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Quantifying the land use effect on suspended sediment flux within catchments of the Mau Forest Complex, Kenya

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Land use affects sediment yield in the headwaters of the Sondu River basin in Kenya's largest remaining tropical montane forest, the Mau Forest Complex. Streams containing sediments originating from eroding cultivated land or unpaved roads can lead to on- and off-site effects that have economic and social impacts. The Sondu River drains into Lake Victoria, the second largest fresh water lake in the world, which is an important water resource for five countries and the source of the River Nile.

East African streams are often characterized by high concentrations of suspended sediment, however, the availability of sediment yield data is severely limited. Within Kenya, there are only a few studies. Here, we report on a unique, four-year, high temporal resolution turbidity monitoring suspended sediment dynamics data set (10.2014 – 12.2018) which we use to assess temporal and spatial variability within three catchments (27 – 35 km^2) under distinct land uses (natural forest, smallholder agriculture and tea/ tree plantations). As a surrogate for total suspended sediments, turbidity was calibrated by using an *ex-situ* suspended sediment increment suspension method. The outlet of the natural forest catchment had the lowest suspended sediment concentrations (33.75 ± 87.15 mg L^{-1}) followed by the tea/ tree plantation (49.32 ± 97.59 mg L^{-1}) and highest concentrations were observed at the outlet of the smallholder agricultural catchment (122.92 ± 184.43 mg L^{-1}). Annual rainfall varied from 1677, 1580 and 1445 mm yr^{-1} among the three catchments of the natural forest, tea/ tree plantations and smallholder agriculture, respectively. Catchment runoff coefficients (annual runoff/ annual rainfall) ranged from 0.3 for the natural forest and 0.4 for both agricultural catchments. Sediment catchment yields showed seasonal variations in all three catchments with highest seasonal yields (3.52 – 142.05 t km^{-2} mth^{-1}) during the long rains (Apr – Jul) and lowest yields (0.01 – 1.78 t km^{-2} mth^{-1}) during the start of the long rains (Mar), closely followed by discharge and rainfall patterns during the four year observation period. The high-resolution data set showed that the catchment under smallholder agriculture had the highest sediment yields when compared to the catchments under tea/ tree plantation and natural forest (96.1, 39.0 and 17.9 t km^{-2} yr^{-1}, respectively). The study indicated the importance of keeping natural forest ecosystems and managing agricultural systems to protect water resources from sediment pollution.