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Towards Improving the SLEMSA Model using the Statistical Method of Assigning Erosion Factors

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1. Introduction

SLEMSA is one of the erosion estimate models presented by Stocking (1978). On one hand, this model has accurate ability y of assessing the erosion rate due to application of non-linear relation evaluating methods. On the other hand, the model benefits from the application of actual deductible numbers in calculation, and its educational approaches. The main question raised in relation to this model is that whether we can add a new capability to this model which can enable us to show us the portion of each element in the erosion. To respond this question, the drainage basin was chosen and we proceeded to calculate the erosion factors rate in SLEMSA model in 214 cells (4km2) and then through the use of vectorial dimensionless method, the main volumes of the model including X, K, C elements were made dimensionless and then the portion of each factor in each cell was calculated by Logarithmic Revers method.

2. Study Area

The Gulpayegan drainage basin at the west of Esfahan Province is located in the area of 1045 cubic kilometers; the geographical longitude coordinate is chosen 50 degrees and 2 minutes to 50 degrees and 18 degrees E and the geographical latitude is 33 degrees to 33 degrees and 33 minutes N. From the north it leads to Khomein, from the south to Khunsar and Freidan, from the east to Meymeh and Esfahan, and from the west it leads to Aligudarz.

3. Material and Methods

The numerical data of Gulpayegan drainage basin is obtained from DEMIran (90m).Then, these data were divided to 214 cells (each cell 4 Km2) and cultivated the rate of X, K, C (these are the main factors in SLEMSA model) for each cell. By using the Kreging technique, mapping of erosion estimate was made possible in this way.
In the second phase, , the portion of each erosion factor (X, K, C) for each cell is calculated, using the vectorial dimensionless and the Logarithmic Revers methods. The

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Logarithmic Revers method clearly showed that it is possible to determine each factor portion, specify the factor having more effectiveness in each pixel unit, and then to proceed to draw the region erosion map based on the premier factor.

4. Results and Discussion

SLEMSA model has special framework within which Stocking (1978) first introduced the erosion factors, then developed it, defined, and determined the scale and method of quantitative evaluation technique for each of the factors with non-linear relations, combination, and minimization.

Z = K.C.X formula

According to the SLEMSA model framework, three topographic factors (x), erosion and soil corrosion capability (K) and the agricultural management factor (C) were calculated for each of pixels and the soil erosion rate which has been lost in ton/hectare/year was calculated annually based on the z=k.c.x equation for the region under study and the obtained results were changed into the erosion rate map in the surfer program through the use of the Kreging technique in SLEMSA model.

The dimensionless operation on obtained data known as the statistical technique in this article is considered as the basis and essence of the argument developed in Stocking model. After identifying the dimensionless erosion numbers of each pixel, the condition for providing each element portion in the SLEMSA model is obtained. In order to prepare each portion, it is sufficient to take logarithm from both sides of equation to be able to identify the portion of each element in whole evaluation.

(2) Zs = Xe.Ke.Ce

Therefore, the condition for calculating the effect rate for each of the model factors is obtained in this phase by taking logarithm from both sides of equation 3 .

(3) LogZs = logXe +logKe +LogCe

In the end, the portion rate for each factor is obtained for the whole Z volume.Following the identification of the premier factor in each pixel, we can proceed to separate and clarify them through some specified colors.

5. Conclusion

As we observed, the evaluation of the rates of this model could show the erosion point differences but it is never capable of analyzing the effective factors in estimate although this method has important values and the map results cannot be overlooked. By using this improved technique, the ability of SLEMSA method is upgraded.

The results of this study showed that:

1- By performing the statistical dimensionless technique in SLEMSA model, the triple-factor portion of erosion is identified.

2- By using this method, we can achieve the regions priority area for fulfilling the erosion control plans, as this priority is based on the premier factor portion in evaluation and erosion estimate.

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3- By assigning the portion of erosion factors in this model, we can determine the techniques against erosion in different regions and avoid using just one method for its control.

Keywords; Erosion, Gulpayegan, SLEMSA model, Vectorial dimensionless.

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