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Predicting Soil Erosion Rate at Transboundary Sub-Watersheds in Ali Al-Gharbi, Southern Iraq, Using RUSLE-Based GIS Model

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Abstract: The empirical soil loss model, RUSLE, was used in conjunction with remotely sensed data and geographic information system technology to delineate the soil erosion and watershed priorities in terms of conservation practices at seven boundary sub-watersheds (labeled as SW-00, SW-01, …, SW-06) between Iraq and Iran in the district of Ali Al-Gharbi, southern Iraq. The six factors of the RUSLE model, i.e., the rainfall erosivity, the soil erodibility, the slope steepness length, the crop management, and management practice, were calculated or estimated using information from different data sources such as remotely sensed data and previous studies. The results revealed that the annual soil erosion loss ranges from 0 to 1890 (tons h^{-1} y^{-1}) with an average of 0.66 (tons h^{-1} y^{-1}). Values of soil erosion were classified into five classes: very low, low, moderate, high, and very high. The potential soil loss in the high and very high classes ranges from 14.84 to 1890 (tons h^{-1} y^{-1}), and these classes occupy only 27 km^2 of the study area, indicating that the soil loss is very low in the area being examined. In terms of the spatial distribution of soil loss, the northern and northeastern parts (mountains and hills) of the sub-watersheds where the slope is steeper are more likely to erode than the plain area in the southern and southeastern portions, indicating that slope, in addition to rainfall erosivity, has a dominant effect on the soil erosion rate. The study of soil erosion in the watersheds under consideration reveals that only the northern portions of the SW-00, SW-02, and SW-04 watersheds require high priority conservation plans; however, these portions are primarily located in mountain regions, making the implementation of conservation plans in these areas impractical. Due to low soil loss, other sub-watersheds, particularly SW-01, SW-03, SW-05, and SW-06, are given low priority.

Keywords: soil erosion; GIS; RUSLE model; remote sensing; Iraq

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1. Introduction

Landscape globally is facing significant environmental challenges such as extreme climate changes, droughts, floods, and intensive agriculture practices that cause soil erosion. A significant impact of these challenges will lead to deterioration of the soil and water quality within a watershed, and might subsequently influence the sustainability and productivity of watersheds. Environmental processes in a watershed are all interdependent where the change in one can influence the other. The process of soil erosion is the detachment and transport of soil particles due to erosion forces. The forces of erosion may be caused by wind, ice, or water, such as raindrops or surface runoff [1–