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Abstract: We use an integrated hydroeconomic model for Lake Naivasha Basin, Kenya (LANA-HEBAMO) to analyze the impact of institutional and biophysical changes on resource allocation and water system performance. An extended mathematical programming approach called MOPEC (multiple optimization problems with equilibrium constraint) is used. This approach allows each economically independent water user to maximize its own objective function subject to another agent's water use decisions as well as other biophysical and institutional constraints. MOPEC is an individual optimization approach and avoids unrealistic assumptions in aggregate optimization that assume omniscient decision maker with perfect foresight to reallocate water such that the water related benefit of the entire basin is maximized. We compare simulation results from this individual optimization approach to the classical aggregate optimization using two institutional scenarios for water use regulation – unregulated water use and tradable water rights. Market clearing for tradable water rights is used as an equilibrium constraint (variational inequality). The model is represented by three sectors: Agriculture, Municipalities and Reservoir Managers and calibrated using Positive Mathematical Programming (PMP). Stochastic random draws from historical monthly precipitation are used to drive water inflows to the Basin. The model solves in recursive dynamic mode in monthly and annual time resolutions. The results illustrate that a model based on decentralized decision approaches using multiple optimization problems is important to realistically simulate agents' behavior in water resource management in a river basin setting.

***Keywords**:* Hydroeconomic; MOPEC; Water trading; Irrigation; Agriculture; Kenya