Impact assessment of soil Physio-chemical properties on the development of the gully erosion

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Extended abstract

1. Introduction

Water erosion has been a problem worldwide, which causes the phenomenon of land degradation in semi-humid areas of dry land. The risk of soil erosion in arid and semiarid areas, especially in mountain ranges is of significant cases in land use planning. Soil erosion in these areas is one of the important consequences of climate change, or in general, the obvious impacts of environmental and ecological changes. The erosion implications include soil loss, sediment deposition in reservoirs, and vegetation loss, and vegetation cover. Among the different cases of water erosion, gully erosion is one of the most important factors affecting soil destruction, land aspect change, and degradation of water resources and land setbacks**.** Due to the importance and role of gully erosion inland waste and land depletion, especially in the study area due to the existence of fertile agricultural land with high potential production and proximity of these lands to urban areas in Darrehshahr county, the aim of this study is identifying effective soil factors in the development of gully geometry characteristics and their prediction. Identifying effective factors in the development of this process can be an approach for helping managers and authorities to control and prevent the development of gully erosion.

2. Methodology

There are many gully areas in the province of Ilam, where the study of Darrehshahr has been investigated. It is located in the Darrehshahr county and the eastern city of Ilam in the geographic range between 47° 30′ 8″ to 47° 46′ 03″ longitude and 33° 12′ 14″ to 33° 23′ 03″ latitude. Geological formation is composed of the sediments of the lake, which is caused by the landslide. It is a cold semi-arid climate that is based on synoptic stations at an average temperature of 21 C° and the average precipitation in the region is 497 mm**.** The basic data and statistics required are topographic maps of scale 1: 25,000 military organizations and the country's mapping organization, on a scale 1: 100,000 geological maps of the country, map of soil and land resources on a scale of 1: 25,000 of the institute for water conservation and soil. The measurement of gully geometric properties, including depth, length, high and low level, cross-sectional area, lateral slope, was done by surveying in the field using the Total survey camera at three cross-sections (head cut, median and outlet) of the gully. Then the region was divided into 12 work units, and in each case, three replicates were selected, and finally, 36 gullies were selected in the study area. The geometrical features of the gully using aerial photographs, digital maps and field operations, and physical-chemical properties of soil were determined using laboratory methods. To determine the impact of these factors on each of the geometric characteristics of the gully and the relationship between the dependent and independent variables was obtained using multivariate regression.

3- Results

After grouping the gullies, the relationship of soil properties with geometry properties, including depth, length, Up and down width, was investigated based on the methods of correlation analysis and multiple regression models**.** The results showed that EC (3.43), SAR (7.55) and Na^{+} (3.95) have the highest impact factor and the most important role in the development of the gully**.** Whereas the amount of organic matter and total of $Ca^{++}Mg^{++}$, will be the role of adherence to the soil and prevent gully development. Also, based on the cross-section development model, the amount SAR (3.41), Na^{+} (2.87), and the Gypsum (2074) has the highest

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impact factor in the increasing cross-section of the gully. But the amount of total of Ca^{++} and Mg^{++} (-0.36) and OM (-0.097), playing the most important role in the control and prevention of the gully development. The validation of the geometric characteristics of the gullies using statistical indexes (MRE and RMSE) was calculated. Due to very low RMSE values for both models, we can say that the proposed models are highly valid and can be used for regions with similar conditions of the study area.

4- Discussion & Conclusions

Due to the importance and role of gully erosion in soil loss, especially in the case study area, this study aimed to identify effective soil factors in the development of protective gully characteristics. Therefore, according to the findings of this study, it was found that:

-Based on the conceptual model of extension of gully length, the amount of EC, SAR, and Na+ have the highest impact and the most important role in the development of the gully. Conversely amount of organic matter and total of $Ca^{++}Mg^{++}$, will be the role of adherence to the soil and prevent gully development.

-Based on the cross-section development model, the amount SAR and the Na^{+} have the highest impact in the increasing cross-section of the gully. But the amount of gypsum and total of Ca^{++} and Mg^{++} playing the most important role in the control and prevention of the gully development.

-Soil texture, especially silty texture, plays a more effective role in gulling and sedimentation of gullies.

Key Words: Aerial Photo, Geometric Characteristics, Gully Erosion, Multiple Regression, Soil Physio-Chemical Characteristics.