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Erosion in Tropical Rain-Forest Terrain: Effects on Sediment and Water Chemistry

K.V. Annammala[1,2]*, N.A. Mohammad[2], D. Sugumaran[2], L.S. Masilamani[2], M.H.Jamal[3], Z.Yusop , A.R.M.Yusoff and A.Nainar[5]

[1]Centre of Environmental Sustainability & Water Security (IPASA), Research Institute for Sustainable Environment (RISE), Universiti Teknologi Malaysia, Malaysia

[2]Department of Water & Environmental Engineering, School of Civil Engineering, Universiti Teknologi Malaysia, Malaysia

[3]Centre for Coastal and Ocean Engineering (COEI), Universiti Teknologi Malaysia, Malaysia

[4]Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, Malaysia

[5]Ecohydrology Research Institute, The University of Tokyo Forests, Graduate School of Agricultural and Life Science, The University of Tokyo, Japan

Land-disturbancessuch as logging lead to major, but short-lived increase in erosion (~2years) until revegetation of slopes occur. Such vegetation isknown to offer protection against erosion. This paper questions and re-assesses thishypothesis using the Modified Laser Erosion bridge method in a gradient of land-disturbance from near pristine to Oil palm and rubber plantations (with bench-terraces), which has greatly expanded in recent decades.Additionally, this study seeks to determine contamination by selected metals (Mn, Cd, Cu, Pb, Ni and Zn) in both water and sediment within the Kelantan River Basin, West Malaysia. Geo-accumulation Index, (Igeo), Pollution Load Index, (PLI) Enrichment Factor (EF) and Potential Ecological Risk (PE) assessment were applied to assess heavy metal contamination in sediment samples. Soil erosion rates were measured and monitored from March 2017 to February 2019 at five different sites: a) high conservation value forest (HCVF), b) logged forest (LF), c) 10-years-old mature oil palm plantation (MOP),d) Newly planted oil palm (NOP) and e) 13-years-old mature rubber plantation (MR). NOP showed the highest erosion rate at 92.2 t ha-1yr, followed by HCVF (63.3 t $ha^{-1}yr^{-1}$), MOP, LF and MR (43.8, 42.4 and 5.9 t $ha^{-1}yr^{-1}$ respectively). Mn in both water and sediment was 0.0376-10.2031 mgL^{-1} and 7.977-17684.673 $mgkg^{-1}$, respectively. Igeo indicated that sediment samples from most stations were slightly polluted (grade 1). EF value for Pb was the highest in most stations. Heavy metal concentration in water was compared against the National Quality of Water Standard Malaysia - most of the elements in each station were below the maximum permissible concentration for Class IIA/IIB except for the Mn in Aring, Chalil, Pahi and Krai; and Cu in Koh. This paper summarised the key findings to date - focussing on differences in erosion rates and sediment and water quality, with regards to heavy metal contamination.

Keywords: Erosion, Oil Palm Plantation, Rubber Plantation, water quality