

SUMMARY

PhD THESIS

Geodetic-topographic methods, GIS and UAV scans used for landslides evaluation in Cluj Hills and Feleacu Hill

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The aim of the PhD thesis research was to obtain relevant information on the current state and the situation regarding landslides, their analysis and the risk of erosion and soil degradation due to some ecological and anthropic factors in the Cluj Hills and the Feleac Hill area.

The complexity of proposed research has placed a particular emphasis on designing a well-founded scientific and practical experimental algorithm, based on appropriate and adapted methodologies to the hills of the proposed area and knowledge of the natural hazards represented by landslides and their particularities in the area.

Through a laborious and rigorous analysis and documentation, five experiences were established, the first being an overall one, and the following representing distinct experiences, carried out as a case study. The issues pursued in these experiences were also the objectives of the research, depending on the particularities of the experiences, the objectives having a general or specific character.

1. Experience I - General Study (Overall Experience). The researched problem: the assessment of susceptibility to landslides in the area of Cluj Hills and the Feleac Hill on the basis of bivariate statistical analysis and GIS maps. This first experience was considered 'as a whole' because it comprised an ample area, the following four experiences being carried out in the form of case studies on smaller surfaces located within this area with an surface of 1041 km².

The identification of susceptibility to the landslide area investigated by the BSA method (*'Bivariate statistical analysis'*) has allowed the comparison of the landslide inventory map with landslide parameters and the hierarchy of the corresponding classes according to their role in the

formation of landslides on the analyzed area, located in the eastern sector of the Transylvanian Depression, in the county of Cluj, on an area of 1041 km², including Cluj Hills and Feleac Hill.

The model assured the development of landslides vulnerability maps according to the factors that can influence the mass movements on the slope: altitudes, slopes, fragmentation density, depth of fragmentation, WI (*Wetness Index*), SPI (*Stream Power Index*), distance to the hydrographic network, distance from human settlements and distance to the roads. Thus, maps were developed for each triggering factors involved in landslides susceptibility, classifying them on five classes of vulnerability: small, medium, medium-high, high and very high.

The individual analysis of the factors taken into account for completing the landslide vulnerability model based on the implementation of the BSA equation provided relevant and useful information on the different influence on the vulnerability classes illustrated by the maps created for each factor.

The results obtained by applying the spatial analysis equation on the basis of the geoinformational software ArchGIS and the creation of the raster database with the spatial representation of the cumulative vulnerability for the entire territory analyzed were extremely conclusive. Thus, the “Natural Breaks (Jenks)” classification method with the spatial identification of five vulnerability classes has faithfully highlighted the characteristics of the analyzed territory compared to the other classification methods available in the geoinformation software.

The territorial vulnerability map reveals the very high probability class, indicated by the high density of active landslides, which are located in contact of Cluj Hills with the Someș Meadow, as well as with Feleac Hills, in the areas with high slopes.

The outcome of modelling has highlighted some hotspots (hot spots or critical areas on the map) of major importance, including for Cluj-Napoca. An example was the spatially overlapping area of Cetățuia Hill in Cluj-Napoca, classified as a very vulnerable category, with a high risk induced by the territorial infrastructure of housing and services (residential structures, urban networks, tourist facilities, etc.), but also on communication routes developed in that area. Among the other hotspots identified and ranked in the highrisk category of landslide vulnerability, there was the south-eastern part of the city of Cluj-Napoca, territorially superimposed on the steep slope of the Feleac Hill, an area with spectacular development in the extension of residential complexes.

For all identified hotspots as well as for the rest of the large and vulnerable class (with major impact on the human component), it is recommended to carry out ameliorative and land stabilization works to mitigate the risks to which they are exposed. In this respect, concrete measures and actions are required, based on which these areas no longer belong to the high risk