

Title: Effects of land use and land cover changes on the hydrology of Weruweru-Kiladeda sub-catchment in Pangani river basin, Tanzania

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Abstract: Land-use and land-cover changes have negative consequences on watershed management in Pangani River Basin. They increase impervious ground surfaces, decrease infiltration rate and increase runoff rate, hence causing low base flow during the dry seasons. Comparatively, little is known on the driving forces that affect land-use change and their effects on the hydrology of Weruweru-Kiladeda Sub-catchment. This study, was undertaken to achieve four specific objectives, namely i) to determine the land-use/cover changes in Weruweru-Kiladeda Sub-catchment between 1990 and 2009; ii) to identify factors contributing to land-use changes in Weruweru-Kiladeda Sub-catchment; iii) to identify the hydrological response of the sub-catchment to land-use/cover change; and iv) to investigate the measures taken to mitigate the negative effects of land-use/cover change in the sub-catchment. Satellite data was integrated in GIS to examine the extent of land-use and cover change in the sub-catchment. Through a GIS overlay of land-use type, a topographic index distribution of each land-use type was created. Both quantitative and qualitative data were used for this study. Various data types such as socio-economic data, land-use data, rainfall data and river flow data were collected in order to supplement information from landsat images. Analysis was done using classified landsat images of 1990, 2000 and 2009. SPSS and Ms Excel were used to analyse descriptive data. The study revealed a significant change of land-use/cover between 1990 and 2009 with a subcatchment- wide increase in urbanization (15%), shrub (1.9%) and bare land (3%), and a decrease in forested land (1.9%) and agricultural area (7.8%). Environmental degradation, resource use conflicts, erosion, deforestation and decreasing river discharges were some of the key outcomes of land-use change. These are coupled with demographic changes, institutional factors, socio-economic transition, traditional and climate variation. Trends in river flow indicated predominantly low dry season flows and peak wet season flows between the 1990s and 2009. These changes could be attributed to spatial decrease in forest and shrub land areas that occupied upper sub-catchment over the study period. This situation has strong implications to water resources management in Pangani Basin where conflicts related to periodic water scarcity are increasing. The findings provide a useful support for land-use planning and management. Also, the results provide necessary inputs to decision makers that must balance trade-offs between the positive benefits of land-use change and potentially negative unintended consequences. The study calls for a multidisciplinary approach with a comprehensive view towards the hydrologic processes that maintain ecological health and human requirements for food, water and shelter.