Geomorphologic Risk in Rural Settlements. Case Study: Chiuzbaia Depression

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Introduction

The assessment of the main geomorphologic constraints on Chiuzbaia Depression followed multiple directions. We performed a general geomorphologic analysis, including geological, morphometric and morphological features. Every parameter was weighted and numerical values were associated to them. Additionally, we performed a spatial raster analysis using GIS techniques and procedures. The final results are two maps: a geomorphologic homogeneous unit map and a geomorphologic risk map. Development projects, resources management and built-up areas management in rural areas are often conditioned by geomorphologic restrictive characteristics. It is about structural, morphometric, morphological and dynamic features of the landforms.

The study area, Chiuzbaia Depression, is situated in the southern side of Igniş Mountains, part of Oaş-Gutâi Neogene volcanic chain.

Geological setting

Thai main geological features are related by through Neogene volcanic activity. As a result of these, volcanic rocks (pyroxene andesite and dacite) and structures had a large extension. Post-volcanic erosion of these structures and displacement of volcanic rocks generated a small depression and the outcrops of Pannonian sedimentary deposits (figure1).

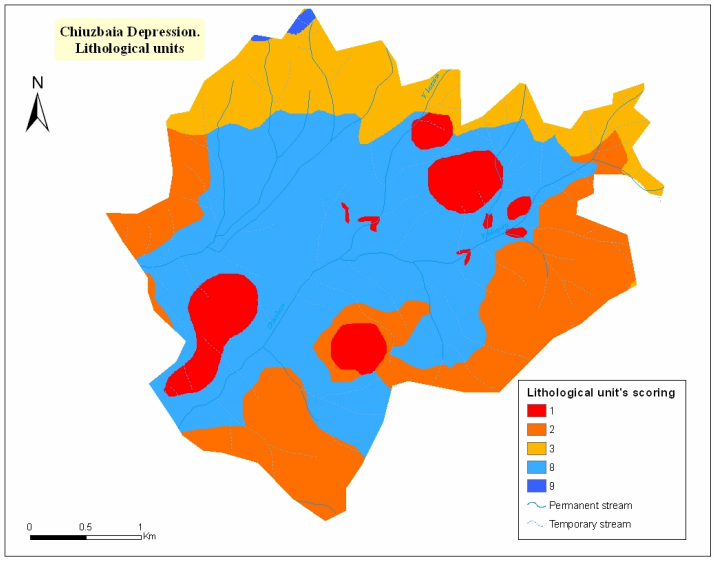

Figure 1. Lithological units' scoring.

The present-day geological frame is draw-up by the large extension of marls, clays, sands and some residual, island-like, volcanic structures (known as "knolls" in the region). A large number of geological studies were performed on this area (Ilie, M.D, 1955, Gherasi, N., 1964, Borcoş, M., Lang, B., 1973, Giuşcă, A. et alii, 1973, Edelstein, O., et all, 1978, Borcoş, M. et all, 1979, Edelstein O. et all, 1992,). According to these, a simplified geological map was performed. On the other hand, according to the susceptibility of the geological entities to natural geomorphologic processes, numerical values were associated to them.

Morphometric features

Using topographical maps, 1:50.000, we performed a computed morphometric analysis: slope, drainage density, relative altitude and DEM. The ranking of those data allowed associating them values as is shown in table 1.

Table 1. Morphometric features.

Morphometric features	Values	Score
Relative altitude (m)	0-50,0	1
	50,1-100,0	2
	100-150,0	3
	150-200,0	4
	200,1-250,0	5
	250,1-300,0	6
	300,1-350,0	7
	350,1-400,0	8
	400,1-429,0	9
Stream density (km/km^2)	0-2,0	1
	2,1-4,0	2
	4,1-6,0	3
	6,1-7,8,0	4
Slope (^{o})	0-2,0	1
	2,1-5,0	2
	5,1-15,0	3
	15,1-35,0	4
	35,1-55,0	5
	>55,0	6

Present-day geomorphologic processes

Field investigations and mapping of present-day geomorphologic processes was one of the main phases of the study. Types and intensity, area and interaction with human activities were the main characteristics, which we analyzed. Mapping and scoring these elements was also performed (table 2).

Table 2. Present day geomorphologic processes.

Process type	Score
Alluviation	2
Mechanical weathering	9
Sheet/rill erosion (low intensity)	2
Sheet/rill erosion (high intensity)	8
Weathering	1
Gully erosion	9

According to geological and morphometric features, with direct influence of land-use and human interventions, sheet and rill erosion, gully erosion, mechanical weathering and alluviation represent the main geomorphologic processes.

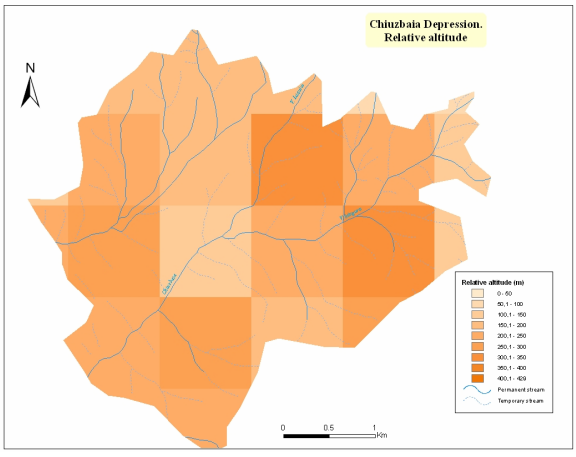

Figure 2. Relative altitude map.

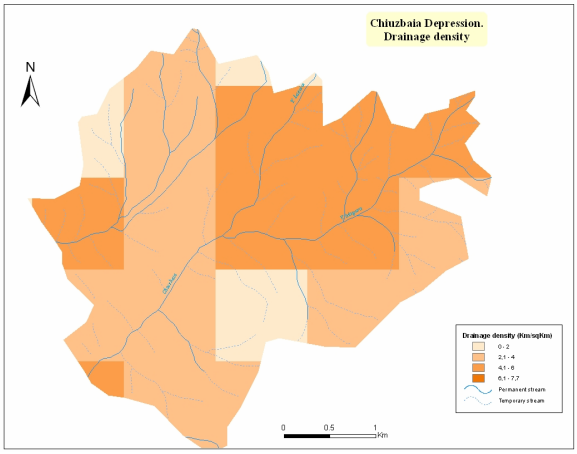

Figure 3. Drainage density map.

Differentiation between the processes intensity is a result of human interventions. Change in land-use, mainly by deforestation, lead to a change of the type of processes, on the one hand, and to an increase in their intensity, on the other hand.

The area unaffected by land-use changes has a moderate rate of erosion, even on steep surfaces (> 35^o). The maximum rate of erosion is on low re-vegetated slopes.

A particular aspect is related by the mining activity impact on landforms. It is about specific geomorphologic processes as the gravitational ones.

The result is a large number of sinkholes with various size (1,5- 2 m to ~15 m width and 0,3 to ~ 20 m depth) and shapes (circular-elliptic to oblong), spatially associated and related by underground mining tunnels on Piciorul Herjei Hill (west side of depression).

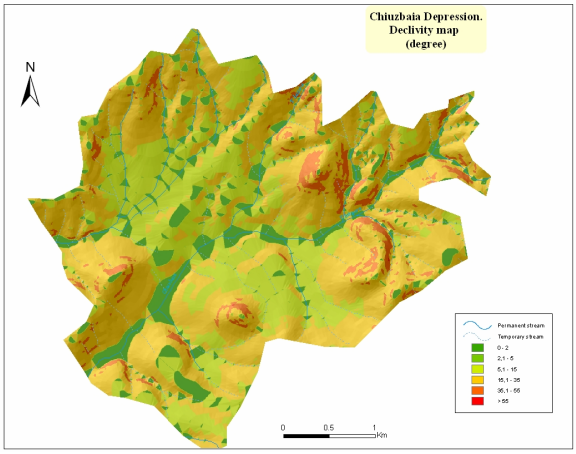

Figure 4. Declivity map.

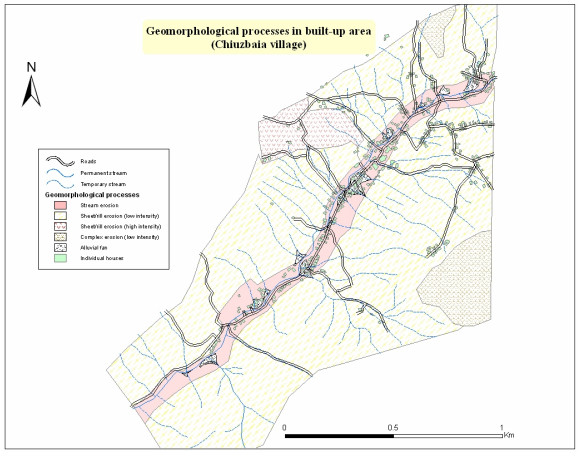

Figure 5. Geomorphologic processes in built-up areas.

Data synthesis

The final phase consists of overlaying and combining all of available data using GIS techniques. As a result two kinds of maps were produced. *Geomorphologic homogeneous units map* is the cumulative result of geological and geomorphologic data.

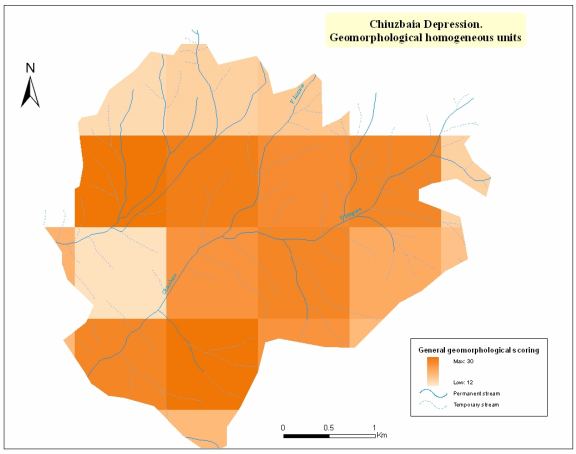

Figure 6. Geomorphologic homogeneous units map.

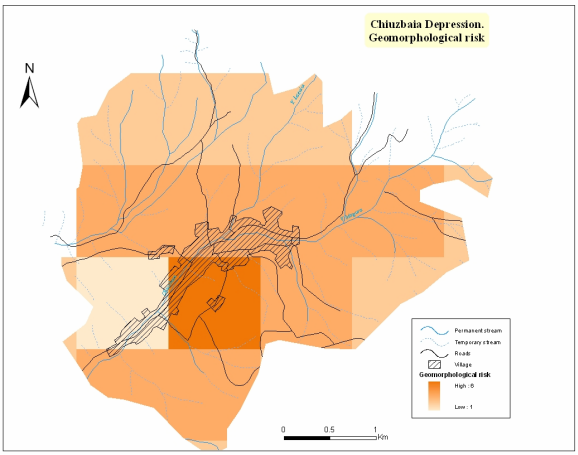

Figure 7. Geomorphologic risk map.

Additionally, using CORINE database and field mapping, we introduced land-use data. Highly values correspond to highly values of geomorphologic parameters and a high-prone morpho-dynamics of landforms due to substratum and land-use features. *Geomorphologic risk map* is the result of combining the first one with the elements of anthropic vulnerability in the area. It is about built-up areas, with individual houses, roads and small bridges.

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