Time Series Assessment of Soil Erosion Risk Using RUSLE Model: A Machine Learning Approach - A case study in Abaya Lake Sub-Catchment

Tesfaye Abebe Tesema (Ethiopia)

Key words: Geoinformation/GI; Land management

SUMMARY

ABSTRACT

The objective of this study was to examine the nature, extent and rate of soil erosion in Abaya Lake sub-catchment using model estimate and GIS. Revised Universal Soil Loss Equation (RUSLE) integrated with Machin learning approach; satellite remote sensing and geographical information systems (GIS) are used as a methodology. Annual precipitation, FAO digital soil map, 12.5m digital elevation model, land-cover map, land use types and slope steepness were used to determine the RUSLE factors. Findings indicated that, the total soil loss in the sub-Catchment amounted to 2.38 million tons per year, with potential annual soil loss varying from 0.0 to 508.97 tons/ha/year and average annual soil loss rate of 32.84 tons/ha/year, exhibiting notable spatial variability. Specifically, the average annual soil loss in the western catchment ranged from 0.0 to 507.97 tons/ha/year, while the upper and lower section of the Sub-catchment showed average annual soil loss ranging from 0.0 - 101.1

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0.0 - 64.94 tons/ha/year respectively. The study classified areas experiencing sever erosion covering approximately 13,724 hectares (16% of the total catchment), while regions at high and very high risk accounted for 62,707.5hecatrs (73%) and moderate risk covers 9,614.55hectars (11%). To facilitate effective soil and water conservation strategies, the sub-watersheds were prioritized based on erosion severity. The finding highlighted the critical need for conservation measures in areas classified as sever and very high risk to prevent irreversible degradation. Consequently, sub-watershed “A” was identified as the top priority for immediate conservation efforts followed by sub watershed “B”, “G”, and “D” in the second phase, with “H”, “F” and “E” in the third phase and finally subwatershed “C” last.

Key words: Soil Erosion, RUSLE; GIS; Soil conservation; Machin learning