THE RELATIONSHIP BETWEEN GULLY EROSION AND MORPHOMETRIC CHARACTERISTICS WITHIN THE THE LARGA CATCHMENT (THE TIGHECI HILLS, REPUBLIC OF MOLDOVA)

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Abstract. The Larga catchment is located in the southwestern part of the Republic of Moldova. The natural conditions of the catchment are typical for the Tigheci Hills, where deep erosion and gullies are the most characteristic geomorphologic processes. The shape, dimension and spatial differences of gullies are conditioned by lithological characteristics of the morphologic substrate and climatic conditions. The most important feature is represented by the morphometric variables.

Keywords: *gully erosion, morphometric characteristics, The Larga catchment, The Tigheci hills*

1. Introduction

The Larga catchment, a left-side affluent of the Prut River, is a part of the typical hilly area of the Tigheci hills, in the south-western part, having a surface of about 14783.86 hectares. The total length of the streams is 45 km. The length of the Prut River is 36, 2 km.

The geology is represented by sedimentary formations. It is dominated by sands, clays intercalated with more consolidated layers of sandstones and arranged in a dominant monoclinic structure. Meotian and Khersonian deposits are spread over the whole surface of the catchment. The lower basin is represented by Pontian and Quaternary deposits.

Within the Larga catchment, the valley direction is initially consequent and then subsequent. The subsequent direction starts from the Flocoasa village. Overall, the consequent aspect becomes dominated by the subsequent asymmetry, where the right slope is a typical cuesta backslope with eastern exposition, very well outlined and uniform and the left slope is a cuesta front with the western exposition. (Ionita, 2000).

The most characteristic geomorphologic process in the Larga catchment is the gully erosion. Based on the topographic maps 1:25000 scale, there were identified 158 forms of gully (Figure 5) divided in 121valley-side gullies and 37 valley-bottom gullies. Gully erosion has occupied more than 800 hectares. If the drainage network density in the catchment represents 0, 9 km/km^2, then the density of gullies is 0,8 km/km^2 and results in one of the most affected areas of the Republic of Moldova. A gully density is closely connected to human activity, to the presence of natural and artificial boundaries that cause increased concentrations of the water flows and high rates of erosion. (Voloschuk and Ionita, 2006).

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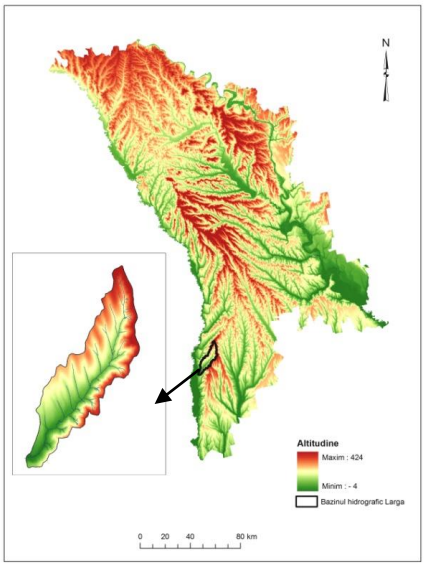

Figure 1: The geographic location of Larga catchment

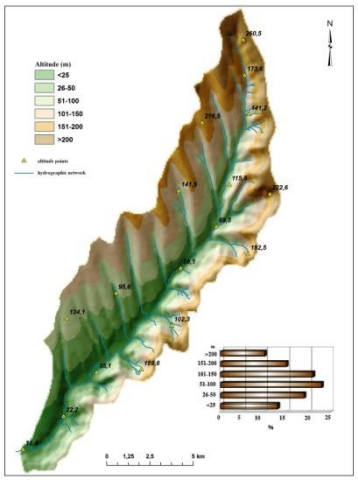

Figure 2: Hypsometric map of the Larga catchment

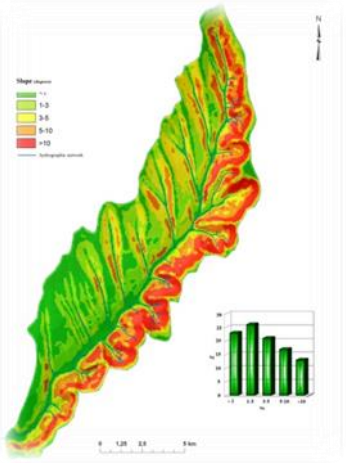

Figure 3: Slope map of the Larga catchment

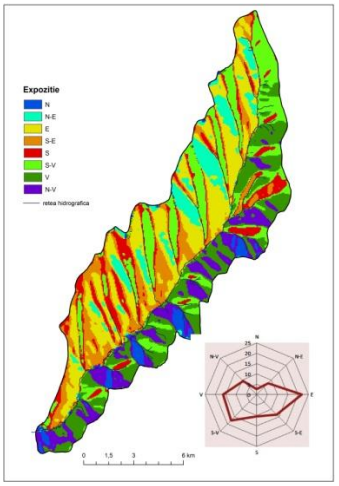

Figure 4: Aspect map of the Larga catchment

2. Materials and methods

This research is carried out in the Larga catchment. The region is affected by gullies erosions. Their number exceeds the 150, which have more 25 m length and 1 m depth. The choice of morphometric variables and gully erosions that are examined in this study is based on the result obtained from the previous studies (Voloshciuk 1970).

The topographical maps at the scale of 1:25,000 and 1:5000 have been scanned and georeferenced when they were imported into the GIS software. The digitized elevation lines allow us to interpolate the digital terrain model. In this order of actions were performed the most important morphometric maps - hypsometric, slope, and aspect map. The imported Gully's shape files from MapInfo 9 into ArcGis 9.3 have been rasterized and overlaid on the surfaces and represent specific hill slopes parameters.

3. Results and discussions

In order to highlight the relationship between the relief and gully erosions I have analyzed the following morphometric parameters: slope exposition, length, slope, altitude and area slopes.

Table 1: Morphometric characteristics within the Larga catchment (Voloschuk, 1970)

Slope aspect	**Total area (ha)**	**Slope length (m)**			**Slope mean (^{0})**	**Relative altitude (m)**			**Total length of gullies (m)**	**Density of gullies (km/km^2)**
		min	max	mean		min	max	mean		
N	628.5	125	1875	524	7.9	25	155	56	7260	1.1
NE	75.9	250	1620	681	8.1	25	175	83	1825	2.5
E	2959.0	350	800	575	3.7	73	157	110	1120	0.03
SE	1972.6	125	2300	1128	3.0	55	95	76	14035	0.7
S	281.2	530	970	873	5.8	86	126	106	1310	0.4
SW	2300.6	50	1220	690	4.7	50	220	109	23960	1.0
W	1584.9	125	1925	657	7.7	15	180	92	31685	2.0
NW	1997.2	75	1575	667	7.9	18	206	87	46405	2.3

The predominant altitude in the Larga catchment contains values between 50 m and 150 m. It represents 50% of the area. The minimal altitudes are recorded along the floodplain where it does not exceed 15m. The lowest elevation - 8.8 m - is marked at the confluence with Prut. The majority of gullies are spread over altitudes ranging between 100-150 m, especially on the left side of the catchment (Figure 6).

A factor that is crucial in gully erosion assessment is the slope. In The Larga catchment the total percentage of the gullied area in relation to the slope angle is depicted in fig.7. This figure shows that gullies are predominant in the slope class 5°–10° (44.4% of gullied area). A considerable amount of gullies can also be seen in the 3°–5° class compared to the steeper slopes above 10°. In terms of land use, on 3°–10° gradient, the slope is dominated by agricultural land. Most valley-side gullies are situated in the 5°-10° class of slope, while the bottom-valley side appears in the 1°-3° class of slope. Valley-side gullies have a higher frequency in the cuesta front slopes, with a steeper slopes and north- western exposition.

The erosion hazard in this area is fulfilled by the slope length parameters. As shown in the table, the parameter of the slope aspect varies with a slope length from 524 m with northern exposition reaching 1128 m on the slope with south-eastern exposition. The most affected by gullies erosions are slopes with western and north-western exposition. The total length of the gullies exceeds 45 000 m. The smallest slope length of gullies can be found among the eastern slopes and reaches 1120 m. On these slopes, the density of gullies barely meets 0, 03 km/km^2. On the other hand, the highest density of gullies is recorded on the slopes with north-eastern exposition. Sometimes, the value exceeds 2, 5 km/km^2.

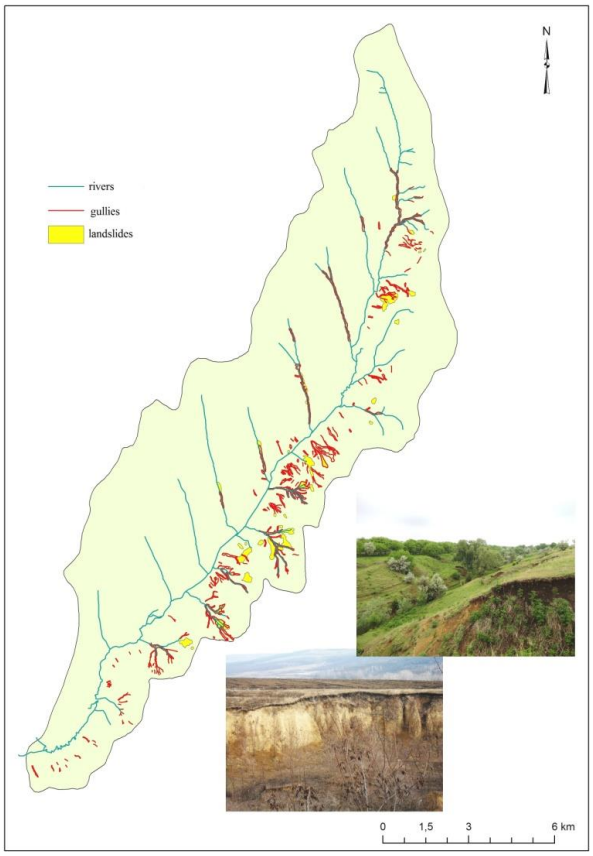

Figure 9 Distributions of gullies and landslides in Larga Catchment

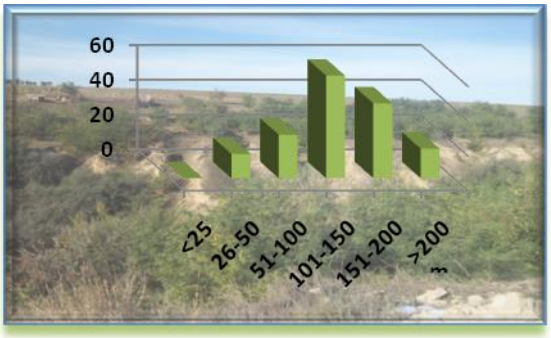

Figure 6: Distribution of gullies on altitude in Larga catchment

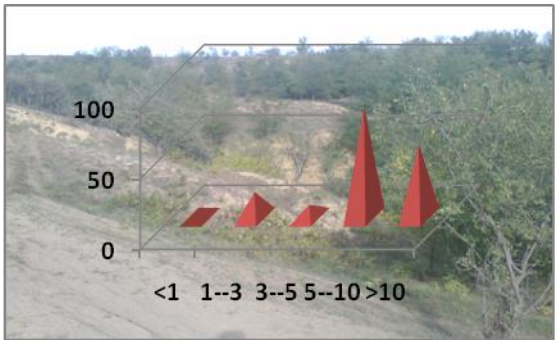

Figure 7: Distribution of gullies on slope categories in Larga catchment

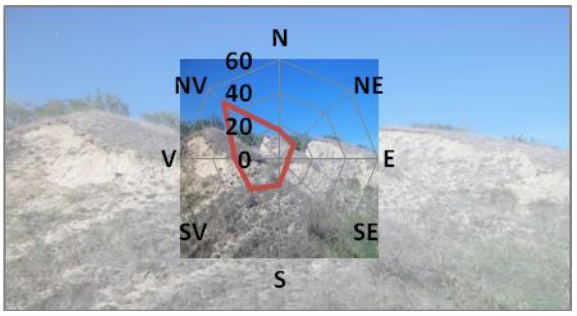

Figure 8: Distribution of gullies on aspect class in Larga catchment

Conclusions

The Larga catchment is located in the southwestern part of the Tigheci Hills. The gullies are widespread and most actively developing on the left side slopes of the catchment. Along with the lithological factor, the climate and human activity, the morphometric analysis represents one of the most important factors in the development of gullies. The Larga catchment is mostly affected by slopes, by gully erosion and cuesta front slopes with north-eastern, western and north-western exposition and their length exceeds 70000m. Thus, the slope and its length are the most significant morphometric parameters and perpetually contribute to the development of gullies.

Acknowledgements

This research is supported by Marie Curie International Research Staff Exchange Scheme Fellowship within the 7th European Community Framework Programme.

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