Abstract

Climate change and deforestation are increasingly depleting the little “blue water” available in streams and groundwater in most tropical lands by increasing evapotranspiration and depleting plant water (“green water”). Green Water Saving (GWS) schemes are innovative pro-poor mechanisms suggested to mitigate climate risks and impacts, and alleviate poverty in Arid and Semi-Arid Tropics (ASATs). This study assessed: (i) past, current and future variations of the micro-climate and land use/cover in Bwathonaro and Muooni Catchments of Eastern Region of Kenya; (ii) the blue water balance in the selected catchments; (iii) drivers to farmers’ vulnerability to water disasters; (iv) efficient and effective adaptive strategies put in place by farmers to curb water disasters; and (iv) the cost-efficiency and recovery of investments in GWS schemes under conditions of drought and flood in a watershed. A quasi-experimental design was used to assess formal GWS schemes going on in Bwathonaro Catchment versus informal ones implemented in Muooni Catchment. Empirical tools of scientific research included a survey of 272 farms, 50 in-depth interviews, 2 Focus Group Discussions and an extensive literature review. Analytical techniques involved time series forecast of selected hydroclimatic variables and of the water balance from 1965 to 2030 using SPSS and MS Excel spreadsheets and the WEAP tool; LULCC spatial models using ILWIS and ArcGIS software; HERAM, VCA and VCA+ tools; SWOT, PESTLE and PMR analylitical tools; HEI and BCA mathematical models and CVM econometric models. Results indicate that Muooni catchment is re-greening though warming at 0.8 to 1.2oC in a century under the effects of agro-forestry and rainfed agriculture within what seems to be like a “natural forest”, while Bwathonaro experiences a cooling of more or less 2oC in a century triggered by high urbanization rates of 640% in 35 years. These trends are accompanied by decreased rainfall of about 30 to 50 mm per century and decreased discharges ranging from 0.01 to 0.05 m3/s. Consequently, the prediction of blue water balance revealed catastrophic situations by the year 2030, high rates of unmet water demands and low rainfall inputs undermining farmers’ innovations to worsen their vulnerability to drought. Though environmentally needed and socially accepted, GWS schemes are inefficient and unprofitable in agriculture, thus questioning their economic feasibility in Eastern Region of Kenya. To achieve high efficiency levels under any hydro-climatic condition, the study recommended (i) enhancing local watershed institutions’ capacity; (ii) achieving a consensual agreement between upstream and downstream farmers to enable fair Payment for Watershed Services (PWS); and (iv) designing contingent water disasters’ plans.