Impacts of Climate and Land Use Changes on Water Quality in Sironko Catchment, Mt. Elgon

Surface water and rain fed agriculture underpins livelihoods in Sironko catchment. Hence, this study determined the impacts of climate and land use changes on water quality in Sironko catchment. Water quality were monitored from January to December 2018 following standard procedures. Land use and Land Cover Change (LULCC) maps of Sironko catchment 1986-2016 and 2016-2040 were developed as detailed in chapter five. Baseline 1980-2009 and future scenarios 2025-2040 climate were derived as explained in chapter six. The climate and LULCC scenarios were used to simulate streamflow, Total Suspended Solids (TSS), Total Nitrogen (TN), and Total Phosphorus (TP) loads using the Soil and Water Assessment Tool (SWAT). Mean values of monitored parameters were compared against the Uganda National Bureau of Standards (UNBS) guideline. Repeated measured t-test was employed at $p < 0.05$ level to determine any significant seasonal difference in water quality. Trends and trend magnitudes were determined using the Mann–Kendall trend test and Sen's slope estimator and p-values of trends were generated using liner regression. One-way sample t-test was used to confirm any significantly different in baseline and future scenarios 2025-2040 streamflow, TSS, TN, and TP. The contribution of climate and land use changes on streamflow, TSS, TN, and TP were computed using a 2^2 matrix regression model. Result shows that agriculture; forest; and wetland were reduced by 8%; 32%; and 20%, respectively between 1986 and 2000. But between 2000 and 2016, forest and wetland increased by 84% and 5%, respectively while woodland and agriculture decreased by 43% and 13% respectively. From 2016 to 2040, built-up areas will increase by 74 %; agriculture by 5%; and grassland by 2%; while wetland will decrease by 9% and woodland by 7%, respectively. MAM rainfall was/will be less variable $20 < CV$ or moderately variable $20 < CV < 30$ while SON rainfall was/will be highly variable $CV > 30$. No significant trends were detected in seasonal rainfall while annual rainfall will increase at $p < 0.05$ in Kumi and Nakapiripirit stations between 2025 and 2040. Increasing trends at $p < 0.05$ have been detected in mean temperature between 1980 and 2009 and between 2025 and 2040. Fecal Coliform was above UNBS limit while seasonal differences were detected at $p < 0.05$ for pH, EC, TP, and DO. Between 2025 and 2040; climate change will increase streamflow at $p < 0.05$ more than LULCC under both RCP 4.5 and RCP 8.5 while LULCC will have a stronger signal on TN at $p < 0.05$ under both RCP 4.5 and RCP 8.5. Local communities should improve on their hygiene, sanitation, and waste disposal mechanisms while they also adapt to and mitigate the impacts of climate and land use change on water quality in Sironko catchment.