Using GIS techniques to detect the impact of territorial evolution on producing natural hazards in northern Romania, commune Vorniceni

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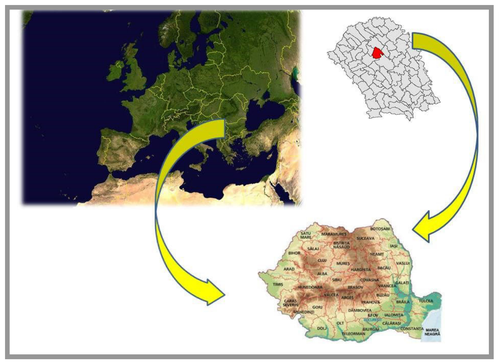
INTRODUCTION

Methods such as Geographical Information System (GIS) employed for spatial analysis offer many possibilities concerning the evolution of the study area, highlighting sites that are most vulnerable to hazards and related risks.

Despite other modern methods, the use of GIS in the analysis of spatial planning remains the most important technique used. Maps obtained by GIS are more objective, with a high degree of accuracy compared to those constructed by traditional techniques if based on the same database and conceptual model.



The study area, i.e. the territory occupied by the village Vorniceni, is situated in the northern Romania, in the Ibăneasa River catchment, a tributary of Jijiei River. Although covering only 63 km², the study area has undergone clear territorial and morphometric changes over time, with the occurrence of new, small-sized landforms.

Figure 1. Study area, located in the commune Vorniceni, northern Romania

This study aims to assess the impact of the territorial evolution of Vorniceni village on the occurrence of natural hazards, specifically landslides.

Land use for agricultural purposes is one of the largest anthropogenic activities with a major impact on the morphology of the area. Brutal human interventions in the landscape, such as for instance building the Ibaneasa dam on the Ibăneasa River, current reservoir silting, inappropriate management of agricultural fields etc. are prerequisites for the intensification of natural hazards and other negative phenomena.

Over time, the pressure and the effects of anthropogenic activities were identified in the geographical landscape of commune Vorniceni.

METHODS AND MATERIALS

- Digitizing, georeferencing and spatial analysis using the ArcGIS platform.
- Slide hazard assessment in the study area was performed by the SINMAP method (GIS method for estimating the stability of slopes, according to the Guidelines of developing hazard and risk maps for detail).
- The susceptibility map was done using the ModelBuilder method (GIS application written to create, edit, and manage models).
- We used the topographic maps 1: 25.000, namely sheets L-35-6-A-b (1961, 1986) and orthophotos 1:5000 and 1:25000 (2009, 2011).

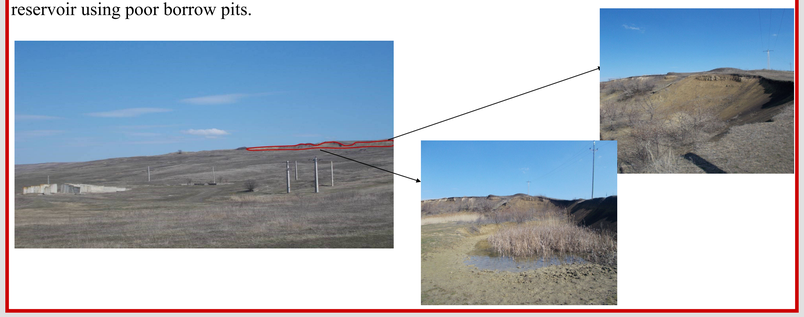
ISSUES-PROCESSES

Figure 2. In the western part of the village, landslides are semifluid, i.e. mudflows, large thickness deluviale deposits.

Figure 3. Landslides affecting roads, buildings and other constructions.
In this respect, no measures have been taken yet to limit the effects of sliding.

Active landslides in the area of Ibaneasa dam include two alignments of main scarps and a series of uneven sliding waves starting from the crown. The main scarps, the oldest, are covered by a poorly developed soil horizon, herbaceous vegetation and sometimes scattered trees and shrubs.

The trigger point of lanslide occurrence in this area was the construction of the Ibaneasa River reservoir using poor borrow pits.



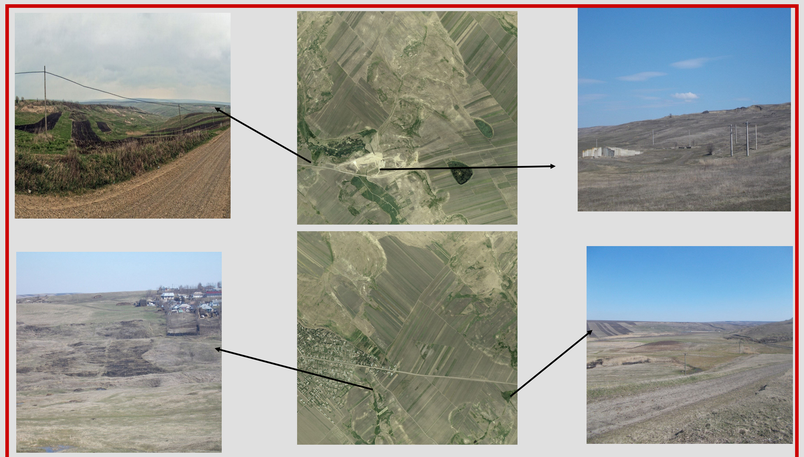
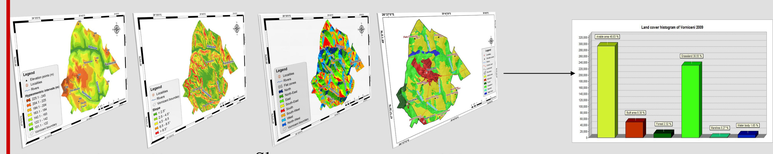
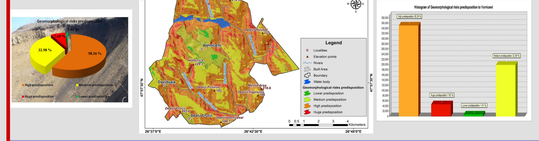


Figure 4. Areas with major landslide occurrence caused by territorial development

MAPPING AND ANALYSIS

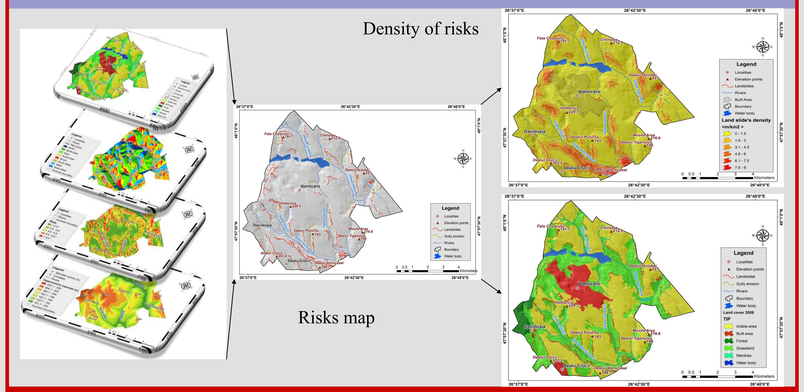
Susceptibility mapping





To obtain the landslide susceptibility map an indicator of susceptibility was calculated, based on slope, aspect, land use and geomorphologic hazards recorded in the area.

Risks mapping



CONCLUSIONS

Over 58.36 % of the commune Vorniceni's area is subjected to geomorphological risks, particulary landslides. Only the central part is relatively less susceptible to landslides, while only 1.01 % has lower predisposition to risks.

The built area is surrounded by surfaces with high and extreme vulnerability to landslides. The bad lands are constantly expanding, with observed, long-term effects.

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