Research Paper

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Prioritization of Linear Erosion Using Morphometric and Geomorphological Indicators
Case Study: Gheshlagh Watershed, Sanandaj West of Iran

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1-Introduction

The soil erosion issue and lands degradation are among the most important issues in natural sciences related to soil and water protection issues. Soil is a valuable resource for humans, and soil erosion determines the earth's features. Soil erosion is the predominant geomorphic process on many land surfaces. Soil erosion is a complex process and a potential geomorphological hazard, and its magnitude reflects land management and environmental indicators of degradation. It is also known as Earth Cancer due to its resonant nature and the obvious multifaceted effects. In order to assess the environmental and economic consequences of soil erosion and the implementation of management plans, quantitative data on soil erosion and the identification of erosion-prone areas on a regional and global scale are needed. According to studies conducted in Iran, an average of 1670 tons of soil per square kilometer of land is washed away by water erosion, which means that one millimeter of soil thickness is reduced every year. In this research, soil erosion is studied to evaluate the applicability of morphometric and geomorphological parameters, prioritization of basins in terms of erosion sensitivity. For this purpose, the Gheshlagh river basin in Sanandaj city, one of the most important catchments in Kurdistan province, was studied

2-Methodology

Gheshlagh river basin in Sanandaj city, one of the most important catchments in Kurdistan province, was studied. First, the waterways and the border of the main basin

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were digitized using Google Earth and ARC GIS software. Then, the canals were ranked using the Strahler ranking method. Areas with a rating of more than two and entered directly into the main river were plotted as sub-basins for morphometric calculations. These areas included 47 sub-basins. The number of 16 morphometric parameters include: drainage density, flow frequency, mean bifurcation ratio, texture ratio, channel constant maintenance, surface flow length, infiltration number, elongation coefficient, roundness coefficient, form factor, shape factor, compaction coefficient, basin roughness index, unevenness number roughness ratio, and slope were calculated to determine the morphometric conditions of the basin and were considered as the input layer. Then, the results of these parameters were aggregated by four multi-criteria decision models TOPSIS, VIKOR, SAW, and CF. According to each model, 47 sub-basins were selected in Gheshlagh river basin and classified into five categories: very low sensitivity, Low, medium, high, and very high sensitivity. The correlation between the rankings of these four models was determined using the Spearman correlation coefficient. In each of the multi-criteria decision models, each morphometric parameter had to be weighed according to the expert opinion. The variance of the factors calculated the weight of the layers. Indices were converted to factors in SPSS software, and after rotation of Varimax, the variance of the factors was used as the weight of the layers to aggregate the layers.

3- Results and Discussion

The results of the models showed that according to the TOPSIS model, the sub-basins are in four classes: very low sensitivity, low sensitivity, medium, and high sensitivity. The results of the VIKOR model classified sub-basins into five classes of very low, low, medium, high, and very high sensitivity. The results of the SAW model classified the sub-basins into three classes of low, medium, and high sensitivity. The CF component factor also classified sub-basins into four very low, low, medium, and high sensitivity classes. According to the three TOPSIS, VIKOR, and SAW models, basin 1 was very low in terms of sensitivity to erosion. This is due to the small 1number of waterways compared to the basin area and the impact of lithology. Also, Basins 17 and 25 were in the high and very high sensitivity classes. This issue is also due to many waterways to the basins' small area and weak and impenetrable lithology. In all four TOPSIS, VIKOR, SAW, and CF models, the northern sub-basins were classified as areas with low and very low susceptibility to erosion. These basins are often located in volcanic rocks. In a general view, according to all four models studied, the basins in the lithology of dark gray shale (Sanandaj shale), flysch and lichen, thin-bed sandstone with shale, silt, and clay, their sensitivity to erosion have been classified from moderate to very high.

4- Conclusions

Finally, the results showed that the analysis of morphometric parameters would be useful to evaluate the degree of susceptibility to erosion. Also, the final results showed that the multi-criteria decision-making methods, by presenting a classification, divide the region into several classes in terms of the degree of erosion sensitivity and the VIKOR method, due to the greater coefficient of variation, has more accurate than the others.

Keywords: Morphometric parameters, Multi-criteria decision-making models, Spearman correlation coefficient, Gheshlagh Watershed, Sanandaj, West of Iran

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