



Effects of land cover change scenarios on storm runoff generation in the Nyando River Basin, Kenya

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Abstract: This study evaluated the effects of land cover change scenarios on the generation of storm runoffs using synthetic storm events, as a basis for catchment management and restoration efforts. The conceptual scenarios were formulated considering the general trends of previously detected land cover changes, and represented spatial alternatives that vary between almost full deforestation and reforestation. The synthetic storm events were selected based on the climatological rainfall patterns and assumed to have the same durations corresponding, approximately, to the times of concentration of the sub-catchments of the basin. The effects of the scenarios on storm runoff were subsequently assessed using hydrologic models employing a physically based lumped approach. The model estimates were evaluated relative to the simulated values of the actual land cover state in 2000 to understand the most appropriate scenario, and how the basin would respond if the options were to be adopted for the respective regions. The result obtained indicated that a largely agricultural (86%) land cover scenario would increase flood runoffs by about 12%, while an agricultural and forested land cover scenario with about 40% and 51%, respectively, reduced storm runoffs by about 12% relative to the land cover state in 2000. Alternatively, a scenario depicting a largely forested (78%) land cover was likely to reduce the volume of flood discharge by about 25% according to the model output. A majority of sub-catchments within the lowlands indicated that an agricultural-forested scenario would be the most appropriate for flood runoff management. The simulated results also showed that the storm runoff volumes were likely to reduce by about 15% if the appropriate land cover scenario for the respective sub-catchments were to be adopted. In general, this contribution tested land cover regulation as a soft option for flood runoff management. The results obtained are hence imperative in understanding the possible flood runoff bandwidth consequent of such land cover changes within the vulnerable river basin.

Keywords: land cover scenario; synthetic storm; hydrological model; runoff generation; land-use regulation; Nyando basin