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HUMAN IMPACT ON THE LANDSCAPE IN THE TOKAJ FOOTHILL REGION, HUNGARY

ABSTRACT: NYIZSALOVSZKI R. & FÓRIÁN T., *Human impact on the landscape in the Tokaj foothill region, Hungary*. (IT ISSN 1724-4757, 2007).

Despite Hungary's small size, there are currently 22 wine districts. Although large amounts of wine are produced in regions located in the southern part of the country, the most famous and the most fashionable wines come from the north. The Tokaj foothills (Tokaj-Hegyalja), one of the world's great historical wine-producing regions, lies in the close proximity of the northernmost climatic limit of wine production. It is an area with strong viticulture traditions, which have survived for over 1000 years. The formation of the strongly marked features of the cultural landscape (the Tokaj-Hegyalja terroir, as designated today), started in the 16th century in the wake of intensifying commercial contacts. The innovative processes significantly transformed the landscape. The development of the area and its ability to sustain population has continuously changed throughout the past centuries and the region reached the peak of its development in the 18th century. A royal decree in 1737 declared Tokaj to be a closed wine region, thus ensuring the conservation of its unique values. In 2002 UNESCO included it on its World Cultural Heritage list as a region of outstanding cultural significance.

KEY WORDS: Viticulture, Man-made landforms, Terroir, Tokaj wine region (Northeast-Hungary).

VITICULTURE IN HUNGARY

The oldest print of a Vitis-species leaf (*Vitis hungarica nova sp.*) was found near Eger on the Kiseged Hill. Hungarian viticulture goes far back to more than two thousand years, as the first recorded evidence was dated back to the Romans by some authors (Feyér, 1981). The Hungarian tribes kept on cultivating grapes after the Hungarian conquest (9th century) and wine has played an important role in Hungarian economy since the 11th century.

Although wines from several counties were popular in the 13th century, not all of them are regarded as wine-counties presently. Protected by the castles and fortresses on the top of the hills, new vineyards were established, e.g. Somló Hill, Gyöngyös, Eger, Pécs, Siklós, and became the centres of quality wine districts (Katona & Dömötör, 1963). Wine trade intensified after the 12th century especially in the next wine districts: Buda, Sopron, Eger (fig. 1). Thanks to the immigrating ethnic groups such as Germans, Italians, Walloons, Serbs new *Vitis vinifera* varieties (i.e. Furmint, Kadarka) appeared over the centuries and modern methods of cultivation were adopted. After the 150-year Ottoman occupation new production methods were developed and viniculture spread around occupying all areas available by the later half of the 19th century. In the 19th century the phylloxera epidemic destroyed more than half of the plantations (between 1873 and 1894).

After collectivization after World War II, the best vineyards on steep slopes began to be abandoned due to economic conditions, and mass production on the huge units of gentle footslopes was practiced. Shrinking cultivated area led to the expansion of grassland and forests at the same time. It meant significant changes in landscape pattern. However, since the 1960-1970's there has been a growing abandonment of vineyards. In the early 1990's complex privatization also induced transformations. Modern mega-corporations appeared and invested reshaping the land to create new mechanized plantations.

STUDY AREA

Tokaj-Hegyalja is situated on the pediment of the Tokaj Mountains, a member of the inner Carpathian volcanic range. The official name of the Hungarian wine region is Tokaj-Hegyalja (*Hegyalja* means «Foothills» in Hungarian and was the original name of the region).

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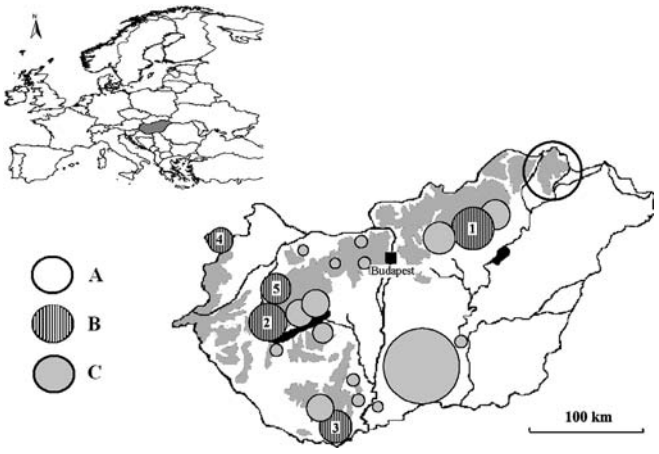

FIG. 1 - Hungarian wine regions (by T. Fórián, 2006) A - research area: Tokaj-Hegyalja wine region; B - internationally known wine regions; C - other, less significant wine regions; wine regions: 1 - Eger, 2 - Badacsony, 3 - Villány-Siklós, 4 - Sopron, 5 - Somló.

The region extends from the Sátor Hill of Abaújszántó to Sátor Hill of Sátoraljaújhely) (fig. 2) and consists of 28 villages and 7 000 hectares of classified vineyards, of which an estimated 5,000 haectares are currently planted.

The area in which Tokaj wine is traditionally grown is the foothills of the Carpathian Mountains. The soils of this volcanic region are varied, but clay soils are predominant, mixed with various minerals and rocks (rhyolite, tuff and zeolite) and yellow loess (an accumulation of wind-blown silt). Volcanic soils absorb heat, show high concentrations of trace elements and smaller amounts of carbonates.

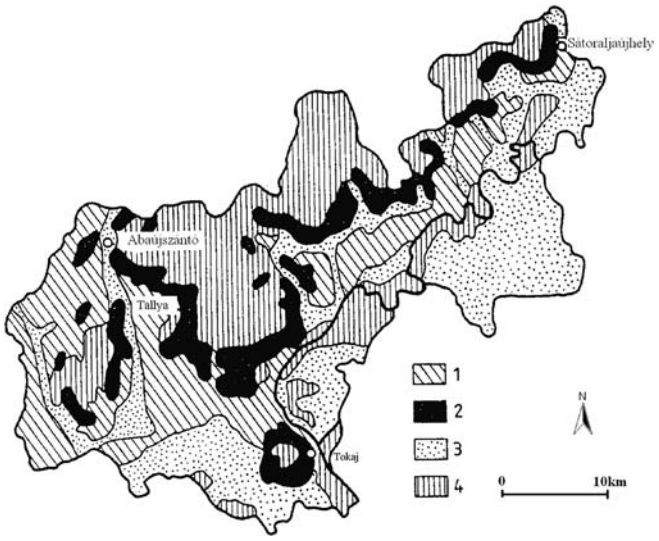

FIG. 2 - Traditional zones of land use in Tokaj-Hegyalja (after Frisnyák, 2001) 1 - forest; 2 - vineyard; 3 - arable land; 4 - meadow, pasture.

The climate is continental: dry and relatively sunny. The average temperature in the hottest month (July) is 20.6°C, while annual rainfall is between 516 and 680 mm. The summer and early autumn months tend to be warm and sunny, although there is a risk of thunderstorms. The microclimate is determined by the sunny, south-facing slopes and the proximity of the Tisza and Bodrog rivers, and the proliferation of *Botrytis* (noble rot) and the subsequent desiccation favours grapes.

THE HISTORY OF TOKAJ WINE

Nobody knows when wine was made in the Tokaj region for the first time. Historical records show that vineyards were established in Tokaj as early as in the 12th century. A number of experts claim that viticulture could have started in the Tokaj region as early as in the Celtic times. A petrified grape leaf found in Erdőbénye and dated from the late 3rd century AD, points to the existence of viticulture in the Roman times. Slavs arrived in the region in the late 5th/early 6th century. One possible origin for the name Tokaj is that it is derived from the Slavic word *Stokaj*, meaning confluence of the rivers Bodrog and Tisza. Hungarian settlers arrived in Tokaj from the end of the 9th century and there is an alternative theory that viticulture was introduced in the region from the East, possibly by the Kabar tribe. Another possible origin for the name Tokaj is that it comes from an Armenian word meaning grape.

People speaking a Neolatin language were invited to settle in Tokaj by King Béla IV (1235-1270) after the Mongol invasion of Hungary (1241-42). These immigrants were most probably Walloons from northern France, although some researchers claim that they were Italians. However, the rise of Tokaj as a major wine region can be dated back to the early 16th century. Before the Turkish Era, Tokaj-Hegyalja was in a peripheral situation. After the partition of Hungary Tokaj wine became an increasingly important commodity for the region. In the 18th century, Tokaj reached the height of its prosperity. Both Poland and Russia became major export markets for its wine.

The royal decree by Emperor Charles VI of the Holy Roman Empire in 1737 declared Tokaj to be a closed wine region (production district), thus ensuring the conservation of its unique values. Tokaj-Hegyalja became the world's first wine appellation system. Vineyard classification began in 1730 and was completed by the national censuses of 1765 and 1772. The partition of Poland in 1795 and the subsequent imposition of custom duties meant a severe blow to the exports of Tokaj wine and precipitated the economic decline of the region. However, this was only the first of the three major crises for Tokaj. The second occurred when the phylloxera epidemic reached Tokaj in 1885 and destroyed the vast majority of the vineyards in a matter of years. The third blow was that Hungary lost two-thirds of its territory un-

der the Treaty of Trianon, thus Tokaj wine lost access to the majority of its domestic market.

LANDSCAPE TRANSFORMATION

Cultural landscape history can be divided into three main periods. The first of them, the formation of the strongly marked features of the cultural landscape (the Tokaj-Hegyalja terroir), as we mean it today, started in the 16th century in the wake of intensifying commercial contacts. Innovations came from the Saxon (German) settlements of the Felvidék ("Upper Hungary"), for example Metzenzéf, through Saxon and Slovakian wage labourers and significantly transformed the landscape. It was the first significant impact of vine plantations on the landscape when vineyards were forced to shift to unfavourable lands such as the edge of forests and the foothill regions of mountains to gain spaces for crop cultivation. Due to this translocation, a deforestation began all over the country including Tokaj-Hegyalja.

The land use of Tokaj-Hegyalja followed the pattern of the macro- and microrelief and the altitudinal zones were regulated (Frisnyák, 2001). The highest region (above 300-350 m) was covered by forest. Under this zone the eroded pediments with slope angles of 15-30 per cent areas were the main terrains of grapes cultivation. The accumulation slopes (1-10 per cent) of the pediments were occupied by discontinuous arable land. Alluvial plains were utilized as pastures or meadows (fig. 2).

The second era is associated with the phylloxera epidemic, which Tokaj-Hegyalja in 1885 and destroyed the vast majority of the vineyards in a matter of years. Their extension decreased by 83 per cent (Feyér, 1981). Traditional viniculture was destroyed. The first recontruction started at the beginning of the 20th century (1903-1907), the second plantation program was decided to start in the socialist era (1955-1965) and that was the first reason why the disintegration of the traditional zonal land use system began. New plantations preferred the accumulational lower pediment sections of gentle slope (i.e. the skirts of hills) where viticulture was more profitable as opposed to steeper and higher so these vineyards became abandoned step by step.

The third stage started after the change of the political system in 1990 and another significant transformation began. Old abandoned vineyards were replanted, so these activities resulted in increased human impact and also led to changes in landscape pattern.

CLASSIFICATION OF MAN-MADE FEATURES IN TOKAJ-HEGYALJA

The «innovative revolution» of the 16-17th century significantly transformed the landscape again. A number of new man-made elements were created both under- and overground: terraces, dry stone walls, stone hedges (obalas), waterways, «lictor holes» (sediment traps), cellars and wine-press houses. These man-made features have integrated into the landscape as its organic parts and influence geomorphic and environmental processes. At that time grapes were grown predominantly on south and southeast-facing steep slopes of the Tokaj Mountains, so the risk of soil erosion was high.

In the 17th century environmental approach and sustainable land use were manifested in rigorous local laws and vineyard regulations of Tokaj-Hegyalja. These laws regulated the protection of environment and soil on steep slopes, for example digging and servicing of «lictor holes» (sediment traps), servicing of balks. The most successful forms of the protection against erosion were terraces and dry stone walls built by Saxons from Metzenzéf in Felvidék. According to the historical data the oldest dry stone walls were built in the first part of 17th century. Terrace constructions improved microclimate on the individual plots and reduced the risk and the damage of soil erosion as well.

1. *Permanent features*

Landforms in this category caused the most significant impact on the landscape when they were constructed and, moreover, after abandonment they remain decisive elements of the landscape. Nevertheless, we have to distinguish the older forms from recent structures, because of the methods and ways of establishment. First, the traditional and more «environmental-friendly» buildings are described, then the new man-made forms.

The oldest man-made elements are the *cellars* deepened into rhyolite-tuff (near Tokaj into loess). They were built in the inner part of villages and towns in contrary to other wine districts of Hungary. According to Frisnyák (1988) and Papp (1985) we claim that a high percentage of cellars were made mostly in the 16-18th centuries. The estimated number of cellars was 4-5000 in the 17-18th centuries but it decreased to 3100 by 1869 (Frisnyák, 1988). On the basis of their ground-plans the cellars can be divided into three categories: 1. Cellars with only one tunnel, 2. One tunnel cellars with cells, 3. Labirinth-cellars.

Generally we can say that the *wine-press houses* are connected to cellars in Tokaj-Hegyalja. Isolated wine-press houses situated in the vineyards are not too common. Permanent wine-press houses consisting of stones or bricks and greater floor space were built on the bigger manorial domains only, which are used as headquartes of the new modern (sometimes foreign) investments nowadays. The so-called «peasant» wine-press houses have already been destroyed and those constructed from plywoods in the socialist era and later proved to be too small and unstable buildings.

The *stone hedges* (obalas in Hungarian) represent the largest antropogenic landforms of 3 or 4 m width and 2 or 3 m height in the study area (fig. 3). The frequency of occurrence and the size of obalas depend on the amount of the debris excavated out of the ground. They were built from the debris that became unnecessary after the application of terraces. The obalas mark the boundary of the earlier vineyards cultivated in an intensive way, following the

FIG. 3 - Stone hedges (obalas) from the 19th century (photo by Nyizsalovszki, R. 2003).

direction of the slopes from the upper part of the area, which are continuously cultivated, over several tens of meters length. Recently the stone hedges together with the dry stone walls can be found in the bush-forest region located between the forest region (on the top of the hills) and the mechanized plantations (on the lowermost slope of the hills).

In general, dry stone walls of special kind protect the stability of hill roads on either side. They are twice as wide as the supporting walls, and in some places higher than 4 m, consequently they are also more permanent forms. The 1,5-2 m tall (in extreme situations they can be even 4 m high) supporting walls consist of 2-3 rows. Associated with field boundaries they can reach tens of meters in length. They were built of stones of different size and shape without any binding material. A cross-section of some walls can be trapezoid, i.e. the front can slightly incline backwards. Compactness and stability were achieved by filling the gaps with smaller fragments. In the structure of the supporting walls we can find huge volcanic blocks (fig. 4). Dry stone walls are characterized by great stability, their structures are slowly broken. At first a weak point can be observed in the upper third of the dry stone wall, being in close connection with the depth of cultivation. Due to clay accumulation in the ground a slip plane develops, than the earth overload and the weight of the stones push out the side of the wall, finally the supporting wall breaks and caves in at the weak points. (fig. 5, next to the stairway right).

However, weaker structures were created in consequence with less debris on the lower foothills with unstable loess slopes. For this type washed-down soil is a major hazard which arrives from the upper part of the hill as well as root pressure of vegetation. Stability is not sufficient to resist these effects, thus the rows disintegrate and stones pile up at the base of the dry stone wall or migrate further with the sediments. Finally in the same place where the supporting walls existed a smaller bench covered with vegetation is formed. Other smaller or larger

FIG. 4 - One of the extreme high dry stone walls on the slopes of the Sátor Hill of Abaújszántó (photo by Fórián T., 2006).

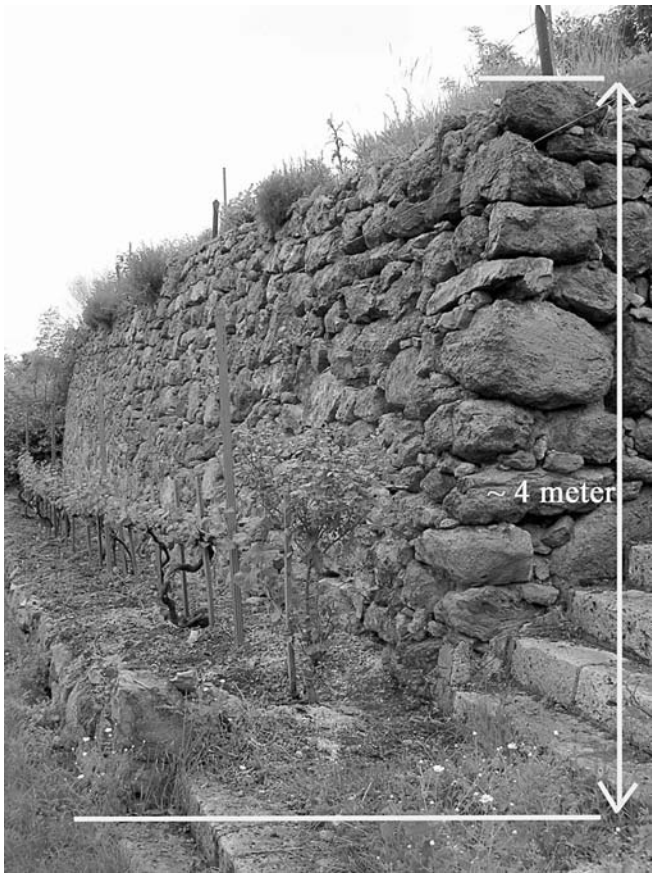

FIG. 5 - Abandoned decaying dry stone walls on the slopes of the Sátor Hill of Abaújszántó (photo by Nyizsalovszki R., 2006).

stone-heaps of 2-3 m diameter are found along boundaries or hill roads. Remnants of the here mentioned forms, although covered by vegetation, are still clearly visible in the landscape.

Large-scale measures levelling and terracing involve major larger displacement of material to create new terraces suitable for the mechanized cultivation of the vineyards, another function of terracing is soil conservation by reducing slope gradient and allowing the rainwater to spread out and infiltrate on terrace flats. However such interventions may result in deleterious environmental and landscape impacts (fig. 6). This double problem appeared in Tokaj Hegyalja. Since the levelling and terracing are subsidized by the EU policy for vineyard restructuring (Council Regulation EC 1493/1999, and its rectifications Commision Regulation EC No. 1227/2000), they represent a potential problem for the cultural landscape of the World Cultural Heritage.

The other way of modern viticulture is mechanized plantations with the removal of the original forms, but in this case, huge uniform plots of trained vineyard plantations having rows with ridges running in the direction of the slopes are established after levelling. Such operations induced antropogenic geomorphic processes like rapid changes in the shapes and inclination of slopes, a radical modification of the natural water regime, alteration of runoff properties and in some places intensifed soil erosion (fig. 6).

2. *Less permanent features*

In many cases, this category includes the «negative» (excavational) forms, since they can be easily destroyed if not maintained appropriately. Behind and next to the dry stone walls *ditches* had to be dug to drain off rainwater to and trap sediments in a «lictor hole». This system was connected to the hill road network where surplus water could runoff. The *grassed waterways* and the ditches strengthened by stones were rather shallow and ran along boundaries. Therefore, surplus rainwater could be drained from the surface. On the other hand, grassed waterways found along the present mechanized uniform parcels generate deeper gullies.

Traditionally the sediment traps were *dug pits* (sometimes stone-bedded traps) about 1-1.5 cubic meter per plot, which were cleaned after each rainfall. Nowadays they are prepared from concrete; unfortunately we only find them close to larger vineyards. In some places temporarily placed cisterns (concrete or sheet buttes) occur in vineyards to collect rainwater and to spray it around.

The soils of plantations and tillage methods influence the intensity of soil erosion. The trained vineyard plantations having rows with ridges running parallel with the contour lines and the traditional non-trained plantations are characterized by moderate soil erosion. Unfortunately, under socialism rows parallel with the direction of the slopes planted in line with a spacing of 2-4 m were established to use tractors for cultivation, and the same method is often applied during replanting, too.

CONCLUSION

The study of man-made landforms is timely in Hungary and mainly in Tokaj-Hegyalja today. The re-privatization of agricultural land and the foreign capital brought about changes in cultivation and in the cultural landscape. The importance of traditional small-scale parcels is decreasing.

The area has suffered some damage from intensive viticulture and through the destruction of traditional features. Vineyards are divided into two groups. With respect to the traditional viticulture the remaining forms now mainly abandoned, but in many cases still visible in forests, similar to those found in other European coutries with traditional viniculture, such as in Italy and Spain (Cots-Folch & *alii*, 2006; Carl & Richter, 1989). Moreover, these forms are endangared and devastated by the new resized vineyards, mechanized plantations established to be profitable (though alien to the landscape). Further destruction on traditional plots has to be prevented and cultivation in an enviromental-friendly way fitting in the traditional landscape has to be encouraged as far as possible by restoring supporting walls and applying soil conservation measures.

FIG. 6 - New plantation and erosion gully near Tokaj (photo by Nyizsalovszki R., 2004).

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