportal.lt tool “Draw relief profile and set altitude of point on location” . The mean squared error M has been calculated by using the formula (1) for every difference of land cover altitudes (Živatkauskas, 2013):

$$M = \sqrt{\frac{M_1^2 + M_2^2 + \dots + M_n^2}{n}}(m) \quad (1)$$

Here:  $M_1^2 + M_2^2 + \dots + M_n^2$  – error of measurements of separate points,  
n – number of points.

The data is processed by using GeoMap and Microsoft Excel programmes, the charts informative pictures have been provided.

### **Results and discussion**

Geoportal.lt is a state information system, whose scope is to allow all data users to freely access geographic data, maps and e-services. Currently, 38 organisations use this system to provide 289 services of spatial data review and download. The users can find, review and download various maps, data sets, compare them, use measurement and data analysis tools (Lietuvos..., 2015). Complex map tools, which allow analysing the data accessed through Geoportal.lt are proliferating. The drawing of relief altitude along the line drawn by the user or setting the altitude of point on location is provided to the users of this portal. It is performed by using a tool “set altitude of point on location” (Zemes..., 1015, GIS... 2015).

The information obtained by using this tool is based on LIDAR data, whose accuracy and collection methods are still a topical novelty in the cartography of the Earth surface objects.

The research has been carried out in Marijampole district. It employed the point altitudes measured by GPS device and altitudes of the same points measured by using geoportal.lt tool. The measurement data is selected from 10 not interrelated topographic plans in order to cover larger territory.

The measurement data has been divided into three groups:

First group includes points located in flat territories with thin land cover (farm land, natural fields);

- The second group consists of points in built-up territories (near buildings);
- The third group includes points in forest areas (among trees).

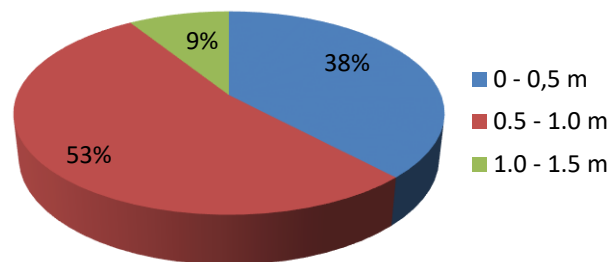
Most of the points, i.e. even 65 points were chosen for comparison in open, flat areas, since they comprised the majority in the mapped territory (Fig.1).



**Fig.1.** Examples of points selected in open areas

Coordinated points are completely in open areas, there are no buildings, trees, shadows or other objects that may influence the accuracy of LIDAR data near them.

The dispersion of deviation in altitudes based on size when comparing the GPS measurements with NTVA data is provided in percentage (Fig. 2).



**Fig. 2.** The dispersion of deviations according to size

The measurement discrepancies were divided into 3 groups: altitudes with 0-0.5 m accuracy, altitudes with 0.5-1.0 m accuracy and altitudes with 1.0-1.5 m accuracy. It was determined that the discrepancies whose altitude difference ranges from 0.5 to 1.0 m comprise the largest percentage share, i.e. 53 per cent of all the discrepancies in flat land cover. A minor percentage share crosses the one meter limit, however, taking into consideration the fact that the tool is created on the basis of LIDAR data for 1:50000 cartography, the assumption can be made that this error does not exceed the maximum limit.

The second group of the selected altitude points is in built-up territories, i.e. near buildings. 20 coordinated points, whose altitudes have been established by performing geodesic measurements and using Geoportal.It tool, were analysed in this group (Fig. 3).



**Fig. 3.** Examples of points located in built-up territories

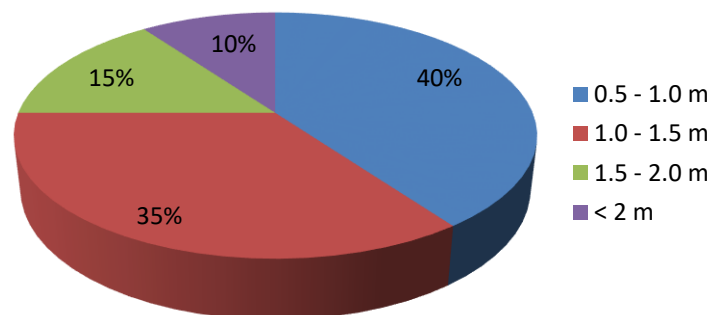
Taking into consideration the error of every point, the mean squared error is 1.6 m and 1.30 m when calculating the mean squared error arithmetically. When comparing the data of built-up territories with the data of points with thin land cover, it can be observed that the differences among altitude and mean squared error vary more than two times. According to the obtained differences in altitudes, two coordinated points, whose errors exceed 3 m can be observed. The photos of the points are provided in Figure 4.



**Fig. 4.** Major errors in built-up territories: 1 – 3.5 m difference, 2 – 3.6 m difference

These points have the biggest error when comparing the data obtained using the tool to the GPS device. The error of the first point may have been influenced by the fact that the point is measured in close proximity to the building, and in the second photo, the measurement is performed in case of being near the building, whose shadow may have interfered with the beam.

The altitudes measured in built-up territory have various deviations grouped according to size and presented in percentage (Fig. 5).



**Fig. 5.** The dispersion of deviations according to size

The errors were divided into 4 groups: errors with 0.5-1.0 m altitude difference, the second group includes 1.0-1.5 m altitude difference, the third - 1.5-2.0 m altitude difference while the fourth – 2 m or greater difference.

The built-up territory features no errors lower than 0.5 m, while the only and the lowest error of these measurements is 0.8 m. All the errors up to 1 meter comprise the largest percentage share i.e. 40 per cent, while the errors with 1.0-1.5 m deviation constitute 35 per cent of all the errors. Errors with deviation up to 2 m make up 15 per cent. In built-up territories 10 per cent of all the errors are the errors with 2 m and greater deviation, which may reach up to 3.5 m in some areas. Such errors are not acceptable even for 1:50000 maps. However when comparing them with the altitudes provided in topographic (analogous format) maps, which are established by using horizontals, it can be stated that the obtained data are more reliable, since the deviations in horizontals are up to 10 m (Gudritiene, 2013). Based on the obtained data it can be stated that the altitudes in built-up areas provided by geoportal.lt tool are of average reliability and can be used when there is no need for highly accurate data.

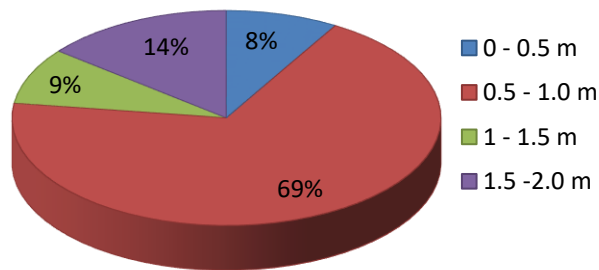
The third point group selected for altitude analysis is in forest area. Altitudes of 35 points have been analysed in this group (Fig. 6).



**Fig. 6.** Points selected in forest area

Having evaluated all the deviations of point altitude errors, the obtained square error is 0.99 m and the average point error calculated arithmetically is 0.64 m. The dispersion of point deviation varies with the smallest deviation being 50 cm and the largest reaching up to 2 m. The errors do not exceed the permissible limit.

The point altitude deviations in forest areas according to the grouped sizes are provided below (Fig. 7).

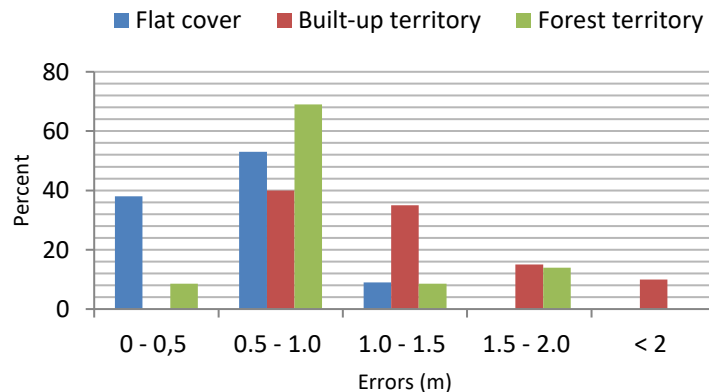


**Fig. 7.** Altitude deviations in forest area

The altitude deviations in forest territory were divided into 4 groups: the first group is from 0-0.5 m, the second – from 0.5-1.0 m, the third 1.0-1.5 m and the fourth up to 2 m.

Errors with altitude deviations up to 50 cm constitute 8 per cent of all the errors. Errors with deviations from 1 m to 1.5 m make up 9 per cent. The largest part is comprised of errors with deviations from 0.5 m to 1 m represented by 69 per cent. The largest group of errors (up to 2 m) comprises 14 per cent of all points. Since the data whose altitude error does not exceed 1 m dominates, it can be stated that the tool provides accurate data in forest territory.

Having compared all the data of tool accuracy analysis, the percentage of the errors of different covers (open, built-up, forest) are provided in the diagram below (Fig. 8).



**Fig. 8.** Total review of territories in percent

The lowest percentage of errors up to 50 cm occurs in land covers where fields, greenlands, arable land and other lands prevail as well as in forest areas, where it reaches 10 per cent. Based on the research

carried out by other authors and the results that they have obtained, it can be stated (Kraus 2008, Zachary 2007, Žalnieriukas 2009) that such errors comply completely even with the requirements raised by LIDAR and the obtained data is highly reliable. Such errors in thin land cover make up approximately 40 per cent and in forest territory approximately 10 per cent.

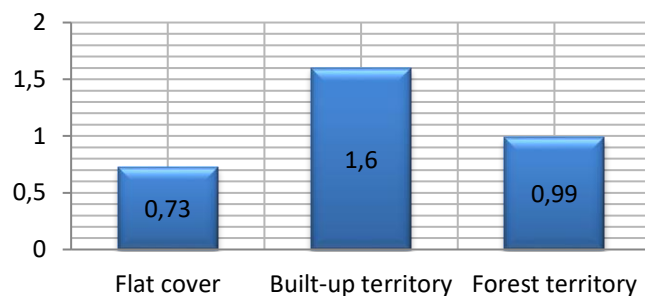
The most common errors are from 0.5 m to 1.5 m. Such altitude errors may occur in all three types of land covers. Based on the fact that geoportal.lt website operates on the basis of orthographic map, whose coordinate accuracy is 1 m, it can be assumed that such errors are permissible and the obtained data is reliable, since it complies with the requirements for 1:50000 scale maps. Such errors are most common in forest areas, i.e. approximately 70 per cent, approximately 40 per cent in built-up areas and approximately 50 per cent in fields.

The analysed tool works on a zooming principle, therefore it can be claimed that the errors from 1.0 m to 1.5 m are also minor, since the tool provides the altitude of the nearest known point.

The errors from 1.5-2.0 m are of average reliability. In built-up territories, errors reaching 2 m and more are unavoidable and constitute approximately 10 per cent. They may be caused by buildings and their shadows that interfere with the penetration of laser beam during the scanning process.

In conclusion it can be stated that the tool is reliable in open areas with thin land cover in approximately 91 per cent of cases. The reliability is also high in forest areas and constitutes 86 per cent, while in built-up areas the data of the tool is less reliable and make up to 75 per cent. It may be influenced by the shadows and the built-up land cover that may limit the penetration of laser ray.

The mean squared error has been calculated according to the formula provided by the methodology. The graphical results of calculations are provided in Figure 9.



**Fig. 9.** The dispersion of average square inaccuracies of Geoportal.lt tool “set point on location altitude”

The largest mean squared error is in built-up territory and constitutes 1.6 m, in open area it is more than two times lower, i.e. 0.73 m, while in the forest territory it reaches 0.99 m.

Having checked all 120 analysed point altitudes and their errors and without excluding the land cover or built-up territory it can be stated that the most frequent error of the tool is up to 1 m. In total, there are 94 deviations of such kind, which makes up 80 per cent of all the analysed altitudes. However, even in case of major errors, the tool is useful since the altitudes on maps provided by using horizontals differ by up to 10 m (Gudritiene, 2012). Therefore, geoportal.lt tool is more beneficial for setting altitudes than old cartographic material of analogous format.

## Conclusions

1. 120 points were selected for the analysis (65 of them are in open area, 20 – in built-up territories, 35 – in forest territories). The mean squared error of the data provided by the tool is: 73 cm in territories with thin land cover; 1.6 m in built-up territories; 99 cm in forest territories.
2. Errors up to 50 cm comply completely with the requirements of LIDAR, they usually prevail in territories with thin land cover (38 per cent), while in forest territories they make up 8 per cent. There are no such errors in built-up territories.
3. The most frequent errors in all the land cover types are from 0.5 m to 1.5 m. They constitute 70 per cent in forest territory, 35 per cent in built-up territory and 53 per cent in territory with thin land cover.
4. Taking into consideration the fact that geoportal.lt website operates on the basis of orthographic map with 1 m accuracy and the discussed tool shows the altitude of the nearest known point it can be stated that the obtained errors are permissible except for two cases mentioned in the analysis.
5. To conclude the obtained data it can be stated that the tool is reliable. The accuracy of its data in thin land cover is 91 per cent, 86 per cent in forest territory and 75 per cent in built-up territory. In

comparison with the topographic maps of analogous format, where the altitudes differ by up to 10 m, the tool is reliable even with the highest error.

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# THE ANALYSIS OF THE LAND USE OF THE HOMESTEADS OF FORMER MANORS

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## Abstract

From the old times Lithuanian manors were the main centres of diplomacy, administration and culture. The applied land reforms, war and post-war periods and changing regimes altered the structures of the manors; their owners and users changed as well. The number of homesteads of manors and their territory highly decreased. During various periods of time more than 150 manors were present in the current territory of Panevėžys district municipality. The aim of the research is to analyse the land use of the least researched homesteads of former manors in 1923 and 2016. Six homesteads of former manors that are located in Panevėžys district have been analysed. The research has revealed that a great amount of small land lots aggravates the farming conditions and does not allow the rational land use. Certainly, this problem is solved partially by renting or selling the land to the owners of the adjacent land lots. Land consolidation would help to pass beneficial decisions for the land use. In the recent years, due to the initiatives of state institutions and individual people a fair part of homesteads of manors are being rebuilt and adjusted to the use of society.

**Keywords:** homesteads of former manors, land use.

## Introduction

Manors are a valuable part of country's history. During long centuries both Lithuanian and Latvian manors and small manors were the centres of culture, art and spiritual life as well as known for perfect architecture of the palace and parks. In specific regions several different manors, owned by the same landlord, were the sources of long-term economic growth and region prosperity that determined the advantage of a specific competitive business. The owners, structures and the territory of the manors varied during the years.

The building of traditional homesteads of manors started between the end of the 14 c. and the beginning of the 15 c. In the 16 c., Lithuania already had various types of manors: patrimonial, mother's, bought, mortgaged, rented, etc. (Kiaupienė, 2001; Sandstrom, 2011). From the 16 c. to the beginning of the 19 c. a big manor was constituted of a main homestead of the landlord, few arable lands of manors with industrial factories and peasant villages or sometimes even with little towns that belonged to the landlord. In 1861, after the abolishment of the serfdom, villages were separated from the manor. From this period only the homesteads of the landlords with a specific land lot were referred to as manors. In the second half of the 19 c. most of them became big market economy farms (Lithuanian..., 2004; Baranauskas, 2001; Vaskela, 1998). Folwarks are introduced as a separate territorial farm unit of a land lot ruled by the manor (usually a big one) that was employed for narrower and specialised farm use (Lithuanian..., 1993). After the 17-18 c. the manors destroyed in the wars were usually rebuilt or reconstructed according to the old plans, though new ones were also built. After the World War I, when the aristocracy lost their privileges, new homesteads of manors were no longer built (General..., 2004). Until 1940 there were about 4 thousand manors in Lithuania (with folwarks) (Lithuanian..., 2008). Many homesteads of manors were damaged during wars and the post-war period, while some of them rapidly declined during the Soviet period, when they were nationalised.

After the restoration of the independence, 817 manors were enlisted in the cultural heritage register; 239 that were completely decayed or did not remain were crossed out from the list. According to the data provided by the Ministry of Culture in 2008, 576 manors were enlisted in the cultural heritage registry (Lithuanian..., 2008). Majority of the homesteads of manors are in a bad shape.

“Many buildings have become ruins in our times, after the restoration of the independence. In recent years, the situation has begun to change. Some of the manor buildings have been renewed by their new owners. The revival of the manors has attracted the attention of people – manors are becoming popular objects of tourism” (Svitojus, 2016). Only about one fifth of the manors is restored and visited.

In 1992-1993, when the privatisation of the real estate started, the government passed several acts dealing with the protection of the homesteads of manors (Lithuanian..., 1992; 1993) and a list of manors that cannot be privatised was prepared. The laws regulated that natural environment and land resources should be preserved and adjusted for the use of humans (Lithuanian..., 1994b), as well as that the real estate cultural heritage should be kept since it is an authentic witness of country's and regional history or a work of art (Lithuanian..., 1994a). Specialists and representatives of state institutions thought that

the most valuable objects should remain open to the society and should be protected by the initiative and expenses of the government. According to J. Glemža (2002) and other authors (Bražaitė-Dijokienė, 2000; Riaubienė, 2003; Steponavičienė, 2001), in order to protect the homesteads of manors from the decay and to provide legal protection, it was necessary to preserve the heritage of remaining manors by providing them with the heritage status.

Personal initiatives play a big part in the restoration of the manors. Due to active people in Lithuania and Latvia more than 100 manors and castles have been restored and used for recreational purposes. The owners of these objects belong to the associations of manor and castle owners (Lithuanian..., 2016; Latvian..., 2016). In Lithuania about 100 people, that own 50 manors and castles, participate in these activities. The Latvian association connects owners of 78 manors and castles. The majority of these objects are perfect cultural centres and interesting objects for tourism.

However, not all of the former manors are advised to be restored (Levandraitytė, 2010). Though only parts or even ruins are left of some historically significant objects, in some cases it is suggested to retain them (Stulpinas, 1993). The remaining fragments of the manors can be suitably integrated into the landscape (Muceniece, 2015).

Although there is a lot of information about manors, the research on the land use conditions of manor lands is quite scarce. An analysis of the use of a few northern Lithuania homesteads of manors and buildings (Abalikštienė et al., 2008; Čirvinskienė, 2016; Žvironaitė, 2007) and an overview of the peculiarities of the territory planning of the Panemunė homesteads of manors have been carried out (Abromaitė, 2015). As currently a quite immense attention is given to the restoration and protection of manors it has been decided to analyse the least researched and described homesteads of former manors situated in Panevėžys district.

**The object of the research** is the homesteads of former manors in Panevėžys district.

**The aim of the research** is to analyse the land use of the least researched homesteads of former manors in years 1923 and 2016.

**The objectives of the research are as follows:**

1. To analyse the chosen homesteads of former manors located in Panevėžys district.
2. To estimate the influence of the land reform on the land use of homesteads of former manors.

### **Research methodology and material**

The research was carried out by applying literary sources, mathematical statistics and cartographic material methods of analysis. The data analysis was conducted by applying comparative and descriptive methods and by employing a comprehensive documentation of the object by including archival and natural research.

The land use of the manors in years 1923 and 2016 was analysed in selected manors from Panevėžys district: Jotainiai, Spirakiai, Upytė-Deblovas, Anitava, Rodai and Milešiškiai. The chosen and analysed manors are in a bad shape and decaying and only one of them is well preserved and managed. The selected ratio coincides with the situation of the analysed periods. The archival documents of the object were collected from the funds of Lithuanian Central State Archives.

During the research standard documents, scientific articles, other literary sources and statistical data collections were analysed. The archival documents collected from the Panevėžys division of State Archives allowed to determine the land lots of these homesteads of manors as well as agricultural lands and their owners. In addition, plans, obtained from the Panevėžys division of the National Land Service under the Ministry of Agriculture (further – NLS), in which the boundaries of the homestead territories of former manors were marked, were used to determine the land lots formed in these territories.

### **Results and discussion**

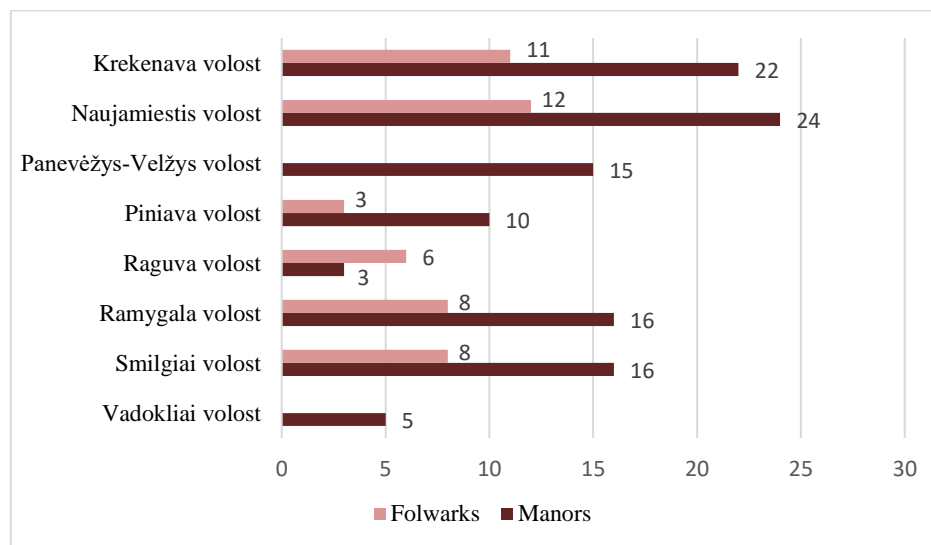
The preservation of manor heritage is an important objective of many countries. Both in Lithuania and Latvia, after the restoration of the independence and the 1991 land reform, homesteads of manors that have historical and cultural value became the matter of concern. The government institutions confirmed the lists of manors that cannot be privatised as well as the programmes to save these objects. The most valuable homesteads were awarded the heritage status.

According to J. Glemža (2002), the slow and quite late process of making the manors a part of the heritage determined that in northern Lithuania, according to a database (Lithuanian, 2008), 33% of the former manors were crossed out. In Panevėžys district only, 16 manors are left currently, while 159 homesteads of manors were registered during the interwar. Manors that have no remaining information about them were also crossed out. The most famous remaining manors and castles in the northern



Lithuania are: Biržai castle, homestead of Žagarė manor and Bistrampolis manor. According to the newest data, 142 manors and their homesteads are registered in the northern Lithuania. In 2008, five manors of Panevėžys district – Alančiai, Kučiai (or Bistrampolis), Naudvaris, Pamiškė (or Paliesė) and Puziniškis – were declared as protected by the state, and 11 objects of cultural heritage – fragments of homesteads of manors – were registered in the registry of cultural heritage. These numbers reveal that lots of manors decayed and collapsed not only during the Soviet period but also in the period of modern independent Lithuania, as they were not used. Thus, only 10% of the homesteads of former manors in Panevėžys district that existed till 1940, witnessed the end of the Soviet period.

The research focused on the search of the owners of the homesteads of former manors, the influence of the last land reform on the use of the territories, the changes of buildings, etc. The number of manors and folwarks, that remained until 1940, was estimated. According to the data from of the general population census of the Republic of Lithuania conducted in 1923 (Lithuanian..., 1929), 3508 manors and folwarks existed in Lithuania (Gražulis, 2007). In the current territory of Panevėžys district only 159 manors and folwarks exist (Fig. 1).

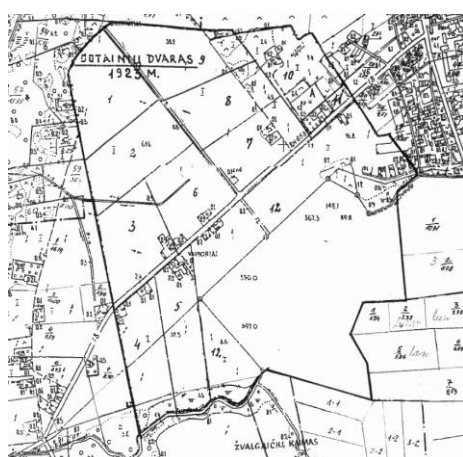


**Fig. 1.** The number of former manors and folwarks in volosts situated in the current territory of Panevėžys district

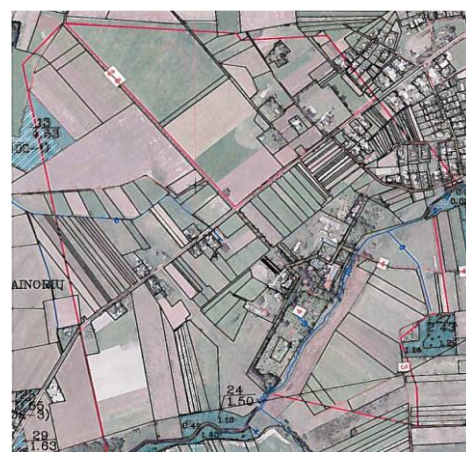
In Panevėžys district most of the manors and folwarks were concentrated in the then volosts of Naujamiestis (even 36) and Krekenava (33).

The situation has vastly changed. The territories that belonged to the manor owners started to be diminished, from 1922, already during the inter-war, by executing a land reform and by performing the parcellation of manors. The homesteads of manors were severely damaged during the war, post-war and Soviet periods. After the restoration of Lithuanian independence, a vast influence on the use of these territories was made by the land reform that was applied from 1991. Some buildings in these homesteads experienced vast damages for not having owners for a long time.

To achieve a better understanding how the land is currently used in the lands of former manors, a detailed analysis of six objects was carried out. Homesteads of former manors, that were selected for this analysis (Jotainiai, Spirakiai, Upytė-Deblovas, Anitava, Rodai and Milešiškiai), can be distinguished by their quite big territories, varying from 41 to 384 ha. Information provided in the written sources about the majority of the homesteads dates only from the 18 c. to 19 c. The first mentioned homesteads are Rodai manor (15 c.) and homestead of Jotainiai manor (16 c.). Jotainiai manor is the only analysed manor, that is currently enlisted in the database of Lithuanian manors and is established as protected by the state. Jotainiai manor was mentioned for the first time in 1564. From the 19 c. the manor was owned by Zavišai (Juknevičius, 1994; 1995; 2000). 199.38 ha of land belonged to the manor (Fig. 2).



a) 1923 year



b) 2016 year

**Fig. 2.** The territory of the homestead of Jotainiai manor

Sources: a) a distribution plan of the Jotainiai vicinity, 1926 (from the Panevėžys archives), b) the land reform project of the cadastral vicinity of Jotainiai (NLS)

During the post-war years a psychoneurological care home and its auxiliary property were established in the nationalised palace. Six buildings of the former manor remained. The adornment of the former manor is the three-story barn, made of stone. The current manor land lot amounts to 11,4021 ha. The land is still used by the care home. Almost all territory that currently does not belong to the manor is occupied by land lots that are privatised or designed for privatisation.

The number of buildings in the homesteads of manors, their arrangement and exterior varied during different periods. Buildings of the homesteads of manors usually were splendid and could be distinguished by their complicated architectural shapes. Naturally, the main buildings of the manors were the most splendid. Subsidiary service buildings were situated next to the palace. Further from the palace the farm buildings were built with their own separate approach roads. Large areas were occupied by the farm-hand buildings. To establish the change of the number of buildings, 12 homesteads of former manors of Panevėžys district were analysed (Table 1).

**Table 1**

Buildings of the homesteads of former manors in the Panevėžys district

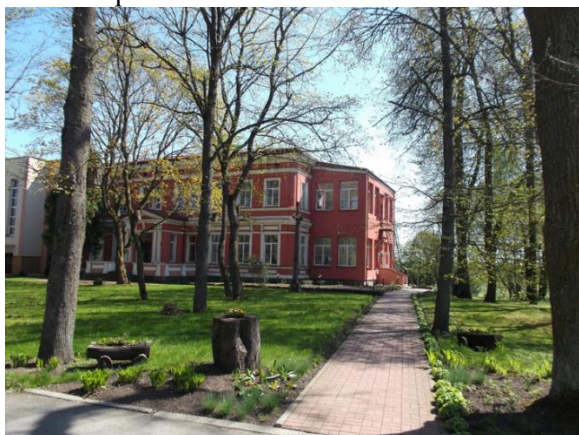
Name of the manor		Number of manor buildings						2016 in total
		1923-1925						
		in total	living buildings	farm buildings	manufactory buildings	other buildings	remains of buildings	
1	2	3	4	5	6	7	8	
<b>In the analysed homesteads of manors</b>								
1.	Jotainiai	31	3	18	1	9	-	6
2.	Spirakiai	29	2	22	1	3	1	1
3.	Upytė-Deblonas	37	1	33	1	2	-	5
4.	Anitava	6	1	4	-	1	-	2
5.	Rodai	21	2	16	2	1	-	-
6.	Milešiškiai	33	5	25	1	2	-	-
	<b>All in all in the analysed homesteads</b>	<b>157</b>	<b>14</b>	<b>118</b>	<b>6</b>	<b>18</b>	<b>1</b>	<b>14</b>

	1	2	3	4	5	6	7	8
<b>In other homesteads</b>								
1.	Anytava	9	1	6	1	1	-	
2.	Parcel of a Gudžiūnėliai village	11	2	9	-	-	-	
3.	Liubitis	1	1	-	-	-	-	
4.	Padumlaukis folwark	2	1	1	-	-	-	
5.	Rukiškis	14	2	9	-	3	-	
6.	Taruškos	12	1	8	-	-	3	
	<b>All in all in other homesteads</b>	49	8	33	1	4	3	
	<b>All in all</b>	<b>206</b>	<b>22</b>	<b>151</b>	<b>7</b>	<b>22</b>	<b>4</b>	<b>14</b>

Source: Lithuanian Central State Archives (made by A. Čirvinskienė)

In 1923-1925, homesteads were constituted of 206 buildings. This number includes the nationalised manor living houses, farm, manufactory and other buildings built during the period of the manor. The highest number of buildings was in the homestead of Upytė-Deblonas manor – 37 buildings (18% of all buildings). The main building that has the best remaining state is in the homestead of Jotainiai manor (Fig. 3).

The homestead of Upytė-Deblonas manor (Fig. 4), that remained until present times, represents the common pre-war homestead of a small farm owner.



**Fig. 3.** Homestead of Jotainiai manor, 2016  
(Photos by A. Čirvinskienė)



**Fig. 4.** Homestead of Upytė-Deblonas manor, 2016

During the inventory of the homestead of Upytė-Deblonas manor, five buildings were described. The state of the main building of the manor is satisfactory.

It was determined that during the period of 90 years in all of the analysed territories of the homesteads of former manors, an average of 20 new land lots with buildings were formed in each one. However, only two homesteads of manors included living houses and subsidiary buildings. Hence, the majority of the buildings were meant for agricultural and manufactory activities.

According to the data provided by the National Land Services in the 2016, it has been determined how the territories of the homesteads of former manors in Panevėžys district are divided by the reinstatement of property rights of the owned land and other ways to privatise the land (Table 2).

**Table 2**

The division of the analysed land lots of homesteads of manors in Panevėžys district, in accordance with the land reform, 1<sup>st</sup> January 2016

Name of the homestead of the manor	The general area of the homestead of former manors in 1923 <sup>1</sup> , ha	The reinstated property rights <sup>2</sup>									Open national land <sup>2</sup>	
		Land return in kind		Given as a free of charge property		Land of a personal farm		Home domain and other land under the buildings		Agricultural land, ha	Number of land lots	ha
		Number of land lots	ha	Number of land lots	ha	Number of land lots	ha	Number of land lots	ha			
Anitava	41.5	2	7.4	-	-	25	11.6	16	11.4	18.9	7	9.1
Jotainiai	199.4	13	64.0	1	3.7	200	99.1	35	10.7	162.8	1	1.50
Milešiškių	320.0	30	189.7	9	89.7	27	44.7	1	0.8	284.2	-	-
Rodai	384.6	39	218.0	8	49.1	51	42.8	17	10.1	328.0	10	35.7
Spirakiai	312.0	29	239.7	17	48.2	14	13.2	12	5.4	233.1	4	3.7
Upytė-Deblonas	309.2	40	99.9	11	10.9	71	81.5	21	10.2	203.6	4	17.5
In all	1566.7	153	818.7	46	201.6	388	292.9	102	48.6	1231	26	67.5
% from the previous general area	100		52		13		19		3	79		4

Sources: <sup>1</sup> – Panevėžys division of the Lithuanian Central State Archive, <sup>2</sup> – National Land Service under the Ministry of Agriculture

From the 1991, by applying the land reform, the property rights to the land were reinstated in accordance with the situation of the land owning in 1940. Until the 1<sup>st</sup> January 2016, half (52%) of the territories of the analysed manors were returned to their owners (or their successors determined by law) in kind, i.e. in those places, where they ruled the land in 1940. In the area of 201.60 ha given free of charge, land lots for 46 people were formed. Almost one fifth of the area is divided into small lots for personal users farming lots. Thus, if in 1923 six homesteads of manors had only few land lots, by the 2016 687 land lots were formed in the analysed territories, i.e. in average 115 land lots per one homestead of manor. Currently the land of the homesteads of former manors is administrated by various forms of property and by many users. For instance, the homestead of Jotainiai manor is administrated by juridical and natural people. One third of the owned area of the homesteads of manors was returned in kind. Personal farming lands constitute 47% of the whole area of Jotainiai manor territory. The average area of a land lot is 0.75 ha. The average area of a land lot returned in kind is 5 ha. As more than 80% (163 ha) of the former area of this homestead is constituted of agricultural land, this division of the territory into small land lots is not good for agricultural activities and insurance of the rational use of the land. This situation could be improved by the renting and transferring of the land, land consolidations and other needed works.

Hence, the land reform that is being applied since 1991, has had a vast influence on the current use of the homesteads of former manors. Differently administrated land lots were formed, whose owners are not connected by agricultural or family ties. Thus, the territory is divided for many users. When applying privatisation, retaining of solid homesteads was not important.

The analysis revealed that almost all territories of homesteads of manors and buildings are privatised. According to the use, manors can be divided into these categories:

- 1) National manors used for public activities;
- 2) Private manors;
- 3) Abandoned manors and their fragments;
- 4) Not-remained homesteads of manors.

It can be seen that the relation between remaining buildings of the former manor and the land-use are no longer existent.

It was revealed that the remaining heritage of homesteads of manors that belong to the state in the analysed places very often have no owner, thus, it can be stated that on the one hand, the privatisation of homesteads of manors is a positive indicator. Upytė-Deblonas homestead, that belong to the list of the manors that were not privatised, is decaying, as a suitable use of the manor buildings has not been found and construction works are stalled due to the lack of funding. The homesteads of former manors of Anitava currently belong to the National wealth fund. The state of the buildings is awful. They are not managed or supervised, hence their state is getting worse. From the analysed manors, the only supervised manor is homestead of Jotainiai manor. Though it is used for special purposes, it always had an owner, thus it is supervised and protected.

The restoration of solid manor lands is quite complicated. It is possible only if specific and favourable conditions exist. The future of these manors will depend on the economic activities that will be developed in them and the purpose of the homesteads of manors. In every specific way it could be achieved if owners of the homesteads of manors would order a thorough analysis and an agri-business plan or by integrated planning and fixing of these territories.

### Conclusions and proposals

1. Currently in the database of manors 142 homesteads of manors from the northern Lithuania are registered. In Panevėžys district during the inter-war majority of the homesteads of former manors were situated in the South-Western part of the district. In this district only 16 manors remained from 159, i.e. 10%. Many manors decayed and collapsed not only during war, post-war and Soviet times, but also by not being used during the current period of independent Lithuania. It was established that during a period of 90 years the landscape changed vastly, as in every homestead of former manors that was analysed, in average 20 new land lots with buildings were formed.

2. From 1991, by applying land reform, homesteads of former manors were divided to a number of land owners and users. It was determined that an average area of land lots that constituted one homestead of manors in 1923 was 11.06 ha and in 2016 – only 2.2 ha. These small land lots that have productive agricultural lands are not rational in accordance with farming. One of the means to achieve sustainable development of these territories could be land consolidation.

3. 47% of the whole territory of homesteads of manors is constituted of personal agricultural land. The average area of a personal land lot amounts to 0.75 ha. Some of these land lots are not used, abandoned, hence the visual quality of surrounding territories of homesteads of manors is getting worse and this also negatively affects the use of the territories of the manors. Irrespective of the land property form, the planning and maintenance works of the manor territories that are being restored and adjusted to public use should be financed by the funds of EU, government and municipalities and they should get more attention from the communities.

4. It can be stated that the problems of protection and rational land use of homesteads of manors are still not solved. The future of the manors will depend on the initiatives of state institutions and individual people, the purpose of the homesteads of manors, the applied economic activities and the possibilities to achieve the necessary support.

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# THE CHANGE OF ANTHROPOGENIC COMPONENTS IN KAUNAS CITY

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## Abstract

The article presents the comparative analysis of the Kaunas city anthropogenic landscape change during the period between 2006 and 2014. For this analysis, the land fund statistics of the Republic of Lithuania, were used. The components of anthropogenic landscape change is graphically shown in the figures. During the analysis the Kaunas city statistics were compared with the data of Kaunas County and the Republic of Lithuania.

Comparative, analytical as well as statistical and logical analysis methods were used for the investigation.

The object of the investigation is anthropogenic components of Kaunas city.

The aim of the investigation is to carry out the analysis of the change of Kaunas city anthropogenic components in the period of 2006 – 2014.

The work analyses the change of urban landscape components, the reasons of the established change. The built-up territories comprise the majority of anthropogenic landscape of Kaunas city i.e. 90.05 per cent, while the damaged territories make up 0.06 per cent and Kaunas city roads constitute 9.89 per cent of the analysed landscape. It was established that during the analysed period the built-up territories of Kaunas city increased by 312.78 ha i.e. 3.53 per cent. Within 9 years the road area increased by 14.04 ha or 1.44 per cent, while the damaged areas increased by 1.89 ha.

Having analysed the statistical data of Kaunas city anthropogenic landscape areas it was estimated that within the period of 2006 – 2014 the area of these territories increased by 328.71 ha or 3.34 per cent.

**Keywords:** landscape, anthropogenic components, anthropogenisation.

## Introduction

Cities are the mirrors of societies' development. They represent the level of humanity's development, economic potential of a country, positive and negative social phenomena, traditions, cultural and scientific achievements. Every city is different. A lot of them can be described as unique according to their spatial or functional structure, factors influencing the development or its extent, social phenomena, prevailing development tendencies (Cereškevičius, 2012).

A modern city faces new forms and functions (Loureiro, 2014). Cities endure periods of prosperity and depression. The change of politics and external environment brings changes to social processes influencing the change of cities (Wekel, Koriakina, 2014).

The man's activity is seen in various territories: protected, agricultural, settlements. Currently more than three quarters of the Earth's dry land have been restructured. It is a constant transformation of Earth including anthropogenic changes, climate change as well as changes in hydrographic network, biodiversity (Ellis, 2014).

Anthropogenic influence to environment is usually destructive i.e. irrational human activities worsen the environmental quality, reduce the natural resources and biodiversity, damage the heritage. In extreme cases, it may cause ecological crises and catastrophes, natural disasters. All of these phenomena are in turn related to the decline in human health and their economic welfare (Pileckas, 2004).

The process of landscape polarisation began when humans started to intensify their activities. The anthropogenic environment started forming gradually, while natural environment became smaller. The term landscape polarisation came into landscape science in the second half of the twentieth century. At that time, polarised landscape was understood as a consequence of territorial planning i.e. highly structuralised and strictly zoned landscape (Eckel, 1978).

Throughout time the understanding of the term landscape polarisation changed. Currently the term landscape polarisation is used ambiguously i.e. on the one hand it is understood as an expression of landscape fragmentation while on the other hand it is a simultaneous existence of highly urbanised and deserted (uninhabited) territories. The research on landscape polarisation, as it is known today, has been started only recently. Therefore there is no appropriately prepared and universally acknowledged methodology of its calculation and since research is based on different methods thus the provided results cannot be compared. One of the most topical problems is not only the methodology of landscape polarisation but also regards the landscape naturalness / artificiality in other research on landscape (Vinclovaite, Veteikis, 2011).

Landscape and its condition change due to various reasons. The changes originating from human activity that strains the landscape, which, in turn, influences the change of its condition, are important in terms of environmental protection (Pileckas, 2004).

In order to understand the reasons for landscape change, scholarly research, knowledge and diffusing of the outcomes of landscape change on global, regional and national levels is necessary (Magliocca et. al., 2015).

In the majority of cases the concept of anthropogenesis can be narrowed down to the phenomenon described by employing the term technogenesis i.e. the influence of technology on landscape. Landscape technomass definition includes origin, content and its position in the system of landscape masses and phenomena. It encompasses buildings (volumetric – buildings, linear – communication lines) and movable elements (means of transport). Natural and household human activities often leave a lot of waste, which is stored in landfill sites, warehouses. Finally the volume of technology-created objects is practically equal to the volume of natural material, therefore the occurrence of technomass in one place results in depressive forms in other place, or, to put it in simple terms, technological activities leave negative relief forms i.e. quarries, mines, pits, canals, ditches (Veteikis, 2005).

In urbanised environment, where the anthropogenic and natural processes occur, the changes in urbanised and natural areas may be significant to the landscape system, quality, and suitability to live. Therefore it is important to establish the relation of urbanised and natural areas separately in built-up urban territories and city territories up to administrative boundaries (Veteikis, Jankauskaitė, 2004).

Anthropogenesis influences natural environment therefore the expansion of cities results in its reduction, while its components are vulnerable. Therefore, landscape changes are related to the expansion of cities, change in relation of urbanised and natural territories, landscape condition.

**The object of the investigation** is anthropogenic components of Kaunas city.

**The aim of the investigation** is to carry out the analysis of the change of Kaunas city anthropogenic components in the period of 2006 – 2014.

**Tasks of the investigation:**

1. To analyse the historic development of Kaunas city.
2. To analyse the changes in Kaunas city anthropogenic components of landscape during the period between 2006 and 2014.
3. To carry out the analysis of city anthropogenic landscape areas.

**Methodology of research and materials**

Comparative, analytical as well as statistical and logical analysis methods were used for the investigation. The article analyzed Lithuanian and foreign scientific literature and legal acts. Also, the Spatial planning documents were analysed in the work. The collected material was analyzed, systematized and generalized.

The land fund statistics of the Republic of Lithuania (Nacionalinė žemės, 2006-2014), graphically depicted in figures, were used for the fulfilment of the research of the Kaunas city anthropogenic landscape change for the years 2006 - 2014. Every component is analysed and its change is established. During the analysis the Kaunas city statistics were compared with the data of Kaunas County and the Republic of Lithuania.

**Discussion and results**

*Historic development of Kaunas city.* The history of Lithuanian landscape is dynamic and includes evolution and stages of rapid change. It is related to the changes of social, political and economic conditions, various social and economic reforms. The abovementioned factors influence the changes in land structure, development of various landscape types.

Archeological excavations and their findings show that people started to settle in the confluence of the rivers Nemunas and Neris in the 7<sup>th</sup> – 6<sup>th</sup> century BC, while locations of large amount of findings refer to the 2<sup>nd</sup> – 1<sup>st</sup> century BC. At that time, people started settling in Kaunas i.e. Eiguliai, Zaliakalnis, Kaniukai, Lampedziai, Sargenai, Marvele, Pajiesys, Romainiai, Linkuva, Petrasionai, Versvai and Santaka regions (Vasarskyte, 2014).

The history of the analysed city municipality began in 15<sup>th</sup> century, when in 1408 the city received Magdeburg rights (Kauno..., 2014).

The stamp of Kaunas city coat of arms originated at the beginning of the 15<sup>th</sup> century during the reign of Vytautas and is known as the oldest stamp of city herb in the Grand Duchy of Lithuania (GDL). Kaunas experienced the highest economic rise at the end of the 16<sup>th</sup> – the beginning of the 17<sup>th</sup> century. At that time, a lot of masonry houses were built. However the mid-17<sup>th</sup> century brought wars and the



majority of houses were destroyed, the crafts and trade decreased. Later on, the nearly rebuilt Kaunas was severely damaged by the Great Northern War. In 1701 – 1707 the city was destroyed and burned down and in 1708 – decimated by hunger and plague. In 1732 Kaunas was destroyed by fire. Conditions for craft and trade improved in the third quarter of the 18<sup>th</sup> century. 1771 marked the beginning of the reconstruction of Town Hall and parish church. Having recovered, Kaunas, which was the biggest and the most important city of GDL, entered the changes occurring during the Four-Year Sejm period. However in 1795 after the collapse of the state, Kaunas was under the Russian authority (Vasarskyte, 2014).

At the end of the 18<sup>th</sup> century Kaunas city territory was restricted by the defensive wall. Agricultural lands were stretched at the east and further from it was the Carmelite Monastery and Kaunakiemis village. The city development plan, which was drawn in 1821, was not implemented, the existing condition was not evaluated and the change of street network was not intended. In 1843 Kaunas was announced the centre of a new governorate and in 1847 a project of Kaunas city plan was prepared and approved. It was decided to expand the city to the east between the Nemunas river bed and its slopes to Girstupis without changing the formerly built-up territories. The implementation of the plan continued for two decades. The perimetrical development of Nicholas prospect (currently Laisves aleja) was completed only at the end of the 19<sup>th</sup> century. The real plan was not as correct as it was projected, since the existing city garden territory i.e. private Kartofliškes folwark, was to be taken into consideration. The train station complex was built and the remaining area was given to the city by the state treasury in exchange for the pasture land. Since in 1847 the development of Zaliakalnis and Karmelitai was not intended, the additional plan was prepared in 1869 and approved by tsar in 1871. Karmelitai was designed based on the principles of regular plan with regards to the existing road from Petrasiuonai and Zemieji and Aukstieji Sanciai network as well as the Girstupis stream. In 1869 the roadway of the current Vytautas prospect was started to install. In 1909 a market was opened near the Church of the Holy Cross and a local centre started to form. At the beginning of the 20<sup>th</sup> century Karmelitai region already contained a lot of factories, shops, taverns, hotels, other institutions, numerous residential houses (Lietuvos..., 2012).

Since the majority of Lithuanians were peasants, the village landscapes prevailed in the cultural memory. The first significant stream of urbanisation was observed when creating the independent state, excluding Vilnius and Klaipeda townsmen. Kaunas became the capital of the state and the architects working here started to form urban face of a new Lithuanianism. The Soviet occupation interrupted their activities and in the 60s Lithuania became an urbanised land. After the war, newcomers started to pour to the empty Vilnius and Klaipeda and villagers became townsmen. Only Kaunas' community retained its identity, since the visual urban heritage of formerly independent state prevailed (Rubavicius, 2013).

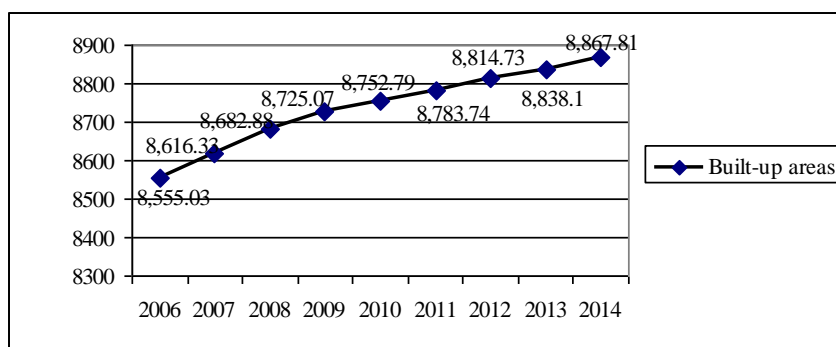
Currently Kaunas is the second metropolitan city in Lithuania, a large centre of industrial, cultural, technological and scientific potential. The city is located at the intersection of the main Lithuanian roads and national and international integration axes; it is crossed by two international transport corridors, existing and planned European gauge railway tracks, potential river corridors, not far away – the airport and a free economic zone (Zaleckis, Kamicaitytė – Virbasienė, Ramanauskas, 2013).

Kaunas city has a municipal status; it is divided into 11 subdistricts. The city covers an area of 15,688.47 hectares, i.e. 1.94 percent of Kaunas County and 0.24 percent of the area of the Republic of Lithuania. There are 1,232 objects of cultural heritage in Kaunas city, of which 1,043 objects include immovable and 189 – movable cultural heritage.

*The change of Kaunas city urban components.* City anthropogenic components consist of built-up territories, roads, damaged land. Anthropogenic areas include: built-up areas, roads, damaged land.

Built-up territory – land covered with structures (excluding roads): squares, public places, stadiums, aerodromes, fields, lawns, cemetery, household land plots or parts of them.

In 2014 built-up territories constituted 2.79 per cent of Lithuanian territory and 4.29 per cent of Kaunas county. In Kaunas city, such territories comprise 8867.81 per cent or 56.43 per cent of the territory of municipality. Compared to the data of the period of 2006 – 2014 it was estimated that each year the built-up territories increased (Fig. 1) and within the analysed period the area of built-up territories in Kaunas city increased by 312.78 ha i.e. 3.53 per cent.



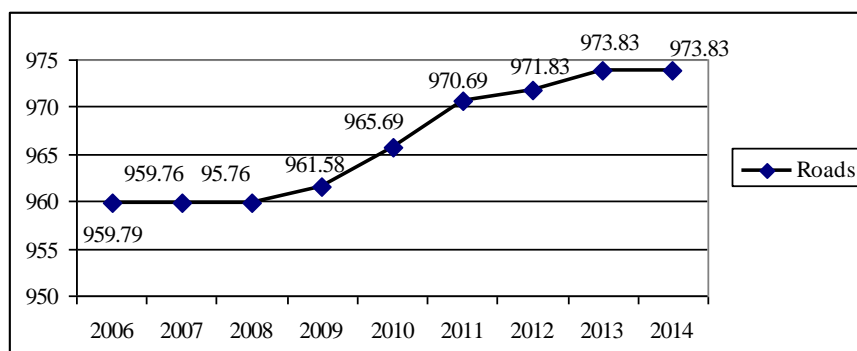
**Fig. 1.** Built-up areas change of Kaunas city in hectares during the period between the years 2006 and 2014

The area of built-up territories increased by reducing agricultural land as well as natural and anthropogenised landscape. In Lithuania, the growth of the demand of new development areas and infrastructure does not agree with the demographic situation. It is necessary to orient towards the restoration of the already built-up, devastated territories, motivate conversion and not investments to plain field. In such a way, Kaunas city economic vitality and ecological balance of the environment are ensured.

Roads – land areas covered with engineering structures employed for the traffic of vehicles and pedestrians.

In 2014 roads made up 131385.45 ha or 2.01 per cent of the territory of the Republic of Lithuania, 2.17 per cent in Kaunas county and 6.20 per cent in Kaunas city.

Having carried out the analysis of road changes in the period of 2006 – 2014 it was estimated that within the period of nine years, the road areas increased by 14.04 ha or 1.44 per cent (Fig. 2).



**Fig. 2.** Roads change of Kaunas city in hectares during the period between the years 2006 and 2014

Since the areas of built-up territory increased every year, the areas of city infrastructure needed for its maintenance increased as well. Kaunas district and external arterial road network is not equally linked to Kaunas city street structure.

Junctions in the north eastern part of the city are good, while those in Petrasiuonai, southern part of the city and Vilijampole are unsatisfactory. The greatest problems in terms of traffic organisation rise in the Old Town, centre of the city and sub-centre area. The increase of the number of transportation means brings about the important issue of vehicle parking in Kaunas centre. The need for transportation is constantly increases therefore the number of cars on the road increases and has great influence on the load of road and street network. The increasing number of cars should result in the installation of the development of road and street network, reconstruction of the existing network, improvement of continual maintenance and means of traffic organisation.

Damaged land – exploitation of mineral quarries, moors, landfill sites.

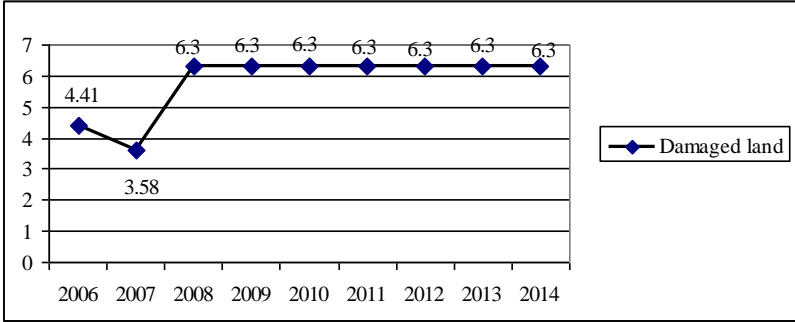
In 2014 the damaged land constituted 0.3 per cent of Lithuanian territory and 5.5 per cent of other land areas. During the analysed period the area of the damaged land decreased by 3922.65 ha or 16.46 per cent.

In 2006, 850 municipal waste landfill sites (contaminated sites) were registered in Lithuania; 350 of them were still in use (Valstybes..., 2013). Some of them operated illegally, were not registered, were not granted permits. In 2009, there were about 680 small (up to 1 ha) municipal waste landfill sites,

about 120 average (1–5 ha) landfill sites, and approximately 35 large (larger than 5 ha) landfill sites in Lithuania. In 2011, 11 regional landfill sites were established and prepared for utilisation in accordance with the environmental requirements.

In Kaunas county, the analysed territories constituted 0.3 per cent of the Lithuanian area and 6.32 per cent of the county area. A decrease of the damaged land area was observed in the county, i.e. by 656.16 ha or 21.10 per cent. In Kaunas county, the largest number of damaged territories is observed in the district municipalities of Kedainiai (21.27 per cent), Prienai (21.03 per cent) and Kaunas (19.56 proc.), whereas the lowest number of damaged territories is in the municipalities of Kaunas city and Birstonas. 409 damaged territories were determined in Kaunas county. Kaunas municipal waste management region encompasses 6 municipalities. In the region, 58 old landfill sites were closed, 2 regional landfill sites of non-hazardous waste were established: Lapes regional landfill site (Lepsiskiai village, Kaunas district) and Zabeliskis regional landfill site (Zabeliskis village, Kedainiai district); 3 waste transfer stations (Raseiniai, Kasiadorys, and Jonava districts), 11 bulky waste collection sites, 3 green waste composting sites were set up, mechanical and biological waste treatment equipment was set up in Kaunas city and Zabeliskis village, Kedainiai district, 30000 individual composting containers were purchased.

During the analysed period, damaged land areas in Kaunas city increased by 1.89 ha (Fig. 3) as opposed to the statistics in the country and in the county, and constituted 0.04 per cent of the urban land area and 1.6 per cent of other land area.

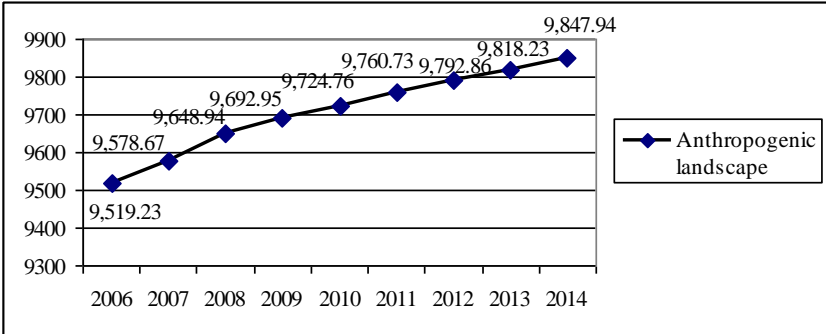


**Fig. 3.** Damaged land area change of Kaunas city in hectares during the period between the years 2006 and 2014

Successful socio-economic development of Lithuanian regions and city municipalities should be based on sustainable and efficient utilisation of minerals, and rational management of waste. It is important to follow the principles of sustainable development so that mineral prospecting, extraction and exploitation of landfill sites would not cause harm to the natural environment of the regional and individual municipalities.

*The change of anthropogenic landscape areas.* Due to urbanisation processes, in the period from 2006 to 2014 anthropogenic landscape areas in Kaunas county increased by 79.84 ha or 0.15 per cent.

Having analysed the data of the change of anthropogenic landscape areas, it was determined that the area of these territories increased by 328.71 ha or 3.34 per cent in the period from 2006 to 2014 (Fig. 4).

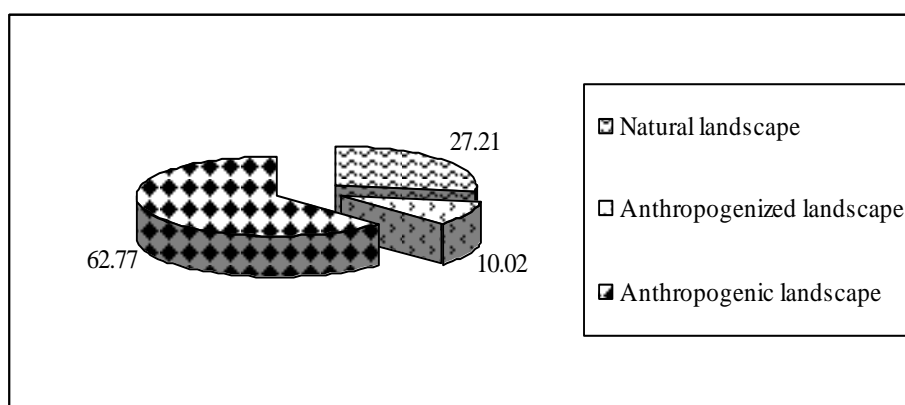


**Fig. 4.** Anthropogenic landscape change in Kaunas city in hectares during the period between the years 2006 and 2014

It was determined by the increase of the areas of built-up territories by 312.78 ha (1.3 per cent), roads by 14.04 ha (1.44 proc.), damaged land by 1.89 ha.

Over the entire analysed period, the major part of Kaunas city anthropogenic landscape, i.e. 90.05 per cent, has been occupied with built-up territories, and the smallest part has been occupied with damaged territories, i.e. 0.06 per cent.

In 2006, the total area of anthropogenic territories (built-up territories, roads, damaged land) occupied 9519.23 ha, constituting 60.68 per cent of Kaunas city area. In 2014, anthropogenic territories constituted 62.77 per cent (9847.94 ha) of the analysed city area. The analysis of the percentage distribution showed that anthropogenic landscape constituted the greater part of Kaunas city (Fig. 5), whereas anthropogenized landscape constituted the smallest part.



**Fig. 5.** Distribution of Kaunas city landscape in 2014, in percent

The main factors influencing the quality of the living environment of the city are urban natural and seminatural and built-up areas ratio (rate of naturalness). With increasing urbanisation, it is necessary to maintain natural green areas that provide comprehensive value to the city and its residents. Urban development must be carried out in accordance with the principles of sustainable development by maintaining the balance between the components of natural and anthropogenic landscape.

## Conclusions

1. In 1408, Kaunas city received Magdeburg rights. At the end of the 16<sup>th</sup> century – beginning of the 17<sup>th</sup> century a lot of masonry houses were built, economic rise was being experienced. Although later on wars and fires destroyed the city, the third quarter of the 18<sup>th</sup> century brought better conditions for the restoration of Kaunas. Kaunas city development plans were prepared (years 1821, 1847, 1871, etc.).
2. The city covers an area of 15,688.47 hectares, i.e. 1.94 percent of Kaunas County and 0.24 percent of the area of the Republic of Lithuania.
3. The following territories have been assigned to Kaunas city anthropogenic components: built-up territories, roads, damaged land. In 2014 it was estimated that built-up territories comprised 2.79 per cent of Lithuanian territory and 4.29 per cent of Kaunas country. In Kaunas city, such territories constituted 8867.81 ha and made up 56.43 per cent of municipality area and 90.05 per cent of anthropogenic landscape area. Within the period of 2006 – 2014 built-up territory area increased by 312.78 ha i.e. 3.53 per cent. The area of built-up territories increased when decreasing the agricultural lands, natural and anthropogenised landscape.
4. In Kaunas city, roads comprise 6.20 per cent. Having carried out the analysis of road changes in the period of 2006 – 2014 it was estimated that within the nine-year period, the road area increased by 14.04 ha or 1.44 per cent. Such increase was influenced by the development of built-up areas and the increase of areas of infrastructure needed for the city's maintenance. During the analysed period, damaged land areas in Kaunas city increased by 1.89 ha and constituted 0.04 per cent of the city and 1.6 per cent of other land areas as opposed to the statistics in the country and in the county.
5. Due to the on-going urbanisation processes, areas of anthropogenic territories in Kaunas city increased by 79.84 ha or 0.15 per cent within the period of 2006 – 2014. Having analysed the data of the changes of Kaunas city anthropogenic areas it was estimated that in 2006 – 2014 the area of such territories increased by 328.71 ha or 3.34 per cent. In 2006 the total area of anthropogenic territories (built-up

territories, roads, damaged land) constituted 9519.23 ha or 60.68 per cent of Kaunas city area. In 2014, anthropogenic territories made up 62.77 per cent (9847.94 ha) of the area of the analysed city.

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# THE ROLE OF AGRICULTURAL PROPERTY AGENCY IN SPATIAL DEVELOPMENT OF RURAL AREAS

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## Abstract

The changes in the ownership structure were to be implemented by the Agricultural Property Agency of the State Treasury, which, under the Act of Law of 11 April 2003 on the structuring of agrarian system (i.e. The Journal of Laws of 2012, item 803, as amended), on 16 July 2003 became the Agricultural Property Agency with eleven local branch offices.

For the purposes of this article the monographic method was used for the overview of relevant literature and legal provisions, whereas the statistical analysis was employed in the data of the Central Statistical Office and reports on the activities of the Agricultural Property Agency. Until the end of 2015 the main objective of the Agricultural Property Agency was to restructure and dispose of the assets within the Agricultural Property Stock of the State Treasury. Since its foundation, the Agency expanded the Stock by 4.74 million ha. Over time, the operating conditions for the Agency were in a state of flux – they were being adjusted to the changing socio-economic situation. At the beginning, leasing was the basic form of disposal of the Stock land. After Polish accession to the European Union an increased interest in the acquisition of agricultural property was observed. By the end of 2014, as a result of land sale, free-of-charge land transfers or other transactions, approximately 3.2 million ha were disposed of, i.e. about 70% of the whole land which was taken over. Currently, according to the legal provisions, long-term lease is the basic form of disposal of the Stock land.

**Key words:** Agricultural Property Agency, rural areas, agricultural land, sale of property, land lease.

## Introduction

The Act of Law of 19 October 1991 on the management of the agricultural real property of the State Treasury (i.e. The Journal of Laws of 2015, item 1014, as amended) legally regulated the issues connected with the management of the property of State Treasury after the closedown of state agricultural farms (PGR). It marked the onset of transformations in the agrarian structure in Poland. The Agriculture Property Agency (hereinafter referred to as ‘the APA’) is the legal successor of the Agricultural Property Agency of State Treasury (hereinafter referred to as ‘the APAST’), which was established on 1 January 1992. The APAST changed into the APA on 16 July 2003. The APA has continued the activities commenced by the APAST in compliance with the provisions under the Act of Law of 11 April 2003 on the structuring of agrarian system (i.e. The Journal of Laws of 2012, item 803, as amended). Primarily, the said Act provides for: the improved protection and development of family-run agricultural holdings, which, according to the Constitution of the Republic of Poland, are the basic building blocks of the agrarian system in the Republic of Poland; proper spatial management of agrarian land; food security for the citizens; and support for sustainable agriculture in line with environmental standards and requirements and contributing to the development of rural areas. Moreover, the scope of activities of the APA enlarged as the Agency was entrusted by the State Treasury with the proprietary right and other rights in rem to the State agricultural property and the Agency thus acted for and on behalf of the State Treasury as regulated by separate legal provisions.

The Agency’s activities, counting from its establishment, can be periodised (Nawrocki, Podgórski 2009). The following division into these characteristic periods is related to the socio-economic and political changes currently taking place in Poland.

- Period 1992 – 1995: land transfers to the Agricultural Property Stock of the State Treasury (hereinafter referred to as ‘the Stock’) and land development; lease as the main form of property disposal.

- Period 1996 – 2003: continued process of land disposal and completed processes of land transfer to the Stock; sale and lease as the main forms of property disposal. Characteristically, secondary demand for land emerged in places where it had been rather limited. Based on a statutory regulation, in 1999 a restricted tendering procedure became possible: no more than 500 ha of agricultural acreage could be sold to one entity. Under the amended Act of Law of 19 October 1991 on the management of agricultural real property of the State Treasury, the deadline for the property transfer from the State Land Fund to the Stock was set on 30 June 2000. The agricultural property which had not been transferred to the Stock became, in the light of law, the property of the communes in which the real estate was located (Suchoń, 2007). The Act of Law on the structuring of agrarian system was made effective on 16 July 2003,

whereby the Agency's scope of activities was enriched with the tasks related to the management of private transfers of agricultural land (Marks-Bielska, 2010).

- Period 2004 – 2015: the twelve-year period following Polish accession to the European Union, when the negotiated terms and conditions of property acquisition by foreigners were valid. The period saw: an annual growth in the price of agricultural land; an increased demand for agricultural land; and unchangingly high sales of the Stock land.

- Year 2016: new legal regulations on management of the Stock; introduction of statutory limitations for the sale of agricultural land; lease as the main form of the Stock land disposal.

The Agency is a trust institution. Being state-owned and having a legal personality, it exercises proprietary rights (rights to property and other rights in rem) with respect to the assets it has been entrusted with. The Agency, on its own behalf, executes the rights and fulfils the duties connected with the State Treasury assets which were entrusted to the Agency upon the closedown of state agricultural farms, including the rights vested and duties imposed by way of administrative decisions.

The concept of 'the stock' became a regulatory notion at the onset of system transformations. It first appeared in the Act of Law of 19 October 1991 on the management of the agricultural real property of the State Treasury (Pessel, 2008). This Act provided for the establishment of the Agricultural Property Stock of the State Treasury (the Stock), which is currently at the disposal of the Agricultural Property Agency (Klusek, 2013). Section 44 of the Civil Code distinguishes the category of state property administered by the State Treasury and other legal persons. The definition of the property indicates that proprietary rights and other rights in rem are applicable here.

The property entrusted to the Agency is a separate part of the State Treasury property – it constitutes the Agricultural Property Stock of the State Treasury. The Stock was created in the 1990s and included the assets of the liquidated state-owned agricultural holdings (together with their liabilities), state agricultural farms and other agricultural property belonging to the State Treasury, e.g. the State Land Fund.

The main objective of the Agricultural Property Agency was to transfer all the state-owned agricultural property to the Stock and to manage the Stock (Suchoń, 2013). What belonged to the APAST at that time was the transferred property of the State Treasury, which included, for instance:

- agricultural property as defined by the Civil Code, located in the areas dedicated for agricultural activities in the land-use plans, excluding land managed by the National State Forests and national parks;
- other property and items of property remaining after the closedown of state agricultural farms, cooperatives and associations;
- forests without subdivision survey within the real estate (Act of Law on the management of the agricultural real property of the State Treasury, section 1).

The above-mentioned assets include not only agricultural and forest land but also outbuildings and households, as well as a whole range of constructions and equipment which made social, technical, production, trade and service infrastructure. Thus, the APA's inventory also covered some distilleries, wineries, breweries, butcher's, slaughter houses, dairies, fruit and vegetable processing plants, mills and goat mills, grain and green fodder drying facilities, fodder mixing plants, grain warehouses, brickworks, sawmills, tanneries and furrieries, cold storage facilities, inns, pubs, shops, service points, common rooms, cultural and sport facilities, palaces and manor houses with surroundings, sewage treatment plants, infrastructure elements, and others.

Currently, property transfers are made to the Stock of the Agency under three legal provisions:

- Act of Law of 11 April 2003 on the structuring of agrarian system;
- Act of Law of 20 December 1990 on farmers' social security<sup>1</sup>;
- Act of Law of 19 October 1991 on the management of the agricultural real property of the State Treasury.

The basic regulations governing the expansion of the Stock with agricultural property are covered by the Act of Law on the structuring of agrarian system. Upon the analysis of the data on APA's activities in particular years, it can be concluded that the Agency exercised its right to land acquisition to a small extent only. Similarly, the Agency acquired small acreages under the Act of Law on the management of agricultural real property of the State Treasury, which gave the Agency the pre-emptive right and the right of repurchase when acting for and on behalf of the State Treasury in cases when a buyer of property intended to sell it within five years from its purchase from the APA.

Under the subsequent amendments of the legal provisions, the nature and objectives of the Agency were reviewed in the following manner: the initial focus being on privatisation, later the centre of gravity was

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<sup>1</sup> i.e. The Journal of Laws of 2015, item 704, as amended

on the support for positive structural changes. Preferably, agricultural property was to be acquired by people owning family-run agricultural holdings and having appropriate qualifications. The legislator waived the right to State intervention in these transactions. Until 2010 the APA wielded control over all agreements on transfer of proprietary rights to agricultural property. In 2010, consequent upon the amendment to the Act of Law, size restrictions were introduced: if agricultural property was below 5 ha in area, the transfer of the proprietary right was unsupervised. On 30 April 2016 owner supervision over all agricultural property in transfer was re-instated.

One of the APA's activities relies on transferring agricultural land. Transfer of agricultural land is any situation which leads to a change of business entities handling an agricultural holding (Maśniak, 2011). Thus, any change of the owner or tenant is a result of agricultural land transfer (Kozłowska-Burdziak, 2013). Until 2016, the APA was mostly responsible for privatisation of the State Treasury assets in forms prescribed by the Act of Law on the management of the agricultural real property of the State Treasury. Privatisation of agricultural land was supposed to improve the agrarian structure (Dzikowska, 2010). Through selling agricultural land the Agricultural Property Agency played a non-negligible role in the structuring of the agricultural property market (Jasińska, Preweda 2012).

Since its foundation, the Agency has transferred 4.74 million ha to the Stock. A lion share of these lands, over 80% (3.7 million ha), came from the former state agricultural farms, while the land from the State Land Fund constituted 13%.

### **Methodology of research and materials**

The aim of the research is to summarise the activities undertaken by the Agency so far and to present its role in the spatial development of rural areas taking into account the changing conditions for managing the Agricultural Property Stock of the State Treasury. For the purposes of the analyses, different data sources were used, including: reports on the activities of the Agricultural Property Agency related to the Agricultural Property Stock of the State Treasury; data of the Central Statistical Office; studies conducted by the Institute of Agricultural and Food Economics; studies conducted by the Department of Economic Analysis and Agricultural Statistics (DEAAS); and a body of literature on the subject.

The abovementioned aim is reached by applying the statistical data, scholarly literature analysis, legal document analysis and synthesis, comparative analysis and descriptive methods of research. This year marks the 25th anniversary of the establishment of the Agency which is a good enough reason to summarise its foregoing performance and assess to what extent it has managed to meet its obligations. The research problem was also inspired by the transformations in the agrarian structure and the spell of a more intense interest taken in acquisition of agricultural property observed in the last few years.

### **Discussions and results**

The regulations on the management of the Agency's property stock can be found in the Act of Law of 19 October 1991 on the management of the agricultural real property of the State Treasury. Section 24 thereof stipulates that the Agency manages the Stock by:

- leasing or selling agricultural property for enlarging or creating family-run agricultural holdings<sup>2</sup>;
- letting the property to legal or natural persons for chargeable use over a definite period;
- using the property in its entirety or in part to make contribution in any commercial-law company in which the State Treasury or a research centre has the majority of stocks or shares;
- letting the property in its entirety or in part to an administrator for management over a definite period;
- setting administration of property;
- exchanging the property.

The fact that in the first period of its work the Agency was statutorily obliged to fulfil other priorities with regard to the assets making the Stock is noteworthy as well. The Agency managed the Stock by:

- selling the property in its entirety or part;
- letting the property to legal or natural persons for chargeable use over a definite period;
- using the property in its entirety or in part to make contribution in a company;
- letting the property in its entirety or in part to an administrator for management over a definite period,
- setting permanent administration of property.

Apart from the above-mentioned forms of property management, the APA may also dispose of the property from its Stock by free-of-charge transfers to various entities.

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<sup>2</sup> Effective as of 30 April 2016.



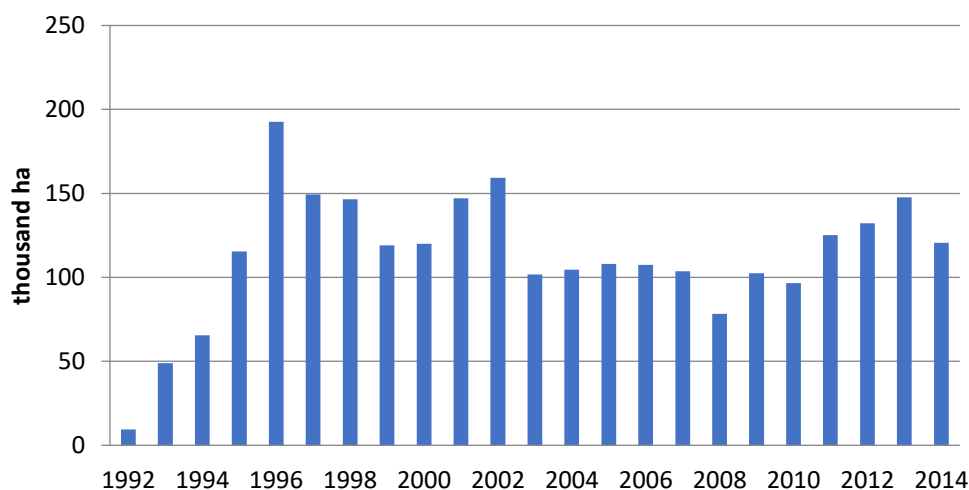
What should be emphasised is that until the end of 2015 property sale was far more common than lease. Not all of the property could be disposed of. For example, restrictions applied to: land with the right of perpetual usufruct and under permanent administration; land with unregulated legal status; and land dedicated for public use (Nawrocki and Podgórski 2011). The total area of land transferred to the Agricultural Property Stock of the State Treasury and forms of property disposal is shown in Table 1.

**Table 1**

Area of land transferred to the Agricultural Property Stock of the State Treasury and forms of property disposal (data of 31 December 2014)

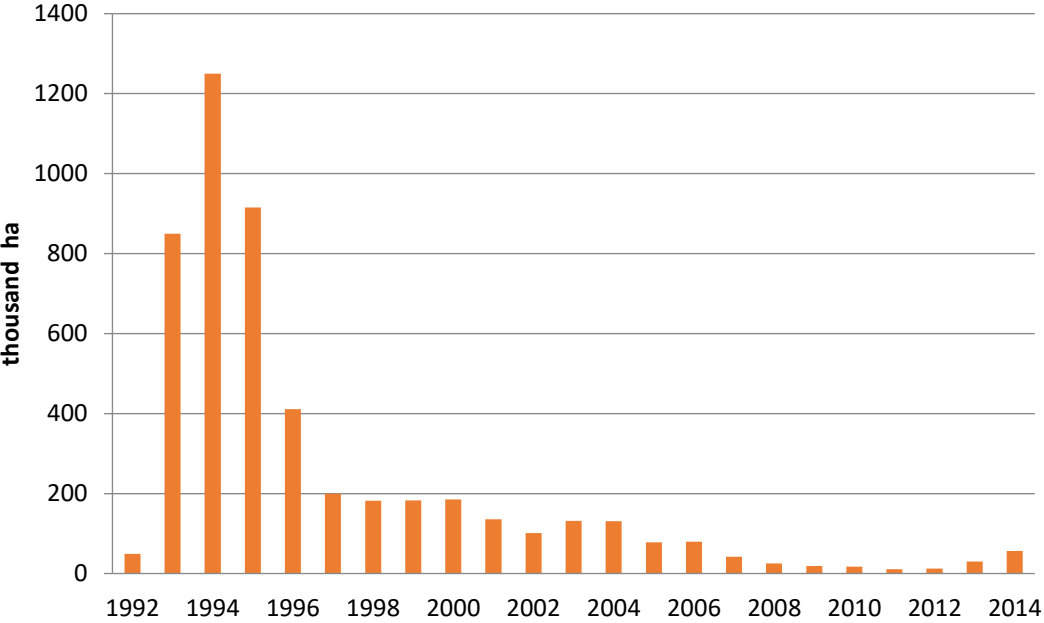
Voivodship	Area of land transferred to the Stock ha	Area of sold ha	Land remaining in the Stock, including			
			Land lease ha	Perpetual usufruct ha	Permanent administration ha	Other forms of disposal ha
Dolnośląskie	509 587	249 169	155 249	6 304	1 213	3 454
Kujawsko-Pomorskie	275 632	125 021	73 597	3 322	1 619	503
Lubelskie	189 555	128 865	25 729	999	1 169	205
Lubuskie	354 304	204 757	70 879	1 706	876	1 528
Łódzkie	79 539	53 665	12 709	1 675	52	15
Małopolskie	38 945	18 128	7 779	2 994	39	5
Mazowieckie	117 490	75 194	17 966	3 788	342	149
Opolskie	181 613	100 272	62 443	1 715	266	91
Podkarpackie	153 412	100 678	17 381	2 199	1 976	17
Podlaskie	128 227	63 720	22 934	1 593	32	331
Pomorskie	431 569	269 780	78 433	4 331	1 288	503
Śląskie	87 015	40 082	22 677	2 169	469	61
Świętokrzyskie	50 334	35 423	5 386	28	170	40
Warmińsko-Mazurskie	820 744	495 428	124 977	4 654	2 125	1 983
Wielkopolskie	499 752	221 445	172 290	8 530	1 227	1 131
Zachodniopomorskie	821 618	426 845	218 956	6 107	7 309	3 916
Total	4 739 338	2 608 473	1 089 386	52 114	20 171	13 933

By the end of 2014, as a result of land sale, free-of-charge transfers or another form of permanent disposal, the Stock decreased by approximately 3.2 million ha, i.e. approximately 70% of all the land taken over. In 2014 the Agency had 1.49 million ha at its disposal, of which approximately 1.1 million ha were leased. Recently, land sale has been the dominant form of the Stock land disposal; the APA has been selling property by way of tenders, whereby it increased the number of restricted tendering procedures and significantly more eagerly sold property to lessees, who enjoyed pre-emptive rights (Report 2015). The area of land sold in each year since foundation of Agency is shown in Figure below (Fig. 1).



**Fig. 1.** Sold area from the Stock of the Agricultural Property Agency in the period of 1992-2014

Until the end of 2015 sale of property from the Stock was the major form of permanent property disposal. It arose, among other things, out of the legal provisions under which the Agency operated. At the onset of Agency’s work, land sale was rapidly gaining momentum, reaching the record-breaking level in 1996 with 192.6 thousand ha sold. The subsequent years (1997-2002) saw much lower sales figures, which oscillated around 120-160 thousand ha annually. In the period of 2003-2010 land sale dropped to 100 thousand ha per annum. Outstandingly, in 2008 the sales of the Stock land was as low as 78.2 thousand ha. Between 2011 and 2014 the sales bounced back and peaked in 2013 (147.7 thousand ha). It was consequent upon the accelerated privatisation of all property items within the Stock and a greater pressure exerted by the APA to prioritise land acquisition rather than long-term land lease. Another important form of property disposal from Agricultural Property Stock of the State Treasury is land lease. Land lease in Poland is a long-lasting phenomenon. So far it has not been on a large scale and usually it has not gone beyond informal oral agreements. The scope and the nature of land lease in Poland were conditioned by historical changes and agrarian development. The political system transformations initiated by the events of 1989 changed the economic and legal situation in Poland (Jarka 2010, Ostrowski 1999). At that time there was a considerable growth in the share of leased land in the land use structure of the State Treasury land. The period of 1993-1995 saw about 3 million ha leased, which then constituted a significant share of the Stock (4.7 million ha). The acreage of land leased from the Stock of the Agricultural Property Agency between 1992 and 2014 is depicted in Fig. 2.



**Fig. 2.** Land leased from the Stock of the Agricultural Property Agency in the period of 1992-2014

Since its foundation, the APA leased incrementally 4.74 million ha. It is due to the fact that some property was repeatedly leased. Everything points to the fact that by 2012 there was a downward trend in the acreage of land leased in total. The lease of land from the Stock is circulatory in nature, which means that the leased land often returns to the Stock for further disposal. In 2011 a statutory obligation called for designation of 30% of agricultural acreage for sale (applied to lease agreements of land exceeding 400 ha in total area) (Majchrzak, 2012). The Agency used land lease as the basic form of land development predominantly when the land could not be sold. It was due to the fact that a given plot of land lacked a regulated legal status or it had to undergo subdivision survey. Short-term lease was also in place when it was possible to use a plot for other purposes or when it was requested by the Chamber of Agriculture. Recent years have also shown that acquisition of agricultural land as a form of investment has been remarkably attractive. It translated into high transaction prices of non-built-up agricultural property. The Agency’s core scope of duties is regulated by the Act of Law on the management of the agricultural real property of the State Treasury, section 6, whereby the Agricultural Property Agency fulfils objectives compliant with the state policy, particularly by:

- creating and developing the area structure of family-run agricultural holdings;
- creating conditions favouring rational utilisation of the productive potential of the Agricultural Property Stock of the State Treasury;
- restructuring and privatising the State Treasury assets used for agricultural purposes;
- transferring real estate and other items of property belonging to the State Treasury and used for agricultural purposes;
- administering the State Treasury assets dedicated for agricultural purposes;
- securing the State Treasury assets;
- initiating agricultural activities involving machinery on the State Treasury land and fostering the creation of private agricultural holdings on the State Treasury land;
- exercising the rights on stocks and shares.

The real estate, which was part of the Stock, underwent the following structural and proprietary transformations controlled by the Agricultural Property Agency: it was sold by way of restricted and non-restricted tendering procedures, in recognition of pre-emptive right to purchase; it was subject to secondary restructuring and then it was further committed. Particularly, that occurred in the case of large properties which had been leased and the lease agreement was nearing its expiry date or was terminated, or part of the land under the running lease agreement was excluded from the lease and dedicated for individual use by other tenants, including mostly individual farmers.

Another important obligation assigned to the Agency is the improvement of the area structure, especially creation of conditions for enlarging the existing family-run agricultural holdings.

Besides the above-mentioned tasks, the also Agency fulfils the duties imposed on it by separate legal provisions, chiefly the Act of Law on the structuring of agrarian system and the Act of Law on the management of the agricultural real property of the State Treasury, as well as by the stipulations on the execution of right to compensation for abandoning the real estate situated beyond contemporary borders of the Republic of Poland. Moreover, the Agency performs or participates in the performance of duties prescribed, for example, in the legal provisions on: the relation of the state to the church and religious communities; farmers' social security; environmental protection and nature preservation; forests and forest land; water law; and other (Report..., 2015).

On 16 July 2003 the Agency gained rights to wield control over some of the agricultural property transfers, which was in compliance with the Act of Law on the structuring of agrarian system. Legal provisions regulate the principles of the State Treasury agricultural property disposal and introduce restrictions on acquisition of that property (Laskowska, 2011). The Agricultural Property Agency, acting for and on behalf of the State, is to partially control the agricultural property market, and, if needed, intervene in the market through exercising the right of pre-emption enjoyed by the State. Consequently, the Agency is also competent in taking decisions on the form and mode of land disposal. The Agency exerts owner supervision through different forms of the Stock disposal. The supervision is to ensure that the State Treasury assets are properly utilised, i.e. used for the intended purposes by their users.

The Agency allocates funds for maintenance (renovating, servicing, modernising) of Stock buildings and constructions as well.

So far, the restructuring of agricultural property handled by the Agency has been mostly aimed at: curbing irrational concentration of land, e.g. by division of holdings; releasing some land for enlargement of individual holdings; separating the social activities run in the holdings from the agricultural ones; defining plots of land required for satisfaction of non-agricultural planning and zoning, e.g. plans related to motorways, environmental protection, forestation, and provision/maintenance of work places in as high a number as possible.

Ultimately, privatisation of the State sector in agriculture was supposed to create favourable conditions for effective management. It was reflected in resignation of the State from management of agricultural holdings and in exploitation of entrepreneurial flair exhibited by people undertaking their own holdings by means of their funds and at their risk. The legal regulations valid at the time enabled an individual approach to every single holding which was being transformed and the employment of various forms of property disposal, such as: sale, lease, administration, and creation of commercial-law companies. The law also provided for diverse forms of property disposal: bids, tenders, restricted tendering procedures, non-tender procedures, free-of-charge transfers; moreover, the law allowed various entities to participate in the privatisation of the State Treasury agricultural property: individual farmers, former employees of state agricultural farms, companies from agriculture-related branches, companies with foreign capital share.

In the course of time the operational conditions for the Agency were gradually changing. The most significant changes occurred in the last few years when, due to the solution of the problem of debts incurred together with property, the incomes surpassed the outcomes. The consequent surplus gave opportunities for more intensive activities in the social domain and for stimulation of the group of former employees of state agricultural farms. The Agency undertook activities aiming at maintenance or creation of work places; it also assisted children and teenagers from households whose members were formerly employed on state agricultural farms in obtaining access to educational facilities, for one thing, and helped residents of housing districts which used to belong to state agricultural farms with social matters, for another thing.

Whether the management of agricultural property of the State Treasury by the Agricultural Property Agency was reasonable or not was checked by the state authorities and, if needed, appropriate legal provisions were introduced. In 2002, the Act of Law provided that a Minister responsible for the State Treasury would be given stocks and shares which had been acquired or obtained by the Agency, excluding the shares in companies which were particularly important for the national economy i.e. those implementing breeding programmes.

After Polish accession to the European Union it was observed that acquisition of agricultural property started gaining in attractiveness. Land prices rocketed; however, it should be noted that land transfers in private market were stunted. Poland became a member of the European Union on 1 May 2004 and negotiated a twelve-year transition period for unrestricted transfers of agricultural land in Poland. On 1 May 2016 the transition period came to an end, thus, giving foreigners the right to acquire property. New legal provisions were drafted in order to render it impossible for people without Polish citizenship to acquire land.

On 30 April 2016 the Act of Law of 14 April 2016 on the suspended selling of real property from the Agricultural Property Stock of the State Treasury and on changes in certain Acts of Law (The Journal of Laws of 2016, item 585) came into force, which amended, for instance, the Act of Law of 11 April 2003 on the structuring of agrarian system (i.e. The Journal of Laws of 2012, item 803, as amended).

Upon analysis of this legislation it can be concluded that the new legal regulations primarily aim at: improving the protection of agricultural land against speculations and purchase by domestic and overseas entities (natural and legal persons); halting the unfavourable trend in the agrarian system; and strengthening the economical standing of Polish farmers. The Act is also supposed to guarantee real protection of the Polish land against uncontrolled purchasing, particularly that involving foreigners.

Consequent upon introduction of the new legal provisions, lease is to be the basic form of State land development. The legislator's intention was to implement solutions favourable to farmers (lease being the cheapest form of agricultural land acquisition). Lease agreements are to be long-term ones – made for a period as long as ten years or more. These solutions are supposed to enable individual farmers to rationally plan their production.

The fact that the Agency cannot identify itself with the State Treasury is vital. It acts as an individual entity and operates in compliance with the agricultural policy of the State Treasury, which, in fact, is the owner of the property transferred to the Agency stock. The Agency is not the owner of the acquired assets (assets within the Agricultural Property Stock of the State Treasury) but merely an entity which exercises on its own behalf the entrusted proprietary rights.

### **Conclusions and proposals**

The Agricultural Property Agency has been playing an important role in the development of property in the rural areas which used to belong to the state agricultural farms (PGR) and the State Land Fund. From regional perspective, the Agricultural Property Stock of the State Treasury was heterogeneous. Therefore, a special role has been ascribed to the Agency in the north and west of Poland where the share of land ownership among natural persons was negligible. One of the outcomes of APA's transformative work was a change in the proportions between the private and public sectors in the ownership structure of agricultural land in Poland, which was achieved through activation of state land market and stimulation of an increase in the average size of the agricultural holding. Real estate market, owing to the Agency, experienced reorganisation and qualitative changes, including, first and foremost, a substantial growth in the value of agricultural property.

To a large extent, transfer of agricultural land in Poland is controlled by the Agricultural Property Agency. As a result of implementation of new regulations concerning the principles of management of agricultural land remaining in the Agricultural Property Stock of the State Treasury as of 1 May 2016 land lease is to be the major form of the Stock land disposal.

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# THE ANALYSIS OF THE IMPLEMENTATION OF THE LAND CONSOLIDATION PROJECT OF THE PARTS OF ALKSNĖNAI AND SŪDAVA CADASTRAL AREA

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## Abstract

The land consolidation project of the parts of Vilkaviškis district municipality, Pilviškiai and Klausučiai elderates, Alksnėnai and Sūdava cadastral area is analysed in the article, the main indicators of the project, the meaning of land consolidation, the need to improve the order of the execution and implementation of these activities are described in the article. The survey was carried out to examine the opinion of the participants of the project regarding the advantages of the proceeding and results of the project as well as some of its drawbacks.

**Keywords:** Land consolidation, land parcel, agricultural land.

## Introduction

One of the major tasks and aims of the European Union is sustainable rural and agricultural development (Backman, 2002), therefore in order to integrate into the economic system of the European Union and become an equal partner one of the priorities is to cultivate the competitiveness of farms (Aleknavičius, Augustienė, 2004).

When the independence of the Republic of Lithuania was restored, the collective farms (kolkhozes) were replaced by private ones, the land parcels which were expropriated during the occupation were returned to the citizens. A lot of small land parcels have appeared due to this; many owners have several land parcels in different locations and this becomes an obstacle in the development of the land market, the productivity of farms and competitiveness. Many post-communist countries face similar problems (Riddell, Rembold 2000; Hartvigsen, M. 2006). Small and non-competitive farms with the average size of 9,37 ha still prevail in our country, the size being too small in comparison to the farms of the European Union (Žemės ūkio..., 2016). The existing land management structure does not meet the needs of Lithuanian farming and its reorganization is necessary in order to be able to compete in the common market of the European Union.

Upon restoration of the property rights, the focus was drawn on the land restitution rather than formation of farms, therefore now one owner or tenant often farm in several small land parcels, having irregular shape and being apart from one another. It is uneconomic, uncomfortable and irrational to work in this way and it is problematic to use agricultural machinery to farm separate land parcels (Daugalienė, 2006). In order to ensure the conditions to the farmers to compete in the market of Lithuania and the European Union successfully, it is necessary to foresee new measures of the land restoration, which would re-shape small and scattered land parcels into rational land use suitable for more efficient farming (Daugalienė, 2006). In order to reach the aim, land consolidation is applied.

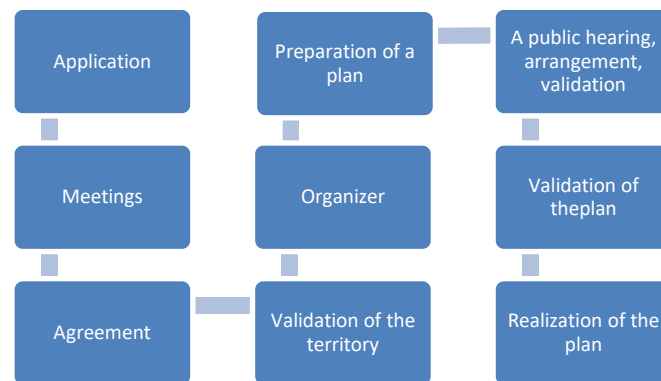
Land consolidation is a special process of land management, during which complex rearrangement of the boundaries of land parcels of the certain rural residence territory is performed by connecting them in order to form rationally managed agricultural holdings, to improve their structure, to create the necessary rural infrastructure and to implement other tasks and aims of agriculture, rural development and environmental policy (Žemės įstatymo..., 2004).

In 1987, a research was carried out by Soerensen in Denmark, the possibilities of the displacement and consolidation of land parcels and the main element in the process of land consolidation planning were examined, as appropriate land rearrangement is an important condition in the successful implementation of the consolidation project (Soerensen, 1987). It was proved that the three main factors influencing the success of consolidation projects are as follows:

1. Structure of local land parcels. This factor is important from the very beginning of the project because it partly leads to the potential of land parcel improvement. If land parcels are small, of irregular shape, the owners have more than one of them, then the potential of land parcel improvement is great, as well as the motivation of the owners of the land parcels to participate in the consolidation project is stronger rather than that of the owners of large land parcels of regular shape.
2. Existing land parcels. In the process of consolidation, free public land parcels can be used while consolidating private land parcels. Furthermore, land parcels can additionally increase if some owners

decide to sell their land parcels, particularly if they are the elder and do not plan to engage in any agricultural activity.

3. Possessed knowledge and skills. This is the third important factor because if the land owners have some knowledge about consolidation projects and successful experiences in applying the land consolidation in the neighbourhood, their motivation to participate in these projects increases. The success of consolidation projects also depends greatly on the knowledge of the people implementing the project, their personal skills, planning experience and sociability (Soerensen, 1987; Hartvigsen, 2014). There are different approaches to land consolidation projects being currently implemented in the Republic of Lithuania. Some authors consider this process as controversial and required to be improved (Pašakarnis, 2015, Katarsiekė, 2013), therefore the aim to carry out a survey of participants of the consolidation project and find out their opinion was raised during the research.



**Fig. 1.** Proceeding of land consolidation

The object of the work is the participants of the consolidation project and land parcels owned under their ownership.

The aim of the work is to analyse the land consolidation project of the parts of Alksnėnai and Sūdava cadastral area and to identify advantages and drawbacks of it; to carry out the analysis of the opinion of land owners regarding the applied consolidation.

The tasks of the work:

1. To analyse the proceeding, solutions and implementation of the project.
2. To carry out the survey of the participants of the project.
3. To form and present research conclusions and recommendations.

### Methodology

When carrying out the research, the analysis of the land consolidation project (hereinafter – the Project) of the parts of Marijampolė district, Vilkaviškis district municipality, Pilviskiai and Klausučiai elderate, Alksnėnai and Sūdava cadastral area was performed. A detailed research of the changes of the land parcels before and after consolidation was performed by distinguishing out the advantages and drawbacks of the consolidation project.

In order to find out the opinion and approach of the participants of the project towards the project and its results, a survey-questionnaire to land owners was prepared in March 2015. 93 land owners, who participated in the Project, were interviewed. Questions related to the implementation of the Project were presented to the respondents.

### Results and discussion

The basis to start organizing the consolidation project was 21 applications submitted to the State Enterprise “State Land Fund”, which indicated to start preparing the land consolidation project in the territory of 459,36 ha. The persons who submitted the applications to prepare the project requested:

- to form agricultural and forestry land parcels of rational size and form – 21 participants in the area of 443,03 ha;
- to consolidate land holdings and improve their adjacency – 4 participants in the area of 258.83 ha;
- to reduce the distance between land parcels in the land holding – 8 participants;
- to create the needed rural infrastructure – 6 participants;
- to establish land use restrictions regulated by law – 2 participants;



- to improve recreational, rural tourism and aesthetic resources of the territory – 2 participants. The plan of preliminary territory of the project is presented in Figure 2.



**Fig. 2.** Preliminary territory of the land consolidation project

Land parcels of the owners who have submitted the applications to participate in the project are marked in yellow, as well as other land parcels falling in the territory of the project selected according to the rules.

Since seized land parcels or land parcels which became the object of litigation could not be assigned to the territory of the project, the preliminary territory of the project is not continuous.

The territory of the project is located in the northern part of Vilkaviškis district municipality and cover Pilviškiai and Klausučiai elderates, Alksnėnai and Sūdava cadastral areas Smilgiai, Garsviniai, Mažučiai, Našiškiai, Alksnėnai, Starkai, Galiakiausiai, Čižiškiai, Mažieji Šelviai, Teiberiai, Augalai, Didieji Šelviai, Rementiškiai, Stimėnai villages and their parts, the area of the territory is 1404.9337 ha. The first meeting of the participants on 12 December 2015 is considered to be the beginning of the project. During the meeting it was stated that after the reorganization of the territory the average area of the land parcel would increase by about 3.74 ha. 279 land parcels were assigned to the territory of the project, 265 of them belonged to natural persons and their total area was 1387.8126 ha (98.78%), and one land parcel with the area of 2.69 ha (0.19%) belonged to legal persons by their ownership, as well as two land parcels with the area of 0.3819 ha (0.03%) owned by an agricultural cooperative. Eleven state land parcels were also included in the territory approved for the project preparation and they constituted only 14.0492 ha (1%) of the total area of the territory of the project. State lands were located through the entire territory of the project, the average area of the state land is 1.28 ha.

At the beginning of reorganization there were 269 land parcels in the territory of the Project, and after the reorganization of the Project territory there remained 26.77% less land parcels, i.e. 197. During the projection, land parcel boundaries were identified with the natural contours: trenches, existing ways, and new or proposed easements of ways were designed in the places where were not any, not infringing the interests of the owners and users of the adjacent land parcels.

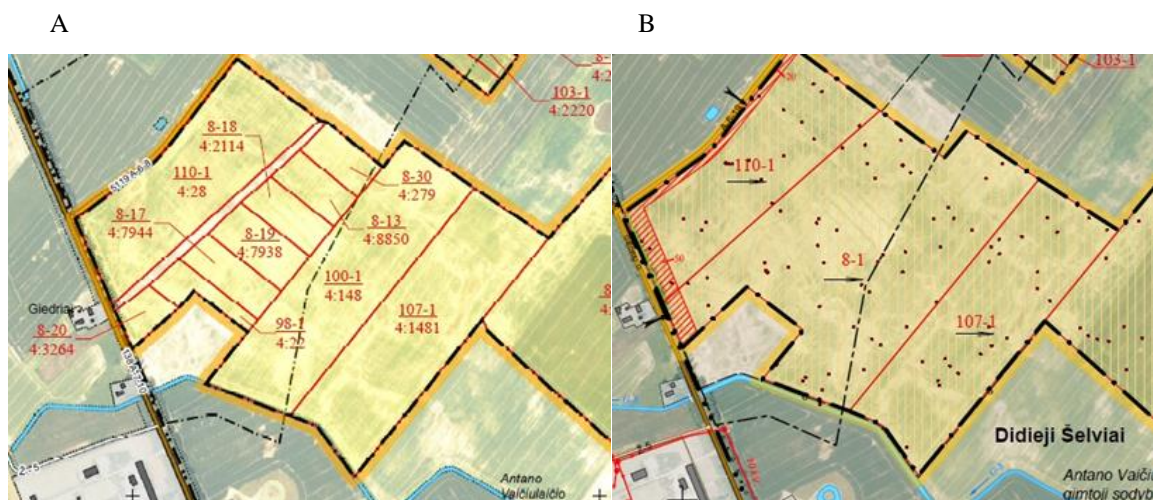
The majority of land parcels assigned to the project territory were of irregular configuration, irrational size and form. The land parcels of one owner were scattered through the entire territory of the project, and this location of the land parcels interfered with efficient farming and achievement of optimal results in farming. The owners having one or several land parcels did not request to change the location of the land parcel, therefore only configuration of these land parcels has slightly changed, the boundaries of the land parcels were revised. Large farmers who participated in the project exchanged land parcels intensely and consolidated massifs of land parcels. The exchange of unequal land parcels by mutual



agreement between the participants of the project was carried out in the entire territory of the project, the boundaries of the land parcels were straightened and adjusted during the reorganization.

Two family farms participating in the land consolidation project had the greatest benefit. The members of one family owned 42 land parcels with the total area of 165.1979 ha before the reorganization of the project and this constituted 11.76% of the total area of the territory of the whole project. These land parcels were reformed into 13 land parcels of rational size and form.

The other family owned 45 land parcels in the territory of the Project with the total area of 165.1979 ha and this constituted 17.75% of the total area of the territory of the project. All land parcels were reorganized into 21 agricultural land massifs. The organizers of the project succeeded in finding the rational solutions regarding the land consolidation, one of them is that 8 land parcels were combined into 1 land parcel with the area of 21.9437 ha by mutual request of the owners (Fig. 3).



**Fig. 3.** Land parcel (A) before the projection (B) after the projection

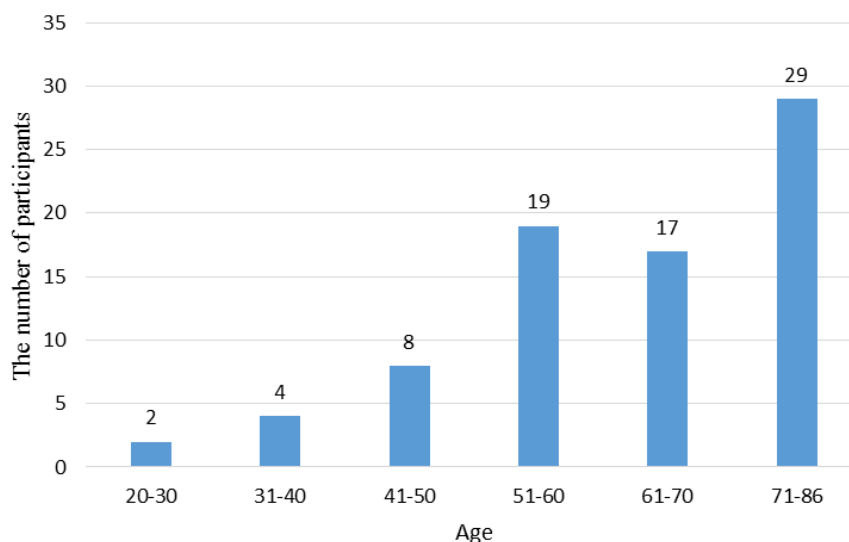
After the reorganization of the territory of the project 193 land parcels designated for agricultural purposes were created. Three land parcels of other purpose as well as one aquacultural land parcel were also created. The total average area of all created land parcels after the reorganization of the project is 7.22 ha.

Even better results were not achieved due to local public roads which crossed 6 land parcels in the territory of the project during the projection. By the request of the owners, 3 land parcels were separated from the common partial ownership and 3 land parcels were divided into parts indicated by the owners of the land parcels.

Successful implementation of the planned reorganization of the territory was interfered by the fact that even 75 participants of the land consolidation project owning 72 land parcels with the area of 463.3732 ha wanted just to perform cadastral measurements during the consolidation project and this constituted only 30.7% of the entire territory.

In order to find out the opinion of the participants of the project about the proceeding of the project and its advantages 93 of 139 participants were interviewed; other participants were not willing answer the questions or there was no possibility to contact them.

The owners of the land parcels of the project territory are the elderly people. The majority falls into the age group from 40 to 75. It was identified that the average age is 59 years, the eldest participant is 86 years old and the youngest is 25 years old. Having analysed the results, it may be stated that the age of the participant has influence on the projection of the land parcels since 46 out of 75 project participants who were not willing to change the location or configuration of the land parcel, were older than 60 (Fig. 4).



**Fig. 4.** Analysis of the age of the persons who were not willing to change the location of a land parcel

To the question if the land consolidation project satisfied their expectations, 75 participants answered 'yes', 10 participants answered 'partly' and 8 participants answered 'no' by reasoning that their requests were not fulfilled during the creation of the drawing of solutions and that the cadastral measurements were not performed qualitatively.

When carrying out the survey and asking what problems were faced during the preparation of the project, the participants mentioned two problems in most cases:

- the lack of information about the stage of the project;
- all wishes and requests were not taken into consideration during the creation of the drawing of solutions.

One of the aims of the land consolidation project is perceptible economic efficiency, therefore land owners were asked if they would have any economic benefits after the project implementation. All 93 respondents answered that they think they would. The farmers having the largest amount of land parcels reasoned that regarding the improved configuration of the land parcels and smaller distances between the land parcels, the rational level of the use of productive resources would allow increasing the income. Even the participants of the project having only the cadastral measurements performed to their land parcels think that they could have greater economic benefits while renting or selling their land parcel in the future.

To the question if they positively assessed the results of the project 75 (80.6% of all respondents) participants of the project answered 'yes'. 10 participants chose the answer 'partly' and 8 participants stated that they assessed the results of the project negatively.

The persons who assessed the results partly positively or negatively were asked to detail their answer and stated that their wishes and requests were not taken into consideration during the creation of the drawing of solutions, and they expressed their dissatisfaction with the organizers of the project regarding too complex formulation of informative papers. Dissatisfied with the results of the project were also the persons who were eliminated from the project not by their own choice. When one of the participants left the project after the projection of solutions when the land parcels were exchanged by mutual agreement, both land parcels were eliminated from the territory of the project.

To the question if they would recommend the other participants to take part in land consolidation projects, the answers of all respondents were similar. The majority think that these projects are beneficial only to large farmers or to the persons who have many land parcels. To the question if they would have participated in the project if they had been required to partly or completely contribute by their own funds, only several answered that 'probably yes' and the majority would not have participated in the project.

## Conclusions

1. While implementing the land consolidation project, the number was decreased from 269 to 197 and this constituted 26.77%; the average land parcel size varied from 5.52 ha to 7.22 ha. It was hoped that

the average land parcel size would increase to 9.6 ha, however it failed to be implemented due to land owners who did not accept the proposed solutions of land reorganization and who wanted only cadastral measurements to be carried out.

2. More effective reorganization of the territory of the project was not achieved due to the following reasons: many participants of the project were not willing to change the location or configuration of the land parcel. Optimally designed solutions were not successfully realized due to the fact that the land owners left the land consolidation project regarding the documents not being submitted on time, the deaths or by their own choice.

3. The survey showed that the participants of the project are highly dissatisfied with the organizers of the project as not all of their expectations were fulfilled, however they think that the project will bring the financial benefit regarding the improved configuration of the land, diminished distance between the agricultural land parcels and performed cadastral measurements.

4. Taking the research results into consideration, it is proposed to make some changes in laws so that they would precisely regulate the actions which are performed when the shortage of the area is set by cadastral measurements and if the area of the land parcel exceeds the maximum permissible error.

5. Furthermore, it is suggested regulating that the land owners who participate in the project with one or several land parcels and do not agree with the correction of the land boundaries would cover 10% of the project outgoings by their own funds preserving the same area of the land parcel if it is necessary to the rational projection of the boundaries of other land parcels.

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# PECULIARITIES AND PROSPECTS OF SOLVING LAND DEGRADATION PROBLEM IN UKRAINE

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## Abstract

In Ukraine, degradation of land resources is a complex ecological problem, preventing sustainable development of land employment. Land protection from degradation requires development of measures in the process of land management at regional and local levels. Efficiency of the measures depends considerably on reliable information about quantitative and qualitative conditions of lands, due to the fact that it forces timeliness of the research.

The aim of the research is to study problems of land degradation in terms of land management while developing measures of land resource protection. To reach this aim, the following tasks were set out: to analyse the drawbacks of informational support in terms of land management fulfilment at the current stage of land relations development; to describe prospective ways to implement the measures on land protection from degradation in Ukraine.

Methodological basis of the research includes the method of system analysis (performed while studying the process of land resource degradation) and cartographic method (employed while detecting the spread of degradation processes and its drawbacks in land employment).

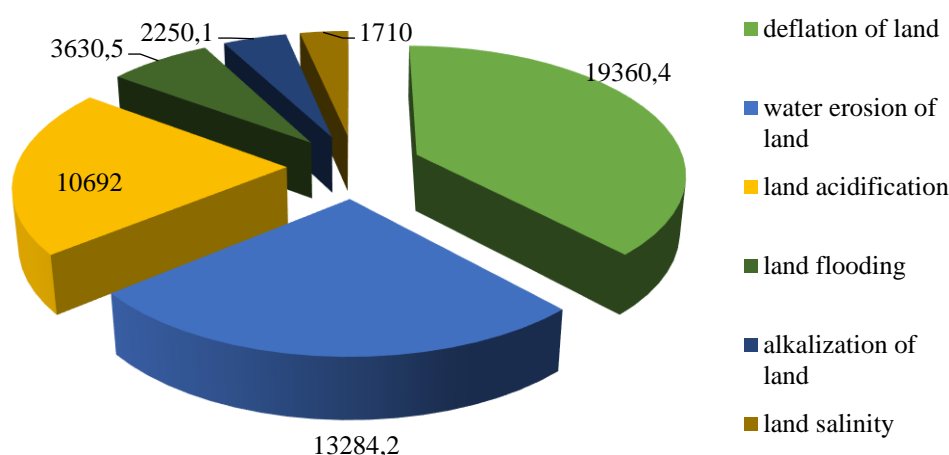
The research has determined that soil maps and plans of employment of lands do not provide reliable information about quantitative and qualitative conditions of land resources. The existing organisation of land use, first arable one, does not always correspond to soil-conserving requirements.

It is proposed: to update plan-cartographic material based on space images and data of agrochemical classification of agricultural lands; to establish efficient organisational and economic mechanisms to implement ecological policy in the field of land management.

**Key words:** land use, land degradation, soil map, land management, land protection.

## Introduction

To stop the process of land degradation is one of the tasks of sustainable development of society (Transforming our World, 2015). In Ukraine, the problem is still extremely important, in spite of the established regulatory system on the issue of land protection and degradation (Pro ohoronu zemel, 2003, Pro zemleustrii, 2003, Pro zatverdghennia Poriadku konservacii zemel, 2013, Pro shvalennya Konceptiyi..., 2014). The most widely spread kinds of land degradation are water erosion and soil deflation (approximately 57 % of the country's area), land flooding (approximately 12 %), soil acidification (approximately 18 %), soil salinity and alkalization (approximately 6 %) (Pro shvalennya Konceptiyi..., 2014) (Fig. 1). Every year, direct losses from erosion constitute about 5 billion USD, while incidental ones, caused by yield loss on eroded soils, make 1 billion USD (The national report..., 2015).



**Fig. 1.** Division of agricultural lands according to the kind of degradation, the ha (Rozshirenii piatirichnii zvit..., 2012)

Among the main reasons, causing the problem of land degradation, the following are determined by the authors of this article (Pro shvalennya Konceptiyi..., 2014):

- 1) high level of agricultural land development and non-balanced correlation among land farms (agricultural land development of the territory of Ukraine makes 68.8 %, ploughed lands make 53.9 %, ploughed agricultural lands – 78.4 %, forested territory – 17.6 %);
- 2) deterioration of scientifically argued principles of land employment and fundamentals of arable farming, including breaking of crop rotation rules, decrease of the amount of applied agrochemicals, first fertilizers, including organic ones;
- 3) unsatisfactory conditions of land management support in terms of drafting of documents on land protection and fulfilment of anticipated measures, as well as insufficient information supply from the system of the State Land Cadaster;
- 4) insufficient support on performance of the state system concerning the monitoring of land and environment;
- 5) poor financial resources for solution of problems in the field of protection and sustainable land employment;
- 6) low level of population competency, interest and capability of landowners and land-users that constitute more than 25 million of people, to secure sustainable employment of lands and solve the problems of their degradation.

The aim of the article is to study the problem of land degradation in terms of land management, particularly in relation to the development of measures of land protection and stop of soil degradation processes.

Thus, the following tasks are set: to analyse the drawbacks of informational support in terms of land management fulfilment at the current stage of land relation development; to describe prospective ways to implement the measures on land protection from degradation in Ukraine.

#### **Methodology of the research and material**

Methodological basis of the research includes the method of system analysis (performed while studying the process of land resource degradation) and cartographic method (employed while detecting the spread of degradation processes and drawbacks in land employment).

Object of the research is the process of land degradation in Ukraine at the present stage of land relation development in the implementation of the land management.

The subject of research is theoretical, methodical and practical aspects of solving the problem of land degradation in the implementation of the land management, including the development of measures to stop the land degradation.

The research uses the regulatory system of Ukraine in the field of employment and protection of land, data of the Advanced Five-Year Report on Desertification and Degradation of Lands and National Report on Completion of Land Reform, documents on land management, scientific works of national researchers and information from the Public cartographic map of Ukraine.

The following main approaches were used in the research to solve the problem of land degradation and reclaim soil fertility:

land conservation, i.e. the cease of economic employment of degraded and low-productive lands for a determined period and meadowing or foresting of them, due to the fact that economic use of land is ecologically and economically inefficient. Land conservation also deals with the lands in industrially polluted areas, incapable to provide ecologically-clean products and causing hazard to the health of people who stay in the territory (Pro zatverdgenia Poriadku..., 2013);

contour-reclamation organisation of territory, i.e. a differentiated approach to employment of agricultural lands, including arable ones, with contour-reclamation organisation of territory (Stoiko N., Kryshenyk N., 2015).

The measures are practically applied during the process of land management, not including complex of socio-economic and ecological measures, focused on regulation of land relations and rational organisation of territory of administrative-territorial units and farming subjects (Pro zemleustrii, 2003). Measures of land management as to rational use and protection of lands are defined in documents on land management at regional and local levels (Fig. 2).

Drawing of the documents of land management require the use of information about the current conditions of land employment within administrative-territorial units; material of soil examinations; cartogram of steepness of slopes; materials of geodesic inspections and land surveying projecting, etc.



### Regional level

**Scheme of land management and technical-economic argumentation of employment and protection of lands of administrative-territorial units (district, town, village):** determination of prospective directions to use and protect lands (redistribution of lands considering the needs of agricultural, forest and water economies, development of villages, settlements, towns, areas of curative, recreational, historic and cultural importance, natural-reserve fund and other nature-protective land, etc.)

### Local level

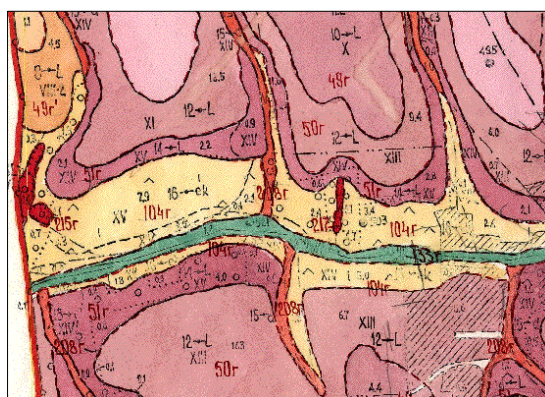
**Working projects of land management:** implementation of measures concerning the reclamation of deteriorated lands, conservation of degraded and low-productive lands, improvement of agricultural and forest areas, land protection from erosion, flooding, waterlogging, secondary salinity, draining, landslides, consolidation, acidification (e.g. contour-reclamation **organisation** of territory, land transformation, etc.)

**Fig. 2.** Documents of land management, defining measures of land protection

## Discussion and results

Peculiarities of land degradation problem at the current stage of land relations development in terms of performance of land management.

**Absence of new soil examinations.** In Ukraine, the first complete large-scale soil examination was made in 1957-1961 on the area of almost 47 million ha of agricultural lands. The examination provided an objective agrochemical characteristic of soils in the form of soil maps in scale 1:10000, 1:25000. The second soil examination (“amendment” of soil maps) was carried out in 1975-1985 on the area of 40,2 million ha (Daciko L. V., 2013) (Fig. 3).



**Fig. 3.** Copy from the cartogram of agro-productive groups of soils on the materials of soil examinations in 1985

Since 1991, no complete soil examination has been performed (Kanash O., 2013). The average term of reliability of soil maps is 15-20 years (in case of hydromelioration – 5 years). According to the land legislature, in Ukraine agrochemical examination of soils should be carried out once in five years (Pro ohoronu zemel, 2003). In fact, such examinations are carried out not on every land plot, but on some chosen land plots (for example, in Lviv region there are 38 such land plots) (Doslidzennya gruntiv i roslin...). As degradation processes (water erosion and deflation, dehumification, salinity, draining, flooding, etc.) occur in a considerable area of agricultural lands and change qualitative characteristics of soils, the authors of this article believe that such examinations do not demonstrate objective conditions of soil layer.

Thus, more than 30 years have passed from the moment of the large-scale soil examination of the territory of Ukraine. Information from the soil maps, made in the 60-80s of the last century, does not correspond to the current conditions of soil layer. It influences indicators of agricultural lands estimation, complicating the solution of the problem of efficient land employment, protection and reclamation of soil fertility.

In general, current conditions of degradation processes of soil is of larger scale than it is described in plan-cartographic materials.

**Spreading of degradation processes on shared lands.** The land reform, which started in 1991, resulted in privatization of lands of collective agricultural enterprises (land sharing). It causes certain complexity in solution of the problem of degraded lands, since the organization of land shares was carried out without taking into consideration the soil-conserving requirements (Stoiko N., Kryshenyk N., 2015). In most cases, slope low-productive and degraded lands were shared and submitted to private ownership (Fig. 4, 5).



**Fig. 4.** Fragment of location of land shares by longer side along the slope (Poliana village council, Lviv region)



**Fig. 5.** Spreading of degradation processes on arable lands (Obukhiv village council, Vinnytsia region):

- a) tract of arable land with the processes of linear erosion;
- b) location of land shares on erosion-dangerous land plot

Fig. 4 presents the visual investigation of a land plot of private ownership, used for personal farming, subjected to erosion processes. Generally, in the area of Obukhiv village council, 245 ha of arable lands are located in the territory with steepness of more than 5° and mediate or heavy washed-off soils. Taking the degraded land of private ownership out of economic circulation, in particular by means of conservation, is a problematic task. According to the legislature of Ukraine, conservation of degraded and low-productive land plots should be carried out at the initiative of landowners and land-users (Pro zatverdzhennia Poriadku..., 2013). However, lately land conservation in Ukraine has not been performed, mainly because of the absence of an efficient mechanism of motivation (interest) of landowners and land-users as to application of the measures of land protection (The national report..., 2015).

**Self-foresting of agricultural lands.** Self-foresting of agricultural lands, being in private or state ownership, is a widely spread phenomenon, especially for Polissia and Forest-steppe zones. According to the regulatory documents, process of self-foresting is not considered land degradation. To our mind, the process should be studied and reflected in the data of the State Land Cadaster and land surveying documents (Fig. 6, 7).





**Fig. 6.** Self-foresting of land plots (shares): a) Dihtiarivka village council, Chernihiv region; b) Krasnovolia village council, Volyn region.



**Fig. 7.** Self-foresting of land plots with low-productive soil of the state ownership (Zamlychi village council, Volyn region): a) copy from the plan of the village council territory; b) fragment from the public cadaster map

Self-foresting mainly occurs in agricultural lands, which are not used in agriculture due to different reasons: low-productive soil, need for pasture or hay-making, impossibility to register the rights of land lease because of the absence of the landowner, etc.

**Absence of full-scale land inventory.** Reforming of land relations in Ukraine has resulted in appearance of a great number of landowners and land-users of different forms of ownership. Unfortunately, in Ukraine there is no reliable information system, linking all data on quantitative and qualitative conditions of land plots.

According to the data (Monitoring zemelnih vidnosin..., 2016), as of December 1, 2015, there are 16 661 051 registered land plots with the area of 41 812 127.76 ha (69 % of the territory of Ukraine), only 22,6 % of the state owned lands are registered in the State Land Cadaster. In the period of 2013-2015, lease right was registered for 832 551 land plots with the total area of 3 513 015.64 ha (about 16 % of all leased lands). Not issued ("Vidumerla") heritage consists of 9 650 land plots with the area of 35 802.5 ha. Almost 45 % of them are submitted to lease. In general, statistics of land distribution between state, communal and private forms of ownership is not true to the fact. It complicates the preparation of qualitative documents on land management, anticipating measures of land protection.

**Prospective ways to fulfil the measures of land protection from degradation in Ukraine.** To solve the problem of land degradation, one should develop a long-term strategy of land protection and keeping of soil fertility, directed at preventing negative consequences of economical deteriorations.

In terms of land management as to land protection, it is necessary:

- to perform land inventory and update plan-cartographic material, using space images obtained by means of aerospace monitoring of lands;
- to apply the data of agrochemical classification of agricultural lands according to the acting legislature while developing project decisions as to use and protection of land.



Establishment of an efficient organisational and economic mechanism to secure implementation of ecological policy in the field of land management is an important condition to fulfil the measures of land protection. Essential components of the mechanism should include:

- ecological norms and standards of land employment according to the requirements of sustainable development;
- economic instruments to stimulate land protection by means of differentiation of payments for land resource employment, payment for deterioration of qualitative characteristics of soil, increase of fines for breaking land protection rules;
- ecological audit of agrarian enterprises, ecological management, ecological insurance and ecological education in the field of land employment;
- state and public control for land protection;
- planning and management of territory development, based on the schemes and projects of land management as to employment and protection of lands.

## Conclusions

1. In Ukraine, erosion and deflation of agricultural land are the most widespread kinds of land degradation. Development of measures to stop land degradation and reclamation of soil fertility is made in documents on land management. Preparation of the documents requires reliable information about conditions of land resource employment.
2. Current conditions of soil degradation processes is of larger scale than described in plan-cartographic materials. Soil maps and plans of land use do not provide reliable information about land employment. The existing organisation of agricultural land use, first arable one, does not correspond to soil-conserving requirements.
3. Performance of land management needs updating of plan-cartographic material, based on the space images and data of agrochemical classification of agricultural lands.
4. To motivate landowners and land-users to apply measures of land protection, it is necessary to establish an efficient organisational and economic mechanism to support implementation of ecological policy in the field of land management.

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# UPDATING GEOREFERENTIAL DATA

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## Abstract

Land cover objects are reflected in a set of georeferential data and are constantly changing. These changes can be accurately examined by computer and interactive information systems. One of the main advantages of computer information systems is the fact that their maps can be constantly improved and updated. The update of georeferential data was conducted in a selected area using the ArcGIS software. After the analysis of the Lithuanian land cover data, the area meeting the following criteria was selected: a diverse landscape, the abundance of different objects (built-up areas, forests, bodies of water), an adjacent city and good access to major metropolitan areas. The article presents the updated georeferential data and tracks changes in the updated data of built-up areas, areas overgrown with trees and shrubs, dams, swimming pools, lakes, ponds and roads in the selected area within the period from 2008 to 2015. The results revealed that changes occurred in all analysed layers. It proves that land cover objects are constantly changing. The greatest change was observed in the data of built-up areas. In comparison with 2008, in 2015 even 41% of built-up areas was changed (i.e. the old boundaries were revised, new and defunct built-up areas were discovered), 125 new areas have overgrown with trees and bushes and 46 changes were observed in ponds and pools.

**Key words:** *georeferential data, built-up area, forests, roads, bodies of water.*

## Introduction

Land cover objects are reflected by georeferential data. Georeferential data are the geo-data of universal use on the most important topographic, engineering and geodetic objects. Georeferential database is a set of georeferential data of a certain area composed in accordance with principles of geoinformation systems. The main georeferential objects include roads, streets, railways, rivers, drainage channels, canals, lakes, ponds, dams, buildings, lands, built-up areas, forest section lines, geodetic points. Most of these objects are depicted by several geometric types. The object is depicted by the linear type as an apparent axial line of the object or as road edges, lake shores, as well as covered areas of various objects, spatial type reflects the territory covered by the object, while the dot type displays the coordinates of the object centre (Papsiene, 2014).

Georeferential data are updated throughout the world. A number of works of foreign scientists also deals with georeferential data (Werneck, 2008; Williams et al., 2002; Burget et al., 2013). Georeferential data are not only used for mapping but are also becoming an important basis for integrating. These trends are supported by the INSPIRE Directive (INSPIRE..., 2009), which is based on the fact that spatial data shall be created once and used at various levels, and their accuracy and reliability shall be strictly regulated (Beconyte et al., 2009). Orthophotographic maps are most commonly employed to update georeferential data. It is also important to note that the processing of geographic data includes the interactive revision of data, therefore the responsibility is borne by the operator himself/herself (Davalgaite et al., 2012). Taking into account the fact that GIS is applied in more and more research areas including not only land management but also soil science, forest management, hydraulic engineering, geology, environmental monitoring and urban planning, its significance in the national economy as science and technology is constantly increasing (Huisman, 2009). It is essential to process and provide any spatial data so that they would result in effective analysis and adoption of correct planning solutions (Beconyte et al., 2010).

The research aims at updating the georeferential data in the selected area.

To achieve the aim, the following tasks have been set:

1. To update the data of built-up areas, areas overgrown with trees and bushes, dams, pools, lakes, ponds and roads in the selected area.
2. To perform the analysis of changes in the data under investigation.

The object of the research includes layers of built-up areas (pu0), roads, dams, pools (hd4), lakes, ponds (hd3), areas overgrown with trees and bushes (ms0) in a part of Igliauka elderate, situated in Marijampole municipality. The area has been selected for research according to the following criteria: a diverse landscape, the abundance of different objects (built-up areas, forests, bodies of water), suburban, close to major metropolitan areas.

### Methodology of research and materials

Georeferential data in Igliauka elderate were updated using the orthophotographic map of this area and ArcGIS software. Built-up areas, roads, forests and hydrographic layers marked in 2008 were employed: LEAVES, AREAS, HIDRO\_L, FOREST \_L, and ROADS. The orthophotographic map of 2008 showing depicted layers was obtained from UAB "Aerogeodezijos institutas".

The research was conducted analysing the entire area and searching for discrepancies to the data of 2008, and making corrections if any were found. However, it is complicated to trace all visual changes. Fortunately, the functions of ArcMap software enable to do that. The Intersect function allows creating a new layer out of two selected layers leaving only those elements (of part thereof) which appear in both input layers. In addition, corrections were made revising some of the objects by the method of outdoor mapping.

The research involves methods of analysis of various bibliographic references, graphic data display, analysis of cartographic material and generalisation. The article deals with changes in georeferential data in Igliauka elderate within 7 years.

### Discussions and results

Some of the largest changes have been determined in the layer of built-up area. The analysis revealed that main changes have occurred outside inhabited areas. Updating the layer of built-up area, a number of discrepancies were detected and may be grouped in 3 groups. Group one: comparing the data of 2008 with the territorial map of 2015, it was determined that the layer drawn in 2008 was incorrect, changes in the built-up area were noticed, the area has increased (Fig. 1).



**Fig. 1.** Former area of homestead in 2008 and corrected area of homestead in 2015

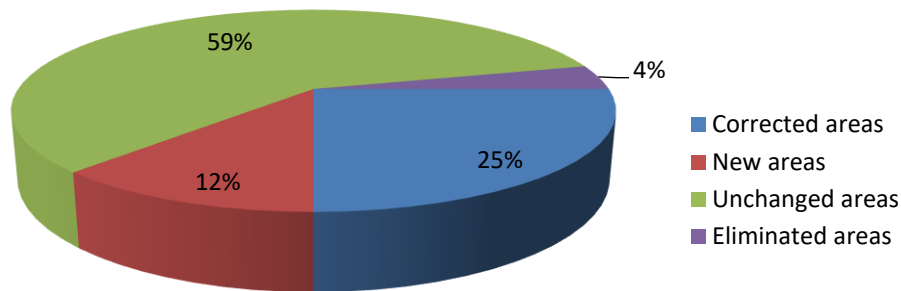
Group two involves cases where the built-up area was marked incorrectly in 2008 as the analysis of the orthophotographic map in 2015 revealed the absence of the built-up area (Fig. 2).



**Fig. 2.** Former built-up area in 2008 and the changed built-up area in 2015

Group three deals with cases where the built-up area was not marked in the map of 2008 but was reflected in the data of 2015.

The analysis of the attributive data on the built-up area revealed that corrections (the increase/decrease of the area) were made for 71 objects, 35 areas were newly drawn and 11 built-up areas were eliminated (Fig. 3).



**Fig. 3.** Details on the updated built-up areas

The analysis of forest areas revealed that large forest areas changed only marginally, however, a number of new forest appeared. Changes can also be grouped in several groups. Group one includes cases where forest areas were drawn incorrectly. Comparing the data of 2008 with the map of 2015, changes are obvious, the area is usually increased (Fig. 4 No. 1). However, there were cases where according to the orthophotographic map of 2008 the forest area was larger but then it was cut down and a bare field remained in its place (Fig. 4 No. 2, 3).



**Fig. 4.** Discrepancies found in the forest layer comparing the data of 2008 with the data of 2015

Group two concerns cases where forest areas contain bodies of water, which no longer exist. There are also many cases where the forest area was not marked at all. It happened because of the fact that during the period from 2008 to 2015 new forests appeared in those areas.

The collected data revealed that the number of objects overgrown with trees and bushes increased in 2015, a bit more small areas overgrown with forests appeared occupying only a few acres (Table 1).

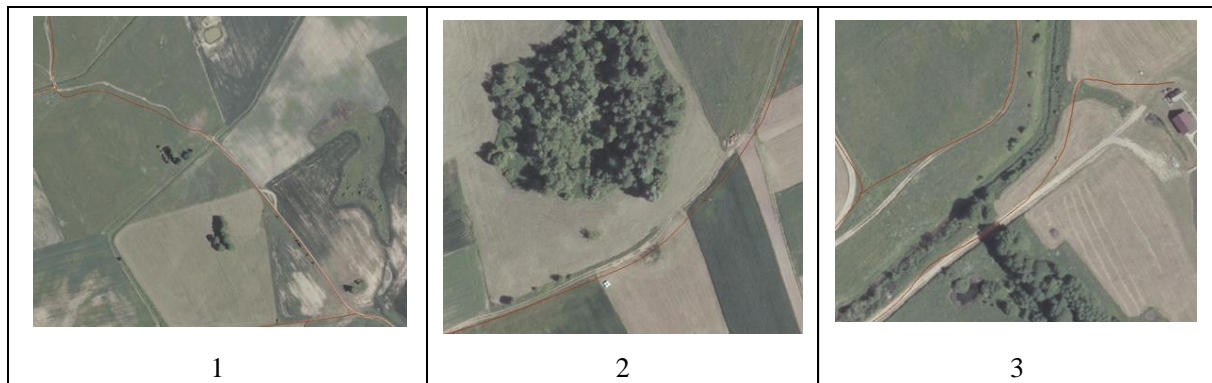
**Table 1**

The change in areas overgrown with trees and bushes within the period from 2008 to 2015

Indicators/ Period	2008-2015
Number of objects	+125
Largest area (a)	+506a
Smallest area (a)	-79a

Having updated the areal layer of forests, the linear layer MISKAS\_L, forest clearings and section lines were checked. No changes in sections lines have been detected within 7 years.

Analysing and correcting the layer of roads, the largest changes were determined among field roads. As in previously updated layers, the road layer also includes several groups of objects requiring corrections. Group one includes cases where the road does not correspond the existing position (Fig. 5).



**Fig. 5.** Roads with changed boundaries from 2008 to 2015

The changes of roads were influenced by a number of factors over 7 years: natural conditions, i.e. the road could have been waterlogged, therefore land users could have formed a new road, which remains in use by now; what is more, boundaries of land plots could have been changed, therefore a new road was formed by the altered land boundaries. Group two involved cases where the road has shortened or some of it has disappeared over 7 years. It happened because in 2008 the road was used to access the land plot or forest. In 2015 the road disappeared as cultivated fields were used by a single land user and some of the road became redundant. Group three involves road discrepancies in cases where the formation of a new road is viewed although it was not observed in 2008 but already existed in 2015. Such new field roads occur due to the formation of a new land plot and the necessity to access it. The analysis of road data also revealed changes in the settlement. The settlement expanded, new buildings, residential houses appeared and were necessary to access. The analysis of the attributive data on roads revealed that corrections (the road was prolonged, shortened or resettled) were made for 26 objects, 56 roads were newly drawn, most of them were short, designed to access homesteads.

Comparing roads with hydrographic linear objects (rivers, drainage ditches), no changes were observed in these layers within the period from 2008 to 2015. Lakes and ponds changed slightly over 7 years as well. The most noticeable changes in the hydrographic layer were observed in dam basins (hd4). A number of new bodies of water appeared nearby homesteads. After the analysis of statistics of the observed and corrected discrepancies in the layer of the bodies of water, it was determined that the total number of dams and pools in the area in question increased by 25, and 21 discrepancies were observed (i. e. the area was increased or decreased). The total area of dams in the territory increased by 51997 m<sup>2</sup>. The analysis of the data suggests that georeferential data must be constantly updated because they are constantly changing as a result of both natural and anthropogenic factors.

### Conclusions

1. Updating the layer of built-up area, it was determined that its total area increased by more than 1%, i.e. 23763 m<sup>2</sup>. According to the revised data, the built-up area occupied 25% of the total area, out of which newly detected built-up area comprised 12%, while defunct built-up area comprised 4% of the total area under investigation.
2. The number of objects overgrown with trees and bushes increased by 125 units. Large forest areas expanded, the territory overgrown with forest increased by small areas. In comparison with the year 2008, in 2015 the total forest area increased by 12470 a. Forest section lines and clearings have not changed over 7 years.
3. The existing roads changed slightly. Comparing the data of 2008 and 2015, it was determined that only 6% of the total number of roads has changed.
4. No changes were observed in hydrographic linear objects (rivers, drainage ditches) within the period from 2008 to 2015. Comparing the total area of dams and pools in 2008–2015, their total area in the territory increased by 51997 m<sup>2</sup>, and the number of objects grew by 125. However, the area of lakes and ponds little changed as little discrepancies were observed in this layer.

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# THE ANALYSIS OF CADASTRAL MEASUREMENTS OF LAND PARCELS IN SAKIAI DISTRICT

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## Abstract

This article analyses the issue of the inadequacy between the results of preliminary measurements performed during the land reform and results of cadastral measurements. The aim of the research is to analyse the change of areas of land parcels of Sakiai district, the mistakes which were made during the measurements and their causes, as well as to make the comparison between preliminary and cadastral measurements. The research methods are as follows: the review and analysis of scientific literature, the analysis of statistical data, the comparative analysis and the method of graphical modelling. The total area of analysed land parcels is 282718 m<sup>2</sup>. During the research, while comparing the preliminary data and the data of the measurements of land parcels obtained while performing cadastral measurements, it was established that an average increase of areas of land parcels is 0.0223 ha, decrease is 0.0034 ha, the total perimeter of all land parcels decreased by 24.9 m, the total area of arable land in land parcels increased by 0.1390 ha due to the increase of areas of land parcels, new mapped lands: tree and shrub plantations, grasslands, gardens. The average shift of turning points of land parcel boundaries in the locality after the performed cadastral measurements is 2.64 m. What is more, by applying some formulae, the accuracy of calculation of areas of land parcels was determined. It turned out that land parcels, which cover 96% of the area of the analysed land parcels, changed to the maximum permissible error of areas, and 4% exceeded the maximum permissible error. According to the data presented by the National Land Service it was established that 15% of the submitted cadastral files are not accepted. The most common causes are an inadequacy of land parcel boundaries to the documents of the planning of territories or the land holding projects (44%), mistakes in the preparation of files of cadastral data of land parcel, in the completing (23%), in the preparation of the land parcel plan (21%), and while filling in the form of land parcel cadastral data (13%).

**Keywords:** *cadastral measurements, preliminary measurements, land reform.*

## Introduction

The significance of cadastral measurements has been increasing as they are necessary in making the majority of land deals. Having performed cadastral to land parcels which were calculated using preliminary measurements, more significant or slight inaccuracies were observed. Due to them, the areas of land parcels change as well as the length of lines, the place of points and the composition of lands, this being very significant to the land parcel user.

The literature which was reviewed during the analysis of the chosen topic is not contradictory since land parcels and their measurements are legally regulated objects (Nekilnojamojo..., 2002; Lietuvos..., 2000; Lietuvos..., 2002; Kadastriniam..., 2013; Kadastro..., 2013; Žemės..., 2009), and the authors of the articles and other literature present unanimous information and opinion regarding the significance of the land reform, and agree that cadastral measurements of land parcels are necessary and even a must (Žemėtvarkininkų..., 2013; Parsova et al., 2013; Lietuvos..., 2002). When carrying out the review of literature, the attitude was also faced that the measurements were performed inaccurately during the land reform (Tarvydienė, 2007; Vainauskas, 1994; Jonauskienė ir kt., 2009; Kam reikalingi..., 2011), as well as the discontentment with the necessary repeated measurements (Nacionalinė..., 2014), but it is also assented that the land reform which is implemented, and its completion would greatly increase the functioning of the land market (Palionytė, 2000), and cadastral measurements would optimize the abilities of land owning and using as well as agricultural policy.

The changes of land parcels after performing cadastral measurements have already been analysed by several authors, however while writing this paper, a different form of primary information and other methods of research were used, therefore the topic of this article is relevant and significant. It is also relevant for the reason that the changes of data characteristic of agricultural land parcels of Sakiai district and their causes are analysed in the paper. Theoretical and practical significance of the paper is the assessment and the adaptation of changes of the analysed land parcels by performing cadastral measurements, adapting land parcel to the objects which were registered previously, and by solving other problems of the adjustment of land parcels.

The aim of the paper is to analyse the change of land parcels of Sakiai district, the mistakes which are made by land surveyors and their causes as well as to make the comparison between cadastral and preliminary measurements.

The tasks of the paper are as follows: to compare preliminary and revised measurements of land parcels, to set the causes of the changes, to identify the change of areas of land parcels, and to analyse the mistakes which are made by land surveyors.

Research results: the analysis of the areas of land parcels, the lengths of lines, perimeters, lands and the changes of coordinates of points, the analysis of the shift of points and the results of it, the compliance of the changes of areas of land parcels with the maximum margin of error, and the results of the analysis of the mistakes which are made by land surveyors.

### **Methodology**

Land parcels, which were chosen for the analysis of the parameters of land parcels, are situated in Zvirgzdaiciai and Sintautai elderates. In Zvirgzdaiciai elderate, one land parcel is situated in Zvirgzdaiciai town and one in Ramoniškiai village, two land parcels are situated in Tupikai village. In Sintautai elderate, 4 land parcels are in Santakai village and one in Versiai village. The same 9 land parcels together with the other 17 land parcels from other cadastral areas (Daukantiskiai, Girenai and Uzseniai) were used for the analysis of the maximum margin of error of areas. All these 26 private land parcels are of the area of 0.15 – 6.46 ha.

The material for the research of cadastral measurements of land parcels was collected from the files of cadastral measurements performed by the employees of the State Enterprise “State Land Fund” and preliminary plans of the same land parcels, i.e. the land management projects of land reform. Preliminary measurements to 9 chosen agricultural land parcels were performed in 2005 and 2007, to one parcel in 2009, and cadastral measurements were performed in 2013 and 2014. Preliminary measurements to other land parcels were performed during 1995–2008, and cadastral measurements mostly in 2015, one case in 2010 and one in 2014.

When information necessary for the research was collected, the literature related to the chosen topic was examined, and the data processing was performed. Preliminary plans were copied using the *GeoMap* programme and inserted into cadastral plans with original coordinates, unnecessary data were deleted and necessary data for the comparison were written in different colours, distances between turning points of boundaries determined by using preliminary and cadastral measurements were measured, the differences between these coordinates were determined, the orthophoto of cadastral area is inserted. After analysing the collected data, the causes of the changes of land parcels were presented on the basis of the performed analysis of land parcels and comments of SLF land surveyor, who performed the cadastral measurements. All the necessary data for the research were put into tables, the differences of studied parameters were calculated, described and grouped for the general analysis of the changes of land parcels.

Due to a different scale of preliminary plans and cartographical material, as well as areas of land parcels, the maximum margins of error of areas were calculated separately for each of 26 land parcels according to the formulae suitable for them. Actual deviations of areas from the maximum permissible errors of areas and their percentage were calculated, the analysis of results was carried out.

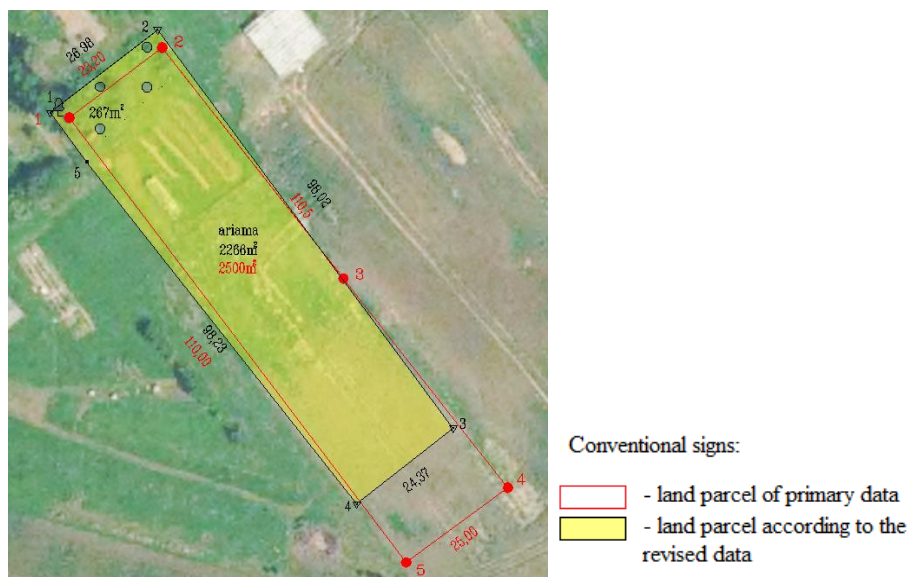
The mistakes of land surveyors were discussed by using the revised results of cadastral data files of National Land Service (193 files). After the assessment of the frequency of occurrence of mistakes and the examination of files of cadastral data of Sakiai district, which were not accepted from 6 January 2016 till 15 March 2016, the infractions were summarized.

### **Results and discussion**

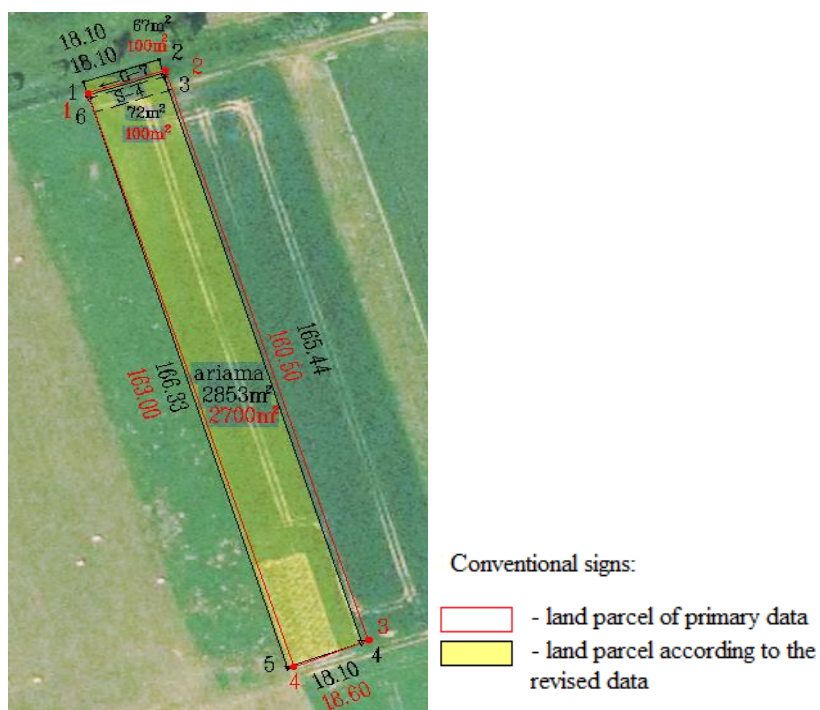
Land parcels, which were used in the research, constituted the area of 8.3400 ha according to preliminary measurements, and 8.5151 ha according to cadastral measurements. After performing cadastral measurements, the area of the ninth land parcel decreased and of all other land parcels increased. The average change of the area is 0.0202 ha and the total increase of nine analysed land parcels is 0.1751 ha. The changes of areas of land parcels do not exceed the maximum permissible error of areas. According to State Land Fund surveyor, the changes of areas of the analysed land parcels were a result of inaccurate preliminary measurements of the boundaries and areas of land parcel, specification of boundaries of land parcels according to the previously registered roads, residential areas or land parcels.

Perimeters of the majority of the analysed land parcels have decreased after performing cadastral measurements (Table 1). The perimeter of the first land parcel have decreased mostly (Fig. 2), yet by 21.10 m, and the largest increase of the perimeter is 7.27 m. of the seventh land parcel (Fig. 1).





**Fig. 1.** Land parcel No. 1 graphical comparison of primary and revised data



**Fig. 2.** Land parcel No. 7 graphical comparison of primary and revised data

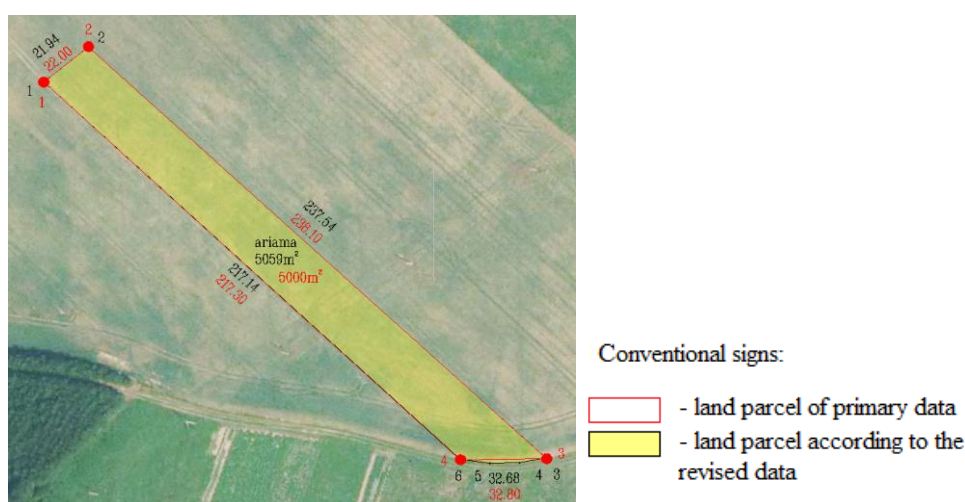
**Table 1**

Changes of data of the nine analysed land parcels after performing cadastral measurements

No. of Object	Difference of areas (ha)	Shifts of turning points of boundaries (m)	Difference of perimeters (m)
1.	0.0033	9.67	-21.10
2.	0.0013	1.89	-0.78
3.	0.0450	0.75	-3.50
4.	0.0351	2.76	0.50
5.	0.0371	1.05	-0.10
6.	0.0416	1.41	3.70
7.	0.0092	2.41	7.27
8.	0.0059	0.24	1.10
9.	-0.0034	3.55	-11.99
Total	0.1751	2.64 (average)	-24.90

The average perimeter of land parcels was 621.88 m according to the primary data, and 619.11 m according to the revised data. Dimensions of perimeters of the analysed land parcels as well as dimensions of lengths of lines changed due to incorrectly performed preliminary measurements and adjacent roads, trenches and revised boundaries of land parcels.

Having analysed the changes of agricultural area of nine land parcels, it may be stated that there are several reasons why the lands and their areas have changed. Several analysed land parcels consist only of arable land, therefore when the area of land parcel changed, the area of arable land changed as well. The average change of the area of arable land in land parcel is 0.0883 ha, and the total area of arable land in land parcels increased by 0.1390 ha. Areas of other lands which form land parcels were also specified. New lands, i.e. tree and shrub plantations (0.1399 ha in total), grasslands (0.1335 ha in total), gardens (0.1016 ha in total) appeared due to the shifts of land parcels or poor farming conditions. The areas of roads and water changed slightly. After the determination of coordinates of turning points of boundaries of the analysed land parcels, the shifts of turning points of boundaries were determined as well. The least average shift is of the eighth land parcel and it is 0.24 m. (Fig. 3), and the largest one, i.e. 9.67 m, is of the first land parcel (Fig. 1).



**Fig. 3.** Graphical comparison of primary and revised data of land parcel No. 8

The average shift of turning points of boundaries of all land parcels is 2.64 m. These inaccuracies emerge due to the same reasons as inaccuracies of all data of cadastral measurements emerge: the coordination of boundaries of land parcels and turning points with previously registered roads, residential areas or boundaries of land parcels, the combination with accurately measured trenches, the addition of new points by adjusting the form of land parcel.

When cadastral measurements were performed and the obtained data were compared to the data collected when performing preliminary measurements, the changes of the areas of lands and newly emerged lands were observed (Table 2).

To summarize the research result, the following changes of land parcels are observed: the area of the first land parcel did not increase much, but the perimeter of land parcel decreased even by 21.1 m. What is more as anew land, i.e. garden emerged. Areas and perimeters of the second, sixth, seventh and eighth land parcels changed slightly. The area of the third land parcel increased, however the area of arable land decreased because the new agricultural area around the electric power pole appeared, i.e. shrublands. The area of the fourth land parcel has increased after cadastral measurements. The area of the fifth land parcel was determined to increase by 0.0371 ha; since lengths of lines and perimeter has increased slightly, it may be stated that the area of land parcel was measured imprecisely during the preliminary measurements. The ninth land parcel is the only parcel with the decreased area out of the analysed ones.

Table 2

## Comparison of primary and revised data on land parcels

Determined area	Area (ha)	Perimeter (m)	Agricultural areas (ha)					Roads
			Arable	Grassland	Garden	Plantations	Water	
Land parcel No. 1								
Primary	0.2500	268.70	0.2500		0.0000			
Revised	0.2533	247.60	0.2266		0.0267			
Difference	0.0033	-21.10	-0.0234		0.0267			
Land parcel No. 2								
Primary	1.5000	1078.90	1.5000	0.0000		0.0000		
Revised	1.5013	1078.12	1.3966	0.0125		0.0922		
Difference	0.0013	-0.78	-0.1034	0.0125		0.0922		
Land parcel No. 3								
Primary	1.6400	642.00	1.6400			0.0000		
Revised	1.6850	638.50	1.6742			0.0108		
Difference	0.0450	-3.50	0.0342			0.0108		
Land parcel No. 4								
Primary	1.0500	798.10	1.0500	0.0000	0.0000	0.0000		
Revised	1.0851	798.60	0.8523	0.1210	0.0749	0.0369		
Difference	0.0351	0.50	-0.1977	0.1210	0.0749	0.0369		
Land parcel No. 5								
Primary	1.3600	557.60	1.3600					
Revised	1.3971	557.50	1.3971					
Difference	0.0371	-0.10	0.3710					
Land parcel No. 6								
Primary	1.2500	977.10	1.2400				0.0100	
Revised	1.2916	980.80	1.2805				0.0111	
Difference	0.0416	3.70	0.0405				0.0011	
Land parcel No. 7								
Primary	0.2900	360.70	0.2700			0.0100	0.0100	
Revised	0.2992	367.97	0.2853			0.0067	0.0072	
Difference	0.0092	7.27	0.0153			-0.0033	-0.0028	
Land parcel No. 8								
Primary	0.5000	510.20	0.5000					
Revised	0.5059	511.30	0.5059					
Difference	0.0059	1.10	0.0059					
Land parcel No. 9								
Primary	0.5000	403.60	0.5000					
Revised	0.4966	391.61	0.4966					
Difference	-0.0034	-11.99	-0.0034					

The accuracy of calculation of areas of land parcels was also analysed in the research, i.e. the registered areas and the areas set after performing cadastral measurements were compared. 26 land parcels of the area of 0.15–6.46 ha situated in Sakiai district, Sintautai, Zvirgzdaiciai, Daukantiskiai, Girenai and Uzseniai cadastral areas were chosen randomly. Preliminary plans of these land parcels were prepared in a different scale, by using different cartographic material, the areas of land parcels were also different. Due to this, according to the formulae approved in the new edition of the Real Estate Cadastre regulations of the Republic of Lithuania, a permissible deviation of areas was calculated according to different formulae for each land parcel, depending on the parameters of preliminary plans.

The scale of the analysed plans was 1:5000 or 1:2000, and the scale of only two plans of land parcels was 1:10000, due to which the maximum margin of error of areas is slightly greater. The extent of the maximum margin of error was also determined by the used cartographic material, i.e. an orthophotographic map, there were 62% of them (they determined a smaller maximum margin of error), outlines drawn by hand (they determined a greater maximum margin of error). Areas of the majority

(sixteen) of land parcels were up to 1 ha, the area of seven land parcels was from 1.1 to 2 ha, areas of two land parcels were between 2.1–4 ha, and one land parcel was of the area of 6.64 ha, what determined a greater maximum margin of error of area of this land parcel. The analysis of differences between areas of land parcels is presented in Table 3.

**Table 3**

Analysis of errors of areas of land parcels

No.	Cadastral area	Preliminary area (m <sup>2</sup> )	Revised area (m <sup>2</sup> )	Actual deviation (m <sup>2</sup> )	Maximum permissible error (m <sup>2</sup> )	Actual deviation in the range of error (%)
1	Sintautai	2500	2533	33	150	22.00
2	Sintautai	15000	15013	13	490	2.65
3	Žvirgždaičiai	16400	16850	450	512	87.89
4	Sintautai	10500	10851	351	410	85.61
5	Žvirgždaičiai	13600	13971	371	466	79.61
6	Žvirgždaičiai	12500	12916	416	447	93.06
7	Žvirgždaičiai	2900	2992	92	162	56.79
8	Sintautai	5000	5059	59	212	27.83
9	Sintautai	5000	4966	-34	212	-16.04
10	Žvirgždaičiai	1500	1867	367	155	236.77
11	Žvirgždaičiai	3600	3629	29	240	12.08
12	Žvirgždaičiai	4700	4945	245	274	89.42
13	Žvirgždaičiai	21300	21365	65	876	7.42
14	Žvirgždaičiai	2500	2407	-93	200	-46.50
15	Žvirgždaičiai	2500	2507	7	200	3.50
16	Žvirgždaičiai	8300	8395	95	364	26.10
17	Žvirgždaičiai	10100	9463	-637	402	-158.46
18	Žvirgždaičiai	5800	5739	-61	305	-20.00
19	Žvirgždaičiai	2000	2092	92	179	51.40
20	Daukantiškiai	26600	26859	259	815	31.78
21	Girėnai	4600	4556	-44	203	-21.67
22	Sintautai	2100	2137	37	137	27.01
23	Sintautai	64600	65945	1345	2033	66.16
24	Užsieniai	18600	19407	807	818	98.66
25	Užsieniai	5400	5477	77	220	35.00
26	Žvirgždaičiai	10600	10777	177	412	42.96
Total		<b>278200</b>	<b>282718</b>	<b>6256</b>	<b>10894</b>	

Areas of 2 land parcels out of 26 analysed land parcels exceed the permissible error (their average deviation is 502 m<sup>2</sup>), therefore some primary documents of formation of these land parcels have to be revised: to specify the land management project and develop the solution regarding legitimization of the ownership of land parcels on the basis of this project. The largest actual deviation is the decrease of land parcel of 637 m<sup>2</sup>, when the permissible deviation is 402 m<sup>2</sup>. The land parcel presented in the tenth line of the second table exceeded the maximum permissible error even two times, its area has increased by 367 m<sup>2</sup> after cadastral measurements, and the permissible deviation is 155 m<sup>2</sup>. The least change of area was 7 m<sup>2</sup>, the average – 241 m<sup>2</sup>.

Although the measurements of land parcels during the reform could not be very precise as they were performed by using simple measurement tools, however according to the research data it may be stated that 92% of areas of land parcels during their privatization were determined with having rather precise measurement data. After carrying out the research it turned out that the change of area of land parcels covering 96% of total area was up to the permissible limit after performing cadastral measurements.

After analysing the results of 193 files of cadastral data of Šakiai municipality, which were submitted from 6 January 2016 till 15 March 2016, it was determined that 15% of cadastral files are refused. The most common causes are an inadequacy of land parcels to the documents of the planning of territories

or the land holding projects (44%), after the performed cadastral measurements – an inadequacy of boundaries of land parcels, their length or areas, the absence of excerpts from the documents territory planning. 23% of mistakes occur in the preparation of files of cadastral data of land parcels, in the completing (the absence of application, consent, extract or other document), 21% in the preparation of land parcels plans (the lack of some signatures, the tables are filled in incorrectly), and 13% while filling in the form of land parcel cadastral data (unfilled fields).

## Conclusions

1. While comparing preliminary and revised data of measurements of land parcels it was established that the average increase of areas of 8 land parcels is 0.0223 ha, the decrease of one land parcel is 0.0034 ha, the total length of perimeters of all land parcels decreased by 24.9 m, the total area of arable land in land parcels increased by 0.1390 ha due to the increase of land parcels, new lands emerged: tree and shrub plantations, grasslands, gardens, the average shift of turning points is 2.64 m. The changes of areas of the analysed land parcels were a result of inaccurate preliminary measurements of the boundaries and areas of land parcel, specification of boundaries of land parcels according to the previously registered roads, residential areas or land parcels, precisely measured trenches.

2. Land parcels, covering 96% of the total area of all analysed land parcels changed up to the permissible error, 4% exceeded the maximum permissible error, the average deviation of revised area from preliminary area is 502 m<sup>2</sup>, the greatest actual deviations are: the decrease of 637 m<sup>2</sup> when the permissible deviation is 402 m<sup>2</sup>, the increase of 367 m<sup>2</sup> when the permissible deviation is 155 m<sup>2</sup>. The least deviation of area was 7 m<sup>2</sup>, the average was 241 m<sup>2</sup>.

3. 15% of cadastral files are rejected; the most common causes are an inadequacy of boundaries of land parcels to the documents of territory planning or land holding projects (44%), mistakes in the preparation of files of cadastral data of land parcels, in the completing (23%), in the preparation of a land parcel plan (21%), and while filling in the form of land parcel cadastral data (13%).

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