Prioritization of Factors Affecting the Occurrence of Landslides and Zoning Its Sensitivity Using Multiple Linear Regression Case Study: Vahargan Catchment-west of Isfahan Province

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1-Introduction

Landslide as a process of change in the stress-strain state of a slope occurs under the influence of natural and human parameters leading mass separation and its movement to down slopes. However, the relationship between the sliding mass and the slope remains constant. Accordingly, the mechanism of formation and development of a landslide is a systematic sequence of changes in the stress-tension state of a slope influenced by natural and anthropogenic parameters. This event is destroying human settlements and infrastructures and causing financial losses and many deaths around the world annually. The rapid population growth in the last half-century, the expansion of settlements towards steep mountainous areas on the one hand, and the false human being intervention in the destruction and changes of slopes, on the other hand, increased the frequency of landslides and this has led to an increase in damages. Iran has favorable natural conditions for a wide range of landslides with mainly mountainous topography, high tectonic and seismic activity as well as diverse climatic and geological conditions. Therefore, landslide studies on understanding factors and parameters affecting it, and identifying high risk and vulnerable areas in the world as well as in Iran have received serious attention. This research mainly aims to investigate the parameters affecting the landslide in the Vahregan catchment which located in the Sanandaj-Sirjan construction zone. Where metamorphic rocks, marl and shale, as well as wide area of quaternary sediments, have provided very favorable conditions for landslide occurrence.

2-Methodology

Multiple linear regression method was used to perform this research. Thus, the scatter map of the landslides of the region as dependent variable and twelve factors includes elevation, slope, slope direction, lithology, fault, precipitation, drainage network, road,

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land use, vegetation, TWI and SPI as independent variables were considered. To prepare landslide distribution map of the study area, aerial photographs of 1994 with a scale of 1: 40,000 were used and interpreted. Accordingly, the landslides area and their location in Google Earth software were determined. Then, 138 landslides occurred in the Vahregan catchment were determined with field studies, with the help of available maps and information, and the use of GPS system. It was then mapped using GIS software. After converting all the factors to information layers in GIS, these layers were adapted to the scattering map of the landslides of the region and were calculated the percentage of region located within the landslide area for all factors.

3-Results and Discussion

The results showed that the most effective factors in Vahregan catchment landslides based on multivariate regression method are distance from road, lithology, precipitation, land use, slope direction, distance from drainages, distance from faults, SPI drought, elevation, slope and TWI, with coefficient of 0.851, respectively. Their coefficient of R is 0.851 which is acceptable. The results showed that although natural factors can alone cause landslides, human factors are currently the most important parameters in causing landslides in the study area. Accordingly, most new landslides occur in close proximity to roads. In other words, it can be said that the downstream cutting of slopes by human being has increased the frequency and magnitude of landslides. Therefore, results showed that the road with 0.411 standard coefficient was the most important factor in creating landslide so that much of the landslide has occurred within less than 3 km of roads. Then, the natural factors includes lithology and precipitation with a standard coefficient of 0.362 and 0.299 and land use with a standard coefficient of 0.286 played the most role. However, vegetation factor and the TWI index with a standard coefficient of 0.103 and 0.127, played the lowest role in the landslides of the Vahregan catchment. According to the final landslide zoning map, more than 50% of the area has located in a high risk area.

4-Conclusion

The study area has great potential for landslides in terms of natural features such as lithology, precipitation, elevation, Permanent River, and slope. The landslide map with 382 landslides indicates this. However, in the last two to three decades, environmental changes such as drought and consequently changes in vegetation covers on the one hand, and false human intervention, including the construction of multiple roads and the geometrical change of slope, on the other hand, have increased the frequency and magnitude of landslides in the studied area. The results of the final mapping showed that more than 50% of the basin is in high and very high risk areas. Accordingly, special

attention should be paid to the extent of landslide risk and its threat in all human activities, especially environmental planning and management.

Keywords: Landslide, Linear Multivariate Regression, Vahregan, Isfahan