THE CHANGES IN THE FUNCTIONAL STRUCTURE OF THE LANDSCAPE IN TIME HORIZON 1822-2012 IN MOUNTAIN VILLAGE OF JAKUBANY

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Abstract

The structure of cultural landscape is a result of long-lasting process of interaction between of humans and nature in the historical development. In the Slovakia the most intensive changes of the landscape structure were realized over the 40 - 50 years. A new wave of changes in the structure of cultural landscape was originated mainly over the last two decades, predominantly in foothill landscape. These changes are considered as positive from the aspect of ecological stability of landscape. Ecological stability has increased in the last two decade in relation to the stoppage of excessive use of chemical fertilizers, pesticides, herbicides and heavy mechanisms at tillage. Biodiversity and retentive ability of the landscape have increased and erosion of soil has decreased. The negative consequences were reflected into the visual form as abandonment of landscape the man. The aim of this paper is research changes of land cover and functional structure of the landscape in the rural settlement Jakubany in time horizon 1822 – 2012.

Key words: *land use, land cover changes, land utilization, rural settlement Jakubany*

1. INTRODUCTION

Cadastral territory of Jakubany is located on contact zone of the Levočské vrchy Mts. and Spišsko-šarišské medzihorie Mts. (Fig. 1). Greater part of the cadastral territory in the Levočské vrchy Mts. was from year 1953 into December 2010 in the former Military Department Javorina. Return of land and property settlement will be conducted end of year 2015. The aim of this paper is the research of land cover and functional structure of the landscape. In this context, we cannot leave out the exceptional work of Lukniš (1946) about the Jakubiany, which was published in 1946. Rehashed term genius loci, which in present is experiencing a kind of renaissance is the leitmotif of this work and reached in her the remarkable of perfection. Genius loci - the spirit of the place village Jakubany since 1946 have changed considerably in 1953, but not from a naturally, but with artificial intervention, especially the establishment of the Military Department Javorina (in 1953) on the most territory cadastre of Jakubany village (Military Department Javorina lasted more than 60 years, which can be considered much damage from the aspect of scientific research this specific place and your spirit). The Military Department Javorina was abolished by the Slovak Government in December 2010, but the plots have not yet been returned to the owners. Developments since 1953 into the present time can be considered a dramatic, full of contradictions.

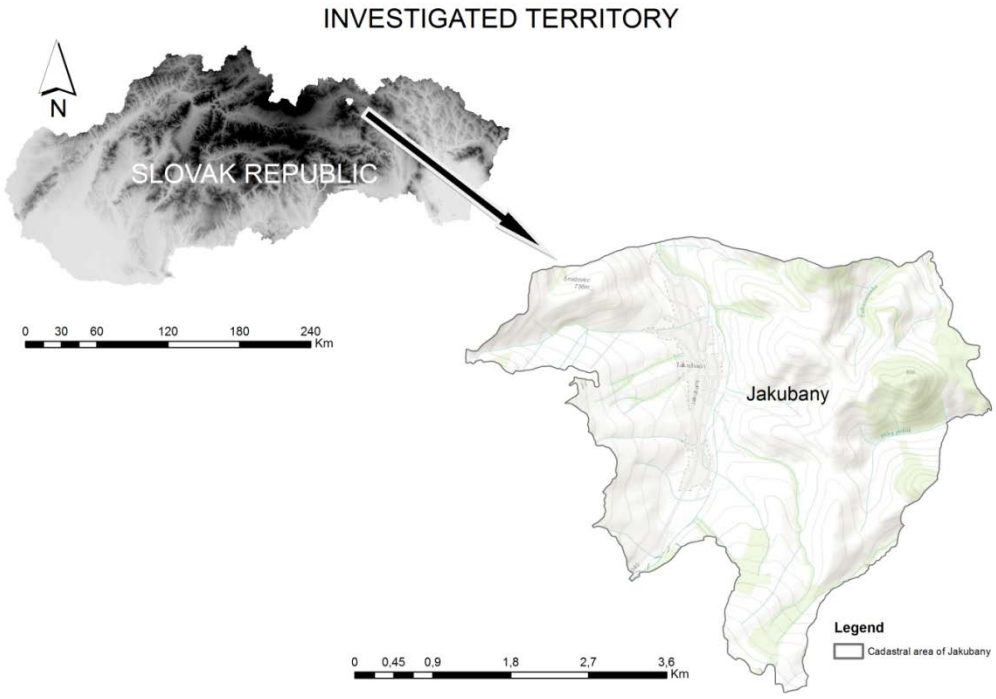


Fig. 1. Location of the investigated territory

2. DATA AND METHODS

Data preparation was based from the main objective of the research taking on the analysis of land cover we used historical maps for the years 1822, 1979, and orthophotos of 2012. Through vectorization we created maps of the land cover classes for the fourth hierarchical level (Fig. 2, 3, 4). Into the linear elements of land cover classes were included transport communications and watercourses with a minimum width of 1 m. For maintain consistency of analysed documents we used topology control in the Arc Map application of the software of ArcGIS 10, which eliminated overlapping areas or absent areas. We have achieved so final size of investigated territory in all time horizons with the accurate to two decimal places. When identifying the land cover classes was necessary the legend of CORINE Land Cover (CLC) which is used for processing of data layers of the land cover classes for the entire territory of Slovakia (Bossard, Feranec & Oťahel' 2000; Feranec & Oťahel' 2001) adapt itself so that take account of the specificities of investigated region. From this aspect, we used CLC legend processed for the needs of landscape research in the scale of 1:50 000 for the PHARE countries (Feranec & Oťahel' 1999). On this basis each group classes of the land cover was divided after the fourth hierarchical level which is sufficient to work with the territory in a large map scale. The resulting maps of the identified land cover classes within the three time horizons were the basis to the statistical and spatial analysis land cover of the investigated territory. The land cover was analysed in chronological order from earliest the time horizon 1822 to the present (time horizon 2012). Subsequently were results compared and expressed in the transformation matrix of changes.

3. FACTORS AND CONDITIONS WHICH AFFECTED THE CHANGES OF LAND COVER AND FUNCTIONAL STRUCTURE OF THE LANDSCAPE

The land cover changes in the cadastral territory same time indicate also on the changes in the functional structure of the territory i. e. the use of the landscape. In the context of the work Feranec & Oťahel' (2001) the term the land cover is not identical to the term of land use of the landscape. In the term of land use are two aspects, namely: the character of the land cover and it function - the land

utilization (Burley 1961, in: Feranec & Oťaheľ 2001). These two aspects have been in village Jakubany clearly distinguished from year 1946 (and of course before) until year 1952.

Acreage cadastral area in year 1946 was 6577 ha. According to Lukniš (1946) were divided into two parts, the fields part and mountains part. Division of territory to these two parts closely connected with the way of life (pastoral way of life) of the population of the village and from economic activity - land use of the landscape. While in the upper part of the territory dominated forests (2,800 ha) and grasslands (mostly meadows 1,590 ha) and there are a variety of seasonal dwelling of the shepherds different quality (kram, cradle, chalet, chyžka) in the part of fields was prevailingly arable land (1,301 ha) to the cultivation of staple crops for subsistence population (Tab. 1).

Table 1. Land Management in Jakubany in 1946, 1953, 2004

Land Management 1946	Are in ha	%	Land Management 1953	Area in ha	%	Land Management 2004	Area in ha	%
Arable land	1 301	19,8	Arable land	1 301	80,8	Arable land	138	8,2
Meadows	1 709	26,0	Meadows	119	7,4	Meadows	1 279	76,3
Pastures	577	8,7	Pastures	80	5,0	Pastures	-	-
Forests	2 823	43,0	Forests	23	1,4	Forests	133	8,0
Garden	2	0,27	Garden	2	0,12	Garden	35	2,0
Barren area	165	2,2	Barren area	85	5,3	Barren area	90	5,3
Together	**6 577**	100	Together	**1 610**	100	**Together**	**1 675**	100

Fundamental changes in the structure of land use of the landscape caused institutional and political factors and conditions in the year 1953 (creation of the Military Department Javorina in Levočské vrchy (Mts.). From the cadastral territory into the Military Department Javorina the army foreclosed the more than 75% of the area (4 967 ha). In the village was declared ban the construction of houses (the houses built without building permits were liquidated) and a similar fate befell the seasonal dwelling of the shepherds in the Levočské vrchy Mts. Aim of communist state power was delete the village from the map and resettle inhabitants into State flats in the neighbouring municipalities or town settlements. Also the Urbariat (management of local forests) ended their activities in the same year. The area was guarded by the military and the entrance to military area had only the employees of military forests or the persons which had the permission. The residents of the village the permission have not received. By separating of the mountainous part of the cadastral territory Jakubany have occurred to the significant changes in the functional structure of the landscape and in the land cover.

The acreage of cadastral territory have been reduced to less than one quarter (1 610 ha) in the year 1953 and prevailed here arable land (1 301 ha). The acreage of grasslands was only 200 ha and the forests were only marginally represented (23 ha). The areas unsuitable for agriculture (river floodplain and gravel benches in the riverbed) occupy about 85 ha (Tab. 1). Despite this situation in the village persisted the classical system of private farming until the year 1979.

In year 1979 the village was founded cooperative - JRD (first attempt of the establishment was in 1948, but was unsuccessful). Creating of the cooperative led to further changes in the functional structure of the landscape. Most of the arable land was converted to grasslands (meadows, but especially pastures). From original acreage arable land (1 301 ha) remained only 138 ha and this proportion was further reduced what was associated with specialization of cooperative to breeding cattle for milk and to the cultivation of medicinal plants for export.

The landscape structure succumbed of significant transformation as a result of natural factors and conditions (climate, pedogenetic factors and conditions and geomorphological conditions, e. g. soil erosion and slope deformation). Climatic conditions of the territory are less favourable. In the cover of soils from the aspect of agricultural soils predominate of less productive soils and less productive grasslands. The large area occupies on the agricultural production unsuitable soils on the floodplain river of Jakubianka. Approximately 80% the cover of soils have tendency to erosion and to landslides. The grassing of the territory after 1989 have alleviated soil erosion and too to some extent stabilized the subsurface creeping movements and landslides.

Economic factors and conditions have caused other very notable changes in the landscape structure. After 1989, agricultural production to the state-controlled and planned was transformed on the market economy. The reduction of agricultural subsidies has brought about other changes in the structure of the land use in the landscape and functional structure of the landscape.

Sociological factors have played in this period an important role in the formation the structure of the landscape (Genius loci). The people from municipality as a social group had the remarkably deep attachment to land ownership. The soil was considered in this mountainous poor landscape as an important source of livelihood and significant material wealth and hence wanted continue (older generation) in the classic system of private farming on their land but lacked the will to the younger generation.

4. CHANGES OF LAND COVER AND FUNCTIONAL STRUCTURE OF THE LANDSCAPE

In the cadastral territory of Jakubany was in the time horizon 1822 of identified 13 land cover categories with the largest surface areas of Grasslands with share of 648.74 ha (pastures and meadows) prevailingly without trees and shrubs. The smallest area was occupied the River banks. In the next time horizon in 1979 were identified 16 types classes of land cover. The largest area was represented of Grasslands (pastures and meadows) prevailingly without trees and shrubs (685.4 hectares). The most significant increase we have recorded in Broad-leaved forests with continuous canopy, not on mire (73.47 hectares) and in category of Discontinuous built-up areas with family houses with garden (59.22 hectares). These areas were located mainly in peripheral parts of the territory and on the area Discontinuous built-up areas with family houses with garden within the built-up area municipality of Jakubany. This effect is characteristic for the rural settlements in which increased the population and so has been thus extended built-up area at the expense of the surrounding areas. Marginal areas due to their non-use for agricultural purposes, they were either naturally or man-wooded. In the time horizon 2012 from the aspect of land cover we are recorded a large decline in the category of Grassland (meadows and pastures) with trees and shrubs. As a result of the care about these areas have been increased share in the class of land cover in the category of Grassland (meadows and pastures) prevailingly without trees and shrubs. The area of Arable land prevailingly without dispersed vegetation receded particularly for the mosaic structures. Comprehensive overview of the representations of different categories of land cover in the investigated time horizons presents Table 2 and Fig. 2, 3, 4 indicate the spatial distribution and abundance of land cover categories.

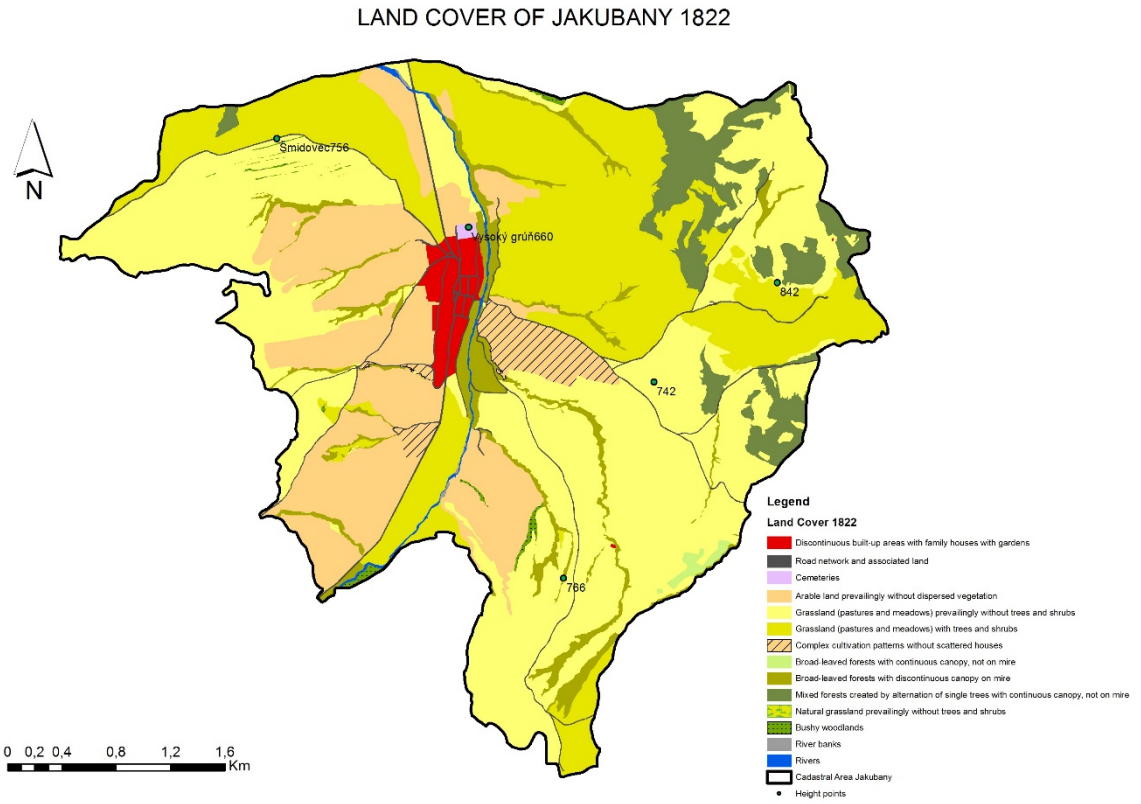


Fig. 2. Land Cover of Jakubany 1822

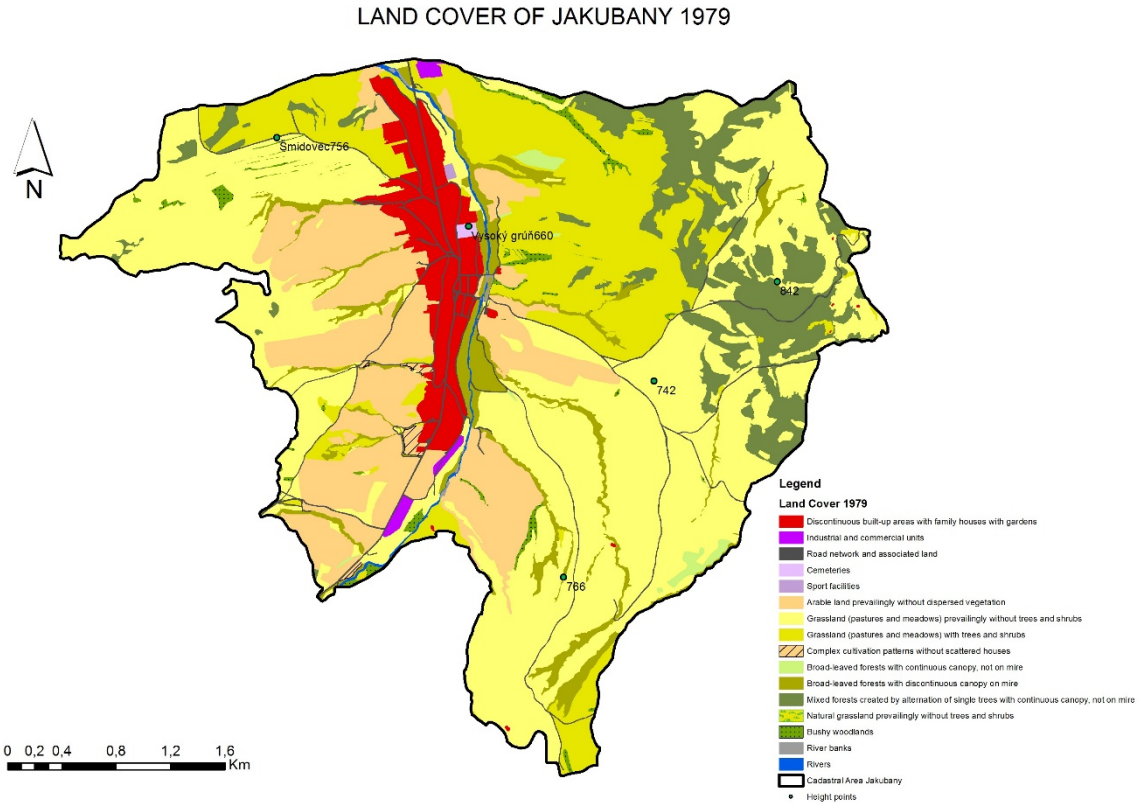


Fig. 3. Land Cover of Jakubany 1979

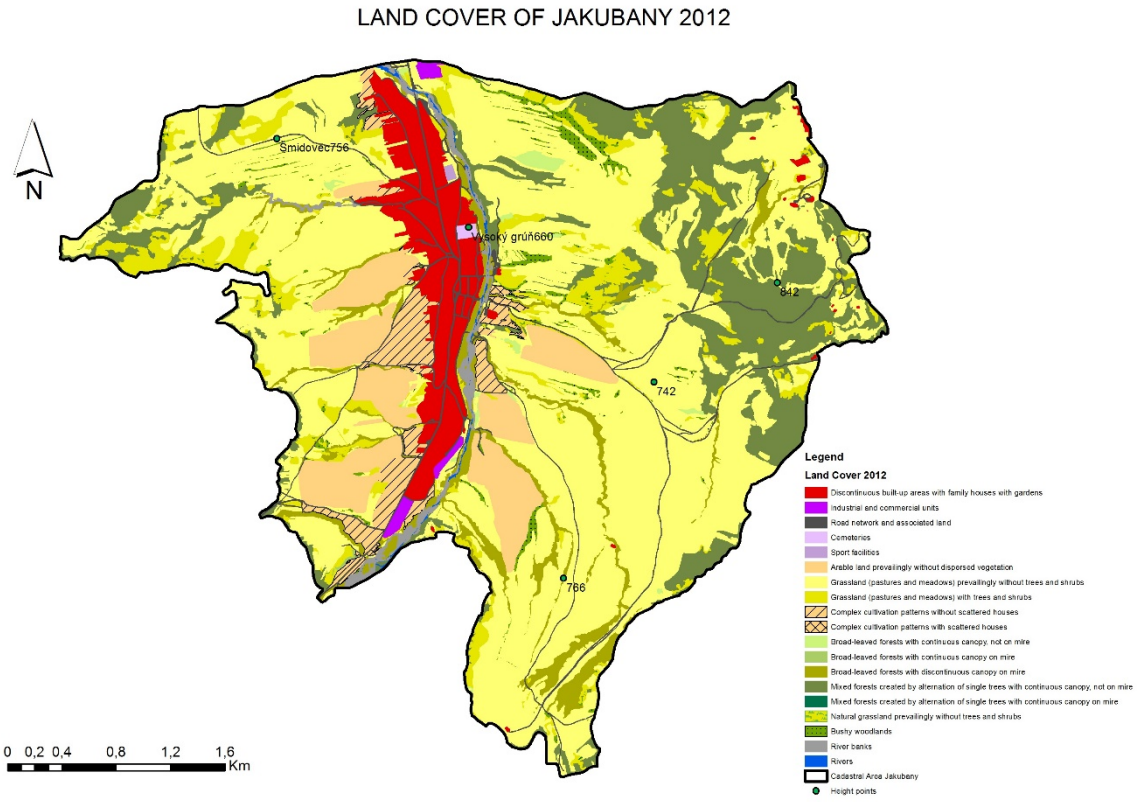


Fig. 4. Land Cover of Jakubany 2012

On the basis of the created maps from the three time horizons we have defined the changes in the classes of land cover for the whole investigated period 1822-2012. Result from a comparison of the individual maps of land cover categories is Fig. 5, which shows the surfaces without change and changed surfaces within in the period under review. The total area of territory without change represents 763 ha. Most stable area from the aspect the categories of land cover is located in the south-eastern part of the cadastral territory, hereinafter the older part of the built-up area of the village from the year 1822 and north-western and north-eastern slopes covered with forests. On the other side the changes of the categories of land cover are most commonly along the line elements (watercourses, roads) and around the built-up area of the village. For clarity, the changes of individual types land cover to another type of land cover, we have created a transformation matrix changes between two time horizons, namely the time of the 1822 and 2012 (Tab. 3). In this table it is possible to clearly identify any change in the context of land cover categories. The amount of the data we choose the most relevant changes: built-up area of the village is expanding more than threefold, mainly at the expense of Arable land prevailingly without dispersed vegetation and Grasslands vegetation (pastures and meadows) with trees and shrubs. The area of greatest transformation of one category of land cover to another type is between categories Grassland (pastures and meadows) prevailingly without trees and shrubs and Grassland (pastures and meadows) with trees and shrubs (218.33 hectares).

Table 2. Expanse of different categories of Land Cover in ha

Land Cover categories	1822	1979	2012
1.1.2.2	28,02	87,24	99
1.2.1.1	0	6,11	6,22
1.2.2.1	12,89	17,17	20,33
1.4.1.2	1,52	1,51	1,51
1.4.2.1	0	0,75	0,75
2.1.1.1	279,81	268,31	122,44
2.3.1.1	648,74	685,4	822,53
2.3.1.2	444,01	290,37	114,58
2.4.2.1	40,3	4,61	56,1
2.4.2.2	0	0	1,5
3.1.1.1	4,82	9,7	9,24
3.1.1.2	0	0	0,81
3.1.1.4	98,61	97,78	94,69
3.1.3.1	104,75	178,22	272,72
3.1.3.2	0	0	0,05
3.2.1.1	0	0,03	0,03
3.2.4.3	8,73	24,65	37,31
3.3.1.3	0,42	0,86	13,15
5.1.1.1	4,3	4,21	3,96
∑	**1676,92**	**1676,92**	**1676,92**

Explanatory notes: 1.1.2.2 Discontinuous built-up areas with family houses with garden; 1.2.1.1. Industrial and commercial units; 1.2.2.1 Road network and associated land; 1.4.1.2 Cemeteries; 1.4.2.1 Sport facilities; 2.1.1.1 Arable land prevailingly without dispersed vegetation; 2.3.1.1 Grassland (pastures and meadows) prevailingly without trees and shrubs; 2.3.1.2 Grassland (pastures and meadows) with trees and shrubs; 2.4.2.1 Complex cultivation patterns without scattered houses; 2.4.2.2 Complex cultivation patterns with scattered houses; 3.1.1.1 Broad-leaved forests with continuous canopy, not on mire; 3.1.1.2 Broad-leaved forests with continuous canopy on mire; 3.1.1.4 Broad-leaved forests with discontinuous canopy on mire; 3.1.3.1 Mixed forests created by alternation of single trees with continuous canopy, not on mire; 3.1.3.2 Mixed forests created by alternation of single trees with continuous canopy on mire; 3.2.1.1 Natural grassland prevailingly without trees and shrubs; 3.2.4.3 Bushy woodlands; 3.3.1.3 River banks; 5.1.1.1 Rivers

Table 3. Transformation matrix of changes

in ha		Land Cover 1822													
		1.1.2.2	1.2.2.1	1.4.1.2	2.1.1.1	2.3.1.1	2.3.1.2	2.4.2.1	3.1.1.1	3.1.1.4	3.1.3.1	3.2.4.3	3.3.1.3	5.1.1.1	∑
Land Cover 2012	1.1.2.2	27,9	0,08	0	29,68	12,18	26,37	2,42	0	0,3	0,07	0	0	0	99
	1.2.1.1	0	0	0	0	0	6,22	0	0	0	0	0	0	0	6,22
	1.2.2.1	0,1	12	0	1,08	3,78	2	0,28	0	0,86	0,22	0	0	0,01	20,34
	1.4.1.2	0	0	1,51	0	0	0	0	0	0	0	0	0	0	1,51
	1.4.2.1	0	0	0	0	0,75	0	0	0	0	0	0	0	0	0,75
	2.1.1.1	0	0	0	94,62	12,98	0	14,76	0	0,08	0	0	0	0	122,44
	2.3.1.1	0,01	0,41	0,02	93,29	495,12	218,33	9,85	0,06	1,88	3,54	0,04	0	0	822,53
	2.3.1.2	0	0	0	8,03	46,26	54,51	1,87	0,03	0,67	2,3	0,92	0	0	114,58
	2.4.2.1	0	0,09	0	36,25	1,24	5,61	7,6	0	5,32	0	0	0	0	56,1
	2.4.2.2	0	0	0	0	0	1,5	0	0	0	0	0	0	0	1,5
	3.1.1.1	0	0	0	0,22	2,41	4,84	0,83	0,19	0,74	0	0	0	0	9,24
	3.1.1.2	0	0	0	0,81	0	0	0	0	0	0	0	0	0	0,81
	3.1.1.4	0,01	0,01	0	10,06	9,6	6,43	0,68	0	67,39	0	0,31	0	0,19	94,69
	3.1.3.1	0	0,27	0	3,01	55,39	99,71	1,03	4,54	9,86	98,62	0,23	0	0,08	272,72
	3.1,3.2	0	0	0	0	0	0,05	0	0	0	0	0	0	0	0,05
	3.2.1.1	0	0	0	0	0	0,03	0	0	0	0	0	0	0	0,03
	3.2.4.3	0	0	0	2,35	7,22	15,35	0,89	0	5,43	0	6,05	0	0,01	37,31
	3.3.1.3	0	0,04	0	0,42	1,74	2,95	0,08	0	6,06	0	1,02	0,42	0,42	13,15
	5.1.1.1	0	0	0	0	0,08	0,1	0	0	0,02	0	0,16	0	3,61	3,96
	∑	**28,02**	**12,89**	**1,52**	**279,81**	**648,74**	**444,01**	**40,3**	**4,82**	**98,61**	**104,75**	**8,73**	**0,42**	**4,31**	**1676,92**

Explanatory notes: 1.1.2.2 Discontinuous built-up areas with family houses with garden; 1.2.1.1. Industrial and commercial units; 1.2.2.1 Road network and associated land; 1.4.1.2 Cemeteries; 1.4.2.1 Sport facilities; 2.1.1.1 Arable land prevailingly without dispersed vegetation; 2.3.1.1 Grassland (pastures and meadows) prevailingly without trees and shrubs; 2.3.1.2 Grassland (pastures and meadows) with trees and shrubs; 2.4.2.1 Complex cultivation patterns without scattered houses; 2.4.2.2 Complex cultivation patterns with scattered houses; 3.1.1.1 Broad-leaved forests with continuous canopy, not on mire; 3.1.1.2 Broad-leaved forests with continuous canopy on mire; 3.1.1.4 Broad-leaved forests with discontinuous canopy on mire; 3.1.3.1 Mixed forests created by alternation of single trees with continuous canopy, not on mire; 3.1.3.2 Mixed forests created by alternation of single trees with continuous canopy on mire; 3.2.1.1 Natural grassland prevailingly without trees and shrubs; 3.2.4.3 Bushy woodlands; 3.3.1.3 River banks; 5.1.1.1 Rivers

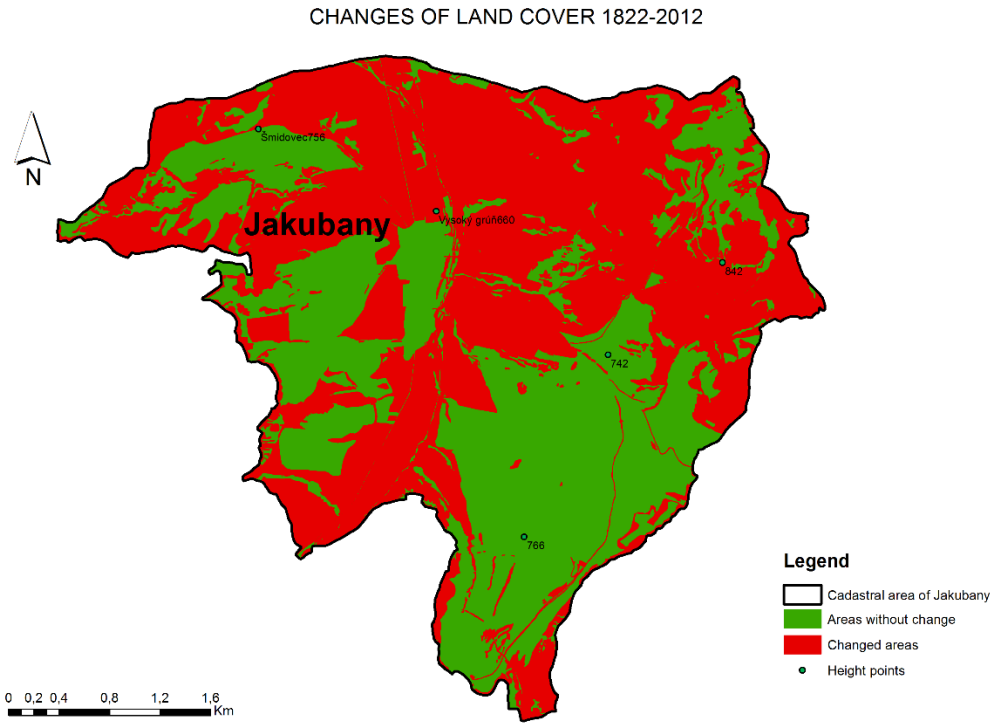


Fig. 5. Changes of Land Cover 1822-2012

5. CONCLUSIONS

From the aspect the categories of land cover, we are analysed cadastral territory of the municipality Jakubany on the fourth hierarchical level, which corresponds to mapping in the maps of big scale (1:10 000) with using relevant maps documentation as well as the contributions of authors (Michaeli, Ivanová & Koco 2015; Ivanová et al. 2013). Within investigated territory we have in three time horizons (1822, 1979 and 2012) identified a total of 19 land cover classes. The most widespread categories the classes of land cover were throughout the period under review Grassland (meadows and pastures) prevailingly without trees and shrubs and Grassland (meadows and pastures) with trees and shrubs. The most important changes in the classes of land cover occurred after 1979 which was caused particular processes that had affect management and land use (creation of a unified agricultural cooperative in 1979) as well as a change of ownership after 1989 (except of the major changes in year 1953 that were related to the change of the size of the cadastral area). The built-up area of the village however obtained their character primarily to the year 1979 what related with to population growth and its activities in this territory. In the period under were the most stable categories of land cover - Cemeteries and Rivers and on the other hand were the least stable Grassland (meadows and pastures) prevailingly without trees and shrubs. Areas where changes occurred in the categories the classes of land cover have been registered mainly along of linear habitats and around of built-up area. Areas on which no change has been during the whole investigated period time horizon (1822 - 2012) are located in the south-eastern part of the cadastral territory and also in peripheral mostly wooded areas. The specific features from the aspect of land ownership has acquired land cover in year 2012, when around the built-up area of village has created the Complex of cultivation patterns.

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