

Changes of Land Uses in Arable Lands in the 19-20th Century in the Gödöllő Hillside, Hungary

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***Abstract:** Land use change has a great influence on our natural environment. In the last 200 years the landscape changed tremendously and become more fragmented. I analysed former military maps from 1770s until 1890s and later EOV and CORINE Land Cover maps. I observed the transition direction of areal distribution of various land uses. I established that the land stability has different changes in Gödöllő Hillside. The former surveys did not show the relevant changes for some type of land uses (e. g. forest). Other areas such as arable lands, meadows and pastures were changed tremendously at the end of the 20th Century. Due to the urbanization processes we found great transformation in distribution of different landscape types, mainly in the ratio of built up and arable land areas. Namely Gödöllő and its neighbourhoods became suburbs region of Budapest. The transformations are demonstrated by changes of arable land areas. They have mainly become family housing areas. Wetlands, orchards and vineyards extremely decreased. The quantification of anthropogenic effects is in progress.*

***Keywords:** Gödöllő Hillside, arable lands, historical maps*

1 Introduction

Landscape has changed tremendously in the last centuries. In one hand people need more and more nature areas for relaxing, sports activities etc. Otherwise natural areas are under great pressures (e.g. expansion of building areas, expansion of transport systems, social changes such as suburbanization processes).

The Gödöllő Hillside is situated close the capital; it is rich both in nature and landscape values. It belongs to the Northern Mountain Ranges macro region according to the micro-region classification. The area of Gödöllő Hillside is 550 km², and it consists of 16 settlements. The landscape varies between 130 and 344 m above sea level, which reduces towards the south-east [1]. The highest point of the hillside is Margita (344 m) which is situated near the village of Szada, located

in a suburban region, and the lowest point is near to Gyömrő (130 m). It is a diverse micro-region with twofold natural characteristics. Due to its landscape characteristics, the micro-region is a transitory area between a plain terrain and medium-height mountain ranges from the aspect of geological, climatic, botanical and soil features. Besides the natural conditions, the land use in the micro-region is determined by its role in the country's economy, good accessibility and ecological conditions. The change in land use happened in parallel with the transformations in the population number [2] This analysis focuses on four inner settlements of Gödöllő Hillside (Veresegyház, Szada, Gödöllő, Isaszeg), where significant changes happened in the studied period.

The Hungarian literature in the past decades several review studies were written about the Gödöllő Hillside. These studies are presented the topography, geological, climatological, hydrological, botanical and pedological features of the area [1, 3,4, 5, 6, 7, 8, 9]. These overviews are focus on the natural factors duality, which are basically between northern and southern part of the hillside. Similar research objectives have been investigated in various regions of Hungary [10, 11, 12, 13, 14], and in other countries as well [15, 16 , 17, 18]

2 Materials and Methods

For the analyses I used former military maps from 1770s until 1890s and later EOV and CORINE Land Cover Maps. Firstly I prepared land cover maps of the area. Secondly I separated different seven main land use categories (1. built up areas, 2. forests, 3. wetland areas, 4. meadows and pastures, 5. arable lands, 6. orchards and 7. vineyards). Finally I observed how and which directions changes the arable lands (I marked with "1" = changes areas or non-stable areas, "0" = no changes or stable areas).

To the mapping I used following maps:

1. 1st (1763-1787) Military Survey Map (Scale=1:28,800) (Arcanum Ltd.)
2. 2nd (1806-1869) Military Survey Map (Scale = 1:28,800) (Arcanum Ltd.),
3. 3rd (1872-1885) Military Survey Map (Scale = 1:25,000) (Arcanum Ltd.),
4. Maps of the Unified National Mapping System (Scale = 1:10,000),
5. Corine Land Cover Maps of 2006 (Scale = 1:100,000).

3 Results and Discussion

The results of mapping analysis show that significant changes happened in Gödöllő Hillside in the last 200 years (Table1). Due to an intensive land use the spatial structure becomes more and more fragmented.

Table1.
Land use change between 1763-2006 (%)

Land use type	1 st Military Survey Map	2 nd Military Survey Map	3 rd Military Survey Map	EOV	Corine Land Cover Map of 2006
Built up area	0.74	1.09	1.27	13.78	19.26
Forest	33.30	33.66	27.09	44.40	46.17
Wetland	7.77	5.26	4.86	1.23	1.22
Pasture, meadow	48.23	41.94	25.31	11.59	1.73
Arable land	4.59	12.23	34.13	23.05	21.00
Orchard	0.90	1.22	1.26	5.13	0.60
Vineyard	4.47	4.60	6.09	0.83	0.00
Other agricultural land					8.51
Other semi-nature land					1.53

3.1 Transformation between 1st and 2nd Military Map

Survey shows that the share of stable areas in arable lands was more considerable than distribution of non-stable areas in this period (1763-1869). 73.48% of arable land weren't changed, so this means that only 26.52% were non-stable areas (Figure1). The main directions of changes are the following: 1st wetland (53.61%), 2nd meadow and pasture (42.44%), 3rd forest (3.87%).

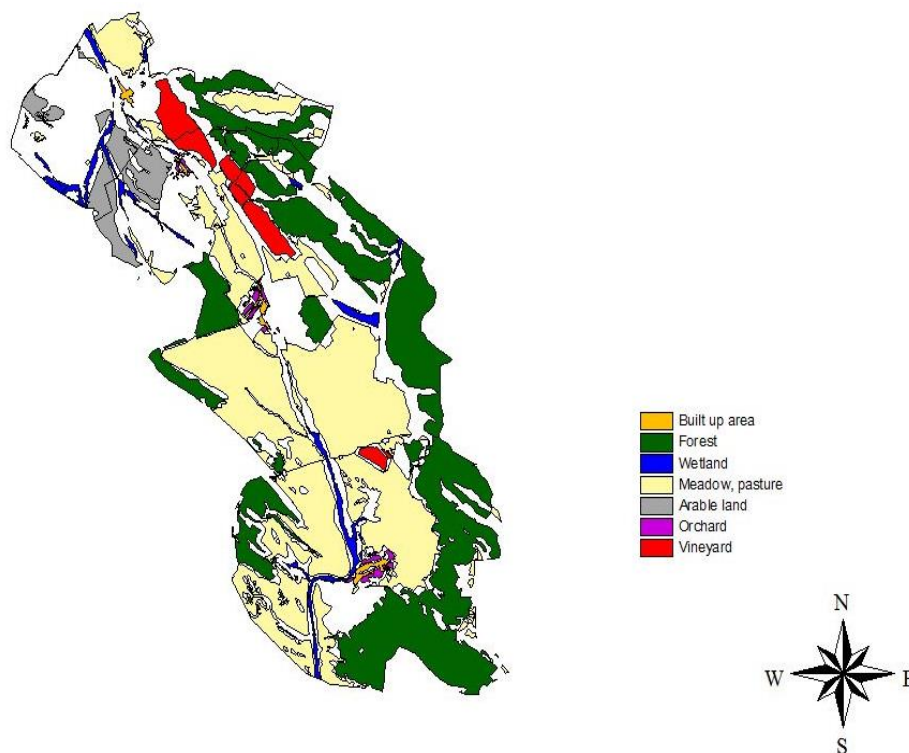


Figure 1

Distribution of stable areas on 1st and 2nd Military Maps (1763-1869)

3.2 Transformation between 2nd and 3rd Military Map

Furthermore, the most significant category was the stable areas in the 19th century. In this case, most part of arable lands weren't transformed (81.80%). The main directions of changes are the following: 1st meadow and pasture (38.02%), 2nd wetland (31.89%), 3rd orchard and vineyard (21.7%).

3.3 Transformation between 3rd Military Map and EOV Map

In the next studied period the proportion of arable land was decreased. Its maximum coverage was 23.05% at the end of 20th century. In this case the non-stable areas were considerable (56.22%) than stable parts (43.78%) (Figure 2). The main directions of changes are the following: 1st forest (44.55%), 2nd meadow and pasture (22.66%), 3rd built up area (18.82%).

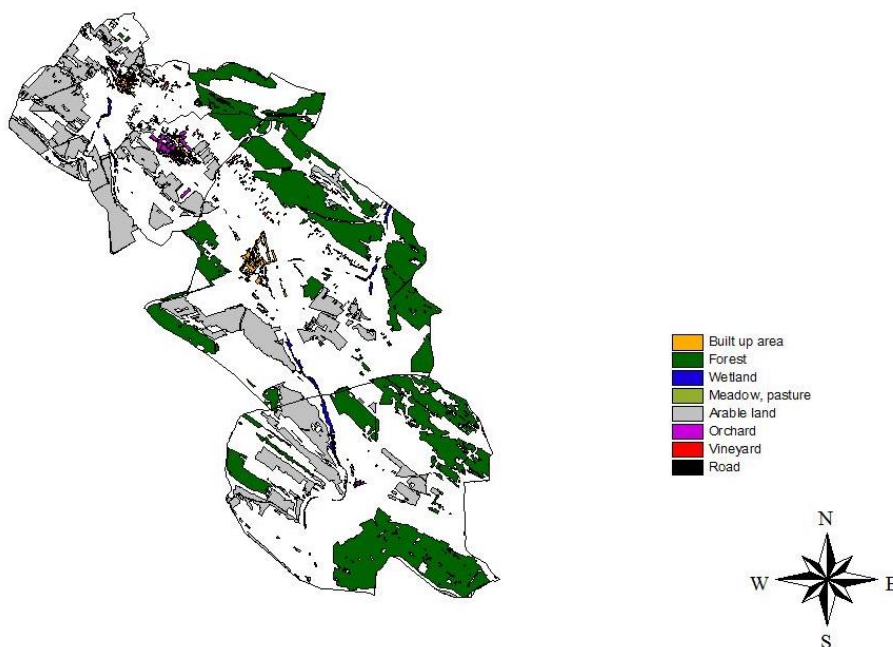


Figure 2
Distribution of stable areas on 3rd Military Map and EOVS Map (1872-1990)

3.4 Transformation between EOVS Map and Corine Land Cover Map

In this term the coverage of arable land was similar than former period (21%). However, the share of stable and non-stable areas was reverse. In this case 77.15% of arable land was stable. The main directions of changes are the following: 1st built up area (44.91%), 2nd other agricultural area (21.90%), 3rd forest (18.56%).

4 Conclusion

Parallel with quantitative changes (the proportion of different forms of cultivation), land use structure has been transformed. It has become fragmented, due to a change in land use (construction of new roads, plots for new houses, shrinking and fragmented agriculture and sylviculture) during the last 2-2.5 centuries.

The proportion of different forms of land use (orchard, vineyard, meadow, pasture, wetland) were gradually decreasing. However, besides the forest areas the arable land has been the most dominant land use form in the Gödöllő Hillside, although it has decreased by today due to the expansion of settlements and

forestations. According to share of arable lands stable areas were more considerable. The main directions of transformation were wetlands, meadows and pastures, forests and built up areas. These shows that transformation was not only due to physical characteristics of the area but economic and social processes, too (suburbanization).

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