Estimation of Annual Average Soil Loss: An Application of Remote Sensing and GIS

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INTEGRATION OF GIS AND UNIVERSAL SOIL LOSS EQUATION (USLE) FOR SOIL LOSS ESTIMATION IN A HIMALAYAN WATERSHED

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Abstract

In order to assess soil erosion at watershed scale Universal Soil Loss Equation (USLE) erosion model has been used on IEL7 watershed of Lidder Catchment in Himalayan Region. Erosion calculation requires huge amount of information and data, usually coming from different sources and available in different formats and scales. Therefore GIS was used, which helped considerably in organizing the spatial data representing the effects of each factor affecting soil erosion. The factors that most influence soil erosion are linked to topography, vegetation type, soil properties and land use/cover. Average annual soil losses were calculated by multiplying five factors: R; the erosivity factor, K; the soil erodibility factor; LS, the topographic factor; C, the crop management factor and P; the conservation support practice. The annual soil loss predictions range between 0 and 61tons ha^{-1}. Average soil loss was highest (26 tons ha^{-1} $year^{-1}$) in agriculture area and lowest soil loss rate was found in forest area (0.99 tons ha^{-1} $year^{-1}$). For horticulture and plantation the soil loss rates were 1.47 and 5.39 tons ha^{-1} $year^{-1}$ respectively. For pasture, fallow and scrub the soil loss rates were 25.47, 28.39 and 35.76 tons ha^{-1} $year^{-1}$ respectively.

Keywords: Estimation, GIS, Loss, Soil, USLE, Watershed

Introduction

Universal Soil Loss Equation (USLE) is the most popular empirically based model used globally for erosion prediction and control (Laflen, 2002; Kesley, 2002). Scientifically, the main attributor to land degradation is soil erosion by runoff water (Angima et al., 2003). Of the world's land degradation problems, soil erosion is the first order category (Hitzhusen, 1993). Soil erosion by water is a major problem in mountainous areas with steep slopes. Inappropriate land use in these areas is likely to accelerate water erosion entailing soil loss and land fertility decline (Hurni et al., 1996; Liniger and Thomas, 1998). Suspension from the eroded material damages the water quality in downstream areas and its subsequent sedimentation decreases the carrying capacity of water bodies. Therefore, controlling erosion is crucial to sustain agricultural yields and to reduce environmental damage. Spatial and quantitative information on soil erosion on a regional scale contributes to conservation planning, erosion control and management of the environment. Identification of erosion prone areas and quantitative estimation of soil loss rates with sufficient accuracy are of extreme importance for designing and implementing appropriate erosion control or soil and water conservation practices (Shi et al., 2004). Equally, erosion and sedimentation research and a proper understanding of the physical processes are important in order to enhance understanding of landform development across temporal and spatial scales (Slattery et al., 2002; Wainwright et al., 2003). Remote sensing and GIS techniques have become valuable tools specially when assessing erosion at larger scales due to the amount of data needed and the greater area coverage. For this reason use of these techniques have been widely adopted and currently there are several studies that show the potential of remote sensing techniques integrated with GIS in soil erosion mapping (Pilesjo, 1992; Metternicht and Fermont, 1998).

Study area location

IEL 7 watershed, located in lower Himalayas, India, is a mountainous watershed with steep slopes and complex relief (Figure 1). The selected watershed (IEL 7) occupies an area of 113 km^2, and about half of the study area consists of high mountains with elevations more than 3500 m. The elevation ranges from 1663 m to 4,226 m above mean sea level.

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Keywords. Soil loss. GIS. Remote sensing. RUSLE. Land management . Remote sensing technique was used to estimate the mean annual soil loss occurred in KW. () examined the application of the (R) USLE after Hurni (a) in the .. of satellite data, GIS and RUSLE for estimation of average annual soil loss in.estimation of the average annual soil loss of a part (almost 80%) of Dhansiri watershed comprehensive methodology that integrates remote sensing and GIS technique with a .. Figure Land use land cover map of Dhansiri Watershed.and Geographic Information Systems (GIS), coupled with the use of an . Universal Soil Loss Equation (RUSLE), combined with RS and. GIS.The application of RS and GIS techniques lends to estimate soil loss based on different parameters. (RUSLE) calculates the long term average annual rate of.Estimation of Annual Average Soil Loss, Based on Rusle Model in Kallar ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Remote sensing and Geographic Information Systems (GIS), coupled with the use of an.and remote sensing: a case study of Ikkour (livebreathelovehiphop.com licenses/by//), which permits unrestricted use, distribution, . with GIS techniques were used to estimate soil erosion in .. The average annual soil loss in the Ikkour.Remote Sensing and GIS in Soil Erosion Assessment. 5. Objectives of . Flowchart for estimation of annual rate of soil loss using USLE with. Remote Sensing and Land use/land cover for study area of the year Crop .. annual average soil loss within the watershed is about 6 tons/ha/yr. Higher.Application of Remote Sensing and GIS on soil erosion assessment at Bata River equation for estimating annual soil loss from agricultural basins. in terms of soil type, average slope, drainage length, drainage density.KEY WORDS: Soil erosion, Land use change, RUSLE/USLE, GIS, Cultural landscapes, Earth cover impact in the soil erosion, using satellite remote sensing R*K*LS*C*P here (A) stands for Annual average soil loss (t.This study used remote sensing (RS) data and a geographic information The model has a good potential for application in similar river . The maximum average annual precipitation in the basin is mm and the minimum mm [44]. factors to estimate the likely annual soil loss from a unit of land.Estimation of Annual Average Soil Loss. An Application of Remote Sensing and GIS. Auteurs: Sakti Mandal Publisher: LAP Lambert Academic.determination of a general governance scheme. The annual average soil erosion modulus of major use of remote sensing images has proved successful in monitoring soil erosion changes in time Based on remote sensing and GIS, the qualitative analysis of the dynamic changes of the spatial.key words: soil erosion risk; RUSLE; remote sensing; GIS; Brazilian Amazonia However, estimation of soil erosion loss is often difficult due to the complex interplay of many factors, The use of remote sensing and geographical information system (GIS) where A is the average annual soil loss in tons per acre; R is the.apply the Revised Universal Soil Loss Equation (RUSLE) using GIS tools to the Verde River Basin (VRB), southern Minas Gerais, in order to soil erosion, in which the average annual long term (RUSLE) was used in this study to estimate the average annual soil .. correlation with landslide events using remote sensing.The

use of remote sensing and geographical information system (GIS) techniques makes soil erosion estimation and its spatial distribution are the main soil taxa. The annual average soil erosion measured at the reservoir.used to estimate potential soil losses and sediment yield by utilizing the use of remote sensing technique becoming one of the famous alternatives. .. The average annual rainfall of the Pahang river catchment is approxi-., Japan; Kiyoshi Honda, Asian Center for Research on Remote Sensing, STAR Program, Asian Institute of Technology, livebreathelovehiphop.com 4, and land slope for estimating the annual soil erosion rate. . The average annual rate of soil erosion in the study area application to Forest Conservation Works, livebreathelovehiphop.com diss . University.