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Modelling Risk and Uncertainty in Flood-based Farming Systems in East Africa

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Abstract

Flood-based farming systems (FBFS) rely on seasonal floods that provide beneficial water and nutrients, but also pose many risks and uncertainties for agricultural production. FBFS are extensive in East Africa, particularly in Kenya and Ethiopia, where they provide food to millions of people, along with many other agro-ecosystems services. Scientists have developed many crop models as important tools for agricultural development, but existing models are difficult to use in FBFS settings, due to the particular water supply characteristics of such systems. Development of new models that produce reliable results in FBFS settings has proven difficult due to system complexity, site-specific differences among different FBFS and lack of adequate datasets to develop and parameterise models. This difficulty is further exacerbated by socio-economic and management aspects that are crucial for system functioning. FBFS models must consider sediment management, infrastructure for water acquisition and social rules for water sharing among FBFS users.

Bayesian Networks (BN) are useful tools for analysing complex systems. They can be used for creating expert-informed probabilistic models that can help overcome the lack of information that is common in agricultural systems such as FBFS. In order to apply a BN informed by available sources of information on FBFS in Kenya and Ethiopia, we held knowledge gathering group discussions with farmers, academics, and practitioners at Mekelle University and Alamata town in Ethiopia, and Kisumu County in Kenya in 2016. Experts were asked to start with a high level discussion to frame the overall BN and identify important influencing factors in FBFS. Thereafter, the participants were engaged in model development to produce graphical models that represented all important relationships. Probability distributions were then estimated using experts' knowledge together with many other sources of information, including the FBFS literature. Initial results indicate the volatility and the maintenance of the flooding system as important factors determining the performance of FBFS of the region.

Keywords: Bayesian Networks, Crop Model, East Africa, flood-based Farming Systems

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