Lanuza, R. 1999. Modeling soil erosion in a watershed. M.S. thesis. Abstract. University of the Philippines, Los Banos, Laguna.

Abstract: Most erosion models have been developed based on a plot scale and have limited application to a watershed due to the differences in aerial scale. In order to address this limitation, a GIS-assisted methodology for modeling soil erosion was developed using PCRaster to predict the rate of soil erosion at watershed level; identify the location of erosion prone areas; and analyze the impact of landuse changes on soil erosion. The general methodology of desktop modeling or soil erosion at watershed scale is composed of the following: a) model development and structuring; b) formulation of assumptions; c) gathering of information; d) database creation, manipulation, and processing; and e) dynamic modeling with PCRaster.

The GIS-assisted model was validated at Tanghaga Watershed using the observed values from previous experiment. The predicted peak rates, Qp, showed a highly significant relationship with the observed Qp, with an r^2 value of 0.75. For soil loss prediction, a significant relationship was also noted with an r^2 value of 0.74.

Sensitivity analysis using four parameters was done. The model response was most sensitive to Manning's roughness coefficient (n) for the peak rate. An increase in n value from 0.02 to 0.13 resulted in a decreased if 546% in the predicted Qp. On the other hand, the predicted soil loss was most sensitive to the vegetative cover. Increasing the value of vegetative cover from 0.20 to 0.95 resulted in a decrease of about 1,567%.

The model was applied to Mapawa Watershed. The computer simulation showed higher Qp values at Mapawa than at Tanghaga. Moreover, the model was also used to predict and evaluate the impact of landuse change and different farming activities. A change in the existing farming practice (cropland area) to agroforestry-based farming system reduced both the predicted Qp values and the soil loss. Among the farming activities considered, land preparation was predicted to be the most erosive. On the other hand, simulation by completely removing the vegetation of the whole catchment had tremendously increased the predicted Qp and soil loss. The runoff rate was greatly reduced and did not reach a peak rate under a forested catchment.

The location of erosion hotspots was predicted along the section near the tributary channels and in areas with steeper slope gradient. The capability of GIS-assisted model in predicting the location of erosion hotspots is a significant finding and this approach is a valuable tool in the formulation of a good watershed rehabilitation program.