



Modelling land use/cover change scenarios in a transboundary catchment

Stanley Chasia¹, Luke Olang², Lewis Sitoki³, and Mathew Herrnegger⁴

¹Department of Geoscience and Environment, Technical University of Kenya, Nairobi, Kenya (stanley.chasia@tukenya.ac.ke)

²Department of Biosystems and Environmental Engineering, Technical University of Kenya, Nairobi, Kenya (luke.olang@tukenya.ac.ke)

³Department of Geoscience and Environment, Technical University of Kenya, Nairobi, Kenya (sitoki@hotmail.com)

⁴Institute for Hydrology and Water Management (HyWa) BOKU, Vienna, Austria (mathew.herrnegger@boku.ac.at)

Changes in land use/cover are among the most important anthropogenic transformation on the physical environment affecting proper functioning of the earth system. Hitherto, land characterization has often been studied using archived satellite data products to understand trends in space and time. However, due to future uncertainties in land use change in developing countries and the associated impacts on the physical environment, there is need to model these changes at a local scale. A modelling framework to simulate empirically quantified relations between land use and its driving factors was used in the Sio-Malaba-Malakisi catchment between Kenya and Uganda. Changes for the catchment were simulated for a period of 30 years (2017 – 2047) using model parameters that define location characteristics, spatial policies, area restrictions, land use demand and conversion elasticity settings. Elevation, slope, population density, soil organic carbon, soil CEC and precipitation were potential factors selected to evaluate the suitability of devoting a grid cell to a land use type using a stepwise regression model. The scenarios evaluated include first growth, slow growth and an urbanization scenario. The high ROC value in all statistical tests (>0.72) indicated that the spatial distribution of some land use types in the basin could be explained by the selected driving variables. In a fast growth scenario (under policy restriction), areas under open soil and shrubland would be converted to cropland when demand for cash crop goes up in the region. Areas under open trees and marshland outside protected zones, would be converted to agricultural land while barren land with rock outcrops would remain largely unchanged over the period. In a slow growth scenario, expansion of the area under cropland would follow historical trend at 1.25% growth per annum. Marshland areas unsuitable for agricultural expansion are projected to remain the same. In an urbanization scenario, built-up areas would increase steadily at >1% per annum especially in areas earmarked for infrastructural development. In all the scenarios explored, topography, precipitation, soil characteristics and population density were identified as the key drivers of land use change. Results of this study would enhance the understanding of the complexities in projecting future land cover changes and provide baseline data for supporting ongoing soil and land management programs in a data scarce area.

Key words: Land use change; CLUE-S model; Scenario analysis; Sio-Malaba-Malakisi catchment; Transboundary basin