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The Dynamics of Land-Use Change in Kilombero Valley Floodplain Wetland: An Agent Based Modelling Approach

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Abstract

Floodplain wetlands, such as those of the Kilombero Valley Floodplain (KVFP), are endowed with a productive natural resource base, fertile land, reliable water availability and extensive pastures. Shared by Kilombero and Ulanga districts, the valley supports a plethora of socio-economic activities. It also remains the major focal area for the Tanzanian government particularly in its bid to transform the farming system and eradicate poverty in the country. However, in recent decades, prompted by different economic, social and environmental disturbances, land-use change through rapid expansion of crop-land and grazing-land (especially, after the immigration of agro-pastoralists with their oxenisation technology) and commercial agriculture endeavours at the expense of wetlands is threatening the stability of the system and triggering recurrent conflict of interest between different users.

Arguably, the observed dynamics of land-use and land cover change in KVFP is the result of the interplay of individual decision making and the natural systems that operate across a range of temporal and hierarchical spatial scales. Given this complexity, we are developing an Agent Based Model (ABM) that integrates both the agent's decision making mechanism and biophysical process of wetlands through specification of feedback and interdependencies among agents and their environment at landscape and regional scale.

Herein, as the first step in system conceptualisation of ABM, we present the empirical characterisation of agents and their behaviour. Agricultural Sample Surveys and individual interviews with 304 farmers and other stakeholders are used to elucidate agents' land-use decision-making architecture and a set of rules governing their strategy when allocating means of production to alternative land-use options. Although agents are diverse in terms of experiences, preferences, objectives, abilities, and resources, agent typologies were created to simplify their diversity and reduce decision making complexity at regional scale. More so, we show, once finalized, how the ABM serve as a virtual laboratory to experiment the effect of different policy interventions, management options and climate change on heterogeneous agents, their land-use and the resilience of the wetland landscape of which they are part.

Keywords: Agent based modelling, agent typology, decision making, floodplain wetland, resilience

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