International Journal of Advanced Science and Technology
Vol. 29, No. 7s, (2020), pp. 4931 - 4934

An Appraisal on the Progress of Geoinformatics Applications in Soil Erosion Studies

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Abstract

The main objective of the study is to establish the model of soil erosion. Globally, applications for remote satellite sensing in soil erosion mapping and modelling has gathered significant momentum in the last decade. This degrading phenomenon weakens the soil fertility and drastically affects the agricultural practices. However, there is a method to identify the most vulnerable areas and quantify the soil erosion. Revised Universal Soil Loss Equation (RUSLE) has been adopted to estimate soil erosion. This model takes into consideration the parameters including runoff-rainfall erosivity factor (R), soil erodability Factor (K), topographic factor (LS), cropping management factor (C), and support practice factor (P). This work details on the focusing an overall view in the advancements of Geoinformatics applications in soil erosion study. The soil erosion mainly occurs in hilly areas and the steep slopes.

Keywords:*Soil loss Estimation, RUSLE, Land degradation, Data, Soil conservation, Vegetative cover*

1.Introduction:

Soil erosion is one of the main forms of land degradation. Erosion happens in many ways like through transportation and erosion agents like water, wind, gravity. There are many ways to find out the soil erosion, one way to find is Revised Universal Soil Loss Equation (RUSLE). Using this method, we can able to find out the different factors to estimate the soil erosion.Erosion by human activity is agriculture, logging, burning and mining. Erosion will cause flooding, disruption of ecosystems, and water pollution. The erosion is an action by which the surface of the Earth into weak. The erosion can be affected with water, ice, and wind are fluids because they will flow to one place to another place with to the force gravity. These are three elements is a main agent to happen of soil erosion in the earth's surface. If runoff has adequate energy flow, it will carry sediment particles down slope and it results the erosion these types of erosion mainly happens when the rain comes.soil loss rate can becalculated by measurement of annual rainfall, slope, crop cover and practice erosion control factors. By using the RUSLE method, we can able to find out the soil erosion by using all parameters.

2.Literature Review:

2.1Soil erosion distribution

In many ways the soil loss happens through different agents and it may be a slow process that distinctly unnoticed and it results the disturbing the top layer of the soil and it happens mainly in hilly and sloppy areas and also in the agricultural land. In agricultural land the loss of soil reflected in reduced crop production. Soil erosion is a worldwide problem that relates the impact the top layer of the soil and also it may damage the agricultural land practices.

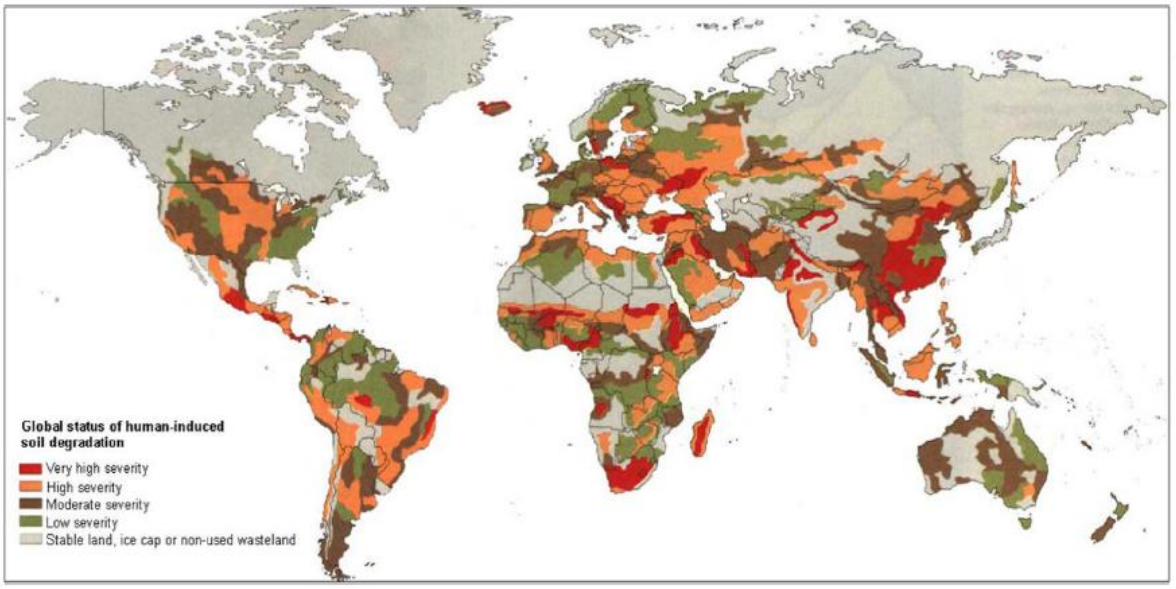

Fig. 1.Human-induced soil loss across the globe status. (Source: Oldeman et al., 1990).

Due to erosion over the past 40 years, 30% of the world's cultivable land has become unfertile. Most of the literature has shown that eroding of soil in the agricultural land results the loss of nutrients and other minerals and reduce the crop productivity/. Soil erosion has three-stage process involving detachment, transport and. There are some methods like Universal Soil Loss Equation (USLE) and its revised version Revised Universal Soil Loss Equation are the most widely used to find out the soil loss. By using the RUSLE method, we can find out the erosion in all parameters. Erosion may also happen due to the transport and other usages for human beings.

2.2. Satellite remote sensing of soil erosion

Instead of using different soil erosion models for predicting which is high of cost and time consuming we can use the remote sensing technique which may consumeless time and cost, andalso it willgive the requiredinformation which is essentialfor evaluating and observing thesoil erosion level in particular areas. In remote sensing technology we need an additional data to find the soil erosion in different factors. Data required like NDVI and LANDSAT Images by using these techniques we can able to find out how much erosion happening.

Water Erosion mainly happens through the rainfall and runoff and this erosion majorly happens according to the direction of flow of water. The have four type of soil erosion from water is sheet erosion, gully erosion, splash erosion and rill erosion. Sheet erosion is the uniform removal of soil in thin layers by the forces of raindrops. By using the software like Qgis an ENVI with the help of data and usage of various tools we can find the how much erosion happening in particular area and this may take several steps to estimate the soil erosion. There are different factors available to estimate and monitoring the soil erosion. As many high spectral resolutions are available but it may consume time and cost.

2.3. Soil erosion under different nature land management scenario:

According to the research 40% of the worlds agricultural land is seriously degraded. Along with the soil loss in agricultural land more amounts of nutrients are lost from the cultivable soil and it may deplete the fertility of soil. Thus, the huge loss of soil nutrients lowers the productivity of agricultural land. Some are the main causes of soil erosion is deforestation, overgrazing, mining and constructive projects.Some preventive measures should follow to reduce the erosion like vegetation and other techniques and it disturbed the soil. By using the rainfall data, we can estimate the rainfall erosivity factor and the erosion is serious problem across the world.

As per the research when the population increases then automatically the production of crop productivity increases and C-factor is the vegetative factor which will show the greenery image and this factor will able to stop the erosion in some areas. By using the NDVI data we can find out the

vegetative factor in the agricultural and also the cover management practice and this NDVI factor will be done in ENVI software.

C factor describes the cropping, soil cover, soil biomass and soil disturbing activities on erosion. RUSLE uses as a subfactor method to find the soil loss. By using the below formula, we can find out the c factor.

C factor = 0.431-0.805*NDVI

Using these formulae in qgis we can find out the cropping management factor and it will give the image of the vegetative land and erodible land. By using these formulae in qgis we can do the C-factor which will give the vegetative cover and this will reduce the soil erosion.

2.4. Spectral characteristics and vegetation cover for soil erosion mapping

High space resolution involves the advantages of remote sensing on the basis of satellite images, which may be the data derived from the long data series that are cost efficient. In this paper we are going to find out the soil loss estimation by using LIS III satellite image.There are four types of multispectral bands present in LISS III satellite image like green band (0.52-0.59), red band (0.62-0.68), near IR (0.77-0.86), mid IR (1.55-1.70).By using these bands and images with high spectral resolution we will find out the soil loss.

Normalized Vegetation Diversity Index (NDVI), one of the most broadly used and applied indexes compared to multispectral data. By using the NDVI we can find out the c factor and cropping factor andremote sensing technology is used to identify the vegetative changes in semi-arid wetlands and to assess the same.By using the remote sensing techniques, we can find out the erosion factor in C-factor along with this we need to assess the drought prone areas which is used to observe the earth surface vegetation cover and crop production.

In remote sensing technology we can see different colors in soil like dry soil is bright and wet soil is much darker than dry soil can have low red reflectance but the difference between NIR reflectance and Red reflectance for soil is much less than for live vegetation. Vegetation indices based on highlighting the difference between red and NIR reflectance in image pixels. By using the different bands and images we can find out the erosion land and vegetative land to predict the slope and cropping factor.

2.5. Remote sensing techniques for soil erosion mapping

Many techniques are using in remote sensing to find the erosion. We can use the latest remote sensing technologies and the data availability in various resolutions using these data we may find out the rainfall factor, soil erodibility factor, slope & steepness factor, vegetative factor and practice factor these are the different factors to predict the entire soil loss estimation. Soil erosion modelling is able to deal with many of the complex connections that control erosion rates by simulating the erosion in watersheds. High resolution satellite images provide the valuable information related to the agricultural land with the advance remote sensing technology to find out the soil loss estimation.DEM and LANDSAT for slope and land use map. Mainly the soil degradation happens in slope areas and according to the wind flow and it may also happen due to the lack of vegetative cover and conservative practices.

3. Conclusion

We can use RUSLE method as to find the soil erosion different factors and through this we can easily find the erosion. Soil erosion is a worldwide problem when it comes to the hilly areas and we need to predict the erosion happening. Use of GIS techniques and remote sensing techniquesto estimate the soil loss can be more substantiate and reliable with high spectral data. It has capable of estimating the erosion in different factors. Ultimately in this paper we will estimate the soil erosion in different factors by using the GIS techniques.

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