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Global Agrifood Systems Outlook to 2050

Keith Wiebe, Nicola Cenacchi, Shahnila Dunston, Sherwin Gabriel, Faaiqa Hartley, Abhijeet Mishra, Richard Robertson, Mark W. Rosegrant, Timothy B. Sulser, Timothy S. Thomas, and Dirk Willenbockel



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Executive Summary

Agrifood systems — comprising the interlinked people, resources, and processes used to produce, transform, transport, and consume food — are changing in remarkable ways, driven by changes in population, income, technology, climate, and many other factors. Preparing for the future requires learning from the past while exploring how the future will differ. Many sources currently provide near-term forecasts and medium-term outlooks on selected aspects of agrifood systems, particularly those related to major agricultural commodities and markets. But information on longer-term agrifood systems challenges is limited — particularly for matters of concern to low- and middle-income consumers, producers, and countries. Helping public and private decision-makers in those countries plan strategically to meet future agrifood systems challenges requires a more comprehensive longer-term outlook.

This report uses advanced modeling tools to explore the likely direction and magnitude of changes in major agrifood systems indicators under “middle-of-the-road” assumptions about long-term changes in drivers. It is important to note that the projected impacts presented here are not forecasts and they are not set in stone. This is because they depend critically on the choices we make today and in the coming years — in terms of daily decisions about what we eat, and in terms of policy and investment decisions that shape how firms and nations use resources, innovate, and trade.

This report presents projections for a wide range of agrifood systems drivers and impact indicators over the next 25 years at global and regional levels. Substantial progress is projected across regions and agrifood systems indicators, but major challenges remain. Notwithstanding a diversity of results across thematic areas, geographies, and commodities, several general themes emerge. Key findings include the following.

Agrifood systems drivers

Population. Population growth was a major factor driving concerns in the mid- to late-20th century about the agrifood system’s ability to meet future demand. But population growth has slowed in recent decades in most regions, and populations have even begun to decline in parts of Europe and East Asia, giving rise to different concerns. At the same time, populations are projected to continue growing rapidly in sub-Saharan Africa and in Central and West Asia and North Africa, adding pressure to agrifood systems in those regions. (Section 3.2)

Income. Along with population, income growth is a major driver of changes in food demand. GDP per capita is projected to increase worldwide between 2025 and 2050, and most rapidly (albeit from lower initial levels) in Asia and sub-Saharan Africa. This combination of low current income levels and rapid projected growth in both income and population suggests that these regions will be major sources of growth in food demand in the coming decades. (Section 3.2)

Technology. Consistent with past experience, productivity growth is projected to be the primary source of increased crop and animal-source food production in most regions between 2025 and 2050, driven by investments in R&D, efficiency gains, and mechanization. Yield growth rates for many crops and livestock are expected to be fastest in regions with low initial yield levels, such as ESA, but in most cases, the regional distribution of yields remains unchanged over time. (Sections 2.2, 3.2, 4.2, 5, and 6)

Climate. Climate change, including changes in temperature and precipitation as well as the frequency and intensity of extreme events, poses major challenges to agriculture and agrifood systems, and these challenges are expected to increase. Areas facing both temperature and precipitation concerns are foreseen in parts of Southern Africa, North Africa, Southwest Asia, East Asia, and North America. These areas are expected to face multiple climate challenges for food production, but with widely differing capacities to adapt. In addition, climate change is expected to increase the frequency of extreme events such as droughts and floods. (Sections 2.3 and 3.2)

Climate change has already slowed growth in crop yields in recent decades relative to what they would have been without climate change, and our projections indicate that this effect will continue in the future. Impacts will vary by crop and location. In the case of rainfed maize, for example, yields are projected to increase by about 20–35 percent in most parts of the world by 2050, although these increases are less than they would have been in the absence of climate change. In contrast, yields of wheat are projected to increase more rapidly than they would have in the absence of climate change, particularly in temperate latitudes. For many crops, climate change impacts on yields are projected to be more severe in low- and middle-income regions than they are in high-income regions. (Sections 4.2, 5, and 6)

Agrifood systems indicators

These changes in population, income, technology, and climate interact through biophysical and socioeconomic processes to drive changes in key agrifood systems indicators.

Food demand. Historically, the share of per capita income spent on food has fallen sharply as incomes rise, and this pattern is projected to continue over the next 25 years. Per capita food demand will grow most rapidly in low-income countries, diets will become more diverse in middle-income countries, and diets will remain relatively stable in high-income countries. Consumption of animal-source foods and oils and sugars is projected to increase in all regions. Consumption of pulses and fruits and vegetables also increases but from lower levels, and remains below dietary guidelines. These trends are expected to have mixed impacts on nutritional outcomes, with improvements in food security accompanied by challenges related to micronutrient deficiency and overweight and obesity.

Total global demand for food commodities is projected to grow by 25–47 percent over the next 25 years, depending on the food group. Total demand for all food commodities grows more rapidly in low- and middle-income countries, especially for pulses and animal products, driven by both faster population growth and more rapid dietary change as lower incomes rise. In contrast, in high-income countries, total demand for most food commodities grows more slowly and even begins to decline by 2050. (Sections 4.1, 5, and 6)

Food production. Driven by changes in demand, production is projected to increase between 2025 and 2050 for most commodities and regions. Overall, the CGSIX regions (that is, CWANA-Central and West Asia and North Africa; ESA-East and Southern Africa; LAC-Latin America and the Caribbean; SA-South Asia; SEA-Southeast and East Asia; WCA-West and Central Africa) currently account for over 75 percent of global agricultural production, and that share is projected to increase slightly by 2050. Production of cereals continues to be led by high-income countries, followed by Asia and LAC. Consistent with past experience, productivity growth is projected to be the primary source of increased crop and animal-source food production in many regions. However, in LAC and sub-Saharan Africa, about half of the increase in production by 2050 is projected to come from an increase in harvested area. (Sections 4.2, 5, and 6)

Food prices. Real prices of most food and other agricultural commodities are projected to rise between 2025 and 2050. This indicates continued pressure on agrifood systems and challenges to improving the affordability of healthy diets. Projected price changes vary widely across individual commodities, but among commodity groups, projected increases are largest for other crops (especially coffee and cacao), roots, tubers, and bananas (RTB) (especially yams and cassava), and oils and sugars (especially soybeans and groundnuts). (Sections 4.3 and 6)

Trade. Driven by these changes in demand and production (as well as prices), the CGSIX regions as a group are projected to more than double their net imports of cereals, oils and sugars, and pulses over the next 25 years, while reducing their net exports of fruits and vegetables and animal-source (including aquatic) foods. However, regional differences are striking. Net imports of all food commodities in aggregate are projected to remain largest in CWANA but to increase most rapidly in sub-Saharan Africa. Net imports in SEA are projected to rise initially and then fall as populations decline in some countries and per capita demand growth slows at higher consumption levels. South Asia is projected to move from being a net exporter to being a small net importer late in the projection period. LAC and the rest of the world are projected to remain net exporters of food and even increase their exports. (Sections 4.4, 5, and 6)

Resource use. Projected increases in production will be generated by a combination of changes in yields and harvested area (both of which are further affected by changes in climate). Harvested area is projected to increase most rapidly over the next 25 years in WCA (driven by expansion of RTB) and LAC (cereals and oils and sugars), followed by ESA (cereals) and Southeast Asia (oils and sugars). Increases in harvested areas indicate pressure for expansion of cropland onto lands formerly in pasture, rangeland, or forest land. These pressures are greatest in tropical regions, giving rise to concerns about increased greenhouse gas emissions and loss of biodiversity, carbon sequestration, and other ecosystem services.

As is the case for land, water use for crop production will be affected by a combination of agricultural demand, competing uses, and climate change impacts, and is projected to increase in most areas by 2050. South Asia and East Africa are projected to experience the largest increases in blue water use (surface and groundwater delivered by irrigation), while parts of WCA and South America are projected to experience the largest increases in green water use (rainfall held in soils and available to plants). These trends raise concerns about sustainability, resilience, and the provision of ecosystem services in some regions over the longer term. (Sections 4.2, 4.5, 5, and 6)

Food security and nutrition. Over the next 25 years, the share of population facing insufficient food availability and access to meet dietary energy requirements is projected to decline globally and in most regions. This will mean stable or declining numbers of people who are undernourished in most regions, except for WCA, where growth in population is projected to outpace improvements in food availability and access. For the CGSIX regions as a whole, the population at risk of hunger is projected to decrease — falling by more than 26 percent to reach 493 million in 2050 — but most of the CGSIX regions are not on track to achieve Sustainable Development Goal 2.1 to end hunger by 2030. Per capita availability of micronutrients is also projected to increase in all regions. Nevertheless, micronutrient levels are projected to remain below recommended levels in many regions. (Sections 4.1, 4.6, and 5)

Employment and income. The agriculture sector is a key source of livelihoods for lower-skilled and vulnerable workers, especially in SA, ESA, and WCA. However, these regions are also where the largest

declines in agriculture's contribution to income are expected, driven mainly by structural change, including improvements to education and technology, increased urbanization, and faster growth in industrial and services sectors. These factors are expected to draw workers away from agriculture to other sectors, resulting in a lower share of agriculture in total employment. By 2050, the share of agriculture in total unskilled labor income is projected to decline by about half to 18 percent in SA, 12 percent in ESA, and 10 percent in WCA. The share of skilled labor income from agriculture is also expected to decline. (Section 4.7)

Implications for policies and investments

This report focuses on the challenges to agrifood systems posed by changes in population, income, technology and climate, and the outlook for major agrifood systems indicators to 2050. These challenges are complex, interrelated, and daunting, not least because they depend on the decisions made by the more than 8 billion people who make choices that affect food systems multiple times every day. But these challenges are not insurmountable, and those decisions are not made in a vacuum. Rather, they are influenced each day by the policy and market environment that shape how we use resources and produce, process, transport, trade, and consume food. That environment includes policies and investments affecting R&D, innovation, resource use, trade, health, and many other dimensions, both within agrifood systems and in other sectors linked to agrifood systems. This analysis shows the agrifood systems interlinkages that are evident today and will remain important in the future across regions, commodities, indicators, impact areas, and over time, as for example, changes in demand for particular commodities in one region affect production and consumption of other commodities as well as the use of land and water resources in other regions. These widespread consequences, many of which are not fully anticipated in decision-making at the national and subnational levels, indicate the existence of trade-offs and synergies between alternative approaches to addressing challenges in any given area, and the importance of an integrated, forward-looking agrifood systems approach to inform the public and private decisions we make today.

Caveats

This report considers some of the major drivers that are expected to drive changes in agrifood systems over the next 25 years, and many of the major indicators that help characterize those changes. But many important aspects could not be included in this analysis. These include other aspects of demographic change (such as aging and migration), technological change (including digital innovation and AI), economic well-being (including poverty and equity), nutrition (including overweight and obesity), social inclusion (including gender and youth), environment (including biodiversity, resource degradation, competition for land, and updated water data), climate change (including variability, extreme events, and impacts on livestock productivity), and geopolitical instability (including conflict and trade disruptions). All of these deserve further attention.

More work is also needed to explore how agrifood systems outcomes projected under the baseline scenario that is the focus of this report might evolve under a wider range of plausible alternative scenarios.

Future work

More work on future agrifood systems pathways and solutions is underway and planned at IFPRI, other CGIAR Centers, and other research institutions to address the gaps noted above. We hope this new work will not only add new dimensions and depth to the results presented in this report, but also engage decision-makers at relevant scales and inform the complex choices they face about the future of agrifood systems.

Acronyms and Abbreviations

Regions

CGSIX	the six CGIAR regions (CWANA, ESA, LAC, SA, SEA, and WCA)
CWANA	Central and West Asia and North Africa
ESA	East and Southern Africa
LAC	Latin America and the Caribbean
LMICs	low- and middle-income countries
ROW	Rest of the World
SA	South Asia
SEA	Southeast and East Asia
WCA	West and Central Africa

Commodity groups

ASF	animal-source foods
CER	cereals
F&V	fruits and vegetables
O&S	oils and sugars
OTH	other commodities
PUL	pulses
RTB	roots, tubers, and bananas

Models

DSSAT	Decision Support System for Agrotechnology Transfer crop model
ESM	Earth System Model
GLOBE	a global computable general equilibrium economic model used in this report
IMPACT	International Model for Policy Analysis of Agricultural Commodities and Trade
MPI-ESM	Max Planck Institute Earth System Model
MRI-ESM	Meteorological Research Institute Earth System Model
SPAM	Spatial Production Allocation Model

CGIAR Centers

AfricaRice	Africa Rice Center
Bioversity	Bioversity International
CGIAR	an international publicly funded agrifood research network
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute

IWMI	International Water Management Institute
WorldFish	World Fish Center

Other institutions

FAO	Food and Agriculture Organization of the United Nations
IIASA	International Institute for Applied Systems Analysis
IPCC	Intergovernmental Panel on Climate Change
ISDC	Independent Science for Development Council
OECD	Organisation for Economic Co-operation and Development
UNEP	United Nations Environment Programme
USDA	United States Department of Agriculture

Other terms

AI	artificial intelligence
CO_2	carbon dioxide (an important greenhouse gas)
GDP	gross domestic product
GEO	*Global Environmental Outlook* report published by UNEP
GHG	greenhouse gas
kcal	kilocalories
NOCC	a no-climate-change scenario used in this report
R&D	research and development
RCP	Representative Concentration Pathway (a type of climate change scenario)
REF	the Reference scenario used in this report
SOFA	*State of Food and Agriculture* report published by FAO
SOFI	*State of Food Insecurity and Nutrition in the World* report published by FAO
SSP	Shared Socioeconomic Pathway (a type of socioeconomic scenario)

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1 INTRODUCTION AND OVERVIEW: Why this report?

1.1 Recent agrifood systems trends and major drivers of change

Agrifood systems — comprising the interlinked people, resources, and processes used to produce, transform, transport, and consume food — have changed in remarkable ways in recent decades. Food demand and production have nearly quadrupled since the 1960s, increasing faster than population, and the abundance and variety of food items available in markets around the world exceed what could have been imagined several generations ago (Reardon et al. 2021; Schneider et al. 2023; Fuglie et al. 2024).

These changes have been driven by a variety of factors, including changes in population, urbanization, and incomes, which together have altered the level and composition of food demand, especially in rapidly growing developing economies (Popkin 2017; FAO 2022). Agrifood systems changes have also been driven by developments in the technologies used to produce, process, and market food, many of which originated outside the agriculture sector (Herrero et al. 2020). While changes in demographics and technology have long been recognized as critical to the evolution of agrifood systems, other drivers of change have become increasingly important in recent decades, including changes in climate and changes in policies affecting trade.

Despite remarkable progress in many areas, changes in how we produce, transform, transport, and consume food have also generated significant challenges. Increases in the abundance and affordability of staple foods and highly processed foods relative to more nutrient-dense foods, combined with lagging income growth among poor populations, mean that healthy diets remain out of reach for many. As a result, micronutrient deficiencies persist alongside overweight and obesity (FAO et al. 2026). The pace of technological change is accelerating, making it difficult to keep up with the (sometimes unintended) consequences of innovation both within and outside of agrifood systems. Depletion and degradation of land and water resources raise concerns about the sustainability of food production and other ecosystem services over the longer term (UNEP 2025). Increasing frequency of extreme weather events and other manifestations of climate change undermine the resilience of producers and consumers alike (Rosenzweig et al. 2026). And uncertainty regarding policies, conflict, and trade heightens concerns about the ability of households and agrifood systems to withstand market shocks (Glauber 2026; Thurlow and Jones 2026). Under these circumstances, better information on these challenges and their implications is needed to support decision-making by policymakers, the private sector, households, and other stakeholders (HLPE 2020).

Agrifood systems trends and drivers of change are discussed further in Section 3.

1.2 Key impact areas of concern

The rising complexity, dynamism, and interconnectedness of agrifood systems means that agrifood systems performance can no longer be measured in terms of the volume of food produced or the number of calories consumed. Instead, national policymakers, researchers, and development partners are concerned with a wider range of agrifood systems dimensions, outcomes, and impacts. These concerns and goals can be expressed in many ways and combinations. As articulated by CGIAR, they include improvements in nutrition, health, and food security; poverty reduction, livelihoods, and jobs; gender equality, youth, and social inclusion; environmental health and biodiversity; and climate adaptation and mitigation.

Measuring all of these dimensions is difficult; even more so, projecting them into the future. Recognizing the limitations in our current ability to do this for all desired metrics in a globally consistent way, this report presents an outlook through mid-century for selected agrifood systems outcomes — focusing on food demand, production, markets, resource use, food security, employment and income — at global and regional levels.

1.3 Approach and methods

This report follows the recent book, *What Do We Know About the Future of Food Systems?* (Wiebe and Gotor 2025), in which more than 100 experts from CGIAR and its partners summarized the current state of knowledge about the future of diverse aspects of agrifood systems. The present report complements that book by presenting the latest projections to 2050 from an integrated analysis using IFPRI's International Model of Agricultural Production and Trade (IMPACT) modeling framework. This analysis incorporates updated information from across CGIAR on future growth in agricultural productivity and other dimensions of agrifood systems, and allows more explicit assessment of interlinkages and trade-offs across drivers of change, impact areas, regions, food commodities, and other agrifood systems indicators. More details on the approach used in this report are presented in Section 2.

1.4 Relation to other outlook reports

Several other publications also offer insights into the future of different aspects of agrifood systems. Major agricultural outlook reports focus on commodities (especially major staples), particularly in high-income countries and major producing regions, with a 10-year horizon (OECD-FAO 2026; USDA 2026). The *State of Food Insecurity and Nutrition in the World* (SOFI), produced by the Food and Agriculture Organization of the United Nations (FAO), and the U.S. Department of Agriculture's *Global Food Assessment* reports focus on food security in low-income countries, also looking 10 years ahead (Zereyesus et al. 2025; FAO et al. 2026). FAO's *State of Food and Agriculture* (SOFA) report (FAO 2025) and the World Bank's *World Development Report* (World Bank 2026) explore a variety of themes but not primarily with an explicit forward-looking focus. The UN Environment Programme's *Global Environmental Outlook* (GEO) report focuses on the environment but not primarily on agrifood systems (UNEP 2025). Our present report seeks to complement these other perspectives with an explicit forward-looking analysis of multiple dimensions of agrifood systems to mid-century. The report pays particular attention to the interests and concerns of

low- and middle-income regions within a rapidly changing global context, including details on food commodities that are important to producers and consumers in those regions but that are not addressed in other reports. This analysis is intended to inform and support policy dialogue and decision-making by public and private stakeholders interested in the future of agrifood systems. We use a 25-year horizon because many of the challenges faced by food systems require investments in innovation and infrastructure (both physical and institutional) that may need many years to develop and implement — so those investments must be planned for the conditions of the future, not of the present or the past.

2 APPROACH

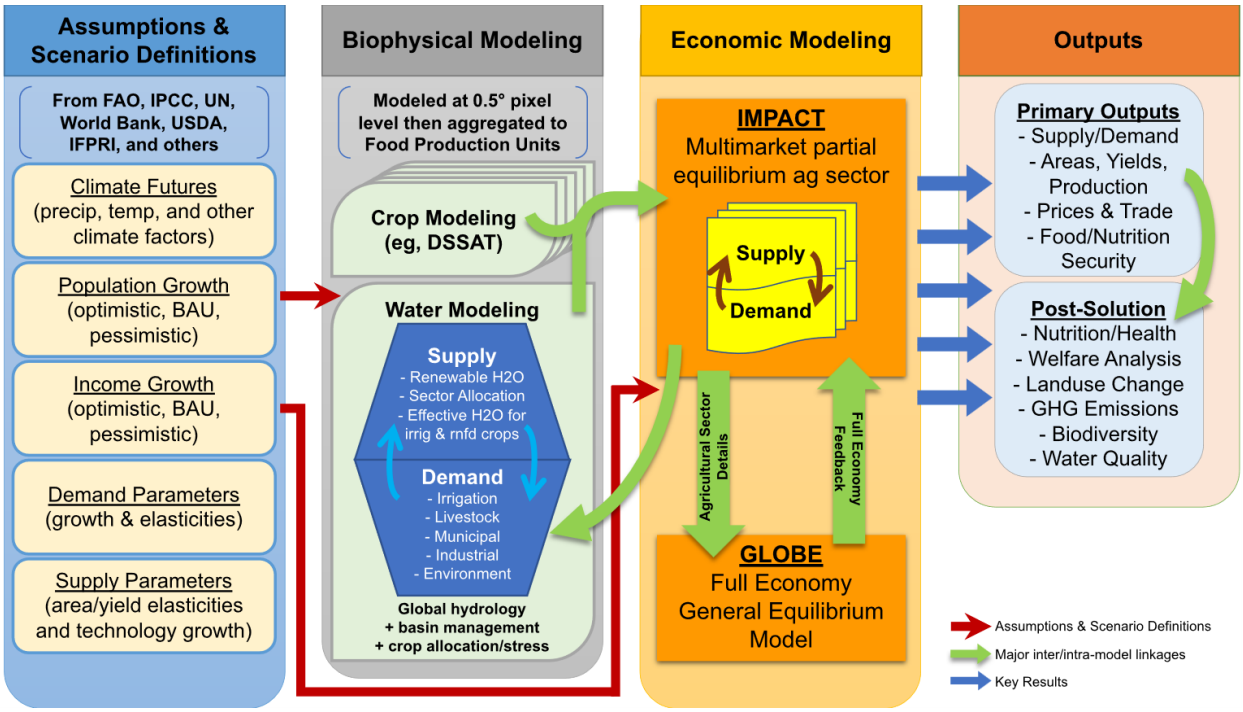
2.1 The IMPACT-GLOBE system of economic, water, and crop models (linked to climate models)

Analysis of the future of agrifood systems requires the careful use of sophisticated modeling tools that draw on insights from historical experience, the latest available data about current conditions, and expectations about interactions between changes in key variables that may occur in the future. Agrifood systems are complex and the future is inherently uncertain. Models allow us to make reasoned and transparent assumptions about alternative possible future pathways, to test those assumptions (and change them if needed), and to explore how different choices we make today could affect outcomes we care about in the future.

The IMPACT model, continuously improved and refined since it was first developed in the 1990s, supports integrated analysis of the future implications of physical, biophysical, and socioeconomic trends and phenomena, allowing for varied and in-depth analysis on a variety of key issues of interest to policymakers (Rosegrant et al. 1995; Robinson et al. 2015; Mishra et al. 2026). The core multimarket model focuses on national and global markets covering 158 countries and regions. Agricultural production is specified by land supply, allocation of land to irrigated and rainfed crops, and endogenous determination of yields. Production is modeled at a subnational level, including 320 regions called food production units (FPUs). FPUs correspond to water basins within the boundaries of these 158 countries and regions. The multimarket model simulates 71 agricultural commodity markets including crops, livestock, aquatic foods, and processed commodities. A complete list of these commodities is provided in the annex to this report.

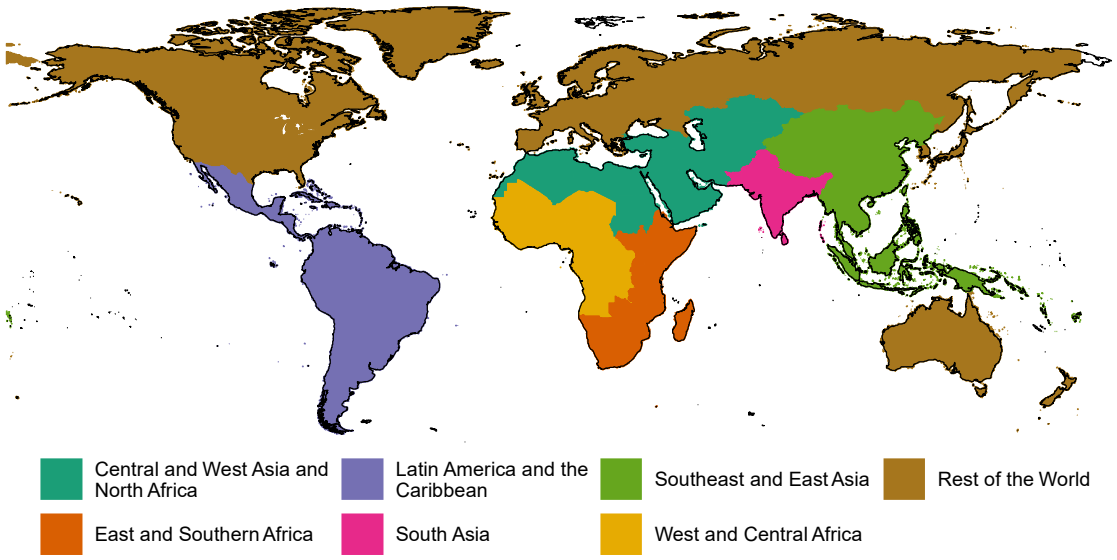
The core model is linked to specific modules that include climate models, water models (hydrology, water basin management, and water stress models), crop simulation models such as DSSAT (Jones et al. 2003; Hoogenboom et al. 2019; Hoogenboom et al. 2024), and maps of production areas from the Spatial Production Allocation Model (SPAM) (You et al. 2014; IFPRI 2024). IMPACT is also linked to GLOBE, a global economywide model that incorporates interactions between agriculture and other sectors (McDonald et al. 2007; Willenbockel et al. 2018; Delzeit et al. 2020). Links to land-use, nutrition, health, and other models allow analysis of a wider range of agrifood systems outcomes at multiple scales (pixel, river basin/FPU, country, region, and global) (see Figure 2.1.1 below). While the present analysis draws on all of these scales, results are presented primarily at global and regional levels (see Figure 2.1.2 below). More information is available in Mishra et al. (2026).

Figure 2.1.1 The IMPACT-GLOBE modeling system



Source: Mishra et al. (2026).

Figure 2.1.2 Regional classification used in this report



Source: Authors.

Note: Map shows CGIAR's six regions (CGSIX). A complete list of countries by region is available in the annex. Illustrative map only. National boundaries are not shown.

This report draws on recent improvements in analysis of two areas of critical concern to the future of agrifood systems, namely changes in technology/productivity and climate.

2.2 Changes in technology and productivity

Changes in technology and improvements in productivity are critically important as drivers of change in agrifood systems (Herrero et al. 2020; Mason-D'Croz et al. 2025). Such improvements arise from both autonomous innovation by farmers and other agrifood systems actors as they respond to changing conditions and opportunities, and from investment in research and development (R&D) by governments and private firms that often have larger budgets and planning horizons. Numerous studies have analyzed agricultural innovation at various scales (Evenson and Gollin 2003; Pardey, Alston, and Ruttan 2010; FAO 2014; Fuglie et al. 2020 and others), but globally consistent data on expected future changes in agricultural technology and productivity are scarce.

This report incorporates new information from scientists across CGIAR and around the world on expected future changes in crop, livestock, and fish productivity and yields. Such information is difficult to gather as it requires inputs not only from experts in crop and animal breeding, agronomy, and livestock husbandry, but also understanding of how changes in those areas are likely to interact with — and be affected by — future demand and market conditions. CGIAR is well-placed to pull together this information, with multidisciplinary experts and partners in commodities and regions around the world, including (especially) in low- and middle-income countries (LMICs). Hareau and Rosegrant et al. (2025) present the results of such a study, which are incorporated in the present analysis. More details are provided in Section 3.2.

2.3 Changes in climate

Changes in temperature and precipitation have always influenced production of crops and livestock, but such changes and their impacts on many dimensions of agrifood systems are expected to become larger and more systematic in the coming decades as a result of rising emissions of greenhouse gases (GHGs). Projecting these impacts is complicated because it involves the interaction of multiple biophysical and socioeconomic processes, each of which varies across countries and over time.

To explore these impacts, this report incorporates the latest available information on changes in temperature, precipitation, and other climate indicators from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (IPCC 2023) and global climate models. These data are used as inputs to the IMPACT-GLOBE system of models to analyze how changes in various climate metrics interact with changes in resource use, technology, food production, demand, markets, and trade to influence projected agrifood systems outcomes and impacts in the future. More details are provided in Section 3.2.

2.4 Future scenarios

In this report, we analyze a plausible future baseline scenario (which we call the reference scenario), in which we explore how various agrifood systems processes are expected to interact under plausible "middle-of-the-road" assumptions about future changes in population, income, technology, and climate, and what effects those changes will have on selected outcomes related to food demand, production, trade, resource use, employment and incomes, and food security. We also explore how these outcomes could vary under alternative assumptions about population, income, technology, and climate. These scenarios do not consider alternative policy or investment options in specific countries; those will be the subject of future work.

It is essential to note that these projections are not forecasts or predictions. Forecasts and predictions involve an assertion about what is most likely to happen in the future, based on an understanding of the probabilities of different future events. But agrifood systems are extremely complex, and the future is highly uncertain. Instead, a projection identifies what is expected to happen under an explicit set of assumptions, without assigning probabilities to those particular assumptions. The value of a projection lies not in claiming to know the future, but rather in being able to understand the implications of particular assumptions, including assumptions about how the choices we make as individuals and societies can affect future outcomes. Of course, to be useful, those assumptions need to be plausible. This report presents results from a plausible baseline scenario to provide a broad outlook on the future of key aspects of agrifood systems, as a reference against which alternative scenarios can be explored and compared in future work.

The primary baseline scenario we analyze uses assumptions about future socioeconomic change and GHG emissions drawn from standard pathways that were developed as part of the IPCC's periodic assessment reporting process to facilitate analysis and comparison by research institutions around the world. Specifically, we use "middle-of-the-road" assumptions about future changes in population and GDP from the IPCC's Shared Socioeconomic Pathway (SSP) 2, developed by IIASA and OECD, respectively (Riahi et al. 2017; IIASA 2024), and assumptions about future changes in temperature and precipitation from the IPCC's Representative Concentration Pathway (RCP) 7.0 as modeled by the MRI-ESM2-0 general circulation model (Eyring et al. 2016; Yukimoto et al. 2019). The choice of SSP2 and RCP7.0 is consistent with the baseline assumptions adopted across the ensemble of leading global modeling teams that contributed to the 2025 EAT–Lancet Commission analysis on healthy, sustainable diets (Sundiang et al. 2025; Beier et al. 2025; Mishra et al. 2025; Gibson et al. 2026), where SSP2–RCP7.0 served as the shared reference scenario. We use the MRI model because its results are at or near the median (relative to other general circulation models we considered) in terms of impacts on production of major crops in most regions. As such, this scenario represents a plausible and internally consistent baseline for which to present projections of key outcomes of interest, and against which alternative future scenarios can be compared.

Note that higher levels of atmospheric carbon dioxide (CO_2) are known to increase yields of some crops under some conditions, but productivity increases are projected in IMPACT based in part on observed yield increases in recent years (during which CO_2 levels have already been rising), so CO_2 fertilization effects are already embedded in those productivity projections. Higher levels of atmospheric CO_2 have also been found to reduce levels of micronutrients in some crops (Beach et al. 2019; Haar et al. 2025).

The extent to which these diverse effects are realized under heat stress, water stress, and ozone effects in different regions — particularly in resource-poor areas in LMICs — remains uncertain. This is an important area for further research.

In addition to the primary baseline scenario, we also explore how agrifood systems outcomes could vary under alternative assumptions about population, GDP, technology, and climate (Table 2.4.1). A more optimistic scenario (Alternative 1) uses assumptions from SSP1 and RCP2.6, and a more pessimistic scenario (Alternative 3) uses assumptions from SSP3 and RCP8.5, while other alternative scenarios use different combinations of assumptions. We also compare results from different climate models and assumptions about CO_2 fertilization effects.

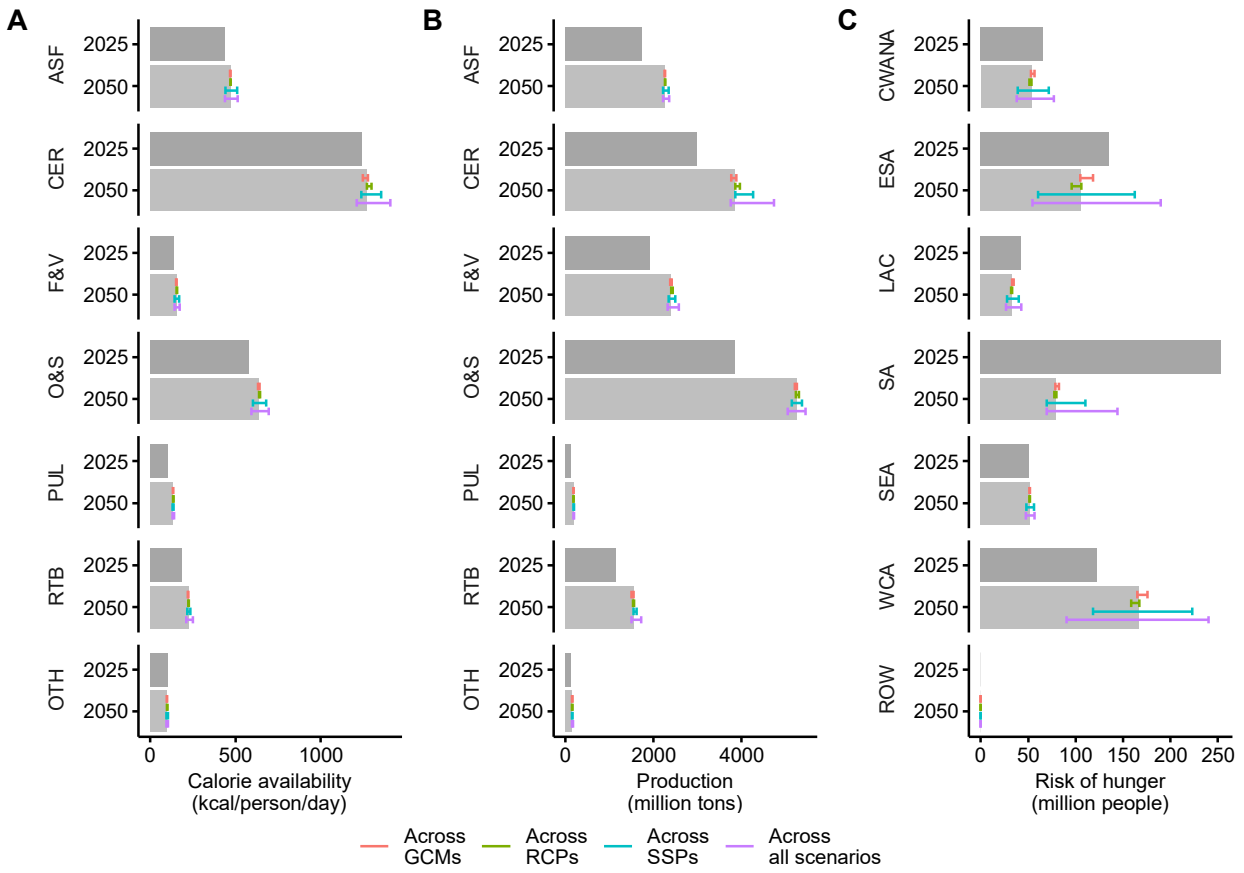
Table 2.4.1 SSP and RCP assumptions in the baseline and alternative scenarios

Scenario	Population growth	Income growth	Technology change	Climate change
Baseline	Intermediate (SSP2)	Intermediate (SSP2)	Intermediate (SSP2)	Intermediate (RP7.0)
Alternative 1	Slower (SSP1)	Faster (SSP1)	Faster (SSP1)	Lower (RCP2.6)
Alternative 3	Faster (SSP3)	Slower (SSP3)	Slower (SSP3)	Higher (RCP8.5)
Other alternative scenarios	*	*	*	*

Source: Authors.
Note: *Other alternative scenarios explore all combinations of SSPs 1, 2, and 3 (Riahi et al. 2017; IIASA et al. 2024), RCPs 2.6, 7.0, and 8.5 (Eyring et al. 2016), and ESMs (MRI-ESM2-0 (Yukimoto et al. 2019), GFDL (Dunne et al. 2020), IPSL (Boucher et al. 2020), MPI-ESM1.2HR (Müller et al, 2018), UKESM (Sellar et al. 2019)), with and without CO_2 fertilization effects, for a total of 93 different scenarios.

Figure 2.4.1 shows how these alternative assumptions affect projected levels of three important agrifood systems indicators — that is, kilocalorie (kcal) availability, agricultural production, and population at risk of hunger — across commodity groups and regions in 2050, as compared to levels in 2025. Each of these assumptions affects each of these indicators to some degree. Assumptions about socioeconomic changes tend to make a bigger difference in terms of projected impacts than do assumptions about climate models or emissions pathways (at least until 2050), and not surprisingly, changing all of these assumptions simultaneously makes the biggest difference. For most indicators, commodities, and regions, different assumptions change the magnitude but not the direction of change between 2025 and 2050. For simplicity in presentation, the remainder of this report presents results from our primary baseline scenario without specifying the range of possible impacts under alternative assumptions.

Figure 2.4.1 How model results vary across alternative scenario assumptions



Source: Authors, based on IMPACT v4.1.4; SSPs 1, 2, and 3; RCPs 2.6, 7.0, and 8.5; and ESMs MRI-ESM2-0, GFDL, IPSL, MPI-ESM1.2HR, and UKESM.

Note: Panel A: Global kilocalorie availability by food group; Panel B: Global agricultural production by food group; Panel C: Population at risk of hunger by CGIAR region. Gray bars represent the baseline scenario (SSP2, RCP7.0, MRI climate model). Colored lines indicate the range of outcomes when varying one dimension of uncertainty at a time: across ESMs (MRI vs GFDL, IPSL, MPI, and UKESM), RCPs (RCP7.0 vs RCP2.6 and RCP8.5), SSPs (SSP2 vs SSP1 and SSP3), and all scenario dimensions simultaneously. ASF is animal-source food; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; and ROW is Rest of the World.

2.5 Glossary of key IMPACT modeling concepts used in this report

This section provides brief explanations of key concepts of the modeling approach used in this report.

Demand for a commodity is the sum of food demand for direct consumption, feed demand from the livestock sector, intermediate demand by processing sectors (e.g., soybean oil processing sector demand for soybeans), and all other demands for industrial uses (e.g., cosmetics, industrial lubricants, biofuels, etc.). Each type of demand includes both the final use (e.g., for food consumption or feed) as well as loss and waste. Except for the few processed products represented in IMPACT, demand is expressed at the commodity-equivalent level (e.g., for aggregated wheat rather than bread, pasta, and other consumer wheat products).

Supply is equivalent to FAO's "supply for domestic utilization," which is Production + Net Trade + Change in Stocks, where Net Trade = Imports – Exports, and Change in Stocks can be either positive or negative.

Production for most commodities is determined as the product of yields times areas harvested (in the case of crops) or yields times the number of producing animals (in the case of most animal-source foods). Production of aquatic foods is determined based on trends in total production at the country level. Production of processed commodities is determined as the outputs of processing activities that transform selected primary commodities (such as soybeans and sugarcane) into processed commodities (such as vegetable oils and refined sugar).

Area harvested is the total number of hectares harvested in a given location and year. Changes in harvested area may result from changes in cropping intensity (that is, the number of harvests per year) and changes in cropland area. Total area harvested can be greater than, equal to, or less than cropland area depending on cropping intensity. **Producing animals** are analogous to area harvested and are the animals either harvested for meat or generating a consumable product (milk or eggs). Trends in area harvested and producing animals are based on historical trends, expert knowledge of potential changes in trends, and practical limits defined at the national level (such as total arable land available for cultivation or grazing).

Yields are the amount of a commodity that can be harvested from areas harvested or producing animals, expressed in kilograms per hectare or per animal. Yields and yield trends are based on historical data, expert knowledge of potential changes in trends, and practical constraints informed by expert knowledge and biological limits.

Trade reflects the difference between demand and production at the country level. Where country-level production exceeds national demand, the surplus is exported. Conversely, a country will import if its demand is greater than its own production. **Net trade** for each commodity is the difference between imports and exports of that commodity. Net trade is modeled in IMPACT via a global market that is governed by world prices for each commodity.

World prices are determined via global markets for each commodity in the exchange of commodities between producers and consumers. **Country-level prices** faced by producers and consumers differ from world prices based on marketing, processing, and regulatory costs that are particular to each country.

Calorie (or nutrient) availability is average food availability per person per day reported in calorie (nutrient) equivalent and can be reported by commodity or a total average calories (nutrients) summed across all food commodities. Changes in food and calorie (nutrient) availability are useful proxies for average changes in food consumption.

Per capita food demand is the average quantity of a commodity available to consumers in a country per person per year. This is calculated as food demand / total population, and is reported in units of mass (i.e., tons or kilograms) per person.

Food and nutrition security is expressed in this report using three population-level metrics: the **share and population at risk of hunger** and **recommended nutrient intake ratios**. The share and population at risk of hunger are equivalent to FAO's Prevalence of Undernourishment (PoU) metric and are based on the per capita availability of calories compared to a minimum dietary energy requirement (MDER) with country-level specific parameters. Recommended nutrient intake ratios compare the per capita availability of particular micronutrients with the World Health Organization's recommended levels of intake for the average adult consumer.

More information on the IMPACT-GLOBE modeling framework and the methods used in this report is available in Mishra et al. (2026).

3 RECENT AGRIFOOD SYSTEMS TRENDS AND FUTURE DRIVERS OF CHANGE

3.1 Megatrends affecting agrifood systems

CGIAR's Independent Science for Development Council recently identified nine interconnected megatrends that are affecting and will continue to affect agrifood systems in the coming decades (ISDC 2023). These are:

1. demographic trends (including population growth, aging, migration, and urbanization),
2. changing consumption patterns (driven in part by changes in affordability and access to different foods),
3. market concentration (characterized by increasing consolidation of global value chains alongside fragmented smallholdings and enterprises),
4. climate change (posing challenges for both mitigation and adaptation, especially for the most vulnerable populations),
5. environmental degradation (especially through land conversion and water withdrawals for agriculture),
6. shifting global health challenges (driven by increased global connectivity and other factors),
7. geopolitical instability (related to the other megatrends),
8. growing inequalities (between and within countries and population groups), and
9. new technologies and innovations (including digital technologies and artificial intelligence [AI]).

In this report we focus on five of these megatrends: demographic trends (particularly population growth and decline), changing consumption patterns (associated with changes in income and prices), climate change (particularly adaptation and impacts), environmental degradation (in terms of pressure on land and water resources), and innovation (particularly as it affects agricultural productivity). We will explore how these trends interact across geographies and over time, and how they jointly determine a variety of future agrifood systems outcomes related to nutrition, poverty, social inclusion, the environment, and climate change.

3.2 Changes in population, income, technology, and climate

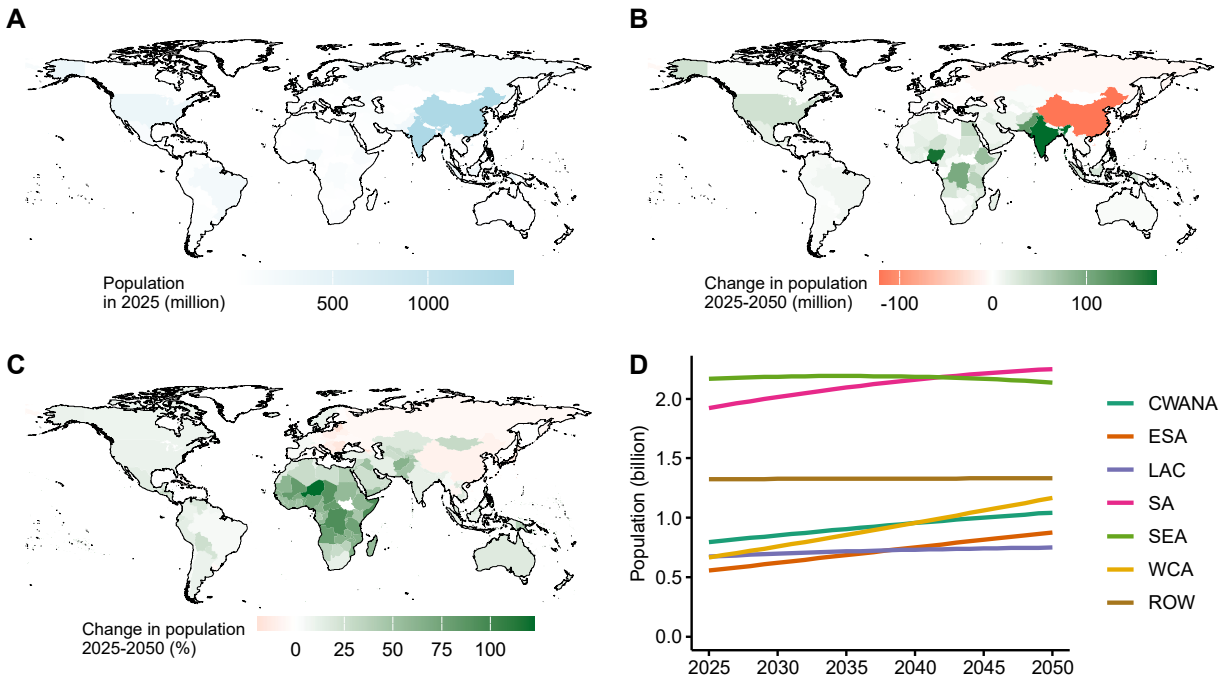
Population, income, technology, and climate are the major drivers of agrifood systems change considered in this analysis. Assumptions about their future changes are drawn from other sources (as identified in Section 2.4). This section shows how they are expected to vary across regions and over time.

Population

Population growth was a major factor driving concerns in the mid- to late-20th century about agrifood systems' ability to meet future demand. But population growth has slowed in recent decades in most regions, and in fact populations have already begun to decline in parts of Europe and East Asia. Today, 51 percent of the world's population lives in Asia. In the future, under SSP2, India's population is projected to grow by another 200 million before leveling off around 2050–2055, but China's population peaked in 2022 and is projected to decline to 1.3 billion by 2050 (Figure 3.2.1) (IIASA 2024). Population decline gives rise to different concerns —

including how smaller working-age populations will support larger aging populations during this new demographic transition. Meanwhile, populations are projected to continue growing rapidly in sub-Saharan Africa (East and Southern Africa [ESA], West and Central Africa [WCA]) and in CWANA, reaching 2.04 and 1.04 billion respectively by 2050 (when they will account for nearly a third of the projected global population of 9.6 billion in 2050), and continuing to grow for at least a generation beyond that (IIASA 2024). In these regions, major concerns persist about future employment, incomes, food production, and food security.

Figure 3.2.1 Projected change in population, 2025–2050

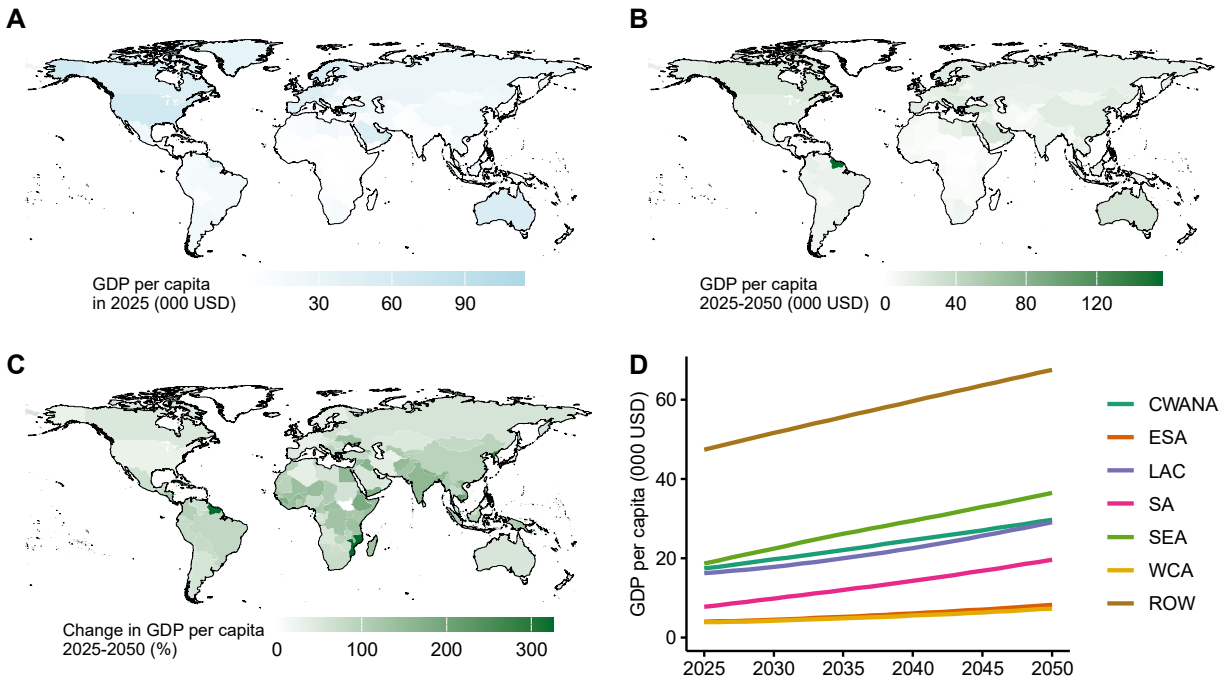


Source: IIASA (2024) population projections for SSP2.
Note: Panel A: total population in 2025; Panel B: change in population, 2025–2050; Panel C: percentage change in population, 2025–2050; Panel D: change in population by region, 2025–2050. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

Income

Along with population, income growth is a major driver of changes in food demand. Today, per capita GDP is two to three times higher in high-income countries than it is in SEA, CWANA and LAC, six times higher than it is in South Asia, and ten times higher than it is in sub-Saharan Africa. Under SSP2, GDP per capita is projected to increase worldwide between 2025 and 2050, but most rapidly (albeit from lower initial levels) in Asia and sub-Saharan Africa (Figure 3.2.2 and Table 3.2.1). This combination of low current income levels and rapid projected growth in both income and population suggests that these regions will be major sources of growth in food demand in the coming decades. (Note that SSP2 assumptions do not account for recent changes and uncertainties in trade and other policies, but rather support analysis of longer-term patterns of change.)

Figure 3.2.2 Projected growth in per capita GDP, 2025–2050



Source: IIASA (2024) GDP projections for SSP2 from SSP Database version 3 (2024), and GLOBE model.
Note: Panel A: GDP per capita in 2025; Panel B: change in GDP per capita, 2025–2050; Panel C: percentage change in GDP per capita, 2025–2050; Panel D: change in GDP per capita by region, 2025–2050. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

Table 3.2.1 Changes in GDP, population, and GDP per capita, 2025–2050, based on SSP2 assumptions

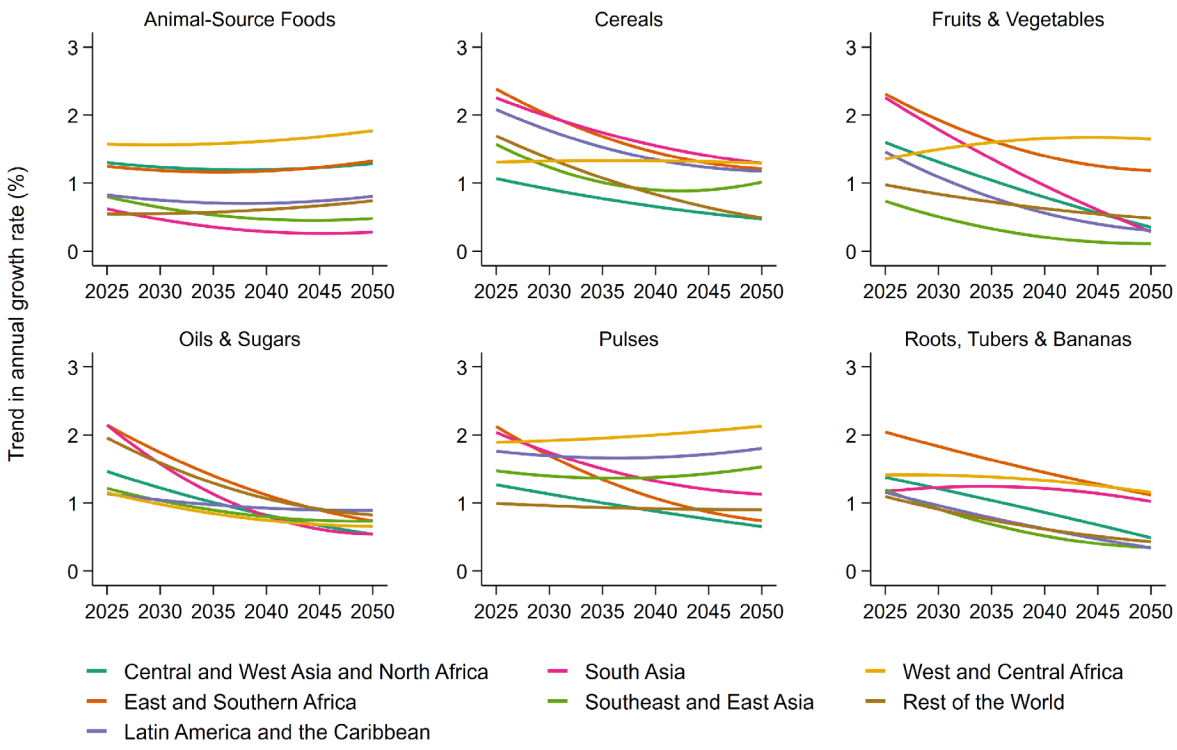
	GDP (2017 billion USD)				Population (million)				Per capita GDP (000 USD)			
	2025	2050	Change 2025-2050	CAGR (%)	2025	2050	Change 2025-2050	CAGR (%)	2025	2050	Change 2025-2050	CAGR (%)
CWANA	13,911	31,044	17,134	3.3%	797	1,044	247	1.1%	17.5	29.7	12.3	2.2%
ESA	2,254	7,264	5,010	4.8%	557	876	319	1.8%	4.0	8.3	4.2	2.9%
LAC	10,979	21,845	10,866	2.8%	675	750	74	0.4%	16.3	29.1	12.9	2.4%
SA	14,991	44,276	29,285	4.4%	1,923	2,249	326	0.6%	7.8	19.7	11.9	3.8%
SEA	40,388	77,971	37,582	2.7%	2,168	2,135	(33)	-0.1%	18.6	36.5	17.9	2.7%
WCA	2,592	8,564	5,973	4.9%	668	1,166	498	2.3%	3.9	7.3	3.5	2.6%
ROW	62,845	89,966	27,121	1.4%	1,324	1,332	8	0.0%	47.5	67.6	20.1	1.4%
WLD	147,960	280,930	132,971	2.6%	8,113	9,551	1,438	0.7%	18.2	29.4	11.2	1.9%

Source: IIASA (2024) population projections and GDP projections for SSP2 adjusted with GLOBE model for climate change impacts.
Note: CAGR is compound annual growth rate. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Technology

Improvements in genetics and management have played major roles in increasing food production to meet growing demand over the past half century (Mason-D'Croz et al. 2025). Innovation in these and other areas is expected to continue playing a key role in the coming decades. Our analysis includes initial assumptions about future changes in yields, specific to each crop and livestock commodity, country, and year (trends in annual yield growth rates are shown in Figure 3.2.3 below). These have been developed through consultation with plant breeders and other commodity and regional experts as described in Section 2.2. Recent updates to crop yield growth assumptions follow Hareau et al. (2025); livestock yield growth rates will be updated in future work. Yield growth is expected to slow but remain positive over the projection period for most commodity groups and regions, albeit with considerable variation, consistent with historical experience (Fuglie 2018; Wollburg et al. 2024). (It is important to note that these initial assumptions are used as starting points in the analysis; final yield projections are subsequently determined in the model by interactions with changes in food demand and climate through their effects on production, markets, and prices, and are reported below in Section 4.2.)

Figure 3.2.3 Trends in baseline annual yield growth rate assumptions, by region and commodity, 2025–2050



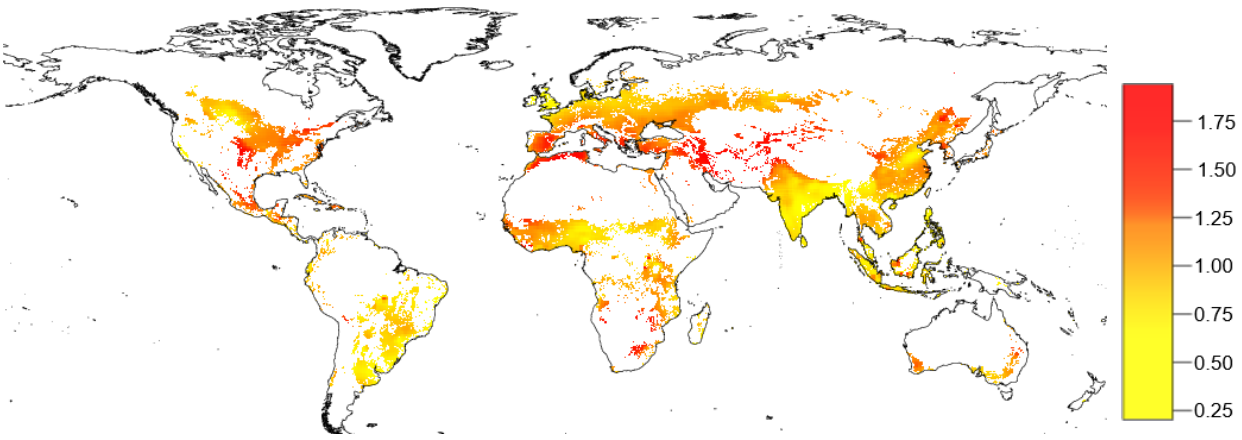
Source: Authors, based on IMPACT database and Hareau and Rosegrant et al. (2025).

Looking beyond yield growth, advances in digital innovation and artificial intelligence (AI) are likely to reshape agrifood systems in many ways that cannot yet be fully anticipated. These offer remarkable opportunities for improved analysis, information provision and efficiency, but they also pose risks in terms of unequal access, misinformation, and additional demands on energy and other resources (IFPRI 2026). Exploring how these risks and opportunities will affect agrifood systems in the future requires further analysis, but is beyond the scope of this report.

Climate

Climate change, including changes in temperature and precipitation as well as the frequency and intensity of extreme events, poses major challenges to agriculture and agrifood systems, and these challenges are expected to increase in the coming decades (IPCC 2023; Thomas and Mukherji 2025). Temperatures are projected to increase worldwide, on average, but at different rates in different locations. Figure 3.2.4 below shows the increase in daily average high temperatures between 2025 and 2050 (as simulated by the MRI general circulation model under our baseline emissions pathway of RCP7.0) for pixels with at least 10 percent of their area currently in cropland. The largest temperature increases are projected in parts of the United States and Mexico, Southern Africa, and a swath running from North Africa to Central and West Asia. (Note that this map shows where current cropland is projected to experience changing temperatures in the coming decades, but cropland itself may shift as temperatures change, meaning that other areas could be affected by changing temperatures as well. Those land use transitions are described in recent work by Robertson et al. [2023].)

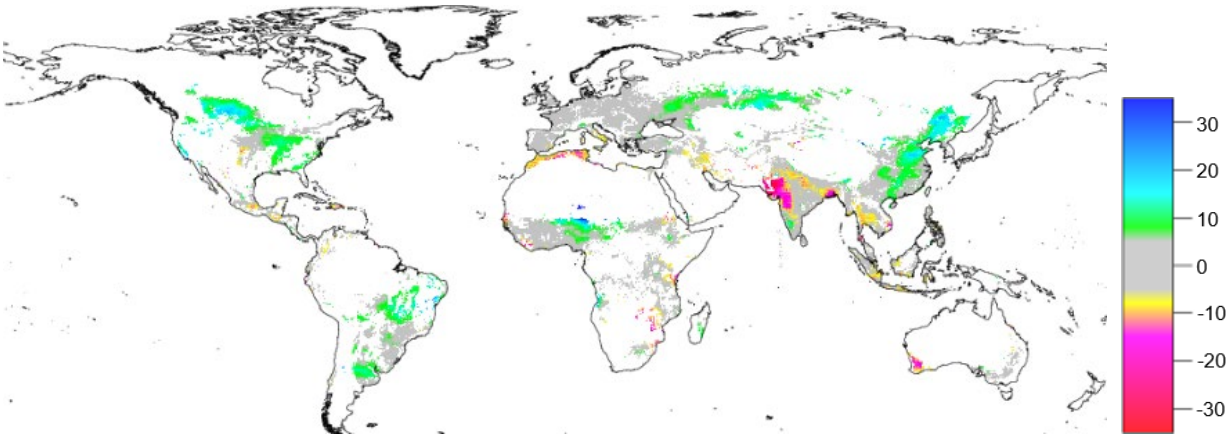
Figure 3.2.4 Projected increases in temperature in currently cultivated areas, °C, 2025–2050



Source: Authors, based on MRI-ESM2-0, RCP7.0 and SPAM 2020, v2r0.
Note: The map shows projected temperature changes in pixels with at least 10 percent cultivated area.

While temperatures are projected to increase in all areas that currently contain at least some cultivated land, changes in precipitation will be more varied, with increases in some areas and decreases in others. In our baseline scenario, precipitation is projected to increase in much of the Americas and parts of West Africa and Central and East Asia, while decreasing in North Africa and parts of East and Southern Africa and South and Southeast Asia (Figure 3.2.5).

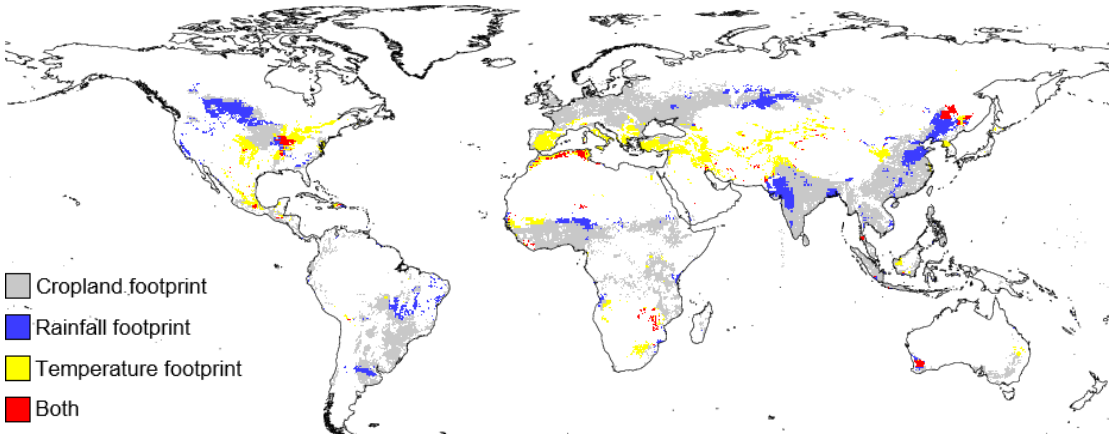
Figure 3.2.5 Projected changes in precipitation in currently cultivated areas, 2025–2050, as a percentage of 2025 levels



Source: Authors, based on MRI-ESM2-0, RCP7.0 and SPAM 2020, v2r0.
Note: The map shows projected precipitation changes in pixels with at least 10 percent cultivated area.

Combining information on projected changes in temperature and precipitation, we can identify "hotspots" of climate concern that face potential challenges from either or both of these factors. In Figure 3.2.6 below, we identify currently cultivated areas that face projected increases in temperature of more than 1.2 degrees or projected changes in annual precipitation of more than 10 percent, or both. Areas facing both concerns are evident in Southern Africa and parts of North America, North Africa, and Southwest Asia. These areas are expected to face particularly difficult challenges for food production in the coming decades, but with widely differing capacities to adapt.

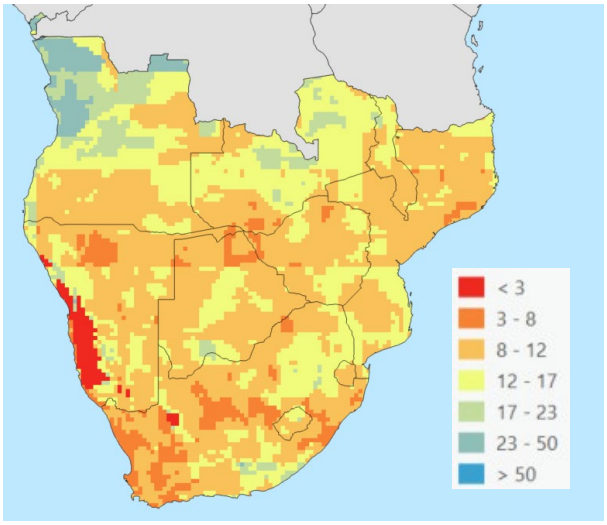
Figure 3.2.6 Areas of concern based on projected changes in temperature and precipitation in currently cultivated areas, 2025–2050



Source: Authors, based on MRI-ESM2-0, RCP7.0 and SPAM 2020, v2r0.
Note: The map shows climate-related concerns in pixels with at least 10 percent cultivated area.

In addition to projected changes in temperature and precipitation as shown in figures in this section, climate change is also expected to increase the frequency of extreme events such as droughts (Thomas and Mukherji 2025). In Southern Africa, for example, many areas that currently experience droughts about once in 20 years on average are projected to experience such events about once in 10 years by mid-century, and in some areas (such as coastal Namibia), the frequency is projected to increase to about once in 5 years (Figure 3.2.7). Other extreme events that may occur more frequently in the future include flooding, heatwaves, landslides, increased storm intensities, and droughts spanning multiple years. This means that disruptions due to climate-related extreme events may affect some areas — including temperate regions (de S. Nóia-Júnior et al. 2025) — above and beyond what would be expected from gradual changes in temperature and precipitation over longer periods of time as projected in this report. This is an important area for further research.

Figure 3.2.7 Projected change in frequency of low-rainfall extreme events in Southern Africa, 2020s to 2060s



Source: Thomas et al. (2022).
Note: The map shows the projected frequency in 2060 (under a high-emissions scenario) of low-rainfall extreme events that currently occur about once in 20 years. For example, a value of 10 indicates a 1-in-10-year event.

3.3 Key messages on trends and drivers

Section 3 has introduced some of the major drivers that are expected to shape the outlook for food demand, supply, and other aspects of agrifood systems over the next 25 years. This brief review shows that:

- Population is changing in diverse ways. Population is still rising in sub-Saharan Africa and South Asia but slowing or declining elsewhere, particularly in Europe and East Asia. Both types of changes pose challenges for agrifood systems.
- Income growth is uneven. Incomes are rising rapidly in sub-Saharan Africa and South Asia in percentage terms, but remain well below other regions in absolute terms. Combined with changes in demand, these drive diverse patterns of change in food demand.
- Productivity is increasing but productivity growth is generally slowing. Yields are expected to continue increasing for all commodity groups and regions, but at declining rates of growth (with the exception of animal-source foods and pulses).
- Climate change risks are widespread but diverse. Temperatures are projected to increase in all cultivated areas, while precipitation will increase in some areas and decrease in others. Extreme events are projected to become more frequent in some areas.

These changes are in turn expected to drive changes in a wide variety of agrifood systems outcomes. To explore these impacts, information on the drivers described in Section 3 is used as inputs to our forward-looking analysis using the IMPACT-GLOBE system of models described in Section 2. Results on food demand, production, trade, resource use, employment, food security, and other outcomes are presented in Section 4, and then summarized by region (Section 5) and commodity group (Section 6). Conclusions are presented in Section 7.

4 GLOBAL AGRIFOOD SYSTEMS OUTLOOK TO 2050 BY KEY INDICATORS

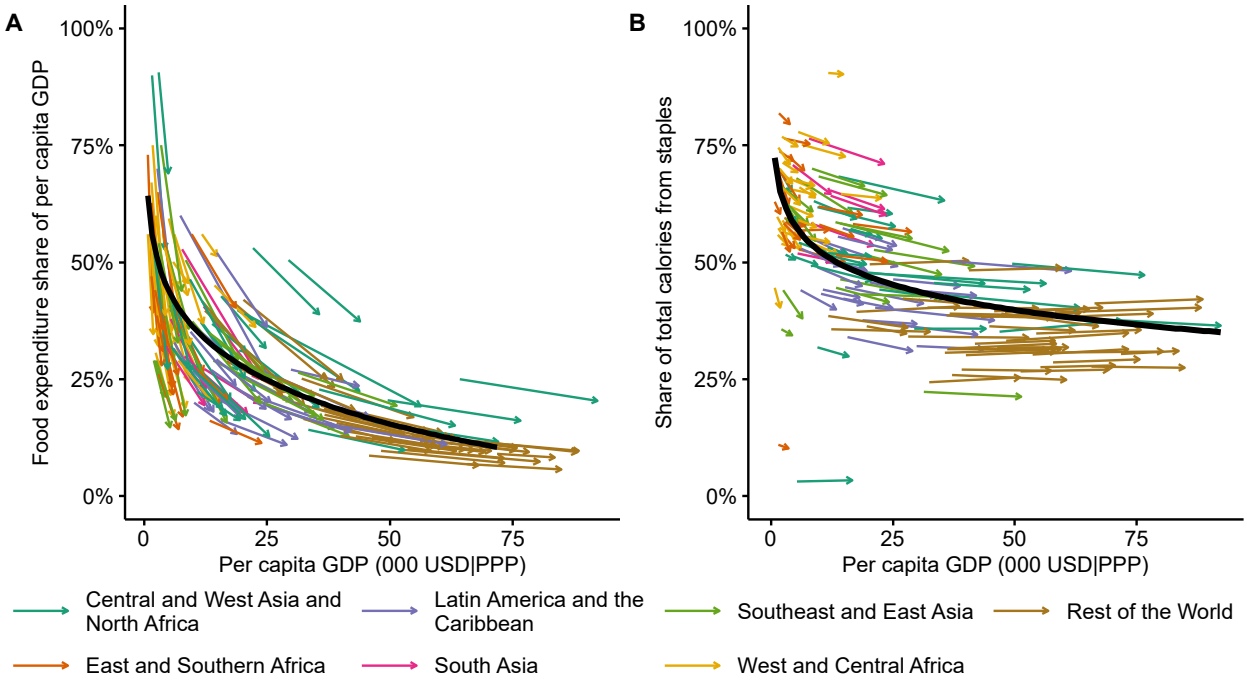
4.1 Demand

Changes in demand are the fundamental driver of changes in agrifood systems. Changes in demand are driven in turn by changes in demographics (including population, age, and urbanization), preferences, and how those respond to changes in income and prices. While food preferences and dietary choices are infinitely varied, some overall patterns are remarkably predictable. The share of per capita income spent on food falls sharply as incomes rise, a relationship known as Engel's Law (Engel 1857), and this pattern is projected to continue over the next 25 years — from as high as 80 percent of income spent on food in some countries in sub-Saharan Africa today to 10–20 percent or less, as is already typical of middle- and high-income countries in other parts of the world (see Figure 4.1.1, panel A). This pattern reflects two unsurprising but critically important points about food demand: that it is a fundamental human need and will use a large share of available income until minimum requirements are satisfied, and that even in its more complete and varied forms it is eventually sated as incomes rise.

A second pattern, less precise but still clear, is that the share of calories consumed in the form of starchy staple foods — defined here as cereals and roots, tubers, and bananas (RTB) including plantains — also fall as incomes rise. This pattern (known as Bennett's Law [Bennett 1941]) is also projected to continue over the next 25 years, from over 75 percent of calories from staple starches in sub-Saharan Africa today to the 25–50 percent range that is already typical in richer countries (see Figure 4.1.1, panel B).

Together, these patterns suggest that as incomes rise over the next 25 years, per capita food demand will grow most rapidly in low-income countries, diets will become more diverse in middle-income countries, and diets will remain relatively stable in high-income countries. These patterns are evident in Figure 4.1.2. While the share of calories from cereals is projected to decline globally and in all regions from 2025 to 2050, cereals remain a major source of calories in all regions, with particularly high shares (more than 50 percent) in South Asia and in Central and West Asia and North Africa. RTB remain an important part of diets, particularly in sub-Saharan Africa. Consumption of animal-source foods and oils and sugars is projected to increase in all regions. Consumption of pulses and fruits and vegetables also increases but from lower levels, and remains below dietary guidelines.

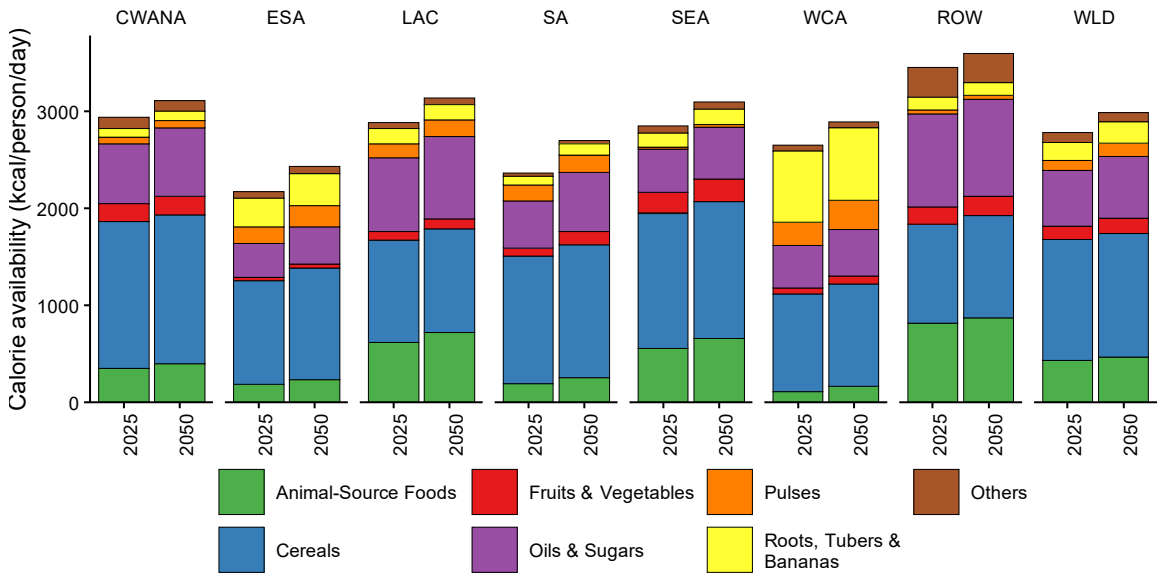
Figure 4.1.1 Projected changes in the share of per capita income spent on food and the share of calories derived from staple foods, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0, using baseline numbers from ERS (2024).
Note: Using estimates of international food expenditures (at home, excluding alcohol) from ERS (2024) as a historical starting point, future changes in the share of income spent on food are projected using IMPACT. Panel A shows food expenditure's share of per capita GDP; Panel B shows the share of total calories from staples. Each arrow represents projected movement of a country between 2025 and 2050. Countries are colored by regions. The black fitted lines are a generalized additive model (GAM) that models the response variable (y-axis) as a smooth, nonlinear function of the logarithm of the predictor (x-axis). In IMPACT, processed products that are not explicitly modeled as distinct commodities are represented in primary commodity equivalents. For example, cassava flour is captured within the cassava primary equivalent, whereas vegetable oils are an instance of a processed product that is explicitly modeled.

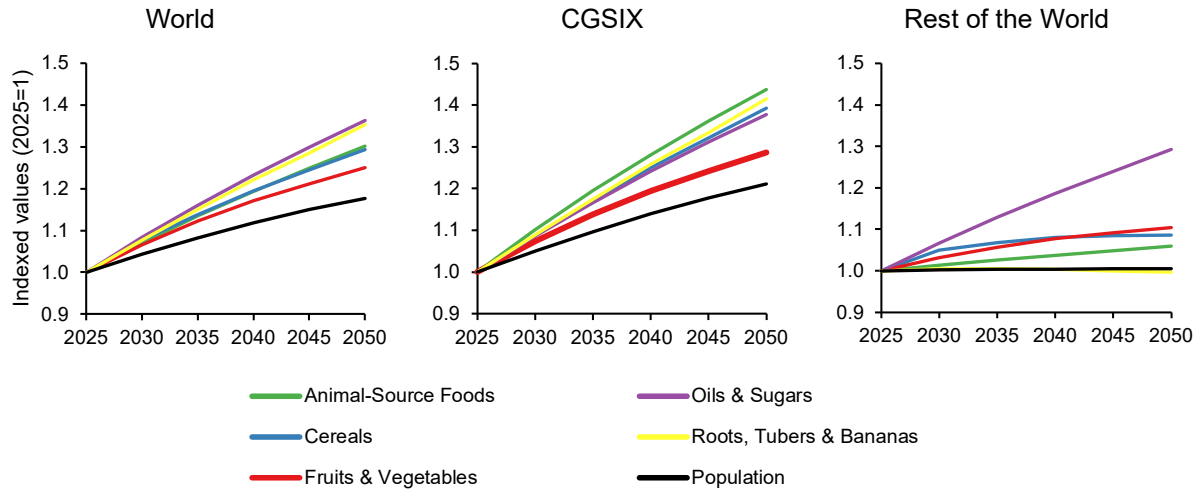
Combining these changes in diets with changes in population noted in Section 3.2 (and changes in demand for feed and other uses), we find that total global demand for food commodities is projected to grow by 25–47 percent over the next 25 years, varying by food group (Figure 4.1.3, panel A). Global demand grows most rapidly for pulses and oils and sugars, RTB, and animal-source products, but patterns vary by income level and region. Total demand for all food commodities grows more rapidly in LMICs (panel B), especially for pulses and animal products, driven by both faster population growth and more rapid dietary change as lower incomes rise. In contrast, total demand for most food commodities grows more slowly and even begins to decline in high-income countries by 2050 (panel C), with the notable exception of oils and especially sugars, for which demand is projected to continue rising through mid-century and beyond.

Figure 4.1.2 Changes in per capita calorie availability by commodity group and region, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0. See Rosegrant et al. (2024) and Mishra et al. (2025) for details on the methodology.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Figure 4.1.3 Changes in population and total demand for aggregate food types, by commodity group and region, 2025–2050

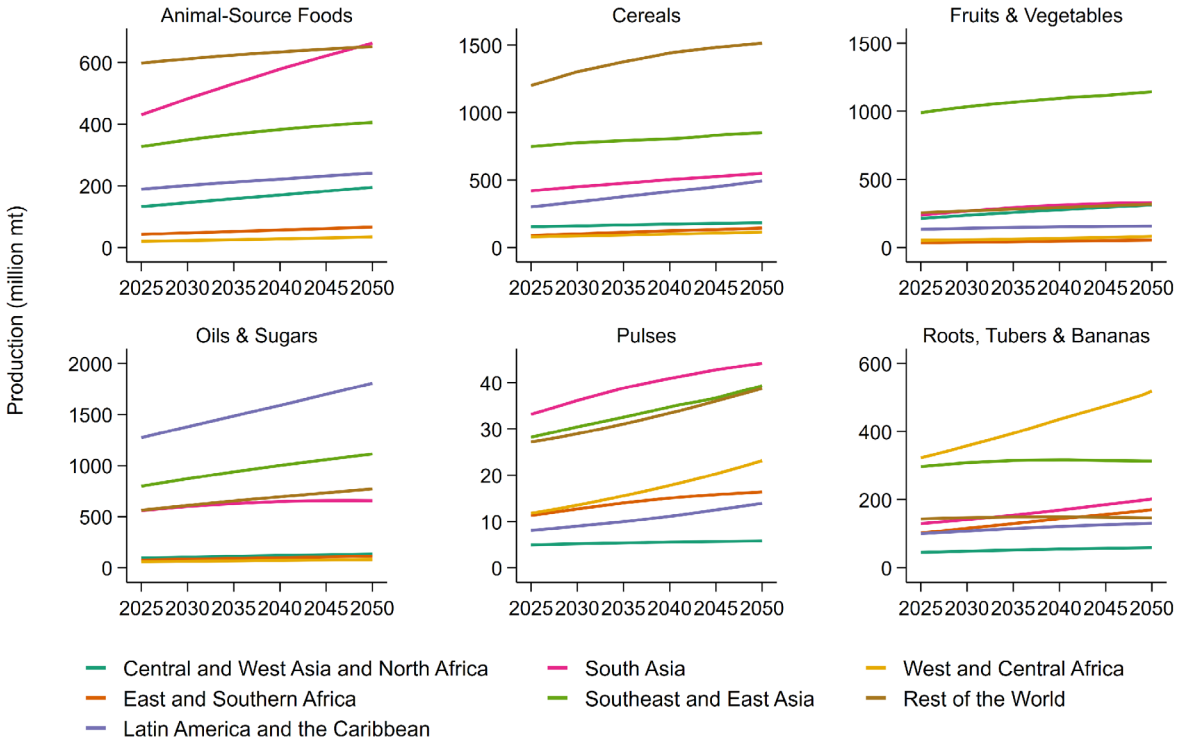


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CGSIX are the CGIAR regions: Central and West Asia and North Africa; East and Southern Africa; Latin America and the Caribbean; South Asia; Southeast and East Asia; and West and Central Africa.

4.2 Production

Driven by changes in demand, production is projected to increase between 2025 and 2050 for most commodities and regions (Figure 4.2.1). Overall, the CGSIX regions (the six focus regions of the CGIAR: CWANA-Central and West Asia and North Africa; ESA-East and Southern Africa; LAC-Latin America and the Caribbean; SA-South Asia; SEA-Southeast and East Asia; WCA-West and Central Africa) currently account for over 75 percent of global agricultural production, and that share is projected to increase slightly by 2050. Production of cereals continues to be led by high-income countries, followed by Asia and LAC. Production of RTB rises by more than 60 percent in WCA between 2025 and 2050, making the region the largest producer by 2050. SEA remains the largest producer of fruits and vegetables. Production of oils and sugars is projected to continue increasing rapidly in LAC, followed by Asia and the high-income countries. Pulse production is led by South Asia but with rapid growth also in SEA and high-income countries. By 2050, SA animal-source food production is projected to match that of high-income countries — increasing by 54 percent between 2025 and 2050 (driven by increased milk production in India). CWANA, ESA, and WCA also experience large increases in animal-source food production with increases of roughly 50 percent or more.

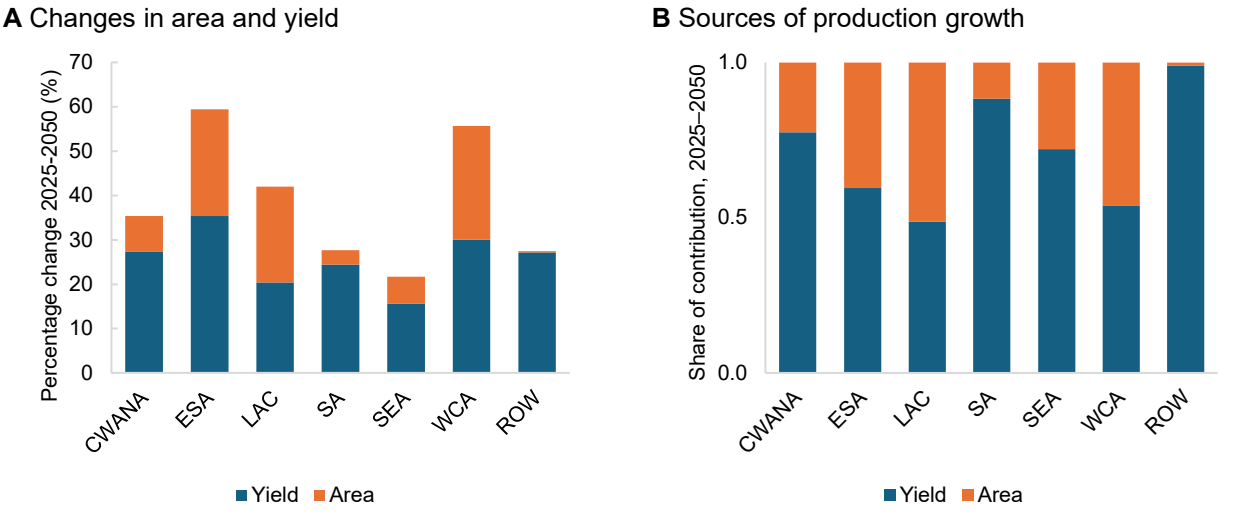
Figure 4.2.1 Projected production by region and commodity group, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Production will increase through a combination of changes in resource use and productivity. Consistent with past experience (Fuglie et al. 2020), productivity growth is projected to be the primary source of increased crop and animal-source food production in many regions, driven by investments in R&D, efficiency gains, and mechanization (Figure 4.2.2). In LAC, however, just over half of the increase in production by 2050 is projected to come from an increase in harvested area, and an increase in harvested area is also projected to contribute nearly half of increased production in sub-Saharan Africa (ESA and WCA). Together, these two regions (LAC and sub-Saharan Africa) are projected to account for over 70 percent of the additional 131 million ha of harvested area needed to meet demand by 2050.

Figure 4.2.2 Contribution of yields and harvested area to growth in crop production between 2025 and 2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

Yield projections start with the initial assumed productivity growth rates introduced in Section 3.2. These are then adjusted in the model through interaction with demand, prices, climate, and other factors to generate final yield projections for each crop, country, and year, which are summarized in Figure 4.2.3. In general, yield projections show continued increases in productivity for all crops and regions, although the rates of increase slow over time (as shown in Figure 3.2.3 in Section 3.2) as yield levels rise and due to the impacts of changes in climate and water availability. Livestock yields are increasing across most regions over the period. In fact, yield growth rates for many crops and livestock are projected to be fastest in regions with low initial yield levels, such as ESA, but in most cases, the regional distribution of yields remains unchanged over time. For example, cereals yields increase from low levels in WCA, ESA, and CWANA but remain well below those in Asia, LAC, and the rest of the world. Fruit and vegetable yields remain highest in SEA, but with faster growth in other regions.

Figure 4.2.3 Projected yields by commodity group and region, 2025–2050

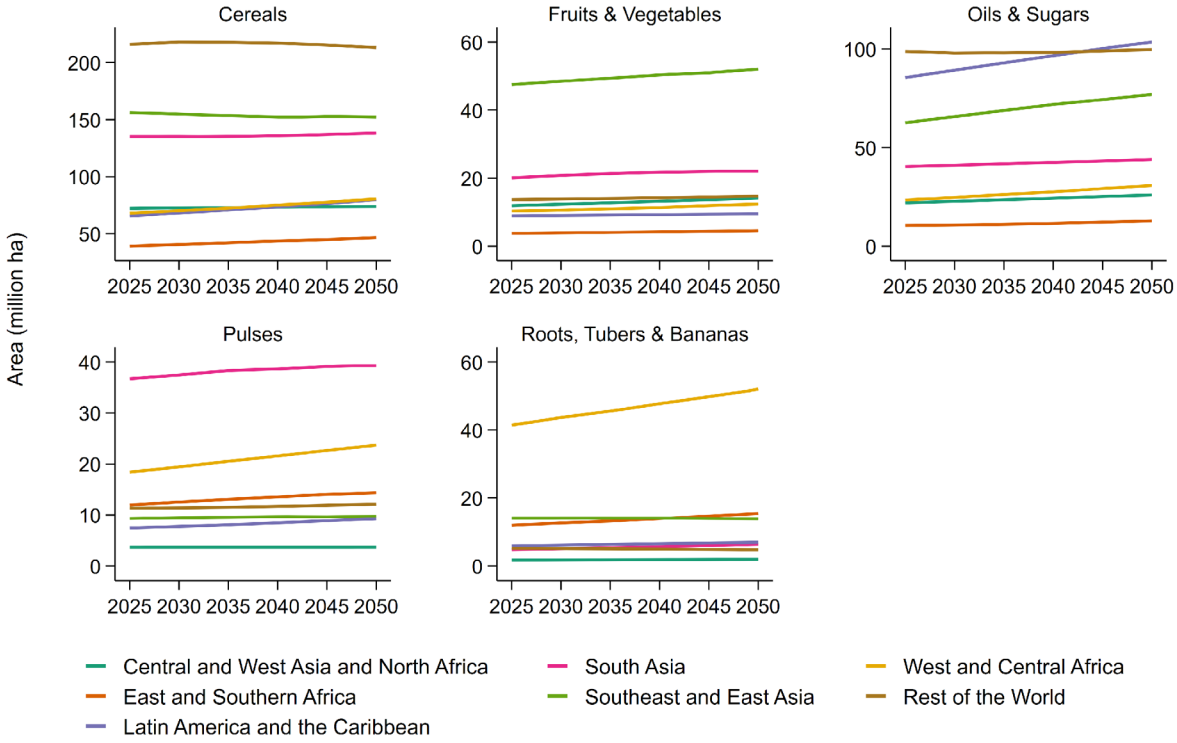


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

While yield growth is the major source of increased production for most commodities and regions, expansion in harvested areas is also an important factor for some commodities and regions (Figure 4.2.4). Global area harvested is projected to increase by nearly 10 percent between 2025 and 2050. Most of this increase will occur in low- and middle-income regions, while harvested areas in the rest of the world are projected to remain roughly level. By region, the largest contributors are WCA (particularly for cereals and RTB) and LAC (particularly for cereals and oils and sugars). Total area harvested is projected to grow most rapidly (more than 20 percent between 2025 and 2050) in these two regions and in ESA. In terms of commodities, the largest contributors are oils and sugars (with an increase of 51 million ha) and cereals (with an increase of 32 million ha).

While yields are projected to increase for most crops and regions between 2025 and 2050, empirical evidence shows that climate change has already had significant impacts on crop yields, and our projections indicate that this will continue in the coming decades, with impacts varying by crop and location. Care must also be taken to distinguish *direct* impacts of climate change (holding other factors such as technology, management practices, and market conditions constant) from *final* yield projections after changes in other factors are accounted for.

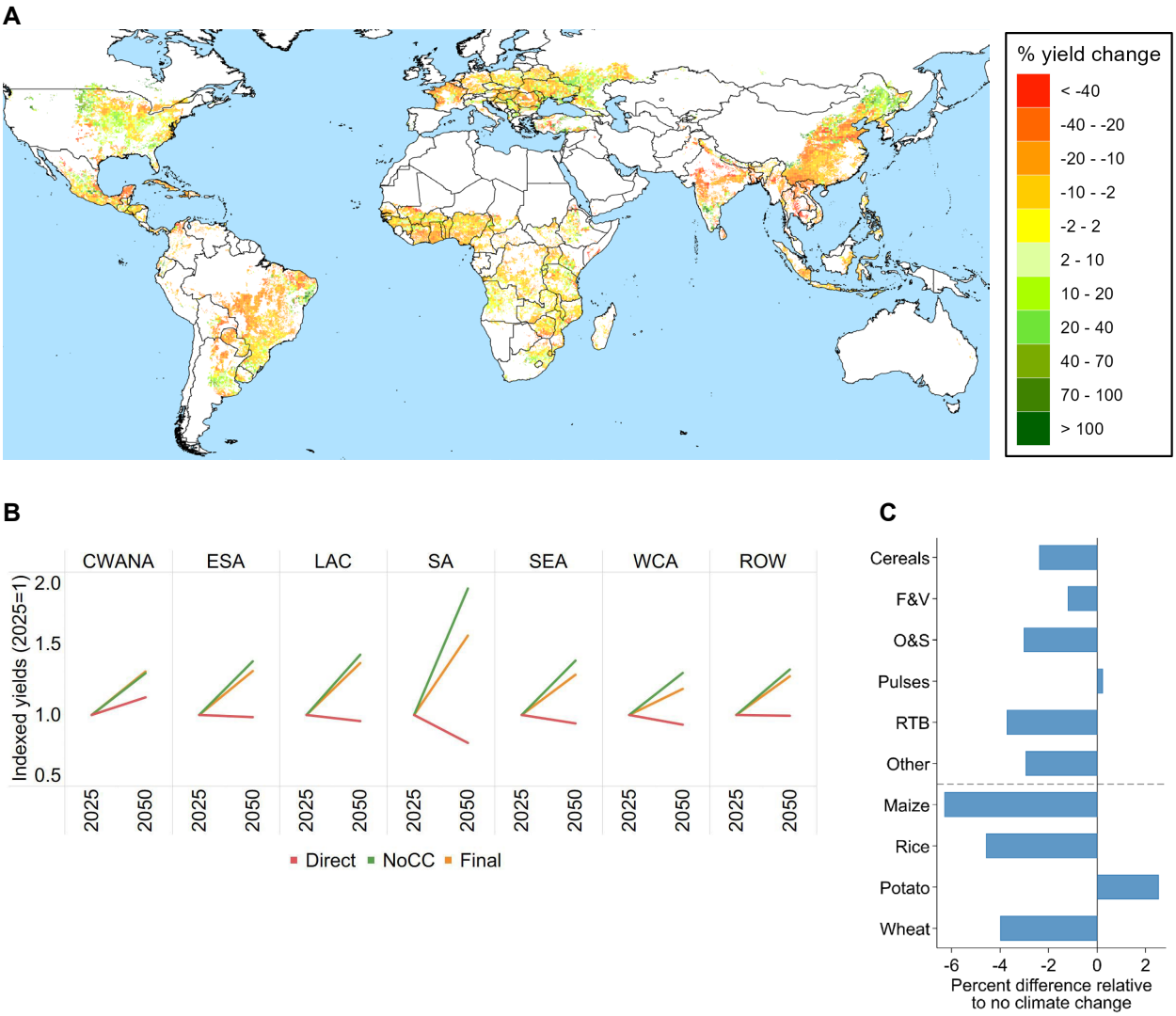
Figure 4.2.4 Projected area harvested by region and commodity group, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Changes in harvested area may come from changes in cropping intensity (i.e., the number of harvests on a given field in a single year) or from expansion of cropland onto lands formerly in pasture, rangeland, or forest land.

In the case of rainfed maize, for example, it is estimated that the direct effects of climate change would reduce yields by 10–20 percent or more in many parts of the world by 2050 (Figure 4.2.5, panel A) — *if* technology, management practices, and market conditions are held constant at 2025 levels. Some areas, mostly at higher latitudes, would see yield increases in this scenario. However, history shows that technology, management practices, market conditions, and other factors will *not* remain constant but will change dynamically in the coming decades — in response both to climate change and to other forces within and outside agrifood systems. Once these other factors and the interactions between them are accounted for (albeit imperfectly), rainfed maize yields are projected to increase by about 20–35 percent in most parts of the world between 2025 and 2050 (panel B), although these increases are less than they would have been in the absence of climate change. Panel C shows how climate change is projected to affect yields of other crops in 2050, after incorporating changes in technology and markets.

Figure 4.2.5 Direct and final impacts of climate change on yields of rainfed maize, percentage change, 2025–2050



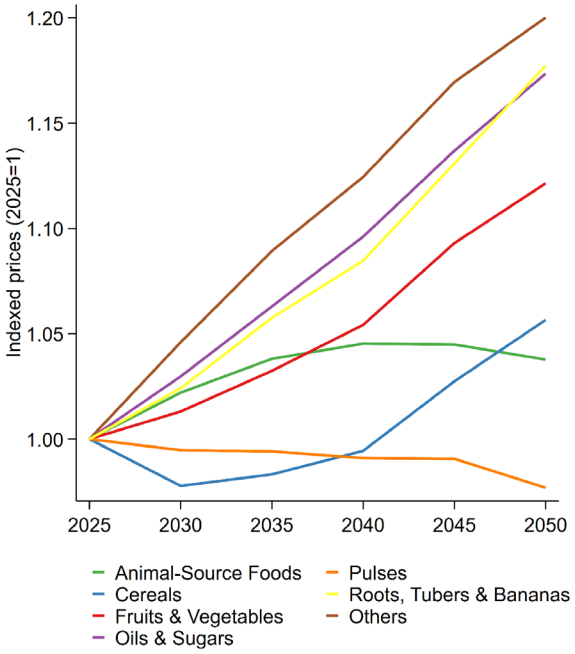
Source: Authors, based on IMPACT v4.1.4, SPAM, DSSAT, RCP7.0, MRI-ESM2-0.

Note: Panel A: Direct biophysical impacts of climate change on yields of rainfed maize without changes in technology and markets, from DSSAT, illustrating potential hotspots for that crop; Panel B: Comparison of changes in rainfed maize yields between 2025 and 2050 considering direct impacts only, changes in technology and markets only (NoCC), and final impacts (considering changes in technology, markets, and climate); Panel C: Final impacts of climate change for all commodity groups and for selected major crops, after incorporating changes in technology and markets (percent difference in total yields between the reference scenario and a scenario assuming no climate change shocks in 2050) as modeled by IMPACT. F&V is fruits and vegetables; O&S is oils and sugars; RTB is roots, tubers, and bananas.

4.3 Prices

Driven by the interaction between changes in demand and supply, real prices of most food and other agricultural commodities are projected to rise between 2025 and 2050 (Figure 4.3.1), with the exception of pulses, for which prices are projected to decline slightly by 2050 as yield growth is expected to remain strong. Projected increases are largest for other crops (especially coffee and cacao), RTB (especially yams and cassava), and oils and sugars (especially soybeans and groundnuts). Prices of animal-source foods (meat, dairy, eggs, and aquatic foods) are projected to level off (and even decline slightly) later in the projection period as demand growth slows in many high-income countries and production increases more rapidly than demand in many low- and middle-income regions.

Figure 4.3.1 Projected price trends by commodity group, 2025–2050



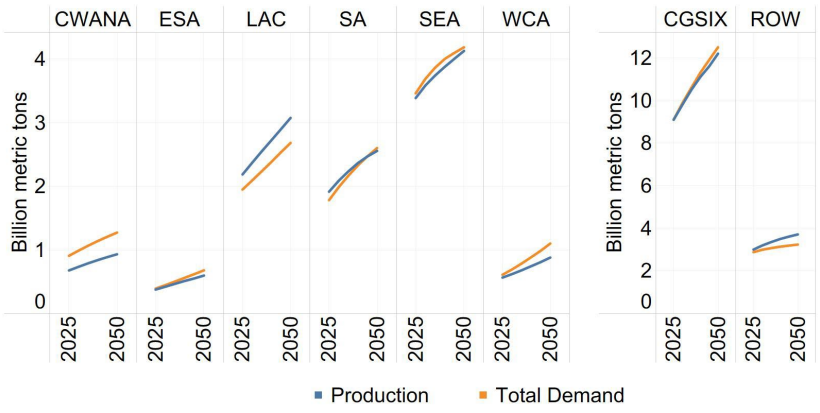
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

4.4 Trade

Total demand is projected to slightly exceed production in volume terms in the CGSIX low- and middle-income regions as a group in 2050, but is projected to be roughly balanced in terms of value (reflecting the importance in those regions of the production of higher-valued commodities, including fruits and vegetables, animal-source foods, and other commodities such as coffee, tea, and cocoa). But the picture differs markedly across regions (Figure 4.4.1). The gap between demand and production is projected to increase (in both volume and value) in CWANA, ESA, and WCA. SEA is projected to close its small gap by 2050 as demand growth slows, and SA is projected to move from a surplus position to a small deficit by 2050 before demand growth begins to slow there as well. In LAC, in contrast, production will continue to exceed demand throughout the projection period.

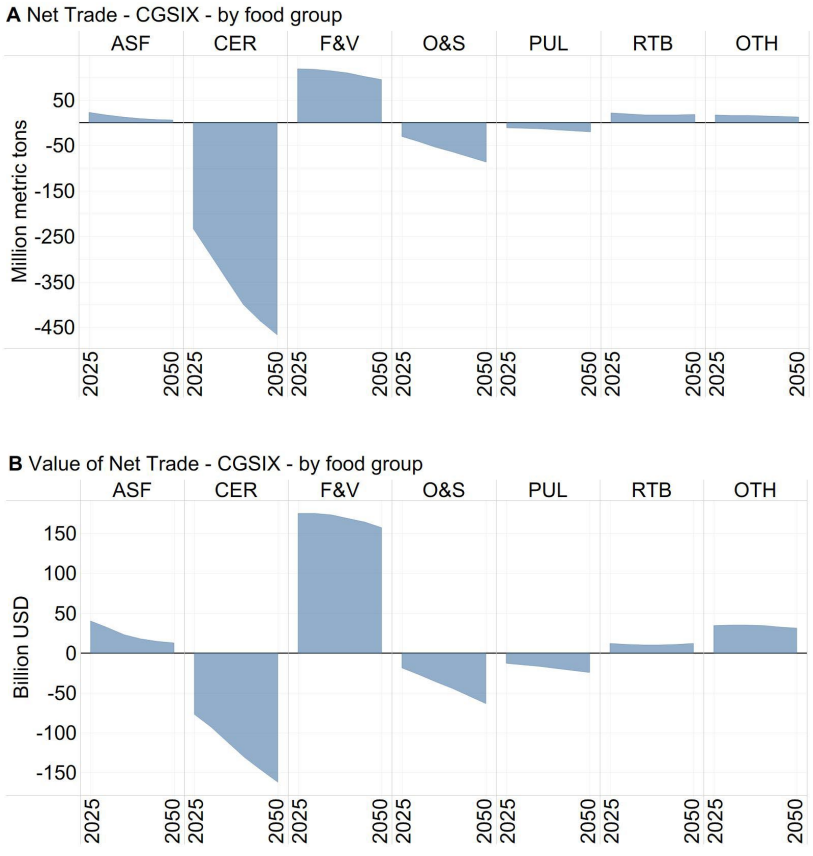
Driven by these changes in demand and production as well as prices, trade patterns are projected to continue evolving between 2025 and 2050. As a group, the CGSIX regions are net importers of staple foods and net exporters of higher-value food commodities (Figure 4.4.2). Over the next 25 years, they are projected to more than double their net imports of cereals, oils and sugars, and pulses (in both volume and value terms), while reducing their net exports of fruits and vegetables and animal-source (including aquatic) foods, but remaining broadly in balance in aggregate value terms.

Figure 4.4.1 Demand and production for all commodities in aggregate, by region, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: This figure shows demand and production in volume terms. The same figure in value terms shows broadly similar patterns. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; CGSIX is the six CGIAR regions; ROW is Rest of the World.

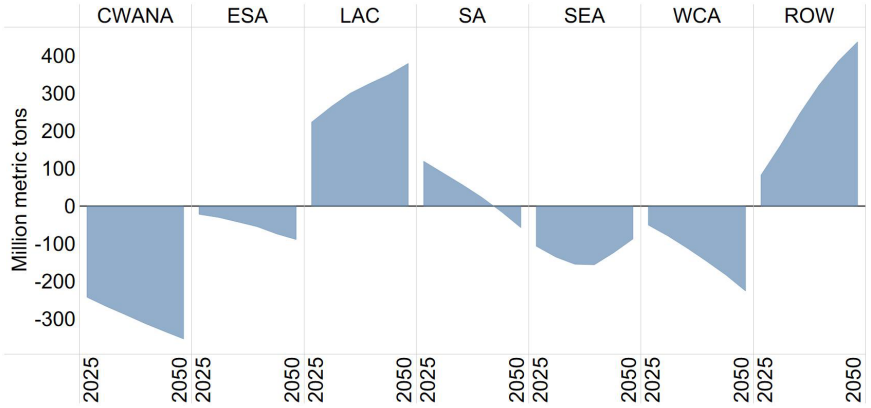
Figure 4.4.2 Projected changes in net trade by commodity group for LMICs as a group, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: LMICs are low- and middle-income countries. ASF is animal-source food; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

These patterns vary markedly by region, however (Figure 4.4.3). Net imports of all food commodities in aggregate are projected to remain largest in CWANA but to increase most rapidly in sub-Saharan Africa, with growth in demand (driven by growth in population and per capita income) outpacing growth in domestic production. Net imports in SEA are projected to first increase and then decline as populations decline in some countries (notably China) and per capita demand growth slows at higher consumption levels. South Asia is projected to move from a position of net exports to become a small net importer late in the projection period as per capita demand rises despite slowing growth in population. LAC and the rest of the world are projected to retain and increase their positions as net exporters of food. More details on the composition of net imports and exports by region are presented in Sections 5 and 6.

Figure 4.4.3 Projected changes in net trade by region for all commodities in aggregate, 2025–2050

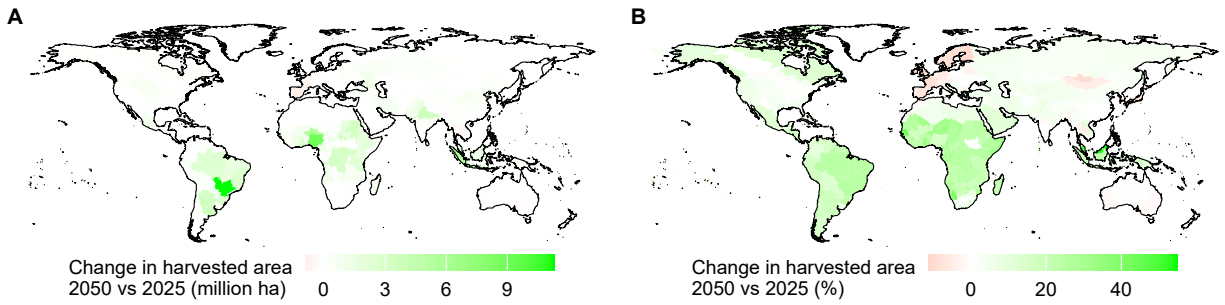


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: This figure shows demand and production in volume terms. The same figure in value terms shows broadly similar patterns. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

4.5 Resource use

Projected increases in production will be generated by a combination of changes in yields and harvested area (both of which are further affected by changes in climate). As noted in Section 4.2 and shown in Figure 4.5.1, harvested area is projected to increase most rapidly over the next 25 years in WCA (driven by expansion of RTB) and LAC (cereals and oils and sugars, especially in Brazil), and followed by ESA (cereals) and Southeast Asia (oils and sugars). In contrast, harvested area is projected to grow the least in parts of Europe and northeastern Asia, due in part to declines in population and demand. Some of these changes in harvested area may result from changes in cropping intensity (that is, the number of harvests on a given field in a single year). But increases in harvested areas also indicate pressure for expansion of cropland onto lands formerly in pasture, rangeland, or forest land. As shown in the figure below, these pressures are greatest in tropical regions, both in absolute terms (panel A) and in terms of rates of change (panel B). This in turn gives rise to concerns about increased GHG emissions and loss of biodiversity, carbon sequestration, and other ecosystem services.

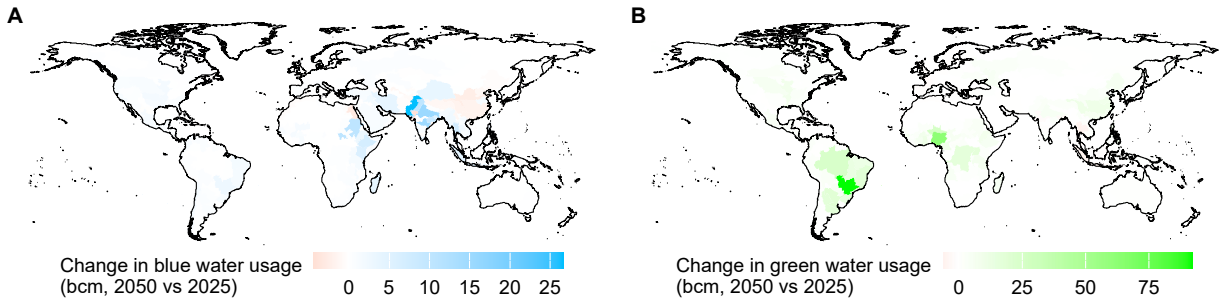
Figure 4.5.1 Projected changes in harvested area, levels and percentage change, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows the change in harvested area between 2025 and 2050; Panel B shows the percentage change in harvested area between 2025 and 2050.

Crop production is the largest user of water worldwide (Chukalla et al. 2025). As is the case for land, future water use for crop production will be affected by a combination of agricultural demand, competing uses, and climate change impacts, and is projected to increase in most areas by 2050. These increases will come from both “blue water” (which is surface and groundwater delivered by irrigation) and “green water” (which is rainfall held in soils and available to plants) (Figure 4.5.2). Irrigation expansion is modeled following expert assessment of regional potential that will depend on recent trends, investments, and water availability. Most often, irrigation is expanded by displacing rainfed area but can, in some situations, be developed on new agricultural land. All river basins in sub-Saharan Africa and almost all in LAC are projected to experience increased water use over the projection period. South Asia (especially Pakistan) and East Africa are projected to experience the largest increases in blue water use (panel A), while parts of WCA and South America are projected to experience the largest increases in green water use (panel B). Increasing blue water use can reduce environmental flows and compete with non-agricultural uses, while greater green water use can indirectly affect ecosystems mainly when it is linked to cropland expansion. Together, these trends raise concerns about long-term sustainability and resilience in some regions over the longer term.

Figure 4.5.2 Projected changes in water use by source, 2025–2050



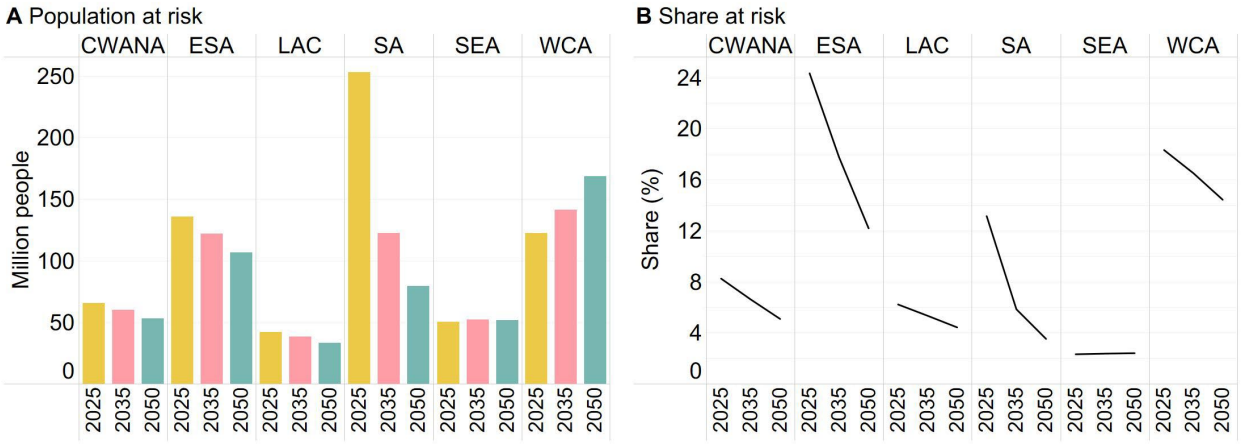
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows the change in blue water use between 2025 and 2050; Panel B shows the change in green water use between 2025 and 2050.

4.6 Food security

Projected changes in demand, production, trade, prices, and other factors will affect all dimensions of food security. Over the time and spatial scales that are the focus of this analysis, we are best able to project changes in availability and access (while noting that stability, utilization, and other dimensions of food security are also important). Households in LMICs typically allocate a higher portion of their income toward food. As income per capita increases, more of a household's disposable income is allocated to nonfood categories (as we saw in Section 4.1). Globally, the median share of income spent on food is projected to decline from 32 percent to 20 percent between 2025 and 2050, and declines are also projected in all regions, indicating an improvement in food security and in households' ability to increase spending on nonfood needs. Within the CGSIX regions, the highest median share of income spent on food is in WCA (55 percent in 2025 declining to 32 percent in 2050) and ESA (44 percent in 2025 declining to 26 percent in 2050). Despite these improvements, these relatively high levels suggest that WCA and ESA will continue to be more vulnerable to food insecurity and fluctuations in food prices and availability than are other regions.

Over the next 25 years, the share of population facing insufficient food availability and access to meet dietary energy requirements is projected to decline globally and in most regions (Figure 4.6.1). This corresponds to stable or declining numbers of people who are undernourished in most regions, except for WCA, where growth in population is projected to outpace improvements in food availability and access. For the CGSIX regions as a whole, the population at risk of hunger is projected to total 493 million in 2050, a decrease of over 170 million (−26 percent) from 2025, but most of the CGSIX regions are not on track to achieve Sustainable Development Goal 2.1 (SDG 2.1) to end world hunger by 2030. The target of ending hunger is based on the FAO et al. (2015) *Achieving Zero Hunger* report, which adopted "a prudential threshold of 5 percent of the population" as indicating ending hunger. Using this 5 percent threshold, most of the regions do not meet SDG2.1, with ESA and WCA especially far from meeting the goal.

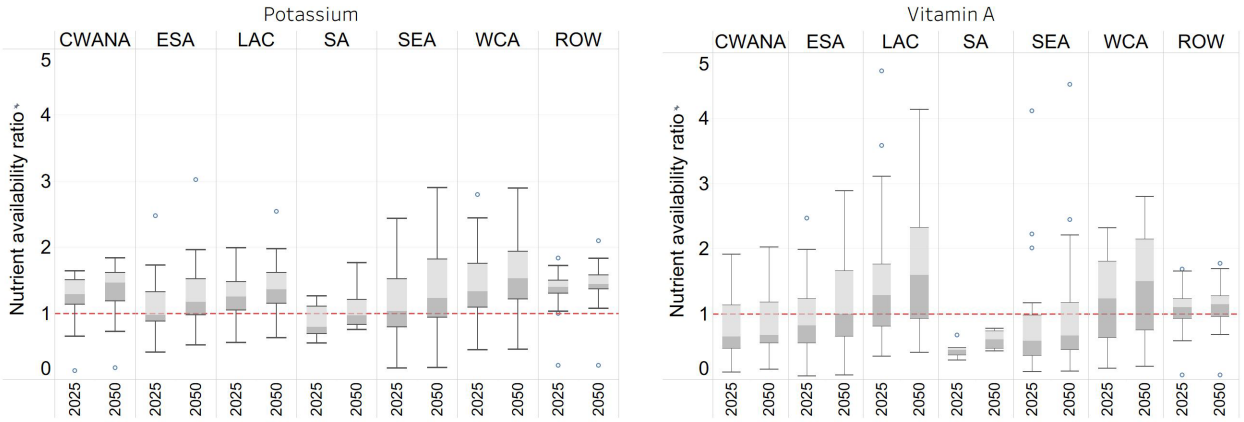
Figure 4.6.1 Projected number and share of undernourished by region in 2025 and 2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows the population at risk of hunger; Panel B shows the share of the population at risk of hunger. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa.

Along with changes in the measure of food security based on dietary energy, per capita availability of micronutrients is projected to increase in all regions (Figure 4.6.2). By 2050, per capita availability of potassium is expected to meet or exceed recommended levels in a majority of ESA countries, and SEA is projected to show a sharp increase in the median per capita availability of riboflavin. Still, despite increases in micronutrient availability, levels are projected to fall short of recommended levels in many regions, including vitamin A in CWANA and SA, riboflavin in WCA, ESA, and SA, and potassium in SA. Of course, these aggregate results mask significant differences in availability across groups within each region. It is also important to note that this measure of availability reflects the micronutrient content of raw food commodities, so it can serve as an indication of broad trends, but final uptake by humans is also affected significantly by food processing and by health and other factors that affect bioavailability.

Figure 4.6.2 Projected micronutrient availability by region, 2025 and 2050



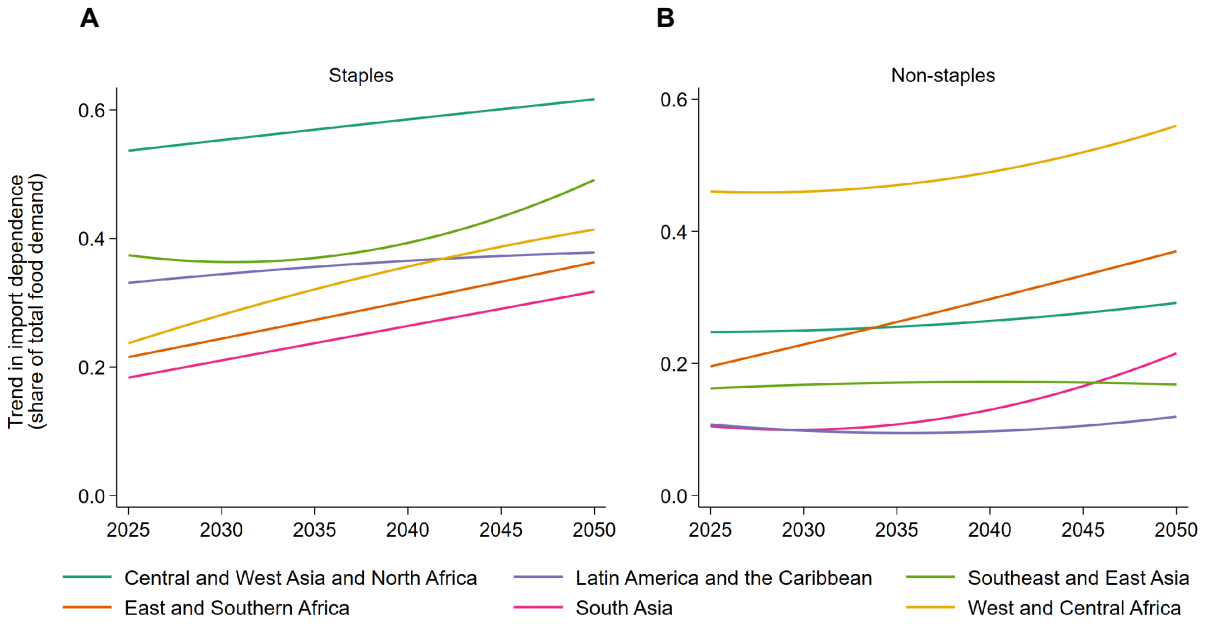
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

In addition to calories and micronutrients, other dimensions of nutritional status are also changing in important ways. These include overweight and obesity, which are increasing in all regions, even while hunger and micronutrient deficiency persist. More than 1 billion people (13 percent of the world's population) are now obese and more than 2.5 billion adults are overweight — exceeding the number who are estimated to be hungry — and those numbers are expected to continue increasing in the future (Bodirsky et al. 2020; Popkin, Corvalan, and Grummer-Strawn 2020; Sulser, Ruel, and Thilsted 2025). Projecting future changes in the number of people who are overweight or obese is beyond the scope of this report, but is an important topic for future research.

The role of trade in ensuring food security is a complex one. Economists have long argued that when markets function well, trade can mitigate the impacts of fluctuations in production and prices on food security by moving food to countries that may have suffered shocks from countries that have not been affected. But national governments have long felt that domestic political considerations call for a measure of self-sufficiency in food production, and this consideration is further reinforced when international

markets function poorly or are subject to unpredictable policy or other market fluctuations. Net imports of food as a share of total food demand are projected to increase in all of the CGSIX regions between 2025 and 2050, but to different degrees for different commodities and in different regions (Figure 4.6.3). Dependence on net imports of staple food commodities (panel A) is projected to increase from around 20–55 percent today to around 30–60 percent in 2050. Dependence on net imports of non-staples (such as fruits and vegetables, coffee, tea, and cocoa; panel B) is also projected to rise, but from lower levels in most regions (from around 10–45 percent in 2025 to around 10–55 percent in 2050). This is especially evident in CWANA, where staples such as maize, wheat, and rice are highly dependent on imports, whereas the only highly import-dependent top-10 non-staple foods are sugar and some aquatic foods. Interestingly, WCA is the only region where dependence is projected to remain higher for non-staples (including dairy, sugar, and palm oil) than it is for staples (for which the region depends on imports for maize and wheat but is a large producer of cassava, yams, and sweet potatoes). More details on net trade by region and commodity are presented in Sections 5 and 6.

Figure 4.6.3 Projected change in dependence on food imports, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows trends in import dependence for staples; Panel B shows trends in import dependence non-staples.

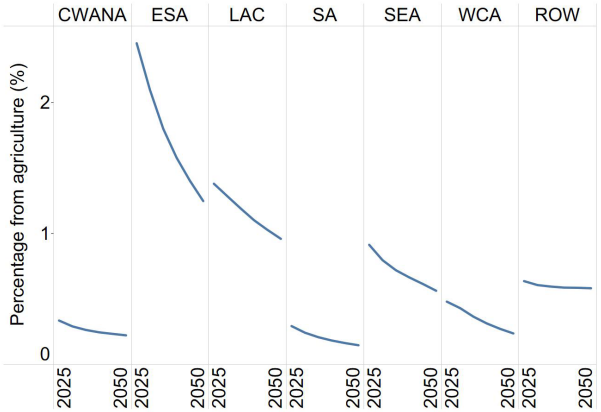
4.7 Employment and income

The agriculture sector is a key source of livelihoods for lower-skilled and vulnerable workers. Globally, the sector is estimated to account for about 8.4 percent of total unskilled labor income in 2025. By 2050, the share of agriculture income going to total unskilled labor income is expected to decline to 5.7 percent. This is driven mainly by structural change, which includes improvements to education and technology, increased urbanization, and faster growth in industrial and services sectors. The combination of these factors is expected to draw more workers away from agriculture to other sectors, resulting in a lower share of agriculture in total employment.

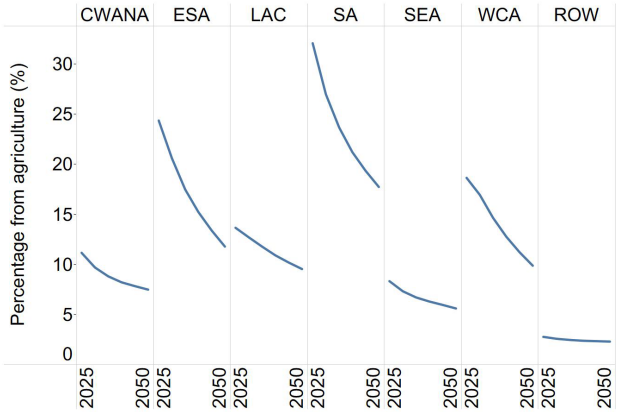
Figure 4.7.1 shows regional projections of the share of agriculture to total unskilled and skilled labor income. These highlight the importance of the agriculture sector in lower-income regions, while revealing notable differences in the distribution of labor income across regions. In SA, agriculture makes up an estimated 32.1 percent of total unskilled labor income in 2025. This is followed by ESA at 24.4 percent and WCA at 18.8 percent. However, it is also in these regions where we anticipate the largest declines in agriculture's contribution to income. By 2050, the share of agriculture to total unskilled labor income is projected to decline to 17.7 percent in SA, 11.8 percent in ESA, and 9.9 percent in WCA. This is not unique to unskilled labor; the share of skilled labor income from agriculture is also expected to decline. To a large degree, this is because economic growth is expected to be stronger in the non-agriculture sectors. As shown earlier in Table 3.2.1 (see Section 3.2), GDP growth in these regions is expected to exceed 4 percent per year. However, agricultural production is expected to grow at a much more modest pace, averaging less than 2 percent per year. This implies that production — and labor — are expected to grow faster in non-agriculture sectors.

Figure 4.7.1 Projected change in agricultural employment, 2025–2050

A Skilled labor income



B Unskilled labor income



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0, and GLOBE.
Note: Panel A shows the percentage of skilled labor income from agriculture; Panel B shows the percentage of unskilled labor income from agriculture. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

4.8 Key messages on major agrifood systems indicators

- Food demand is projected to continue rising but more slowly than over the past half century, and at different rates for different food commodities and regions.
- Responding to food demand, food production is also projected to continue rising more slowly than in previous decades, and will come increasingly from growth in productivity.
- Climate change is projected to slow growth in agricultural productivity, but impacts will vary by commodity and region. Socioeconomic factors (including changes in demand and technology) will remain the dominant drivers of changes in food production through mid-century in aggregate.
- Many LMICs are projected to become increasingly dependent on food imports, particularly for cereals.
- Food security is projected to improve in most regions, with the exception of WCA.
- The share of employment and income from agriculture is projected to decline in all regions as other sectors grow more rapidly, particularly in ESA and South Asia.
- Affordability of healthy diets, pressure on natural resources, and vulnerability to shocks remain key challenges in all regions.

5 OUTLOOK BY REGION

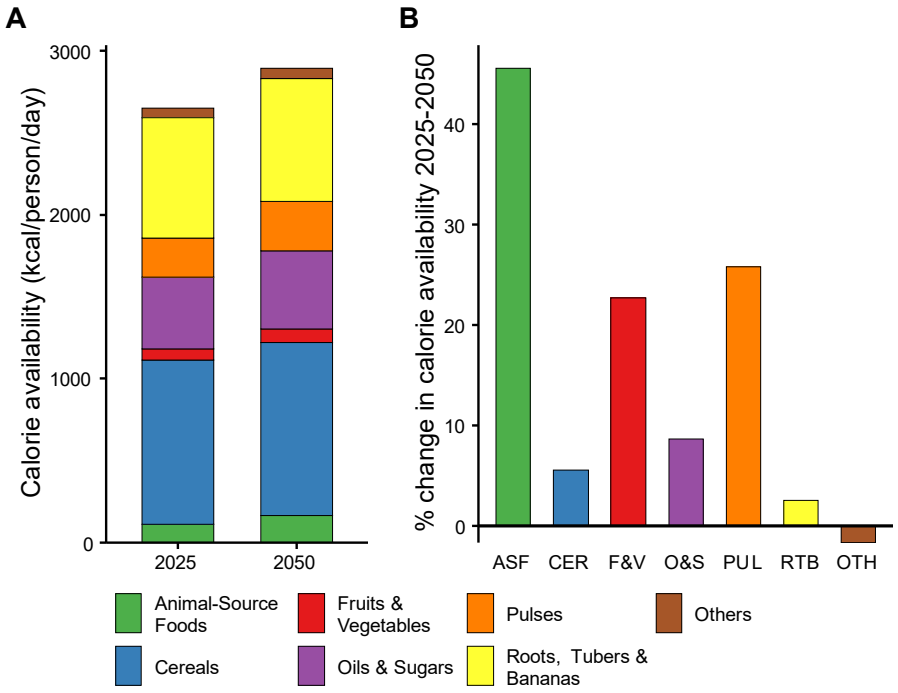
Broad patterns of change in demand, production, trade, resource use, and food security are presented at the global level in Section 4. This section provides a closer look at more disaggregated results for each region.

5.1 West and Central Africa

Food demand

In WCA, food demand is projected to rise by over 80 percent between 2025 and 2050. Increased demand for staple foods largely reflects growth in population, which is expected to increase from 670 million to 1.2 billion people during that period. Cereals (especially maize and rice) and RTB (especially cassava) are the major staple foods in WCA, and will still account for more than half of dietary energy in 2050 (Figure 5.1.1, panel A). But rising incomes will also drive increases in demand for higher-value foods. Per capita consumption of animal-source (including aquatic) foods, pulses, and fruits and vegetables will grow most rapidly over the next 25 years (panel B), accounting for more than half of the increase in per capita consumption in the region (128 out of 240 calories).

Figure 5.1.1 Changes in per capita availability of food commodities in West and Central Africa, 2025–2050

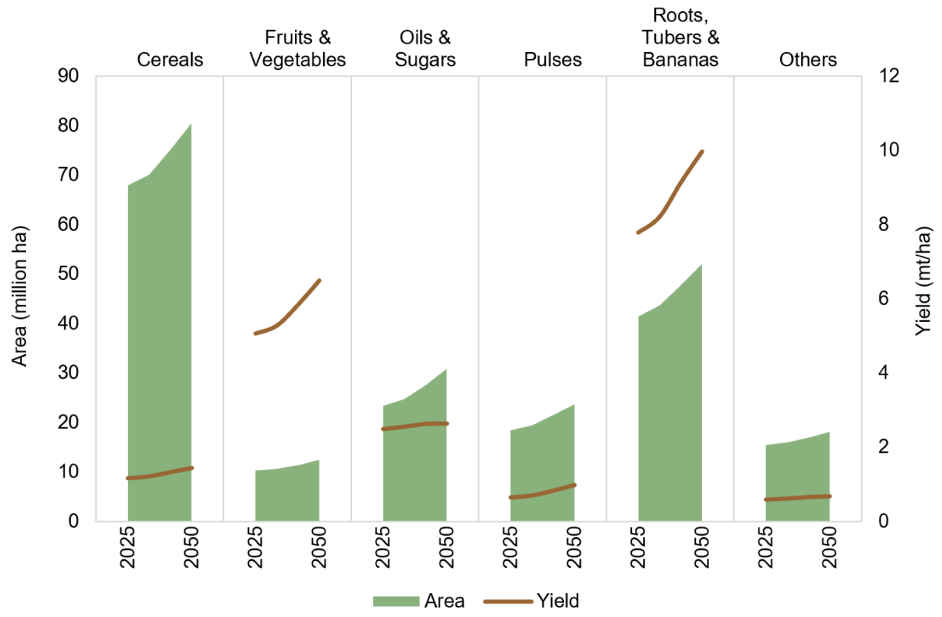


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows calorie availability per person in 2025 and 2050 by food commodity group; Panel B shows the percentage change in calorie availability between 2025 and 2050 by food commodity group.

Total production

Production is projected to increase for all commodities in WCA between 2025 and 2050, most rapidly for RTB (Figure 5.1.2). Increased production in the region will result about equally from expansion in harvested area and increases in yields (see Figure 4.2.2 in Section 4.2). Total harvested area in WCA is projected to increase by 23 percent between 2025 and 2050. Absolute increases in area are largest for cereals and for RTB, reflecting their continued importance as staple food crops, but area in oil and sugar crops increases most rapidly, by 32 percent over the period. Yield increases are largest for RTB and fruits and vegetables, while yields of pulses increase by 52 percent, albeit from low initial levels, to 1 metric ton per hectare by 2050.

Figure 5.1.2 Projected changes in harvested area and yield in West and Central Africa, by commodity group, 2025–2050

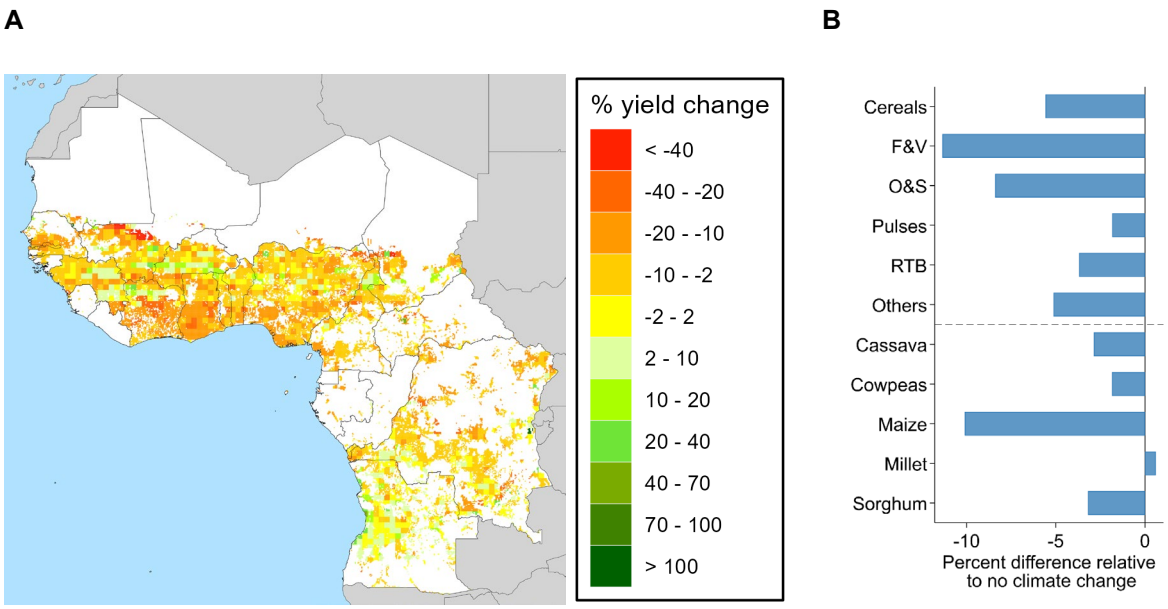


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Changes in harvested area may come from changes in cropping intensity (i.e., the number of harvests on a given field in a single year) or from expansion of cropland onto lands formerly in pasture, rangeland, or forest land.

Yield growth

Yield growth in WCA over the period 2025–2050, while positive for all commodity groups, is projected to be slower than it would have been in the absence of climate change. Looking first at direct effects of changes in temperature and precipitation on yields — assuming other things do not change — suggests areas of potential concern, as in the case of rainfed maize (see Figure 5.1.3, panel A), for which *potential* yield losses in some locations could reach 20 percent or more in the absence of farmer and market adjustments. But these direct effects need to be adjusted for other changes that will take place over the next 25 years. These include changes in technology (e.g., adoption of improved crop varieties), management practices (e.g., changes in input levels), and market adjustments (e.g., changes in cropping patterns in response to changing prices). After accounting for these indirect effects, the final projected impacts of climate change on yields in WCA are generally smaller than the potential impacts before adjustment. As shown in panel B, average yields for the different commodity groups in WCA in 2050 are projected to be 2–11 percent lower than they would have been in the absence of climate change — but they are still projected to be higher in 2050 than they are in 2025 (see Figure 5.1.2). Results for selected major crops in the region illustrate the diversity of impacts even within a single commodity group. Within the cereals group, for example, maize yields in WCA are projected to be 10 percent lower as a result of climate change, but millet yields in the region are projected to be slightly higher. Impacts for other specific crops are reported in Section 6. As noted in Section 3.2, disruptions due to climate-related extreme events may affect some areas above and beyond the impacts expected from gradual changes in temperature and precipitation over longer periods of time that are reported here.

Figure 5.1.3 Climate change impacts on yields in West and Central Africa, 2025–2050



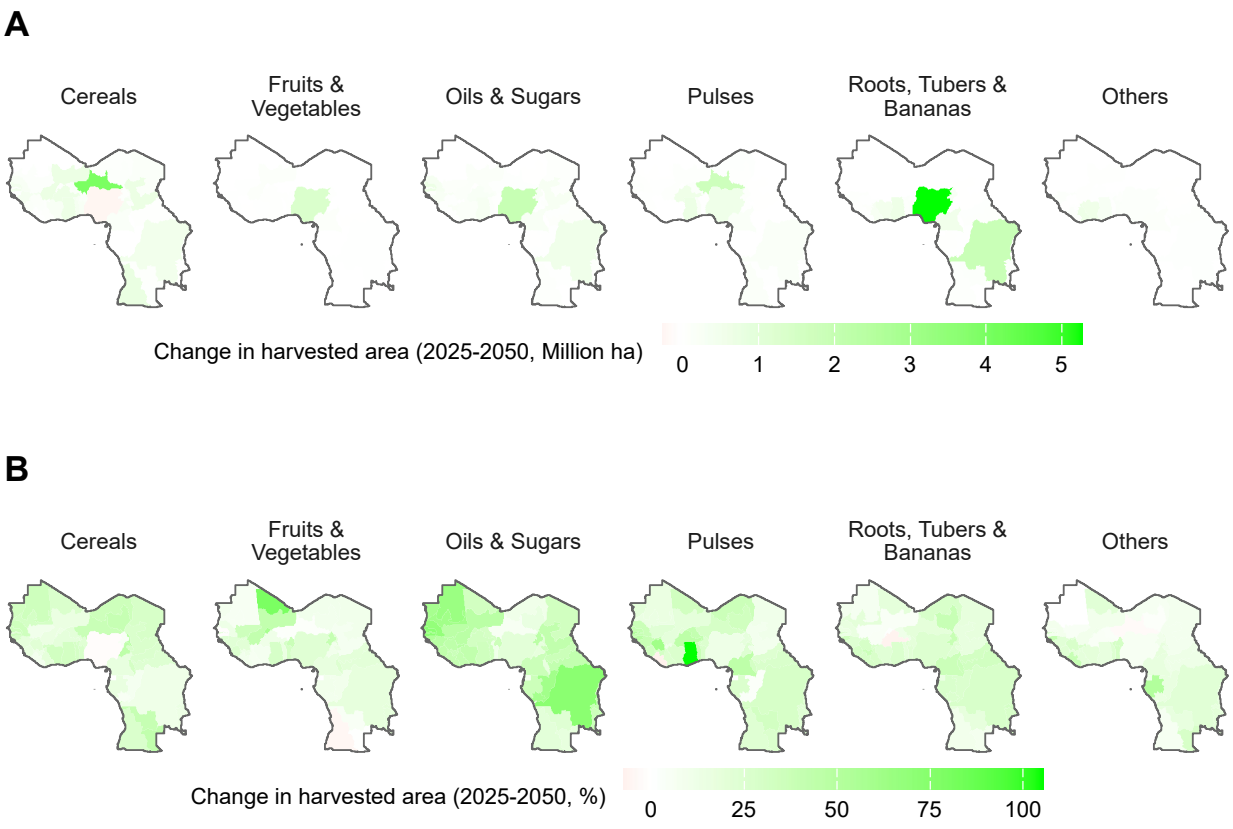
Source: Authors, based on DSSAT, IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A: DSSAT results for rainfed maize without changes in technology and markets, illustrating potential hotspots for that crop; Panel B: IMPACT results for all commodity groups and for major crops in the region, after incorporating changes in technology and markets (percent difference in total yields between the reference scenario and a scenario assuming no climate change shocks in 2050). F&V is fruits and vegetables; O&S is oils and sugars; and RTB is roots, tubers, and bananas.

Harvested area

Because yield growth, while still generally positive, is slowed by climate change, harvested area is projected to increase more than it would have in the absence of climate change, driven also by other factors including changes in demand (Figure 5.1.4). Absolute increases in harvested area are largest in Nigeria (+10 million ha), particularly for RTB (+5.5 million ha). In percentage terms, area growth across much of WCA is fastest for oils and sugars.

Figure 5.1.4 Projected change in harvested area in West and Central Africa by crop, 2025–2050

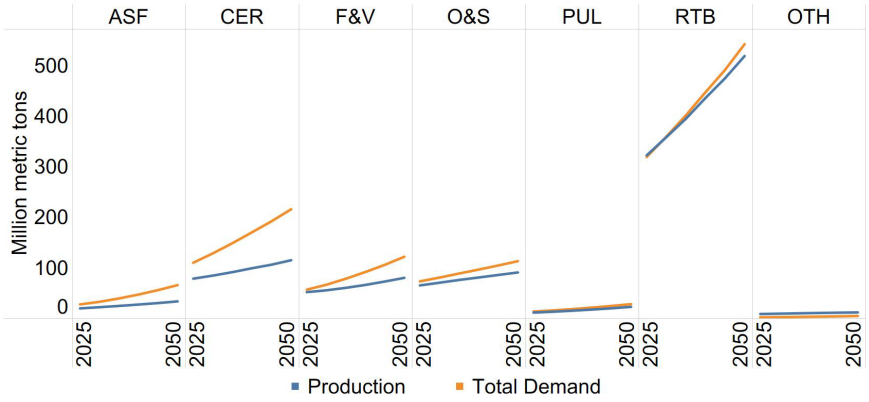


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows the change in harvested area (2025-2050) in millions of hectares; Panel B shows the percentage change in harvested area (2025–2050).

Meeting demand

Despite increases in domestic production, gaps between demand and production are projected to widen for all food commodity groups in WCA between 2025 and 2050, particularly for cereals, fruits and vegetables, and animal-source foods (including aquatic foods) (Figure 5.1.5).

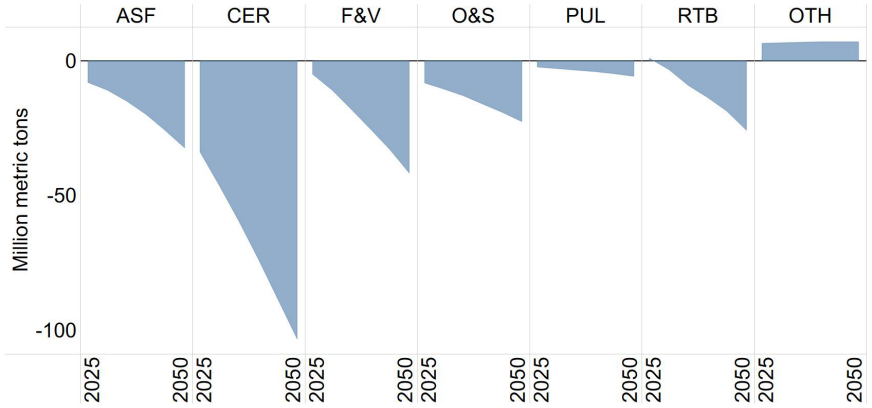
Figure 5.1.5 Changes in total demand and production of food commodities in West and Central Africa, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source food; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

As a result of these widening gaps, net imports are projected to increase for most food commodities in WCA (Figure 5.1.6). Cereal imports are expected to triple between 2025 and 2050; maize imports in Nigeria are a major component, but imports of rice and wheat also increase in the region. Despite sharp anticipated growth in production, WCA is projected to move away from self-sufficiency in RTB, especially for cassava and plantain. Increased net imports of RTB in southern parts of the region (Angola and Democratic Republic of the Congo) more than offsets increases in net exports in countries around the Gulf of Guinea (Côte d'Ivoire, Ghana, and Sierra Leone). Meanwhile dairy drives increased imports of animal-source foods. Alone among commodity groups in the regions, net exports of other crops (including cocoa from Côte d'Ivoire and Ghana) are projected to rise slightly.

Figure 5.1.6 Net trade in food commodities in West and Central Africa, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source food; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

Nutrition

Over the next 25 years, the share of population facing insufficient food availability and access to meet dietary energy requirements is projected to decline in WCA from 18.3 percent in 2025 to 14.4 percent in 2050 (see Section 4.6 and Figure 4.6.1). But growth in population is still projected to outpace improvements in food availability and access in the region, so the number of undernourished people in WCA is projected to increase from 123 million to 168 million over that period. At the same time, affordability of healthy diets, micronutrient deficiency, and overweight and obesity are also expected to remain challenges for segments of the population.

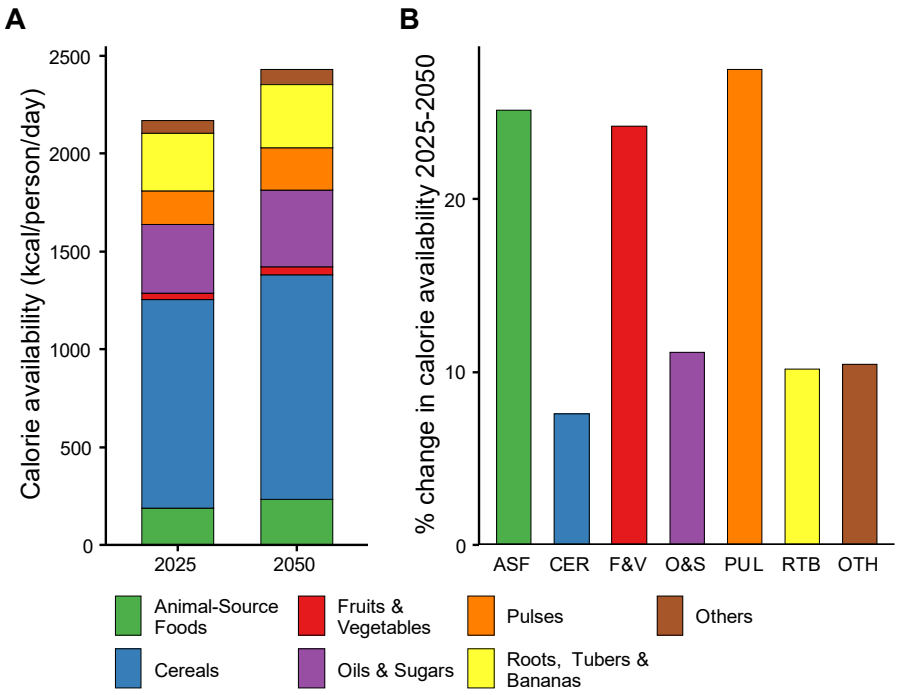
5.2 East and Southern Africa

Food demand

In ESA, food demand is projected to rise by nearly 80 percent between 2025 and 2050. This increase reflects a combination of drivers, the largest of which is an anticipated 57 percent increase in the population over that period. Additionally, per capita income is expected to grow by 2.9 percent per year, on average (see Table 3.2.1 in Section 3.2). This is expected to strengthen demand for animal-source foods and fruits and vegetables. A pronounced increase in pulses demand is also anticipated, as global prices remain steady over the projection period compared with other commodity groups (see Fig 4.3.1).

Today, cereals (especially maize) contribute almost half of average daily calories per capita, while oils and sugars and RTB make up another 30 percent of caloric intake (Figure 5.2.1, panel A). Rising incomes will help diets diversify over time through increased consumption of animal-source foods (both meat and fish), pulses, and fruits and vegetables (panel B), with important benefits in terms of protein and micronutrient availability in addition to dietary energy.

Figure 5.2.1 Changes in per capita availability of food commodities in East and Southern Africa, 2025–2050

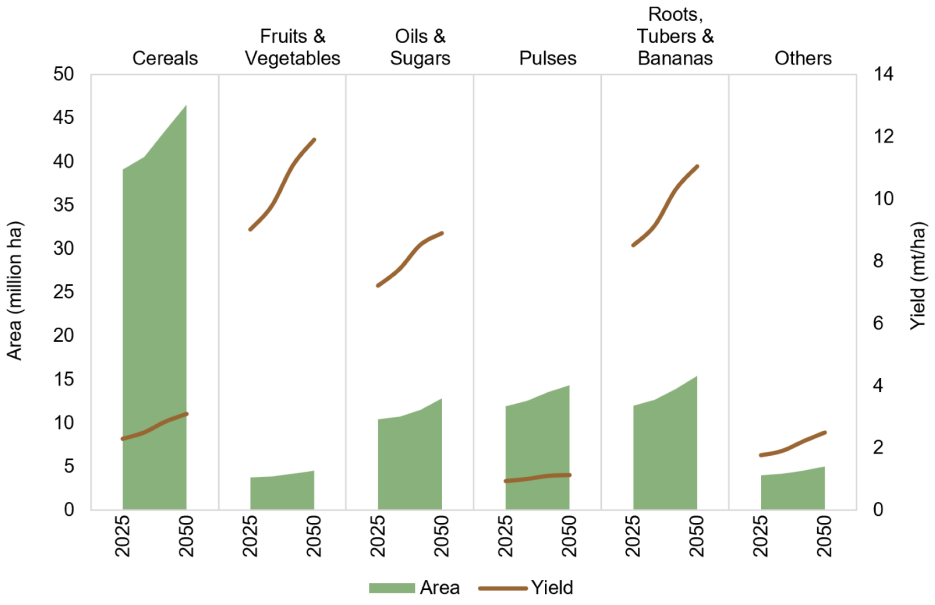


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows calorie availability per person in 2025 and 2050 by food commodity group; Panel B shows the percentage change in calorie availability between 2025 and 2050 by food commodity group.

Total production

Production is projected to increase for all commodities in ESA between 2025 and 2050. Increased production will be driven mostly by growth in yields, but harvested area is also projected to increase significantly (see Figure 4.2.2 in Section 4.2). Yield increases are fastest in cereals (+35 percent), fruits and vegetables (+32 percent), and RTB (+30 percent) (Figure 5.2.2). Total harvested area in ESA is projected to increase by about 18 million ha (or 22 percent) between 2025 and 2050. Absolute increases in area are largest for cereals, with nearly 8 million additional hectares, driven by maize and sorghum, while RTB expands most rapidly, with harvested area growing by 29 percent (+3 million ha).

Figure 5.2.2 Projected area and yield by commodity group in East and Southern Africa, 2025–2050

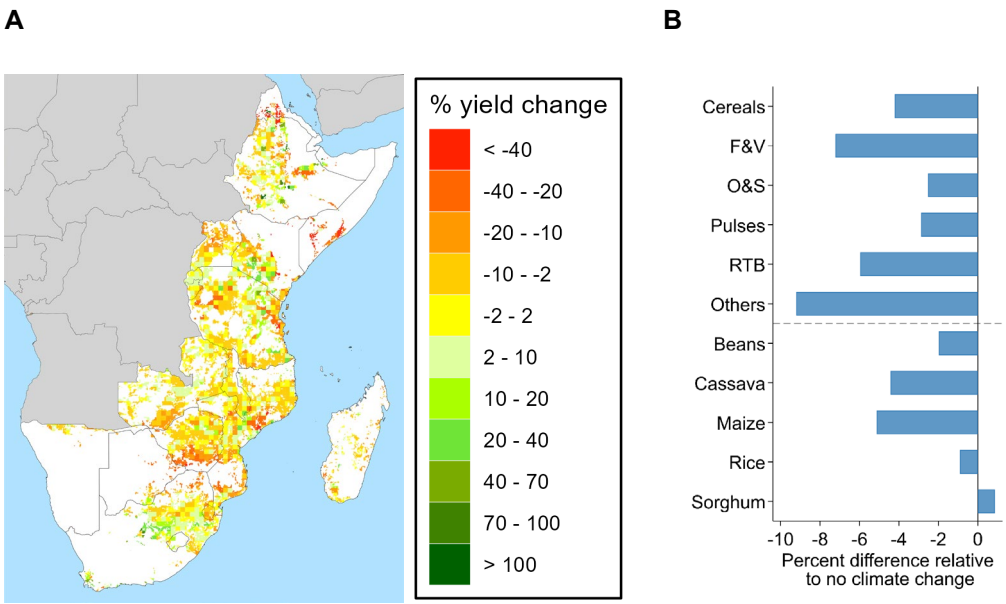


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Yield growth

Yields are projected to grow more slowly in ESA than they would have in the absence of climate change. Looking first at direct effects of changes in temperature and precipitation on yields — assuming other things do not change — suggests areas of potential concern as well as opportunity. For example, in the case of rainfed maize (Figure 5.2.3, panel A) *potential* yield losses in some locations could reach 20 percent or more in the absence of farmer and market adjustments. But these direct effects need to be adjusted for other changes that will take place over the next 25 years. These include changes in technology (e.g., adoption of improved crop varieties), management practices (e.g., changes in planting dates), and market adjustments (e.g., changes in input levels in response to changing prices). After accounting for these indirect effects, the final projected impacts of climate change on yields in ESA are generally smaller than the potential impacts before adjustment. As shown in panel B, average yields for the different commodity groups in ESA in 2050 are projected to be 3–9 percent lower than they would have been in the absence of climate change — but they are still projected to be higher in 2050 than they are in 2025 (see Figure 5.2.2). Results for selected major crops in the region illustrate the diversity of impacts even within a single commodity group. Within the cereals group, for example, maize yields in ESA are projected to be 5 percent lower as a result of climate change, but sorghum yields in the region are projected to be about 1 percent higher. Impacts for other specific crops are reported in Section 6. As noted in Section 3.2, disruptions due to climate-related extreme events may affect some areas above and beyond the impacts expected from gradual changes in temperature and precipitation over longer periods of time that are reported here.

Figure 5.2.3 Climate change impacts on yields in East and Southern Africa, 2025–2050

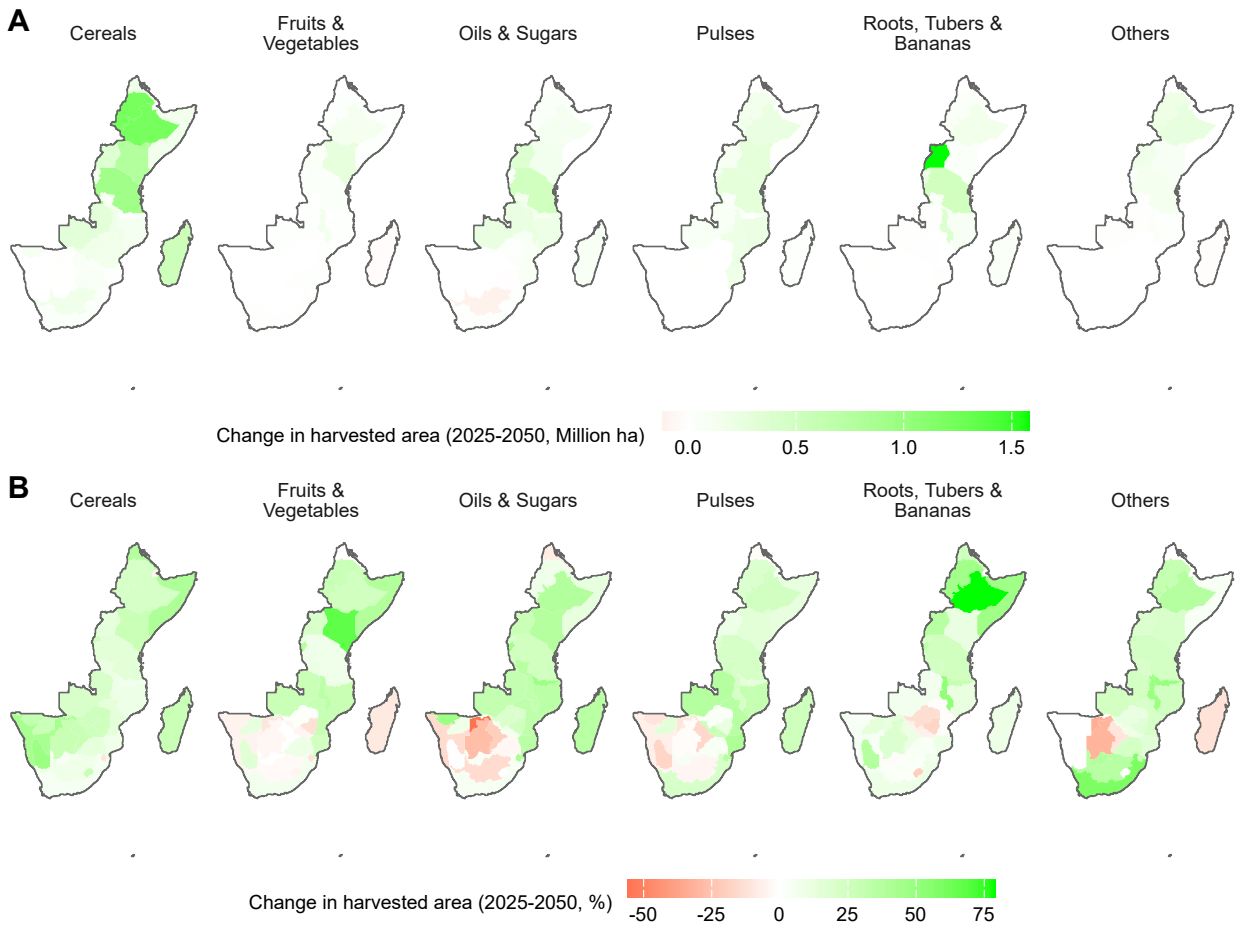


Source: Authors, based on DSSAT, IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A: DSSAT results for rainfed maize without changes in technology and markets, illustrating potential hotspots for that crop; Panel B: IMPACT results for all commodity groups and for major crops in the region, after incorporating changes in technology and markets (percent difference in total yields between the reference scenario and a scenario that assumes no climate change shocks in 2050). F&V is fruits and vegetables; O&S is oils and sugars; and RTB is roots, tubers, and bananas.

Harvested area

Because yield growth (while still generally positive) is slowed by climate change, harvested area is projected to increase more than it would have in the absence of climate change driven also by other factors including changes in demand. Absolute increases in harvested area are largest in Ethiopia (particularly for cereals), Tanzania (cereals), and Uganda (RTB) (Figure 5.2.4). In percentage terms, area growth is fastest for RTB in Ethiopia and for fruits and vegetables in Kenya. As noted in Section 4.5, such increases could adversely affect GHG emissions and ecosystem services, but may be mitigated by national land-use policies (which are not considered in this report).

Figure 5.2.4 Projected change in harvested area in East and Southern Africa by crop, 2025–2050

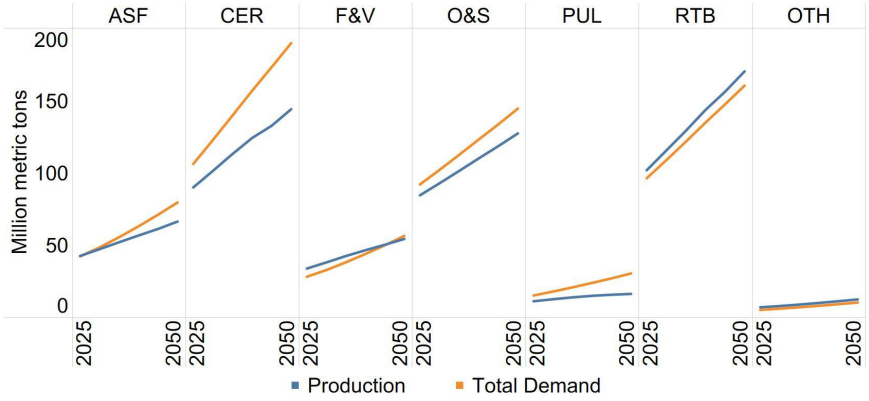


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows the change in harvested area (2025–2050) in millions of hectares; Panel B shows the percentage change in harvested area (2025–2050).

Meeting demand

Despite increases in domestic production, the gap between demand and production in ESA is projected to widen between 2025 and 2050, especially for cereals, animal-source foods (mainly dairy), and pulses (Figure 5.2.5). Demand for these foods is greater in magnitude and grows faster than production over the entire 2025–2050 period. Oils and sugars are consistently an important share of the diet (around 17 percent) over the time period; however, despite a large increase in sugarcane production (+55 percent), sugar production is not projected to keep up with demand. Production is generally greater than demand in the region only for RTB, driven by increases in production of cassava and sweet potatoes, for fruits and vegetables (at least until 2045), and for other crops.

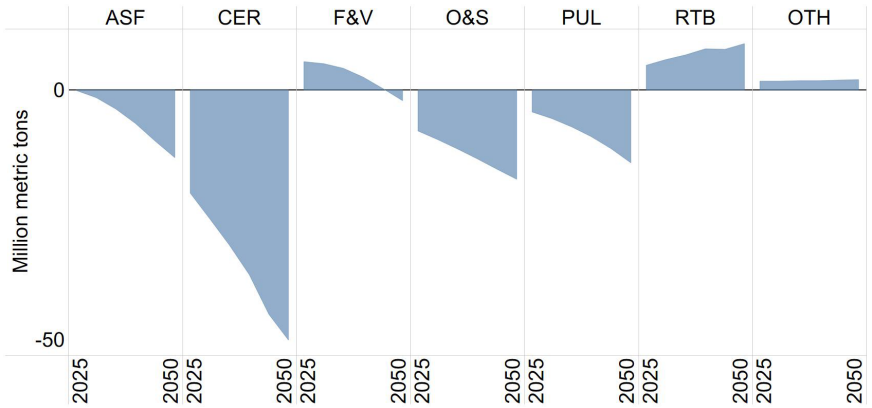
Figure 5.2.5 Changes in total demand and production of food commodities in East and Southern Africa, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source food; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

As a result of these widening gaps, net imports are projected to increase for most food commodities in ESA between 2025 and 2050 (Figure 5.2.6). Cereal imports increase rapidly; imports of maize (the most demanded cereal) more than triple; and imports of wheat almost double. Imports of pulses also triple in the region, while dairy drives the rapid increase in imports of animal-source foods. ESA continues to be a net exporter of RTB, especially sweet potatoes and cassava, and exports are projected to almost double.

Figure 5.2.6 Net trade in food commodities in East and Southern Africa, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source food; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

Nutrition

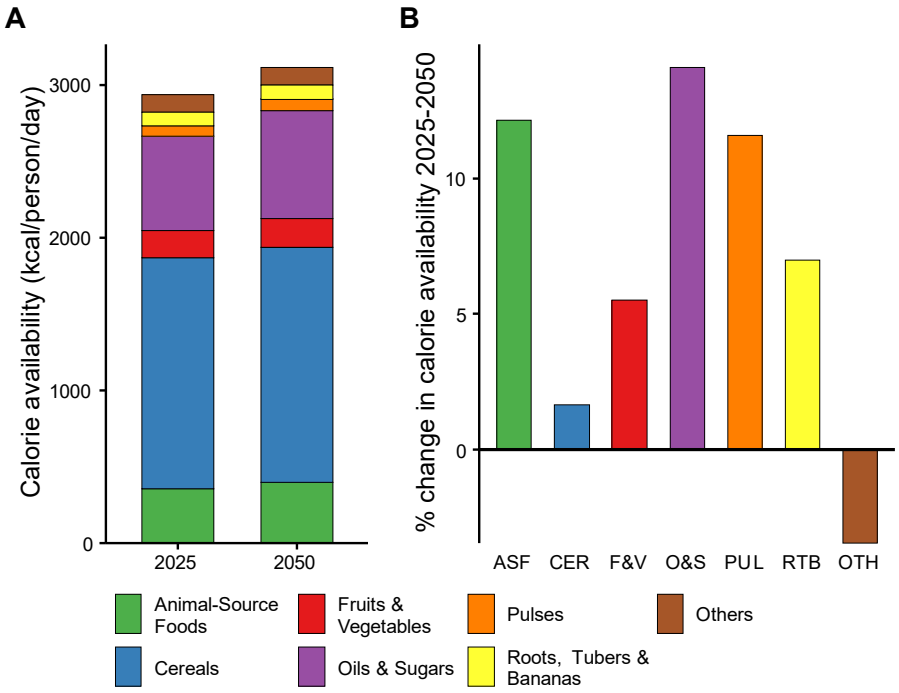
Over the next 25 years, the share of population facing insufficient food availability and access to meet dietary energy requirements is projected to decline in ESA from 24.3 percent in 2025 to 12.2 percent in 2050, while the number of undernourished people is projected to decrease from 136 million to 107 million over that period (see Section 4.6 and Figure 4.6.1). Even so, affordability of healthy diets, micronutrient deficiency, and overweight and obesity are expected to remain challenges for segments of the population.

5.3 Central and West Asia and North Africa

Food demand

In CWANA, food demand is projected to increase by nearly 40 percent between 2025 and 2050, driven by both population growth (population is projected to increase by almost 250 million) and rising per capita incomes (+70 percent). While cereals remain the dominant source of calories, over the next 25 years per capita calorie availability expands fastest for oils and sugars (+14 percent), animal-source foods (+12 percent, mainly driven by demand for dairy), and pulses (+12 percent) (Figure 5.3.1). This reflects gradual diversification beyond traditional staples as incomes rise. The rapid increase in demand for oils and sugars reflects changing preferences but raises concerns about diet-related health impacts. Nonetheless, staple grains will continue to account for more than half of dietary energy, reflecting the continued importance of cereals even as the diet diversifies.

Figure 5.3.1 Changes in per capita availability of food commodities in Central and West Asia and North Africa, 2025–2050

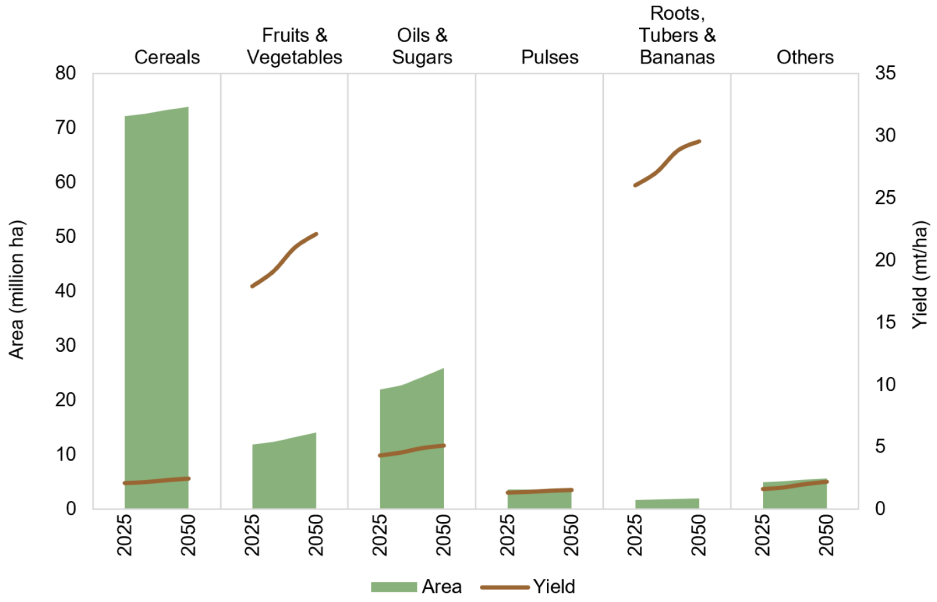


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows calorie availability per person in 2025 and 2050 by food commodity group; Panel B shows the percentage change in calorie availability between 2025 and 2050 by food commodity group.

Total production

Production is projected to grow for all commodity groups, and it is fastest for animal-source foods and fruits and vegetables. Increased production in CWANA will be underpinned primarily by improvements in yield (+25 percent) rather than by land expansion (+8 percent). Yield increases are fastest for fruits and vegetables (+23 percent) (Figure 5.3.2). Increases in yields for the other food groups range from 14 percent for RTB to 18 percent for oils and sugars, with cereals growing by more than 17 percent. Total harvested area in CWANA is projected to increase by 9 million ha (+8 percent) between 2025 and 2050. The fastest area expansion is projected for fruits and vegetables, followed by oils and sugars. However, in absolute terms the largest area increase is for oils and sugars, which is projected to gain nearly 4 million ha driven by area under groundnut and other oilseeds. The area in cereals expands by 2 percent (+1.7 million ha).

Figure 5.3.2 Projected area and yields in Central and West Asia and North Africa, by commodity group, 2025–2050

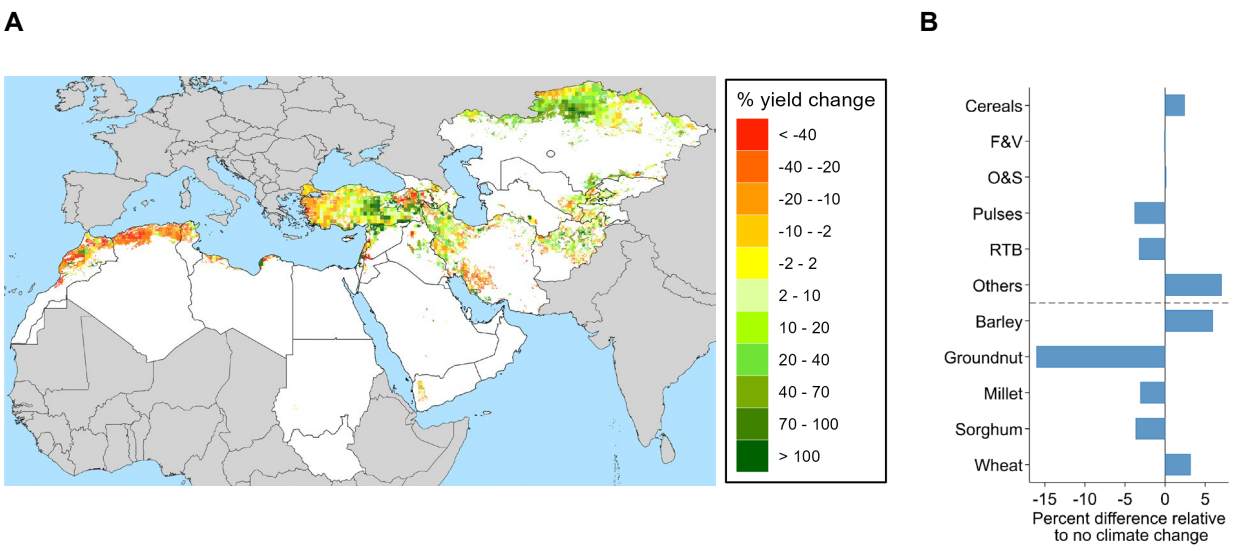


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Yield growth

Climate change is projected to have mixed effects on yield growth in CWANA, varying by crop and location. Looking first at direct effects of changes in temperature and precipitation on yields — assuming other things do not change — suggests areas of potential concern as well as opportunity. For example, in the case of rainfed wheat (Figure 5.3.3, panel A) *potential* yield losses in some locations could reach 20 percent or more in the absence of farmer and market adjustments. But these direct effects need to be adjusted for other changes that will take place over the next 25 years. These include changes in technology (e.g., adoption of improved crop varieties), management practices (e.g. changes in planting dates and tillage practices), and market adjustments (e.g. changes in input levels and subsidies in response to changing prices). After accounting for these indirect effects, the final projected impacts of climate change on yields in CWANA are generally smaller than the potential impacts before adjustment. As shown in Figure 5.3.3, panel B, average yields for pulses and roots and tubers in CWANA in 2050 are projected to be 3 to 4 percent lower than they would have been in the absence of climate change — but they are still projected to be higher in 2050 than they are in 2025 (see Figure 5.3.2). In contrast, yields of cereals and other commodity groups appear to benefit from changes in climate. Results for selected major crops in the region illustrate the diversity of impacts even within a single commodity group. Within the cereals group, for example, wheat and barley yields in CWANA are projected to be 3–6 percent higher as a result of climate change, but sorghum and millet yields in the region are projected to be 3–4 percent lower. Impacts for other specific crops are reported in Section 6. As noted in Section 3.2, disruptions due to climate-related extreme events may affect some areas above and beyond the impacts expected from gradual changes in temperature and precipitation over longer periods of time that are reported here.

Figure 5.3.3 Climate change impacts on yields in Central and West Asia and North Africa, 2025–2050



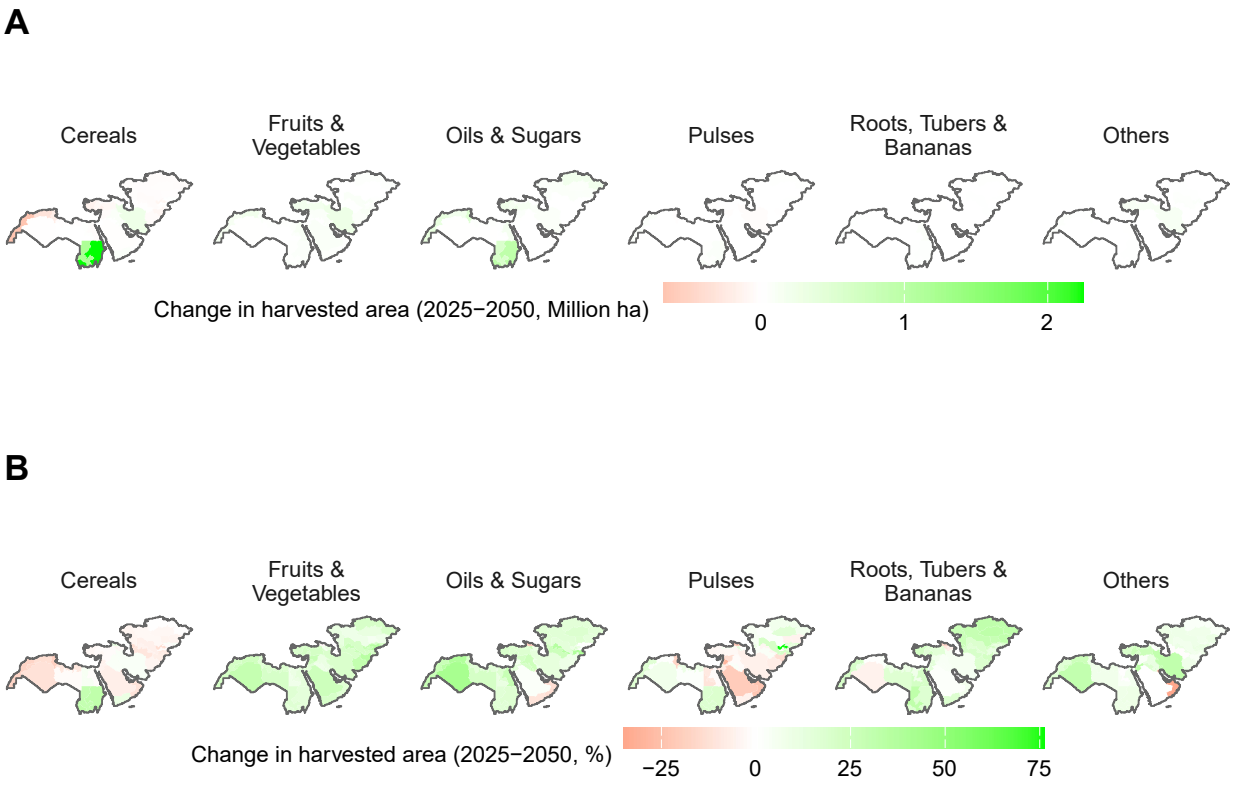
Source: Authors, based on DSSAT, IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A: DSSAT results for rainfed wheat without changes in technology and markets, illustrating potential hotspots for that crop; Panel B: IMPACT results for all commodity groups and for major crops in the region, after incorporating changes in technology and markets (percent difference in total yields between the reference scenario and a scenario that assumes no climate change shocks in 2050). F&V is fruits and vegetables; O&S is oils and sugars; and RTB is roots, tubers, and bananas.

Harvested area

As is true for yields, projected changes in harvested area in CWANA vary by crop and location driven also by other factors including changes in demand. Absolute increases in harvested area are largest in Sudan (for cereals) and Türkiye (fruits and vegetables) (Figure 5.3.4). In percentage terms, area growth is widespread across the region for oilseeds as well as fruits and vegetables, with declines in many countries for cereals and pulses.

Figure 5.3.4 Projected change in harvested area in Central and West Asia and North Africa by crop, 2025–2050

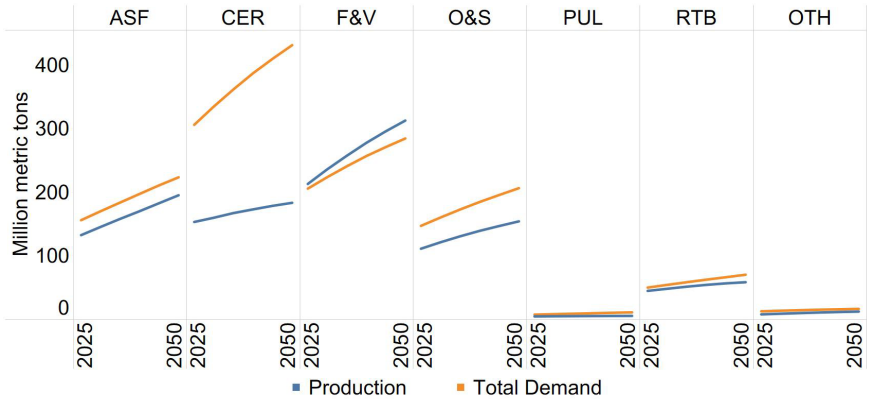


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows the change in harvested area (2025–2050) in millions of hectares; Panel B shows the percentage change in harvested area (2025–2050).

Meeting demand

Despite this positive production outlook, demand growth is projected to outpace production in the region over the next 25 years. The expansion of the gap (from 230 to 340 million tons in total demand) is mainly driven by cereals, and oils and sugars (+52 million ton gap in 2050) (Figure 5.3.5). Per capita total availability for cereals, pulses, and RTB is both larger and grows faster than production between 2025 and 2050. The largest gap between demand and production in cereals is driven by the three most-demanded grains: wheat, maize, and barley. Production is greater than demand in CWANA only for fruits and vegetables, driven by vegetable production for domestic consumption and tropical fruits mainly for export (although concerns have been raised about the dependence of these sectors on groundwater depletion).

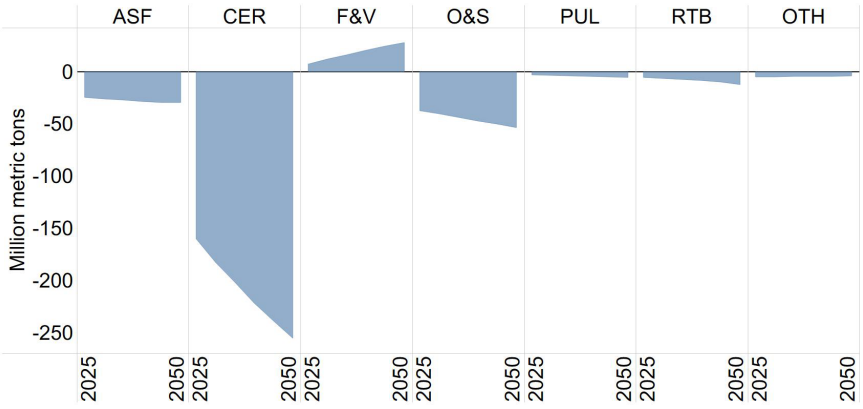
Figure 5.3.5 Changes in total demand and production of food commodities in Central and West Asia and North Africa, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source food; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

As a result of these trends, CWANA's net imports are projected to increase by over 100 million tons. The sharpest need for imports is observed for cereals (especially wheat) but also for oils and sugars (despite the increased production of sugar beets) (Figure 5.3.6). In contrast, net exports of fruits and vegetables increase, particularly for tropical fruits and vegetables.

Figure 5.3.6 Net trade in food commodities in Central and West Asia and Northern Africa, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source food; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

Nutrition

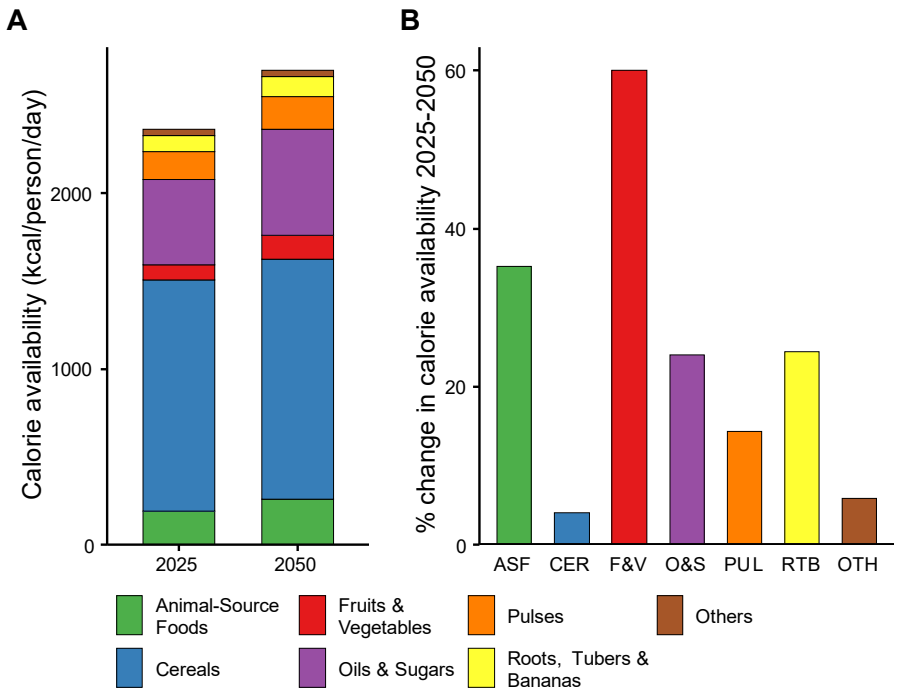
Over the next 25 years, the share of population facing insufficient food availability and access to meet dietary energy requirements is projected to decline in CWANA from 8.3 percent in 2025 to 5.1 percent in 2050, while the number of undernourished people in the region is projected to decrease from 66 million to 53 million (see Section 4.6 and Figure 4.6.1). Even so, affordability of healthy diets, micronutrient deficiency, and overweight and obesity are expected to remain challenges for segments of the population.

5.4 South Asia

Food demand

In SA, food demand is projected to rise by nearly 50 percent between 2025 and 2050, driven by the fastest growth in per capita income across the CGSIX regions (close to 4 percent annual average) and a population increase of 325 million people. Cereals (mainly rice and wheat) are projected to continue providing half of dietary calories, but per capita calorie availability of fruits and vegetables increases most rapidly (+60 percent), followed by animal-source foods (+35 percent), and oils and sugars and RTB (+24 percent each), reflecting a shift toward dietary diversification as incomes rise (Figure 5.4.1). This brings with it a shift in nutrition-related concerns. Undernourishment in terms of calories remains a challenge for some segments of the population, but risk of overweight and obesity will likely become more widespread, while micronutrient sufficiency will require continued attention.

Figure 5.4.1 Changes in per capita availability of food commodities in South Asia, 2025–2050

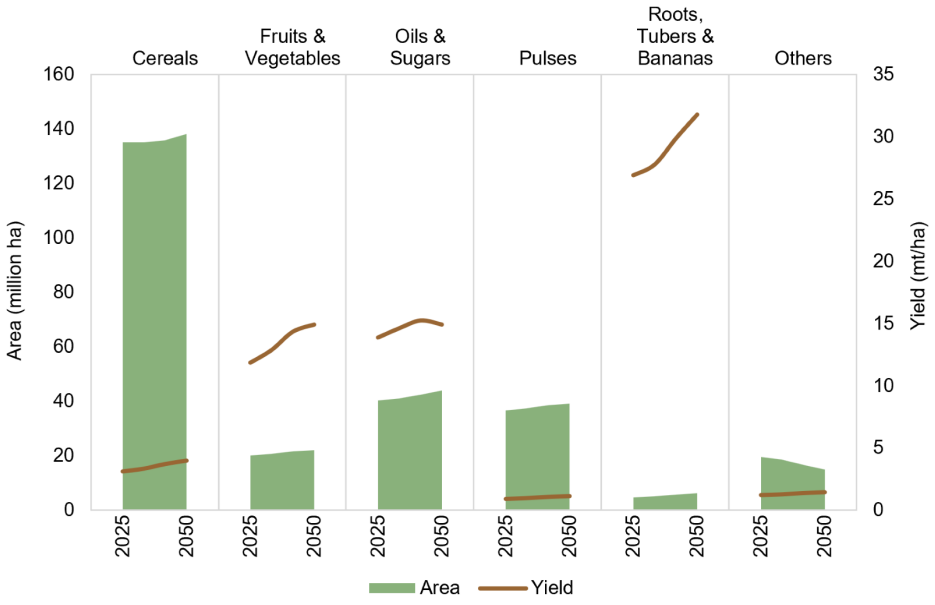


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows calorie availability per person in 2025 and 2050 by food commodity group; Panel B shows the percentage change in calorie availability between 2025 and 2050 by food commodity group.

Total production

Production is projected to increase by about 33 percent over the period, driven predominantly by intensification. Yields are projected to rise by 42 percent, but harvested area by only about 3 percent. Yields grow faster for cereals (average of +28 percent, driven especially by maize and rice), for fruits and vegetables, and for pulses (+26 percent, Figure 5.4.2). Area expansion in the region is small for all crop groups (less than 10 percent), with the exception of RTB which increases by 30 percent, although from a low base value. In absolute terms, harvested area expansion is largest in oils and sugars (+3.6 million ha) and cereals (+3 million ha).

Figure 5.4.2 Projected area and yield in South Asia by commodity group, 2025–2050

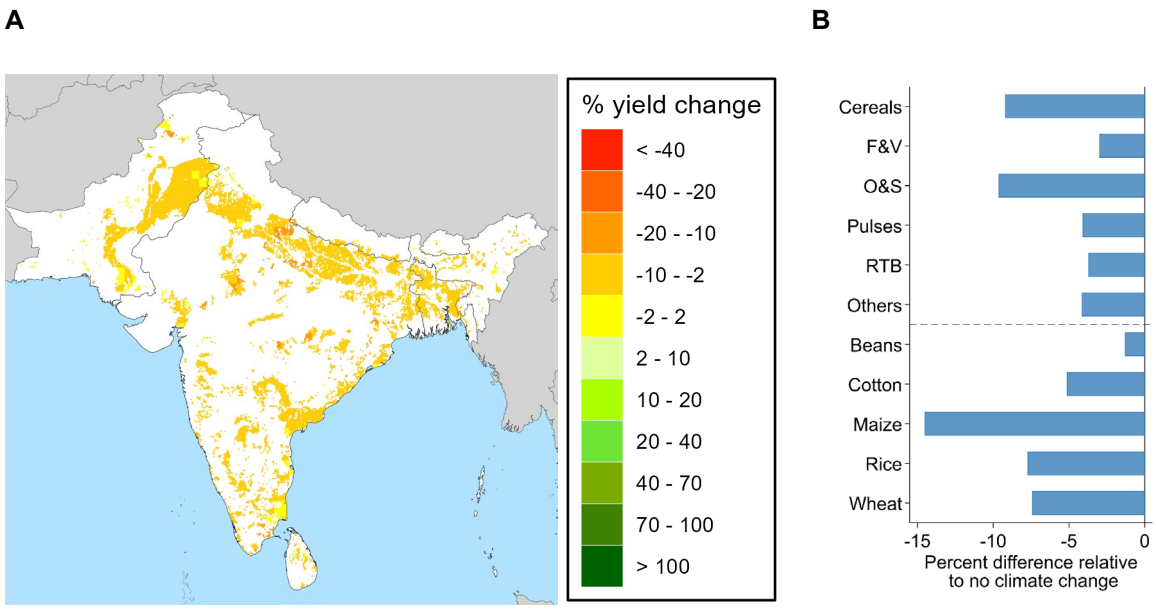


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Yield growth

Yields are projected to grow more slowly in SA than they would have in the absence of climate change. Looking first at direct effects of changes in temperature and precipitation on yields — assuming other things do not change – suggests areas of potential concern, as in the case of irrigated rice (Figure 5.4.3, panel A), for which *potential* yield losses in some locations could reach 10 percent or more in the absence of farmer and market adjustments. But these direct effects need to be adjusted for other changes that will take place over the next 25 years. These include changes in technology (e.g., adoption of improved crop varieties), management practices (e.g., changes in planting dates), and market adjustments (e.g., changes in input levels in response to changing prices). After accounting for these indirect effects, the final projected impacts of climate change on yields in SA are generally smaller than the potential impacts before adjustment. As shown in Figure 5.4.3, panel B, average yields for the different commodity groups in SA in 2050 are projected to be 3–10 percent lower than they would have been in the absence of climate change — but they are still projected to be higher in 2050 than they are in 2025 (see Figure 5.4.2). Results for selected major crops in the region illustrate the diversity of impacts even within a single commodity group. Within the cereals group, for example, maize yields in SA are projected to be about 14 percent lower as a result of climate change, while impacts on rice and wheat yields in the region are projected to be about half that amount. Impacts for other specific crops are reported in Section 6. As noted in Section 3.2, disruptions due to climate-related extreme events may affect some areas above and beyond the impacts expected from gradual changes in temperature and precipitation over longer periods of time that are reported here.

Figure 5.4.3 Climate change impacts on yields in South Asia, 2025–2050



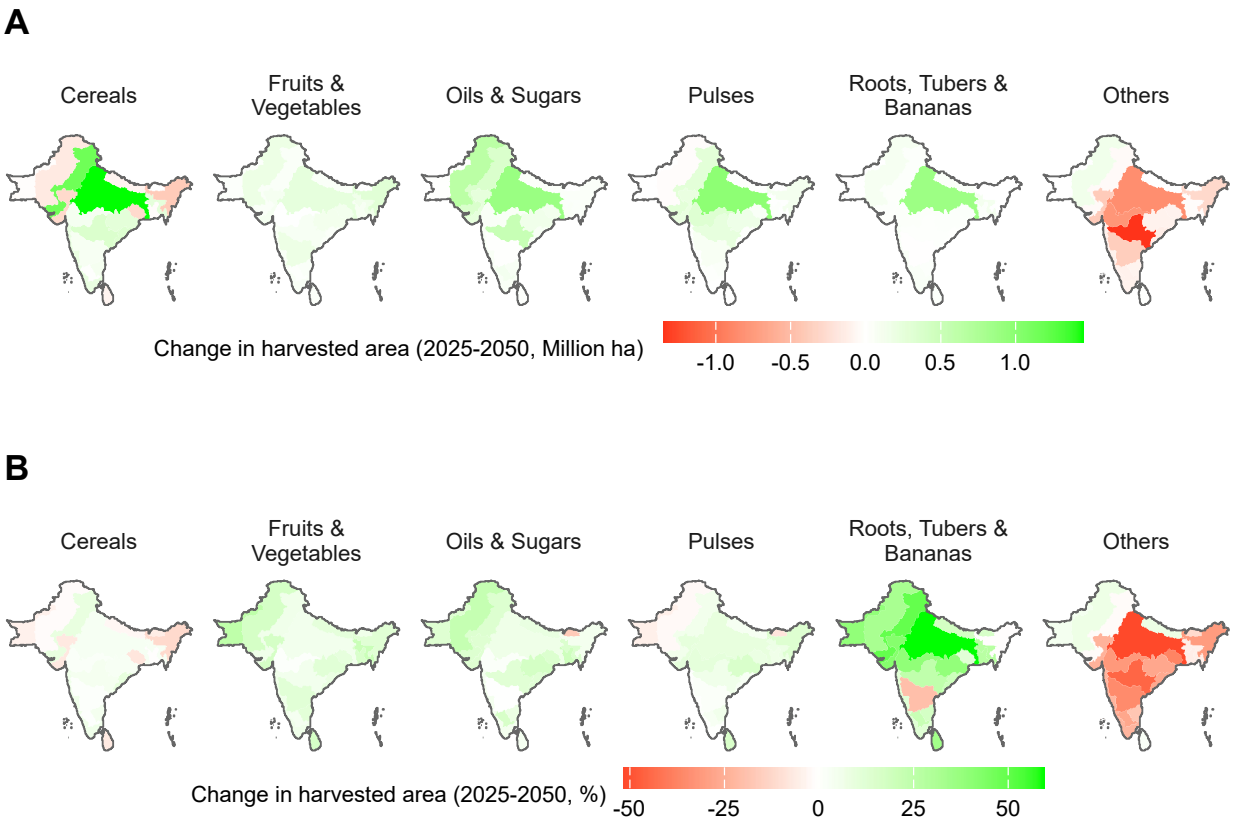
Source: Authors, based on DSSAT, IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A: DSSAT results for irrigated rice without changes in technology and markets, illustrating potential hotspots for that crop; Panel B: IMPACT results for all commodity groups and for major crops in the region, after incorporating changes in technology and markets (percent difference in total yields between the reference scenario and a scenario that assumes no climate change shocks in 2050). F&V is fruits and vegetables; O&S is oils and sugars; and RTB is roots, tubers, and bananas.

Harvested area

Because yield growth in SA, while still generally positive, is slowed by climate change, harvested area is projected to increase more than it would have in the absence of climate change, driven also by other factors including changes in demand. Absolute increases in harvested area are largest in India's Gangetic Plain (particularly for cereals) (Figure 5.4.4). In percentage terms, area growth is fastest for RTB in India, while harvested area for other crops (mainly cotton) declines in India.

Figure 5.4.4 Projected change in harvested area in South Asia by crop, 2025–2050

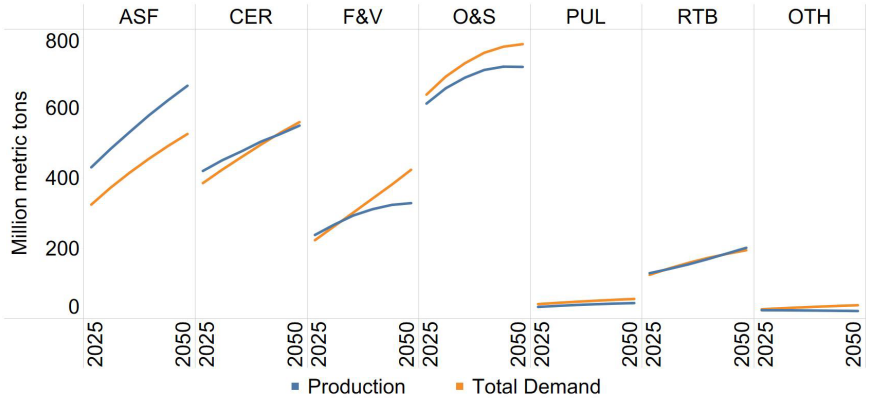


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows the change in harvested area (2025–2050) in millions of hectares; Panel B shows the percentage change in harvested area (2025–2050).

Meeting demand

Despite strong growth in demand for animal-source foods (especially dairy) in SA, increases in domestic production are projected to more than keep pace (including over 50 percent growth for dairy) between 2025 and 2050 (Figure 5.4.5). In contrast, SA's net surplus in cereals is projected to decline to parity over the period, while the region is projected to shift away from a net deficit in fruits and vegetables. Demand for oils and sugars and pulses will continue to exceed production, while RTB will remain roughly in balance.

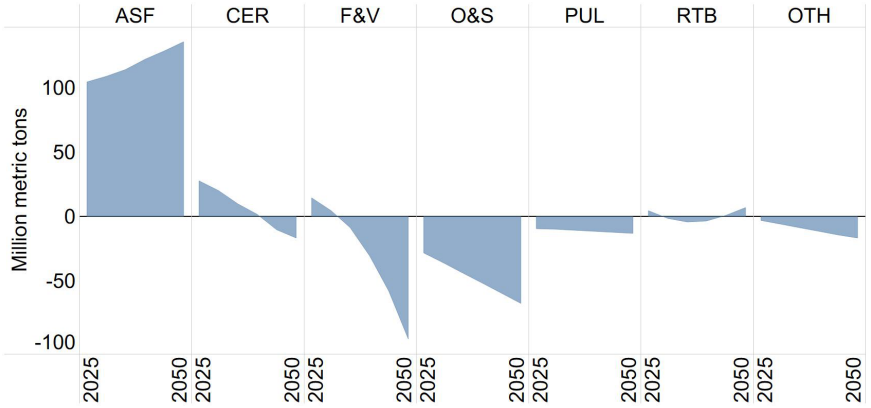
Figure 5.4.5 Changes in total demand and production of food commodities in South Asia, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source foods; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

As a result of these trends, SA is projected to see changes in its net trade position for some commodity groups. Net exports of animal-source foods will continue to rise, especially in the case of dairy, for which net exports grow from 100 to 142 million tons, but at the same time the region will also see a large increase in imports of poultry (+7.7 million tons) (Figure 5.4.6). The region is projected to shift from net exports of cereals to modest net imports (with increased rice exports offset by increasing imports of maize and wheat), and from modest exports to substantial imports of fruits and vegetables. Imports will also increase significantly for oils and sugars (especially palm oil and sugar).

Figure 5.4.6 Net trade in food commodities in South Asia, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source foods; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

Nutrition

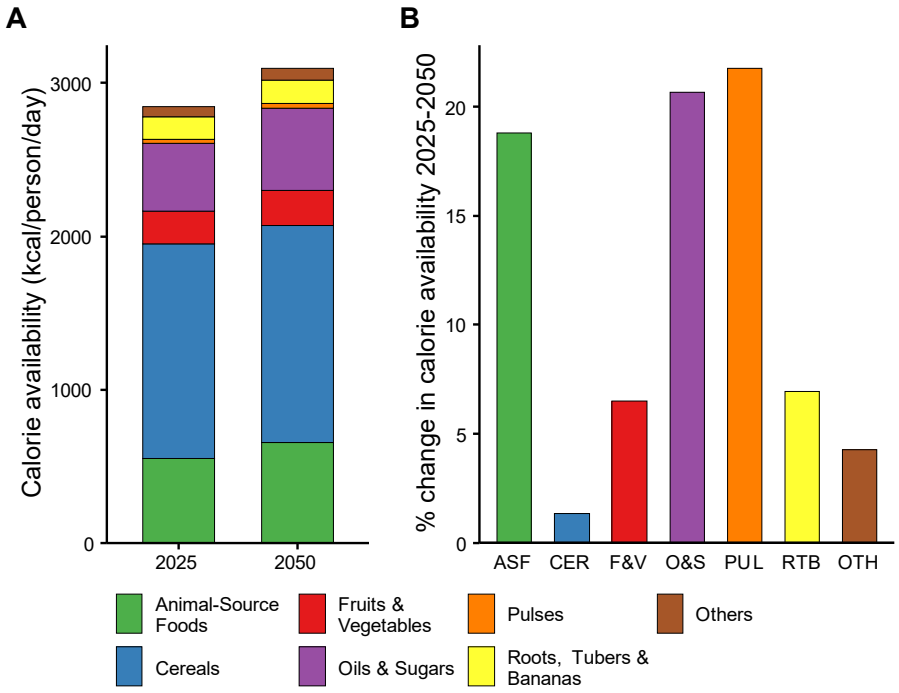
Over the next 25 years, the share of population facing insufficient food availability and access to meet dietary energy requirements is projected to decline in SA from 13.2 percent in 2025 to 3.5 percent in 2050, while the number of undernourished people is projected to decrease from 253 million to 80 million over that period (see Section 4.6 and Figure 4.6.1). Even so, affordability of healthy diets, micronutrient deficiency, and overweight and obesity are expected to remain challenges for segments of the population.

5.5 Southeast and East Asia

Food demand

In SEA, food demand is projected to grow at the slowest rate across all the CGSIX regions in percentage terms (+7 percent). The increase is expected to stem entirely from growth in income per capita (+2.7 percent average annual growth) as population in the region is projected to decrease by about 33 million people by 2050. As incomes rise, diets diversify further toward processed and higher value commodities and proteins. Per capita demand growth is fastest for animal-source foods (especially for pork, dairy, and poultry) and for oils and sugars and pulses (Figure 5.5.1).

Figure 5.5.1 Changes in per capita availability of food commodities in Southeast and East Asia, 2025–2050

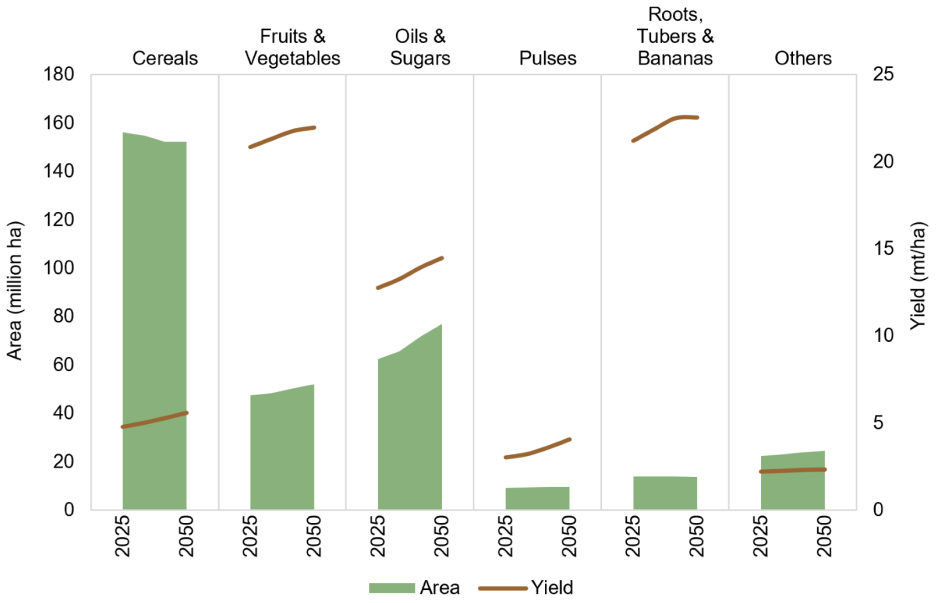


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows calorie availability per person in 2025 and 2050 by food commodity group; Panel B shows the percentage change in calorie availability between 2025 and 2050 by food commodity group.

Total production

Production is projected to increase by 22 percent between 2025 and 2050. Intensification is the dominant driver of growth in the region (average +13 percent in yields), with relatively little additional land brought into production (total harvested area in the region increases by 6 percent). Pulses have the fastest growth in yields (+34 percent), followed by cereals (+17 percent), and oils and sugars (+13 percent, driven by soybeans and sugar beets) (Figure 5.5.2). Oils and sugars contribute the most to change in harvested area (+14.4 million ha) in the region between 2025 and 2050. Most of this increase comes from palm fruit. Total harvested area for cereals is projected to decrease by 4 million ha in the region between 2025 and 2050, primarily driven by a 7 million ha reduction in the harvested area for rice.

Figure 5.5.2 Projected area and yields in Southeast and East Asia by commodity group, 2025–2050



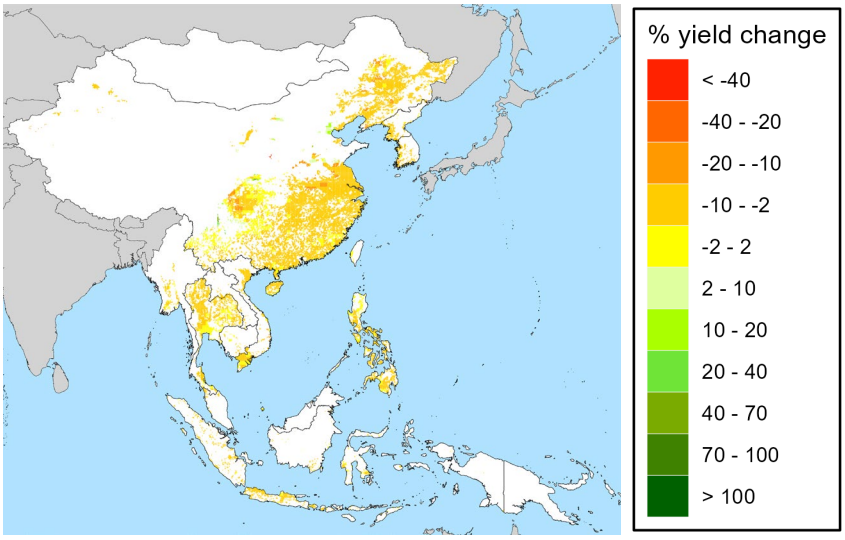
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Yield growth

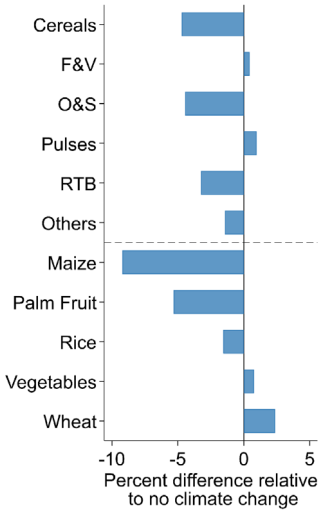
Yields are projected to grow more slowly in SEA than they would have in the absence of climate change. Looking first at direct effects of changes in temperature and precipitation on yields — assuming other things do not change — suggests areas of potential concern, as in the case of irrigated rice (Figure 5.5.3, panel A), for which *potential* yield losses in some locations could reach 10 percent or more in the absence of farmer and market adjustments. But these direct effects need to be adjusted for other changes that will take place over the next 25 years. These include changes in technology (e.g., adoption of improved crop varieties), management practices (e.g., changes in planting dates), and market adjustments (e.g., changes in input levels in response to changing prices). After accounting for these indirect effects, the final projected impacts of climate change on yields in SA are generally smaller than the potential impacts before adjustment. As shown in Figure 5.5.3, panel B, average yields for most of the commodity groups in SEA in 2050 are projected to be lower than they would have been in the absence of climate change — but they are still projected to be higher in 2050 than they are in 2025 (see Figure 5.5.2). Results for selected major crops in the region illustrate the diversity of impacts even within a single commodity group. Within the cereals group, for example, maize yields in SEA are projected to be 9 percent lower as a result of climate change, but wheat yields in the region are projected to be 2 percent higher. Impacts for other specific crops are reported in Section 6. As noted in Section 3.2, disruptions due to climate-related extreme events may affect some areas above and beyond the impacts expected from gradual changes in temperature and precipitation over longer periods of time that are reported here.

Figure 5.5.3 Climate change impacts on yields in Southeast and East Asia, 2025–2050

A



B

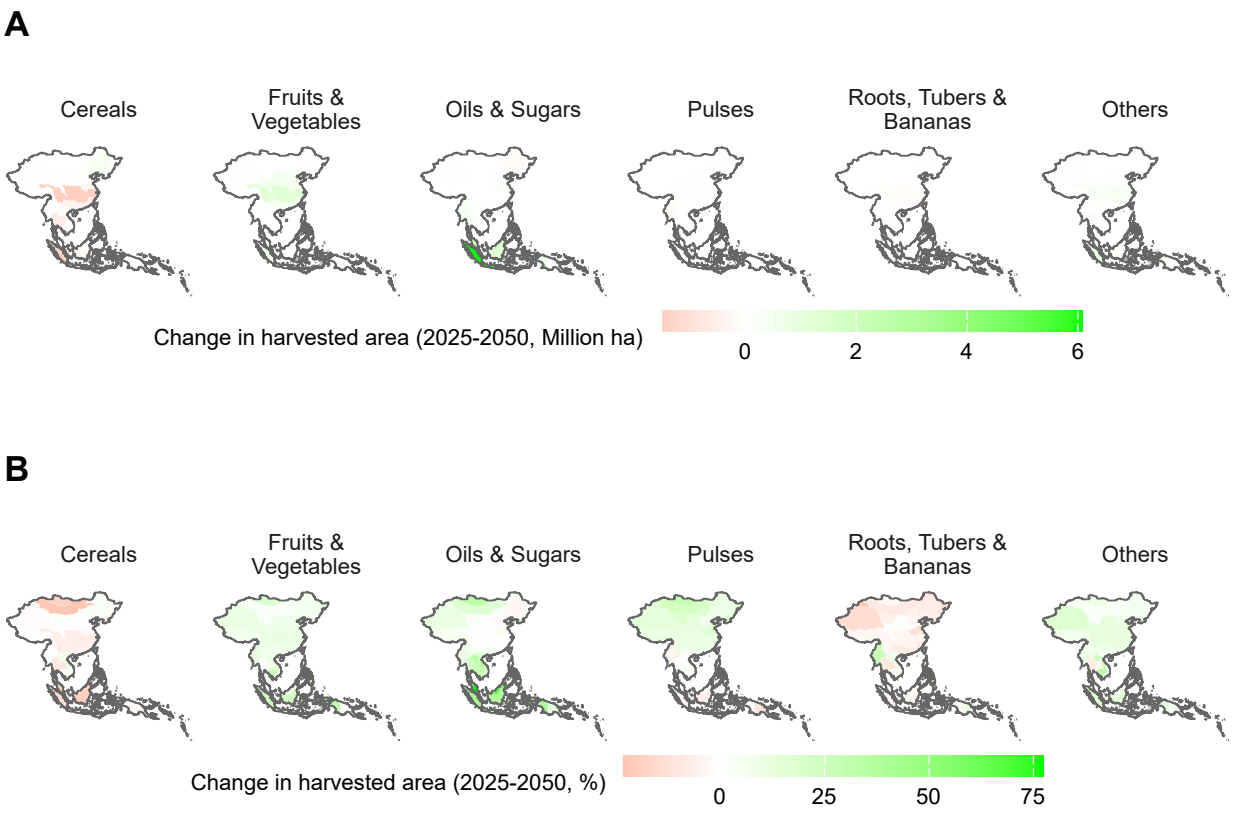


Source: Authors, based on DSSAT, IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A: DSSAT results for irrigated rice without changes in technology and markets, illustrating potential hotspots for that crop; Panel B: IMPACT results for all commodity groups and for major crops in the region, after incorporating changes in technology and markets (percent difference in total yields between the reference scenario and a scenario that assumes no climate change shocks in 2050). F&V is fruits and vegetables; O&S is oils and sugars; and RTB is roots, tubers, and bananas.

Harvested area

Because yield growth in SEA (while still generally positive) is slowed by climate change, harvested area is projected to increase more than it would have in the absence of climate change, driven also by other factors including changes in demand. The largest and most rapid increases in harvested area are for oil crops in Indonesia (driven by palm fruits), while harvested area for cereals (especially rice) decline in several countries (Figure 5.5.4).

Figure 5.5.4 Projected change in harvested area in Southeast and East Asia by crop, 2025–2050

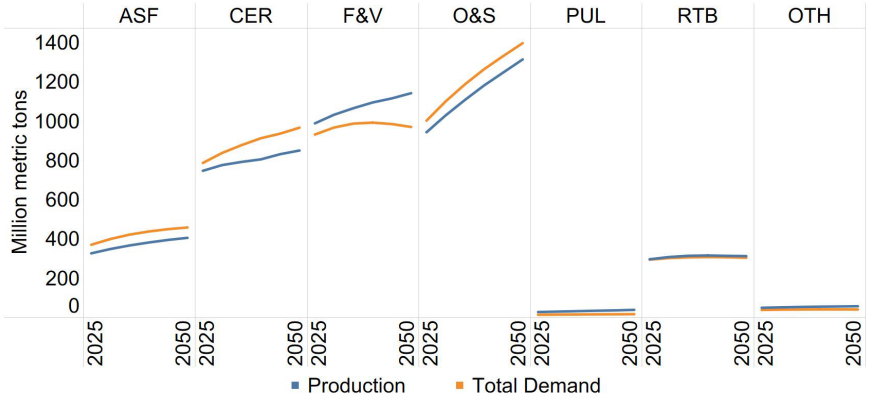


Source: Authors, based on DSSAT, IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows the change in harvested area (2025–2050) in millions of hectares; Panel B shows the percentage change in harvested area (2025–2050).

Meeting demand

Oils and sugars and pulses show the fastest production gains in SEA (+39 percent), followed by animal-source foods and fruits and vegetables (Figure 5.5.5). Oils and sugars are the largest and fastest growing crop group in the region, reflecting expansion in palm fruit and sugarcane for processing into palm oil and sugar. In raw tons, fruits and vegetables show the second largest increase in production. For animal-source foods, production of dairy, beef, and poultry show the fastest growth, but dairy and food fish have the largest absolute increase. Despite rapid growth in production, production continues to be outpaced by demand growth for cereals, animal-source foods, and oils and sugars, while the opposite is true for fruits and vegetables and for pulses and other crops.

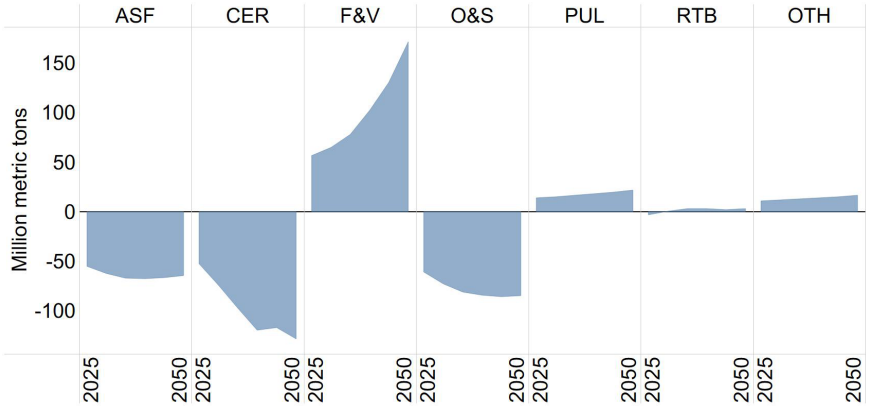
Figure 5.5.5 Changes in total demand and production of food commodities in Southeast and East Asia, 2025–2050



Source: Authors, based on DSSAT, IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source foods; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

These shifts in demand and production are reflected in trade shifts. Although SEA remains a net importer of food commodities in aggregate, net imports decline between 2025 and 2050. This is mainly the result of a tripling in net exports of fruits and especially vegetables (Figure 5.5.6). Increases in imports are concentrated in cereals, imports of which more than double (especially driven by maize and wheat), and also by oils and sugar, as 45 million additional tons of soybean imports by 2050 more than offset large increases in exports of palm oil. Dairy drives the imports of animal-source foods. In short, SEA expands horticultural exports through strong yield-led supply responses, while cereal and oilseed import dependence deepens.

Figure 5.5.6 Net trade in food commodities in Southeast and East Asia, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source foods; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

Nutrition

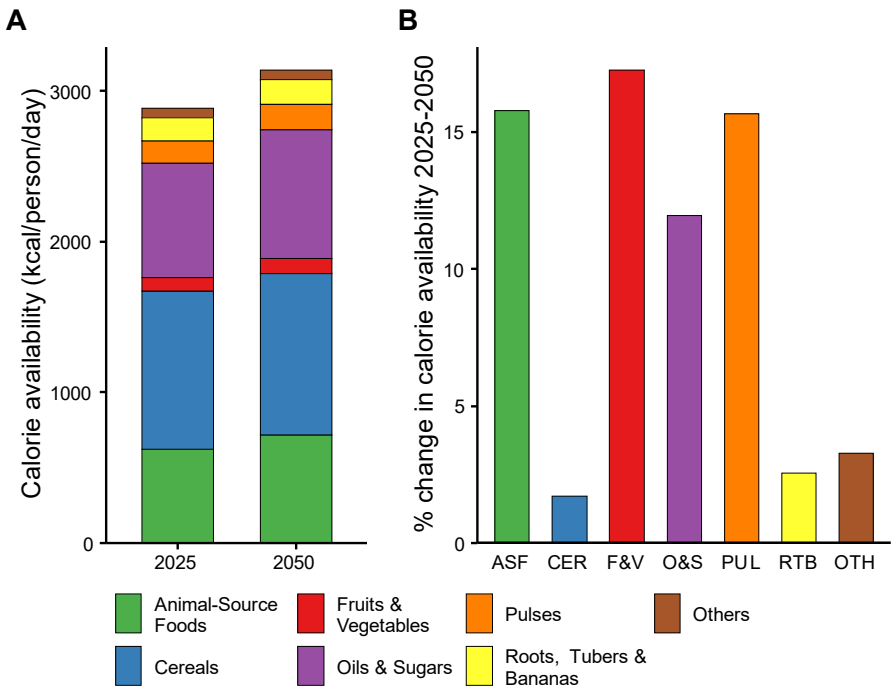
Over the next 25 years, the share of population facing insufficient food availability and access to meet dietary energy requirements is projected to increase slightly in SEA from 2.3 percent in 2025 to 2.4 percent in 2050, while the number of undernourished people is projected to increase slightly from 51 million to 52 million (see Section 4.6 and Figure 4.6.1). At the same time, affordability of healthy diets, micronutrient deficiency, and overweight and obesity are expected to remain challenges for segments of the population.

5.6 Latin America and the Caribbean

Food demand

In LAC, food demand is projected to rise by roughly 23 percent between 2025 and 2050. The change is driven by a combination of growth in per capita income (+2.4 percent annual average) and a population increase of around 75 million people by 2050. Per capita calorie availability grows fastest for fruits and vegetables (+17 percent), followed by animal-source foods and pulses (+16 percent each), as income gains lift protein and micronutrient consumption (Figure 5.6.1). LAC today already has the largest contribution of calories from animal-source foods among all CGSIX regions (over 20 percent), and the share will increase by 2050, mainly driven by the growing demand for dairy and poultry. Therefore, diet diversification proceeds steadily, though not as rapidly as in other developing regions.

Figure 5.6.1 Changes in per capita availability of food commodities in Latin America and the Caribbean, 2025–2050

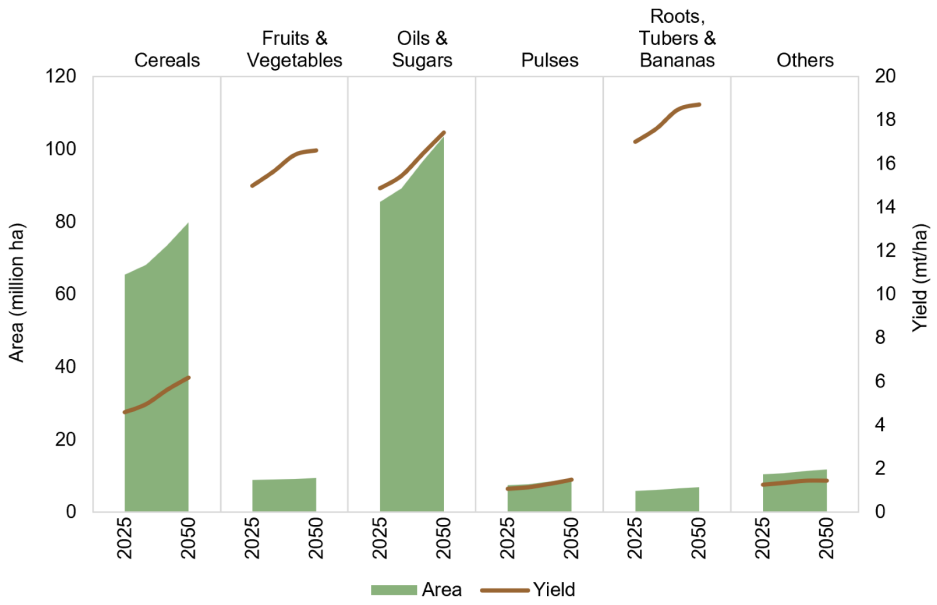


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A shows calorie availability per person in 2025 and 2050 by food commodity group; Panel B shows the percentage change in calorie availability between 2025 and 2050 by food commodity group.

Total production

Production is projected to increase by 40 percent between 2025 and 2050, more than half of which is from expansion in agricultural area (see Figure 4.2.2). Total harvested area grows by 20 percent, while yields across all commodities grow by an average of 19 percent. The fastest growth in area expansion and yields is observed for pulses, cereals, and oils and sugars, although pulses increase from a low base (Figure 5.6.2). In absolute terms, area expansion is largest for oils and sugars (+18 million ha), driven by soybeans and sugarcane, while maize area is estimated to increase by 14.3 million ha.

Figure 5.6.2 Projected area and yields in Latin America and the Caribbean, by commodity group, 2025–2050

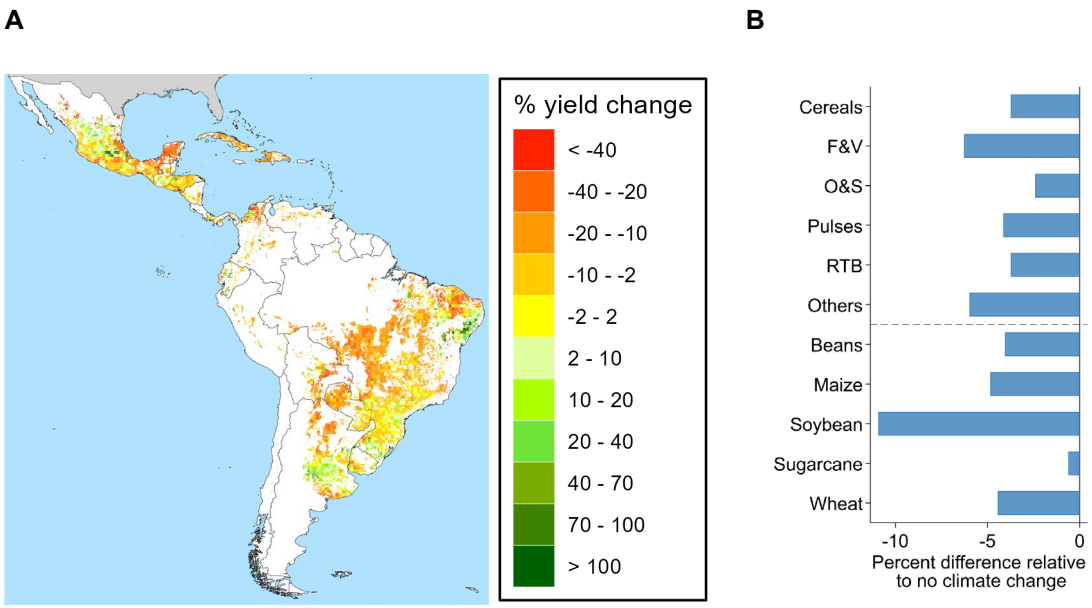


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Yield growth

Yields are projected to grow more slowly in LAC than they would have in the absence of climate change. Looking first at direct effects of changes in temperature and precipitation on yields — assuming other things do not change — suggests areas of potential concern as well as opportunity. For example, in the case of rainfed maize (panel A), *potential* yield losses in some locations could reach 20 percent or more in the absence of farmer and market adjustments. But these direct effects need to be adjusted for other changes that will take place over the next 25 years. These include changes in technology (e.g., adoption of improved crop varieties), management practices (e.g., changes in planting dates), and market adjustments (e.g., changes in input levels in response to changing prices). After accounting for these indirect effects, the final projected impacts of climate change on yields in LAC are generally smaller than the potential impacts before adjustment. As shown in Figure 5.6.3, panel B, average yields for the different commodity groups in LAC in 2050 are projected to be 2–6 percent lower than they would have been in the absence of climate change — but they are still projected to be higher in 2050 than they are in 2025 (see Figure 5.6.2). Results for selected major crops in the region illustrate the diversity of impacts even within a single commodity group. Within the cereals group, for example, maize yields in LAC are projected to be about 11 percent lower as a result of climate change, but impacts on sugarcane yields in the region are projected to be much smaller. Impacts for other specific crops are reported in Section 6. As noted in Section 3.2, disruptions due to climate-related extreme events may affect some areas above and beyond the impacts expected from gradual changes in temperature and precipitation over longer periods of time that are reported here.

Figure 5.6.3 Climate change impacts on yields in Latin America and the Caribbean, 2025–2050



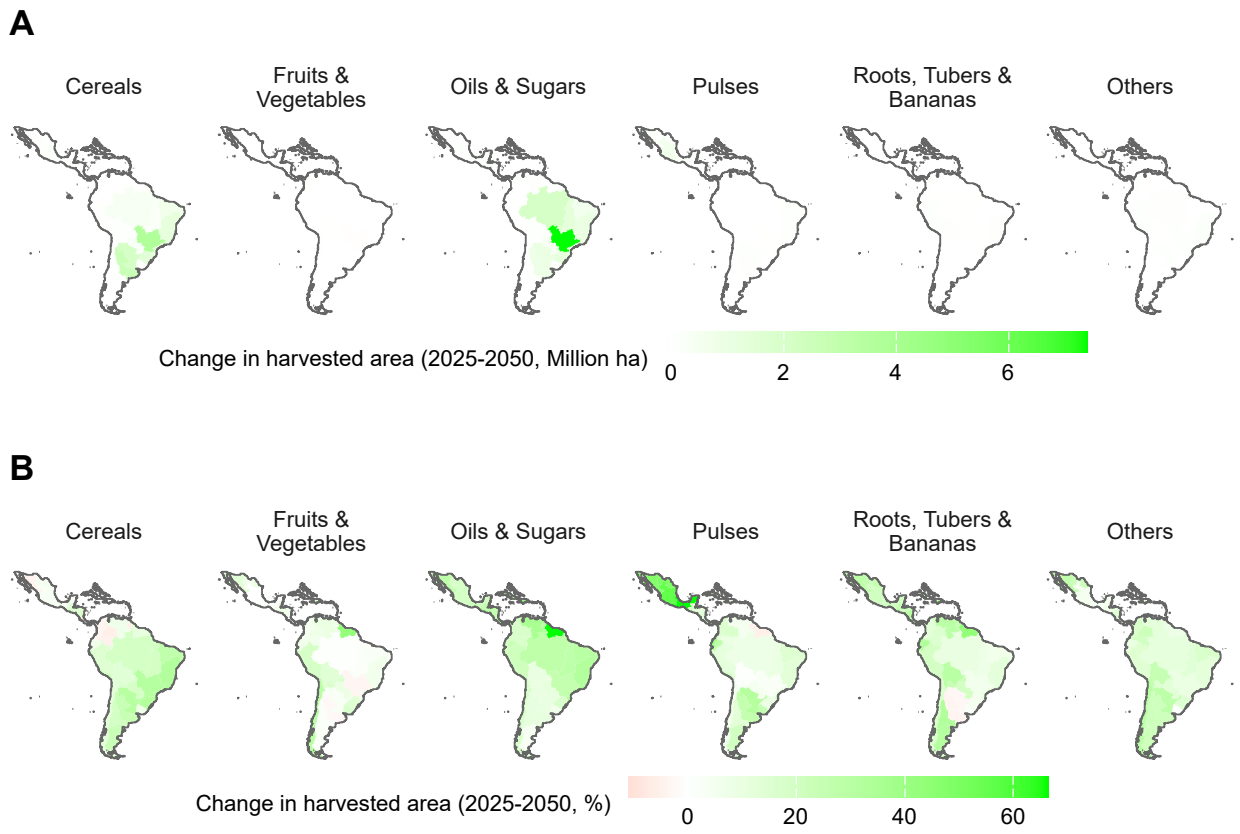
Source: Authors, based on DSSAT, IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A: DSSAT results for rainfed maize without changes in technology and markets, illustrating potential hotspots for that crop; Panel B: IMPACT results for all commodity groups and for major crops in the region, after incorporating changes in technology and markets (percent difference in total yields between the reference scenario and a scenario that assumes no climate change shocks in 2050). F&V is fruits and vegetables; O&S is oils and sugars; and RTB is roots, tubers, and bananas.

Harvested area

Because yield growth in LAC, while still generally positive, is slowed by climate change, harvested area is projected to increase more than it would have in the absence of climate change, driven also by other factors including changes in demand. Absolute increases in harvested area are largest in Brazil (particularly for maize, soybeans, and sugarcane) (Figure 5.6.4). In percentage terms, area growth is widespread across LAC for most commodity groups. Such expansion of cropland could compete with tropical rainforest areas. While not explicitly modeled in this exercise, previous research has indicated that the response of the rainforest itself to the change in climate could be more important than expansions or contractions of cropland (Robertson et al. 2023).

Figure 5.6.4 Projected change in harvested area in Latin America and the Caribbean, by crop, 2025–2050



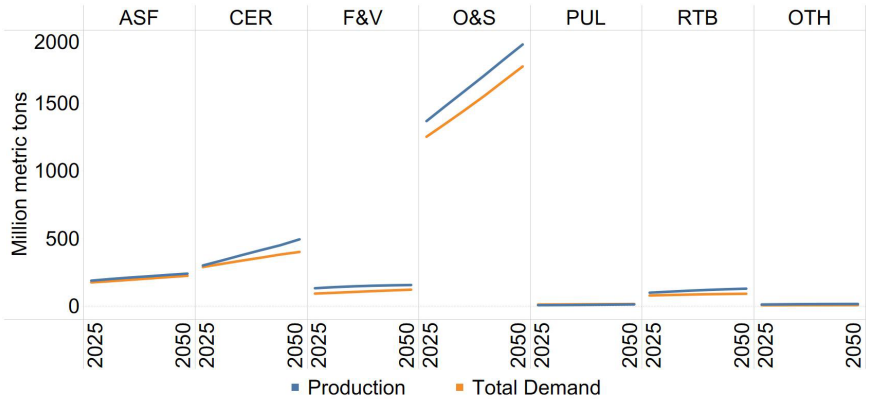
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A shows the change in harvested area (2025-2050) in millions of hectares; Panel B shows the percentage change in harvested area (2025–2050).

Meeting demand

Unlike in other CGSIX regions, production in LAC already exceeds demand, and it is projected to grow at a faster pace over the next 25 years, so the surplus is expected to increase from over 235 million tons to 394 million tons between 2025 and 2050 (Figure 5.6.5). Production exceeds demand in all food groups except pulses. Oils and sugars dominate production and demand in LAC, reflecting rapid growth in sugarcane for processing and soybeans for export. The largest surplus in 2050 is observed for oils and sugars (+163 million tons), dominated by the production of soybeans (a surplus of 103 million tons). A surplus of more than 30 million tons is also projected for RTB and fruits and vegetables and more than 90 million tons for cereals. Cereals are the fastest growing category of demand due to an increase in maize for livestock feed and export. In volume terms, animal-source foods are also expanding strongly, reflecting stronger food demand.

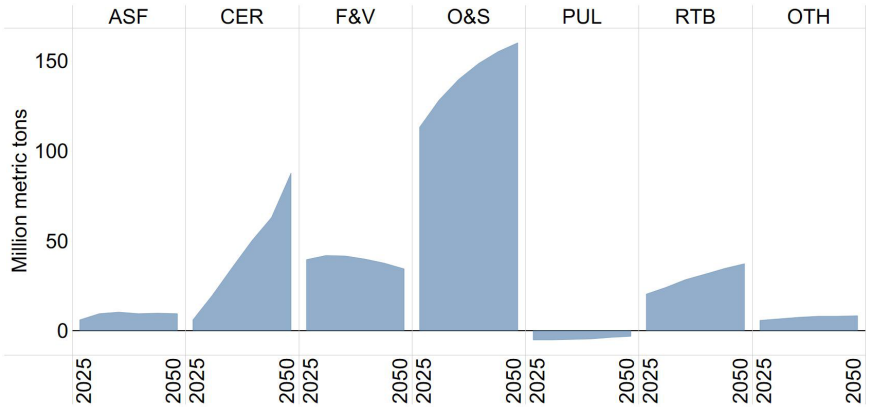
Figure 5.6.5 Changes in total demand and production of food commodities in Latin America and the Caribbean, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source foods; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

The consequence of strong growth in production is that net exports from LAC are projected to increase by roughly 150 million tons over the projection period. The largest increase in exports is in maize, which rises by 85 million tons (Figure 5.6.6). Increasing exports of oils and sugars are driven by sugars and soybeans.

Figure 5.6.6 Net trade in food commodities in Latin America and the Caribbean, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source foods; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

Nutrition

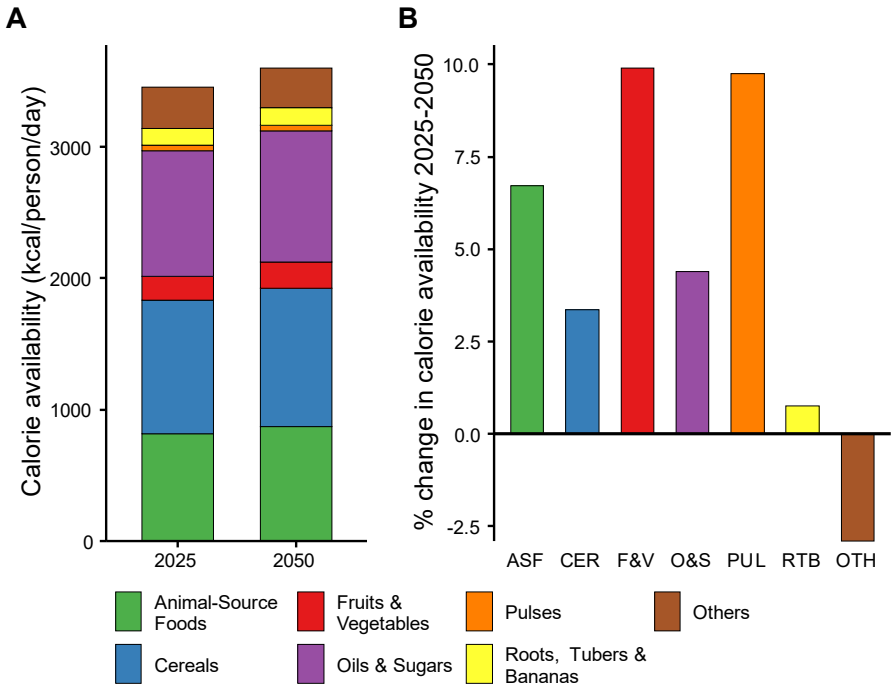
Over the next 25 years, the share of population facing insufficient food availability and access to meet dietary energy requirements is projected to decline in LAC from 6.2 percent in 2025 to 4.4 percent in 2050, while the number of undernourished people is projected to decrease from 42 million to 33 million (see Section 4.6 and Figure 4.6.1). Even so, affordability of healthy diets, micronutrient deficiency, and overweight and obesity are expected to remain challenges for segments of the population.

5.7 Rest of the World

Food demand

In the rest of the world (ROW), food demand is projected to increase by about 5 percent between 2025 and 2050, a modest rise compared to other regions. As this region includes many high-income countries, population growth is slower than in the CGSIX regions, and while income growth remains significant, food demand is close to saturation levels (as evident in Section 4.1) and diets are already diversified. Relatively small increases in calorie availability (compared to other regions) are projected by 2050 (Figure 5.7.1). Demand for animal-source foods (including aquatic foods) only sees a 7 percent increase between 2025 and 2050, with minimal changes in the United States and much of the European Union.

Figure 5.7.1 Changes in per capita availability of food commodities in Rest of the World, 2025–2050



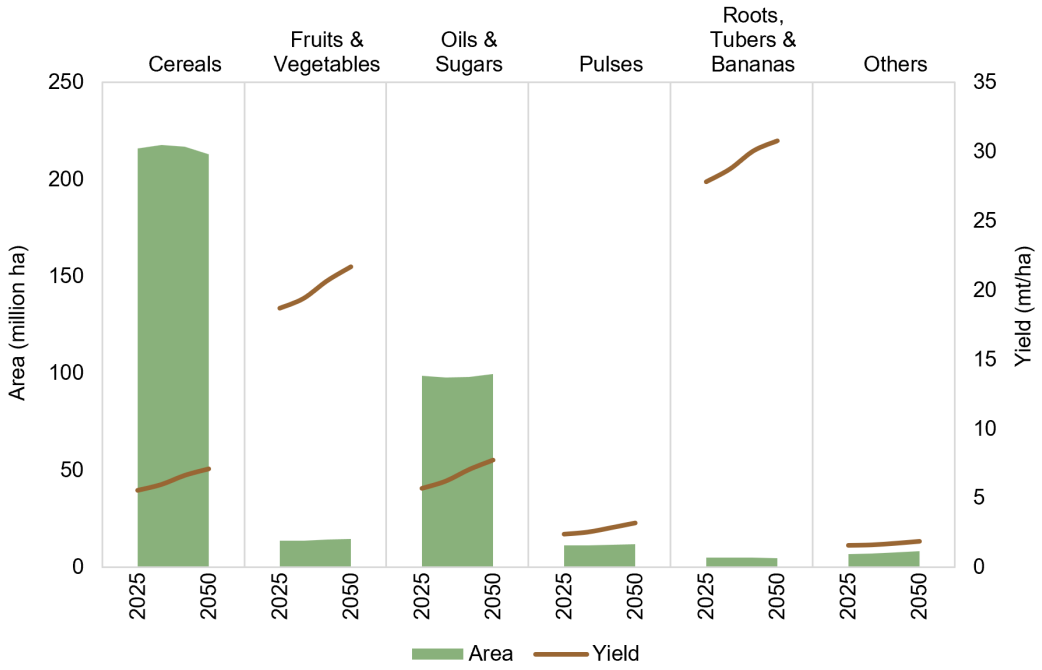
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A shows calorie availability per person in 2025 and 2050 by food commodity group; Panel B shows the percentage change in calorie availability between 2025 and 2050 by food commodity group.

Total production

Production is projected to increase by approximately 23 percent between 2025 and 2050. Growth is overwhelmingly driven by yield improvements, with average yields rising nearly 25 percent, while total harvested area increases by less than 1 percent. Yield increases are fastest for oils and sugars (+36 percent) and pulses (+34 percent), followed by cereals (+28 percent), with smaller changes for other commodity groups (Figure 5.7.2).

Figure 5.7.2 Projected area and yields in Rest of the World, by commodity group, 2025–2050

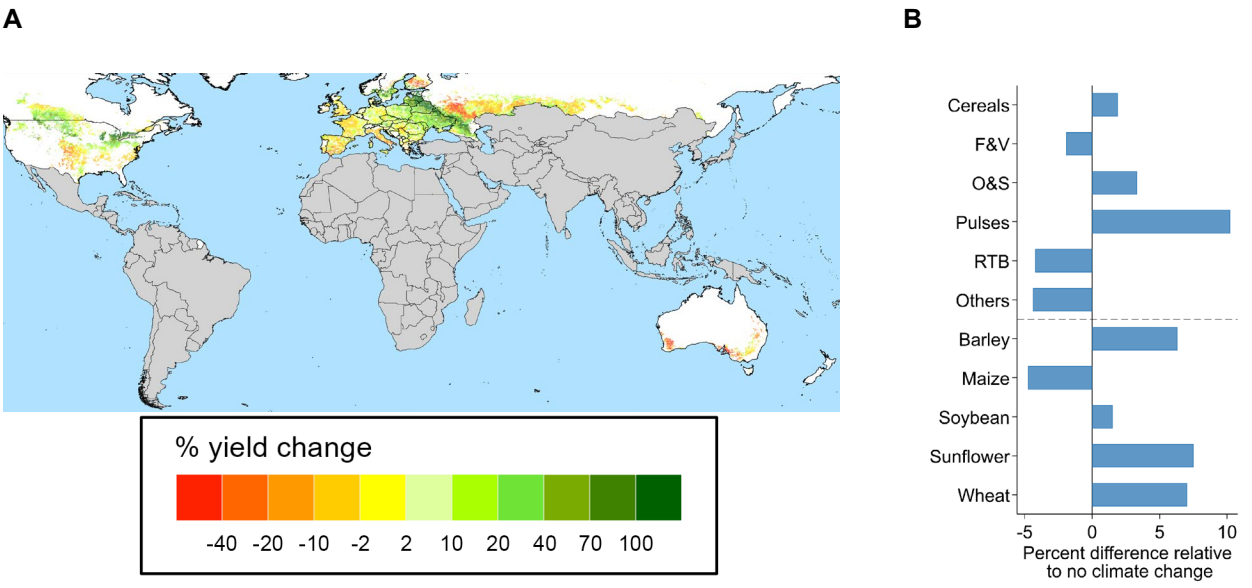


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Yield growth

Climate change is projected to have mixed effects on yield growth in ROW, varying by crop and location. Looking first at direct effects of changes in temperature and precipitation on yields — assuming other things do not change — suggests areas of potential concern as well as opportunity. For example, in the case of rainfed wheat in Europe and southwestern Russia (Figure 5.7.3, panel A) *potential* yield losses in some locations could reach 20 percent or more in the absence of farmer and market adjustment, while other locations could see substantial gains. But these direct effects need to be adjusted for other changes that will take place over the next 25 years. These include changes in technology (e.g., adoption of improved crop varieties), management practices (e.g., changes in planting dates), and market adjustments (e.g., changes in input levels in response to changing prices). After accounting for these indirect effects, the final projected impacts of climate change on yields in ROW are generally smaller than the potential impacts before adjustment. As shown in Figure 5.7.3, panel B, average yields for the different commodity groups in ROW in 2050 are projected to be between 4 percent lower and 10 percent higher than they would have been in the absence of climate change — but they are all projected to be higher in 2050 than they are in 2025 (see Figure 5.7.2). Results for selected major crops in the region illustrate the diversity of impacts even within a single commodity group. Within the cereals group, for example, maize yields in ROW are projected to be 5 percent lower as a result of climate change, but barley and wheat yields in the region are projected to be 6–7 percent higher. Impacts for other specific crops are reported in Section 6. As noted in Section 3.2, disruptions due to climate-related extreme events may affect some areas above and beyond the impacts expected from gradual changes in temperature and precipitation over longer periods of time that are reported here.

Figure 5.7.3 Climate change impacts on yields in Rest of the World, 2025–2050



Source: Authors, based on DSSAT, IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Panel A: DSSAT results for rainfed wheat without changes in technology and markets, illustrating potential hotspots as well as areas that could benefit for that crop; Panel B: IMPACT results for all commodity groups and for major crops in the region, after incorporating changes in technology and markets (percent difference in total yields between the reference scenario and a scenario that assumes no climate change shocks in 2050). F&V is fruits and vegetables; O&S is oils and sugars; and RTB is roots, tubers, and bananas.

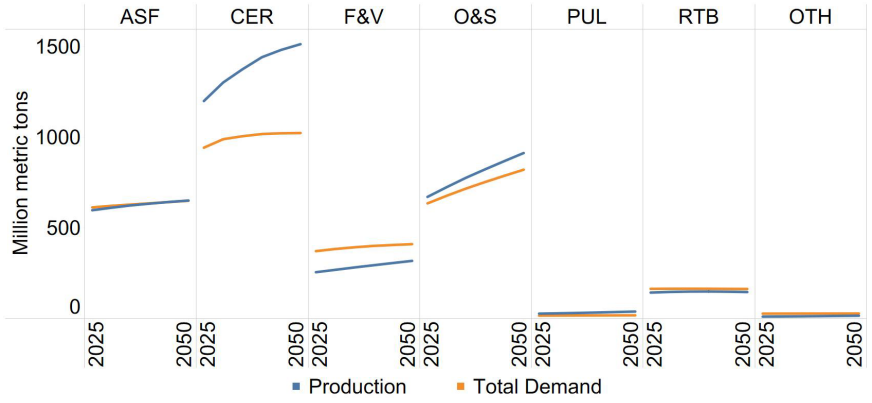
Harvested area

Overall, cereals harvested area in ROW is projected to decline between 2025 and 2050, while area in fruits and vegetables and oilseeds increases. Absolute increases in harvested area are largest in Russia (particularly for wheat and maize) and the United States (for soybeans and cotton). In percentage terms, area growth is modest for most commodity groups, with the exception of declines for RTB (in Russia and Eastern Europe), cereals (in the United States, Western Europe, and Japan), and pulses (in Western Europe and Australia).

Meeting demand

In contrast to most CGSIX regions, production greatly exceeds demand in ROW for cereals and to a lesser extent for oils and sugars — and those gaps are projected to increase over the next 25 years (Figure 5.7.4). Cereals in particular contribute nearly 500 million tons to the region's surplus by 2050, driven by large increases in wheat and maize production. Demand continues to exceed production for fruits and vegetables and for RTB, while animal-source foods remain roughly in balance.

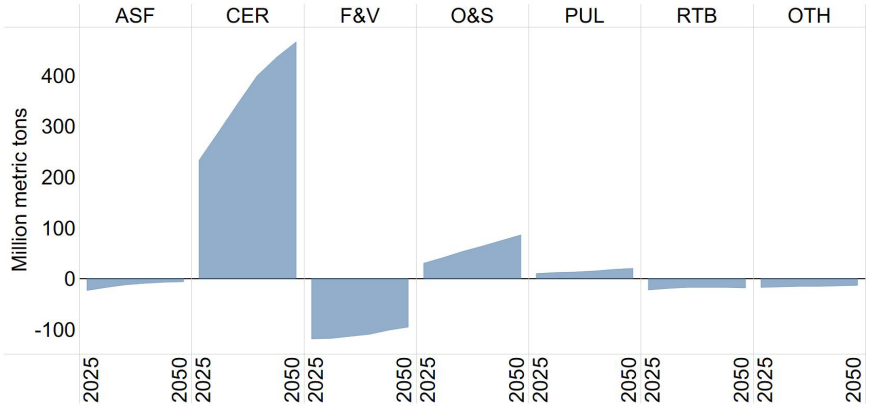
Figure 5.7.4 Changes in total demand and production of food commodities in Rest of the World, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source foods; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

Reflecting these patterns of demand and production, ROW is projected to roughly double its net exports of cereals (especially wheat, maize, and barley) by 2050, and to nearly triple its net exports of oils and sugars (mainly soybeans) (Figure 5.7.5). Although the region is expected to remain a significant importer of fruits and vegetables, higher production of vegetables is expected to reduce the reliance on imports by 2050. Net imports of animal-source foods are projected to fall significantly, from 22 billion tons to 5 billion tons.

Figure 5.7.5 Net trade in food commodities in Rest of the World, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: ASF is animal-source foods; CER is cereals; F&V is fruits and vegetables; O&S is oils and sugars; PUL is pulses; RTB is roots, tubers, and bananas; OTH is other crops.

Nutrition

In the countries of the ROW region, currently 5 percent or less of their population is estimated to face insufficient food availability and access to meet dietary energy requirements, and this share is projected to persist to 2050. Even so, affordability of healthy diets, micronutrient deficiency, and overweight and obesity are expected to remain challenges for segments of the population.

6 OUTLOOK BY COMMODITY GROUP

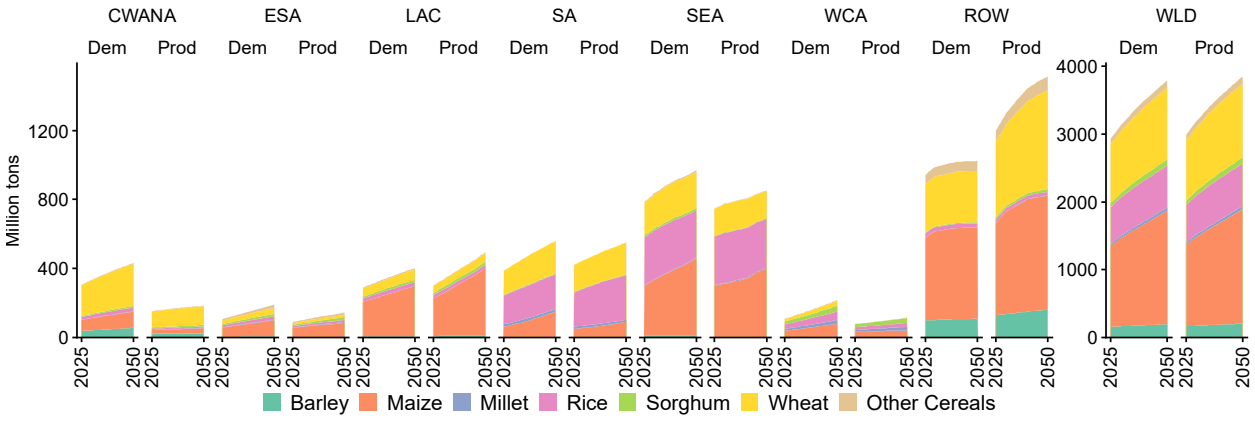
Broad patterns of change in demand, production, trade, resource use, and food security were presented at the global and regional levels in Sections 4 and 5. This section provides a closer look at more disaggregated results for each commodity group.

6.1 Cereals

Cereals demand and production

Total global cereals demand is projected to increase by more than 860 million tons by 2050 (+26 percent), of which about 240 million tons are for food and 530 million for feed. Over 90 percent of the increase in total demand originates from CGSIX regions, especially SA and LAC (Figure 6.1.1). Total demand and production for cereals are largest in ROW and in SEA, both today and in 2050. Demand growth for wheat and rice is primarily for food, while demand growth for maize is driven by feed (in SEA, LAC, and SA) and biofuels (in ROW). In global terms, there is currently relatively little demand for or production of cereals in ESA and WCA, but these regions show the fastest projected growth in demand between 2025 and 2050. ROW is the biggest cereals producer and will continue to be so. Maize, wheat, and rice remain the top cereal crops globally both for demand and production.

Figure 6.1.1 Projected change in cereals demand and production, by crop and region, 2025–2050

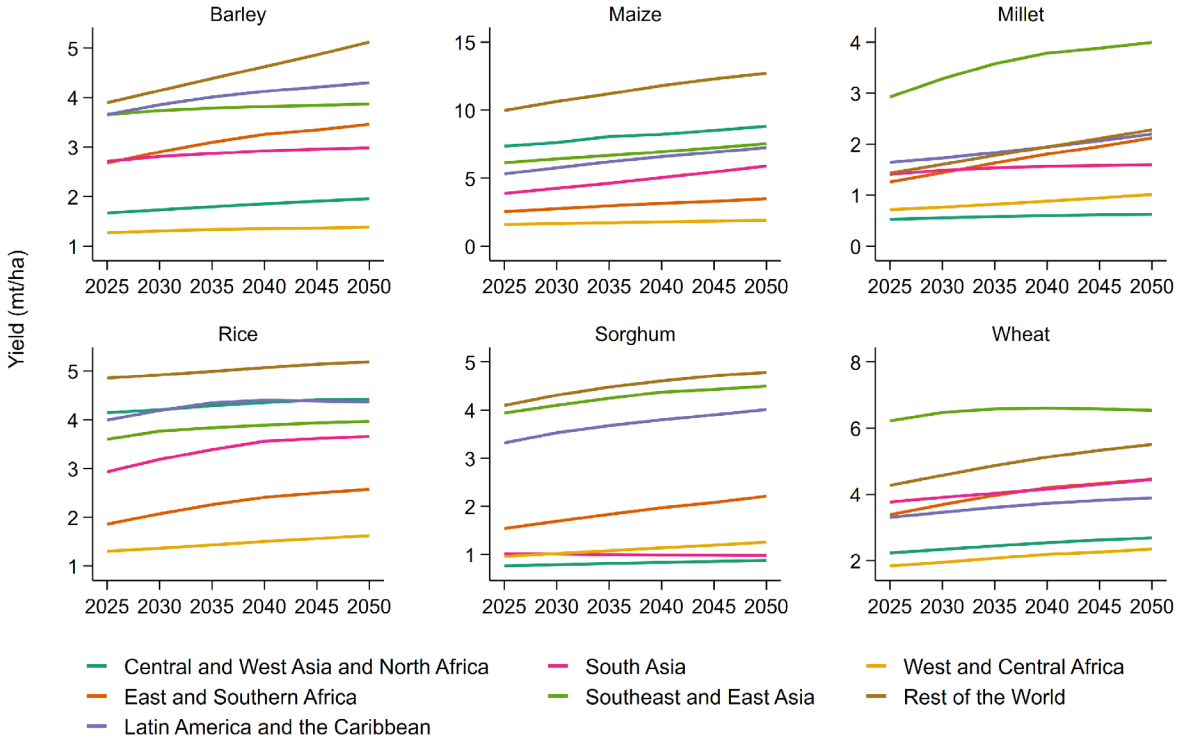


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World. Dem is demand; Prod is production.

Cereals yields

Production changes are driven by changes in yields and harvested area. Globally, yields are growing four times as fast as harvested areas. Yields are projected to increase for most cereal crops and regions (sorghum yields decline in SA), with improvements in technology and management outpacing the effects of climate change through mid-century (Figure 6.1.2). Projected yield gains are largest in ROW (maize and wheat) and LAC (maize and sorghum), but fastest in ESA (millet and sorghum) and SA (maize). Across most regions, maize and wheat see the biggest yield gains, except in SEA, where millet dominates. Rice yields grow most in ESA, SA, and WCA.

Figure 6.1.2 Projected changes in cereals yields, by crop and region, 2025–2050

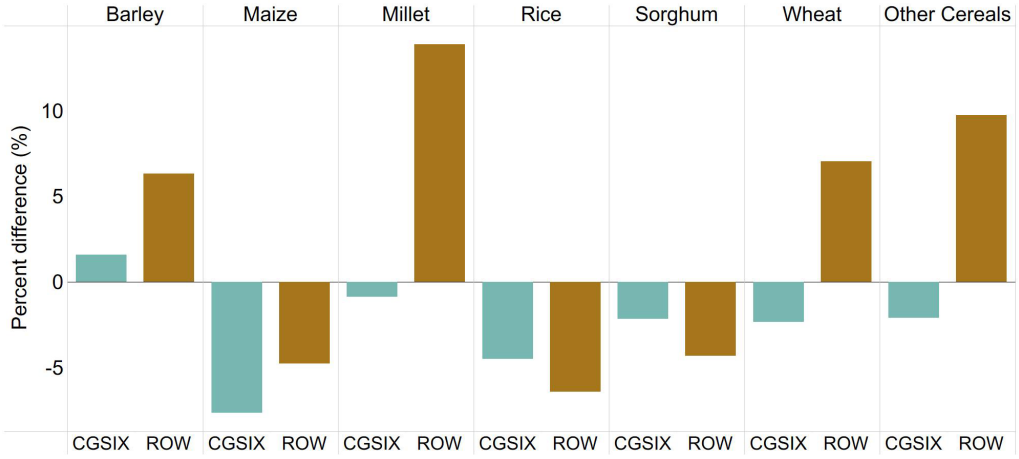


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Climate change impacts on cereals yields

As shown, yields are projected to increase between 2025 and 2050 for most cereal crops in most regions. These trends incorporate the impacts of climate change, but climate change impacts vary widely across crops and regions. For example, higher temperatures adversely affect maize yields in many regions and wheat yields in the tropics, but they benefit wheat yields in higher latitudes. Productivity growth and the ensuing economic feedback may offset some of the most negative impacts of climate change across CGSIX regions (see also Section 4.2), but yield growth is slower and average yields in 2050 are lower than they would have been in the absence of climate change for most cereals in CGSIX regions, especially maize and rice (Figure 6.1.3). In contrast, climate change impacts on cereals yields in ROW are projected to be mixed, with negative impacts projected for maize, rice, and sorghum but positive impacts for barley, millet, wheat, and other cereals.

Figure 6.1.3 Projected impacts of climate change on cereals yields by crop and region, 2050

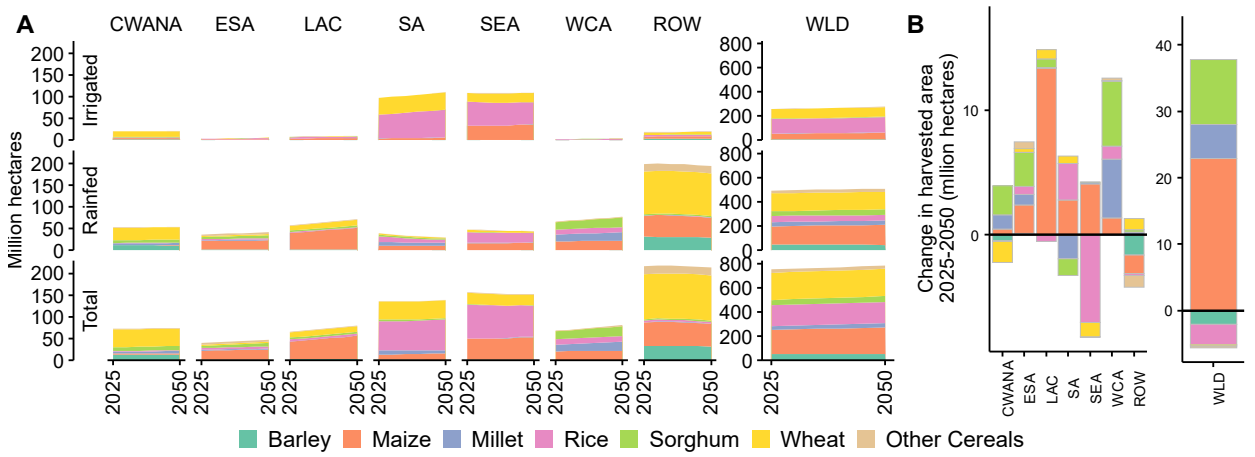


Source: The authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Percent difference in yields in 2050 between the reference scenario and a scenario without climate change shocks. Average effects across the six CG regions (CGSIX) and Rest of the World (ROW).

Cereals harvested area

Driven by increases in demand and slower yield growth in many regions due to climate change, cereals harvested area is projected to grow by 32 million ha by 2050 (Figure 6.1.4). The largest percentage increases (+19–23 percent) are in LAC, ESA, and WCA. LAC and WCA show the largest absolute increase (+14.3 and +12.5 million ha), driven by maize in LAC (more than 50 percent of the increase in global maize area) and sorghum and millet in WCA. Area under rice declines, especially in SEA (−7 million ha), where demand falls.

Figure 6.1.4 Projected changes in cereals harvested area, by crop and region, 2025–2050



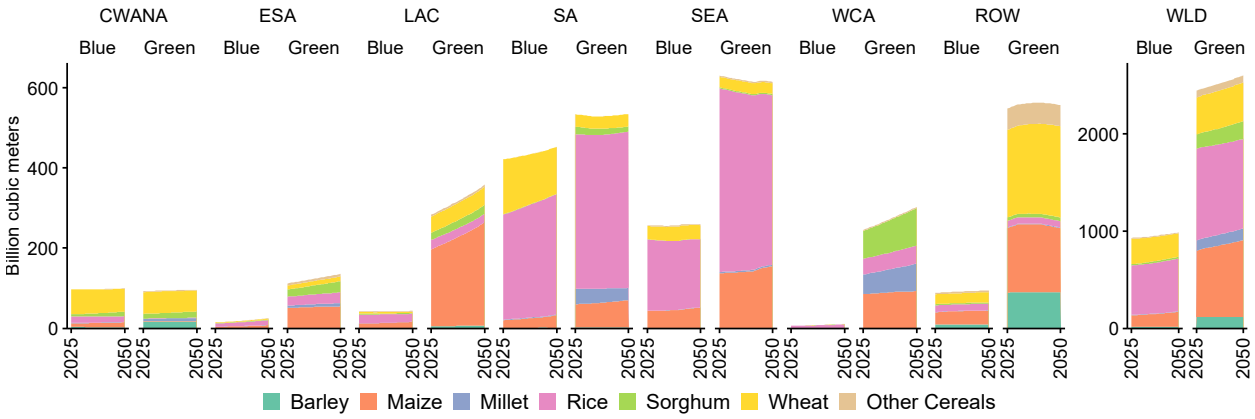
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A shows harvested area for cereals between 2025 and 2050, by crop and region; Panel B highlights the net changes in cereals harvested area between 2025 and 2050 for each crop and region. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Water use in cereals production

Projected changes in water use will be driven by changes in demand and production as well as climate change impacts through temperature and precipitation changes. Among CGSIX regions, SA is projected to continue using the most irrigation (blue) water, primarily for rice, as irrigated area in SA is projected to expand by almost 13 percent (+12 million ha) by 2050 (Figure 6.1.5). SEA and SA are projected to continue using the most green water, also primarily for rice. In LAC, increased use of green water is associated with a 23 percent increase in rainfed area (+13 million ha, up from 58 million ha in 2025), driven almost entirely by maize.

Figure 6.1.5 Projected blue and green water use in cereals production by region, 2025–2050

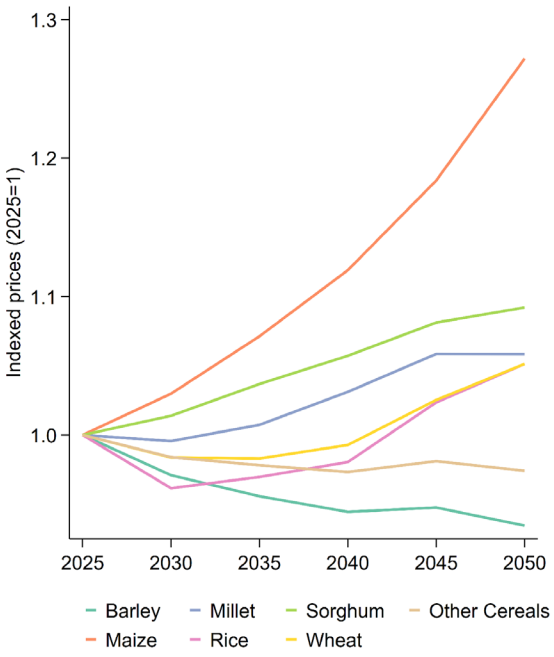


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Cereals prices

Maize prices are projected to increase by 27 percent by 2050, faster than those of other cereals (Figure 6.1.6). This increase is driven by rapid growth in maize demand (especially for feed) combined with the slowest projected yield growth among cereals, reflecting maize's relatively high sensitivity to higher temperatures. Sorghum is similarly challenged by increasing temperatures, but given a more modest expansion of demand, only sees a 9 percent increase in prices by 2050. Millet, rice, and wheat markets see modest price increases of 5–6 percent by 2050, millet because it is relatively more resilient to climate stressors, rice being partially protected from climate due to irrigation, and wheat primarily produced in temperate regions that are projected to experience improved production conditions. Facing more moderate demand increases and climate change impacts, prices of barley and other cereals are projected to increase more slowly or decline slightly.

Figure 6.1.6 Projected changes in cereals prices, 2025–2050

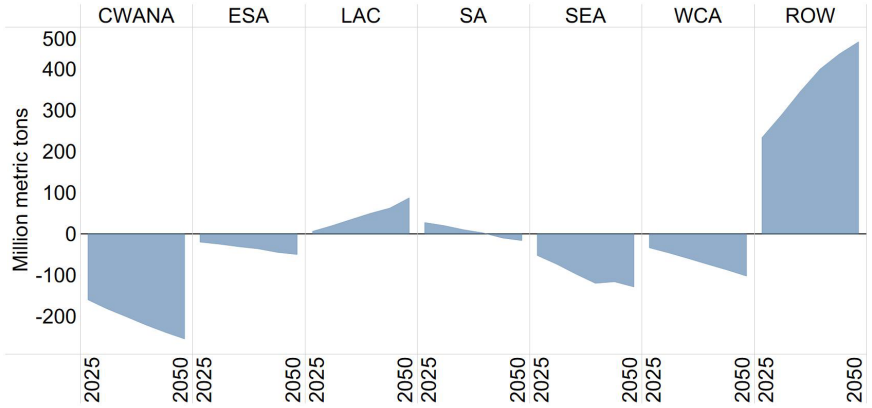


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Cereals trade

Regional production and demand patterns and climate shocks shape trade flows and reinforce the continued position of ROW as a dominant net exporter of cereals. By 2050, combined cereals exports from ROW and LAC are projected to exceed 550 million tons, double the 2025 levels, and driven by wheat (246 million tons in 2050), maize (231 million tons), and barley (50 million tons) (Figure 6.1.7). LAC is a net importer of wheat, but a net exporter of maize. SEA is net exporter of rice and millet, but a net importer of all other cereal crops. While rice and millet exports in SEA are expected to increase, they are expected to be outweighed by significant increases in maize and wheat imports in the region. CWANA imports are dominated by wheat and maize, while ESA and WCA imports are led by maize, wheat, and rice. Imports of these commodities are expected to increase over the projection period. SA, in aggregate, is projected to switch from being a net exporter to a net importer of cereals. This reflects differing regional trends in the three key cereals. SA is already the largest exporter of rice and is projected to double net exports between 2025 and 2050 due to a considerable expansion of net exports by India. However, this expansion is projected to be more than offset by the region's increasing net imports of maize, which largely support the increased production of animal-source foods in SA (see Figure 6.5.1). While India is expected to remain a major net exporter of wheat, production in Pakistan is not expected to keep up with rising demand. As a result, the region shifts from being a net exporter of wheat in 2025 to a net importer by 2050.

Figure 6.1.7 Projected changes in net trade in cereals, by region, 2025–2050



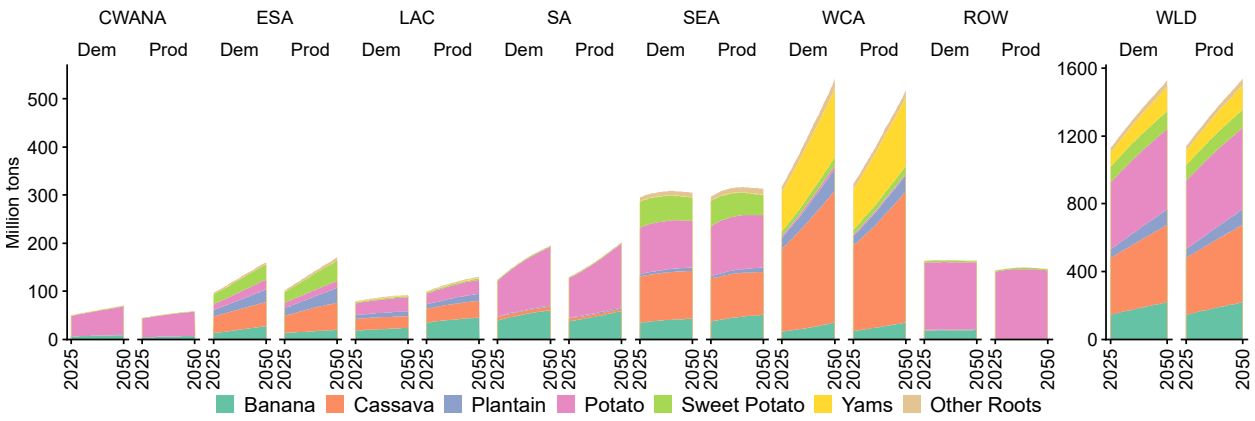
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

6.2 Roots, tubers, and bananas

RTB demand and production

Total demand for RTB is projected to increase by about 400 million tons by 2050 (+35 percent), of which around 270 million tons is for food and over 100 million tons for other demand (e.g., industrial uses). All of the increased demand originates in CGSIX regions (+40 percent), as ROW demand decreases between 2025 and 2050 (Figure 6.2.1). Potatoes remain the leading crop in total output, followed by cassava and bananas. Changes in food demand are driven by cassava and bananas (and by yams in WCA), whereas growth in other demand (e.g., industrial use, especially as sources of starch) is driven by potatoes (and by cassava in SEA). Total demand for RTB is largest in WCA and SEA, and growth is projected to be fastest for WCA and ESA. In WCA, demand growth is driven by cassava and yams, whereas in ESA demand increases by more than 50 percent for most RTB crops. Production is largest in SEA, but is projected to increase the most in WCA in volume terms (+200 million tons) and in ESA in percentage terms (+67 percent).

Figure 6.2.1 Projected demand and production by RTB crop and region, 2025–2050



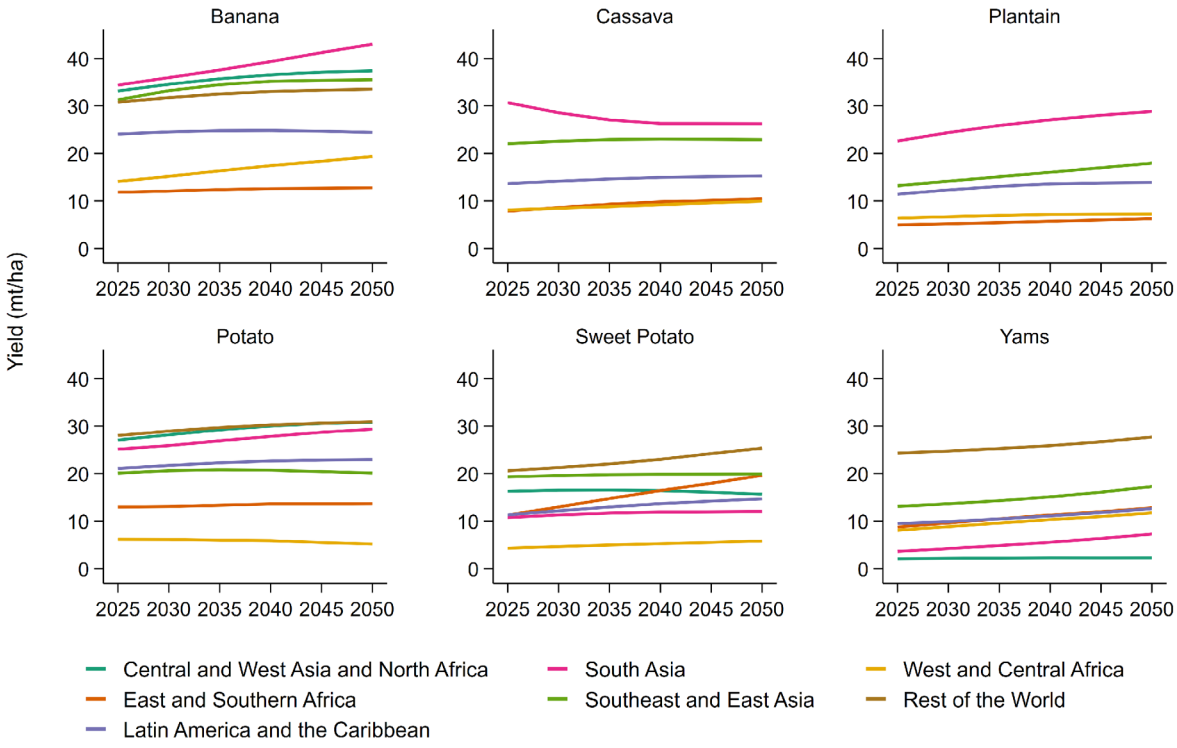
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World: WLD is World.

RTB yields

Average global RTB yields are projected to rise by about 13 percent by 2050. The fastest yield growth occurs for yams in SA and sweet potatoes in ESA, whereas the largest yield increase is in SA for bananas and plantains (Figure 6.2.2). Cassava yields in SA decrease between 2025 and 2050 (driven by declines in India), although SA continues to experience higher yields than other regions. Yields also decline for potatoes in WCA and sweet potatoes in CWANA.

Figure 6.2.2 Projected RTB yields by commodity and region, 2025–2050

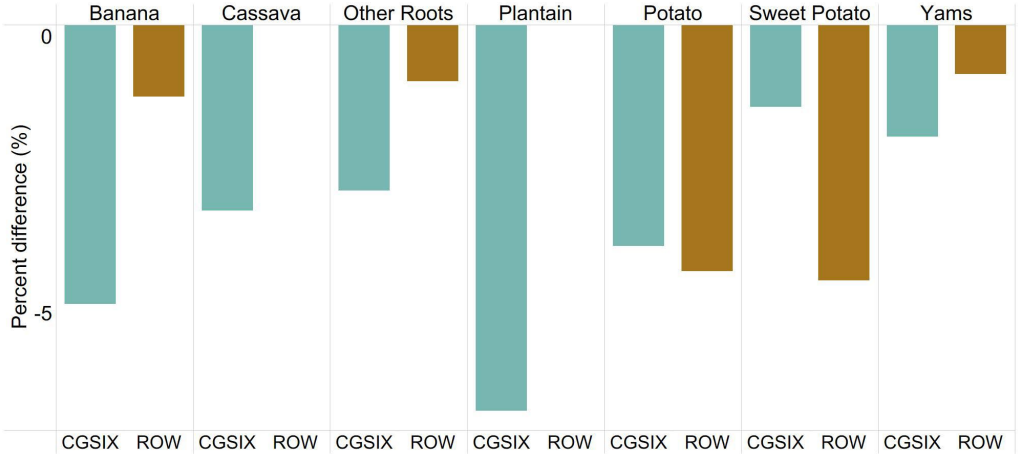


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Climate change impacts on RTB yields

As shown above, yields are projected to increase between 2025 and 2050 for most RTB crops in most regions. These trends incorporate the impacts of climate change, which are projected to adversely affect average yields for all RTB crops (Figure 6.2.3). Productivity growth and the ensuing economic feedback may offset some of the negative impacts of climate change (see also Section 4.2), but yield growth is slower and average yields in 2050 are lower than they would have been in the absence of climate change for all RTB in the CGSIX regions, especially for plantains and bananas. Climate change effects on RTB yields in ROW are projected to be largest for potatoes and sweet potatoes.

Figure 6.2.3 Projected impacts of climate change on RTB yields by crop and region, 2050

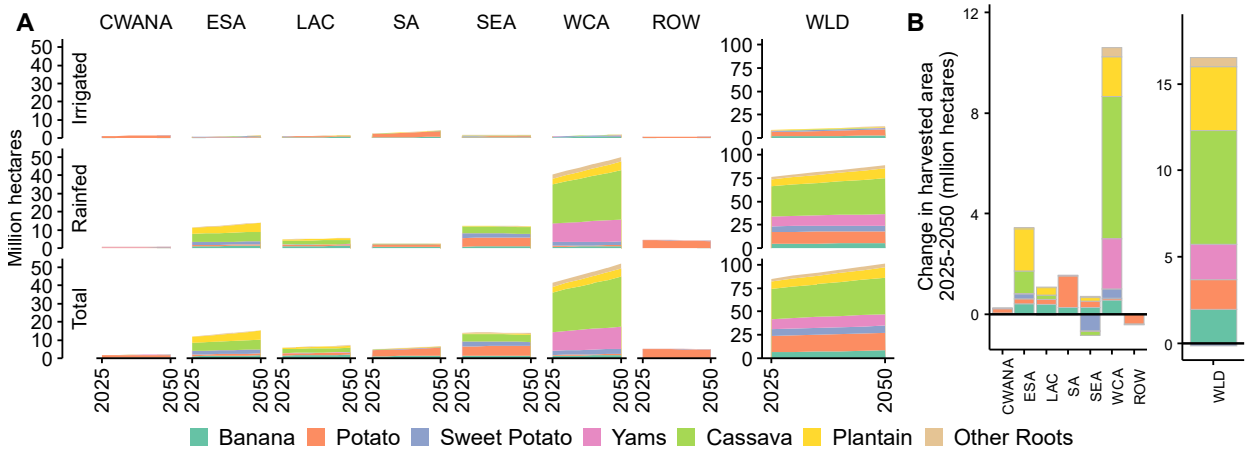


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Percent difference in yields in 2050 between the reference scenario and a scenario without climate change shocks. Average effects across the six CG regions (CGSIX) and Rest of the World (ROW).

RTB harvested area

Production growth for RTB is more dependent on area expansion and less on productivity increases. WCA, SEA, and ESA currently have the largest area under RTB (Figure 6.2.4). Driven by large increases in demand across the CGSIX regions, RTB area harvested is projected to expand by almost 20 percent globally (+16 million ha), particularly in WCA (+10.6 million ha) and ESA (+3.5 million ha). In contrast, harvested area in ROW and SEA declines slightly as productivity gains and diet shifts reduce land requirements.

Figure 6.2.4 Change in RTB harvested area by crop and region, 2025–2050



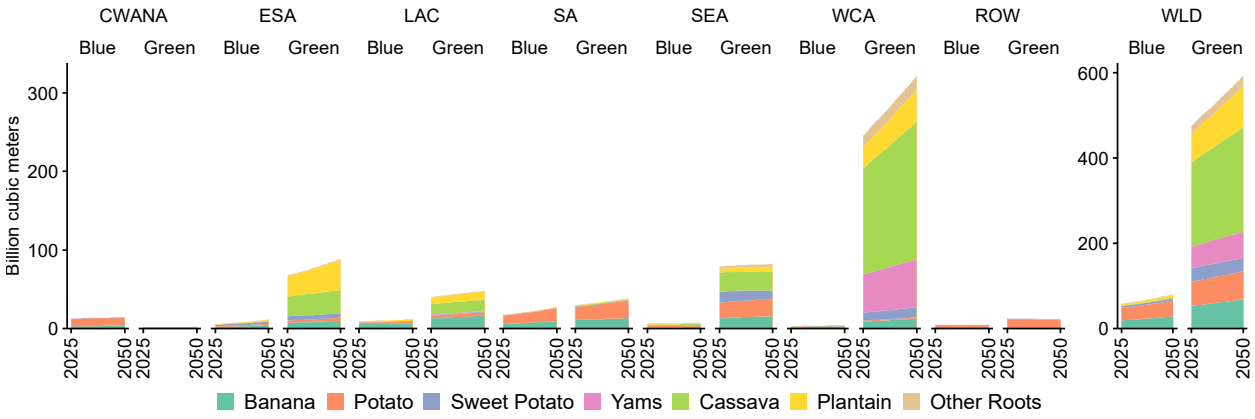
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A shows the harvested area for RTB between 2025 and 2050, by crop and region; Panel B highlights the net changes in RTB harvested area between 2025 and 2050 for each crop and region. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Water use in RTB production

Projected changes in water use are driven by changes in demand and production as well as climate change impacts on RTB crops. WCA is by far the largest user of water for the cultivation of RTB, mostly for cassava, which are almost entirely rainfed (green water use) (Figure 6.2.5). The large growth in green water use in the region is associated with a 24 percent increase in rainfed area, especially for cassava and yams. ESA is second in terms of increase in water use between 2025 and 2050, with most of the increase in green water and associated with a more than 20 percent increase in rainfed area.

Figure 6.2.5 Projected blue and green water use in RTB production by region, 2025–2050

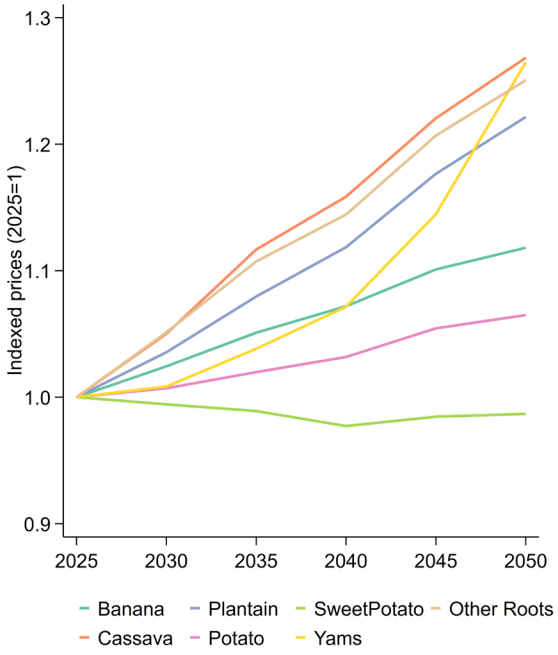


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

RTB prices

Prices for RTB crops are projected to increase on average by 19 percent by 2050, reflecting strong demand (Figure 6.2.6). Cassava and yam prices rise fastest, driven by food and industrial uses. Potato prices rise more slowly because production is keeping pace with demand despite climate shocks. Banana prices increase with trade expansion.

Figure 6.2.6 Projected RTB commodity prices, 2025–2050

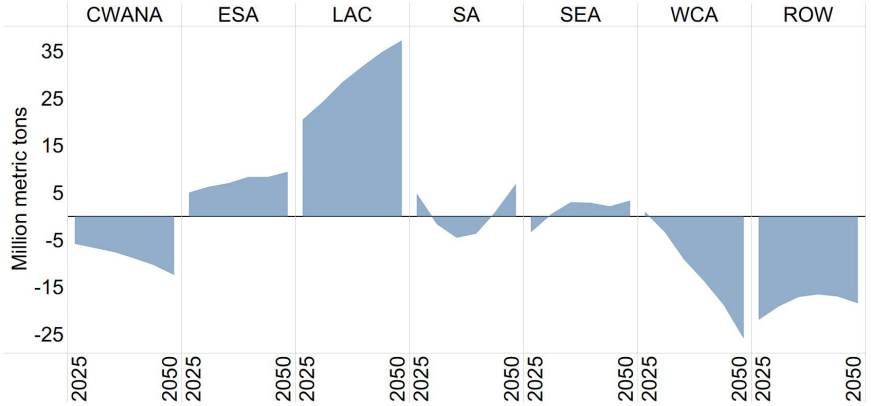


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

RTB trade

Global trade in RTB crops remains limited but grows slightly in volume, with LAC remaining the largest net exporter, especially of bananas (Figure 6.2.7). SEA is the leading exporter of cassava globally and is projected to remain so, but it is also a major importer, so its net trade position in RTB crops will remain nearly in balance. ESA is a growing net exporter of sweet potatoes, cassava, and plantains, although it remains a large importer of bananas and potatoes. In contrast, the large increases in net exports of bananas and potatoes from SEA will make the region a net exporter of RTB, although this shift is partly balanced by higher net imports of cassava and sweet potatoes. In SA, an increase in regional demand for potatoes reduces net exports through 2040; however, as demand stabilizes, continued growth in production supports a recovery in RTB net exports by 2050. Although WCA is the global leader in RTB production, strong demand within the region is projected to drive an increase in imports and increase dependence on imports of plantains, potatoes, and cassava. In CWANA, the increase in net imports is driven by higher demand for potatoes.

Figure 6.2.7 Projected net trade in RTB by region, 2025–2050



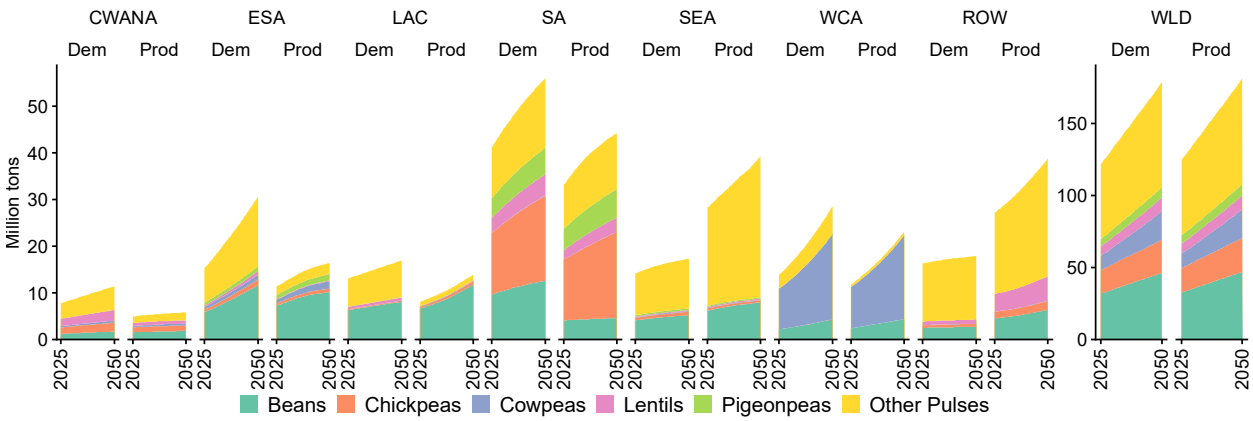
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

6.3 Pulses

Pulses demand and production

Global demand for pulses is projected to increase by 55 million tons globally (+45 percent), of which 40 million tons are for food and the rest is split between feed and industrial uses. This reflects rising demand for plant-based protein and expanding use in processed foods. Over 95 percent of the increase in demand originates from CGSIX regions (Figure 6.3.1). Total demand and production are highest in SA, followed by ESA and WCA, where pulses play a central dietary role. Production is largest in SA, followed by SEA and ROW, where most of the production is exported. Production growth by weight is even in SA, SEA, WCA, and ROW, while the largest percentage increases are in WCA and LAC. Chickpeas and other pulses dominate production in SA, while WCA is the single major producer for cowpeas, and ROW for other pulses (various minor crops that are small individually but large in aggregate). Other pulses and beans remain the top crops globally both for demand and supply, but cowpeas have the fastest rate of growth for both production and demand across the CGSIX.

Figure 6.3.1 Projected pulses demand and production by crop and region, 2025–2050



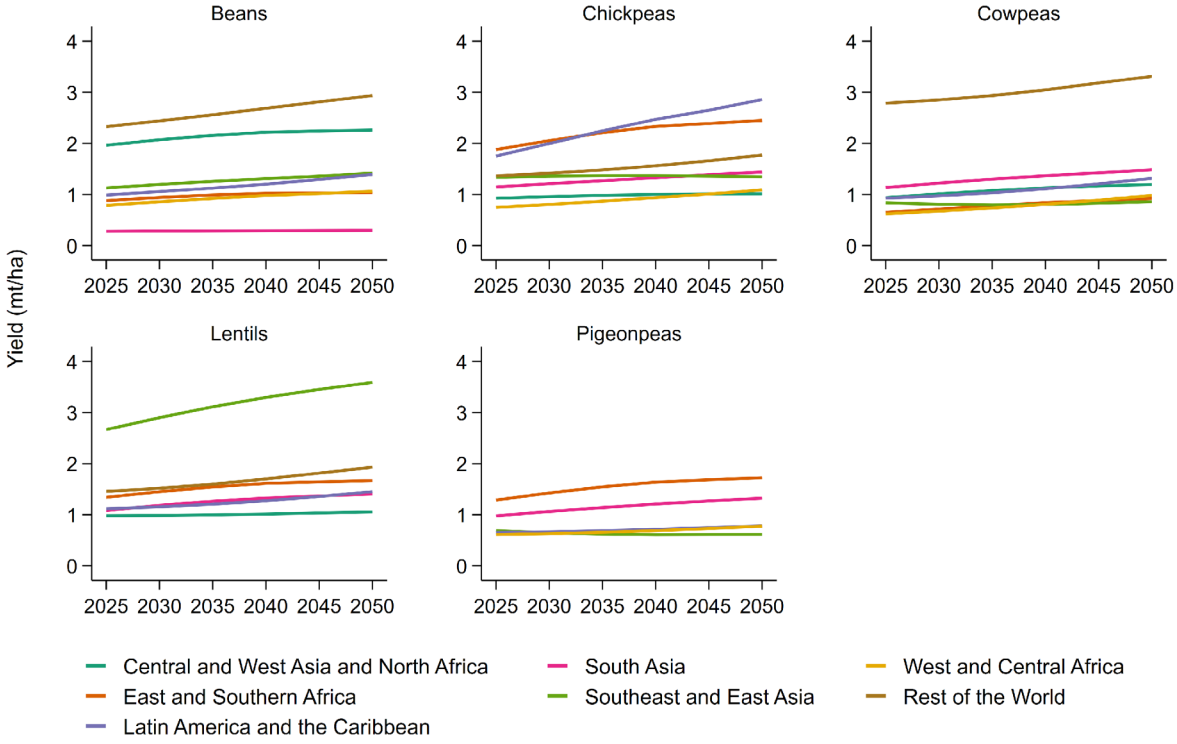
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Pulses yields

Yield growth is the main driver of increase in pulses production, with average productivity increasing at double the rate of area expansion. Globally, average pulse yields are projected to increase by 28 percent by 2050. The highest yields are observed in SEA (lentils) and ROW (beans), while the fastest growth (+60 percent) is projected in LAC (chickpeas) and WCA (cowpeas), reflecting technology diffusion and improved crop management (Figure 6.3.2). Chickpea and bean yields increase most rapidly in LAC, whereas cowpea yield growth is fastest in WCA, ESA, and LAC. Although CGSIX yield growth for cowpeas is larger than in ROW (excluding SEA), cowpea yields in the CGSIX remain relatively small relative to ROW, with the yield gap only marginally declining. In general, yield growth for pulses remains constrained by limited irrigation and input use relative to other crops.

Figure 6.3.2 Projected pulses yields by commodity and region, 2025–2050

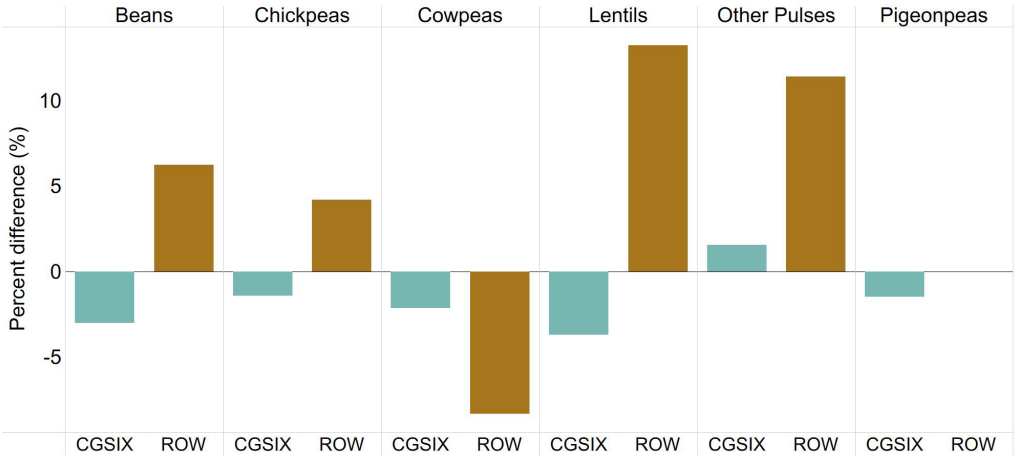


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Climate change impacts on pulses yields

As shown above, yields are projected to increase between 2025 and 2050 for most pulses in most regions. These trends incorporate the impacts of climate change, which are projected to vary across crops and regions. For example, lentils are the most adversely affected pulse crop in CGSIX regions but the most positively affected in ROW. Productivity growth and the ensuing economic feedback may be able to offset some of the negative impacts of climate change (see also Section 4.2), but in CGSIX regions average yields in 2050 are lower than they would have been in the absence of climate change for all pulses with the exception of the "other pulses" group (Figure 6.3.3). In contrast, climate change is projected to have positive effects on most pulses yields in ROW, except for cowpeas.

Figure 6.3.3 Projected impacts of climate change on pulses yields by crop and region, 2050

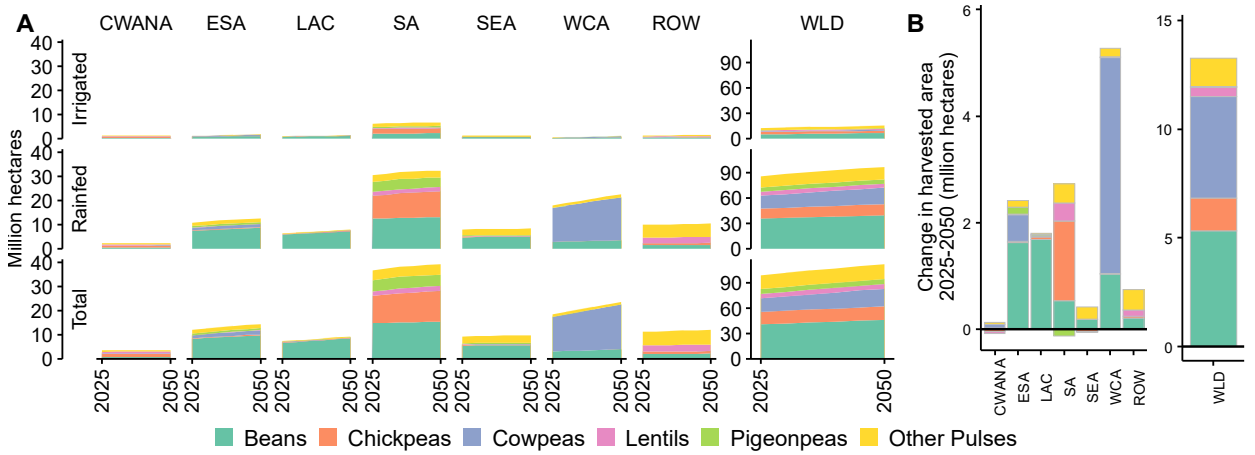


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Percent difference in yields in 2050 between the reference scenario and a scenario without climate change shocks. Average effects across the six CG regions (CGSIX) and Rest of the World (ROW).

Pulses harvested area

Harvested area under pulses is projected to expand globally by 13 percent (+13 million ha), driven by the fastest demand growth among all commodity groups. The largest absolute increases occur in WCA (+5.3 million ha, mainly cowpeas) and SA as well as ESA (+2.5 million ha each) (Figure 6.3.4). The fastest growth is in WCA (+30 percent) and LAC (+24 percnet) and ESA (+20 percent). Harvested area for beans increases in ESA, LAC, and WCA, and SA shows the largest increase in area for chickpeas globally. Expansion is concentrated in rainfed systems.

Figure 6.3.4 Pulses harvested area by crops and region, 2025–2050



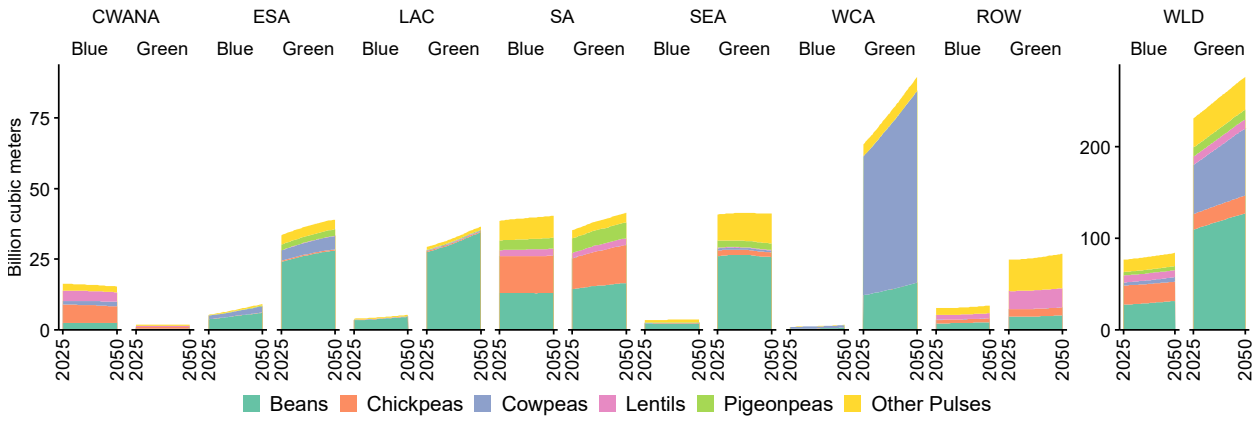
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A shows the harvested area for pulses between 2025 and 2050, by crop and region; Panel B highlights the net changes in pulses harvested area between 2025 and 2050 for each crop and region. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Water use in pulses production

Pulses are mostly rainfed, thus overwhelmingly relying on green water for irrigation. Most of the projected increase in green water use takes place in WCA, SA, LAC, and ESA (Figure 6.3.5). WCA is the region that uses the most green water for pulses production (especially for cowpeas), and WCA's increase in green water use by 2050 is associated with a 25 percent increase in rainfed area. Blue water use for irrigation is largest in SA, and in CWANA blue water use far exceeds green water use.

Figure 6.3.5 Projected blue and green water use in pulses production by region, 2025–2050



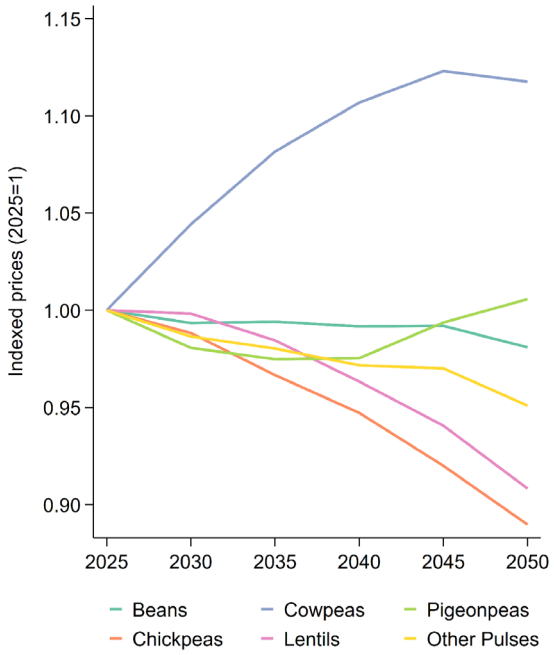
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Pulses prices

Prices in 2050 are projected to remain flat or decline for most pulses as production keeps pace with demand growth. The exception is cowpeas, for which prices are projected to increase by 12 percent, driven by rising demand in WCA and ESA (Figure 6.3.6). Overall, pulses remain relatively affordable sources of protein.

Figure 6.3.6 Projected pulses prices, 2025–2050

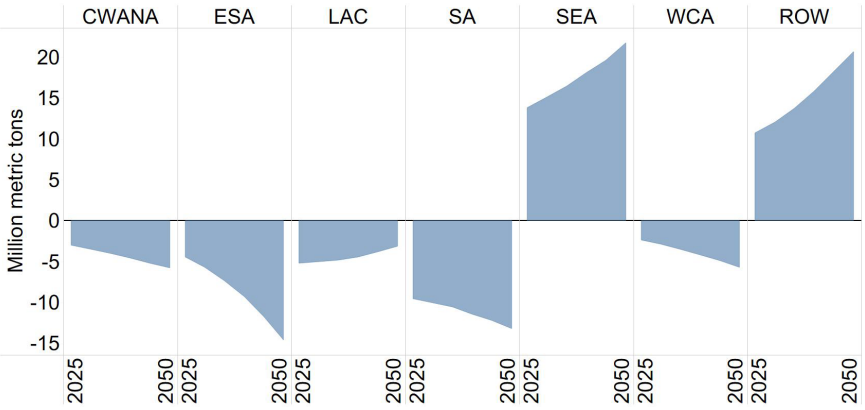


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Pulses trade

Global trade in pulses continues to expand, with net exports projected to rise by 18 million tons between 2025 and 2050. SEA and ROW are the two major net exporters, with both set to expand their exportable supplies through 2050 (Figure 6.3.7). SEA mostly exports other pulses with net flows that increase by 7.5 million tons (+63 percent) by 2050. In 2050, exports by weight from ROW are also dominated by other pulses (+6.5 million tons), followed by lentils (+1.3 million tons) and beans (+1.6 million tons). LAC is also projected to increase exports of dry beans, leading to a narrowing of its net imports of pulses. ESA and SA are the two major importers of pulses due to growing domestic consumption. ESA shifts from being a net exporter of dry beans, to a net importer. This, alongside a sharp expansion in imports of other pulses, leads the region to become the largest net importer of pulses by 2050. Imports into SA are dominated by beans, as demand is more than double the regional production.

Figure 6.3.7 Projected pulses net trade by region, 2025–2050



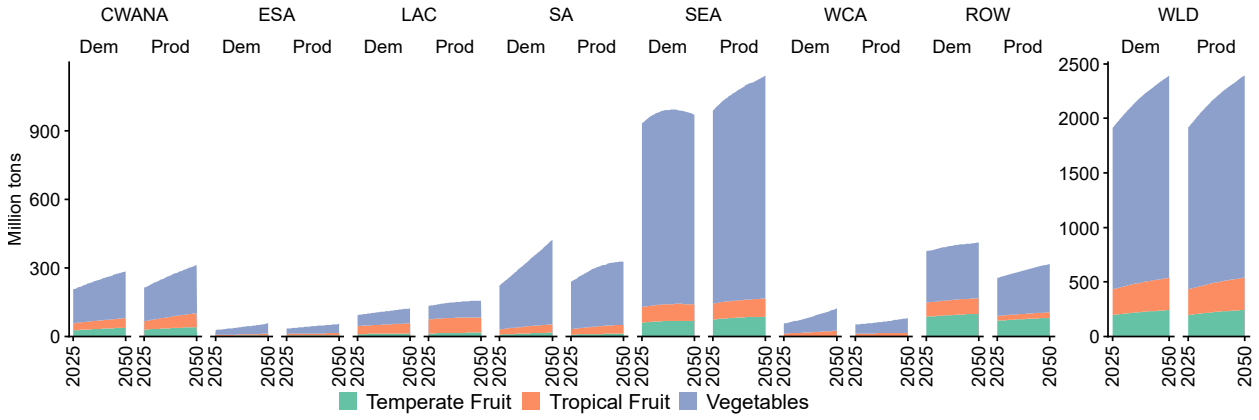
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

6.4 Fruits and vegetables

Fruits and vegetables demand and production

Total demand for fruits and vegetables is projected to increase by over 470 million tons (+25 percent) by 2050. Eighty percent of this growth will come from food demand, while the remaining share reflects other demand (e.g., processing and industrial uses). Over 90 percent of the increase occurs in the CGSIX regions, especially in SA and CWANA (Figure 6.4.1). In volume terms, vegetables account for almost 80 percent of the additional demand, though tropical fruits are expected to show the fastest average growth. SEA remains the largest producer and consumer of fruits and vegetables among the CGSIX regions followed by CWANA and SA. In most regions, vegetables constitute by far the largest share of production and demand, whereas in LAC the volume of tropical fruit production and demand is similar to that of vegetables. In SA, demand for fruits and vegetables is growing linearly, but production starts to taper off in the next 15–20 years. Demand for fruits and vegetables in SA grows by 89 percent, but production only expands by 35 percent due to deceleration in production growth, from 2.4 percent per year in 2025–2030, to only 0.3 percent per year in 2045–2050.

Figure 6.4.1 Projected fruits and vegetables demand and production by crop and region, 2025–2050

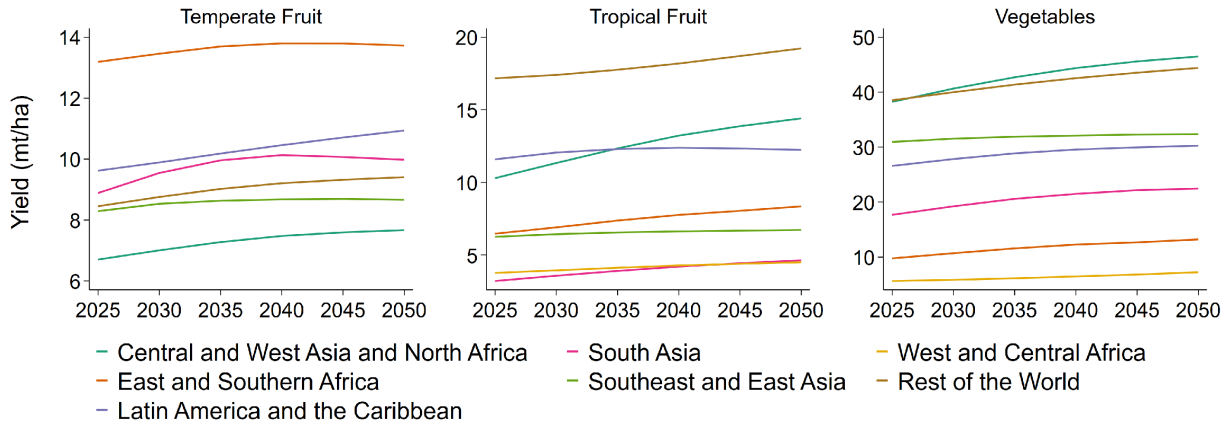


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Fruits and vegetables yields

Production changes for fruits and vegetables are driven almost equally by changes in yields and in harvested area. Average global yields for these crops are projected to increase by around 12 percent by 2050, reflecting continued adoption of improved varieties, irrigation, and agronomic practices. The largest average yield gains are projected in ESA and WCA (+30 percent), especially for vegetables and tropical fruits, while yield growth for temperate fruits is strongest in CWANA (Figure 6.4.2). CWANA, ROW, and SEA maintain the highest absolute yields (about 22 tons/ha), but yield growth rates are more modest due to already high productivity.

Figure 6.4.2 Projected fruits and vegetables yields by crop and region, 2025–2050

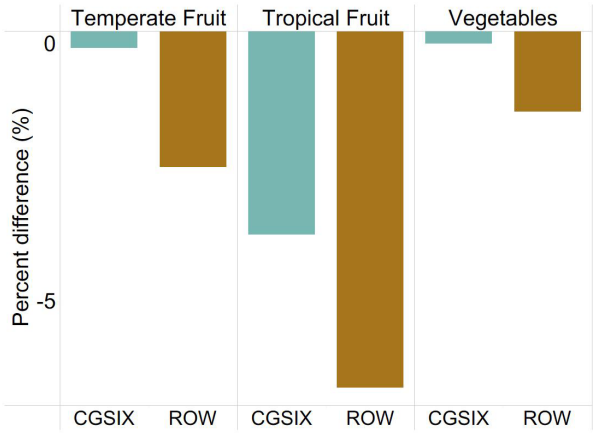


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Climate change impacts on fruits and vegetables yields

As shown above, yields are projected to increase between 2025 and 2050 for most fruits and vegetables in most regions. These trends incorporate the impacts of climate change, which is projected to adversely affect average yields for fruits and vegetables, both in CGSIX regions and in the rest of the world, as fruits and vegetables are highly sensitive to temperature extremes, water stress, and pests. Productivity growth and the ensuing economic feedback may offset some of the negative impacts of climate change (see also Section 4.2), but yield growth is slower and average yields in 2050 are projected to be lower than they would have been in the absence of climate change. Adverse impacts are projected to be greatest for tropical fruits in both CGSIX and ROW regions (Figure 6.4.3), but impacts are expected to vary widely across specific crops and within these diverse regions.

Figure 6.4.3 Projected impacts of climate change on fruits and vegetables yields by crop and region, 2050



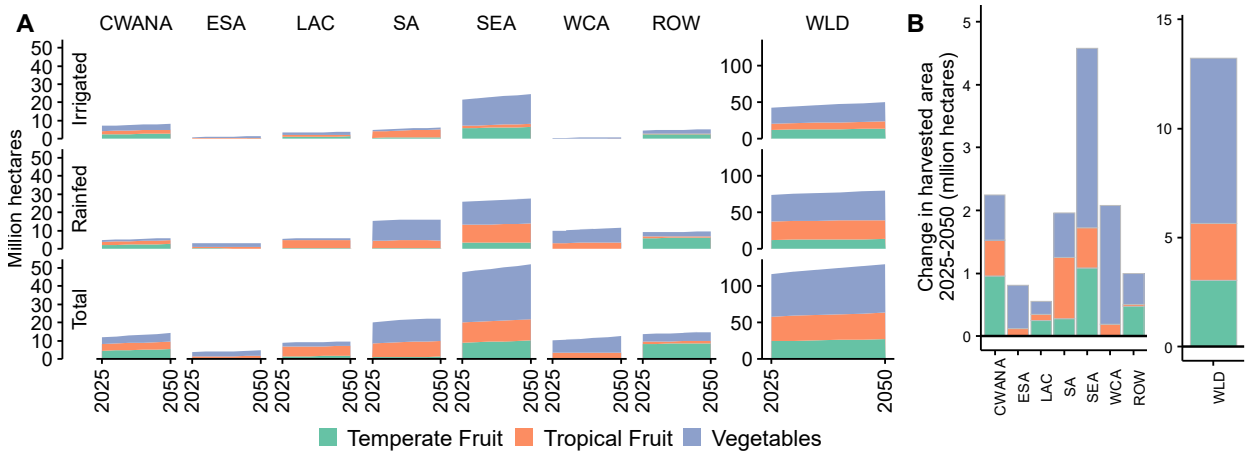
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Percent difference in yields in 2050 between the reference scenario and a scenario without climate change shocks. Average effects across the CGSIX regions and Rest of the World (ROW).

Fruits and vegetables harvested area

Driven by strong demand growth, global harvested area under fruits and vegetables is projected to expand by about 11 percent (+13 million ha) by 2050. The largest absolute increase occurs in SEA (+4.6 million ha) and CWANA as well as SA and WCA (+2 million) (Figure 6.4.4). Expansion is concentrated in irrigated systems, and irrigated vegetable production areas also increase in many regions globally.

Figure 6.4.4 Fruits and vegetables harvested area by crop and region, 2025–2050



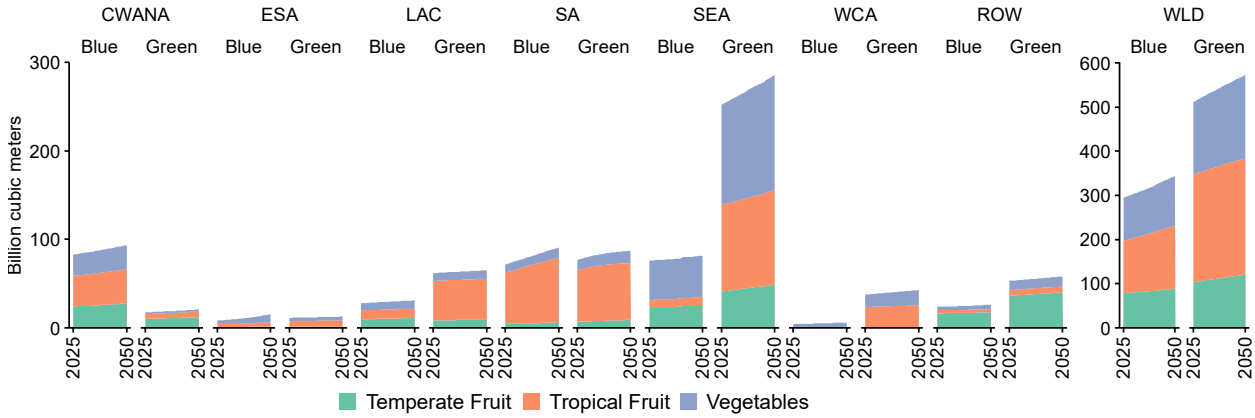
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A shows the harvested area for fruits and vegetables between 2025 and 2050, by crop and region; Panel B highlights the net changes in fruits and vegetable harvested area between 2025 and 2050 for each crop and region. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Water use in fruits and vegetables production

SEA uses the largest amount of water globally for cultivation of fruits and vegetables, and the region is also projected to account for most of the change in water use between 2025 and 2050 (Figure 6.4.5). This is especially true for green water in rainfed systems, although irrigated area increases the most across CGSIX, with 3 million additional hectares. In CWANA, water use for fruits and vegetables is mostly blue water in irrigated systems. SA also becomes a major irrigation user for these crops by 2050, as irrigated area increases by 1.3 million ha.

Figure 6.4.5 Projected blue and green water use in fruits and vegetables production by region, 2025–2050



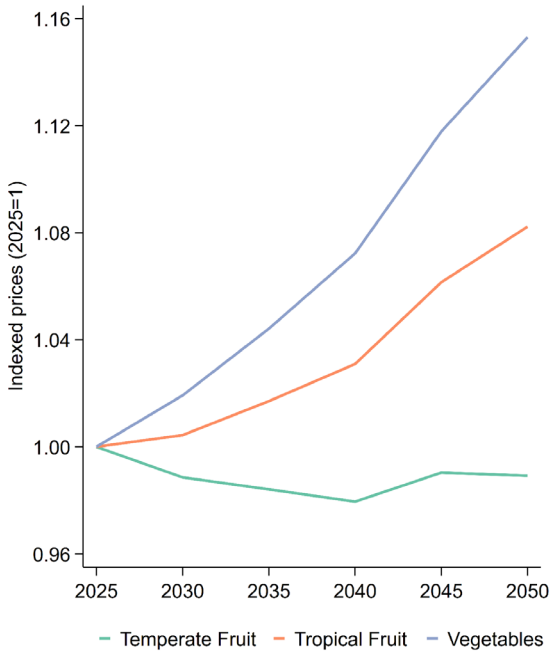
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Fruits and vegetables prices

Fruits and vegetables prices are projected to rise moderately by 2050, with average prices increasing by about 12 percent, reflecting strong demand growth and the impacts of climate change on yields in the CGSIX regions. Vegetable prices increase faster than fruit prices (Figure 6.4.6). Price volatility is expected to increase with climate shocks, especially for perishable crops such as tomatoes and leafy vegetables.

Figure 6.4.6 Projected fruits and vegetables prices, 2025–2050

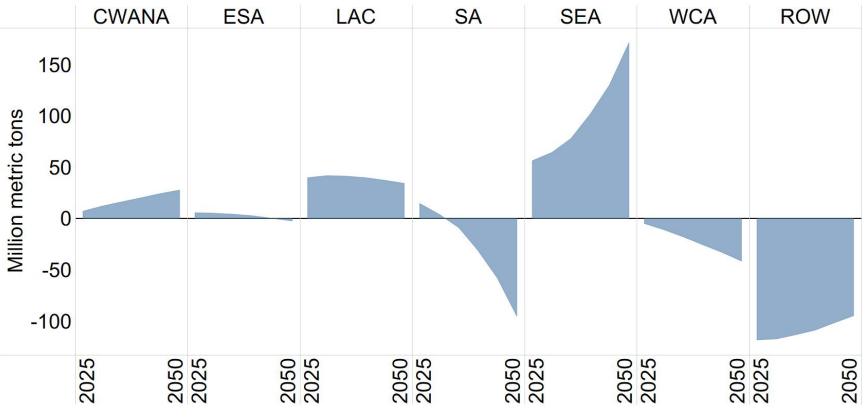


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Fruits and vegetables trade

Trade in fruits is projected to continue to expand, led by exports from SEA, LAC, and CWANA, flowing mainly to SA, ROW, and WCA. Trade in vegetables is dominated by SEA (the major net exporter) and SA (the major net importer). The group of CGSIX regions is projected to remain a net exporter of fruits and vegetables in 2050, with import dependence increasing in SA and WCA driven by urbanization and rising consumer demand for vegetables (Figure 6.4.7). Exports increase in CWANA, largely driven by tropical fruits. In SEA, net exports of these crops triple, due mainly to an expansion of net exports of vegetables by more than 100 million tons. In 2050, net imports in ROW are mainly of tropical fruits, followed by vegetables. Stronger production of vegetables, compared with demand growth, leads to a narrowing of ROW net imports.

Figure 6.4.7 Projected fruits and vegetables net trade by region, 2025–2050



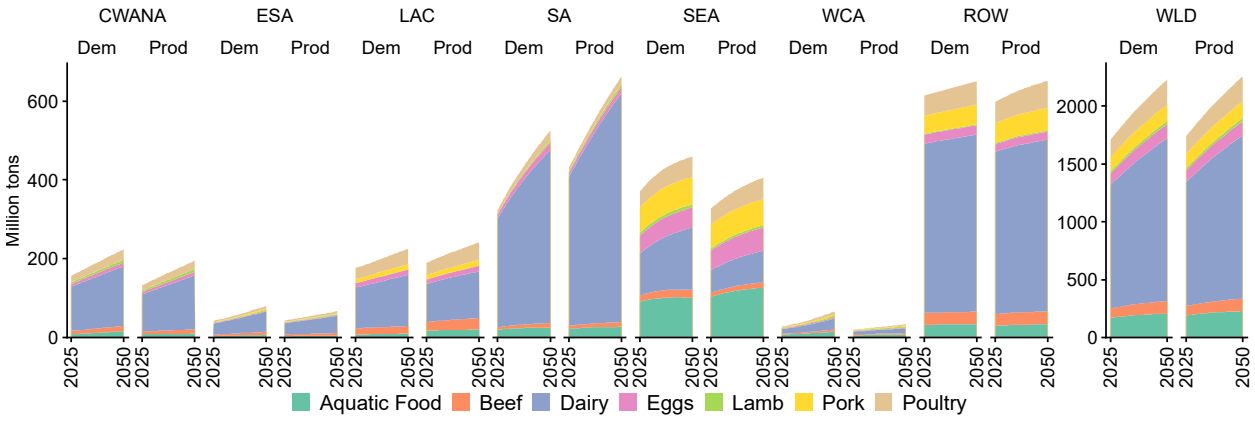
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

6.5 Animal-source foods (including aquatic foods)

Animal-source foods demand and production

Total demand for animal-source foods is projected to increase by around 0.5 billion tons by 2050 (roughly 30 percent). Almost all of the increase in demand originates from CGSIX regions, especially SA (Figure 6.5.1). Demand and production for animal-source foods are largest in ROW, SA, and SEA, both today and in 2050. Demand and production are largest for dairy, especially in SA and ROW, while demand for aquatic foods is largest in SEA. Demand for poultry, pork, and beef are largest in SEA and ROW. In global terms, relatively low levels of animal-source foods are currently demanded and produced in ESA and WCA, but these regions show the fastest growth in demand, which more than doubles between 2025 and 2050.

Figure 6.5.1 Projected animal-source foods demand and production by commodity and region, 2025–2050



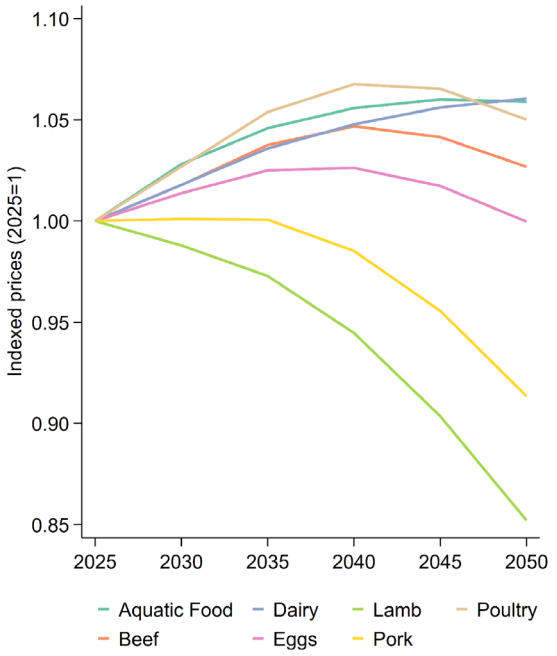
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Animal-source foods prices

Notwithstanding rapid growth in demand for animal-source foods in CGSIX regions, world prices of animal-source foods are projected to level off (and even decline in some cases) late in the projection period, as productivity growth continues and demand growth slows in many high-income countries (Figure 6.5.2). Production is also projected to increase more rapidly than demand in many low- and middle-income regions, including for dairy in SA and poultry in LAC and ROW.

Figure 6.5.2 Projected animal-source foods prices, 2025–2050

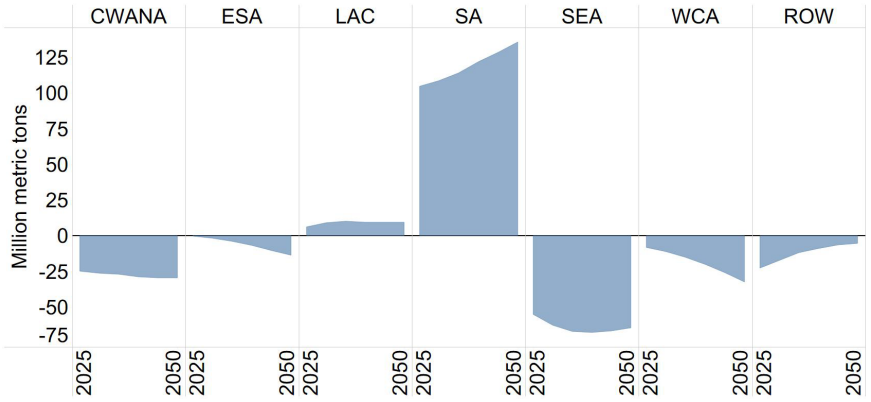


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Animal-source foods trade

Regional demand and production patterns shape animal-source foods trade flows, with SA projected to increase net exports by almost 30 percent between 2025 and 2050 (driven mostly by dairy, despite a significant increase in net imports of poultry) (Figure 6.5.3). SEA remains a large importer, driven mainly by continued large dairy imports. Dairy imports also drive the increase in net imports of animal-source foods in ESA and WCA, albeit from low initial levels. The increase in WCA net imports also reflects imports of aquatic foods, which are similarly a driver of the increase in net imports of animal-source foods to CWANA. The narrowing of net trade in animal-source foods in ROW is due to an increase in poultry net exports and a reduction in dairy imports in the region.

Figure 6.5.3 Projected animal-source foods net trade by region, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

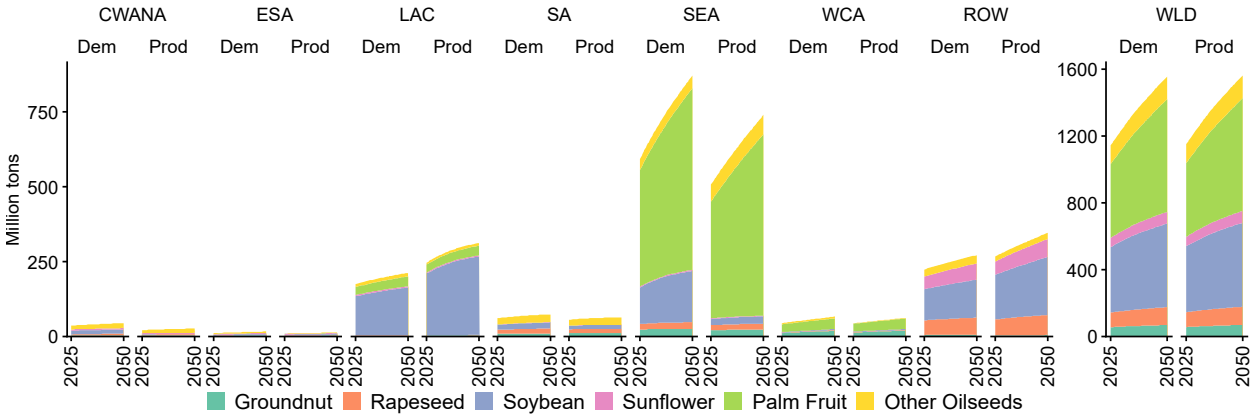
6.6 Oils and sugars

Oils and sugars demand and production

Oils and sugars represent an important set of commodities that, aside from soybeans and groundnuts, are generally beyond the scope of CGIAR's commodity mandate. They do factor in as key commodities for animal-source foods (via oilmeals as feed) and as ingredients for prepared foods, which makes them crucial when considering the human health impacts of the agrifood sector now and into the future. Biofuels, such as ethanol from sugarcane and biodiesel from soybeans, are another linked sector. These commodities are important as cash crops and are often a focus for larger-scale producers. Some oilseeds are consumed directly, though most are processed into vegetable oils, which produces oilmeal as a byproduct that is sought for animal feed. Refined sugar is processed from sugarcane and sugar beets.

Total oilseed demand (Figure 6.6.1) is projected to increase by over 400 million tons by 2050 (+36 percent), while vegetable oil demand will increase by over 300 million tons (+45 percent). Demand for sugars increases by 37 percent at a growth rate of almost 1.3 percent per year. Increases in demand for oilseeds are dominated by palm (in SEA) and soybeans (in LAC, ROW, and SEA). Demand for vegetable oil follows the same pattern as for oilseeds. In other regions, other types of oilseeds can be more important commercial crops that align with local traditions and production practices. LAC is the leading region for expanding sugar demand, with SA, SEA, and ROW the next most important regions. Most of the expansion in sugar demand is met by sugarcane. Production patterns largely follow demand patterns for each region except for the major traded commodities: palm in SEA and soybeans in LAC and ROW.

Figure 6.6.1 Projected oilseed demand and production by crop and region, 2025–2050



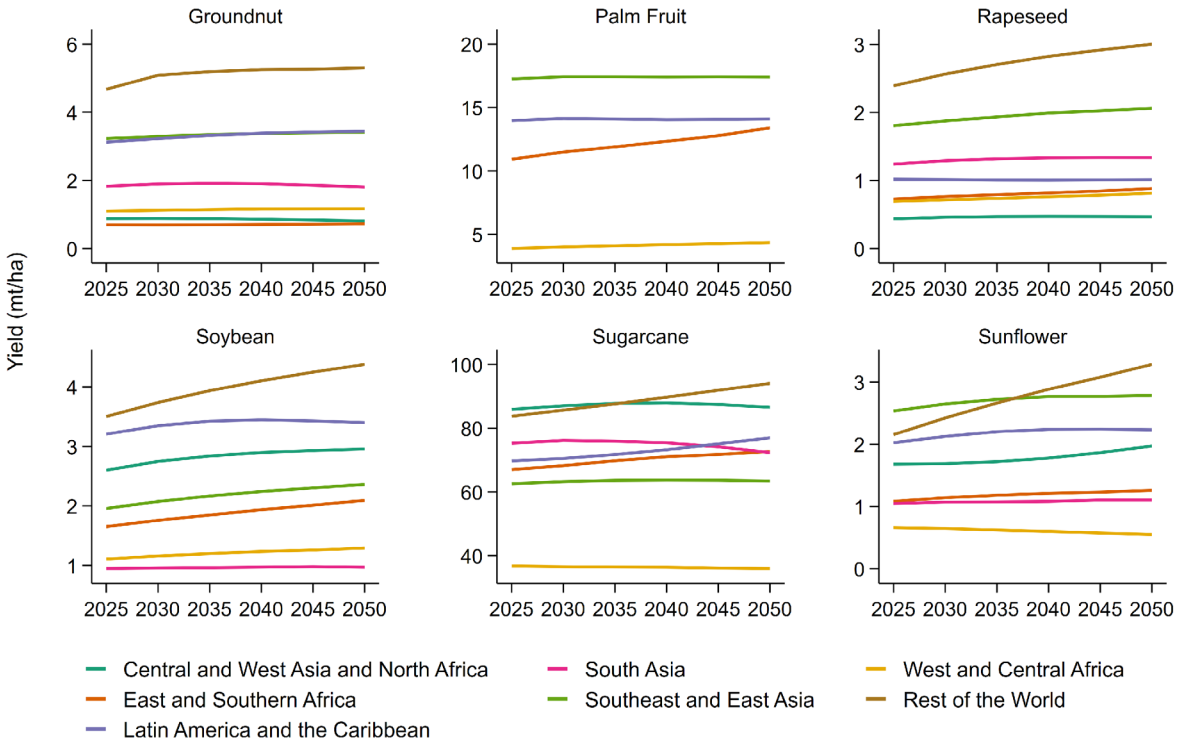
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Oils and sugars yields

Average oilseed yield growth from 2025 to 2050 is fastest in ROW (+1.2 percent per year, +36 percent over the period), which sees higher annual growth rates than the CGSIX regions (Figure 6.6.2). ESA sees the largest absolute increase in yields (+23 percent) across oilseeds among the CGSIX regions. Yields for sugar crops increase on average by 8 tons per hectare globally, with ROW increasing the most (+17 percent) and LAC and SEA both increasing their sugar crop yields by 10 percent. WCA is projected to see flat sugar crop yields while yields in SA decline between 2025 and 2050. For most crops in the oilseeds and sugars category, yield changes in the CGSIX regions are lower than in ROW, resulting in a widening in the yield gap between ROW and CGSIX regions by 2050.

Figure 6.6.2 Projected oils and sugars yields by commodity and region, 2025–2050

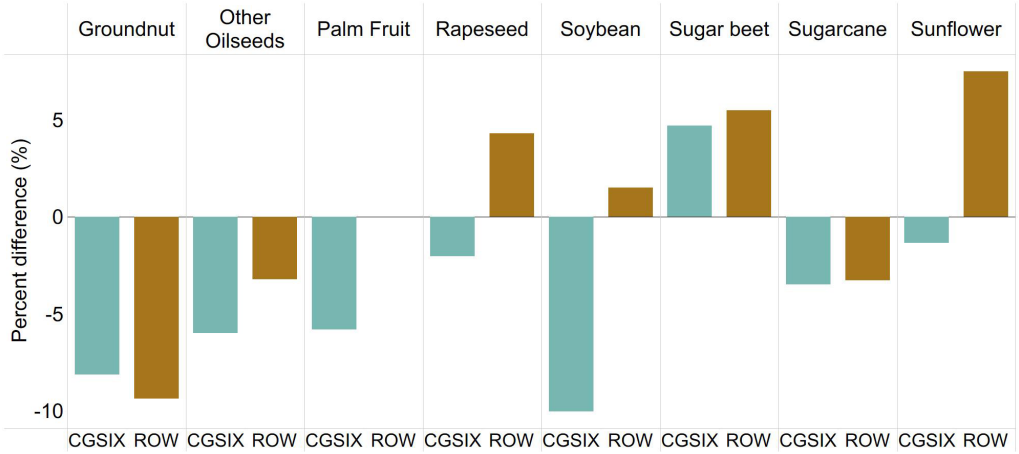


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Climate change impacts on oils and sugars yields

The yield trends above incorporate the impacts of climate change, which is projected to adversely affect average yields for most oils and sugars in the CGSIX regions but have mixed impacts in ROW (Figure 6.6.3). Average yields across oils and sugars and in the CGSIX regions are projected to be 2–10 percent lower in 2050 than they would have been in the absence of climate change, except for sugar beets, which are produced in the few CGSIX temperate climates of CWANA and SEA, where they see higher yields due to climate change. Average yields in ROW are projected to be 3–9 percent lower for groundnuts, sugarcane, and other oilseeds due to climate change, but 4–8 percent higher for rapeseed, sugar beets, and sunflowers.

Figure 6.6.3 Projected changes in oils and sugars yields due to climate change, by crop and region, 2025–2050

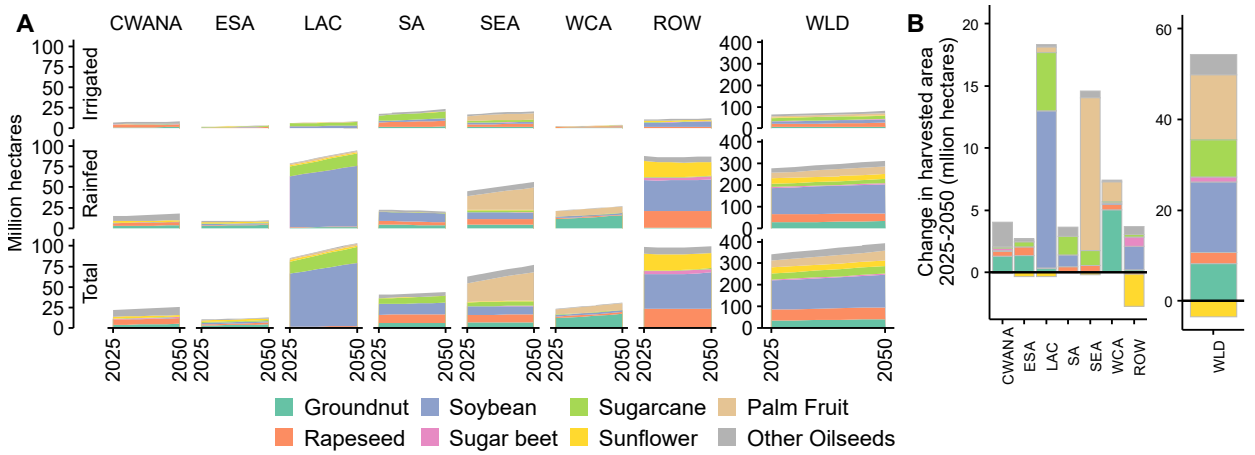


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Percent difference in yields in 2050 between the reference scenario and a scenario without climate change shocks. Average effects across the six CG regions (CGSIX) and Rest of the World (ROW).

Oils and sugars harvested area

Globally, area harvested for oils and sugars is projected to increase by 51 million ha between 2025 and 2050 (Figure 6.6.4), driven by an increase of 18 million ha in LAC (mostly soybeans and sugarcane) and a 14 million ha increase in SEA (mostly palm fruit). Globally, only sunflower area is projected to decline (−3.5 million ha), mostly in ROW (−2.6 million ha). Soybean and palm fruit areas increase the most (+14–15 million ha each). Increases in sugarcane areas are strong in LAC, SA, and SEA. ROW sees a reduction in sunflower harvested area that offsets the expansion in soybeans, sugar beets, and other oilseeds. WCA sees strong increases in groundnut area to keep up with increasing demand in the face of stagnant yield growth. From 2025 to 2050, total irrigated areas increase by over 16 million ha (+26 percent) as rainfed production adds over 34 million ha (+12 percent). Nearly all this expansion is in the CGSIX regions.

Figure 6.6.4 Oils and sugars harvested area by crops and region for irrigated, rainfed, and total, 2025–2050



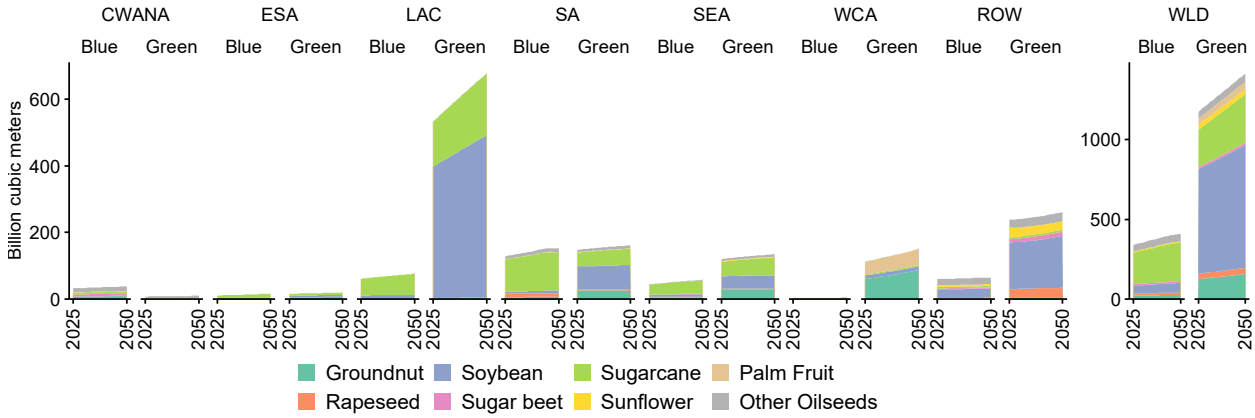
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A shows the harvested area for oils and sugars between 2025 and 2050, by crop and region; Panel B highlights the net changes in oils and sugars harvested area between 2025 and 2050 for each crop and region. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Water use in oils and sugars production

Oils and sugars production relies primarily on green water, though blue water is essential for production in CWANA and supports yields in SA, SEA, and LAC. LAC uses the largest amount of water globally (around 40 percent) for cultivation of oils and sugars, almost exclusively for soybeans and sugarcane (Figure 6.6.5). LAC is also projected to account for most of the change in water use, especially for green water, which will increase by 27 percent. The majority of blue water use for oils and sugars production is dedicated to sugarcane, which raises important questions regarding both the environmental and health implications.

Figure 6.6.5 Projected blue and green water use in oils and sugars production by region, 2025–2050



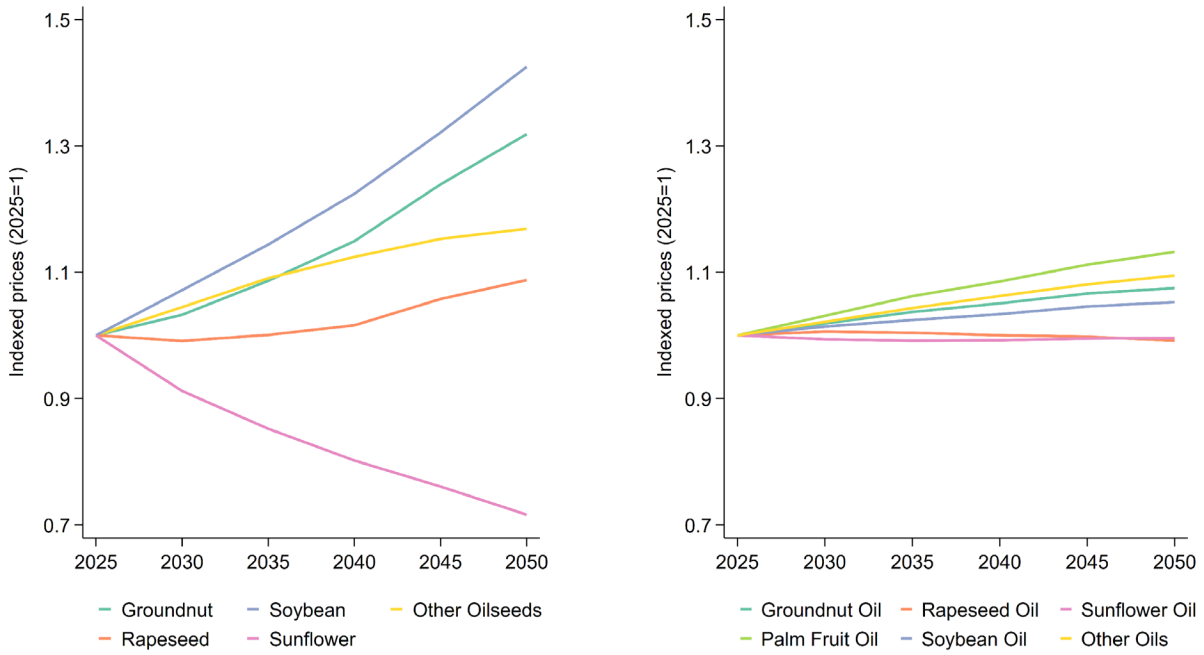
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Oils and sugars prices

International prices across the oils and sugars commodity group are mostly projected to increase from 2025 to 2050, although a few commodities see price declines (Figure 6.6.6). Raw groundnut and soybean prices are projected to increase by 32–43 percent while sugar crops, palm fruit, and other oilseeds prices see increases of 10–20 percent over the same period. On the other hand, sunflower prices are projected to decline by almost 30 percent. Prices for oils made from palm fruit and other oilseeds are projected to increase by 9–13 percent from 2025 to 2050, while soybean and groundnut oils see 5–7 percent increases. Sunflower and rapeseed oil prices are steady throughout the projection period.

Figure 6.6.6 Projected oils and oilseeds commodity prices, 2025–2050

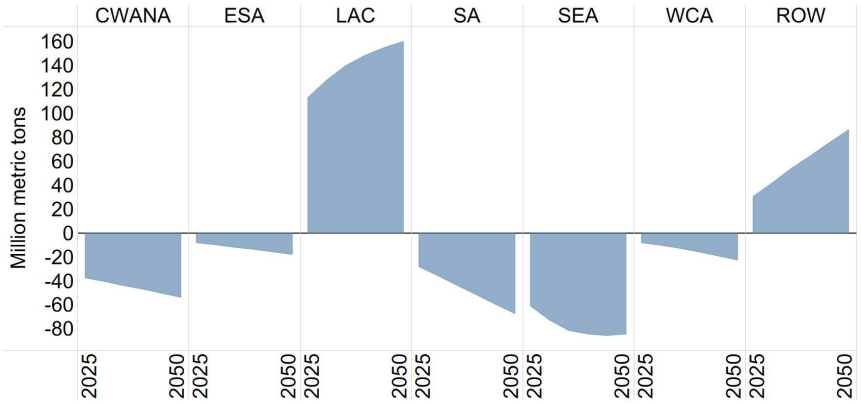


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Oils and sugars trade

LAC is the largest net exporter of oilseeds and sugars (Figure 6.6.7). Between 2025 and 2050, LAC net exports are projected to increase further, mainly due to higher soybean and sugar exports from Brazil. The same is expected in ROW, driven mainly by the United States, Russia, and Ukraine. The largest net importer of oilseeds and sugars is SEA, predominantly made up of soybean imports by China. The region is a major net exporter of palm oil, with exports projected to increase by almost 25 million tons by 2050. In other regions — CWANA, ESA, SA, and WCA — the increase in net imports of oils and sugars is driven mainly by refined sugar, and to a lesser degree, imports of palm oil.

Figure 6.6.7 Projected oils and oilseeds net trade by region, 2025–2050



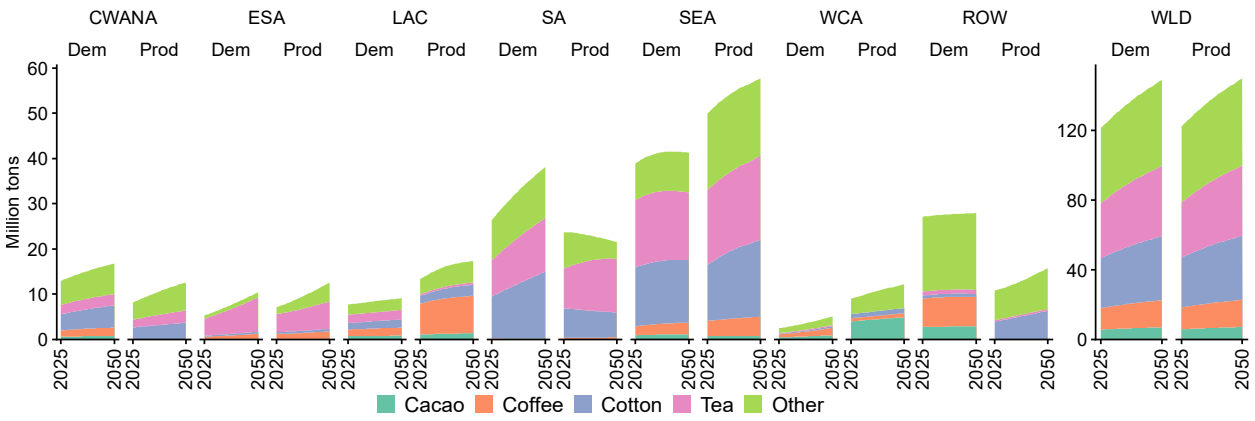
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

6.7 Other crops

Other crops demand and production

Global demand for other crops — including cacao, coffee, cotton, tea, and miscellaneous other commodities — is projected to increase to about 150 million tons by 2050 (+28 million ha, +23 percent), of which 88 million tons are food and 60 million tons are for industrial and export uses. Most of the new demand comes from CGSIX regions, especially SA, ESA, and WCA (Figure 6.7.1). The largest demand volumes are in SEA and SA, followed by ROW. In SEA and ROW, food accounts for the largest share of total demand, while in SA it is nonfood demand. The largest change in demand by volume occurs in SA, especially for cotton and tea, while in percentage terms the fastest growth is in WCA (coffee) and ESA (coffee and tea). SEA dominates raw production in volume, but the fastest production growth is projected for ESA for other crops and in CWANA for tea.

Figure 6.7.1 Projected demand and production of other crops by crop and region, 2025–2050



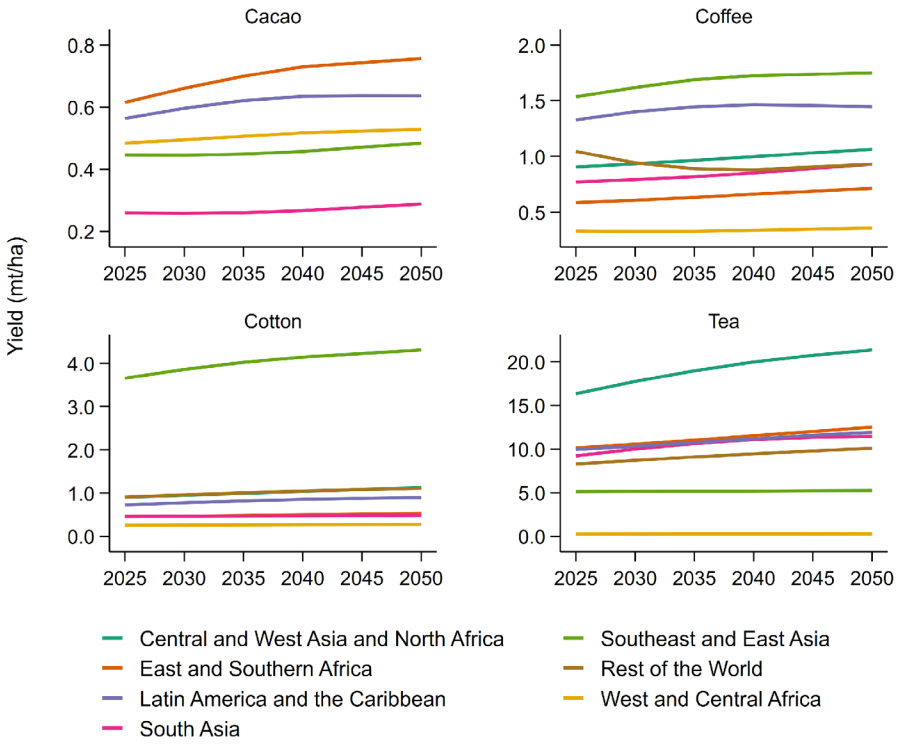
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Other crops yields

Yield growth drives most of the production increase for other crops, with global average yields for this group of commodities projected to rise by 16 percent by 2050. The fastest growth in average yields is expected in ESA (+41 percent) and CWANA (+35 percent) (Figure 6.7.2). In both cases, the large increase in average yields is driven by miscellaneous other crops (that is, nuts, cloves, spices, jute and jute-like fibers, hard fibers, tobacco, and rubber). Cotton and tea are projected to see the largest productivity increase, globally. Tea yields grow fastest in CWANA, SA, and ESA; cotton in CWANA and LAC; coffee in ESA and SA; and cacao in ESA and LAC, driven by improved varieties and agronomic management.

Figure 6.7.2 Projected other crop yields by commodity and region, 2025–2050

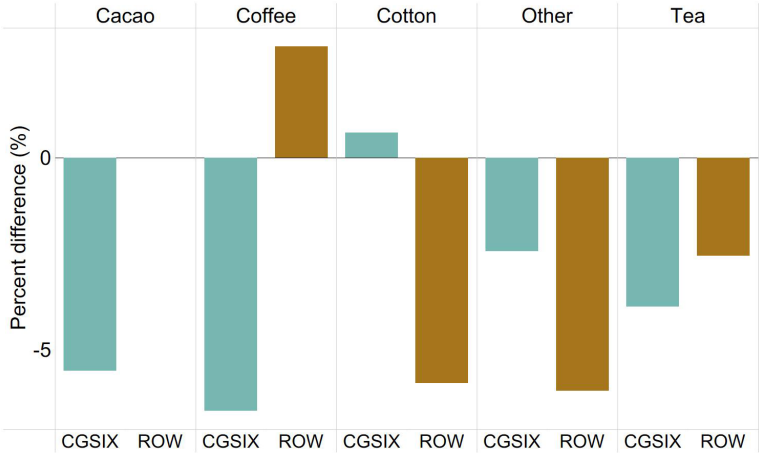


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Climate change impacts on other crops yields

As shown above, yields are projected to increase between 2025 and 2050 for most other crops in most regions. These trends incorporate the impacts of climate change, which is projected to adversely affect average yields for most other crops, both in the CGSIX regions and ROW. Productivity growth and the ensuing economic feedback may be able to offset some of the negative impacts of climate change (see also Section 4.2), but yield growth is slower and average yields in 2050 are lower than they would have been in the absence of climate change for all other crops, with the exception of cotton in the CGSIX regions and coffee in ROW (Figure 6.7.3). Average yields are projected to see the largest declines in ESA and LAC, with cacao yields facing the largest average reduction in WCA. CWANA experiences diverse climate effects, with Central Asian countries receiving a productivity boost across the other crops category due to changes in average temperatures and precipitation.

Figure 6.7.3 Projected changes in other crops yields due to climate change, by crop and region, 2025–2050

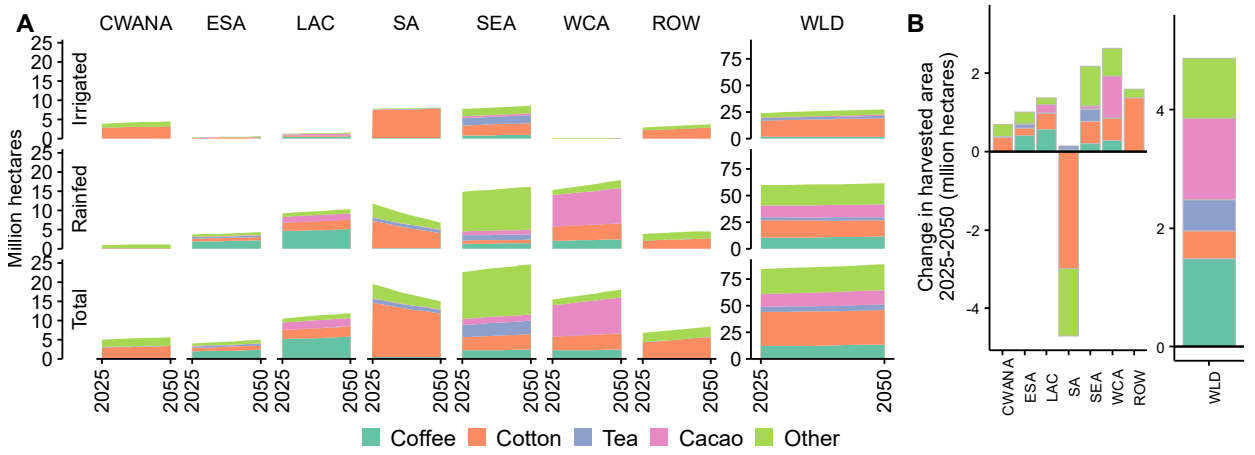


Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: Percent difference in yields in 2050 between the reference scenario and a scenario without climate change shocks. Average effects across the six CG regions (CGSIX) and Rest of the World (ROW).

Other crops harvested area

Global harvested area under other crops is projected to expand by roughly 5 percent (+5 million ha) by 2050, mostly in SEA and WCA (+2.2–2.6 million ha), while SA loses about 4.5 million ha, mostly from reduction in area harvested for cotton (particularly in India) (Figure 6.7.4). Cotton increases by 1.4 million ha in ROW, and cacao grows by 1.1 million ha in WCA. Most of the harvested area increase between 2025 and 2050 is driven by coffee (primarily in LAC) and cacao (primarily in WCA).

Figure 6.7.4 Other crops harvested area by crop and region, 2025–2050



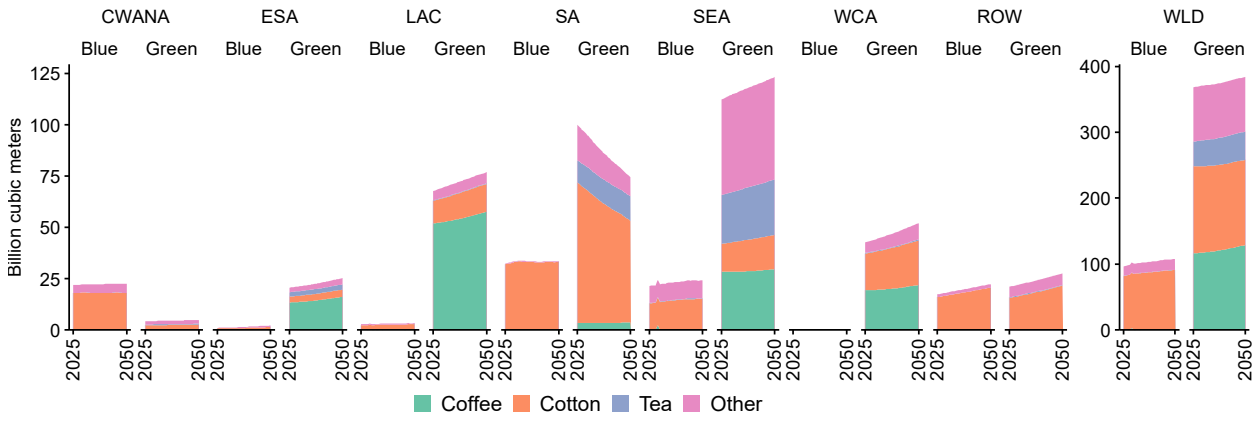
Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: Panel A shows the harvested area for other crops between 2025 and 2050, by crop and region; Panel B highlights the net changes in other crops harvested area between 2025 and 2050 for each crop and region. CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

Water use in other crops production

Other crops are mainly rainfed, and green water use is projected to increase by 4 percent between 2025 and 2050. Green water use grows in all regions with the notable exception of SA, which in 2025 is the second largest user but in 2050 will be surpassed by LAC (largely for coffee production) (Figure 6.7.5). The largest green water user is SEA, especially for other crops, coffee, and tea. Blue water use for other crops is limited globally, with most of it being used for cotton, especially in SA.

Figure 6.7.5 Projected blue and green water use in other crops production by region, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World; WLD is World.

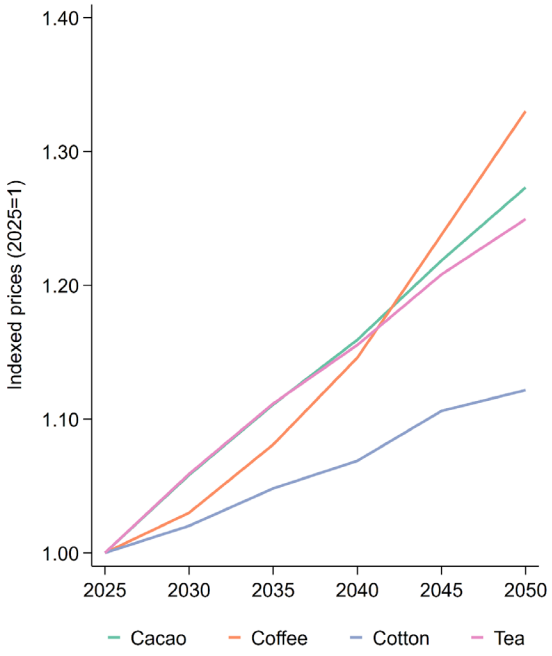
Other crops prices

Prices for most other crops are projected to increase by 2050, led by coffee, cacao, and tea (25–33 percent) due to strong demand outpacing growth in production, in part due to climate change impacts on yields (Figure 6.7.6). Cotton prices are projected to increase more slowly. Price volatility is expected to increase, especially for perennial export crops sensitive to weather shocks.

Trade in other crops

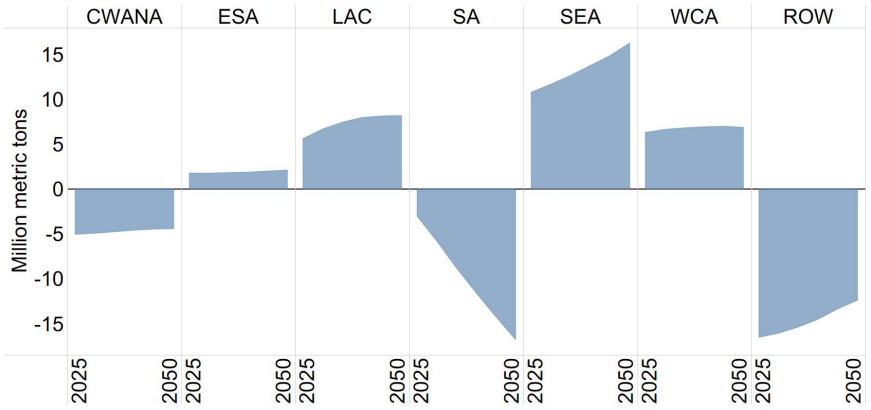
Trade in other commodities is projected to expand significantly, with exports from SEA and LAC increasing by 50 and 45 percent, respectively, by 2050 (Figure 6.7.7). SEA remains the dominant exporter, with over 16 million tons in 2050, reflecting an expansion in cotton and tea exports. An increase in cotton exports also helps to reduce net imports by ROW. The increase in LAC net exports is due to an increase in coffee exports. CWANA is projected to become a net exporter of tea. By 2050, SA will import almost 17 million tons of other crops, about half of which is projected to be cotton.

Figure 6.7.6 Projected prices of other crops, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Figure 6.7.7 Projected net trade in other crops by region, 2025–2050



Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: CWANA is Central and West Asia and North Africa; ESA is East and Southern Africa; LAC is Latin America and the Caribbean; SA is South Asia; SEA is Southeast and East Asia; WCA is West and Central Africa; ROW is Rest of the World.

7 DISCUSSION AND CONCLUSIONS

7.1 Summary of findings and implications for policy and investment

This report presents projections for a wide range of agrifood systems drivers and impact indicators over the next 25 years at global and regional (and in some cases national and subnational) levels. Among the nine megatrends identified in Section 3.1 (ISDC 2023), this reports shows how five of these — demographic trends (particularly population growth and decline), changing consumption patterns (associated with changes in income and prices), climate change (particularly adaptation and impacts), environmental degradation (in terms of pressure on land and water resources), and innovation (particularly as it affects agricultural productivity) will play critical and interacting roles in shaping agrifood systems in the coming decades. Substantial progress is projected across regions and agrifood systems indicators, including growth in productivity and production to meet rising demand and changing diets, but major challenges remain, including the need for faster reduction in hunger, improvements in nutrition, reduction in the growth of water demand, and increased resilience in the face of uncertainty. Notwithstanding a diversity of results across thematic areas, geographies, and commodities, several general themes emerge. Key findings include the following.

Agrifood systems drivers

Population. Population growth was a major factor driving concerns in the mid- to late-20th century about the agrifood system's ability to meet future demand. But population growth has slowed in recent decades in most regions, and populations have even begun to decline in parts of Europe and East Asia. Population decline gives rise to a set of different concerns, including how smaller working-age populations will support larger aging populations during this new demographic transition. At the same time, populations are projected to continue growing rapidly in sub-Saharan Africa (ESA, WCA) and in Central and West Asia and North Africa, adding pressure to agrifood systems in those regions (Section 3.2)

Income. Along with population, income growth is a major driver of changes in food demand. Today, per capita GDP is two to three times higher in high-income countries than it is in SEA, CWANA and LAC, six times higher than in SA, and ten times higher than in sub-Saharan Africa. In the baseline scenario explored in this report, GDP per capita is projected to increase worldwide between 2025 and 2050, and most rapidly (albeit from lower initial levels) in Asia and sub-Saharan Africa. This combination of low current income levels and rapid projected growth in both income and population suggests that these regions will be major sources of growth in food demand in the coming decades (Section 3.2).

Technology. Improvements in genetics and management have played major roles in increasing food production to meet growing demand over the past half century. Innovation in these and other areas is expected to continue playing a key role. Consistent with past experience, productivity growth is projected to be the primary source of increased crop and animal-source food production in most regions between 2025 and 2050, driven by investments in R&D, efficiency gains, and mechanization. In general, yield

projections show continued increases in productivity for all crops and regions, although the rates of increase slow over time due to the impacts of changes in climate and water availability. Livestock yields are projected to increase across most regions over the period. In fact, yield growth rates for many crops and livestock are expected to be fastest in regions with low initial yield levels, such as ESA, but in most cases, the regional distribution of yields remains unchanged over time. For example, cereals yields increase from low levels in WCA, ESA, and Central and West Asia and North Africa, but remain well below those in Asia, LAC, and the Rest of the World. (Sections 2.2, 3.2, 4.2, 5, and 6)

Climate. Climate change, including changes in temperature and precipitation as well as the frequency and intensity of extreme events, poses major challenges to agriculture and agrifood systems, and these challenges are expected to increase. In the baseline scenario explored in this report, temperatures are projected to increase worldwide on average in the coming decades, but at different rates in different locations. Changes in precipitation will be more diverse, with increases in some areas and decreases in others. Areas facing both temperature and precipitation concerns are foreseen in parts of Southern Africa, North Africa, Southwest Asia, East Asia, and North America. These areas are expected to face multiple climate challenges for food production, but with widely differing capacities to adapt. In addition, climate change is expected to increase the frequency of extreme events such as droughts and floods. In Southern Africa, for example, many areas that currently experience droughts about once in 20 years on average are projected to experience such disruptive events about once or even twice in 10 years by mid-century. (Sections 2.3 and 3.2)

While yields are projected to increase for most crops and regions between 2025 and 2050 (in response to rising demand and supported by improvements in productivity), empirical evidence shows that climate change has already slowed growth in crop yields in recent decades relative to what it would have been without climate change, and our projections indicate that this effect will continue in the future. Impacts will vary by crop and location. In the case of rainfed maize, for example, it is estimated that the direct effects of climate change would reduce yields by 10–20 percent or more in many parts of the world by 2050 — *if* technology, management practices, and market conditions were held constant at 2025 levels. However, history shows that technology, management practices, market conditions, and other factors will *not* remain constant, but rather will change dynamically in the coming decades in response both to climate change and to other forces within and outside agrifood systems. Once these other factors and the interactions among them are accounted for, rainfed maize yields are projected to increase by about 20–35 percent in most parts of the world by 2050, although these increases are less than they would have been in the absence of climate change. In contrast, yields of wheat are projected to increase more rapidly than they would have in the absence of climate change, particularly in temperate latitudes. For many crops, climate change impacts on yields are projected to be more severe in low- and middle-income regions than they are in high-income regions. (Sections 4.2, 5, and 6)

Agrifood systems indicators

These changes in population, income, technology, and climate interact through biophysical and socioeconomic processes to drive changes in key agrifood systems indicators.

Food demand. Changes in food demand are driven by changes in population, income, and other factors. Historically, the share of per capita income spent on food has fallen sharply as incomes rise, and this pattern is projected to continue over the next 25 years. The share of income spent on food is currently as high as 80 percent in some countries in sub-Saharan Africa, but has already fallen to 10–20 percent or less in middle- and high-income countries in other parts of the world. The share of calories consumed in the form of starchy staple foods is also projected to continue falling over the next 25 years, from over 75 percent in sub-Saharan Africa today to the 25–50 percent range that is already typical in richer countries. Together, these patterns suggest that as incomes rise over the next 25 years, per capita food demand will grow most rapidly in low-income countries, diets will become more diverse in middle-income countries, and diets will remain relatively stable in high-income countries. While the share of calories from cereals is projected to decline globally and in all regions from 2025 to 2050, cereals remain a major source of calories in all regions, with particularly high shares (more than 50 percent) in SA and in CWANA. Roots, tubers, and bananas (including plantains) remain an important part of diets, particularly in sub-Saharan Africa. Consumption of animal-source foods and oils and sugars is projected to increase in all regions. Consumption of pulses and fruits and vegetables also increases but from lower levels, and remains below dietary guidelines. These trends are expected to have mixed impacts on nutritional outcomes, with improvements in food security accompanied by challenges related to micronutrient deficiency and overweight and obesity.

Combining these changes in diets with changes in population (and changes in demand for feed and other uses), we find that total global demand for food commodities is projected to grow by 25–47 percent over the next 25 years, depending on the food group. Total demand for all food commodities grows more rapidly in LMICs, especially for pulses and animal products, driven by both faster population growth and more rapid dietary change as lower incomes rise. In contrast, in high-income countries, total demand for most food commodities grows more slowly and even begins to decline by 2050, with the notable exception of oils and especially sugars, for which demand is projected to continue rising through mid-century and beyond. (Sections 4.1, 5, and 6)

Food production. Driven by changes in demand, production is projected to increase between 2025 and 2050 for most commodities and regions. Overall, the CGSIX regions currently account for over 75 percent of global agricultural production, and that share is projected to increase slightly by 2050. Production of cereals continues to be led by high-income countries, followed by Asia and LAC. Production of RTB is projected to rise by more than 60 percent in WCA between 2025 and 2050, making the region the largest producer by 2050. SEA remains the largest producer of fruits and vegetables. Production of oils and sugars is projected to continue increasing rapidly in LAC, followed by Asia and the high-income countries. Pulse production is led by SA but with rapid growth also in SEA and high-income countries. By 2050, SA animal-source food production (meat, dairy, eggs, and aquatic foods) is projected to match that of high-income countries — increasing by 54 percent between 2025 and 2050 (driven by increased milk production in India). CWANA, ESA, and WCA also experience large increases in animal-source food production with increases of roughly 50 percent or more. Consistent with past experience, productivity growth is projected to be the primary source of increased crop and animal-source food production in

many regions. However, in LAC and sub-Saharan Africa, about half of the increase in production by 2050 is projected to come from an increase in harvested area. (Sections 4.2, 5, and 6)

Food prices. Driven by the interaction between changes in demand and supply, real prices of most food and other agricultural commodities are projected to rise between 2025 and 2050. This indicates continued pressure on agrifood systems and challenges to improving the affordability of healthy diets. Projected price changes vary widely across individual commodities, but among commodity groups, projected increases are largest for other crops (especially coffee and cacao), RTB (especially yams and cassava), and oils and sugars (especially soybeans and groundnuts). In contrast, prices for pulses are projected to decline slightly by 2050 as yield growth is expected to remain strong. Prices of animal-source food are projected to level off (and even decline slightly) late in the projection period, despite pressure from rising feed prices as demand growth slows in many high-income countries and production increases more rapidly than demand in many low- and middle-income regions. (Sections 4.3 and 6)

Trade. Total food demand is projected to slightly exceed production in the CGSIX regions as a group in 2050, but the picture differs markedly across regions. The gap between demand and production is projected to increase in CWANA, ESA, and WCA. SEA is projected to close its small gap by 2050 as demand growth slows, and SA is projected to move from a surplus position to a small deficit by 2050 before demand growth begins to slow there as well. In LAC, however, production will continue to exceed demand throughout the projection period. Driven by these changes in demand and production (as well as prices), the CGSIX regions as a group are projected to more than double their net imports of cereals, oils and sugars, and pulses over the next 25 years, while reducing their net exports of fruits and vegetables and animal-source (including aquatic) foods, but remain broadly in balance in aggregate value terms. However, regional differences are striking. Net imports of all food commodities in aggregate are projected to remain largest in CWANA but to increase most rapidly in sub-Saharan Africa, with growth in demand outpacing growth in domestic production. Net imports in SEA are projected to rise initially and then fall as populations decline in some countries and per capita demand growth slows at higher consumption levels. South Asia is projected to move from being a net exporter to being a small net importer late in the projection period as per capita demand continues to rise despite slowing growth in population. LAC and the rest of the world are projected to remain net exporters of food and even increase their exports. (Sections 4.4, 5, and 6)

Resource use. Projected increases in production will be generated by a combination of changes in yields and harvested area (both of which are affected by changes in climate). Harvested area is projected to increase most rapidly over the next 25 years in WCA (driven by expansion of RTB) and LAC (cereals and oils and sugars), followed by ESA (cereals) and SEA (oils and sugars). However, harvested area is projected to grow the least in parts of Europe and northeast Asia, due in part to declines in population and demand. Some of these changes in harvested area may come from changes in cropping intensity (that is, the number of harvests on a given field in a single year), but increases in harvested areas also indicate pressure for expansion of cropland onto lands formerly in pasture, rangeland, or forest land. These pressures are greatest in tropical regions, giving rise to concerns about increased GHG emissions and loss of biodiversity, carbon sequestration, and other ecosystem services.

As is the case for land, water use for crop production will be affected by a combination of agricultural demand, competing uses, and climate change impacts, and is projected to increase in most areas by

2050. These increases will come from both blue water (surface and groundwater delivered by irrigation) and green water (rainfall held in soils and available to plants). All river basins in sub-Saharan Africa and almost all in LAC are projected to experience increased water use over the 2025–2050 period. South Asia and East Africa are projected to experience the largest increases in blue water use, while parts of WCA and South America are projected to experience the largest increases in green water use. These trends raise concerns about sustainability, resilience, and the provision of ecosystem services in some regions over the longer term. (Sections 4.2, 4.5, 5, and 6)

Food security and nutrition. Projected changes in demand, production, trade, prices, and other factors will affect all dimensions of food security. Globally, the median share of income spent on food is projected to decline from 32 percent to 20 percent between 2025 and 2050, with declines projected in all regions. This indicates an improvement in food security and in households' ability to increase spending on nonfood needs. However, relatively high shares of income spent on food in WCA and ESA suggest that those regions will continue to be more vulnerable to food insecurity and fluctuations in food prices and availability than are other regions. Over the next 25 years, the share of population facing insufficient food availability and access to meet dietary energy requirements is projected to decline globally and in most regions. This will mean stable or declining numbers of people who are undernourished in most regions, except for WCA, where growth in population is projected to outpace improvements in food availability and access. For the CGSIX regions as a whole, the population at risk of hunger is projected to decrease — falling by more than 26 percent to reach 493 million in 2050, but most of the CGSIX regions are not on track to achieve Sustainable Development Goal 2.1 to end hunger by 2030, with ESA and WCA especially far from meeting the goal. Alongside improvements in food security based on measures of dietary energy, per capita availability of micronutrients is also projected to increase in all regions. Nevertheless, micronutrient levels are projected to remain below recommended levels in many regions, including vitamin A in CWANA and SA, riboflavin in WCA, ESA, and SA, and potassium in SA, among others. (Sections 4.1, 4.6, and 5)

Employment and income. The agriculture sector is a key source of livelihoods for lower-skilled and vulnerable workers. In SA, agriculture currently generates an estimated 32 percent of total unskilled labor income. This figure is 24 percent in ESA and 19 percent in CWANA. However, these regions are also where the largest declines in agriculture's contribution to income are expected, driven mainly by structural change, including improvements to education and technology, increased urbanization, and faster growth in industrial and services sectors. The combination of these factors is expected to draw workers away from agriculture to other sectors, resulting in a lower share of agriculture in total employment. By 2050, the share of agriculture in total unskilled labor income is projected to decline to 18 percent in SA, 12 percent in ESA, and 10 percent in WCA. This is not unique to unskilled labor; the share of skilled labor income from agriculture is also expected to decline. To a large degree, this is because economic growth is expected to be stronger in the non-agriculture sectors. GDP growth in these regions is expected to exceed 4 percent per year, while agricultural production is expected to grow at a much more modest pace, averaging less than 2 percent per year. This implies that both production and labor will grow faster in non-agricultural sectors. (Section 4.7)

Implications for policies and investments

This report focuses on the challenges to agrifood systems posed by changes in population, income, technology and climate, and the outlook for major agrifood systems indicators to 2050. These challenges are complex, interrelated, and daunting, not least because they depend on the decisions made by the more than 8 billion people who make choices that affect agrifood systems multiple times every day. But these challenges are not insurmountable, and those decisions are not made in a vacuum. Rather, they are influenced each day by the policy and market environment that shape how we use resources and produce, process, transport, trade, and consume food. That environment includes policies and investments affecting R&D, innovation, resource use, trade, health, and many other dimensions, both within agrifood systems and in other sectors linked to agrifood systems. This analysis shows the agrifood systems interlinkages that are evident today and will remain important in the future across regions, commodities, indicators, impact areas, and over time, as for example, changes in demand for particular commodities in one region affect production and consumption of other commodities as well as the use of land and water resources in other regions. These widespread consequences, many of which are not fully anticipated in decision-making at the national and subnational levels, indicate the existence of trade-offs and synergies between alternative approaches to addressing challenges in any given area, and the importance of an integrated, forward-looking agrifood systems approach in doing so.

7.2 Caveats

This report considers some of the major drivers that are expected to drive changes in agrifood systems over the next 25 years and many of the major indicators that help characterize those changes. But many important aspects could not be included in this analysis. These include other aspects of demographic change (such as aging and migration), technological change (including digital innovation and AI), economic well-being (including poverty and equity), nutrition (including overweight and obesity), social inclusion (including gender and youth), environment (including biodiversity, resource degradation, competition for land, and updated water data), climate change (including variability, extreme events, and impacts on livestock productivity), and geopolitical instability (including conflict and trade disruptions). All of these deserve further attention.

This report also focuses on a baseline scenario that illustrates the likely direction and magnitude of changes in major agrifood systems indicators under “middle-of-the-road” assumptions about long-term changes in drivers. As noted at the beginning of the report, the projected impacts presented here are not forecasts and they are not set in stone. This is because they depend critically on the choices we make today and in the coming years — both in terms of daily decisions about what we eat and in terms of policy and investment decisions that shape how firms and nations use resources, innovate, and trade. More work is needed to explore how agrifood systems outcomes projected under the baseline scenario might evolve under a wider range of plausible alternative scenarios.

7.3 Future work

More work on future agrifood systems pathways and solutions is underway and planned at IFPRI, other CGIAR Centers, and other research institutions to address the gaps noted in Section 7.2. This includes analysis of returns to investment in agricultural R&D for key commodities that are important to producers and consumers in low- and middle-income regions, analysis capturing the impacts of climate variability and extreme events in addition to long-term trends, analysis incorporating more detailed links with other sectors at the national level (as well as additional subsectors within agrifood systems), and analysis capturing diverse impacts of change on populations that differ by age, gender, income level, and rural versus urban location. We hope this new work will not only add new dimensions and depth to the results presented in this report, but also engage decision-makers at relevant scales and inform the complex choices they face about the future of agrifood systems.

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ANNEX: Supplementary information

Table A.1 lists countries by region as presented in this report. Table A.2 lists commodities by commodity group as presented in this report. Full details on the IMPACT model are available in Mishra et al. (2026). Annex Tables A.4 – A.9 provide country-level detail for selected key agrifood systems indicators. Additional tables and figures with more detailed information on the results presented in this report are available at https://www.ifpri.org/ifpri-book/global-agrifood-systems-outlook-to-2050/.

Annex Table A.1 List of countries in the IMPACT model, by region

Central and West Asia and North Africa (CWANA)

Afghanistan	Israel	Saudi Arabia
Algeria	Jordan	Sudan
Armenia	Kazakhstan	Syria
Azerbaijan	Kyrgyzstan	Tajikistan
Cyprus	Lebanon	Tunisia
Egypt	Libya	Türkiye
Georgia	Morocco	Turkmenistan
Iran	Palestine	Uzbekistan
Iraq	Rest of Arabia	Yemen

East and Southern Africa (ESA)

Botswana	Lesotho	Somalia
Burundi	Madagascar	South Africa
Djibouti	Malawi	Tanzania
Eritrea	Mozambique	Uganda
Eswatini	Namibia	Zambia
Ethiopia	Rwanda	Zimbabwe
Kenya		

Latin America and the Caribbean (LAC)

Argentina	Dominican Republic	Mexico
Belize	Ecuador	Nicaragua
Bolivia	El Salvador	Other Caribbean
Brazil	Guatemala	Panama
Chile	Guyana	Paraguay
Colombia	Haiti	Peru
Costa Rica	Honduras	Uruguay
Cuba	Jamaica	Venezuela

South Asia (SA)

Bangladesh	India	Pakistan
Bhutan	Nepal	Sri Lanka

Southeast and East Asia (SEA)

Cambodia	Myanmar	Philippines
China	North Korea (DPRK)	Solomon Islands
Fiji	Other Indian Ocean	Thailand
Indonesia	Other Pacific Ocean	Timor-Leste
Laos	Other Southeast Asia	Vanuatu
Malaysia	Papua New Guinea	Viet Nam
Mongolia		

West and Central Africa (WCA)

Angola	Ghana
Benin	Guinea
Burkina Faso	Guinea-Bissau
Cameroon	Liberia
Central African Republic	Mali
Chad	Mauritania
Congo	Niger
Côte d'Ivoire	Nigeria
Democratic Republic of the Congo	Other Atlantic
Equatorial Guinea	Senegal
Gabon	Sierra Leone
Gambia	Togo

Rest of the World (ROW)

Albania	Germany	Portugal
Australia	Greece	Romania
Austria	Hungary	Russia
Baltic States	Iceland	Slovakia
Belarus	Ireland	Slovenia
Belgium-Luxembourg	Italy	South Korea (ROK)
Bulgaria	Japan	Spain
Canada	Moldova	Sweden
Croatia	Netherlands	Switzerland
Czech Republic	New Zealand	United Kingdom
Denmark	Norway	Ukraine
Finland	Other Balkans	United States
France	Poland	

Source: Mishra, A., Gabriel, S., Cenacchi, N., et al. 2026. *The International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT): Model Documentation for Version 4*. Modeling Systems Technical Paper 4. International Food Policy Research Institute. https://hdl.handle.net/10568/182731.

Annex Table A.2 List of commodities in the IMPACT model, by commodity group

Animal-Source Foods	Oilseeds	Roots, Tubers, and Bananas
Aquatic Foods	Groundnuts	Bananas
Dairy	Palm Fruits	Cassava
Eggs	Palm Kernels	Plantains
Beef	Rapeseeds	Potatoes
Lamb	Soybeans	Sweet Potatoes
Pork	Sunflower Seeds	Yams
Poultry	Other Oilseeds	Other Roots
Cereals	**Processed Oils**	**Sugar Crops and Sugar**
Barley	Groundnut Oil	Sugar beets
Maize	Palm Fruit Oil	Sugarcane
Millet	Palm Kernel Oil	Sugar
Rice	Rapeseed Oil	
Sorghum	Soybean Oil	
Wheat	Sunflower Oil	
Other Cereals	Other Oils	
Fruits and Vegetables	**Pulses**	**Other Crops**
Temperate Fruits	Beans	Cacao
Tropical Fruits	Chickpeas	Coffee
Vegetables	Cowpeas	Cotton
	Lentils	Tea
	Pigeonpeas	Other
	Other Pulses	

Source: Mishra, A., Gabriel, S., Cenacchi, N., et al. 2026. *The International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT): Model Documentation for Version 4*. Modeling Systems Technical Paper 4. International Food Policy Research Institute. https://hdl.handle.net/10568/182731.

Note: Several other processed commodities and individual aquatic food species are listed in Mishra et al. (2026).

Annex Table A.3 Aggregate food production (index, 2025=1)

Region	2025	2050
CGSIX	1	1.33
CENTRAL AND WEST ASIA AND NORTH AFRICA	1	1.35
Afghanistan	1	1.44
Algeria	1	1.30
Armenia	1	1.19
Azerbaijan	1	1.28
Cyprus	1	1.18
Egypt	1	1.24
Georgia	1	1.27
Iran	1	1.49
Iraq	1	1.50
Israel	1	1.51
Jordan	1	1.21
Kazakhstan	1	1.34
Kyrgyzstan	1	1.83
Lebanon	1	1.21
Libya	1	1.40
Morocco	1	1.31
Palestine	1	1.17
Rest of Arabia	1	1.89
Saudi Arabia	1	1.61
Sudan	1	1.29
Syria	1	1.27
Tajikistan	1	1.30
Tunisia	1	1.36
Türkiye	1	1.35
Turkmenistan	1	1.29
Uzbekistan	1	1.36
Yemen	1	1.60
EAST AND SOUTHERN AFRICA	1	1.59
Botswana	1	1.46
Burundi	1	1.67
Djibouti	1	1.64
Eritrea	1	1.92
Eswatini	1	1.51
Ethiopia	1	1.78
Kenya	1	1.79
Lesotho	1	1.39
Madagascar	1	1.57
Malawi	1	1.83
Mozambique	1	1.35

Region	2025	2050
Namibia	1	1.10
Rwanda	1	1.18
Somalia	1	1.75
South Africa	1	1.37
Tanzania	1	1.60
Uganda	1	1.59
Zambia	1	1.55
Zimbabwe	1	1.60
LATIN AMERICA AND THE CARIBBEAN	1	1.42
Argentina	1	1.44
Belize	1	1.26
Bolivia	1	1.40
Brazil	1	1.45
Chile	1	1.61
Colombia	1	1.17
Costa Rica	1	1.23
Cuba	1	1.52
Dominican Republic	1	1.28
Ecuador	1	1.42
El Salvador	1	1.39
Guatemala	1	1.39
Guyanas	1	1.61
Haiti	1	1.42
Honduras	1	1.27
Jamaica	1	1.15
Mexico	1	1.27
Nicaragua	1	1.44
Other Caribbean	1	1.26
Panama	1	1.37
Paraguay	1	1.53
Peru	1	1.38
Uruguay	1	1.21
Venezuela	1	1.23
SOUTH ASIA	1	1.28
Bangladesh	1	1.24
Bhutan	1	1.30
India	1	1.23
Nepal	1	1.23
Pakistan	1	1.59
Sri Lanka	1	1.28
SOUTHEAST AND EAST ASIA	1	1.22

Region	2025	2050
Cambodia	1	1.05
China	1	1.15
Fiji	1	1.35
Indonesia	1	1.33
Laos	1	1.34
Malaysia	1	1.82
Mongolia	1	1.01
Myanmar	1	1.18
North Korea	1	1.01
Other Indian Ocean	1	1.32
Other Pacific Ocean	1	1.20
Other Southeast Asia	1	1.06
Papua New Guinea	1	1.30
Philippines	1	1.40
Solomon Islands	1	1.11
Thailand	1	1.13
Timor L'Este	1	1.31
Vanuatu	1	1.33
Viet Nam	1	1.16
WEST AND CENTRAL AFRICA	1	1.56
Angola	1	1.40
Benin	1	1.66
Burkina Faso	1	1.57
Cameroon	1	1.52
Central African Rep.	1	1.55
Chad	1	1.60
Congo	1	1.37
Côte d'Ivoire	1	1.54
DRC	1	1.56
Equatorial Guinea	1	1.36
Gabon	1	1.32
Gambia	1	1.58
Ghana	1	1.59
Guinea	1	1.46
Guinea-Bissau	1	1.63
Liberia	1	1.38
Mali	1	1.58
Mauritania	1	1.92
Niger	1	1.83
Nigeria	1	1.55
Other Atlantic	1	1.54
Senegal	1	1.53
Sierra Leone	1	1.67
Togo	1	1.54
REST OF WORLD	1	1.27
Albania	1	1.53
Australia	1	1.26
Austria	1	1.33
Baltic States	1	1.38
Belarus	1	1.21
Belgium-Luxembourg	1	1.16
Bulgaria	1	1.31
Canada	1	1.38
Croatia	1	1.27
Czech Republic	1	1.37
Denmark	1	1.22
Finland	1	1.21
France	1	1.05
Germany	1	1.22
Greece	1	1.22
Hungary	1	1.32
Iceland	1	1.22
Ireland	1	0.98
Italy	1	1.11
Japan	1	1.14
Moldova	1	1.58
Netherlands	1	1.17
New Zealand	1	1.28
Norway	1	1.30
Other Balkans	1	1.24
Poland	1	1.37
Portugal	1	1.22
Romania	1	1.51
Russia	1	1.47
Slovakia	1	1.42
Slovenia	1	1.24
South Korea	1	1.05
Spain	1	1.16
Sweden	1	1.26
Switzerland	1	1.35
UK	1	1.03
Ukraine	1	1.35
USA	1	1.24
WORLD	1	1.31

Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: For details on the methodology, see the main report (Wiebe et al. 2026) and IMPACT model documentation (Mishra et al. 2026).

Annex Table A.4 Total production (million metric tons)

Commodity	Region	2025	2050
ANIMAL-SOURCE FOODS (includes pork, beef, poultry, sheep, and goats, and aquatic foods)	CGSIX	1,142,711	1,606,055
	CWANA	132,688	195,361
	ESA	42,646	66,516
	LAC	189,374	241,272
	SA	430,630	662,854
	SEA	327,262	406,081
	WCA	20,111	33,972
	ROW	597,792	651,439
	WLD	1,740,502	2,257,495
CEREALS (includes barley, maize, millet, rice, sorghum, wheat, and aggregated other cereals)	CGSIX	1,791,467	2,337,633
	CWANA	153,398	183,528
	ESA	90,127	144,338
	LAC	301,370	494,268
	SA	420,221	549,381
	SEA	747,479	850,810
	WCA	78,871	115,308
	ROW	1,200,210	1,514,088
	WLD	2,991,677	3,851,721
FRUITS AND VEGETABLES (includes aggregated temperate fruits, aggregated tropical fruits, and aggregated vegetables)	CGSIX	1,659,883	2,076,209
	CWANA	213,134	312,727
	ESA	33,925	54,449
	LAC	133,451	157,169
	SA	238,049	328,640
	SEA	989,083	1,142,759
	WCA	52,241	80,465
	ROW	255,850	318,296
	WLD	1,915,733	2,394,506
OILS AND SUGARS (includes groundnuts, rapeseed, soybeans, sunflower, aggregated other oilseeds, and sugar crops)	CGSIX	3,184,152	4,336,796
	CWANA	111,334	154,341
	ESA	84,703	127,578
	LAC	1,366,939	1,932,638
	SA	611,990	716,421
	SEA	943,646	1,314,696
	WCA	65,539	91,122
	ROW	671,420	913,409
	WLD	3,855,572	5,250,205

Commodity	Region	2025	2050
PULSES (includes beans, chickpeas, cowpeas, lentils, pigeonpeas, and aggregated other pulses)	CGSIX	97,441	142,685
	CWANA	4,931	5,774
	ESA	11,302	16,384
	LAC	8,067	13,915
	SA	33,137	44,168
	SEA	28,214	39,320
	WCA	11,789	23,124
	ROW	27,202	38,765
	WLD	124,644	181,450
ROOTS, TUBERS, AND BANANAS (includes bananas, cassava, plantains, potatoes, sweet potatoes, yams, and aggregated other roots and tubers)	CGSIX	996,325	1,392,905
	CWANA	45,078	58,694
	ESA	102,028	170,551
	LAC	100,443	130,287
	SA	129,310	201,490
	SEA	296,934	313,102
	WCA	322,532	518,781
	ROW	143,400	146,395
	WLD	1,139,724	1,539,300
OTHER COMMODITIES (includes cacao, coffee, cotton, tea, and other aggregated crops)	CGSIX	111,375	133,928
	CWANA	8,183	12,582
	ESA	7,127	12,588
	LAC	13,361	17,320
	SA	23,736	21,520
	SEA	49,936	57,746
	WCA	9,031	12,171
	ROW	10,801	15,752
	WLD	122,176	149,680

Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: For details on the methodology, see the main report (Wiebe et al. 2026) and IMPACT model documentation (Mishra et al. 2026).

Annex Table A.5 Harvested area (index, 2025=1)

Commodity	Region	2025	2050
ANIMAL-SOURCE FOODS (includes pork, beef, poultry, sheep, and goats, and aquatic foods)	CGSIX	1	1.13
	CWANA	1	1.09
	ESA	1	1.18
	LAC	1	1.07
	SA	1	1.43
	SEA	1	1.10
	WCA	1	1.27
	ROW	1	0.93
	WLD	1	1.08
CEREALS (includes barley, maize, millet, rice, sorghum, wheat, and aggregated other cereals)	CGSIX	1	1.07
	CWANA	1	1.02
	ESA	1	1.19
	LAC	1	1.22
	SA	1	1.02
	SEA	1	0.97
	WCA	1	1.18
	ROW	1	0.99
	WLD	1	1.04
FRUITS AND VEGETABLES (includes aggregated temperate fruits, aggregated tropical fruits, and aggregated vegetables)	CGSIX	1	1.12
	CWANA	1	1.19
	ESA	1	1.22
	LAC	1	1.06
	SA	1	1.10
	SEA	1	1.10
	WCA	1	1.20
	ROW	1	1.07
	WLD	1	1.11
OILS AND SUGARS (includes groundnuts, rapeseed, soybeans, sunflower, aggregated other oilseeds, and sugar crops)	CGSIX	1	1.20
	CWANA	1	1.18
	ESA	1	1.23
	LAC	1	1.21
	SA	1	1.09
	SEA	1	1.23
	WCA	1	1.32
	ROW	1	1.01
	WLD	1	1.15

Commodity	Region	2025	2050
PULSES (includes beans, chickpeas, cowpeas, lentils, pigeonpeas, and aggregated other pulses)	CGSIX	1	1.14
	CWANA	1	1.01
	ESA	1	1.20
	LAC	1	1.24
	SA	1	1.07
	SEA	1	1.04
	WCA	1	1.29
	ROW	1	1.07
	WLD	1	1.13
ROOTS, TUBERS, AND BANANAS (includes bananas, cassava, plantains, potatoes, sweet potatoes, yams, and aggregated other roots and tubers)	CGSIX	1	1.21
	CWANA	1	1.15
	ESA	1	1.29
	LAC	1	1.18
	SA	1	1.32
	SEA	1	0.99
	WCA	1	1.26
	ROW	1	0.92
	WLD	1	1.19
OTHER COMMODITIES (includes cacao, coffee, cotton, tea, and other aggregated crops)	CGSIX	1	1.04
	CWANA	1	1.14
	ESA	1	1.25
	LAC	1	1.13
	SA	1	0.77
	SEA	1	1.10
	WCA	1	1.17
	ROW	1	1.23
	WLD	1	1.06

Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: For details on the methodology, see the main report (Wiebe et al. 2026) and IMPACT model documentation (Mishra et al. 2026).

Annex Table A.6 Crop and animal yields (index, 2025=1)

Commodity	Region	2025	2050
ANIMAL-SOURCE FOODS (includes pork, beef, poultry, sheep, and goats, and aquatic foods)	CGSIX	1	1.27
	CWANA	1	1.36
	ESA	1	1.35
	LAC	1	1.21
	SA	1	1.09
	SEA	1	1.14
	WCA	1	1.50
	ROW	1	1.17
	WLD	1	1.22
CEREALS (includes barley, maize, millet, rice, sorghum, wheat, and aggregated other cereals)	CGSIX	1	1.22
	CWANA	1	1.17
	ESA	1	1.35
	LAC	1	1.35
	SA	1	1.28
	SEA	1	1.17
	WCA	1	1.23
	ROW	1	1.28
	WLD	1	1.23
FRUITS AND VEGETABLES (includes aggregated temperate fruits, aggregated tropical fruits, and aggregated vegetables)	CGSIX	1	1.12
	CWANA	1	1.23
	ESA	1	1.32
	LAC	1	1.11
	SA	1	1.26
	SEA	1	1.05
	WCA	1	1.28
	ROW	1	1.16
	WLD	1	1.12
OILS AND SUGARS (includes groundnuts, rapeseed, soybeans, sunflower, aggregated other oilseeds, and sugar crops)	CGSIX	1	1.13
	CWANA	1	1.18
	ESA	1	1.23
	LAC	1	1.17
	SA	1	1.08
	SEA	1	1.13
	WCA	1	1.06
	ROW	1	1.36
	WLD	1	1.19

Commodity	Region	2025	2050
PULSES (includes beans, chickpeas, cowpeas, lentils, pigeonpeas, and aggregated other pulses)	CGSIX	1	1.28
	CWANA	1	1.15
	ESA	1	1.21
	LAC	1	1.39
	SA	1	1.24
	SEA	1	1.34
	WCA	1	1.52
	ROW	1	1.34
	WLD	1	1.28
ROOTS, TUBERS, AND BANANAS (includes bananas, cassava, plantains, potatoes, sweet potatoes, yams, and aggregated other roots and tubers)	CGSIX	1	1.16
	CWANA	1	1.14
	ESA	1	1.30
	LAC	1	1.10
	SA	1	1.18
	SEA	1	1.06
	WCA	1	1.28
	ROW	1	1.11
	WLD	1	1.13
OTHER COMMODITIES (includes cacao, coffee, cotton, tea, and other aggregated crops)	CGSIX	1	1.15
	CWANA	1	1.35
	ESA	1	1.41
	LAC	1	1.15
	SA	1	1.18
	SEA	1	1.05
	WCA	1	1.15
	ROW	1	1.18
	WLD	1	1.16

Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: For details on the methodology, see the main report (Wiebe et al. 2026) and IMPACT model documentation (Mishra et al. 2026).

Annex Table A.7 Net trade (million metric tons) (negative net trade indicates a net importer, positive net trade a net exporter)

Commodity	Region	2025	2050
ANIMAL-SOURCE FOODS (includes pork, beef, poultry, sheep, and goats, and aquatic foods)	CGSIX	22,537	5,405
	CWANA	-24,902	-29,609
	ESA	-50	-13,519
	LAC	6,161	9,428
	SA	104,713	135,855
	SEA	-55,236	-64,345
	WCA	-8,149	-32,405
	ROW	-22,537	-5,405
CEREALS (includes barley, maize, millet, rice, sorghum, wheat, and aggregated other cereals)	CGSIX	-233,745	-466,641
	CWANA	-160,495	-255,565
	ESA	-20,688	-50,163
	LAC	5,906	87,661
	SA	27,858	-16,751
	SEA	-52,377	-128,559
	WCA	-33,948	-103,265
	ROW	233,745	466,641
FRUITS AND VEGETABLES (includes aggregated temperate fruits, aggregated tropical fruits, and aggregated vegetables)	CGSIX	118,374	94,543
	CWANA	7,026	27,816
	ESA	5,667	-2,160
	LAC	39,651	34,398
	SA	14,634	-95,275
	SEA	56,354	171,491
	WCA	-4,959	-41,726
	ROW	-118,374	-94,543
OILS AND SUGARS (includes groundnuts, rapeseed, soybeans, sunflower, aggregated other oilseeds, and sugar crops)	CGSIX	-30,472	-86,556
	CWANA	-37,680	-53,921
	ESA	-8,248	-17,890
	LAC	113,236	160,208
	SA	-28,354	-67,577
	SEA	-61,043	-84,676
	WCA	-8,382	-22,700
	ROW	30,472	86,556

Commodity	Region	2025	2050
PULSES (includes beans, chickpeas, cowpeas, lentils, pigeonpeas, and aggregated other pulses)	CGSIX	-10,747	-20,695
	CWANA	-3,004	-5,764
	ESA	-4,418	-14,592
	LAC	-5,194	-3,145
	SA	-9,551	-13,229
	SEA	13,812	21,767
	WCA	-2,392	-5,732
	ROW	10,747	20,695
ROOTS, TUBERS, AND BANANAS (includes bananas, cassava, plantains, potatoes, sweet potatoes, yams, and aggregated other roots and tubers)	CGSIX	21,885	18,370
	CWANA	-5,834	-12,402
	ESA	5,003	9,323
	LAC	20,450	37,204
	SA	4,634	6,786
	SEA	-3,249	3,257
	WCA	881	-25,799
	ROW	-21,885	-18,370
OTHER COMMODITIES (includes cacao, coffee, cotton, tea, and other aggregated crops)	CGSIX	16,520	12,359
	CWANA	-5,021	-4,402
	ESA	1,782	2,114
	LAC	5,635	8,209
	SA	-3,024	-16,811
	SEA	10,798	16,325
	WCA	6,351	6,924
	ROW	-16,520	-12,359

Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: For details on the methodology, see the main report (Wiebe et al. 2026) and IMPACT model documentation (Mishra et al. 2026).

Annex Table A.8 Per capita calorie availability (Kcal per capita per day)

Region	2025	2050
CGSIX	2649	2892
CENTRAL AND WEST ASIA AND NORTH AFRICA	2936	3111
Afghanistan	1981	2314
Algeria	3001	3076
Armenia	2810	3237
Azerbaijan	2922	3109
Cyprus	2620	2721
Egypt	3412	3778
Georgia	3125	3638
Iran	3075	3175
Iraq	2354	2729
Israel	3687	3949
Jordan	3128	3371
Kazakhstan	3060	3184
Kyrgyzstan	2760	2962
Lebanon	3126	3264
Libya	3267	3457
Morocco	3275	3523
Palestine	2464	2662
Rest of Arabia	3590	3775
Saudi Arabia	3025	3201
Sudan	1756	1877
Syria	3149	3519
Tajikistan	2084	2299
Tunisia	3258	3509
Türkiye	3638	3743
Turkmenistan	2817	2875
Uzbekistan	2512	2766
Yemen	2080	2357
EAST AND SOUTHERN AFRICA	2170	2430
Botswana	2214	2439
Burundi	1943	2241
Djibouti	2243	2450
Eritrea	1977	2510
Eswatini	2402	2713
Ethiopia	1978	2331
Kenya	2145	2464
Lesotho	2552	2647
Madagascar	2025	2256
Malawi	2179	2395
Mozambique	2088	2558
Namibia	2252	2491
Rwanda	2032	2465
Somalia	1766	1994
South Africa	2926	3181
Tanzania	2137	2364
Uganda	2373	2583
Zambia	1855	2008
Zimbabwe	2093	2253
LATIN AMERICA AND THE CARIBBEAN	2882	3133
Argentina	3076	3257
Belize	2867	3118
Bolivia	2102	2335
Brazil	3119	3506
Chile	2943	3099
Colombia	2646	2944
Costa Rica	2908	3227
Cuba	3354	4029
Dominican Republic	2350	2661
Ecuador	2317	2475
El Salvador	2590	2806
Guatemala	2404	2719
Guyana	3193	3918
Haiti	1863	2059
Honduras	2520	2857
Jamaica	2907	3406
Mexico	3113	3257
Nicaragua	2402	2676
Other Caribbean	3320	3690
Panama	2398	2551
Paraguay	2626	2732
Peru	2427	2628
Uruguay	2883	3047
Venezuela	2557	2727
SOUTH ASIA	2364	2699
Bangladesh	2470	2800
Bhutan	2292	2366
India	2351	2682
Nepal	2447	3113
Pakistan	2356	2695
Sri Lanka	2334	2482
SOUTHEAST AND EAST ASIA	2846	3092

Region	2025	2050
Cambodia	2443	2804
China	2979	3241
Fiji	3265	4100
Indonesia	2602	2897
Laos	2301	2525
Malaysia	2978	3170
Mongolia	2326	2643
Myanmar	2223	2439
North Korea	2211	2262
Other Indian Ocean	2452	2860
Other Pacific Ocean	3557	4462
Other Southeast Asia	3773	3779
Papua New Guinea	2384	2729
Philippines	2573	2839
Solomon Islands	2430	2939
Thailand	2807	3012
Timor L'Este	2047	2499
Vanuatu	2788	3527
Viet Nam	2592	2894
WEST AND CENTRAL AFRICA	2651	2890
Angola	2027	2335
Benin	2502	2975
Burkina Faso	2523	2913
Cameroon	2312	2514
Central African Rep.	1946	2334
Chad	2015	2302
Congo	2149	2329
Côte d'Ivoire	2816	2937
DRC	3403	3838
Equatorial Guinea	2518	2541
Gabon	2735	2970
Gambia	2490	2796
Ghana	2674	2817
Guinea	2458	2693
Guinea-Bissau	2225	2374
Liberia	2118	2316
Mali	2579	2767
Mauritania	2667	2967
Niger	2478	2748
Nigeria	2653	2743
Other Atlantic	2696	3112
Senegal	2313	2536
Sierra Leone	2125	2269
Togo	2276	2491
REST OF WORLD	3454	3599
Albania	2918	3279
Australia	3164	3426
Austria	3756	3900
Baltic States	3481	3586
Belarus	2993	3066
Belgium-Luxembourg	3819	3862
Bulgaria	2805	3014
Canada	3538	3764
Croatia	3101	3285
Czech Republic	3317	3471
Denmark	3450	3518
Finland	3248	3358
France	3581	3672
Germany	3448	3551
Greece	3671	3810
Hungary	3285	3462
Iceland	3563	3767
Ireland	3581	3799
Italy	3749	3940
Japan	2925	3008
Moldova	2689	3001
Netherlands	3250	3372
New Zealand	3184	3387
Norway	3555	3684
Other Balkans	3042	3389
Poland	3424	3641
Portugal	3733	3945
Romania	3477	3670
Russia	3208	3374
Slovakia	2851	3024
Slovenia	3201	3362
South Korea	3228	3389
Spain	3424	3601
Sweden	3161	3275
Switzerland	3423	3478
UK	3475	3704
Ukraine	3182	3428
USA	3815	3852
WORLD	2780	2990

Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.

Note: For details on the methodology, see the main report (Wiebe et al. 2026) and IMPACT model documentation (Mishra et al. 2026).

Annex Table A.9 Hunger (million of people at risk)

Region	2025	2050
CGSIX	669.5	492.8
CENTRAL AND WEST ASIA AND NORTH AFRICA	65.8	53.2
Afghanistan	11.9	6.8
Algeria	1.0	1.2
Armenia	0.0	0.0
Azerbaijan	0.0	0.0
Cyprus	0.0	0.0
Egypt	7.4	10.4
Georgia	0.0	0.0
Iran	5.5	5.4
Iraq	8.1	2.7
Israel	0.0	0.0
Jordan	0.5	0.6
Kazakhstan	0.0	0.0
Kyrgyzstan	0.3	0.3
Lebanon	0.2	0.3
Libya	0.5	0.3
Morocco	2.1	1.4
Rest of Arabia	0.3	0.4
Saudi Arabia	1.5	1.6
Sudan	3.1	3.8
Syria	5.6	0.8
Tajikistan	0.6	0.5
Tunisia	0.3	0.3
Türkiye	3.4	3.7
Turkmenistan	0.5	0.5
Uzbekistan	0.1	0.1
Yemen	13.1	12.2
EAST AND SOUTHERN AFRICA	135.7	106.9
Botswana	0.6	0.4
Burundi	0.0	0.0
Djibouti	0.2	0.1
Eritrea	0.0	0.0
Ethiopia	26.9	6.6
Kenya	13.2	6.5
Lesotho	1.1	1.1
Madagascar	15.9	18.5
Malawi	4.3	3.4
Mozambique	10.6	5.1
Namibia	0.5	0.2
Rwanda	4.2	1.3
Somalia	9.6	11.9
South Africa	4.4	2.9
Tanzania	15.7	14.0
Uganda	15.7	21.1
Zambia	6.9	7.4
Zimbabwe	6.5	6.7
LATIN AMERICA AND THE CARIBBEAN	42.1	33.3
Argentina	1.6	1.6
Belize	0.0	0.0
Bolivia	2.0	0.5
Brazil	7.4	7.1
Chile	0.4	0.4
Colombia	2.9	1.9
Costa Rica	0.2	0.2
Cuba	0.5	0.5
Dominican Republic	0.5	0.5
Ecuador	2.7	1.6
El Salvador	0.4	0.2
Guatemala	2.4	0.8
Guyana	0.0	0.0
Haiti	5.6	4.9
Honduras	1.7	0.8
Jamaica	0.1	0.1
Mexico	2.9	3.3
Nicaragua	1.3	0.6
Other Caribbean	0.2	0.2
Panama	0.2	0.2
Paraguay	0.2	0.3
Peru	2.3	1.9
Uruguay	0.1	0.1
Venezuela	6.4	5.6
SOUTH ASIA	253.0	79.5
Bangladesh	16.7	7.5
Bhutan	0.3	0.2
India	191.5	51.8
Nepal	1.1	1.2
Pakistan	40.7	17.4
Sri Lanka	2.7	1.3
SOUTHEAST AND EAST ASIA	50.5	51.5
Cambodia	0.8	1.0
Fiji	0.1	0.1

Region	2025	2050
Indonesia	17.0	18.8
Laos	0.4	0.5
Malaysia	1.1	1.4
Mongolia	0.1	0.1
Myanmar	1.8	1.9
North Korea	11.7	10.4
Other Indian Ocean	0.0	0.0
Other Pacific Ocean	0.1	0.1
Papua New Guinea	2.4	0.9
Philippines	5.7	7.4
Solomon Islands	0.4	0.3
Thailand	3.4	3.2
Timor L'Este	0.3	0.1
Vanuatu	0.1	0.0
Viet Nam	5.0	5.4
WEST AND CENTRAL AFRICA	122.5	168.4
Angola	9.4	5.3
Benin	1.4	0.8
Burkina Faso	3.7	2.7
Cameroon	2.2	2.1
Central African Rep.	3.0	3.2
Chad	6.1	5.7
Congo	2.1	2.4
Côte d'Ivoire	2.3	2.7
DRC	35.8	69.3
Equatorial Guinea	0.7	1.1
Gabon	0.6	0.6
Gambia	0.5	0.4
Ghana	2.4	2.0
Guinea	1.8	1.1
Guinea-Bissau	0.8	0.9
Liberia	2.2	2.5
Mali	2.6	2.6
Mauritania	0.3	0.2
Niger	3.8	4.3
Nigeria	35.8	53.6
Other Atlantic	0.0	0.0
Senegal	0.8	1.2
Sierra Leone	2.6	2.6
Togo	1.6	1.1

Region	2025	2050
REST OF WORLD	0.0	0.0
Albania	0.0	0.0
Australia	0.0	0.0
Austria	0.0	0.0
Baltic States	0.0	0.0
Belarus	0.0	0.0
Belgium-Luxembourg	0.0	0.0
Bulgaria	0.2	0.2
Canada	0.0	0.0
Croatia	0.0	0.0
Czech Republic	0.0	0.0
Denmark	0.0	0.0
Finland	0.0	0.0
France	0.0	0.0
Germany	0.0	0.0
Greece	0.0	0.0
Hungary	0.0	0.0
Iceland	0.0	0.0
Ireland	0.0	0.0
Italy	0.0	0.0
Japan	0.0	0.0
Moldova	3.2	2.8
Netherlands	0.0	0.0
New Zealand	0.0	0.0
Norway	0.0	0.0
Other Balkans	0.0	0.0
Poland	0.0	0.0
Portugal	0.0	0.0
Romania	0.0	0.0
Russia	0.0	0.0
Slovakia	0.0	0.0
Slovenia	0.0	0.0
South Korea	0.0	0.0
Spain	0.0	0.0
Sweden	0.0	0.0
Switzerland	0.0	0.0
UK	0.0	0.0
Ukraine	1.8	1.2
USA	0.0	0.0
WORLD	669.5	491.5

Source: Authors, based on IMPACT v4.1.4, SSP2, RCP7.0, MRI-ESM2-0.
Note: For details on the methodology, see the main report (Wiebe et al. 2026) and IMPACT model documentation (Mishra et al. 2026).



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