



Valuing investments in sustainable land management using an integrated modelling framework to support a watershed conservation scheme in the Upper Tana River, Kenya

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We analyse the multiple impacts of investments in sustainable land use practices on ecosystem services in the Upper Tana basin (Kenya) to support a watershed conservation scheme (a “water fund”). We apply an integrated modelling framework, building on previous field-based and modelling studies in the basin, and link biophysical outputs to economic benefits for the main actors in the basin. The first step in the modelling workflow is the use of a high-resolution spatial prioritization tool (Resource Investment Optimization System – RIOS) to allocate the type and location of conservation investments in the different subbasins, subject to budget constraints and stakeholder concerns. We then run the Soil and Water Assessment Tool (SWAT) using the RIOS-identified investment scenarios to produce spatially explicit scenarios that simulate changes in water yield and suspended sediment. Finally, in close collaboration with downstream water users (urban water supply and hydropower) we link those biophysical outputs to monetary metrics, including: reduced water treatment costs, increased hydropower production, and crop yield benefits for upstream farmers in the conservation area. We explore how different budgets and different spatial targeting scenarios influence the return of the investments and the effectiveness of the water fund scheme. This study is novel in that it presents an integrated analysis targeting interventions in a decision context that takes into account local environmental and socio-economic conditions, and then relies on detailed, process-based, biophysical models to demonstrate the economic return on those investments. We conclude that the approach allows for an analysis on different spatial and temporal scales, providing conclusive evidence to stakeholders and decision makers on the contribution and benefits of the land-based investments in this basin. This is serving as foundational work to support the implementation of the Upper Tana-Nairobi Water Fund, a public-private partnership to safeguard ecosystem service provision and food security.