

Abstract

Soil and Water Assessment Tool (SWAT) was used to model the impacts of land cover changes on stream flow regime in the Thiba River basin covering a surface area of 1648 km² in central region of Kenya. The basin is characterized by intensive agricultural activities including the largest rice irrigation scheme in Kenya. A study was undertaken to test the capability of the model in predicting stream flow response under changing land use conditions in a typical tropical river basin. Classified land use maps of 1984, 2004 and 2014 were analyzed to investigate land use changes in the basin. Field based survey, National Irrigation Board (NIB), Kenya Meteorological Department and Water Resources Management Authority (WRMA) provided hydro-meteorological data for the study. The results of the study shows that forest cover in the Thiba River basin has decreased by 18.39 % between 1984 and 2014 while area under rice cultivation increased by 9.38 % in the same period. The SWAT Model results showed that there is a significant relationship between the observed and simulated average monthly stream flows in the Thiba River Basin. The Nash-Sutcliffe Efficiency (NSE) and coefficient of determination (R²) during calibration period (1983-1988) were 0.82 and 0.9, respectively, while for the validation period (1989-1993) they were 0.79 and 0.87, respectively. The average monthly stream flows increased by 6.01 m³ /s during the wet season and decreased by 1.92 m³ /s during the dry season. The changes in stream flow were attributed to the land cover change and rainfall variability. About 35% of dry season flow and 3% of wet season flow was found to have been directly abstracted from the Thiba River. The study recommends that the basin stakeholders should optimize utilization of abstracted water to avert future catastrophic stream flow fluctuations, possibly flooding during the wet season and low or dry riverbeds during the dry months. The high water demand in the dry months can be met by constructing water storage reservoirs to harvest the high runoff during the wet months. Also, it's important that further research on impact of climate change be conducted to better understand the relationship between catchment hydrology and climate change.