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Zoning of Debris Flow Risk Using FUZZY-SAW Model Case Study: Leilan Chai Basin, Northwestern Iran

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1-Introduction

Debris flows are mass movements that always threaten human activities and cause a lot of damage. The aim of this study was to zoning the risk of debris flow in the Leilan Chai catchment located in East Azerbaijan province and the impact of this hazard on the Leylan alluvial fan. For this purpose, 10 effective criteria in the occurrence of this hazard, including slope, aspect, elevation classes, land use, lithology, precipitation, distance to fault, river density, distance to river and distance to road were used to prepare a zoning map for debris flow hazard. Identifying areas with high risk sensitivity helps regional managers and planners to manage and control this risk in the basin.

2-Methodology

Leilan Chai catchment as one of the tributaries of Zarrineh Rood River is one of the important rivers in the eastern part of Lake Urmia (Movahed danesh, 1999:45). This basin is located in East Azerbaijan province in terms of political divisions. The area of this basin is 723 Km² and is located in the geographical coordinates of 37° 00' 31" to 37° 38' 20" north latitude and 46° 14' 26" to 46° 38' 37" east longitude. The minimum elevation of the basin is 1356 meters and the maximum elevation in the heights of Sahand Mountain is 3554 meters. This basin forms an alluvial fan at the exit of the mountain that called Leilan. In the present study, the SAW decision-making method has been used to weight the criteria. Layer fuzzy was also performed due to their importance in the occurrence of debris flow in ArcGIS and Idrisi software.

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3-Results and Discussion

Mass movements such as debris flows have always been a threat to the development of human activities. The results of weighting the criteria using SAW method showed that lithology, slope and precipitation criteria with a weight of 0.260, 0.211 and 0.190, respectively, are of more importance in the occurrence of this hazard in the study area. After determining the weight of the criteria and sub-criteria, the layers were overlapped in the GIS environment and a potential map of the risk of debris flow in 5 classes was prepared. The results of the final map show that upstream of the basin area due to having high altitude and receiving more rainfall during the year and also having a high slope are highly sensitive to the occurrence of debris flow. The downstream areas of the basin, despite the high density of river and the presence of numerous faults, but due to the very low slope, show low sensitivity to the occurrence of debris flow.

4-Conclusion

In this study, an attempt was made to prepare a map of the risk of debris flow occurrence in the Leilan Chai basin using effective criteria in the occurrence of this risk. The final debris flow hazard map was prepared by overlaying and multiplying the final weight of the criteria in fuzzy layers in GIS environment. The results showed that about 117 Km² (16% of the area) of the study area is in the high and very high risk classes in terms of sensitivity to debris flow. In contrast, 49% of the total area is low and very low sensitivity to this risk. Areas located in high and very high classes mainly include the upper parts of the basin, which have the potential for this risk in terms of slope, precipitation (more than 400 mm) and lithology (presence of volcanic ash). Also, according to the research results, it can be said that this hazard cannot have much effect on the Leilan alluvial fan. Due to the occurrence of this hazard in the upper parts of the basin, the possibility of transferring these materials to the downstream areas and even the surface of the alluvial fan is very low due to the very long distance.

Keywords: Debris flow, Zoning, GIS, FUZZY-SAW Model, Leilan Chai catchment, Northwest of Iran.

5-References

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