

**D-46: GIS based soil erosion model for Kotmale sub catchment**

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Since hydropower generation was implemented, a considerable degree of environmental and socio-economic changes have occurred within the Kotmale sub catchment. These changes have posed a serious threat for the sustainable management of catchment resources. Land degradation has been identified as a key issue in resolving the environmental hazards associated with soil erosion. It is important to demarcate highly erosion prone areas and these should be the focus for any conservation attempt. Geographic Information Systems (GIS) are found to be capable of handling vast quantities of spatial information. A study was initiated to evaluate the erosion potential of the sub catchment in relation to climatic, topographic, soil and vegetation factors through a comprehensive GIS based erosion model.

**Objectives:** To utilize multi-spectral satellite information to derive digital landuse/land cover map; to develop a GIS database by incorporating information such as mean annual rainfall, soil categories and slope of the area as individual GIS layers; to develop an erosion potential model by overlaying these GIS layers and the developed landuse/land cover map and to interpret results and prepare guidelines and policies for landuse planning and soil conservation in the catchment.

Kotmale is one of the 4 main sub catchments in Upper Mahaweli Catchment Area (UMCA). It is observed that the agricultural practices within the catchment are mostly governed by socio-economic influences such as economic returns of the crops, traditional adaptations, etc. rather than intentions to protect the land resource. As a consequence, the status of land degradation due to soil erosion directly determine the storage capacity of the reservoir because of siltation and thus limiting the potential of hydropower generation. Assessment of erosion risk provides guidelines to formulate a conservation policy which would assist in the sustainable management of the land resource.

## Data sources

- (a) Satellite data: Landsat Thematic Mapper (TM) data acquired on February 26, 1992 covering Kotmale area.
- (b) Maps: Digital thematic maps of rainfall, soil types, slope and stream network at the scale 1:63,360 of the Kotmale area.

Software            (a) ERDAS Microcomputer image processing system  
                         (b) TYDAC SPANS for GIS applications.

The landuse/cover map was prepared using Landsat TM image through the process of supervised classification. Accuracy assessment of the derived landuse was attempted to evaluate the classification by comparing the classified image to ground truth. In addition, the digital thematic maps of rainfall, soil and slope were prepared for GIS analysis based on their numerical estimates. There were 3 linear buffer zones introduced to the stream network map to produce the buffer zonal map.

Initially, the landuse/cover map and slope map were overlaid to produce the landuse/slope overlay map. The combined effect of rain erosivity and soil erodibility was produced by overlaying the rain erosivity and soil erodibility maps. These 2 maps were combined to obtain the "Erosion Model - 1" of Kotmale watershed. The buffer zonal map was combined with the "Erosion Model - 1" to prepare the final Erosion Model.

The band combination of 4, 5 and 3 was found to be the best for the landuse/cover identification. The landuse/cover map contains 11 major landuse classes: dense woodlands, open woodlands, tea, paddy, home garden, grass, non agricultural lands, quarries, rocks, seasonally flooded land and water. Dominant land cover types are dense woodland and tea. Dense woodlands are mostly concentrated in the eastern part of the catchment while tea is scattered all over the catchment. The Kotmale reservoir and a few other smaller water bodies exist within the catchment. The poor ground resolution of the data (30 x 30 m) has led to a loss of a considerable amount of information during the classification.

The accuracy of the classification was 69.04% which is sufficient in view of the comparison between the image resolution and size of the fragmented land allotments. The high erosion areas are concentrated in the northern and western part of the catchment. Only about 0.48% of the area belonged to the very high erosion category. The results of final erosion model includes the effects of streams on the erosion potential of the area. The high and very high erosion area in this model are concentrated in places with high stream orders. There is an apparent increment in high and very high erosion potential area in the final erosion model compared to the Erosion Model 1. Therefore, the effect of stream flow is an important factor in erosion control and measures should be taken to control the stream bank erosion.

During image classification, errors occurred due to the similarities in reflectance patterns of different classes, poor ground resolution of the image, small sizes of holdings and probable landuse changes since image acquisition.

The final erosion model indicates that the erosion potential greatly varies within the catchment.

The incorporation of stream network and the buffers was useful in assessing the stream bank erosion and the total erosion potential of the area.

The developed erosion model provides spatial context for conservation planning in the catchment.