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Estimation of crop management factor and conservation support practice factor of RUSLE model to assess vulnerability to soil erosion in Kalu Oya and Mudun Ela basins using GIS

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Soil erosion is a serious environmental problem, which emerges from intense anthropogenic activities, agricultural practices and improper land use management. River basin soil erosion assessment enables to plan, conserve and manage the watershed areas and associated ecosystems. Revised Universal Soil Loss Equation (RUSLE) model is the most widely used model to predict the long term erosion rates in an area using rainfall-runoff erosivity factor, soil erodibility factor, slope length and steepness factor, crop management factor (C factor) and conservation support practice factor (P factor). Present study has been conducted to estimate the C and P factor to assess the vulnerability to soil erosion in Kalu Oya and Mudun Ela basins located in Gampaha district, Western province, Sri Lanka. The total catchment area of Kalu Oya and Mudun Ela basins (7°7'60" N and 79°54'0" E) are about 78 km^2. C and P factor of RUSLE model were estimated using land use map and 30m resolution LANDSAT 8 OLI/TIRS satellite images acquired on 17th February, 2018 to determine the vulnerability of erosion and conservation status. The C factor values for barren areas and well protected areas were assigned from 1 - 0 respectively, whereas 0 - 1 range was used for the good conservation (0) and poor conservation (1) status of the prevailing land use patterns using the field observations and literature reviews. Spatial join tool of overlay analysis was used to obtain the combined effect of C and P factors and two separate thematic maps were derived using ArcGIS 10.2.2 version to represent the spatial distribution of both C and P factors according to five classes; low, moderate, high, very high and extremely high which represent the vulnerability to soil erosion. The study identified 9.94% of the total area with 0.00 - 0.01, 80.56% with 0.01 - 0.14, 0.61% with 0.01 - 0.20, 8.03% with 0.20 - 0.63 and 1.86% with 0.63 - 1.00 of C factor and 0.01% with 0.20, 0.61% with 0.20 - 0.40, 82.57% with 0.4 - 0.5, 1.45% with 0.50 - 0.60, 15.35% with 0.60 - 1.00 P factor. Significantly higher amount of erosion vulnerability areas were observed besides the tributaries. The study identified 9.01% of the total area under low erosion (0.00 - 0.02), 79.56% under moderate erosion (0.02 - 0.14), 0.61% under high erosion (0.14 - 0.20), 8.03% under very high erosion (0.20 - 0.63) and 1.86% under extremely high erosion (0.63 - 1.00) for combined effect of C and P factor. Moderate erosion could be reduced using suitable agronomic practices. Appropriate conservation measures have to be implemented for the areas under high, very high and extremely high vulnerability to soil erosion within the Kalu Oya and Mudun Ela basins to reduce sediment transport.

Keywords: Conservation, RUSLE model, soil erosion, spatial distribution