

Spatial Assessment of Soil Erosion in a Gently Sloping Coconut Plantation at Dambadeniya (IL1), Sri Lanka

D.M.C.N. Dilshani¹, H. M. A. S. Jayawardana^{2*}, and J. K. W. N. Subashini³

¹University of Colombo, Institute for Agro-Technology and Rural Sciences, Hambantota, Sri Lanka

²Research Unit, Sri Lanka Cashew Cooperation, Puttalam, Sri Lanka

³Department of Horticulture and Landscape Gardening, Faculty of Agriculture & Plantation Management, Wayamba University of Sri Lanka, Sri Lanka

*h.m.a.srikantha@gmail.com

Soil erosion is a major land degradation process affecting agricultural sustainability, soil fertility, and long-term productivity. In low-country agricultural systems, erosion risk is often assumed to be minimal due to gentle slope conditions; however, variations in land cover and management can still generate spatial differences in soil loss. This study applied the Revised Universal Soil Loss Equation (RUSLE) model integrated with Geographic Information System (GIS) techniques to assess spatial soil erosion patterns in a coconut plantation managed by the National Livestock Development Board (NLDB) in Dambadeniya, Sri Lanka, within the Low Country Intermediate Zone (IL1). Rainfall data, soil properties, Digital Soil Map of the World, Digital Elevation Model (DEM), and satellite imagery were used to derive rainfall erosivity (R), soil erodibility (K), slope length and steepness (LS), vegetation cover factor (C), and support practice factor (P). The P factor was assigned based on existing land-use conditions and published RUSLE literature, considering the absence of engineered soil conservation measures. ArcGIS was used to integrate all factors and generate an annual soil loss map. The study area covers 619 acres, including 495 acres (79.97%) cultivated coconut land and 124 acres (20.03%) uncultivated land. Estimated annual soil loss ranged from 0 to 3.58 t ha⁻¹ yr⁻¹, which falls within the low erosion category (<5 t ha⁻¹ yr⁻¹). Although overall erosion is low, spatial variability was observed across the landscape. Higher soil loss was mainly associated with reduced vegetation cover and weaker land management practices, while well-vegetated areas showed minimal erosion. The study demonstrates that in the study area, even gently sloping coconut landscapes exhibit spatially variable erosion controlled mainly by land cover. GIS-based RUSLE modelling effectively identifies erosion variability and supports targeted land management planning.

Keywords: Coconut plantation, GIS, RUSLE, Soil erosion, Spatial variability