Research Paper

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Examining the Relationship between Hydrogeomorphic Variables and Sediment in Gavi and Kanjancham Basins of Ilam Province

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1-Introduction

Knowledge of the hydrogeomorphic characteristics of the watershed basin concerning the production of sediment and its levels at the hydrometric station to manage the basin can pave the way for a sustainable development. It is estimated that around 0.5 to 1 percent of the world's dam storage capacity is declining on an annual basis owing to sediment deposition (Khanchoul et al., 2010: 246). Geomorphic characteristics of the watershed basins refer to a set of physical factors whose values are relatively constant for each basin as they show the apparent form of the watershed basin (Abdideh et al., 2011: 33). In view of the importance of Kanjancham and Gavi basins, their sub-basins and the dams in Ilam province on which three cities of Ilam, Arkavaz Malekshahi and Mehran as well as hundreds of villages are dependent, this study aimed to review the variables affecting sediment production and sediment load in Kanjancham and Gavi basins. By considering regional data, it seems that some geomorphic parameters greatly contribute to sediment production and load at the sub-basins. Thus, this study aimed to estimate the sediment production taking into account the geomorphic characteristics of the sub-basins of Kanjancham, Rostam Abad, Tang-e-Bajak, Asan and Sarjouy with high potential of sediment production. The use of principal components analysis methods along with cluster analysis and stepwise multivariate regression provides accurate statistical, scientific and computational accuracy. However, this mixed method yields slightly better quantitative accuracy compared to the sediment estimation models as this method can, in combination with the variables and factors affecting the sediment estimation, be an innovative one while also being applicable in research on other basins. The present

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research also highlights sub-basins with high potential of sediment production as future policies and planning are required for further necessary measures.

2-Methodology

Two Gavi and Kanjancham basins in Ilam province, covering 8 specific sub-basins equipped with hydrometric stations were selected. Research data included observational data of sediment discharge of the hydrometric stations from 1986 to 2020 as dependent variables which were analyzed using the sediment rating curve. In the next stage, the homogeneity of watershed basins was evaluated using cluster analysis. The cluster analysis standardizes the data by Z-Score method, group them by cumulative class method and calculates the Euclidean distance using the Ward's method. Then, the sub-basins of Chaviz, Sarjouy, Emamlekshahi and Asan were analyzed in the first group while Kanjancham, Rostamabad, Tang-e-Bajak and Gonbad in the second group. Stepwise multivariate regression method was used to analyze the relationship between 20 independent geomorphic variables of the basin (area, circumference, slope, rainfall, minimum height, average height, maximum height, length, form factor, form index, compactness coefficient, elongation ratio, roundness ratio, lemniscate ratio, mean elevation-relief and elevation-relief ratio, drainage texture, bifurcation index, relative elevation-relief and roughness of the basin) and the sediment of each sub-basin.

3-Results and Discussion

By considering the correlation matrix of the variables, it was noted that such variables as slope, roundness ratio, rainfall, drainage texture, area, circumference, basin form, and basin roughness had higher correlation with sediment production in the basin than other variables.

Table (1): Correlation between geomorphic variables affecting suspended sediment in the studied sub-basins

Independent variables		Pearson correlation	Sig.
X1	Area	0.723	0.003
X2	Circumference	0.742	0.003
X3	slope	0.815	0.001
X4	Rainfall	0.779	0.001
X10	Basin form index	0.714	0.003
X13	Roundness ratio	0.820	0.001
X17	Drainage texture	0.785	0.001
X20	Basin roughness	0.664	0.004

A specific value is used to determine the number of factors. The minimum eigenvalue for selecting the final factors is one, and factors with a specific value greater than one are considered final factors. The results show that the three factors of roundness coefficient, slope coefficient and drainage texture coefficient of the basin have a specific value of more than one.

Table (2): Cumulative variance percentage and eigenvalues of different factors

Initial special values	
Percentage of variance	Components
Roundness ratio	44.62
slope	25.22
Drainage texture	16.74

4-Conclusions

The results of examining the relationship between geomorphic characteristics and sub-basins sediment revealed that the level of sediment produced was positively correlated with slope, roundness ratio, drainage texture, rainfall, roughness and area of the basin and was significant at 0.001. Principal component analysis and cluster analysis were used to determine the effects of the variables on the sub-basins' sediment levels. The results indicated that the three factors of roundness ratio, slope coefficient and drainage texture coefficient of the basin explained 44.62, 25.22 and 16.74% of the variance of all research variables, respectively. In sum, the three final extracted factors could explain 87% of the variance of all research variables.

Keywords: Cluster analysis, Multivariate regression, Sediment rating curve, Hydro geomorphic, Gavi and Kanjancham basins, Ilam province.

5-References

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