GIS-based statistical landslide susceptibility analysis a case study from the Bostanlik District, Uzbekistan

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The Bostanlik district of Uzbekistan is mainly characterized by hills, mountains and highlands, whereby mountains cover almost the entire territory. The elevation of the district increases from west to east and from south to north. The southern and western parts of the area are on average at an elevation of 1000 m above sea level. The rest of the district is located between 1200 and 4000 m above sea level. The hills are formed mainly by sandstones and loess. Further, the Bostanlik district is one of the most landslide-prone areas of Uzbekistan. Most of the landslides are triggered by snow melting and precipitation. A significant number of landslides is located near a mountain reservoir (with possible causal relationships). Since the Bostanlik district is important in terms of touristic activities, the monitoring of existing landslides is necessary, and a landslide susceptibility zonation is highly recommended as a basis to mitigate the risk arising from these hazards.

Uzbekistan belongs to a data-scarce region and this issue creates a challenging situation for landslide susceptibility studies. Statistical analyses have to rely mainly on the lithological map, tectonic map and datasets derived from satellite imagery (GeoEye-1 multispectral image and Digital Elevation Model generated from WorldView-1 stereo image). A point-based landslide inventory of past events was created by using the multispectral dataset and Google Earth Pro software for an area of 208 km^2. Various predisposing factors were exploited for the detection of susceptible areas, including slope angle, slope aspect, curvature, elevation, distance to faults, distance to rivers, distance to roads, lithology, and NDVI.

This work represents the first attempt of a statistical GIS-based landslide susceptibility analysis within the territory of Uzbekistan. The results may be valuable for the government authorities and stakeholders for future land use planning and mitigation activities.