SWAT model application for Irrigation development project in Kenya
– Case study of MWEA Irrigation Scheme, KIRINYAGA County, KENYA –

ケニアにおける灌漑計画に対する SWAT モデルの適用

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1. Introduction

Kenya has a potential of about 540,000 ha for irrigation and about 1.0m ha rainfed for rice production. With improved water harvesting, storage, underground water resource utilization and innovative management technologies, the current irrigation potential can be increased by a further 800,000 ha to 1300 mm (Kenya National Rice Development Strategy 2008-2018 report).

The largest rice production scheme in Kenya is known as MWEA Irrigation Scheme. It was started in mid 1950s as an irrigation scheme that predominantly cultivates rice. The scheme is located about 100 kilometres North East of the capital city, Nairobi. MWEA Irrigation Scheme has a gazetted area of about 12200 Ha of which

Fig.1 MWEA Irrigation scheme location in Kenya

about 8000 Ha has been developed for paddy production. The scheme is served by two main rivers namely Nyamindi and Thiba rivers. The scheme is currently undergoing expansion geared towards increasing rice production. The National Irrigation Board (Kenya) is responsible for maintenance and water management in the main and secondary canals, making of cropping program and land administration. Water Users Association is responsible for water management in the tertiary units, facility maintenance (except roads) and ensuring farmers' payment of operation and maintenance fees.

The objectives of this research are; 1) To analyse water supply amount for new irrigation district by hydrological model, and 2) To estimate increase of rice production by developed irrigation scheme. In hydrological model analysis , SWAT model was applied.

2. Methodology

2-1. SWAT Model Approach

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In light of this envisaged expansion, this research sets out to hydrological model and simulate the new expanded scheme (with the dam component in it) and subsequently model the yield projections.

SWAT (Soil Water Assessment Tool) is a river basin scale model developed by Dr Jeff Arnold for the USDA Agricultural Research Services (ARS) It's a physically based model that incorporated data such as weather, soil properties, topography, vegetation and land management practices to
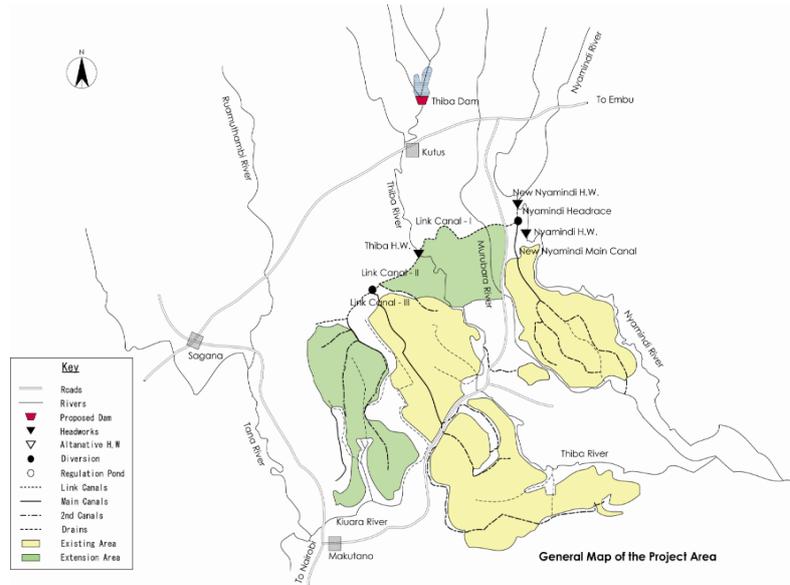

Fig. 1 Project area map; courtesy JICA

continuously simulate watersheds. Thus, it can be used in hydrological simulation and yield projections based on agricultural, information such as crop planting dates, harvest dates, irrigation schedules etc.

2-2. Model Development

The scheme area lies at around 1200m altitude is mainly covered by black cotton soil and partly by reddish brown soil which may have originated from weathered volcanic rocks. The mean annual rainfall in the scheme area is about 900mm (as measured from weather station at Mwea Irrigation Agricultural Development Centre, MIAD) Climatic conditions in this area is characterized by tropical weather dominated by monsoons with two rainy seasons (long rains from April to May and short rains from October to November) In field water management is mainly undertaken by the farmers with coordination from water users association groups.

Relevant softwares and programs (to be used in data analysis and interpretation) and documents reviews are currently underway. Data collection (e.g. specific information about weather, soil properties, topography and land management practices occurring in the research area) are scheduled to be conducted possibly during this summer. The data will then be input to the programs afore mentioned from which calibration, interpretation and analysis of the results will be done.

3. Conclusion

Expected outcomes would include maps and interpreted results/analysis that can be used to make informed decisions in irrigation planning and management in MWEA Irrigation Scheme from models that can dynamically simulate the project area with more accuracy. Recommendations for improvement on land management practices would also be given. This would all aid in achieving the overall goals of the current expansion of the scheme which is to improve the rural livelihoods of smallholder farmers by alleviating poverty through enhancing sustainable income levels from agricultural production.