

Case study area Veľký Bánhedeš / Nagybánhegyes: Land use changes from the past to 2015

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1. Introduction

The expulsion of the Ottoman Turks (1699) and the defeat of the last estates uprising (1711) marked a turning point in economic and social development throughout Hungary and the Central and Eastern European region and adjacent areas of the Balkans. Large migratory movements (especially in the north–south), which occurred after the Treaty of Szatmár in Hungary, affected the ethnic structure of the population. These included the migration of Slovaks to the territory of today's Békés County, which was marked by significant ethnic structure of the region.

Colonization process of the depopulated settlement in fertile Békés plains with chernozems soils took place in several waves and was supported by Hungarian nobility. Since the last third of the 17th century, population from (relatively) overpopulated regions came here. These regions were mainly in Preddunajsko and Upper Hungary (today's Slovakia). Later, at the turn of 18th and 19th century, it has become an important internal colonization of surrounding Slovak enclaves. New settlers were mostly farmers and their aim was the cultivation of grassy wasteland between the rivers Körös and Maros.

The model of land use changes is represented in Slovak enclave of Veľký Bánhedeš (hungarian *Nagybánhegyes*) which was established by the settlers from Nadlak (*Nădlac* in present Romania) in 1842. In this paper we would like to point out the fact that this landscape has its memory created by generations of colonists with characteristic *genius loci* which is significant for formation of planning and decisive processes, i.e. rural landscape management.

2. Objectives

The aim of the paper is to characterize the long-term changes of the Veľký Bánhedeš since prehistoric times (Neolithic) to 2015. The study includes contextual analysis and assessment of land use in prehistory. This is followed by the characterization of areas transformation under different land use classes, describing their dynamics in the context of natural (geoecological) and social factors (driving forces). In addition to these results we also present an outline of proposal for land management of the given Slovak enclave.

3. Methods

Methodological procedure with the aim to characterize the changes of the land use of the studied area was realized in the following steps:

1. Comparative analyses of cartographic sources from the year: 1769 (map of 1st military survey), 1863 (map of 2nd military survey), 1939, 1950 a 1991 (military maps), 2015 (present land use classes by the portfolio map from the 1991).

Digital versions of these cartographical sources were transformed into the GIS (software ArcGIS 10.2) environment, they were georeferenced and interpreted into land use classes (LUC) and enriched by communication linear layers.

Classification of LUC on the maps:

1st military survey (1769). Large scale map (1:28,800) from the Austrian state archive, Military archive in Vienna. Deformation took place because of its low accuracy in geo-reference but it did not have a significant influence to the identification of LUC. On this map was identified only (permanent) grasslands – pastures, which shows an extensive character of the local economy in the second half of 18th century (Fig. 1).

2nd military survey (1863). This map has a large scale (1:28,800). It is accessible in the Austrian state archive, Military archive in Vienna. In comparison to the previous map is more accurate and it captures more details about the landscape use (Fig. 2). Except the permanent grasslands or pastures can identify also the non-forested tree and shrub vegetation (NFTSV) with the function of alleys or windbreaks, based on the study of climatic and soil conditions, i.e. their relationships to the present day (real) vegetation we assume the past NFTSV was represented mainly by *Robinia pseudoaccacia* and *Quercus robur* and various kinds of self-seeding (for example *Crataegus laevigata*, *Corylus avellana*, *Rosa canina*, *Prunus spinosa*) and in the wet areas *Populus sp.* and *Salix sp.* Other LUC in 1863: arable land, settlement (built-up area), house gardens.

Hungarian military maps dated 1939, 1950 and 1991 have a scale 1:25,000. They are accessible in the Hungarian military archive in Budapest. Thanks to their accuracy and depicted details, they are compatible in their content with the above mentioned cartographical sources (Fig. 3–5). In the given time periods we were able to identify the set of LUC (e.g. agricultural-industrial areas, vineyards) which we aggregated (for the purpose of simplification of the study of land use changes) into eight categories.

For actual state of land-use we used satellite image from year 2015. We also realized terrain research to verify present state of land use.

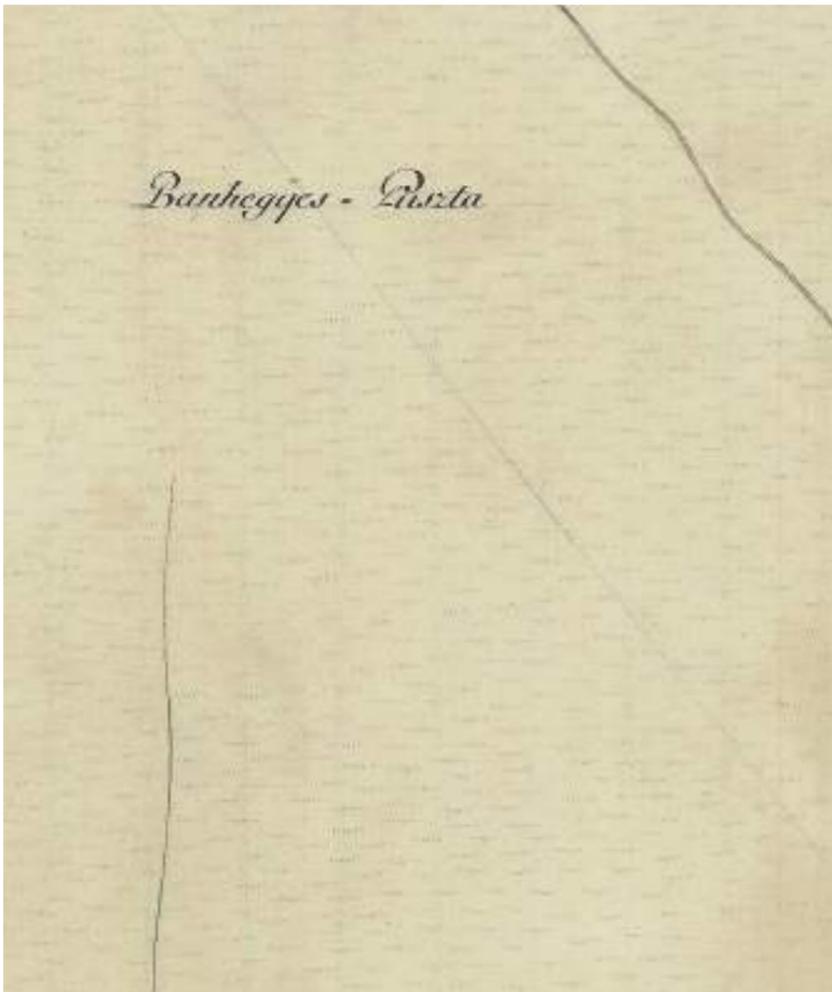


Fig. 1 – The study area in 1769.
 Source: 1st Military Survey, Sec. 22–29.
 The Austrian state archive, Military archive, Vienna.



Fig. 2 – The study area in 1863.
 Source: 2nd Military Survey, Sec. 51–59.
 The Austrian state archive, Military archive, Vienna.

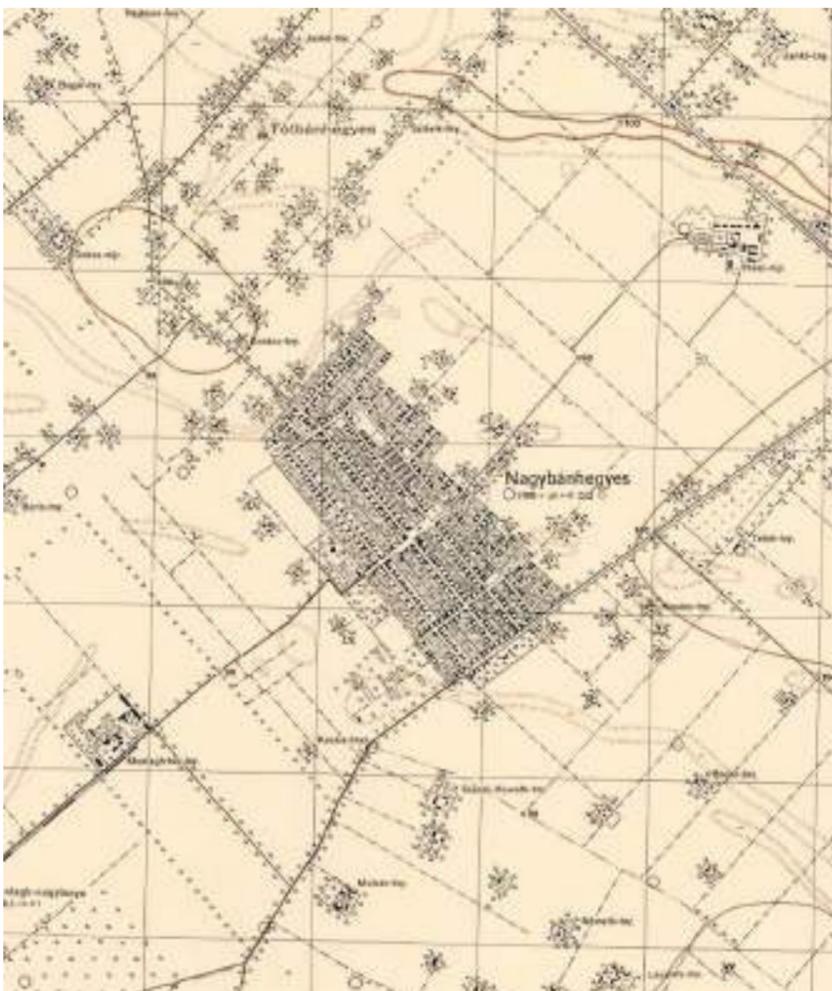


Fig. 3 – The study area in 1939.
 Source: Military map, map sheet 5466.
 The Hungarian military archive, Budapest.

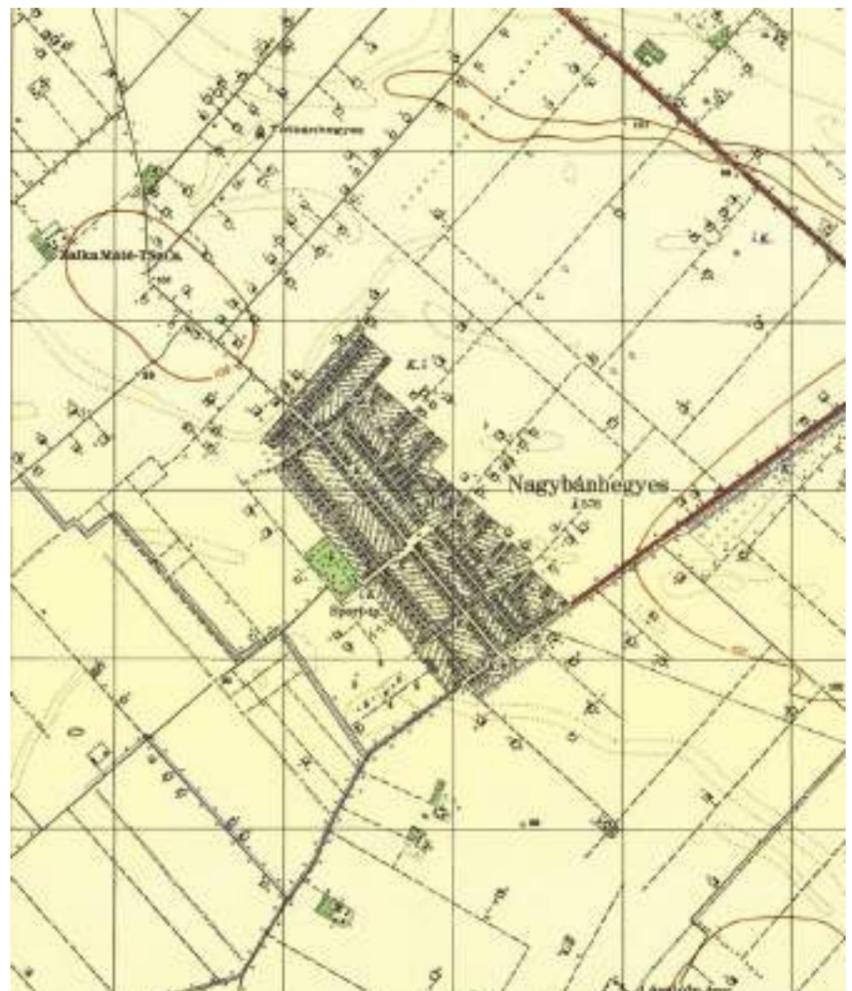


Fig. 4 – The study area in 1950.
 Source: Military map, map sheet L-34-054-D-b.
 The Hungarian military archive, Budapest.



Fig. 5 – The study area in 1991.
 Source: Military map, map sheet L-34-054-D-b.
 The Hungarian military archive, Budapest.



Fig. 6 – The study area in 2015.
 Source: GoogleEarth.

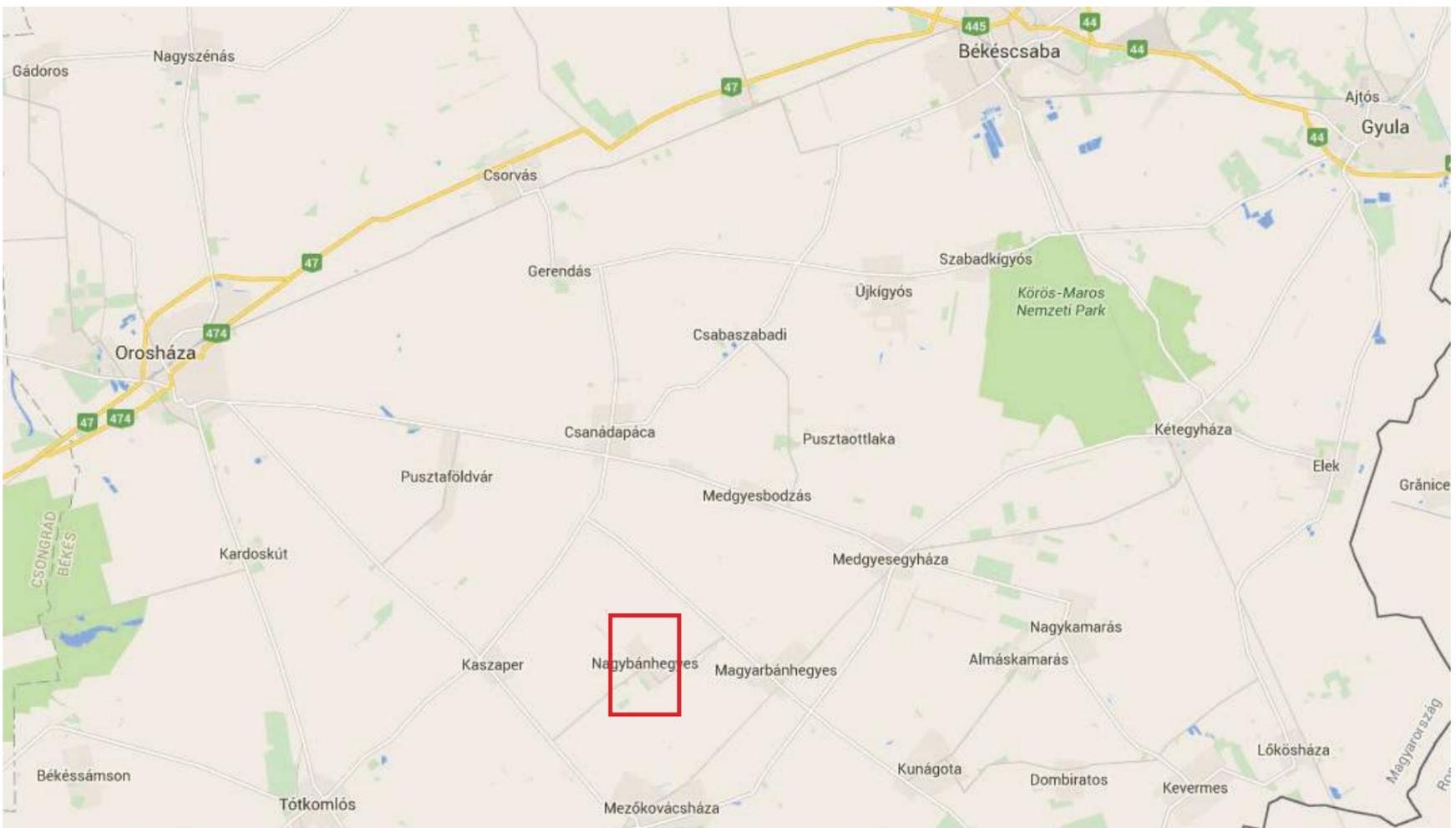


Fig. 7 – The position of the studied area.

In the final phase LUC were the input of comparative analyses. The outcomes are large scale (1:25,000) thematic maps (Fig. 8, 10–14) which shows the situation of land use changes in a specific time horizon.

2. Multi-temporal analysis as a base for the understanding of changes of LUC were realized in two phases.

The first phase consisted of studying the dynamics of LUC in the computer environment of the software product ArcGIS 10.2. Its evaluation comes from watching area relations of the individual classes of land use in the specific time horizons (1769, 1863, 1939, 1950, 1991, 2015) and the following statistic evaluation (numeric and graphic analysis).

Combining the results of the field research, i.e. interviews with informants and realizing the first part of multitemporal analysis we sketched the main axioms of dynamics LUC from the past to present (2015), with the focus on its changes to 1842 as the second phase.

4. Study area

The object of research was the area of Veľký Bánhedeš / Nagybánhegyes village in southern part of Békés County in the southeast Hungary (Fig. 7). From the hierarchical point of view of landscape units (Frisnyák 1988b) we were dealing with Békés plain which is a part of Békés-Csongrád plain which is a part of the plain between the rivers Körös and Maros. The measurement of this area is 2,584 ha while the referential area is created by the cut from the map sheet L-34-54-D-b (Magyarbánhegyes) in a scale 1:25,000.

5. Veľký Bánhedeš / Nagybánhegyes: Land use changes from the past to 2015

Land use changes are realized through space and time oscillations of the land use classes. Dynamics of LUC are caused by social events (wars, political decisions of the center, etc.) or limits of natural environment.

5.1 Land use changes from the past to 1842

According to analogies from the pre-forested area of Bakony Mts. (Chrastina 2006; Chrastina, Boltižiar 2006), Barcău basin (Chrastina, Křováková, Brůna 2006), Timiș plain (Chrastina, Boltižiar 2008) the landscape was formed in its first stage of development by man as early as in Neolithic Era. Neolithic people cultivated mainly deforested areas of backlands next to their habitats. Thanks to the character of Békés plain georelief with small elevations (residues of old flood cones), fertile chernozems and the risk of floods in Körös river, the habitats were established on sand dunes (Hungarian “*hegyes*”), which “dominated” 1–2 m (max.) above the lowland surroundings (Frisnyák 1988a). Thanks to the development of agricultural economy, the favorable conditions attracted the attention of the cultures of the Bronze Era who continued in the deforestation of thermophilic oaks along with *Aceri tatarici-Quercetum*. Mass wood cutting did not exclude the *Lithospermo-Ulmetum carpinifoliae* on blacklands (Šomšák, 1998). Another digression of forests is supposed in the Iron Age. The continuity of anthropogenic influence (spreading of arable land, meadows and pastures at the expense of the forest) is significant also during the Roman Period and the mass movement of the nations (0–500 AD).

Landscape use of the studied area was significantly changing in the Early Middle Ages (6th to 9th century) when the colonization waves of Slavs proceeded against the flow of Körös and Maros and their branches and the areas of rarely inhabited areas of Békés plain. Invasion of the Slavic people had an impact on the torsos of oaks; their remains were turned mainly to permanent grasslands and arable land. The changes of exploitation of the landscape with vast pastures and the mosaic of fields (arable land) and woods were probably brought by Magyar tribe at the end of the 9th century.

The focus on the development of agrarian production from landowners (*Maróthy* family and others) in the 13th and 16th century meant further development of arable land and pastures. Deforestation from the previous era, man’s activities on agricultural field and a significant rise of rain during the 14th century initiated the high drainage from the territory. The answer of man to this risk was setting up of habitats on sand *hegyes*.

According to Krupa (1983) the first written sources about the village Bánhegyes come from the year 1510. Study area and its surroundings were devastated during the Turkish domination many times (for example 1528, 1552). The breaking point was marked in 1596. Military impact was exposed in natural succession of the arable land and habitats and in the 17th century the landscape became a grass wasteland (Krupa 1996). In 1742, the surrounding area of present day Veľký Bánhedeš, was pasture. Fig. 9 and Tab. 1 shows that this status continued also during the 1st military survey in 1769. The pressure of internal colonization from the surrounding Slovak enclaves, more specifically a relative overcrowding of Nadlak influenced the gradual cultivation of Bánhegyes-Pusztá grass wasteland – more accurately extensive permanent grasslands which has in the first third of the 19th century gained a character of ploughed land with landscape area in urban area and the small homesteads called “*sáláše*” in its surroundings.

5.2 Land use changes from the 1842 to 2015

Land use of the studied area was being changed also in the later era. The arrival of Slovaks from Nadlak, i.e. the establishment of Veľký Bánhedeš by inner colonization in 1842 (Sirácky 1980; Zajac, Hahn 2006) can be marked as the most significant turbulence which touched the researched area (in the sense of its cultivation) in the Modern Era. The picture of changes of the given process is displayed in the development of LUC (Fig. 10–14). Analyses in the Tab. 1 and Fig. 8 completed on the bases of the study of dynamics of LUC in six time horizons enable us to point out the following tendencies in landscape use changes:

Non-forested tree and shrub vegetation (NFTSV). In the landscape structure small enclaves and stripes of NFTSV are shown with measurements of 12 ha up to the year 1863 (Fig. 9) which means that as late as in Early Middle Ages (probably as soon as Roman Period) the complete deforestation of the study area took place. It is natural that the arrival of new colonists from Nadlak in 1842 created an interest in the induction of *Robinia pseudoaccacia* into the landscape. This tree species had (and still has) significant meaning in the villages of Békés area (Fig. 15). The mining pits (aluminum) were spontaneously overgrown by *Crataegus laevigata*, *Prunus spinosa* or *Rosa canina*. Wetter areas with high level of underground water were marked by *Salix* sp. and *Populus* sp. largest measurement of NFTSV (more than 183 ha) was marked in 1939. According to the Fig. 10 the lines of wood and bushes copied most of the communications in cadaster. Acacias and oaks marked the economic status of the

Tab. 1 – Dynamics of LUC in 1769–2015.

Land use classes (LUC)	1769		1863		1939		1950		1991		2015	
	ha	%										
Non forested tree and shrub vegetation (NFTSV)			12.0	0.5	183.2	7.1	122.3	4.7	87.8	3.4	123.0	4.8
Permanent grasslands	2,584.0	100.0	182.6	7.1	21.2	0.8	22.5	0.9	7.4	0.3	7.4	0.3
Arable land			2,350.5	90.9	2,107.2	81.5	2,220.9	85.9	2,287.0	88.5	2,249.5	87.1
Vineyards					9.2	0.4	9.6	0.4	0.3	0.0	2.7	0.1
House gardens			16.1	0.6	116.3	4.5	83.2	3.2	66.9	2.6	66.8	2.6
Built-up areas			22.8	0.9	116.2	4.5	119.4	4.6	83.7	3.2	83.7	3.2
Cemetery					4.3	0.2	4.3	0.2	4.3	0.2	4.3	0.2
Agricultural-industrial areas					26.4	1.0	1.8	0.1	46.6	1.8	46.6	1.8
Total	2,584.0	100.0	2,584.0	100.0	2,584.0	100.0	2,584.0	100.0	2,584.0	100.0	2,584.0	100.0

owner of the particular Shepherd's hut creating unchangeable *genius loci* of the rural area. Not even the artificial planting of wood was able to solve the lack of wood in the village. According to oral information from native M. Vidomanec (*1936) the wood was imported from Orosháza or Kovácsháza and in the interwar period from Romanian Banát.

Up to 1950 the measurement of this class of usage has fallen to around 61 ha while reaching 4.7%. We consider this to be a side effect of land reform from 1945 to 1948 (Krupa, 1983). Land use during the collectivization caused further decrease of NFTSV in the study area. Up to 1991 the area of this LUC decreased in 34.5 ha. The last decades show gradual increase of NFTSV (Fig. 13, 14) which in 2015 had 123 ha (4,8%). This status is probably connected to landscape creation and agro-environmental precautions (protection against wind erosion etc.).

In the first period (1769) the extensive permanent grasslands covered the whole area (ca. 2,600 ha). Up to 1863 their measurement was decreased by Slovaks to 93% to the level of 182.6 ha. Fig. 10 shows meadows and pastures (which were in majority) near the village buildings and near the selected small homesteads in rural areas (*sáláše*). This fact corresponds with words of Molnárová (2005) saying that the shepherd and farm work was the main source of income for the Slovaks up to the half of the 20th century. From the second third of the 19th century up to 1950 the area of intensive permanent grassland periodically decreased. Except the epidemics (plague of the livestock, cholera) which in the 19th century decreased the number of inhabitants and livestock on "Dolná zem" (title for the colonized areas of central and south Hungarian Empire by Slovaks) another cause for the decrease of permanent grasslands was their transformation to arable land. Since 1991 the area of given LUC is stabilized to 7.4 ha.

Arable land with its area of 2,350.5 ha was mapped for the first time in 1863 (Fig. 10) here. The fields created almost 91% of this area in this time which is the largest measurement of all time periods. The ploughing of chernozems in the area of Veľký Bánhedeš rises with Slovak colonization and the village establishment in 1842. In the next periods (1939–2015, Fig. 11–14) the area of chernozems creates around 2,100–2,290 ha (ca. 82% to 89%) with gradual accumulation up to 1991 (67 ha more than in 1950). It is one of the results of collectivization which exploited in 1960s (Krupa 1983, 1996).

We could find the vineyards only in 1939 (Fig. 11). It is a vast vineyard (around 9.1 ha) on the southwest of the village, i.e. its smaller variant in the urban area (0.1 ha). Till 1950 their area was stable but the focus of socialist mass production of cereals in 1960s was in 1991 displayed by liquidation of the larger vineyard on the southwest of the village (Fig. 13). The smaller vineyard

on the southwest of the village near the agricultural company with the area of 2.7 ha is only a reminiscence of producing *Vitis vinifera* in Veľký Bánhedeš (Fig. 13 and 14).

House gardens were created along with the village houses; they appear in 1863 (16.1 ha). Fig. 10 shows that the citizens of the village were setting them up on their back yards where they were next to the pastures circling urban area. The land next to some *sáláše* was also used as gardens. In coherence with the enlargement of residential development the area of house gardens also grew. In 1939 it was 116.3 ha. Till 1950 the area lessened for about 33 ha, which is connected to the demolishing of gardens next to the abandoned small homesteads during the first phase of collectivization. They disappeared from the surroundings of the village in 1960s when most of the smaller agricultural manors seized to exist. Since this point the house gardens with the area of 46.6 ha are concentrated only within the urban area of the village (Fig. 13, 14).

In coherence with the enlargement of the anthropogenic impact on the landscape the zone of built-up areas also grew. After almost two decades from the establishment of the village by Slovaks from Nadlak the houses and small homesteads in rural area (*sáláše*) created 23 ha of the area (Tab. 1, Fig. 10–12). From the morphogenetic point of view, it is a street kind of settlement where the oldest development copies the main street (today *Kossuth ut.*). The arrival of the citizens from the surrounding enclaves in 1856, natural accumulation and the improvement of hygienic conditions (Svetoň, 1943) in the village during the first half of the 20th century caused a dynamic growth of the residential development from 116.2 ha (in 1939), i.e. 119.4 ha in 1950 (Fig. 9). After that we mark a decrease caused mainly by decontamination of repatriates of the abandoned huts in 1960s (Fig. 13, 14). It may be said that as in Bihar Slovak enclaves Varzaľ and Borumlak (Chrastina, Křováková, Brůna 2007) nor in Veľký Bánhedeš the change of citizens between Hungary and Czechoslovakia in 1946 till 1948 did not cause major differences in the area of residential development.

Cemetery appears on the reconstructed maps in 1939 (Fig. 11). Its area (4.3 ha) and position has not changed till 2015. According to the unverified sources the graves of the oldest inhabitants are placed on the northeast of the researched area; this is where the burials took place also in the first half of the 20th century when the high level of underground water prevented the burials at the village cemetery. High level of underground water and floods caused problems with storage of cereals in storage pits in the majority of Slovak villages in Békés area. The storage pits were therefore dug on dunes and elevations near shepherds' huts (more information in Sirácky 1980). The same problem arose during the inundation of Körös river when only this part of area remained dry during the floods (Fig. 16).

Fig. 8 – Dynamics of land use classes in 1769–2015 (percentages and graphical display).

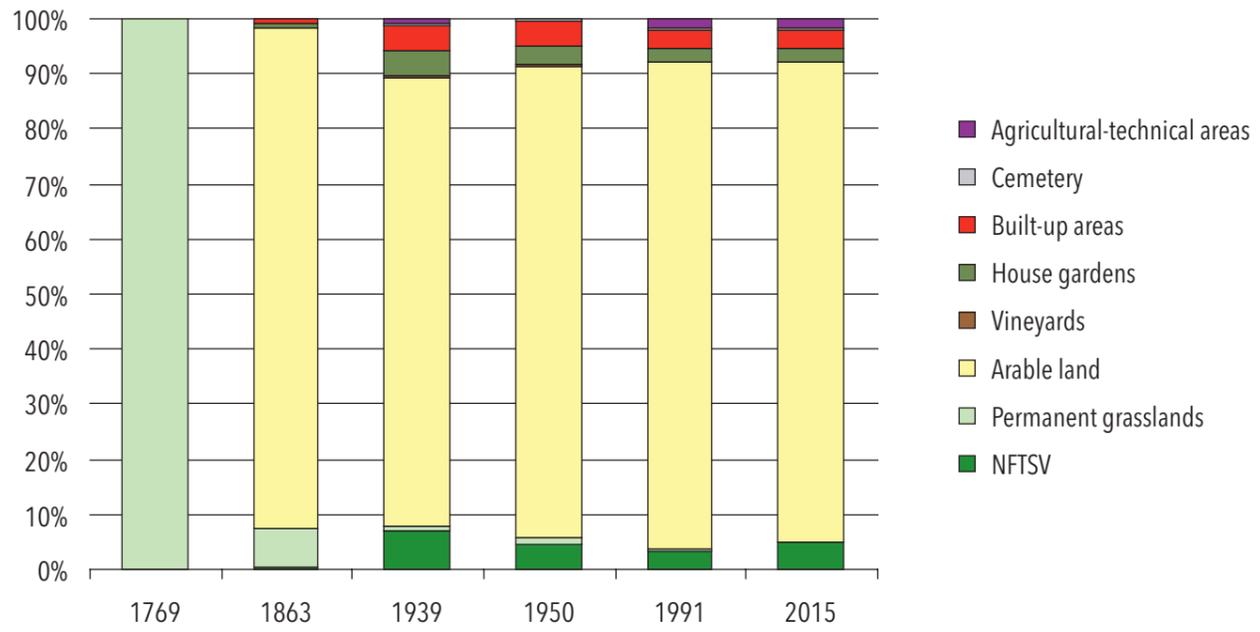


Fig. 9 – Land use classes in 1769. Note: Legend and scale are the same for figures 9–14 (see figure 13).



Fig. 10 – Land use classes in 1863.



Fig. 11 – Land use classes in 1939.

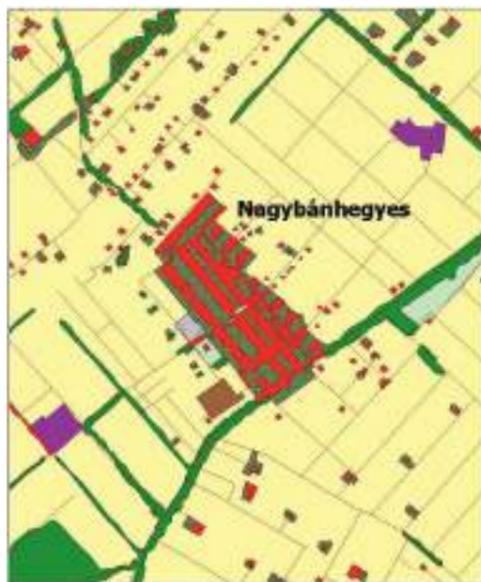


Fig. 12 – Land use classes in 1950.

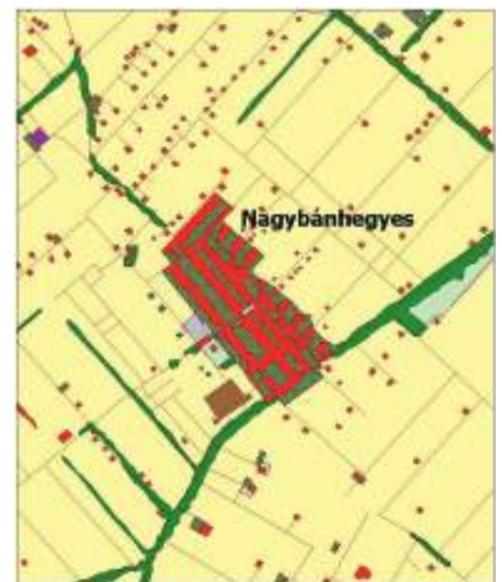


Fig. 13 – Land use classes in 1991.

- Roads
- NFTSV
- Permanent grasslands
- Arable land
- Vineyards
- House gardens
- Built-up areas
- Cemetery
- Agricultural-industrial areas

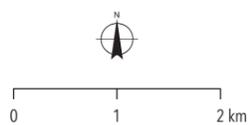


Fig. 14 – Land use classes in 2015.

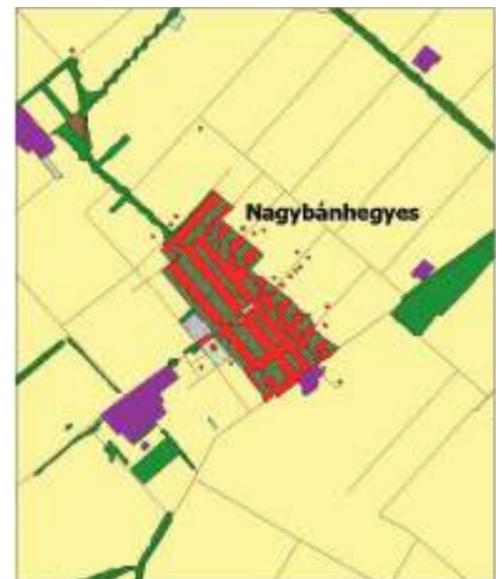




Fig. 15 – Solitaries of locust (*Robinia pseudoaccacia*) and oaks (*Quercus sp.*) marked the place of “*sálaš*” (small homestead) in arable land of Veľký Bánhedeš. Photo: P. Chrastina.



Fig. 16 – Floods in Körös river meant danger also for the inhabitants of Veľký Bánhedeš. Great damages were caused by winter and spring inundations caused by sudden pours. The Picture captures the atmosphere on the verge of 1941/42 when the water from nearby dam flooded most of the researched area (including a major part of Békés area). The only vehicles at this time were temporary rafts produced by local people. Through them also the contact between the village and shepherds’ huts took place. Various social activities (ex. burials) could be done only on several places within the area which were not flooded. Photo: archive of M. Vidomanec.

In the landscape matrix of the study area the agricultural-industrial areas are displayed since 1939. These are manors on northeast and southwest of the area which belonged to *T. Haas* and a Jew Montagh (Fig. 11). Both of them were demolished during the collectivization and were turned into fields with the area of 26.4 ha. Fig. 12 from 1950 shows the position of Agricultural Cooperative on the northwest of the area which was established in 1949 (Krupa 1983). Till 1991 new complexes were being built – cooperatives (*Zalka Maté*, *Aranykalász* and *Kossuth*), i.e. milk producing company from 1970s (Fig. 13). These areas were in the measurement of 46.6 ha (1.8%) in 2015.

6. Conclusions

Presented “view” on the land use changes of rural landscape of the southern part of Békés County (on the example of Slovak enclave in Veľký Bánhedeš) presents one of many approaches to the knowledge of historical-genetic aspects of this area. We consider the study of this issue with the use of old, i.e. reconstructional maps and the results of field research to be a useful tool of documentation of changes in cultural landscape with the focus on the time period since 1842 (establishment of the village) till today.

The results can be used in practice, for example in management of rural landscape. Its main objective is to harmonize the development of anthropogenic activities in the context of preserving cultural and historical potential of the investigated area. Our proposal can be used for example in public administration – in dealing with issues and problems about the natural and socio-economic landscape of the subsystem in a multicultural environment of Békés County with Slovak minority.

Its first part is to maintain the ecological stability of the Veľký Bánhedeš / Nagybánhegyes region. The proposal is followed by assessment of human impact on the local landscape by coefficient of anthropic landscape affect – *Cala* (Kupková 2001) and the coefficient of originality of the cultural landscape – *Cocl*, the coefficient of origin cultural landscape (Žigrai 2001); see Tab. 2.

Cala coefficient has a value started at 0, the upper limit does not exist. Value 1 is reached when the size of both types of surfaces is in balance. Value greater than 1 means that areas with high intensity of anthropic use prevails – H (arable land, built-up areas, permanent cultures). When there is the supremacy of less intensive land – L (forests, NFTSV, permanent grasslands, water bodies), the coefficient approaches the value 0.

Tab. 2 – Dynamics of coefficient *Cala* and *Cocl* in 1769–2015.

	1769	1863	1939	1950	1991	2015
<i>Cala</i> = H/L	×	12.2	11.6	16.7	26.1	18.8
<i>Cocl</i> = forests / NFTSV + grasslands / arable land	×	0.08	0.1	0.07	0.04	0.06

Cocl coefficient refers to the proportion of relatively positive elements of the landscape (forests, NFTSV, permanent grasslands) in relation to the relatively negative elements of the landscape (arable land). If this ratio exceeds 1, the country is stable, and vice versa – the closer it gets to 0, the country becomes unstable.

The coefficients suggest that landscape in the surveyed area is very unstable. Negative human intervention to the landscape structure within the territory of optimal substrate-climatic conditions (deforestation activities on agricultural land, military looting etc.) for centuries adversely affected the ecological stability of the local landscape. Turning the region in to the arable land by Slovak colonists in the mid-19th century and the subsequent impact of communist agriculture (land consolidation, liquidation of “*sálaš*” and NFTSV areas) further diminished ecological stability. Comparison of the coefficients from mid-19th century (1863) and the situation in 2015 shows that the current cultural landscape region has a very imbalanced quasi-natural and



Fig. 17 – Building of the former steam mill in Veľký Bánhedeš from the 19th–20th century. Photo: P. Chrastina.

anthropogenically contingent LUC. Therefore, the agricultural land area must emphasize more optimal spatial and functional use (more in Hrnčiarová, Šimonides 2006).

The second part of our paper draw the framework for land management under the social and cultural diversity of the landscape. The structure of the uniform land use and cultural landscape is the result of activities of Slovak colonists that began in the first half of the 19th century (1842). Concrete evidence of Slovaks agrarian culture could be seen in the preservation of rural architecture and technical monument – e.g. the building of the former steam mill (Fig. 17). The most significant phenomenon of cultural heritage in the area are “*sálaše*” surrounded by higher vegetation (Fig. 15). Therefore, some efforts must be made to preserve the historical landscape structures and specific objects, for example through educational activities under the Slovak minority self-government in the village in cooperation with the public administration.

Acknowledgements

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