scaleWAYS

POLICY BRIEF #1
December 2022

Sustainable Intensification of rice production

Introduction

The five countries in the extended Lake Victoria basin (eLVB), Burundi, Kenya, Rwanda, Tanzania, and Uganda are expected to experience significant demographic and economic growth in the coming decades, leading to substantive increases in food demand. One important staple food that could help meeting future food demand in the region, identified by relevant stakeholders in the eLVB, is rice. Consumption of rice has been increasing in the past decade based on increasing import from Asia. In East Africa, several policy efforts have specifically focused on intensifying rice production to improve food security and boost agricultural development in the region.

The ScaleWAYS project assesses the biophysical and economic potentials for sustainably increasing rice production in the eLVB under various future climatic and socio-economic scenarios. We have developed a coupled biophysical-economic optimization model incorporating several rice production systems, management practices, and technical and resources constraints. A challenge likely to increase for rice farmers in the future is the increased frequency and severity of hydroclimatic extreme events such as droughts caused by climate change. Thus, when planning future rice production, the aspect of resilience to these extremes should also be considered.

Our approach

The figure below shows the scaleWAYS approach applied for identifying agricultural practices and technologies for sustainable intensification. An economic optimization model coupled with a biophysical model is used to identify the most appropriate combination and distribution of rice production options to cover the rice demand of the eLVB in sustainable ways.

A localized version of the FAO/IIASA Global Agro-Ecological Zoning (GAEZ) modelling framework calculates rice production potentials in *competitive and productive* cropland under current and future climates for rainfed and irrigated conditions. Competitive and productive cropland

About ScaleWAYS

The project 'Scaling out resilient water and agricultural systems (scaleWAYS) in East Africa' is being implemented jointly by IIASA, the Lake Victoria Basin Commission (LVBC) and the International Crops Research Institute for Semi-Arid Tropics (ICRISAT). The research for development project analyses scaling options for water and land management practices for resilient and sustainable agricultural intensification in the extended Lake Victoria Basin. Informed by local stakeholder's rice and fodder production systems are chosen for gaining an improved understanding of up-scaling and out-scaling of such sustainable practices through model simulations and integrated analysis of political economy aspects, governance, and social and gender dimensions.

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International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

ICRISAT
INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS

JUMUIYA YA AFRIKA MASHARIKI

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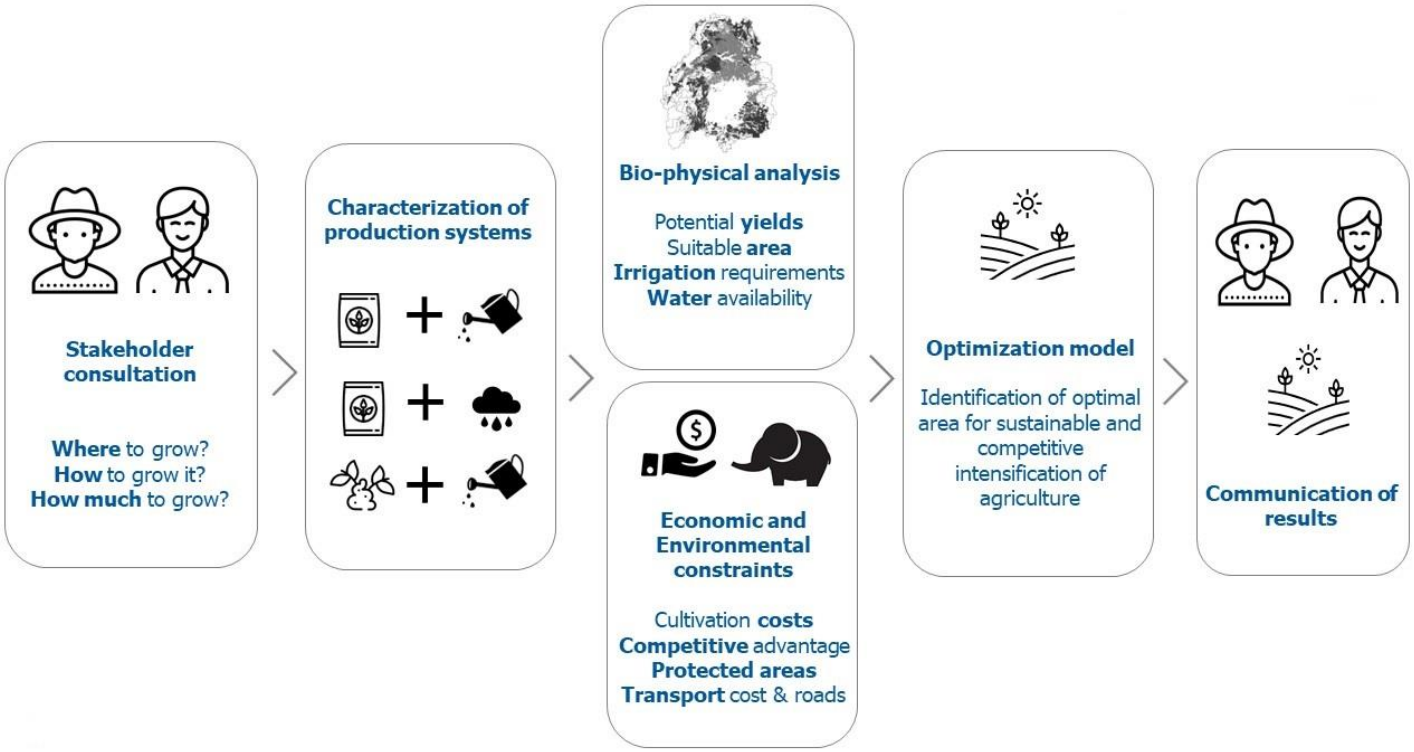

excludes key areas for biodiversity conservation (e.g., protected areas and wetlands), areas where other cereal crops could yield higher economic value (because of higher relative yields and crop prices), and areas marginally productive for rice (where yields were lower than 60% of commonly attainable yields in the region).

We calculate the optimal area and production of rice and related economic profitability, water use and greenhouse gas emissions under different socio-economic and climate scenarios. The economic optimization model maximizes farmer profit subject to several constraints including land suitability, land availability considering the economic profitability of competing crops, level of biodiversity conservation, and rice demand. Model input data includes rice prices, production costs, potential yields and suitable lands, water and fertilizer requirements, and rice demand.

The coupled biophysical-economic model is used to simulate the effects of different scenarios combining different rice demands, environmental constraints, and trade arrangements under average and extreme climate conditions. Using this we derive recommendations for sustainable intensification of rice production. This includes regions where rice production could be increased and policies to guide trade. Future research and development will tackle issues of implementation such as knowledge creation and extension for farmers and technical means of leveraging irrigation potentials and potential adaptations needed to match consumer preferences and producer capabilities.

Opportunities

Modeling results show a range of opportunities for rice production to meet future local demand. The region has sufficient suitable and productive cropland outside of protected areas and wetlands for scaling out rice production to meet local demand. Current and future rice demand in the 2050s can thereby be met using only current cropland extents, where other common crops in the region are not competitive.

The results show that rainfed production is a promising system while irrigation will in some areas play a more important role in mitigating low rainfall and drought conditions. In these years harvests are reduced less in irrigated than in rainfed production systems, challenging the economic viability of rice production. Thus, targeted irrigation is an important adaptation strategy for coping with future increases in climate variability due to climate change.

To ensure production is allocated in regions with highest potentials, trade can play an important role. Notably, market integration significantly reduces the area extents required for meeting local rice demand, reducing the risk of land use change and wetland encroachment. This is because highly productive areas in some countries can supply rice at substantially lower costs than in other countries with lower productivity even after accounting for rice transportation costs.

POLICY RECOMMENDATIONS

Localized assessment of rice production systems

To use the full production potentials of rice in the eLVB it is advisable to assess rice production options locally with farmers. This will help determine biophysical and economic viability on specific farms and plots and increase adoption of sustainable intensification of rice production.

Extension services for sustainable intensification of rice production

Private and public partners as NGOs and farmer organizations, as well can help provide farmers with knowledge needed to intensify rice production. Support to ensure level paddy rice fields is particularly import for farmers to realise the potential of rice cultivation under rainfed conditions. Levelling rice fields improves water use efficiency and is thereby also beneficial for irrigation.

Support a conducive environment for trade of rice in East Africa

The analysis highlights that future demand can best be met in sustainable ways for the entire eLVB when rice production occurs where it is most productive. Trade between the EAC countries will therefore increase the region's competitiveness and self-reliance of the staple food rice.

Assess the needs for irrigation to establish resilient rice supply chains and promote irrigated rice production accordingly

Beyond the results presented here, ScaleWAYS will supply first insights into the ability of irrigated rice production systems to supply sufficient rice under climate variability in coming research articles. In addition to this it is important to monitor and evaluate the resilience of rice supply to climate change by farmers and within local institutions.