

Erosion Dynamics and Conservation Willingness: A Pathway for Sustainable Land Management in the Gurugoda Oya Basin

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Abstract

Soil erosion and sedimentation are pressing environmental challenges in Sri Lanka, threatening agricultural productivity, water security, and hydropower generation. The Gurugoda Oya Basin, a sub-basin of the Kelani River that includes the Ganthuna Small Hydropower Plant catchment, is of high ecological and economic significance, and vulnerable to land degradation. Understanding both the physical drivers of erosion and the socioeconomic willingness of communities to invest in conservation is critical for designing sustainable watershed management strategies. This study aims to assess soil erosion and sediment export in the Gurugoda Oya Basin and evaluate farmers' Willingness To Pay (WTP) for conservation interventions that mitigate these challenges. Primary data were collected from 301 randomly selected smallholder farmers across different elevations and land uses through structured questionnaires and group interviews. Double-bounded dichotomous choice method was used to assess the WTP of the respondents. Socioeconomic variables such as education, income, and awareness levels were analyzed using a bivariate probit model, while erosion and sediment export were estimated using the InVEST Sediment Delivery Ratio (SDR) model integrated with ArcMap 10.8.2. Results indicate that built-up lands contribute disproportionately to soil erosion (USLE C-factor=0.1), whereas forests and agricultural areas show much lower values (0.001). Annual soil loss was estimated at 17,399.75 tons and 19,100.41 tons in two sub-watersheds, while sediment export to streams was comparatively low (913.81 and 976.20 tons/year), reflecting the critical role of vegetation in sediment retention. Socioeconomic analysis revealed that education, income level, and awareness of ecosystem services significantly influenced WTP. Farmers expressed an average willingness to contribute Rs. 1,400 per year for watershed conservation. The findings underscore the importance of linking biophysical assessments of erosion with socioeconomic mechanisms for conservation financing. Mobilizing community contributions could support interventions such as sustainable farming practices, erosion-control infrastructure, integrated watershed management, and awareness programs. By combining physical modeling and farmer participation, this study highlights a feasible, community-based pathway to mitigate erosion and sedimentation, thereby enhancing agricultural resilience and sustaining hydropower generation in the Gurugoda Oya Basin.

Keywords: *Community-based conservation, Sedimentation, Soil erosion, Watershed management, Willingness to pay*