

Landslide risk mapping by Remote Sensing and GIS in Gevgelija-Valandovo Basin

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The objective of this work is a presentation of GIS and Remote Sensing mapping procedure of potential landslide areas assessment, based on digital elevation model (DEM), satellite imagery and other digital data analyses. The research area is Gevgelija-Valandovo basin (1077.0 km²), which is located in the southern part of the FYR of Macedonia, on the border with Greece. This basin is very heterogeneous in regard to topography and vertical relief (44 m to 2112 m), geology (from erodible clastic sediments to very solid limestones), climate (especially with altitude), vegetation, and human impact as well. Thus, as a consequence of suitable natural-geographic factors (geology and soil structure, topography, climate, vegetation) and significant human impact, some sites in this area have severe erosion with numerous landslide occurrences. For that reason, in GIS and Remote Sensing mapping procedure several landslide-related factors are weighted and analyzed, and with cluster classification, areas with different potential to landslides are identified. Landslide risk assessment in study area of Gevgelija-Valandovo Basin is performed through the detailed analyses of several digital datasets: DEM (Digital elevation model) for topography acquired from 3" SRTM DEM; raster grids for vegetation cover acquired from Landsat ETM+ satellite imagery and from Corine Land Cover 2000-CLC2000; digitalized geologic (lithology) map etc. It was estimated the influence of most relevant topographic indices (hypsoetry, slopes, curvatures, aspects), vegetation index (vegetation cover) and lithology hardness. With usage of clustering module incorporated in SAGA GIS software, and superimposing of several layers, sites (clusters) with different potential of landslides were identified, especially showing high risk areas. As a result of those GIS computations was made digital mapping of landslide potential. The results shown on maps, compared with the real indicators and measurements show satisfactory fitting. Certainly, many other factors influenced risk of landslides, but because of avoiding complexity, they are not considered here. However, previous procedure may be helpful to relatively fast and accurately predict landslide risk in the landscape. According to the produced model (with SAGA GIS), about 1/3 of the Gevgelija-Valandovo basin area is under higher treat of landslide occurrences. That are hilly areas with moderate to steep slopes and concave shape (where surface water percolate faster), sparse vegetation (usually weak grasslands), and cracked, weathered or even very soft rocks. Field research confirms that in those areas most of the landslides occur or that there are many potential landslides. Certainly, these results must be validated with very detailed field research, but generally this approach is acceptable on large-scale level. Main factor of such landslide potential is a natural environment, but human activities (such as cutting and filling along roads and the removing of forest vegetation) may increase the natural tendency for a landslide to occur. This is the case also in in Gevgelija-Valandovo basin.