Examining the Usage of GIS in Estimating Soil Erosion and Sediment Yield Using RUSLE Model
(Case study: Ghale chay Basin, Iran)

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Extended Abstract
1. Introduction

Nowadays you can rarely find areas on the earth surface which are not exposed to degradation and erosion and this is mainly due to population growth and excessive use of the land. The severity and extensity of erosion was not the same in different times and places, and it is related to the natural conditions, topography, soil characteristics, and status of land use. The phenomenon of soil erosion and sediment yield has created many problems in human society; accordingly, soil erosion is one of the most serious problems in developing countries and many developed countries now. Although it is not possible to stop the erosion geology, however, prevention and control of soil erosion is a basic need in the basins within the framework of utilization projects of water, soil, and watershed. One of the problems of erosion and sediment studies is the shortage of necessary data and information. This problem was more acute in developing countries and our country, Iran, is one of those countries that faces with this problem.

2. Theoretical Framework

Ghale chay basin is located at the altitude of 37 ° 27' 44" to 37° 42' 25" N and longitude of 45° 54' 36" to 46° 20' 40" E. Ghale chay basin have caused replacement of various human centers due to its coverage with Ghale chay river alluvium, suitable soil, relatively enough water and appropriate environmental conditions that makes it inevitable to investigate the status of erosion and to prepare erosion intensity map in this region. Due to the complexity of the processes, lack of appropriate statistics and measurement stations, and also to facilitate the work, most of the time erosion and sedimentation studies are done using experimental methods in Iran. Therefore the purpose of this study is soil erosion and sediment yield modeling using RUSLE model and Geographic Information System (GIS) and also identification of erosion susceptible areas to perform soil and water conservation operations in Ghale chay basin.

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3. Methodology

In this study, the amount of soil erosion has been studied in Ghale chay basin. To this purpose, the Revised Universal Soil Loss Equation (RUSLE) model has been adopted in Geographic Information System (GIS) technique framework that includes the R, K, LS, C, and P factors. To achieve the target, various documents, such as topographic maps with the scale of 1:50,000 including Hargalan sheet number 5265 III, Shiramin sheet number 5165II, Maragheh sheet number 5264IV, and Ajab Shir sheet number 5164I to perform analysis of topography, check slope and hydrographic network, elevation and quantitative analysis; geological maps of Azar Shahr, Osku, Ajab Shir and Maragheh with a scale of 1:100,000 for the stratigraphy, lithology, the nature of materials, geological structure, development stages etc., and also the rainfall data from weather stations around the basin and Digital Elevation Model (DEM) have been used. Average annual soil loss was calculated by multiplying the rainfall-runoff erosivity factor (R), soil erodibility factor (K), slope length and steepness factor (LS), cover management factor (C) and support practice factor (P) using intended model equation in Raster calculator extension in Arc GIS10.2.

4. Results and Discussion

Ghale chay basin has highly variable topography. This is determined with the range of zero to 10.32 of LS factor. Examining Rain Erosion (R) factor map in the basin indicated that this factor is variable from 3 to 3.71 MJ mm ha. The results also indicated that erosion in the northeast and southwest region under study has a decreasing and increasing trend, respectively. To prepare the C factor map land use and vegetation maps were used. This factor is variable from 0.04 to 0.45 that represents fairly well vegetation in the basin. To calculate the K factor the necessary information of geological map with the scale of 1: 100000 and soil layer were used. The average value of K factor is variable in the basin from 0.1 to 0.5.

5. Conclusion and suggestions

Evaluation of soil erosion risk map shows that amount of risk soil erosion is variable in the plain from 0 to 2.225 tons per hectare per year. According to this map, the studied area was considered as a very low to low sedimentation class. The calculation results of sediment delivery ratio methods show that in the studied area the ratio of sediment delivery is variable from 0.08 to 0.29 and maximum sediment yield is variable from 0.19 to 0.64 tons per hectare per year. Finally, comparing the estimated total deposition in USDA method with the amount of the obtained in EPM model from the research study of Roostaei, Rasooli, and Ahmad Zadeh, shows the ability to integrate RUSLE and GIS models in estimating soil erosion and sediment load.

Key words*:* Soil erosion, RUSLE, GIS, Ghale chay basin

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