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Modeling the annual soil erosion rate in the mouth of river Pineios' sub-basin in Thessaly County, Greece.

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Erosion is a natural – geomorphological phenomenon, active through geological time that is considered as one of the main agents that forms the earth surface. Soil erosion models estimate the rates of soil erosion and provide useful information and guidance for the development of appropriate intervention and soil conservation practices and strategies. A significant number of soil erosion models can be found in literature; however, the most extensively applied model is the Revised Universal Soil Loss Equation (RUSLE) established in 1997 by Renard KG, Foster GR, Weesies GA, McCool DK and Yoder DC. RUSLE is an empirically based model that enables the estimation of the average annual rate of soil erosion for an area of interest providing several alternative scenarios involving cropping systems, management methods and erosion control strategies. According to RUSLE model's specifications five major factors (rainfall pattern, soil type, topography, crop system, and management practices) are utilized for estimating the average annual erosion through the following equation:

A=RxKxLxSxCxP,

where A is the computed spatial average soil loss and temporal average soil loss per unit area (tons ha^{-1} $year^{-1}$), R the rainfall-runoff erosivity factor (MJ mm $ha^{-1}h^{-1}$ $year^{-1}$), K the soil erodibility factor (tons h MJ^{-1} mm^{-1}), L the slope - length factor, S the slope steepness factor, C the cover management factor and P the conservation support practice factor. L, S, C and P factors are all dimensionless.

The present study aims to utilize a GIS-based RUSLE model in order to estimate the average annual soil loss rate in the sub-basin extending at the mouth of Pineios river in Thessaly County, Greece. The area covers approximate 775.9 km^2 with a mean slope angle of 7.8^o. The rainfall data of 39 gauge station from 1980 to 2000 where used in order to predict the rainfall-runoff erosivity factor (R). The K-factor was estimated using soil maps available from the European Soil Portal with a grid cell size of 500 m and a soil map of Thessaly at a scale of 1:150.000. The LS-factor was calculated from a 30-m digital elevation model. The C-factor was calculated by processing a Landsat ETM satellite image, acquired on 11 November of 2014, with a spatial resolution of 30 m. The P-factor in absence of available data was set to 1.

The outcomes of the analysis, in the form of annual soil loss rate maps, indicated that an extended part of the area is undergoing moderate erosion. The maximum soil loss in the area of interest was estimated to have a value of 42.86 (tons ha^{-1} $year^{-1}$), with a close relation to areas with high LS values covered by Natural grasslands and Sclerophyllous vegetation. The results of the presented model can be used as a simple but efficient tool assisting local resource planners to optimize land management in terms of identifying areas of high erosion probability. Also the results constitute an effective tool of predicting possible future changes in land-use as well as in soil erosion evolution.