D-44: Erosion risk assessment using Geographic information systems (GIS) in Nillambe sub catchment

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The estimation of erosion risk in Nillambe sub catchment is of prime importance because soil erosion rates and land degradation are found to be alarmingly high. In an attempt for conservation of the land resource in the catchment, it is imperative to identify the land parcels where the problem is hazardous so that more resources could be allocated for these areas.

Geographic Information System (GIS) has been recognized as an effective tool for analysing and interpreting spatially distributed parameters. The variation in spatial distribution of erosion risk highlights the benefits of a GIS approach to solve the problem. In this exercise, information on erosion determining factors such as soil depth, rockiness, gravelliness, texture, slope, rainfall aggressiveness and land use was collected as basic inputs to the GIS systems. The objective was to derive the association parameters from these basic data so that comparative assessment of erosion risk could be achieved with high accuracy.

The Nillambe Oya sub catchment located within the Upper Mahaweli catchment area (its areal representation is considered to be typical of the central highlands of mid country in Sri Lanka) was selected as the study area. In this area traditional villages are in valley bottoms and lower slopes and paddy is a common crop. Forest gardens and tea are found on the higher slopes covering two third of the land area of the catchment. The total land coverage of Nillambe is about 5640 ha.

This area receives rainfall during both monsoons and also in the inter-monsoonal periods with no rain shadow effect. It lies within 3 agro-ecological regions namely, wet midland 2 (WM2), wet midland 3 (WM3) and wet upland 2 (WU2) in the 300 to 900 m and above 900 m elevation range. The area consists of soils Acrisol, Natosol, Cambisol and Fluvisol, with hills having steep long slopes and surface gravelliness.

The thematic maps of soil depth, rockiness, gravelliness, texture and slope which were already in GIS form, and information on river network and rainfall data were obtained from the Forest and Land Use Mapping Project (FORLUMP), Polgolla, Kandy.

The data was used for the production of maps using ARC/INFO software. TYDAC SPANS software was used for GIS applications. In producing erosion risk map, it was decided to combine the developed 9 thematic maps using overlay/indexing process by giving equal weight for each map.

The rainfall shows a specific pattern which suggests that the storm origin could be located either on the North-Western part or the South-Western part of the catchment.

In Drainage Density map, the places where high stream frequency is evident, show very high values of drainage density they are located at the junction of the stream.

Very high drainage texture values are found at the end of the branches and very low values are a feature along the main stream. This suggests the type of drainage pattern in the catchment.

The erosion potential land use classes are scattered throughout the catchment confirming heavily fragmented land allotments. The classification scheme was based on the subjective identification of erosion risk in different land uses.

The resultant map shows that most of the land is subject to medium erosion risk. These areas are found all over the catchment. The least portion of the area is represented by low erosion risk. Small portion of area is not categorized under erosion risk, because of the unavailability of data. The map demarcates an area representing 5 erosion levels.

According to the potential erosion map and other thematic maps, categories having high slope, medium to high drainage density classes and moderately high to high erosion potential land uses cumulate to form very high erosion risk.

North-West and South-East parts of the catchment record very high values of rainfall making these areas medium erosion potential. Sandy to coarse loamy soils are found in only 0.58% of the total area and therefore, it can be concluded that the soil texture does not contribute much towards erosion potential. Higher values of drainage density is found in North-West, South and South-West parts yielding high erosion potential. Determination of land use capabilities based on erosion risk assessment could improve the ultimate erosion losses.

Only 3.4% of the area has very high erosion risk. High erosion risk is found in an area of 34.26%. However, measures should be taken to conserve medium, high and very high areas which encompass a total of 80.43% of the area. Heavy earth moving operations are not required and agronomic measures are sufficient to manage the problem of soil erosion in Nillambe.