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Understanding the Impacts of Climate Change in the Tana River Basin, Kenya

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In the Tana River Basin in Kenya, the impacts of climate change will be superimposed onto a complex land-use, built infrastructure and an intricate socio-political history. To better understand the possible impacts of climate change seven Regional Circulation Models (RCMs) simulating two Representative Concentration Pathways (RCPs) (i.e. 4.5 and 8.5) were used as input to the Soil and Water Assessment Tool (SWAT) hydrological model to determine the possible implications for the hydrology and water resources of the basin. Four hydrological characteristics – water yield, groundwater recharge, base flow and flow regulation - were determined and mapped throughout the basin for three 30-year time periods: 2020-2049, 2040-2069 and 2070-2099. Results were compared with a baseline period, 1983-2011. Annual catchment average rainfall in the baseline period is 640 mm divided between two main rainy seasons. It is projected to increase to 777 mm and 895 mm, with earlier onset of both rainy seasons, by the end of the 21st century under RCP 4.5 and RCP 8.5, respectively. Annual average outflow from the basin for the baseline period is 6,377 Mm3 and this is projected to increase to 13,636 Mm3 (113.8%) and 20,394 Mm3 (219.8%) by the end of the 21st century under RCP 4.5 and RCP 8.5, respectively. Variability and extreme flood flows are also projected to increase significantly under both RCPs. All four hydrological characteristics show steady increases under both RCPs for the entire basin but with considerable spatial heterogeneity and greater increases under RCP 8.5 than RCP 4.5. The results have important implications for the way water resources in the basin are managed. It is imperative that water managers and policy makers take into account the additional challenges imposed by climate change in operating built infrastructure. In particular the more extreme floods and greater variability requires more flexible and integrated management of the dams in the basin. Changes in built infrastructure needs to accompanied with investment and maintenance of natural infrastructure with greater recognition of the range of ecosystem services provided by the latter and in particular, how these affect the performance of built infrastructure.