PhD Project:

Modelling Hydrological, Economic and Governance Aspects of Water Allocation in the Lake Naivasha Basin, Kenya

Background

The world is facing growing challenges in maintaining water quality and meeting the rapidly growing demand for water resources. The challenge is more severe for developing countries where water is becoming increasingly scarce due to the globalized economy, population growth, and climatic variability. Absences of adequate regulating institutions for efficient water management and allocation worsen the problem; as a result, water is available to users at no cost or heavily subsidized price. So, users have no incentives to conserve water and it is often overused or wasted instead of treated as scarce resource. This led to increased demand for institutional and policy reform for efficient allocation of water resources across users and sectors. However, suitability of these institutions and their likely effect on the hydrological and economic system performance given the volatile water supply is less studied. This study views the Lake Naivasha Basin in Kenya as hydro-economic system to analyze the hydrological, economic and governance aspects using numerical simulation model. The basin’s economy and the livelihood of its inhabitants are highly dependent on the resources water and land, both of which are becoming increasingly scarce due to population growth and the boom in flower industry and other irrigated agriculture.

Research objectives and methodology

The objective of this study is to assess the hydrological, economic and governance aspects of the water management problem of Lake Naivasha Basin in an integrated modeling approach. Multi-period simulation of the hydrological, agronomic, economic and institutional processes that are relevant for the assessment of water allocation problem is carried out using Hydroeconomic River Basin Model (HERBM) for Lake Naivasha Basin called LANA-HEBAMO. Conventional HERBMs are based on mathematical programming explicitly formulated as aggregate optimization problem that assumes central planning of water use, or the existence of perfectly functioning markets for water use rights. Both assumptions are not realistic in the case of the Naivasha Basin where neither central planning nor water trading exists. To enable policy analysis under the assumption of imperfect institution, we use a decentralized decision process modeled as individual optimization approach based on Multiple Optimization Problems with Equilibrium Constraints (MOPEC), developed by Britz et al. (2013). Parametrizing the model requires extensive data input from hydrology, agronomy, and Economics. For hydrology we use secondary data from University of Twente (ITC), the Netherlands for watershed simulation that derives water supply in the basin, and for agronomic and economic data we use information from literature. Survey data collections were also conducted among irrigation farms in the Basin in 2012 and 2016 to collect additional agronomic and economic data.