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Integrating institutions into a socio-hydrological model: an example for water quality management in Burkina Faso

Gemma Carr¹, Marlies Barendrecht¹, Liza Debevec², and Bedru Balana³

¹Institute of Hydrology and Water Management, TU Wien, Vienna, Austria

²Global Water Partnership, Stockholm, Sweden

³International Food Policy Research Institute (IFPRI), Abuja, Nigeria

The variety of demands that people place on water resources, coupled with the dynamics of the natural system, make water resource management highly complex. Models that can integrate aspects of society such as institutions, perceptions and behaviors along with aspects of the natural system such as rainfall, runoff and water quality could offer a realistic approach to better understand and manage these complex systems. Much research progress in the development of such socio-hydrological models has been achieved in recent years. However, many gaps exist on how the decisions and actions of institutions and agencies, and their subsequent impacts on individuals, can be integrated within such models. In this study, a socio-hydrological model was developed using a set of empirical field data from the Black Volta (Mouhoun) watershed in south west Burkina Faso. Cultivation of the riparian zones and use of agrochemicals are commonly associated with increased sedimentation in the river and water pollution, respectively. The model aims to capture the relationships between agency support for water quality management, the capacity of local organizations to support farmers and land users, land use changes in the riparian zones, improved agricultural practices employed by farmers (e.g., reduced tillage, organic farming, or cultivating tree crops rather than vegetables), and suspended sediment concentration in the river as an indicator of water quality. The model is set up to reflect the current situation and scenarios are generated depicting plausible pathways to achieve improved water quality through riparian land management strategies. Comparison of the modelled scenarios shows that water quality could be improved if institutional support and public resource allocation for water management is raised, and the capacity of local level organizations is substantially increased compared to current levels. Semi-quantitative socio-hydrological models, such as the one developed in this study, may provide insights for the comparison and prioritization of different management strategies and guide interventions or support mechanisms that enable riparian land users to change their agricultural practices and lead to water quality improvements.