LANDSCAPE STRUCTURE CHANGES IN MODEL VILLAGE OF HLINNÉ, VYŠNÝ ŽIPOV AND ZLATNÍK

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Abstract: *An important attribute of landscape as geosystem is its structure, inner construction which is presented by unity of mutual bonds among its elements and components as well (Chorley, Kennedy 1971 in Oťaheľ, et. al. 2004). Landscape structure interacts and reflects important countryside characteristics, which importance is evident, from the long term point of view, in their self-regulated abilities. Comparing recent landscape structure represented by land cover layers from quite close time periods, relatively short time changes could be analyzed, which enable to consider the landscape dynamism in context of socioeconomic and political stimuli (Oťaheľ, et. al. 2004).*
The aim of this contribution was to evaluate changes in the landscape structure on the basis of land cover changes evaluation during three time horizonts: 1826, 1956 a 1991. Methodical approach was derived from adapted databasis of Corine Land Cover, which was adapted according to the results of field research and the area of investigated region. The process of identification and following statistically-spatial analysis of land cover layers in particular time periods was realized by GIS softver Arc View 3.2 and softver Microsoft Office Professional - Excel 2000.
Key word: *landscape structure, landscape cover, landscape development, GIS*

INTRODUCTION

Recent landscape is a result of stage process during which existing natural conditions were utilizated by human society to fulfil its needs. Its structure interacts and reflects important information on landscape components, factors, processes and many other phenomena which are not of material character as well (Dobrovodská, 2000). In this context the evaluation of the landscape structural changes could be considered as one of the key tool for planning and designing activities in the country as well as the prediction of its future development resulting from the knowledge of landscape development in particular time horizonts.

Changes in structure of landscape utilization are caused by social oscillation or by limits of natural surrounding. (Olah 2003, Petrovič 2005). Aspects in question activate space-time changes in landscape utilization. This implies that recent forms of landscape utilization, occurence and preserving historic landscape structures in given region is the result of long-term development. (Boltižiar, Chrastina 2006).

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Observing the land cover in particular time horizonts enables to understand better its dynamism and development, intensity of the landscape utilization by a man. The following pieces of work indicate the topicality of the given subject matter: Falťan 2000, Cebecauerová, Cebecauer 2004, Oťaheľ, et. al. 2004, Boltižiar 2007, Cebecauerová 2007, Hofierka 2008, Michaeli, Hofierka, Ivanová 2008a,b)

METHODOLOGY

Human influence on the environment in the researched region cannot be understood as one-shot and short-time matter. Landscape was developed under the influence of more important factors which are reflected in the land use. The contribution concentrates on the evaluation of short-time and middle-time changes, which show the dynamism of the landscape development. These changes were evaluated by comparison of physical states of the landscape structure represented by land cover classes in years 1826, 1956 a 1991. The land cover layers creation and their statistic analysis were analyzed by using ArcView GIS 3.2 software. Military topographic maps from given period were used as an underlayer. After standardizing of topographic maps, identification and digitalization of land cover classes followed, using „on screen" method. A flexible databasis system, which enabled statistically-spatial analysis of the landscape structure was the result. One of the outputs was also cartographic display of the individual land cover layers, which were verificated by the field research. After overlaying them, the contingent tables presenting areal changes in land cover during 1826-1956, 1956-1991 and 1826 – 1991 were created through the script (http://www.geomodel.sk/sk/download/downloadav.htm#make_vector_grid).

STUDY AREA

The area of interest spreads in the Topľa river basin, in the area of the Carpathian subsystem, to be more accurate, at the place of meeting the Inner West Carpathian Mountains and the Outer East Carpathian Mountains. The northern part of the investigated area belongs to the subregion of the Beskydy foothill of the Low Beskydy region subprovince the Outer East Carpathian Mountains, the southwest part belongs to the subregion of the Slánske mountains Matransko – slanská region subprovince the Inner West Carpathian Mountains and the south part belongs to the subregion of the Východoslovenská uplands region, the Východoslovenská lowlands subprovince Big Danube Basin (Mazúr, et. al. 1986).

The west and the east part of the area of interest can be identified with the west and the east borders of the cadastral territories of villages Hlinné, Vyšný Žipov and Zlatník, the northern border is the same as the cadastral border of village Vyšný Žipov, the southern is the same as the cadastral border of village Hlinné. Regarding the cadastral area (632 hectares) the village Zlatník belongs to smaller villages. It is situated at the junction of the Podslanská uplands of the Východoslovenská uplands and Šimonka massive in the Slanské mountains in the valley of the stream Zlatníčok. This one is a right side tributary of the Topľa with its lenght about 4 kilometres. The middle part of the village lies in the altitude 270 metres above sea level, whilst the sea level of all cadastral region of the village is in the range from 210 to 813 metres above sea level.

The village Vyšný Žipov (1139 hectares) spreads in the Beskydy foothill at the border of the Hanušovce and the Mernícka uplands. The village lies in the altitude from 140

to 297 metres above sea level. The altitude 155 metres above sea level was measured in the middle of the village. The vicinity of the village is mostly deforested, there is a forested area only in its eastern part. The village Hlinné is situated in the Topľa floot plain of the Východoslovenská uplands between the villages Zlatník and Soľ. Its area is 1 255 hectares. The highest point of the cadastral territory is Ivanov vrch (813 metres above sea level). The altitude 152 metres above sea level was measured in the middle of the village. In percentage calculation 41,5 % of the whole area belongs to the village Hlinné, 37,6 % to Vyšný Žipov and 20,9 % to Zlatník.

On the basis of the territorial-administrative structure investigated villages belong to Prešov Region, the District Vranov nad Topľou. Regarding the District town, their location is eccentric. The closest is Hlinné village, which air line distance is 10 km.

LANDSCAPE STRUCTURE IN THE YEAR 1826

Regarding the utilization aspect, investigated area represented well balanced country with 49.2% share of agricultural areas and 48.6% share of forests, seminatural areas and waters in 1826 (fig. 1).

From the point of view of the area, the largest village was Hlinné (1255 hectares). Besides urban and agricultural function it fulfilled also spa-recreation function as there are sulphurous springs in locality of Slatinka (the southern part of the cadastral territory of the village), which conditioned the foundation of a small spa. Rheumatic diosorders were cured there. After formation of ČSR the spa cased to exist. Vyšný Žipov and Zlatník had only urban and agricultural function in given period.

Road network was not developed in the period of Austria-Hungarian monarchy (13,4 hectares). It connected the investigated villages with Vranov nad Toľpou and Prešov.

The agricultural land was represented by meadows (279.6 hectares) and arable land (1 208.5 hectares, table 1, fig. 1). Arable land occured in flat and upland parts of the landscape. The largest areas were situated in the vicinity locality of Panská tabuľa in the cadastral territory of the village Zlatník (to the north from the Zlatníčok stream). Permanent grasslands spread in the area of 279.6 hectares. It was represented by meadows only. They occured mostly in the floot plains and in the places, where forest land and arable land met.

The broad-leaved forests occupied almost 47% of all investigated area in 1826. Their biggest occurence was in the north and west part of the cadastral territory of the village Zlatník and in the vicinity of an area Ivanov vrch (813 metres above sea level) in the cadastral territory of the village Hlinné. Concerning the species representation, the most dominant were beech-oak and oak-maple forests.

Water flows occupied the area of 58.9 hectares (table 1). The most important stream of the region was (and still is) the Topľa river. Only a short segment 5.75 km, of its total length 129.8 km, flows through the investigated area. Its numerous meanders had influenced the origination of the dead stream branches in later period.

LANDSCAPE STRUCTURE IN THE YEAR 1956

Urban and technical country (fig. 2) was represented by continual build up area with family houses and gardens (81.7 hectares) and road network (22.7 hectares) in 1956. These were the types of land cover with the highest concentration of human activity. One

of the most important factors was the settlements functional point of view concerning living, work and satisfying all the needs related to life and traffic.

In the effort to ensure employment for the local people and to continue the tradition of the thread craft, the village Hlinné built a flax mill in the period 1950 - 1952 – for a rough process of flax and hemp as a subsidiary of Tatraľan Kežmarok. In 1956 this industrial park took a territory of 25.9 hectares. From the functional aspect the village can be evaluated as a village with developed industrial function and service-housing functions as well. The other two villages of the investigative area fulfilled only housing function.

The main function of the road network (22.7 hectares, table 1) was to interface the villages of the investigated region with the main road line connecting towns Vranov nad Topľou and Prešov. The best road accessibility from the investigated villages had (and still has at present) village Hlinné. The main road and the railway number 193 and 194 in direction Vranov nad Topľou – Prešov goes through this village. There is no railway in the villages Zlatník and Vyšný Žipov, but they are connected to the main road with the access road.

The agricultural land (fig. 2) of the investigated area was represented by the types of meadows (119.4 hectares), pastures (194.3 hectares) and arable land (1 221.7 hectares, table 1). The arable land occured in plain and upland parts of investigated area. Permanent grasslands overgrowth took the area of 313.7 hectares. It was presented by the types of meadows without trees and shrubs (37,4 hectares),meadows with trees and shrubs, pastures with trees and shrubs (82.0 hectares), pastures without trees and shrubs (26,1 hectares) and pastures with trees and shrubs (168.2 hectares).

Forest country (fig. 2) was represented by the types of coniferous (56.9 hectares), broad-leaved forests (1 129.2 hectares) and underwood (123.6 hectares, table 1), which occured as a coherent tree cover with forest industry function. Coniferous forests formed a smaller parts in the northern area of the cadastral territory of the village Zlatník. These were mostly the pine trees. Spruce forests occured only in the saddleback in the north direction from the vicinity area the Spálená hora (550 metres above sea level) in the cadastral territory of the village Hlinné. The other type of the land cover are broad-leaved forests (1 129.2 hectares). The largest area was situated in the west part of the investigated region. Regarding the types, there were beech-oak, beech and beech-maple forests. There were open woodlands in the higher floot plain besides submersible regions. The underwood (123.6 hectares) was planted in the areas of the former timber harvesting. The largest area was taken near the stream Zlatníčok.

Water flows and water surfaces took 39.2 hectares (table 1, fig. 2). There is a certain change in the river network at the present time in comparison to the river network in 1826, especially in the shape of river-bed Topľa and its tributaries (the Zlatníčok, the Slaný potok, the Hrabovec, the Uhliskový, the Hlinský potok and the Petkovský jarok).

The relict of the original river Topľa basin - the dead stream branch, which was announced as a protected natural object with original bank vegetation and water flora was found (and still exists there) near the residential part of the village Vyšný Žipov .

The specific feature is the occurence of the swamp (2.3 hectares, table 1) with herbal vegetation preferring humidity. It is localized near the river Topľa at the border of the cadastral territories of villages Hlinné and Vyšný Žipov.

LANDSCAPE STRUCTURE IN THE YEAR 1991

The influence of the human activity can be seen in its most intensive form in this phase of the landscape development. The area construction with residential houses and gardens covered 146.924 hectares in 1991. The main function for individual villages is the housing function but also another functions can be seen, which are typical for the inner organization of each village.

Regarding the cadastral territory, the largest village in the investigated region was Hlinné. This village did not fulfil only housing function in the research period, but also industrial function. The industrial park takes 19.7 hectares (table 1) and concentrates on linen thread and flax hards production. The terminal figure in its development was year 1984, when the line for processing secondary textile materials with capacity 350 tons and production of unvowen fabrics was launched. The processing capacity was increased to 1 400 tons in year 1990. Gradually the processing of flax stems was finished (company LYKOTEX Slovakia s.r.o.).

The road network was gradually developed as well. The main function of it was to connect towns of the research area with the main road (Vranov nad Topľou and Prešov). The best developed road network was in the village Hlinné with the direct access to the main road line I/18. The bridge over the Topľa was built in the village Vyšný Žipov in 1965 and the access road to the village was improved as well as the road surface and the side roads in the cadastral area (the build up areas extending). The railway in the Hlinne village was very important especially for LYKOTEX Slovakia s.r.o. industrial company. Agricultural cooperatives were buil up in this period, in the village Hlinné (11.3 hectares) and in the village Vyšný Žipov (5.9 hectares).

Agricultural landscape (fig. 3) was characterized by types of meadows (234.4 hectares) and arable land (1 216.8 hectares, table 1) in this period.

Forest and seminatural landscape (fig. 3) was presented by coniferous (32.0 hectares), mixed (61.3 hectares), broad-leaved forests (1 207.4 hectares) and underwood (11.0 hectares, table 1), which surrounded forest areas. Coniferous forests took only smaller areas in the north and the west of the cadastral territory of Zlatník village. In the west part of the cadastral territory of Hlinné village, there was a low moor phytocoenose which was announced by the Ministry of culture of the Slovak Republic as a state natural preserve in 1981 - the Hlinská jelšina – in area 46.15 hectares. It has still been a protected region. It is a foothill depression supplied with water from more springs.

River network did not change significantly in this period. Water flows and water surfaces took an area of 39.5 hectares. There was a new region determined at the Topľa – Alluvial deposits of the Topľa river. A mineral spring, rich in chlorine, calcium and magnesium, occured in the valley of the Hrabovec stream, which runs across the southern part of the cadastral territory of the village. At its basis a protected region – Hlinská jelšina was established. Since 1981 the Landscape area of the Slaný stream in the upper course of above mentioned stream has belonged among the protected regions. Besides dead stream branch of the river Topľa (1956), which has been already mentioned, there was another dead stream branch found at the analysis of the land cover in 1991. It occurs at the border of the cadastral territory of the villages Hlinné and Vyšný Žipov. Humid areas were represented by a swamp in area of 1.139 hectares.

CHANGES IN THE LANDSCAPE STRUCTURE

Landscape structure of the investigated area has sinificantly changed since 1826. The researched area represented well balanced landscape with 49.2 % share of agricultural areas and 48.6 % share of forest, seminatural areas and water from its utilization point of view in 1826. Although the region received its agricultural character during Ausria-Hungarian monarchy, its importance was strenghtened after socialism formation. The second half of the 19th century was marked by huge land disintegration, which could not bring enough food for its users. Agricultural land was transformed during the observed period 1826 – 1991. These changes were influenced by the collectivization. The area of agricultural land increased only in o 1.5 % (table 1) during the period 1826-1956. Gradual intensification of agricultural activities, using of artificial fertilizers and mechanisms in production reflected in yields increase in later period. It is possible to conclude, on the basis of historical notes analysis, detailed statistically-spatial analysis of topographic maps and as well as on the results of the field research, that the landscape kept this character approximately to the end of eighties of the 20th century. The increase of agricultural activities till 1956 was slow. There was no significant change in the land cover, where arable land transformation without scattered line and spot vegetation into arable land with scattered line and spot vegetation (graph 1) dominated. Arable land share increased only in 13.2 hectares (table 1) during this period. More significant increase was observed in type of permanent grasslands overgrowth (in 34.1 hectares). There was a transformation of broad-leaved forests into arable land (in case 134.3 hectares) during the period 1826-1956, but significant increase was eliminated by opposite tendency (graph 1).Regarding the inner political situation in former Czechoslovakia, the greatest increase of agricultural activities could be dated from 60ties to 80ties of the 20th century. It can be seen in 93.83% increase of arable land without scattered line and spot vegetation (observed period 1956-1991). The results of land cover layers analysis from the period 1956 -1991, according to which 74.7 hectares of broad-leaved forests and 435.3 hectares of arable land with scattered line and spot vegetation transformed into arable land without scattered line and spot vegetation (graph 2), are another proofs.

However, the whole share of agricultural land utilization decreased during observed period 1956-1991. The turning point was the year 1989, when the agricultural production transformed as the result of shift toward the market economy system. Disintegration of cooperatives meant attenuation of agricultural activity resulting in the decrease of agricultural land utilization. Although its area was relatively high in 1991 (47.9%), in comparison to 1956, its share decrease in 2.8%, which did not reach the level of 1826 (table 1).

Landscape structure is specified by relevant functions as well, which significantly determine the way of social landscape utilization. Villages fulfilled mostly housing and agricultural functions during all the investigated period. The only exception was the village Hlinné. During Austria-Hungarian period the village Hlinné fulfilled also spa-recreation function, that ceased to exist in later time. From the aforesaid we can conclude that the village started to fulfil its industrial function since 1956 and its natural-protection function since 1981.

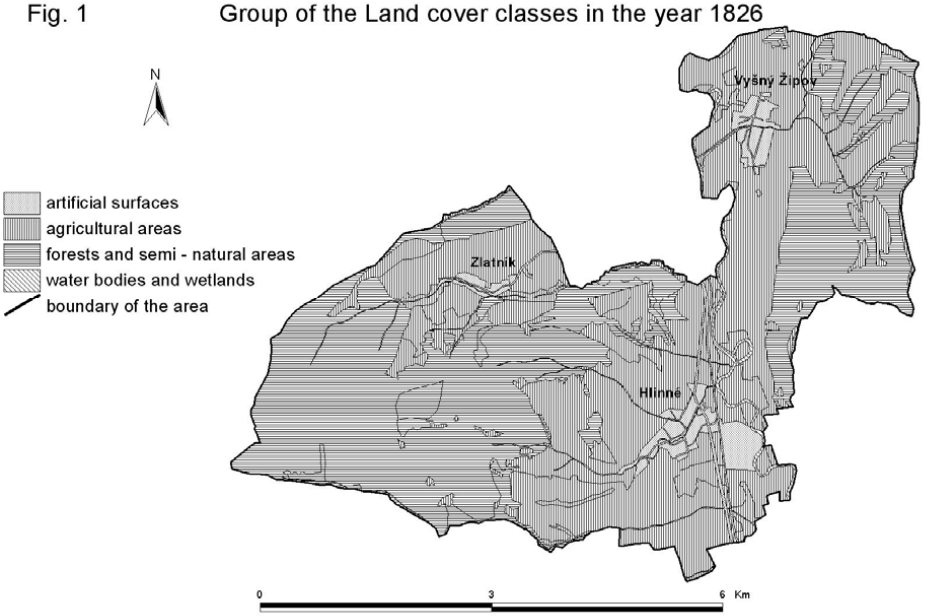
Comparing the maps of secondary military mapping and military topographic maps from 1956 and 1991, the river network changes are observed. Many water intakes of

present existing rivers disappeared, resulting in decrease of water acreage from 58.850 hectares to 39.765 hectares (investigated period 1826-1991, table 1). As a result of the regulation of the river Topľa and its tributaries, the artificial river basins were formed e.g. in Vyšný Žipov and Hlinné. Another change is the formation of a swamp in area of 1.1 hectares (table 1), which was formed by transformation of arable land and water flows in terrain upland depression.

Human intervention into land cover was manifested also in typological forest composition. Whilst in 1826 there were exclusively broad-leaved forests, in 1956 the areas of coniferous forests appeared and in 1991 mixed forests were present in the investigated area as well. The biggest forest overgrowth was seen in 1826, when it covered almost 47 % of investigated area. During period 1826-1991 there was a decrease of braod-leaved forests in 14.5% (table 1) observed. Most of them were transformed into arable land (270.3 hectares) and meadows (101.6 hectares, graph 3).

Significant changes were occured in the residential areas. They reached an increase in 51.4 % in the first investigating period during 1826 – 1956, during the second period in 1956 – 1991 it was even in 80.1 %. The increase was mainly caused by transformation of road network and adjacent areas. Arable land without scattered line and spot vegetation participated significantly in its increase till 1956.

Fig. 1 Group of the Land cover classes in the year 1826



Tab. 1: *Areal acreage of land cover classes in 1826, 1956 a 1991*

Classes of land cover		Area (in ha) in 1826	Area (in ha) 1956	Area (in ha) 1991
1	continual build up area with residential houses and gardens	54.0	81.7	14.2
2	road network and ajacent areas	13.4	22.7	27.8
3	railway network	-	6.7	5.9
4	cemeteries	-	2.2	2.1
5	areas of sports and laisure facilities	-	0.9	3.7
6	industrial areas	-	25.9	19.7
7	areas of agricultural cooperatives	-	-	17.2
8	arable land without scattered (line and spot) vegetation	1208,5	595.3	1153.8
9	arable land with scattered (line and spot) vegetation	-	626.5	63.0
10	meadows without trees and shrubs	279,6	37.4	234.4
11	meadows with trees and shrubs	-	82.0	-
12	pastures without trees and shrubs	-	26.1	-
13	pastures with trees and shrubs	-	168.2	-
14	coniferuos forests	-	56.9	32.0
15	mixed forests	-	-	61.3
16	broad-leaved forests	1412,4	1129.2	1207.8
17	underwood	-	123.6	11.0
18	water flows and regulated water flows	58,9	39.2	39.8
19	swamps	-	2.3	1.1

Fig. 2 Group of the Land cover classes in the year 1956

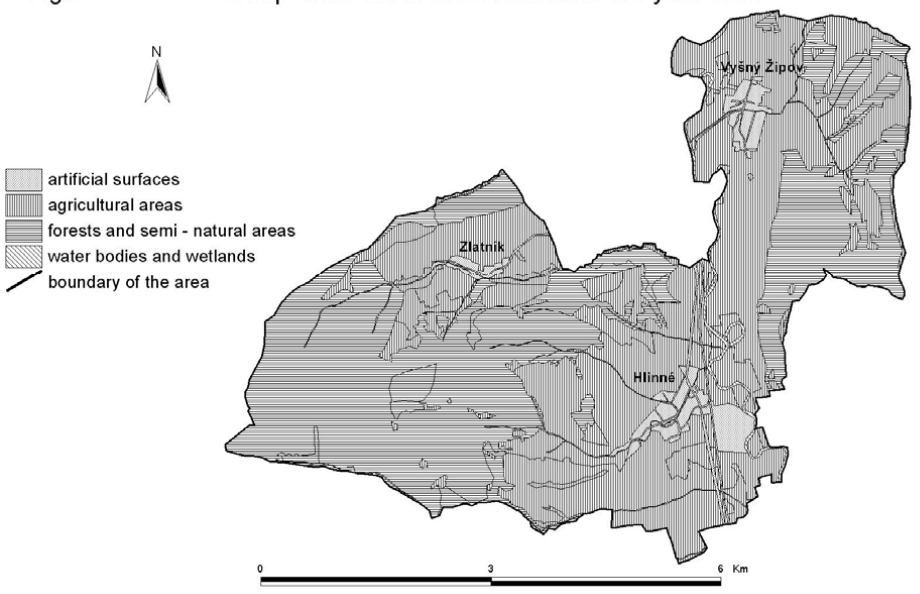
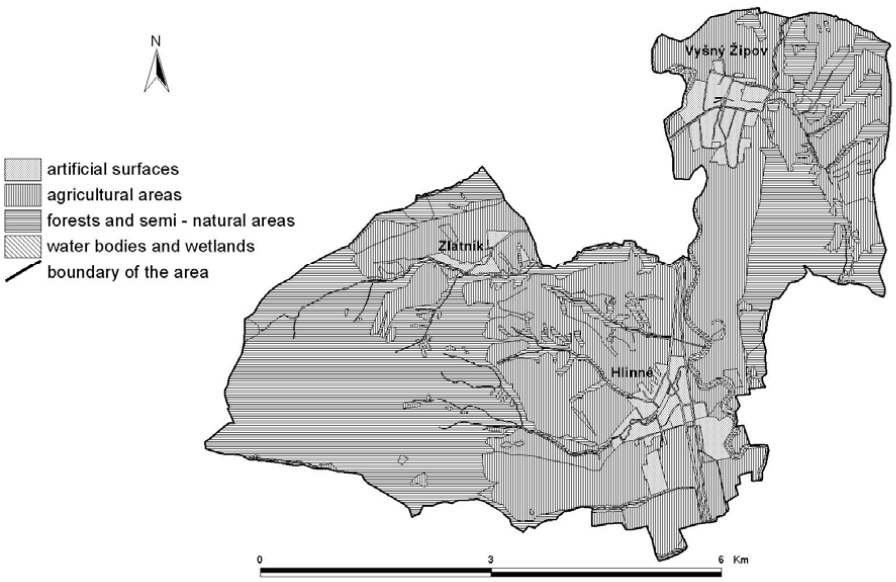
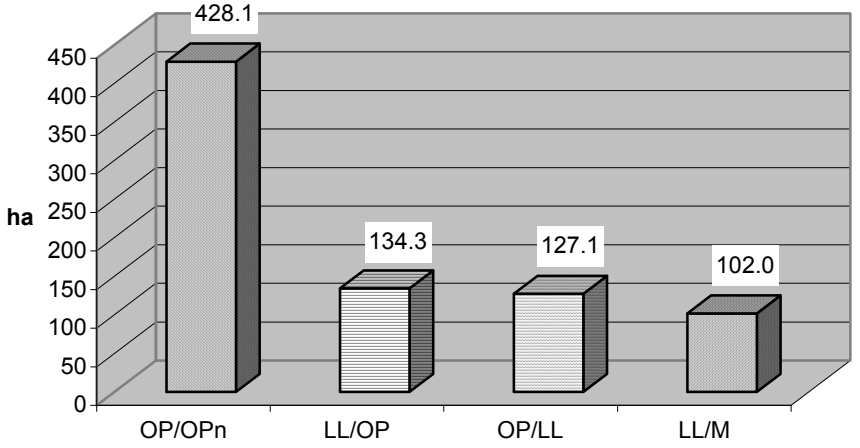


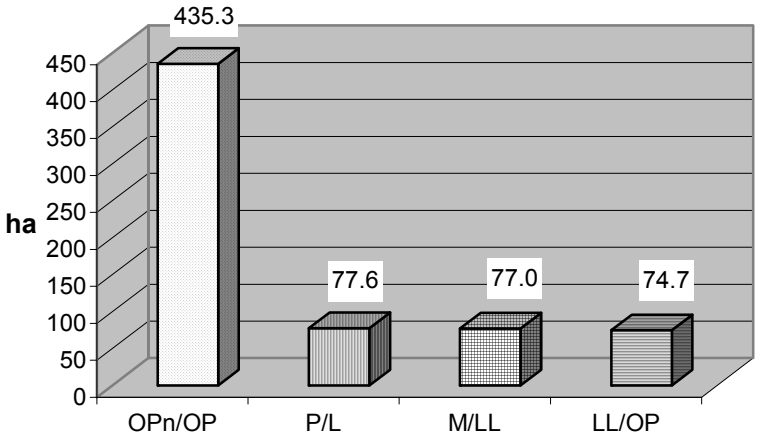
Fig. 3 Group of the Land cover classes in the year 1991



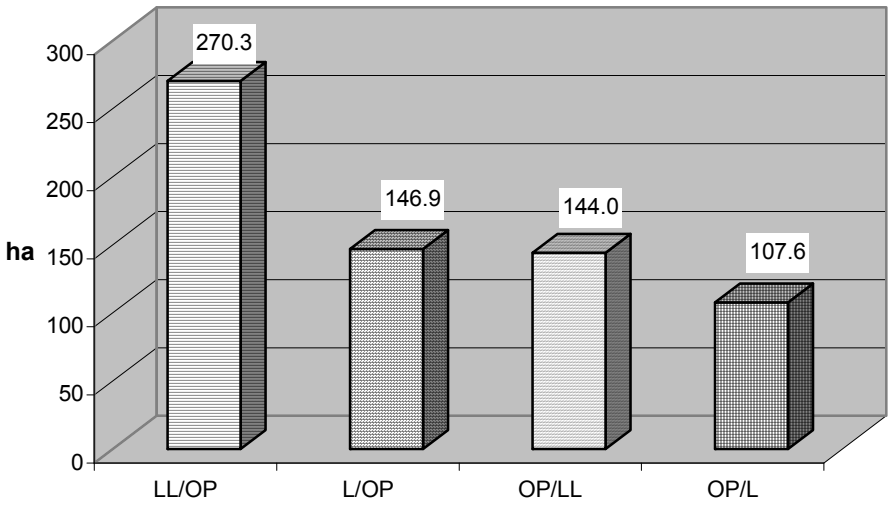
Graph 1 Changes in land cover in period 1826-1956



Graph 2 Changes in land cover in period 1956-1991



Graph 3 Changes in land cover in period 1826-1991



CONCLUSION

Landscape structure of the investigated area has kept balanced landscape character since 1826 by 50.7 % (year 1956) and 47.9 % (year 1991) share of agricultural areas and 48.6 % (year 1826) and 44.6 % (year 1956) share of forest, seminatural areas and water.

The increase of agricultural activity was slow till 1956, which did not effect the land cover changes significantly. More significant changes happened during the collectivization

from sixties to eighties of twentieth century. Agricultural development was interrupted after 1989, when changes in political and economic situation and a shift toward the market economy system caused different conditions for the agriculture. Disintegration of cooperatives and global decrease of agricultural utilization of land was noticed. Although its area was quite high in 1991 (47.9 %), in comparison to 1956 its share decrease in 2.8 %, thus it did not receive the level of 1826 year.

Residential area increased in 172.6 % from 1826 to 1991. There was a typological change of forest and structure and density of the river network.

Changes in land cover influenced functional orientation of the villages. Whilst villages Vyšný Žipov and Zlatník fulfilled during all investigated period only housing and agricultural function, there was also recreational function, except the function mention above, developed in village Hlinné, which was later substituted by natural-protecting function. When there was a textile plant for production linen thread and tows built in Hlinné in 1952, the village got its industrial character as well.

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http://www.geomodel.sk/sk/download/downloadav.htm#make_vector_grid

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