Evaluation and comparison of bivariate and multivariate statistical methods for landslide susceptibility mapping (case study: Zab Basin)

Abstract

Landslides are among the great destructive factors which cause lots of fatalities and financial losses all over the world every year. Studying of the factors affecting occurrence of landslides in a region and zoning the resulting damages will certainly play a crucial role in mitigating such phenomena. In this research, through geological maps and field studies, we primarily prepared a map for landslide distributions in Zab basin-an area of 520 km 2 in the southwest mountainsides of West Azerbaijan Province. By applying other source of information such as the existing thematic maps, we studied and defined the factors (slope, slope aspect, distance to road, distance to drainage network, distance to fault, land use and land cover, geological factors, horizontal gravity acceleration of earthquakes, and climatic condition of the studied area) that affect occurrence of the landslides. To get better precision and higher speed and facility in our analysis, all descriptive and spatial information were entered into geographic information system (GIS) system and Ilwis software. We also used Satellite images (Landsat ETM + and SPOT 5), producing land cover and landslide-inventory maps, respectively. After preparation of the influential parameters on landslides, we drew the zoning maps of slide hazard via four different statistical methods and then evaluated and compared them. By analyzing the obtained index and by comparing landslide distribution map and zoning map of landslide susceptibility prepared by each of the methods in GIS environment, we found that bivariate method of information value analysis, bivariate method of density-area, multivariate method with linear regression analysis, and multivariate method of discriminate analysis take priority, respectively. Finally, as this research shows, despite their simplicity, bivariate statistical methods have more acceptable precision than multivariate methods, and consequently, they are more compatible with landslide susceptibility of the region. From the results, lithology, slope, annual rainfall, land cover, slope aspect, distance to waterway, distance to road, horizontal gravity acceleration, and distance to fault are very influential to landslides in the region.