COMPARISON OF HISTORICAL EVOLUTION OF GULLY NETWORKS ON BOTH SLOVAK AND MORAVIAN FORELANDS OF THE WHITE CARPATHIANS

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1. Introduction

The main objective of the contribution is to present the preliminary results of comparison of historical evolution of gully networks in both Slovak and Moravian forelands of the White Carpathians. This geomorphic unit represents the flysch mountain range situated in the boundary zone of Slovakia and the Czech Republic, reaching the elevation 970 m. The Slovak foreland of the White Carpathians, i.e. the Myjava Hill Land, belongs among those areas in Slovakia that were the most affected by disastrous gullying in the past. This fact was one of the main reasons to choose precisely this area for detailed investigation of historical gullies, lasting at the moment approximately one decade. The study of the Moravian foreland of the White Carpathians, i.e. Hluk Hill Land, started in 2006. Its first goal was to find out if the density of gully network on the Moravian side is comparable with that at the Slovak side. Beside the density of gully networks also the age of gullies and causes of their formation on both sides of the frontier were subjects of this comparison. Comparison of gullies on both forelands of the White Carpathians is introduced in the context of the review of the research dealing with the historical evolution of gullies in Slovakia and Czech Republic.

2. State-of-the-art of research dealing with historical evolution of gullies in Slovakia and Czech Republic

The territory of the former Czechoslovakia is typical for the extensive areas with a relatively dense network of old, historical, relic gullies. Recent research concentrated mostly on spatial organisation of gullies with a special attention to the density of gully networks. At the beginning of the second half of the 20th century, the maps of spatial distribution of gully networks were elaborated, namely separately for Moravia and Silesia (Gam and Stehlík, 1956), Czechia (Gam, 1957) and Slovakia (Bučko and Mazúrová, 1958). Comparison of these maps suggests a generally higher density of gully networks in Slovakia than in the Czech Republic.

Much lesser attention was dedicated to the assessment of the relation of the gully network to the land use pattern, to individual elements of natural landscape, to causes of gully formation and to their dating.

Among the Czech scientists only Láznička (1957) dealt with dating of gully formation in the territory of the Czech Republic. On the basis of the analysis of old maps he documented the growth of existing gullies in the Jihlava River valley (southern Moravia) in the period 1785–1877. Stehlík (1981) identified the phase of accelerated erosion (including gullying) for the Czech Republic as a whole in the 1750-1850 period. However, contrary to the mentioned authors, Slovak Zachar (1970, p.332) found on the basis of the study of historical sources that in the Rakovník region (western Czechia), the majority of larger local gullies were formed in the 17th century and only a minority date to the 18th century.

Some historical framework of gully formation in Slovakia was indicated by Bučko and Mazúrová (1958) who suggested that overgrazing associated mostly with the Walachian colonisation (that penetrated into the Slovak territory in the 15th century and culminated in the 16th and 17th centuries) and the *kopanitse* settlement (taking place since the middle of the 16th until the middle of the 19th centuries) resulted in formation of a dense road and path network that provoked increased water erosion on deforested slopes. Unfortunately, they did not date the gullying itself. According to Midriak and Lipták (1995), the accelerated water erosion (including gullying; the comment of authors), was a frequent phenomenon in the period of the last three centuries. So far the most detailed investigation of historical gullies has been carried out since the second half of the 1990s in the territory of the Myjava Hill Land (cf. Stankoviansky, 2003a, b, c). Aim of this research was the search for the regularities of spatial organisation of gully networks, relative dating of the origin and further growth of gullies on the basis of the analysis of old maps and local historical sources as well as the elucidation of causes of gully formation. It was found out that gully networks are linked mostly to the elements of the old, pre-collectivisation land use, that gullies were formed predominantly in the period since the second half of the 16th until the middle of the 19th centuries and that the cause of gully formation was the cumulated influence of both land use and climate factors in the same period. It was also revealed that gullies were formed in stages, at least in two phases of disastrous gullying, however neither of them affected the whole study area. Identified local disparities in the increase of gully networks suggest that the gully growth was not areawide in

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individual stages. The research with the same aims was extended also to the northern part of the Nitra Hill Land in the last two years (cf. Papčo, 2005).

3. Preliminary conclusions of comparison of historical evolution of gully networks on both Slovak and Moravian forelands of the White Carpathians

The Slovak foreland of the White Carpathians, namely the Myjava Hill Land shows predominantly plateau-like relief with elevations ranging over a span 543–300 m. It is built mostly of flysch-like rocks of medium to low resistance resulting in relatively thick fine-textured regolith. Islands of loess and loess loams are spread locally. Cambisols and luvisols are the most frequent soil types. The mean annual precipitation is 550–800 mm. The natural vegetation was represented predominantly by the oak and hornbeam forests, locally by beech forests.

For the whole area of the Myjava Hill Land, the gully network with an average density approximately 1.2 km km^{-2} is characteristic, while extensive islands show values of 2–3 km.km^{-2} (Bučko and Mazúrová, 1958) and the field research revealed the maximum local density of even almost 11 km km^{-2}. The field reconnaissance and the analysis of old cadastral maps (scale 1 : 2 880) suggest that the pattern and density of these gullies have been controlled primarily by artificial linear landscape elements typical for the original land use from the pre-collectivisation era (access roads, parcel borders, lynchets, drainage furrows etc). The locality with the above mentioned highest density of gully network is the exception as gullies in this place are linked with areal element of the old land use pattern, namely with overgrazed pasture. The old military maps from years 1782, 1837 (scale 1 : 28 800) and 1882 (scale 1 : 25 000) and both regional and local historical sources indicate at least two main periods of gully formation, namely sometime between the middle of the 16th century and the 1730s and between the 1780s and the middle of the 19th century. It is supposed that conditions for gully erosion were created by extensive forest clearance and expansion of farmland due to the *kopanitse* settlers, as well as by overgrazing due to Walachian colonists, but the triggering mechanisms of gullying was represented very probably by extreme rainfalls and snowmelts during the Little Ice Age. Especially colder and wetter fluctuations with increased precipitation totals and greater probability of increased frequency of significant events provided more opportunities for gully formation (Stankoviansky, 2003a, b, c).

The Moravian foreland of the White Carpathians, namely the Hluk Hill Land, shows similar features as the Myjava Hill Land, though it is a little lower. Relief is predominantly smoothly shaped, flat-topped, with average elevation 272 m and highest point 429 m. It is built by flysch rocks of low resistance; quite extensive area of loess is in the SW part. Mean annual precipitation is 600–800 mm, original forest cover was represented by oak-hornbeam and locally by oak forests.

The average density of the gully network on the Moravian foreland of the White Carpathians is considerably lower than in the Slovak part of the boundary zone, it is ranging over a span 500–750 m km^{-2} (Gam and Stehlík, 1956). Comparison of old maps from years 1768, 1836 and 1882 showed that in general, the gullies on the Moravian side are a little younger; it seems that the main period of their formation was sometime between the first and second military mapping, i.e. approximately between the 1760s and 1840s what corresponds well with the younger of two phases of gully formation identified on the Slovak side (Stankoviansky and Létal, 2006).

The next research stage will be aimed at finding the causes of disparities between the different density of gully networks and their age on the Slovak and Moravian forelands of the White Carpathians.

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