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RESERVOIR SILTATION AND FLOOD CONTROL: ESTIMATING SEDIMENT YIELD OF THE SONGWE RIVER WATERSHED

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The 4278km2 watershed area of the Songwe River, faced with biannual flooding, is about to enter a new phase of human interference through infrastructural development central of which is reservoir construction. It is known that water fluxes and sedimentation largely depend on a region's climate and local drainage basin, which together affect the hydrology of the river systems in that region. Because drainage basins do change over time affecting the river discharges, climate parameters are usually estimated from temperature and precipitation proxies from which sediment yield estimates are determined given these conditions. This is substantiated with the knowledge that erosion by running water, resulting from precipitation falling over a particular area, is the most severe hazard threatening the protection of soil loss which defines the bulk of transported sediment.
Climatic, land use, topographic and physiographic properties were therefore, assembled and used to not only estimate and identify critical sedimentation areas but also quantify reservoir siltation through estimation of delivery of the sediment to the proposed reservoir site. Based on hydrological runoff processes using PESERA, most of the sediment generation has been established to be occurring in the upper sub basin while, topographically, the lower sub basin provide a conducive environment for deposition. This has usually resulted into runoff trends in the catchment that are not only episodic for which any one of them can develop into a catastrophic flood but also erratic erosion that has the capacity to dispose of large amounts of sediment within few days or even minutes. The quantified amount of the estimated sediment transported downstream apart from causing the increased flooding events in the lower sub basin, has also been established to pose a great sustainability risk of siltation to the proposed reservoir as it has been shown to be potentially huge averaged at 8.81 t/ha/yr with extreme variability reaching as high as 141 t/ha/yr in some parts of the upper catchment.
The drainage density does not help the catchment at all as it was calculated to be very small at 0.1 126, signifying that the catchment has very few, widely spaced stream channels through which the available runoff and its sediment in the watershed would escape leading to most of it being deposited downstream. The study further highlighted the critical sedimentation areas in the catchment for prioritized conservation management for the economic sustenance of not just the watershed and livelihood of the local community but also the infrastructural developments themselves that include the proposed reservoirs. With the findings further showing no statistically significant correlation between the increasing rainfall trends in the catchment and the discharge causing the increased flooding, the results substantiates catchment degradation to be the cause of the increased flooding events. In the final analysis the paper has called for holistic catchment sustainability approaches to be adopted in the Songwe River watershed with further ground-truthing studies recommended to exact the spatiality of the conservation solutions adopted and their suitability.

Keywords: flooding, sedimentation, PESERA, conservation, degradation, siltation