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Food System Adaptations in Changing Environments AFRICA

FACE-Africa Project Report

In collaboration with

Alliance Bioversity & CIAT

CGIAR

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MRC Unit The Gambia

UNIVERSITY OF CAMBRIDGE

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Food System Adaptations in Changing Environments AFRICA

Summary of findings

Average **yields of cereals and vegetables** in The Gambia are lower than the West African average and **continue to decline**, requiring **heavy import reliance** to bridge gaps in supply (Figure 1).

Average Gambian **diets deviate widely from targets** for health and environmental sustainability (Figure 3).

There will be a **growing gap** between **future food demand and supply by 2050** if agricultural productivity remains at current levels. However, enhanced agricultural productivity through **increased water and sustainable fertiliser use** and **climate-smart agriculture** would significantly **reduce this gap** (Figure 5).

While The Gambia will have to increasingly rely on food imports to support its growing population, **investments in agriculture** to boost productivity and climate smartness can significantly **reduce this reliance** (Figure 6).

Of **23 adaptation options** identified and **ranked by Gambian stakeholders** for their climate-smartness potential, growing **climate resilient crop varieties**, **intercropping**, applying **integrated soil fertility management**, applying **irrigation** (where possible) and improving **feed production** were the highest-ranking options (Table 1).

While the prioritised **adaptation options** have been shown to be **effective** in other contexts, **trials and evaluations within The Gambia are needed**.

Image credit: Pexels, Blue Ox Studio

Introduction

The Gambian food and land-use system must adapt to increasing food demand and future uncertainties, especially in the face of income and population growth. Climate change is a particular risk that may further complicate producing sufficient food and is already impacting crop yields and livelihoods. While the country's contribution to greenhouse gas emissions is low, it is among the most vulnerable countries to climate change.

The Gambia has been one of the most ambitious low-income countries, with a track record of national and international leadership on climate action. The operationalisation of The Gambia's ambitious climate action commitments in agriculture and food systems could be facilitated by upscaling existing adaptation technologies and practices that could be effective and relevant to the context of Gambian agriculture and food systems. However, decision makers will require country-specific information and tools to evaluate possible strategies and determine which will be most effective for both adaptation to climate change and ensuring sufficient healthy food for the population.

The FACE-Africa project began in January 2020 and will end in January 2023. It was designed to bring together researchers from within and outside The Gambia and with expertise including agricultural science, environmental science and nutrition, to help co-design strategies that will help develop a future healthy and sustainable food system. The following sections give an overview of the tools and products that were developed by the FACE-Africa project to provide decision makers in agriculture and food systems with the information needed to make evidence-based decisions.

Nutrition and sustainability gaps in The Gambia

Cereals and vegetables are important components of Gambian diets and form part of the food culture. Supplying and making these foods available is important for food security. This supply can be achieved through domestic production, importation from other countries, or both. Our research shows that over the last 30 years, average yields of cereals and vegetables in The Gambia are lower than the West African average and continue to decline. Given these low yields, The Gambia relies heavily on food imports from other countries to bridge the gaps in supply (Figure 1).

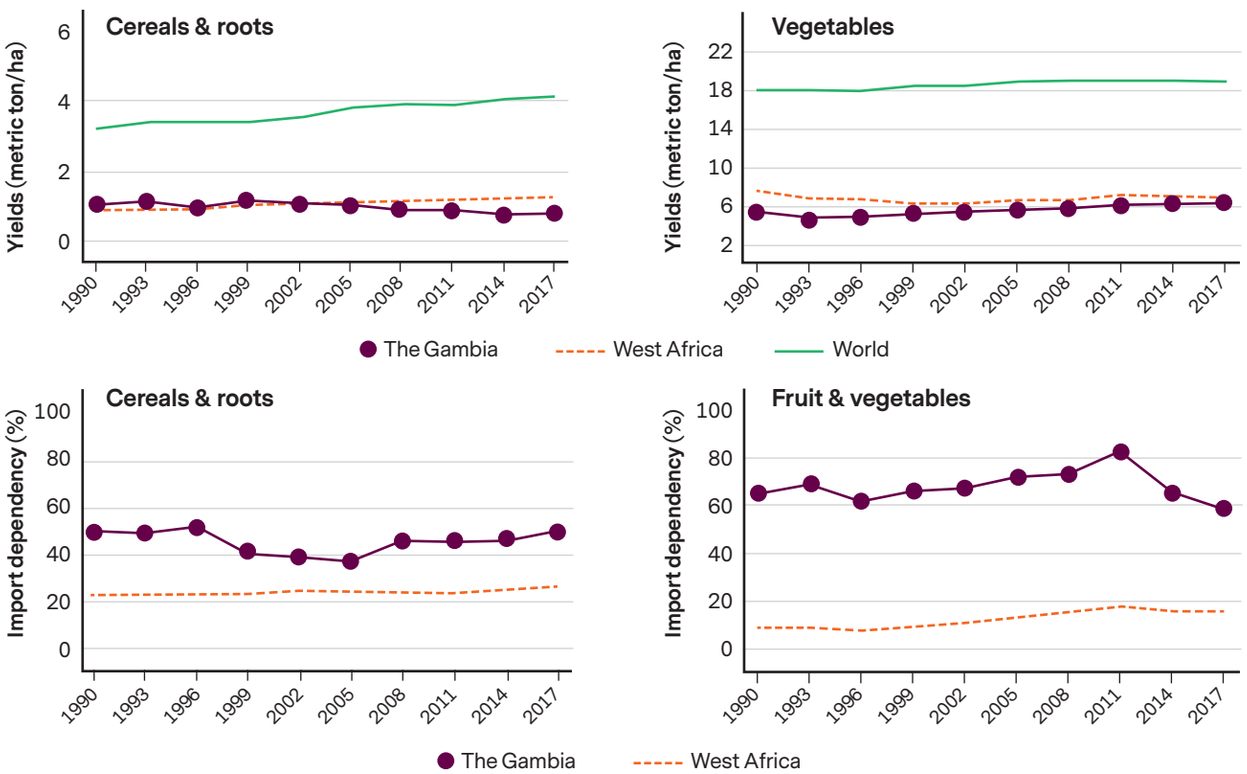


Figure 1 SEQ Figure * ARABIC 1: Gambian (maroon), West African (orange), and global (green) yields of cereals, roots and vegetables, and import dependency of The Gambia and West Africa.

Since 2005, supply of food calories has increased to above the recommended minimum of 2500kcal/person/day in The Gambia. Cereals and roots dominate the total food availability (>56% of total energy), but supply of sugar and oils, which are not very good for health, is also high in The Gambia when compared to the West African region as a whole. However, the supply of nutritionally important fruits and vegetables is lower in The Gambia (Figure 2).

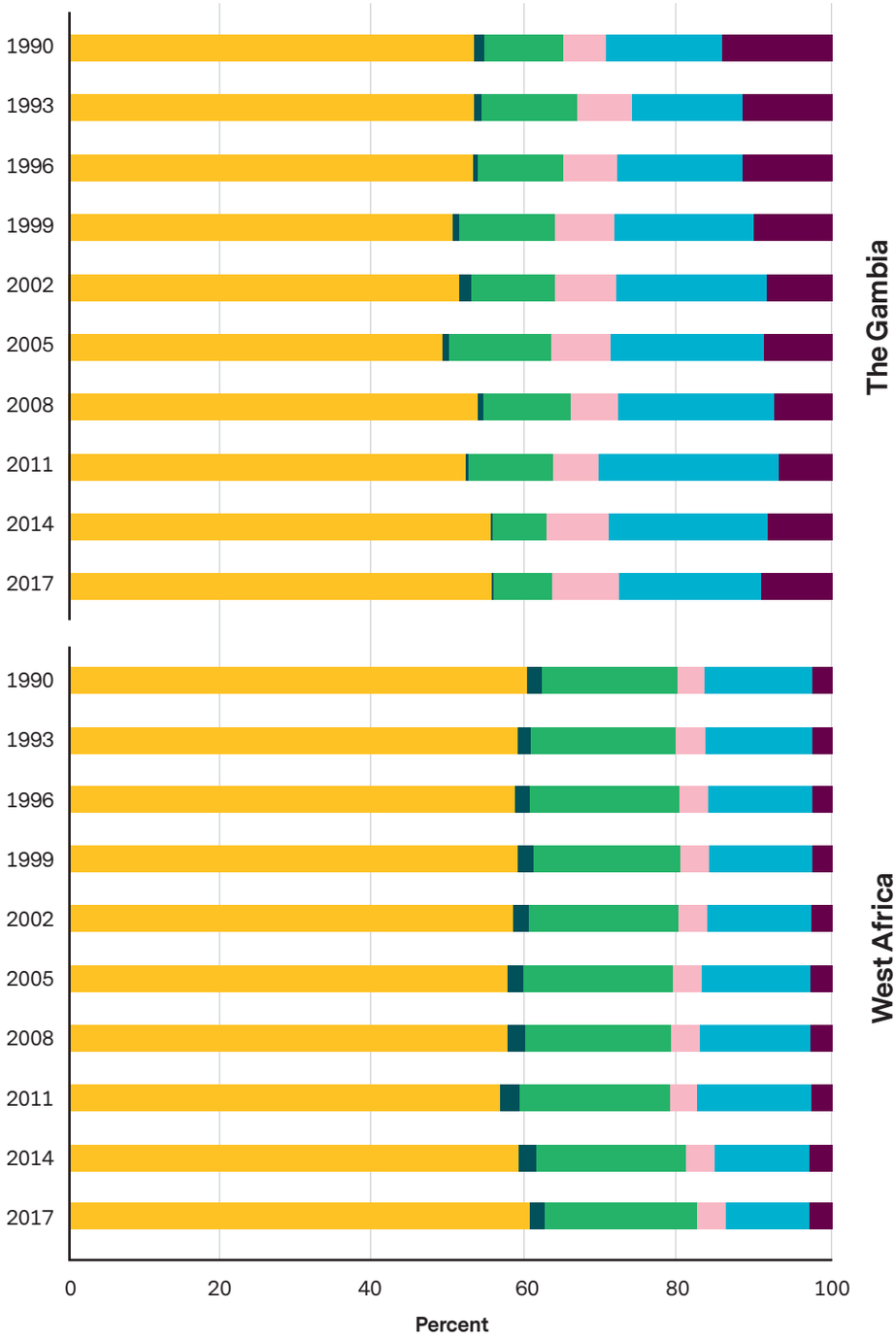


Figure 2: Trends in food supply and availability in The Gambia and West Africa.

- Cereals & roots
- Pulses & nuts
- Fruit & vegetables
- Oils
- Animal sources
- Sugar & sweets

Source of data: FAOSTAT

There are recommendations for how much of various food groups should be consumed to maintain good health without affecting the environment (i.e., "healthy and sustainable foods"). We found that average diets in The Gambia deviate widely from health and environmental sustainability targets; there is high consumption of less healthy foods (refined grains, sugar and oil) and low consumption of nutrient-rich food groups (wholegrains, fruit and vegetables, pulses and nuts). At the same time, Gambian diets are low in some food groups known to be damaging to the environment (such as beef, lamb and dairy) (Figure 3).

Recommendations and next steps

- Food system policy and action in The Gambia should focus on improving domestic food production and reducing reliance on food imports.
- Increase the supply of fruits, vegetables and wholegrains while reducing the intake of refined grains, sugar and oils.

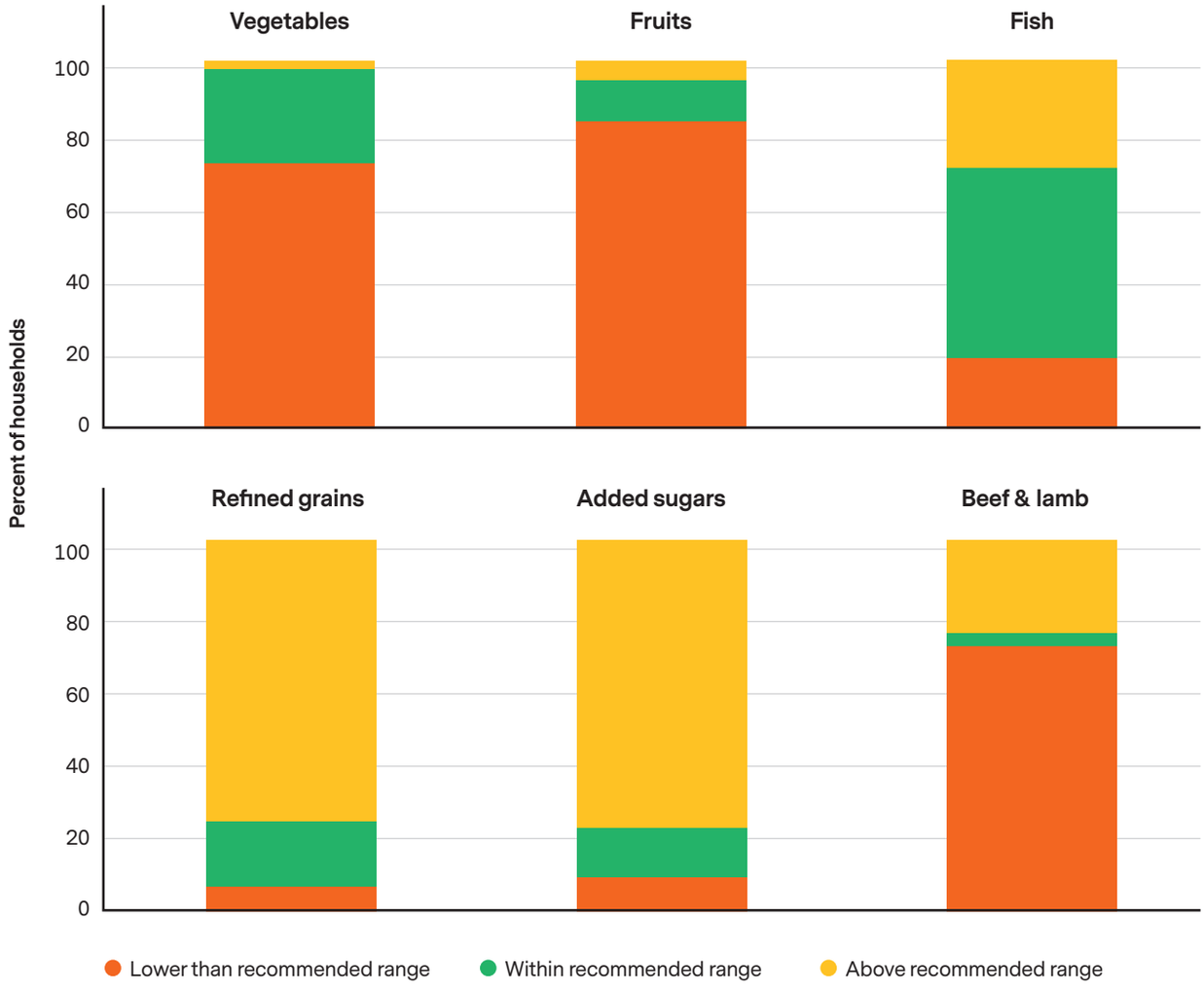


Figure 3: Comparison of average diets in The Gambia to health and sustainability targets.

Future food security under climate change

To investigate how climate change might impact future food security in The Gambia, we adapted an existing global simulator (the FABLE Calculator) to reflect on the Gambian context (FABLE-Gambia). FABLE-Gambia is designed to study the potential evolution of The Gambia's food and land-use systems up to 2050. It assesses the impact of different possible future scenarios (e.g., climate change, agricultural productivity) on key food security indicators to show the achievability of healthy and sustainable diets.

For example, are current agricultural productivity levels and food supply sufficient in The Gambia to ensure that everyone can eat according to the national food-based dietary guidelines that are being developed? If so, will The Gambia's objectives for nutrition security still be possible in the future under various scenarios of climate change, land use, trade, etc?

Using district-level agricultural statistics and existing land cover maps, we created high-resolution land cover and land-use maps of the agricultural areas by crop and management systems in The Gambia (Figure 4). These maps can help to identify locations for targeting intensification or adaptation interventions. Furthermore, we investigated the potential of climate-smart agriculture to increase future yields using published field studies (Carr et al., 2022).

Finally, we explored different possible ways to ensure sufficient production of food to meet increasing demand in The Gambia in the decades to come, based on climate change projections, improvements in crop and livestock productivity, and several climate-smart adaptation options.

Findings: future food security

Our findings highlighted several challenges affecting the food system:

1. There will be a growing gap between future food demand and supply by 2050 if agricultural productivity remains at current levels (the Business As Usual [or "BAU"] scenario). However, enhanced agricultural productivity through increased water and sustainable fertiliser use (the "boost" scenario) and climate-smart agriculture (the "CSA" scenario) significantly reduce this gap (Figure 5).

2. While The Gambia's food imports will have to continue to increase with population growth (Figure 6), investments in agriculture to boost productivity and climate smartness can significantly reduce the required imports.

All results from FABLE-Gambia can also be explored in the FACE-Africa Shiny app. The app could be a useful tool for technical experts, policymakers, researchers, and NGOs working in the food, agriculture, land use, trade, and economics sectors in The Gambia.

Access the FACE-Africa Shiny app here:
https://gambia.shinyapps.io/FABLE/

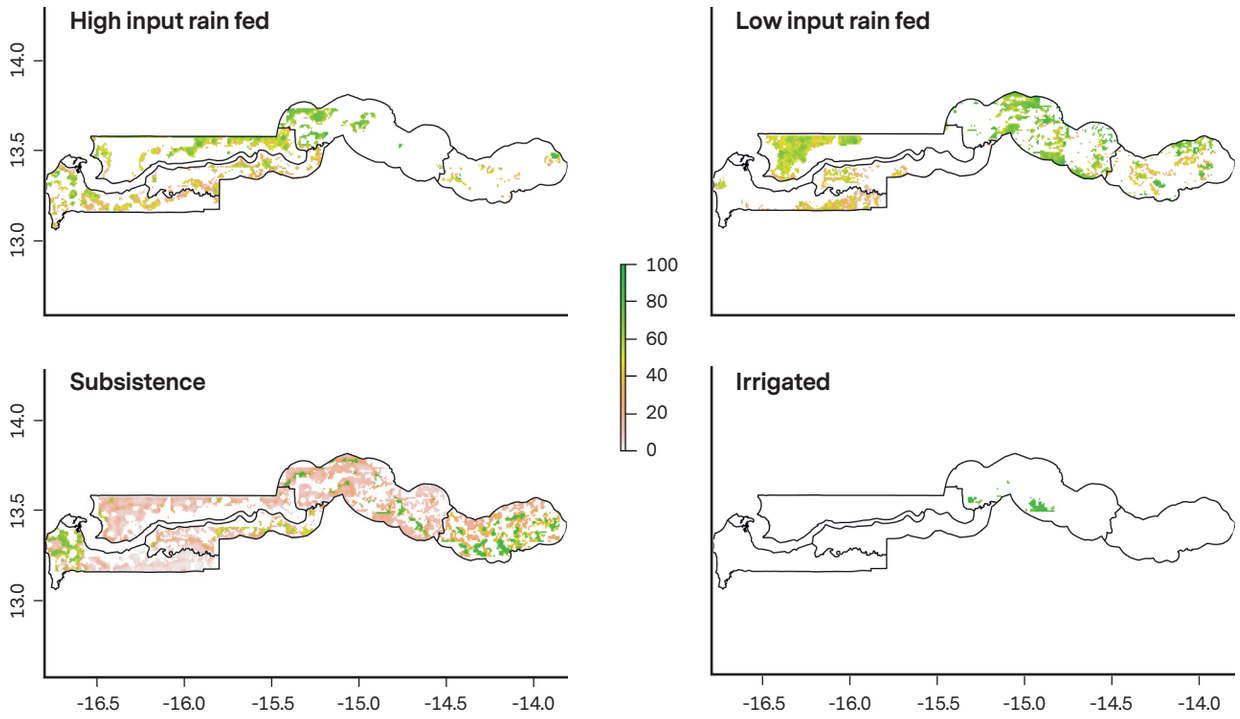


Figure 4: Hectares of cropland area under different management types. Colours indicate the number of hectares under these systems (maximum 100) per pixel, where pink and white indicate only a few hectares, yellow indicates ~50, and green ≥70 hectares.

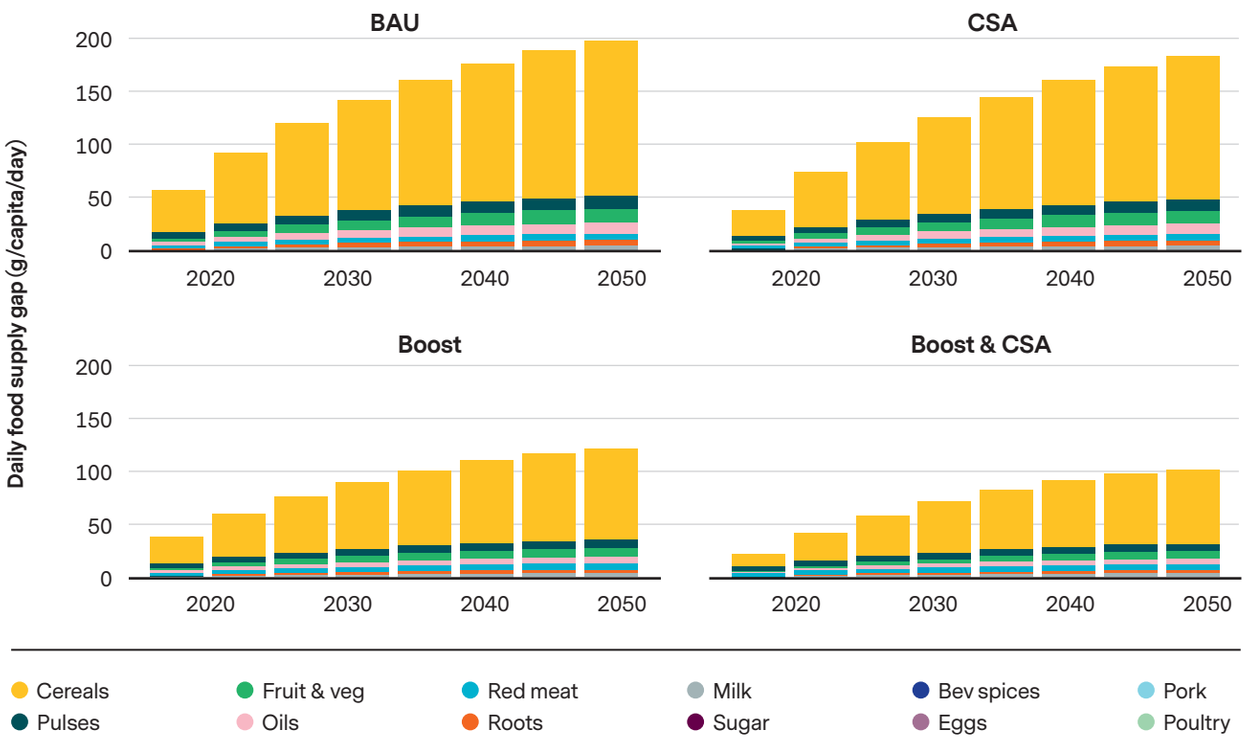


Figure 5: Daily food supply gap (grams/capita/day) under business as usual (BAU) and different strategies to increase production.

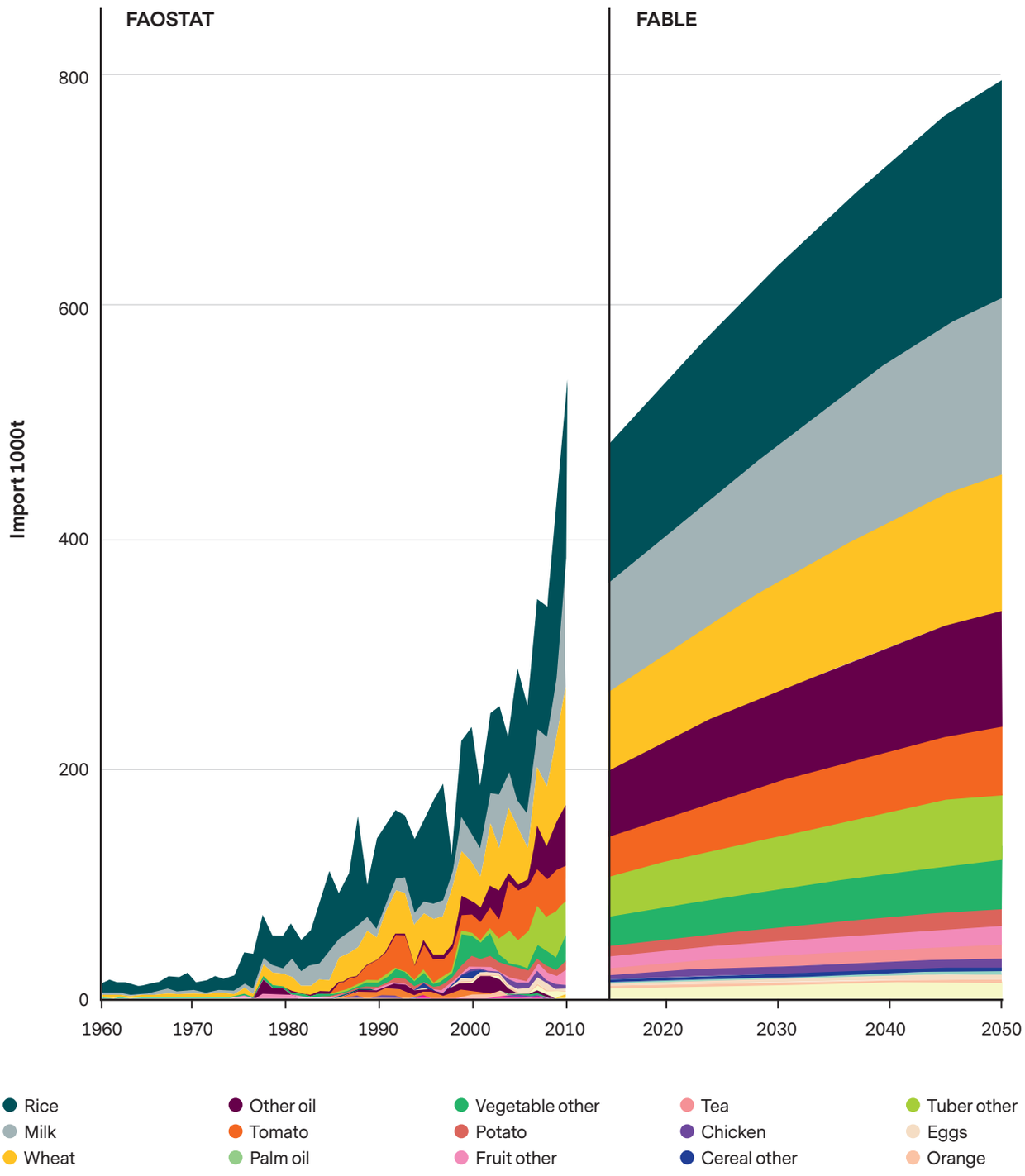
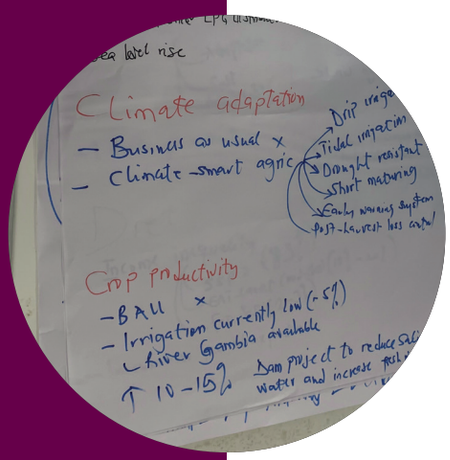


Figure 6: Food imports projections of major products under enhanced agricultural productivity. Import demand is rising even with increased domestic production due to the faster increasing demand of the growing population.

Stakeholder engagement workshop: FABLE Calculator

During a stakeholder workshop organised in The Gambia in June 2022, we consulted with stakeholders from several ministries, departments, and agencies (i.e. FAO-Gambia, Ministries of Agriculture, Health, and Climate Change, The Gambia Bureau of Statistics (GBoS), etc.). Together, we co-developed scenarios of what the Gambian food system could look like in the future. The scenarios that we developed in the workshops, together with national statistics, were used as input for the development of a Gambia-specific version of the FABLE Calculator (FABLE-Gambia).



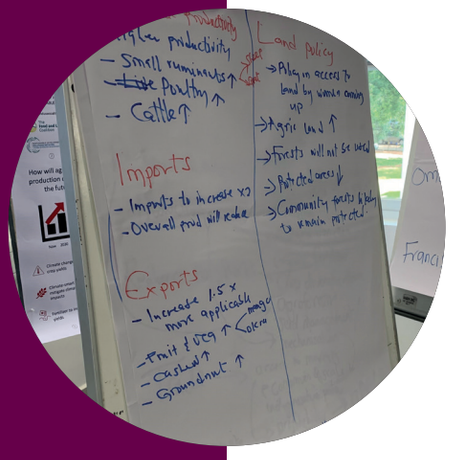
During the stakeholder workshop, all attending experts helped us to improve the modelling of the future Gambian food system by:

- Reviewing the accuracy of the model assumptions
- Plausible applicability of available national data
- Co-developing the scenarios which were used to explore what food people may produce, have access to, and consume in the future.

In multiple, hands-on sessions, stakeholders were able to engage with both FABLE-Gambia and the FACE-Africa Shiny App.

We adapted FABLE-Gambia to better reflect stakeholder views on:

- The current and future drivers of change in the Gambian food and land-use systems.
- The impacts of different agricultural practices (i.e., adoption of climate-smart agriculture, increased crop yields through irrigation and fertilisers).



Climate adaptation for the Gambian food system

Participatory prioritisation of adaptation options

The FACE-Africa team compiled a long list of various possible adaptation options in agriculture and food systems and completed an initial assessment of their climate-smartness potential (productivity, adaptation, and mitigation) in the Gambian context (Segnon et al., 2022).

To identify the priority adaptation options to be tested and scaled up in the context of agriculture and food systems of The Gambia, we developed a hybrid (virtual and in-person) stakeholder engagement approach to prioritise the identified adaptation options, as the COVID-19 pandemic limited traditional participatory research.

An online survey was designed, tested, and administered to key actors from various institutions in The Gambia to capture their ideas on various "long listed" climate change adaptation options in agriculture. The responses were aggregated and consolidated to identify the priority adaptation options.

A final stakeholder meeting saw the results presented back and discussed with stakeholders to ensure that these individual responses reflected their collective perception of adaptation options in The Gambia (Figure 7). Stakeholders shared their opinions on and experiences with each of the adaptation options. During this process, some of the adaptation options were deleted, others were reframed, and a few additional options were added.

Figure 7: Stakeholder meeting to discuss and "rank" priority adaptations, held at The MRC Unit The Gambia, Banjul in June 2022.

Findings: Key adaptations

Considering their adaptation effectiveness, accessibility, and acceptability in The Gambia, the final 23 adaptation priorities were collectively ranked (Table 1).

Five of the identified adaptation options were identified as "key priorities", ranking high in their climate-smartness potential and after collective validation during stakeholder discussions. These included growing climate resilient varieties, using intercropping methods, applying integrated soil fertility management, applying irrigation (where possible) and improving feed production (Table 1).

Findings: limited Gambian-specific evidence for adaptation options

Although there is a useful body of evidence on the effectiveness of the identified adaptation options from other countries and regions, there is a strong need for trials and evaluations of the prioritised options to take place within the Gambian context. These would help inform actionable recommendations for The Gambia.

The FACE-Africa work highlighted that research assessing adaptation outcomes specific to The Gambia is often limited to out-of-date evidence which might not reflect the current biophysical and socioeconomic circumstances of the country. During the process several new adaptation options were identified, which have not yet been described in literature and/or used in field trials. A regular update of the presented work by the FACE-Africa team would be advisable to ensure the list of adaptation options is complete and comprises the latest available adaptation options. In this way, decision makers can reply on high quality evidence for their informed decision making.

Adaptation options	Ranking
Climate-resilient crop varieties Intercropping Integrated soil fertility management Irrigation and improved water management Improved feed production and management	1
System of Rice Intensification Climate information and agro-advisory services Knowledge Exchange/Sharing	2
Integrated Pest Management Improved livestock disease prevention and control Semi-intensive livestock systems Management of soil salinity Improving productivity of animal breeds	3
Crop diversification Farmer Managed Natural Regeneration	4
Changing planting date Livelihood diversification	5
Crop rotation Conservation agriculture Alley farming	6
Contour bunds/farming Stock/herd size management Microfinance & weather-based insurance	7

Table 1: Priority adaptation options for agriculture and food systems in The Gambia, where 1 is most preferred and 7 is least preferred.

Future work

In the next phase of our work, we would like to use the insights of FACE-Africa as presented above to inform future interventions in food systems in The Gambia and the wider West-African region.

1. Generate further evidence for climate adaptation options

- Feed into implementation studies trialling adaptation options in The Gambia and help increase uptake.
- Provide evidence of health and environmental benefits of wider uptake of certain adaptation options.

2. Explore impact of further external factors

- Explore the interregional trade flows, market shocks (e.g., changes in fertiliser prices), and food system dynamics of the ECOWAS subregion.

3. From evidence to practice

- Continue engagement with stakeholders to inform ongoing adaptation projects and policy processes in The Gambia, such as the National Adaptation Planning (NAP) with the findings of FACE-Africa.
- Establish a community of FABLE-Gambia users, with training consisting of several day-long workshops in adapting and using the FACE-Africa products for exploring the impact of climate and global change on the food system.
- Write new scenarios based on government plans, to predict their likely impact on environment, nutrition, and health.

Image credits: Man amongst crops, Pexels, Kureng Workx. Group of Children, Pexels, Shelagh Murphy.

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