Food and Agriculture Organization of the United Nations

OECD-FAO Agricultural Outlook 2025-2034

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Foreword

The *OECD-FAO Agricultural Outlook 2025-2034* is a collaborative effort by the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization (FAO) of the United Nations. Serving as a reference for forward-looking policy planning, the Outlook draws upon the expertise of both organisations, incorporating inputs from collaborating member countries and commodity organisations. It provides a comprehensive assessment of national, regional and global agricultural commodity markets over the next ten years. The *Outlook* uses the OECD-FAO Aglink-Cosimo model to ensure consistency and global equilibrium across all markets. Detailed methodology and model documentation are available online at www.agri-outlook.org.

This 21st joint edition of the *Agricultural Outlook* comprises three parts.

Part 1: Agricultural and food markets: Trends and prospects (Chapter 1) outlines key projections and insights on challenges facing agri-food systems over the coming decade. The chapter presents the recent developments in agricultural markets (Section 1.1), and underlying macroeconomic and policy assumptions (Section 1.2). It discusses the trends and prospects for consumption (Section 1.3), production (Section 1.4), trade (Section 1.6), and prices (Section 1.7). This year, the Outlook highlights the significance of emission reduction technologies for food security and environmental sustainability of food systems (Section 1.5).

Part 2: Commodity chapters describe recent market developments and medium-term projections for consumption, production, trade, and prices for the commodities covered in the Outlook. Each of the nine chapters — Cereals (Chapter 2), Oilseeds and oilseed products (Chapter 3), Sugar (Chapter 4), Meat (Chapter 5), Dairy and dairy products (Chapter 6), Fish (Chapter 7), Biofuels (Chapter 8), Cotton (Chapter 9), and Other products (Chapter 10) — concludes with a discussion of the main issues and uncertainties affecting markets over the next ten years.

Part 3: The Statistical Annex is available online as support material but not included in the printed version of the *Outlook*. The Statistical Annex presents projections for production, consumption, trade, and prices for agricultural commodities, fish, and biofuels, as well as macroeconomic and policy assumptions. Market evolution over the *Outlook* period is described using annual growth rates and data for the final year (2034) relative to a three-year base period (2022-24).

The *Agricultural Outlook* is prepared jointly by the OECD and FAO Secretariats.

At the OECD, the baseline projections and *Outlook* report were prepared by members of the Trade and Agriculture Directorate: Marcel Adenäuer, Fabiana Cerasa, Thomas Chatzopoulos, Armelle Elasri (publication co-ordinator), Hubertus Gay (Outlook co-ordinator), Barbora Gilbert, Céline Giner, Gaëlle Gouarin, Lee Ann Jackson (Head of Division), Edith Laget, Claude Nénert, Grégoire Tallard, and Kotone Yamamoto of the Agro-Food Trade and Markets Division, and for fish and seafood by Claire Delpeuch and Will Symes of the Agricultural Resources Policy Division. The OECD Secretariat is grateful for the contributions provided by the visiting expert Jiayu Zhuang (Chinese Academy of Agricultural Sciences). The section on emission reduction technology is based on collaboration with the International Institute for Applied Systems Analysis (IIASA), with special thanks to Stefan Frank, Petr Havlik and Yazhen Wu. The partial stochastic modelling builds on work by the Economics of the Food System Unit of the European Commission's Joint Research Centre. Communication and publication preparation were provided by Caitlin Boros, Kristina Medekova, and Cem Mehmethanoglu. The publication benefited from the review by David Hallam. Technical support in the preparation of the *Outlook* was provided by Marc Regnier and Eric Espinasse. Many other colleagues in the OECD Secretariat and member country delegations provided useful comments on earlier drafts of the report.

At the Food and Agriculture Organization of the United Nations, the baseline projections and Outlook report were prepared by members of the Markets and Trade Division (EST) under the leadership of Boubaker Ben-Belhassen (EST Division Director), with the overall guidance of Máximo Torero (FAO Chief Economist) and by the Economic and Social Development Stream Management team. The core projections team consisted of: Abdi Ali, Sergio René Araujo Enciso, Isabel Burgos, Giulia Caddeo, Holger Matthey (Team Leader), Svetlana Mladenovic and Irmak Yaka. For fish, the team consisted of Pierre Charlebois, Adrienne Egger, and Stefania Vannuccini from the FAO Fisheries and Aquaculture Division. Advice on fishmeal and fish oil issues and historical data were provided by Enrico Bachis from the Marine Ingredients Organisation (IFFO). Macroeconomic projections benefited from the input by Oxford Economics. The sugar and cotton sections were contributed by Mamoun Amrouk and Fabio Palmeri, with data and technical advice by Peter de Klerk from the International Sugar Organization (ISO) and Lorena Ruiz from the International Cotton Advisory Committee (ICAC). The section on bananas and major tropical fruits was prepared by Sabine Altendorf, with input from Giuseppe Bonavita and Pascal Liu. Commodity expertise was provided by Erin Collier, Delphine Leconte Demarsy, Emanuele Marocco, Shirley Mustafa, Cecilia Nardi, Monika Tothova (Team Leader), and Di Yang. Anthony Bennett contributed to Box 1.3. The Hand-in-Hand Initiative: Transforming Agrifood Systems. Aikaterini Kavallari, Georgios Mermigkas, and Andrea Zimmermann provided Box 1.4 The role of trade in enhancing food security, nutrition, and environmental sustainability. Tiziana Pirelli provided valuable expertise for Box 4.1. The role of the "Sugarcane Complex" in the bioenergy sector. Research assistance and database preparation were provided by Maria Antip, David Bedford, Victoria Johnston, Grace Maria Karumathy, Yanyun Li, Lavinia Lucarelli, Emanuele Mazzini, and Marco Milo. This edition also benefited from comments made by various colleagues from FAO and member country institutions. The authors would like to thank Araceli Cardenas, Yongdong Fu, Jonathan Hallo, Jessica Mathewson, Kimberly Sullivan, and Ettore Vecchione for their invaluable assistance with publication and communication issues.

Finally, information and feedback provided by the International Cotton Advisory Committee, International Dairy Federation, International Fertilizer Association, International Grains Council, International Sugar Organization, Marine Ingredients Organisation (IFFO) and World Association of Beet and Cane Growers is gratefully acknowledged.

The complete *Agricultural Outlook*, including the fully documented *Outlook* database that includes historical data and projections, can be accessed through the OECD-FAO joint internet site: www.agri-outlook.org.

The published *OECD-FAO Agricultural Outlook 2025-2034* is available on the OECD's website and FAO Document Repository.

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Abbreviations

AEDP	Alternative Energy Development Plan
AfCFTA	African Continental Free Trade Area
AFOLU	Agriculture, Forestry and Other Land Use
ASF	African Swine Fever
B30	Alternative diesel fuel consisting of regular petroleum diesel (70%) blended with biodiesel (30%)
B35	Alternative diesel fuel consisting of regular petroleum diesel (65%) blended with biodiesel (35%)
B40	Alternative diesel fuel consisting of regular petroleum diesel (60%) blended with biodiesel (40%)
bln	Billion
bln L	Billion litres
bln t	Billion metric tonnes
CAP	Common Agricultural Policy (European Union)
CIF	Cost, insurance and freight
CMIA	Cotton Made in Africa
CPI	Consumer Price Index
CPO	Crude Palm Oil
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
CV	Coefficient of variation
Cwe	Carcass weight equivalent
DDGs	Dried Distiller’s Grains
dw	Dry weight
E10	Fuel mixture composed of 10% ethanol and 90% gasoline
E15	Fuel mixture composed of 15% ethanol and 85% gasoline
E20	Fuel mixture composed of 20% ethanol and 80% gasoline
EJ	Exajoule
El Niño	Climatic condition associated with the temperature of major sea currents
EPA	US Environmental Protection Agency
ERS	Economic Research Service of the US Department for Agriculture
ERT	Emission reduction technologies
ESPR	Ecodesign for Sustainable Products Regulation
est	Estimate
EVFTA	EU-Viet Nam Free Trade Agreement
EVs	Electric Vehicles
FAO	Food and Agriculture Organization of the United Nations
FBS	Food Balance Sheet
FCR	Feed conversion ratios
FDI	Foreign Direct Investment
FLW	Food loss and waste
FMD	Foot-and-Mouth Disease
FRP	Fair and Remunerative Prices
FTA	Free Trade Agreement
g	Grams
GDP	Gross Domestic Product

GE	Genetically Engineered
GHG	Greenhouse gas
GLOBIOM	Global Biosphere Management Model
GMO	Genetically modified organism
GSP	Generalized System of Preferences
$GtCO_2$-eq	Giga tons of CO_2 equivalents
ha	Hectares
HDB	Healthy Diet Basket
HFCS	High Fructose Corn Syrup
HIH	Hand-in-Hand Initiative
HPAI	Highly Pathogenic Avian Influenza
HQCF	High Quality Cassava Flour
HVO	Hydrotreated Vegetable Oil
ICAC	International Cotton Advisory Committee
IDF	International Dairy Federation
IEA	International Energy Agency
IIASA	International Institute for Applied Systems Analysis
ILUC	Indirect Land Use Change
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
ISMA	Indian Sugar Mills Association
ISO	International Sugar Organization
kcal	Thousand calories
kg	Kilogramme
kha	Thousand hectares
kt	Thousand metric tonnes
LAC	Latin America and the Caribbean
lb	Pound (weight)
LDCs	Least Developed Countries
LULUCF	Land Use, Land Use Change and Forestry
MACCs	Marginal abatement cost curves
MBM	Meat and Bone Meal
MDER	Minimum Dietary Energy Requirement
MERCOSUR	Mercado Común del Sur / Common Market of South America
Mha	Million hectares
MMFs	Man-made fibres
Mn	Million
Mn L	Million litres
MPS	Market Price Support
Mt	Million metric tonnes
Mt CO2-eq	Million metric tonnes of carbon dioxide equivalent
NENA	Near East and North Africa
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development
p.a.	Per annum
PCE	Private Consumption Expenditure
PEF	Product Environmental Footprint
PoU	Prevalence of Undernourishment
PPP	Purchasing Power Parity
PSA	Partial Stochastic Analysis
PSE	Producer Support Estimate
RCS	Regenerative Cotton Standard
RED	Renewable Energy Directive (European Union)

RFS / RFS2	Renewable Fuels Standard in the United States, part of the Energy Policy Act
rtc	Ready to cook
rwe	Edible retail weight equivalent
SAF	Sustainable aviation fuel
SCC	Sugarcane Complex
SDG	Sustainable Development Goals
SMP	Skim Milk Powder
SPS	Sanitary and Phyto sanitary measures (WTO agreement)
SSA	Sub-Saharan Africa
SSB	Sugar-Sweetened Beverage
t	Metric tonnes
t/ha	Metric tonnes/hectare
TFP	Total Factor Productivity
tq	Tel quel basis (sugar)
TRQ	Tariff Rate Quota
TR4	Banana Fusarium Wilt Tropical Race 4
UCO	Used Cooking Oil
UN	The United Nations
US	United States
USDA	United States Department of Agriculture
USMCA	United States—Canada—Mexico Agreement
WFP	World Food Programme
WHO	World Health Organization
WLF	Waste oils and fat
WMP	Whole Milk Powder
WOAH	World Organization for Animal Health (previously OIE)
WTO	World Trade Organization

Currencies

ARS	Argentinean peso
AUD	Australian dollars
BRL	Brazilian real
CAD	Canadian dollar
CHF	Swiss franc
CLP	Chilean peso
COP	Columbian peso
CNY	Chinese yuan renminbi
EGP	Egyptian pound
EUR	Euro (Europe)
GDP	British pound sterling
IDR	Indonesian rupiah
INR	Indian rupee
JPY	Japanese yen
KRW	Korean won
MXN	Mexican peso
MYR	Malaysian ringgit
NZD	New Zealand dollar
PEN	Peruvian sol
PKR	Pakistani rupee
RUB	Russian ruble
SAR	Saudi riyal
THB	Thai baht
UAH	Ukrainian grivna
USD	US dollar
ZAR	South African rand

Executive summary

The *OECD–FAO Agricultural Outlook 2025-2034* provides a comprehensive assessment of the ten-year prospects for agricultural commodity and fish markets at national, regional, and global levels. Jointly produced by the OECD and FAO, in collaboration with their Members and international commodity organisations, the *Outlook* serves as a forward-looking reference to support evidence-based policy planning. This 21st edition examines the evolving landscape of global agriculture in the face of economic, political and environmental challenges.

Total consumption of agricultural and fish commodities is projected to grow by 13% from current levels by 2034 in constant prices. Nearly all the increase is expected to occur in low- and middle-income countries, reflecting expanding and increasingly affluent populations in these regions. However, while half of the consumption growth in middle-income countries is attributed to per-capita increases, three quarter of the growth in low-income countries is based on population growth.

Rising disposable incomes and urbanisation, particularly in middle-income countries, are expected to lead to shifts in dietary patterns toward more diverse and nutritious foods, including livestock and fish products. According to the *Outlook*, the share of total calories in diets contributed by livestock and fish products is projected to rise by 6% globally by 2034. In lower-middle-income countries, a more pronounced 25% growth will bring the average daily per capita intake of nutrient-rich food in these regions to 364 kcal, surpassing the 300 kcal included in the Healthy Diet Basket used by the FAO to compute the cost and affordability of a healthy diet. However, average indicators do not reflect persisting distributional inequalities within and across countries. Despite significant progress, many individuals in lower-middle-income countries will continue to face challenges in accessing adequate nutrition, putting the achievement of the SDG target of improved global nutrition by 2030 at risk. In low-income countries, the situation is more severe, as average daily per capita intake of nutrient-rich animal foods is expected to remain at 143 kcal, just below half the calories identified in the Healthy Diet Basket. This enduring nutritional gap highlights important structural barriers, including limited access to affordable protein-rich foods.

To support growing demand, global agricultural and fish production is projected to expand by 14% in constant prices over the next decade, with middle-income countries expected to remain the principal sources of global agricultural expansion. These structural shifts in production will be driven by a combination of gradual adoption of innovative and improved technologies, capital investments and more intensive use of fertilisers, feeds and other inputs in middle-income countries. Agricultural production growth will be primarily based on productivity gains, but expansion of cropping area and livestock herds are also expected, particularly in Africa and South Asia, where limitations on access to modern farming technologies persist.

As the projected production growth in the livestock and crop sectors is not fully offset by the assumed productivity improvements, direct agricultural greenhouse gas (GHG) emissions are projected to increase by 6% by 2034. The relationship between agricultural growth and emissions will continue to evolve depending on the adoption of more efficient production methods and changing patterns of land use and input utilisation. With the expected productivity improvements, the carbon intensity of agricultural production is projected to decline across all regions over the coming decade.

A scenario analysis conducted in the *Outlook* suggests that by 2034, undernourishment could be eliminated and direct agricultural GHG emissions lowered by 7% from current levels. Achieving these outcomes simultaneously would hinge on a 10% increase in food production and a 15% improvement in agricultural productivity, supported by the widespread adoption of currently available emissions-reducing technologies. Innovations such as precision farming, improved nutrient and water management, feed enhancements in livestock systems, and low-cost scalable practices such as crop rotations, intercropping and compost-based nutrient management represent some of the pathways that could support such emission reductions. The pace and extent of technology implementation, infrastructure development, and knowledge transfer will influence how these outcomes may unfold in practice.

The *Outlook* highlights that trade flows between net-exporting and net-importing regions are expected to increase as agricultural production and consumption become more geographically separated based on different comparative advantages and production capacities as well as food and feed demand developments. As a result, international trade will remain indispensable to the global agri-food sector. By 2034, 22% of calories consumed globally are expected to be traded across borders. Twenty years ago, this share was 17% but has remained stable at around 22% over the last ten years. Multilateral cooperation and a rules-based agricultural trade are essential to facilitating these trade flows, balancing food deficits and surpluses across countries, stabilising prices and enhancing food security, nutrition and environmental sustainability.

The medium-term projection anticipates a modest decline in average annual real agricultural commodity prices, reflecting ongoing average productivity improvements that lower production costs. Consequently, individual farmers, especially smallholders who are often the most vulnerable to market shocks and have limited capacity to adopt innovative technologies, face growing pressure to improve their individual productivity. Sustained improvements in agricultural efficiency, adoption of innovative technologies, and better access to inputs, knowledge, and markets, as well as locally tailored and effective business risk management practices are therefore critical for maintaining farm incomes and livelihoods. The course of actual prices will also reflect volatility associated with the impacts of weather shocks, supply chain disruptions and geopolitical tensions.

The baseline projections presented in this *Outlook* are based on the available historical data and assumptions derived from them about economic, political, cultural, climatic and technological developments over the coming decade, which are all subject to uncertainties. As such, the likely impacts of recent developments, including shifts in trade policy and heightened economic uncertainty, have not been incorporated. Should these uncertainties persist or intensify, they may affect global agricultural markets in the medium-term through macroeconomic channels such as inflation, exchange rates, and global growth trajectories.

Key messages

- Rising incomes, especially in middle-income economies, are expected to increase the daily per capita caloric intake of meat, dairy, fish, and other animal products by 6% over the next decade. However, in low-income countries, daily intake of these nutrient-rich foods will remain low at just 143 kcal by 2034, well below the 300 kcal included in the Healthy Diet Basket used by FAO.
- Global agricultural and fish production is expected to increase by 14% over the next decade, mainly enabled by productivity improvements, particularly in middle-income countries. However, this increased production, along with ongoing structural changes in the sector, is associated with expanded animal herds and cropland areas. Despite reductions in emissions intensity from productivity growth, this results in a 6% increase in direct agricultural greenhouse gas (GHG) emissions.
- However, scenario analysis suggests options to eliminate undernourishment and to reduce direct agricultural GHG emissions by 7% below current levels by 2034. Achieving these dual outcomes would require a 15% agricultural productivity increase complemented by widespread adoption of emission-reduction technologies, while attaining a production level sufficient to eradicate undernourishment globally.
- As demand for food and feed grows, with production often located far from consumption areas, the *Outlook* projects that 22% of all calories will cross international borders over the next ten years. To ensure the efficient movement of agricultural and fish products, multilateral cooperation and a rules-based agricultural trade system are crucial. These frameworks will not only enhance food security but also improve sustainability and resilience in the face of potential supply disruptions.
- Real agricultural commodity prices are projected to decline in the medium term as the overall productivity of the agricultural sector increases, putting pressure on individual farmers, and especially smallholders, at the lower end of the productivity scale to continue to raise their own productivity. Sustained improvements in efficiency, adoption of innovative technologies, better access to inputs, knowledge, and markets, and effective business risk management practices are critical for maintaining farm incomes and livelihoods.

1 Agricultural and food markets: Trends and prospects

This chapter presents key findings on consumption, production, trade, and prices of agricultural and fish commodities covered in the *OECD-FAO Agricultural Outlook*, as well as developments in key sectoral indicators over the 2025-2034 period. It summarises a baseline scenario for the next decade based on specific assumptions about macroeconomic conditions, productivity trends, weather, consumer preferences, and agriculture and trade policies. Global consumption of agricultural commodities is projected to increase at a decelerated pace over the next decade due to slower population and income growth, coupled with saturated food demand in advanced economies. Most of the additional consumption is expected to take place in low- and middle-income countries, where urbanising populations with rising per capita incomes will consume relatively more livestock and fish products. The shift in dietary preferences will likely boost investment in livestock and aquaculture, increasing production. Consequently, global agricultural and fish production, especially animal-source foods, will lead to higher greenhouse gas emissions from agriculture. The chapter also presents a scenario that describes how combining productivity improvements with the widespread adoption of emission reduction technologies could reduce direct GHG emissions from agriculture and end hunger by 2034. The *Outlook* highlights the vital role of multilateral co-operation and effective international agricultural commodity markets in ensuring global food security and rural livelihoods. Projected demand and supply trends suggest a gradual decline in real international prices over the next decade, though changes in environmental, social, geopolitical, or economic factors would alter these projections.

The *OECD-FAO Agricultural Outlook* is the result of a collaborative effort of the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization of the United Nations (FAO). This year's report presents a consistent baseline scenario for the evolution of agricultural commodity and fish markets at national, regional, and global levels for the period 2025 to 2034.

The baseline projections are based on structured expert inputs. These projections are influenced by current market conditions (Section 1.1), as well as assumptions about macroeconomic, demographic, and policy developments (Section 1.2). The OECD-FAO Aglink-Cosimo model, which links sectors and countries covered in the *Outlook*, ensures consistency and global equilibrium across all markets.

In Section 1.6 using a scenario analysis, this *Outlook* highlights the role of a large-scale implementation of greenhouse gas (GHG) emission reduction technologies in balancing food security and sustainability.

1.1. Recent developments in agricultural markets

Figure 1.1 provides information on the current commodity situation which is the starting point of the projections. Due to differences in marketing years across commodities, data is presented for either the calendar year 2024 or the 2024/25 marketing year, as appropriate.

Figure 1.1. Market conditions for key commodities

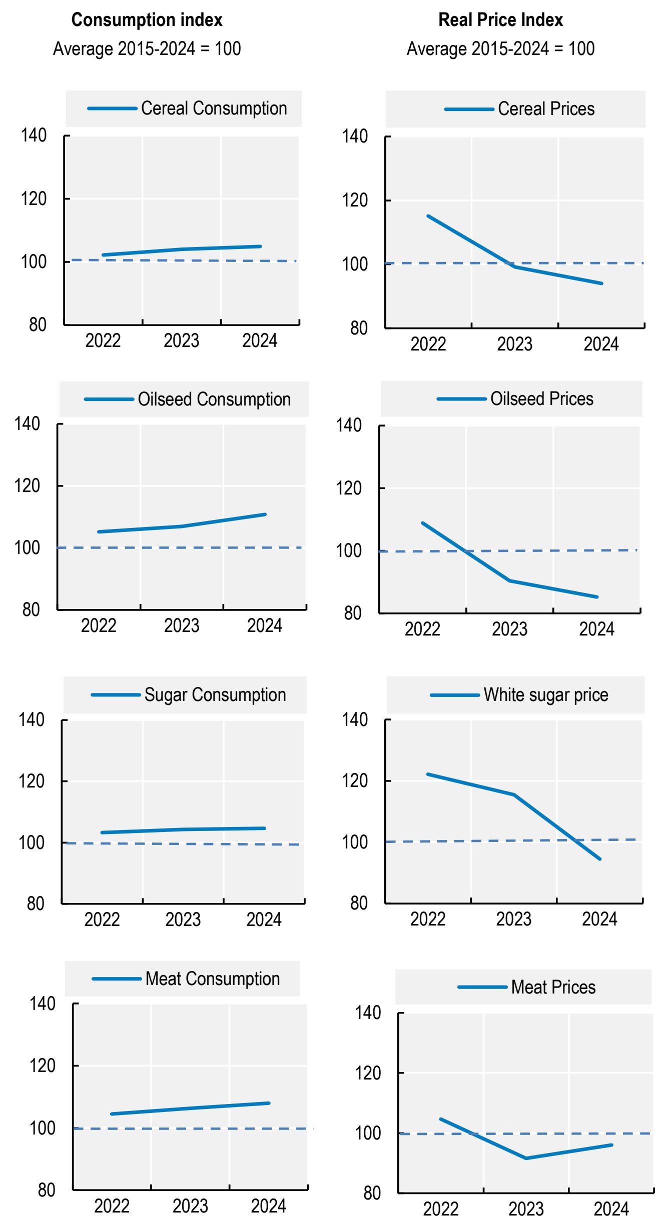
Current market conditions

Cereals: International prices in real terms are estimated to drop for most cereals in 2024/25 owing to generally favorable production and trade prospects, especially for wheat and rice, and despite a tightening global supply for maize. Regional demand and stock trends vary by crop, but the overall easing in international prices suggests that the global cereal market is well supplied.

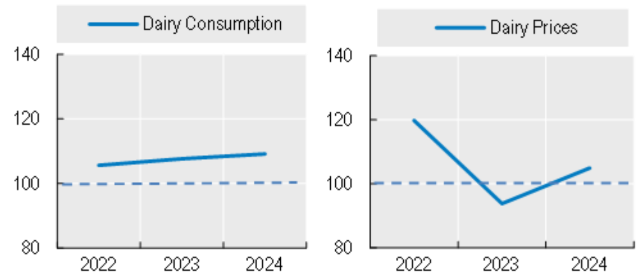
Oilseeds: International prices for soybeans drifted lower in 2024 and continued to linger at multi-year lows in the first half of 2025, weighed down by a 6% increase in global soybean production in 2024/25. Consequently international protein meal quotations also declined. By contrast, world vegetable oil prices increased as below-potential growth in palm oil outputs coincided with reduced crushing of rapeseed and sunflower seed.

Sugar: International prices of white sugar, in real terms, are estimated to decline for a second consecutive year in the 2024/25 marketing year, falling below the average of the past decade. Global sugar consumption is projected to continue expanding over the coming decade though the pace of growth is expected to moderate.

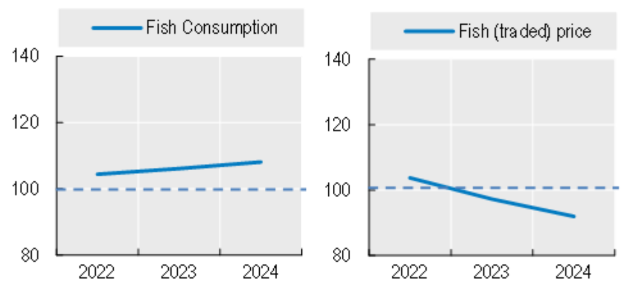
Meat: In 2024, global meat prices rose modestly, driven by strong import demand, partially offset by increased export availabilities from some key meat-exporting countries. Global consumption increased slightly, mainly reflecting higher demand for poultry and beef, partially offset by declines in pig and sheep meat consumption. Per capita meat consumption rose across all regions except Africa, with notable increases recorded in developed economies, amid constrained domestic supply.



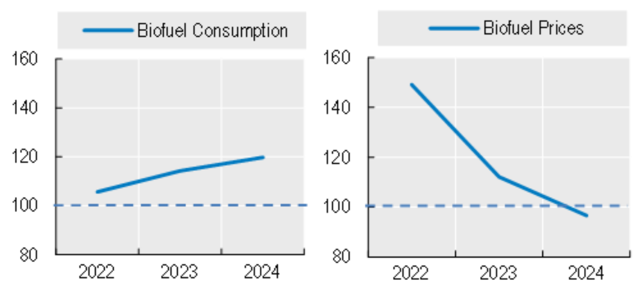
Dairy: In 2024, dairy prices rose under the lead of butter for which the international price reached a new record high. Global production and consumption developments are driven by India and Pakistan which continued to grow domestically by 3% in 2024. Otherwise, dairy has a small international trade share and trade declined in 2024 due to smaller demand from China.



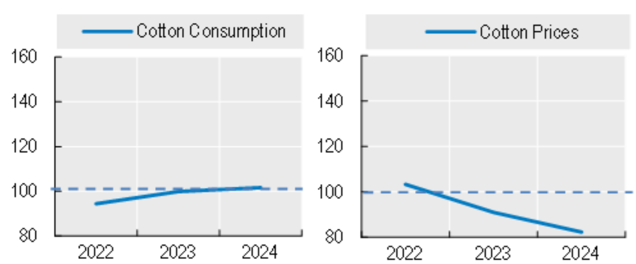
Fish and other aquatic products: In 2024, global consumption of fish and other aquatic products for food uses continued its gradual rise, driven by increases across most regions. International fish prices declined in 2024 for the second consecutive year, continuing a downward trend from the peak levels seen in 2022.



Biofuels: Global biofuel consumption has grown steadily, averaging 3.5% annually over the past decade. In 2024, this trend continued with prices continuing to decrease due to lower crude oil and feedstock prices, favorable tax policies, and strong economic incentives.



Cotton: In 2024, global consumption increased slightly, reflecting higher cotton use in India, Bangladesh, Türkiye, and Viet Nam. International prices have declined since the second quarter of 2024 mainly as a result of strong production prospects. World cotton production rebounded in 2024, driven by expectations of larger outputs in key producing countries, China, Brazil, and the United States.



Note: All graphs expressed as an index where the average of the past decade (2015-24) is set to 100. Consumption refers to global consumption volumes. Price indices are weighted by the average global production value of the past decade as measured at real international prices. More information on market conditions and evolutions by commodity can be found in the commodity chapters.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

StatLink https://stat.link/3pzar9

1.2. Expected macroeconomic and policy trends affecting agricultural markets

This baseline scenario generating 2025-2034 projections incorporates the commodity, policy, and country expertise of the OECD and the FAO, as well as input from collaborating member countries and international commodity bodies. The baseline projections discussed in this section are based on data and policies in place as of December 2024. The following macroeconomic trends are expected to influence the evolution of agricultural markets in the coming ten years.

Box 1.1. OECD-FAO Baseline process and consideration of uncertainties

Baseline process

Since 2004, the OECD and FAO have jointly produced the annual *Agricultural Outlook*, providing transparent and plausible projections for the next decade based on stakeholders' consensus. These projections serve as a baseline for evaluating the impacts of policy changes and alternative scenario developments. The production process is continuously adjusted to reflect evolving requirements and conditions, while maintaining principles that limit subjective assumptions.

The OECD gathers agricultural market data and projections through country questionnaires that take into account national economic conditions and policies. The FAO draws on its institutional capacity and expertise to generate baseline projections. Both processes follow multiple steps involving database management, modelling, and post-model analysis, carried out over several months.

A rigorous, multi-tiered clearance process guarantees the quality of the joint outlook. The projections and findings are reviewed by the OECD Group on Commodity Markets and FAO commodity specialists, while final approval of the text is ensured by the OECD Working Party on Agricultural Policies and Markets and the FAO Chief Economist Stream management team. This established process ensures the development of a plausible and transparent baseline scenario, resulting in a widely recognised medium-term agricultural outlook. Further details on the methodological framework and clearance process can be found in Annex B: Methodology.

Uncertainties surrounding the baseline

The baseline projections presented in this *Outlook* report are based on data and policies in effect as of December 2024 and the assumptions derived from them. Developments that occurred after this date–whether political, economic, environmental, or technological–were not considered.

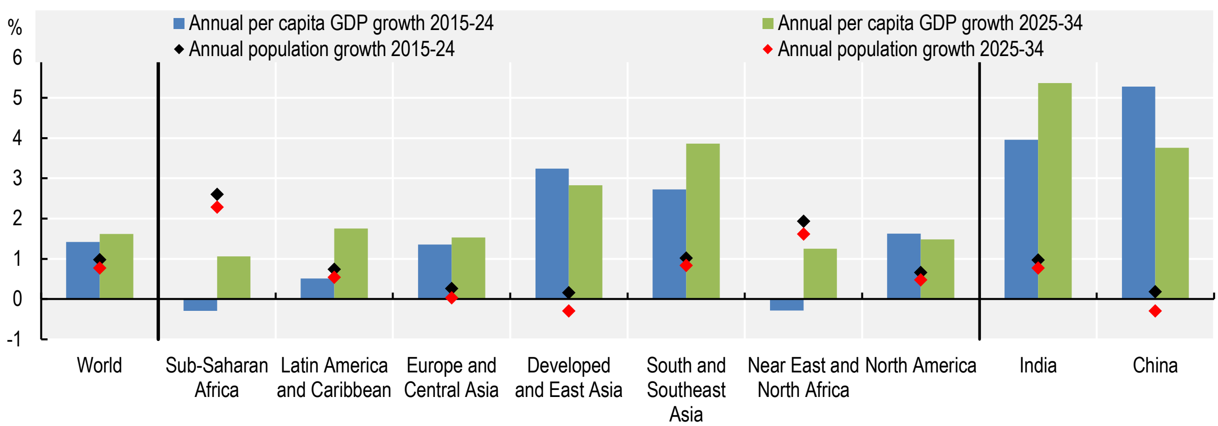
Recent geopolitical developments have heightened short-term uncertainty surrounding international trade relations, regulatory cooperation, and global sustainability efforts. These evolving conditions will be closely monitored to assess whether they develop into structural changes with lasting implications for the medium-term outlook. Given the uncertainty about the nature, scope and duration of these changes, the decision was made to retain the original baseline projections in this report. If key drivers of agricultural markets and derived assumptions consistently diverge from the baseline assumptions, the potential impacts will be analysed through scenario-based simulations.

1.2.1. A slowing pace of global population growth with regional differences

Global population[1] growth is projected to slow significantly, increasing by 729 million people reaching 8.8 billion by 2034. This corresponds to an average rate of 0.8% p.a. over the next ten years, down from 1.0% p.a. in the past decade (Figure 1.2). This deceleration is expected to lead to slower growth in global food demand. However, regional differences in population trends will shape the regional patterns of future demand. India will solidify its position as the most populous country (since 2023), growing at 0.8% annually and accounting for 17.9% of the world's population by 2034. Sub-Saharan Africa will experience the highest growth at 2.3% per year, reaching 17.5% of the global population by the end of the projection period. The Near East and North Africa will be the second fastest-growing region at 1.6% p.a. though still representing a smaller share at 6.3% by 2034.

In contrast, the population of the People's Republic of China (hereafter "China") is set to decline gradually at -0.3% per year over the next decade. However, it will remain the second most populous country with 15.7% of the global total by 2034. The population of Latin America and the Caribbean, and North America is expected to grow at 0.5% p.a. while in Europe and Central Asia it will remain fixed.

Figure 1.2. Annual GDP per capita and population growth rates



Note: Aggregated regional GDP figures are calculated using exchange rate-based rather than purchasing power parity (PPP) weights.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

1.2.2. Stable global economic growth

Global per capita income,[2] measured in constant United States dollars, is expected to grow at an average rate of 1.6% p.a. over the next decade. Growth will be primarily driven by emerging and developing Asian economies with India's growth accelerating to 5.4% p.a. (up from 4.0% p.a. in the previous decade) and China growing at 3.8% p.a. as it transitions to a more mature economic phase. These middle-income countries will reinforce their role as the key drivers of global agricultural commodity demand. Latin America is also expected to outpace the global average with its larger economies contributing to a regional growth rate of 1.8% per year.

In advanced economies, income growth in Europe and Central Asia is expected to see a slight improvement while North America may experience a slowdown with both regions averaging 1.5% p.a. growth over the next ten years. Per capita income growth is projected to remain below the global average at 1.1% p.a. in Sub-Saharan Africa and 1.3% p.a. in the Near East and North Africa.

1.2.3. Easing of energy prices as fossil fuel demand weakens

According to the International Energy Agency (IEA) (IEA, 2004[1]), growth in global energy demand for fossil fuels is expected to slow, reaching its peak before 2030 due to efficiency improvements, electrification, and the rapid expansion of renewable energy. This will potentially result in further easing of international energy prices.

The global reference oil price used in the *Outlook*, which peaked at USD 101/barrel in 2022, declined to USD 80/barrel in 2024 and is projected to decline further to USD 73/barrel in 2025. The *Outlook* expects that the global reference oil price will remain stable in real terms over the projection period. Following this trend, fertiliser prices, which spiked in 2022, are also projected to continue easing and remain stable in real terms over the next decade.

1.2.4. Existing policies are held constant in the baseline

Policies play an important role in agricultural, biofuel, and fisheries markets, and policy reforms usually trigger changes in market structures. The *Outlook* assumes current policies will remain in place and that no new policies are enacted. Only free trade agreements that have been ratified up to the end of December 2024 are considered in the *Outlook*.

1.2.5. Projections are subject to considerable uncertainty

The agricultural commodity market outlook is subject to various uncertainties, including environmental, social, geopolitical, and economic factors that could cause deviations from baseline projections.

The ongoing conflicts highlight persistent energy security risks with direct implications for production. While the immediate effects of the global energy crisis began to subside in 2023, the potential for further disruptions remains high because of the agri-food sector's reliance on energy. Higher input costs, especially for fossil fuel-derived energy, have driven up food prices, exacerbating concerns over global food security. Scenario analysis in the 2023 *Outlook* indicated that rising synthetic fertiliser costs alone could significantly impact food prices. Box 1.2 elaborates on these uncertainties related to inputs by highlighting recent scenario analysis work on synthetic fertiliser markets and policies conducted at the OECD.

Box 1.2. The interconnected dynamics of synthetic fertiliser markets, policies, and agricultural markets

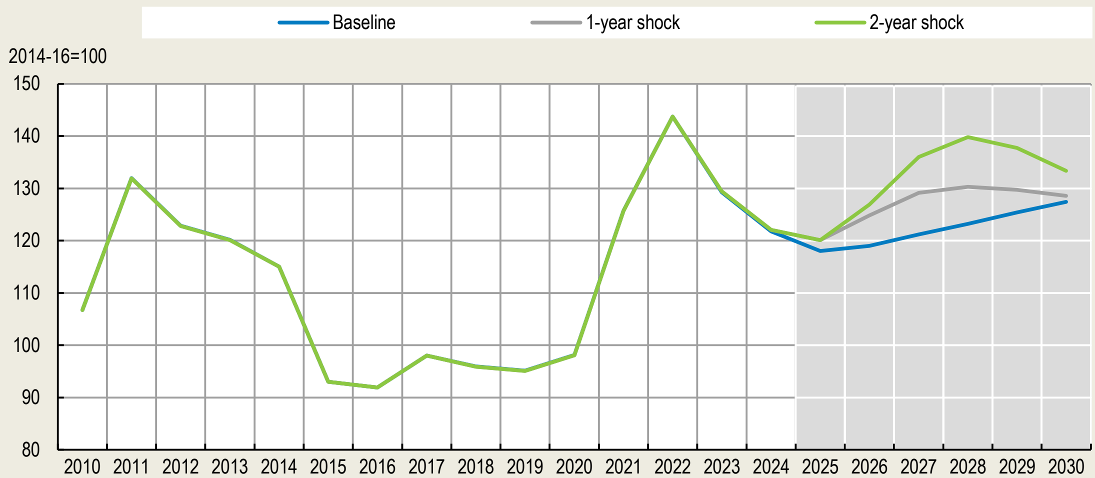
Conditions on synthetic fertiliser markets, which determine fertiliser application with direct implications for yields, have far-reaching impacts on food systems, macroeconomic economic stability and the environment. They are highly concentrated and closely linked to energy markets, making them very susceptible to shocks and supply disruptions. Many countries offer subsidies to encourage agricultural practices based on the use of fertilisers to ensure food security and support farmers' livelihoods.

Using the partial equilibrium model Aglink-Cosimo, a recent OECD report explores the complex relationships between fertiliser markets, synthetic fertiliser policies, and their repercussions on agricultural markets, food security, and environmental sustainability over the medium term (Adenäuer, Laget and Cluff, 2024[2]). This report presents two separate scenario analyses: one examining potential supply shortages of fertiliser; and the other exploring the hypothetical elimination of fertiliser support in India.

The first scenario, involving a 20% reduction of nitrogen (N), phosphorus (P), and potassium (K) fertilisers supply first applied in 2025 only and then in both 2025 and 2026, addresses the major concern of supply shortages. This can be best interpreted as an increase in marginal production costs similar to the price shock observed in 2022. Supply shortages of fertilisers are a major concern for many countries not only since the war between the Russian Federation and Ukraine started, but also due to the broader geopolitical uncertainties affecting global trade and commodity markets.

The supply shortage scenario indicates that existing stocks can to some extent mitigate the negative short-term impacts on yields. However, prolonged shortages can have lasting adverse effects on the agricultural sector. Even modest reductions in yields would result in significant production shortfalls driving up food prices. Figure 1.3 shows that in a scenario where all three synthetic fertilisers are simultaneously affected within a single year (grey line), the FAO food price index could rise by as much as 6% between 2025 and 2028. In contrast, a scenario involving two consecutive shocks (green line) would lead to a more pronounced increase, pushing prices up to 13% over the same period.

Figure 1.3. Impact of shocks to fertiliser supplies on food prices (FAO food price index)



Source: Aglink-Cosimo simulations (Adenäuer, Laget and Cluff, 2024[2]).

The second scenario, focusing on the hypothetical elimination of synthetic fertiliser support in India, suggests that this policy change would prompt a rapid reduction in domestic fertiliser use, leading to a decrease in agricultural production and exports, while simultaneously causing an increase in imports. The decline in nitrogen prices and rise in rice prices, influenced by India's substantial role as both a nitrogen user and rice supplier, would have only a modest impact on global food prices and minor adverse impacts on food security worldwide.

The scenario suggests that global agricultural greenhouse gas emissions would decrease by a notable 7 Mt of CO_2 equivalent due to the substantial reduction in fertiliser application in India and the moderate increase in fertiliser use elsewhere. This highlights the crucial link between domestic policies and global environmental sustainability goals.

The recent developments in the United States' foreign policies, which occurred after the December 2024 assumption threshold, have introduced a degree of uncertainty to the current baseline projections, particularly with respect to international trade, food assistance and global sustainability initiatives.

Rising temperatures, shifting rainfall patterns, disruptions to ecosystem services, and more frequent extreme weather events are increasingly affecting agricultural yield trends. While some regions may benefit from longer growing seasons, others are becoming less suitable for cultivation. It is assumed that farmers will adapt by adjusting planting schedules, diversifying crop choices, and adopting integrated pest management strategies. However, the capacity to adapt remains uneven across regions. In this context, international trade plays a vital stabilising role. By enabling the movement of food from surplus to deficit regions, trade helps buffer local production shocks, thereby supporting stability of both supply and prices (Adenäuer, Frezal and Chatzopoulos, 2023[3]).

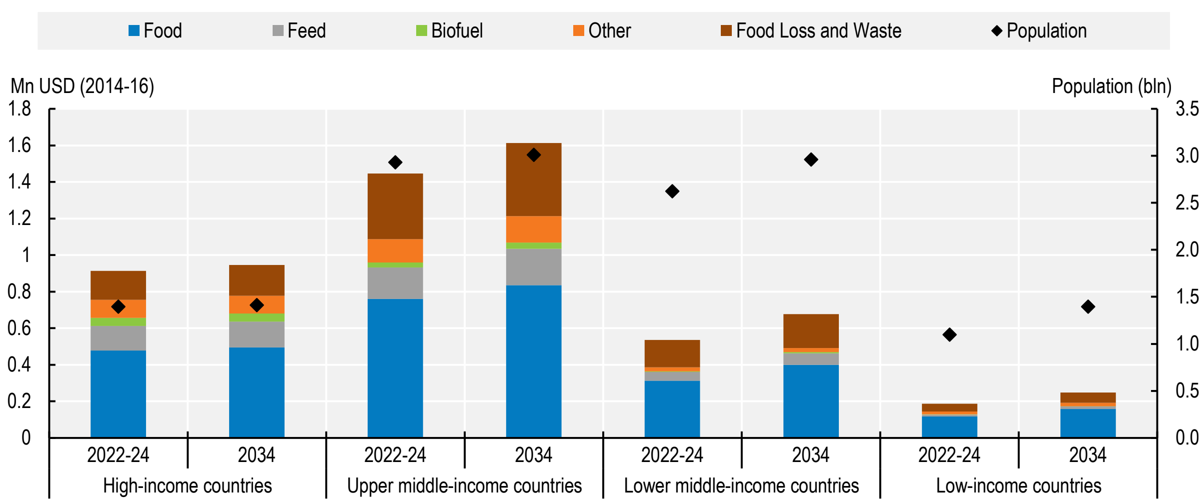
Sanitary and phytosanitary (SPS) risks, notably animal disease outbreaks, are an important source of uncertainty for trade in animal products. While farm-level production in species with rapid turnover, such as poultry, may recover relatively quickly following outbreaks like avian influenza, trade restrictions and structural adjustments can persist, potentially affecting long-term trade prospects. In contrast, diseases affecting livestock with longer life cycles, such as foot and mouth disease in cattle, can trigger prolonged trade restrictions and have serious economic repercussions due to extensive culling and the lengthy process of regaining disease-free status.

1.3. Consumption: Projected evolution for 2025-2034

1.3.1. Emerging economies underpin consumption growth of agricultural commodities

Over the coming decade, the value of global consumption of agricultural and fish commodities is projected to grow by 13% from current levels by 2034 in constant USD, with nearly all the additional use expected to occur in middle- and low-income countries. This growth will be primarily driven by growing, more affluent and increasingly urban populations in these regions. Figure 1.4 shows how countries across different income levels allocate agricultural and fish commodities between food, feed, biofuel and other industrial use. Among these, food remains the primary driver of global agricultural demand.

Figure 1.4. Use of agricultural commodities by type and income group



Note: Values are measured at constant USD of the period 2014-16.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

India and Southeast Asian countries, which are driving most of the development among the lower middle-incomes countries, are expected to account for a growing 39% share of consumption growth by 2034, compared to 32% over the last ten years. Population growth, rising incomes and urbanization in the region are expected to fuel increasing demand for both staple foods and animal-based products, thereby supporting greater use of commodities for both food and feed.

In contrast, China which played a dominant role in driving global demand in the past decade, is projected to contribute only 13% of additional consumption growth by 2034, down from 32% over the previous decade. This shift reflects a declining population, slower disposable income growth and stabilising dietary patterns.

High growth in consumption is also expected in low-income countries, particularly in Sub-Saharan Africa which is projected to contribute 14% of additional global agricultural commodity use over the next decade. While disposable household income gains in the region are expected to be more modest than in Asia, rapid population growth will generate strong food demand, especially for staple crops.

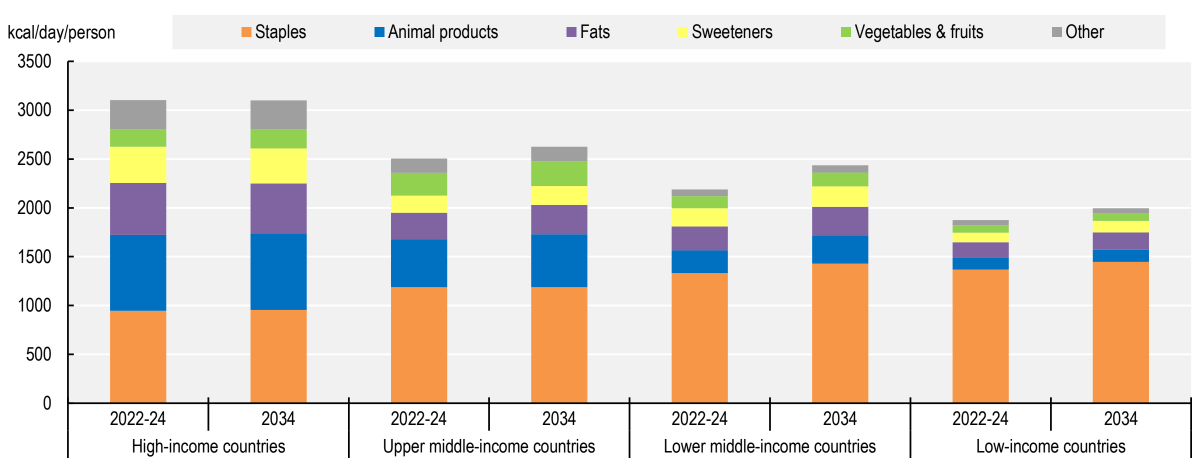
Food remains the primary use of agricultural commodities. In upper middle-income countries, feed use is projected to grow about 1.7 times faster than food use, driven by increased demand for animal-source foods. In contrast, in low-income countries, feed use is projected to grow only 1.1 times faster than food use of crops, underscoring their continued dependence on staple foods to meet basic dietary needs and support food security.

1.3.2. As incomes grow, consumption in low- and middle-income countries is projected to include more livestock and fish products

Daily per capita calorie intake (measured as food consumption[3] net of estimated household waste) is projected to increase most strongly in lower middle-income countries followed by upper middle-income countries where a levelling off in total calorie consumption is expected towards the end of the decade (Figure 1.5). In low-income countries, modest gains in disposable household incomes allow only moderate increases in food consumption compared to middle-income countries. Consumers in high-income economies will increase their calorie intake only marginally as saturation points have been reached.

As incomes rise over the medium term, diets in low- and middle-income countries are projected to shift toward greater consumption of animal products. In contrast, no fundamental shift in dietary patterns is currently observable or expected in high-income countries, particularly with regard to meat consumption. Despite growing awareness and gains in availability, plant-based meat replacements still represent only a small share of total food consumption. Moreover, recent trends suggest that any reduction in meat consumption has largely been driven by price fluctuations rather than a sustained, preference-driven shift in eating habits. As a result, significant changes in consumption behaviour in high-income economies are unlikely to occur in the short term, with more pronounced adjustments potentially emerging over the longer term as generational preferences evolve.

Figure 1.5. Contribution of food groups to total daily per capita caloric food intake



Note: Estimates are based on historical food supply time series from the FAOSTAT Food Balance Sheets database which are extended with the Outlook database and adjusted to account for estimated distributional and household wastes. Products not covered in the Outlook are extended by trends. Staples include cereals, roots and tubers and pulses. Animal products include meat, dairy products (excluding butter), eggs and fish. Fats include butter and vegetable oil. Sweeteners include sugar and HFCS. The category 'Other' includes other crop and animal products.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The projected increase in food consumption from animal sources is particularly notable in lower middle-income countries, where daily per capita intake of livestock and fish products is expected to rise by about 25% on average. This growth is a positive trend toward improving nutrition, as these countries are expected to surpass the 300 kcal/day/person value identified in the Healthy Diet Basket (HDB)[4] used by FAO to compute the cost and affordability of a healthy diet (Herforth et al., 2022[4]).

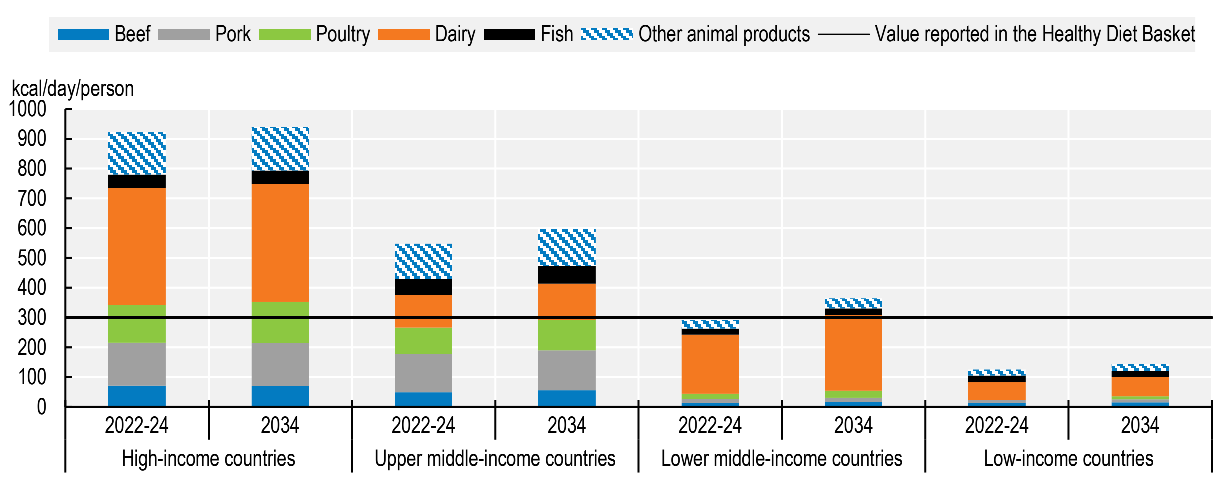
Low-income countries on the other hand are expected to continue to face major challenges in meeting global dietary requirements. By 2034, their per capita intake of nutrient-rich animal foods is projected to reach only 143 kcal/day, well below the 300 kcal/day identified in the HDB. This slow inclusion of livestock and fish products highlights the difficulties to end all forms of malnutrition, particularly due to their role in supplying essential proteins and micronutrients necessary for healthy growth and development (FAO, 2023[5]; FAO, 2024[6]).

While the projections are presented in regional consumption patterns, it is crucial to consider that these numbers mask the unequal distribution of nutrients between and within countries and even households, which are assumed to persist over the medium term. Even in regions and countries where average intake appears adequate, consumers may still face deficiencies.

It is important to consider that both external drivers (such as conflict and extreme weather events) and internal factors within food systems, including low productivity, inadequate supply of nutritious foods, and an excessive availability of cheap, ultra-processed and energy-dense foods high in fats, sugars, and/or salt, continue to raise the cost of nutritious food, making healthy diets increasingly unaffordable (FAO, IFAD, UNICEF, WFP and WHO, 2024[7]). At the same time, the growing reliance on staples like maize and sugar, which provide calories but little nutritional value, further contributes to dietary deficiencies by displacing more nutrient-dense options and increases caloric intake without providing vital vitamins and minerals (FAO, IFAD, UNICEF, WFP and WHO, 2019[8]; FAO, IFAD, UNICEF, WFP and WHO, 2020[9]).

In high-income countries, the projected consumption trends are driven by slowly evolving preferences and emerging health concerns, reinforced by policies aimed at reducing excessive intake of fats and caloric sweeteners. As a result, per capita consumption of fats and sweeteners is expected to decline while demand for nutrient-rich foods such as poultry, fish, fruits, and vegetables rises. The growing consumption of poultry and pigmeat compared to beef is driven by both health considerations and relative price differences.

Figure 1.6. Animal source foods in total food intake



Note: Estimates are based on historical time series from the FAOSTAT Food Balance Sheets database which are extended with the Outlook database. The category 'Other animal products' includes sheep meat, eggs and other products not covered in the Outlook are extrapolated by trends.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The 2024 *Outlook* has shown that reducing food loss and waste (FLW) is a critical part of the global solution for ensuring food security and improving nutrition for a growing global population and enhancing environmental sustainability. Notably, a scenario analysis in the 2024 *Outlook* has estimated that halving food loss and waste by 2030, could reduce the number of undernourished people by 153 million.[5]

The recent OECD report *Beyond Food Loss and Waste Reduction Targets* (OECD, 2025[10]) and associated case studies reporting the food loss and waste policy environment in Australia (OECD, 2025[11]), France (OECD, 2025[12]) and Japan (OECD, 2024[13]) provide a comprehensive review of the international food loss and waste policy environment. This draws on data collected by the OECD from representatives of 42 national ministries and from the European Commission to support cross-country dialogue and accelerate the implementation of more effective evidence-based and context-specific FLW policies (Box 1.3).

Box 1.3. The international food loss and waste policy environment: Key insights from the 2025 OECD report *Beyond Food Loss and Waste reduction Targets*

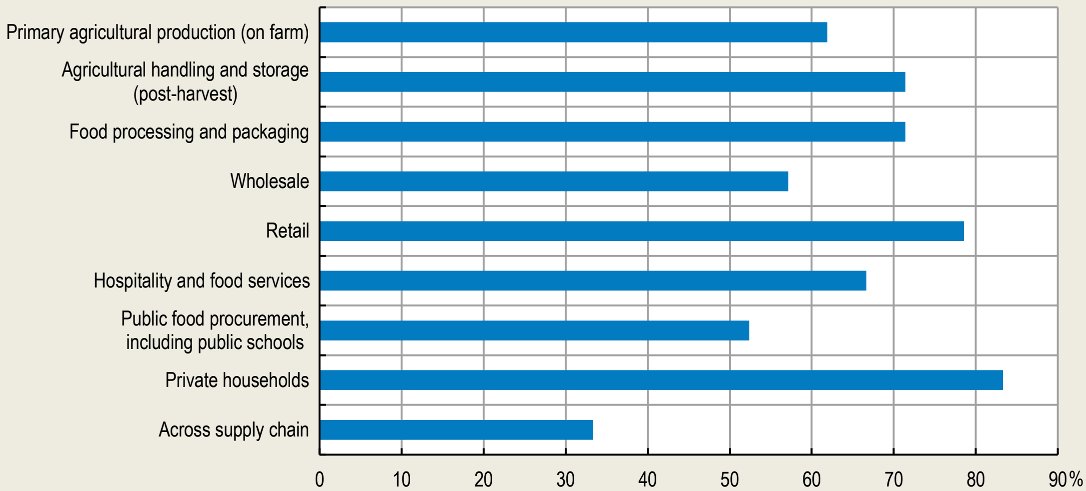
In 2011, the FAO published first estimates on food loss and waste (FLW) which showed that around 30% of all food produced is either lost or wasted (FAO, 2011[14]). Since then, the need to reduce FLW has received significant international policy attention. Countries are committed to the 2030 SDG agenda that was adopted in 2015. Some countries have set FLW reduction targets that are more ambitious than those under their global commitments. For example, France has committed to halving FLW across all supply chains by 2030 and to achieving a 50% reduction in distribution and collective catering by 2025, extending to all stages by 2030.

Recent quantitative analysis undertaken by the OECD confirms that reducing FLW is a key policy lever to address the triple challenge of feeding a growing population, ensuring the livelihood of rural households, reducing GHG emissions and fulfilling sustainability commitments. It shows that achieving SDG 12.3 could reduce agricultural GHG emissions by 4% and lift 137 million people out of hunger by 2030.[1] However, the analysis also identifies a potential loss in agricultural income due to reduced food demand, highlighting the need for policy makers to balance the associated benefits and costs when implementing their national FLW reduction strategies (Nenert et al., 2025[15]).

Efforts to reduce FLW have intensified since 2015, including the introduction of national FLW strategies. In many countries, multiple policy instruments are being used to address FLW, with the household and retail stages receiving the highest level of policy attention (Figure 1.7) through the implementation of soft policy instruments, such as awareness-raising campaigns and voluntary collaboration initiatives. However, unclear reduction targets, which often do not specify delivery dates and baseline levels, and the multiplication of policy initiatives could discourage compliance and commitment from stakeholders across the food supply chain.

Few countries conduct regular and dedicated evaluations of the impact of FLW policies, making it difficult to identify and scale up effective policy initiatives to maximise benefits for food systems. Japan, for example, evaluates the impact of its FLW strategy and associated policy instruments across several dimensions. Consumer awareness and behaviour change are assessed through an annual household survey, while economic and environmental outcomes were assessed through an *ex post* evaluation in 2023.

Figure 1.7. Extent of policy attention across different agro-food chain stages



Note: Share of countries with a least one policy instrument for a given supply chain stage.
Source: OECD (2025[16]).

Note

1. This result is similar to that of the previous analysis published in the *2024 Outlook*, which estimated a reduction of 153 million people living in hunger as a consequence of halving FLW by 2030. The 16 million people difference between the latter and the results in this paper can be attributed to the implementation of the more refined cost structure of reducing FLW into the Aglink-Cosimo modelling framework and its effects on food demand.

1.3.3. Growing feed use is underpinned by herd expansions and increasing intensification of livestock and aquaculture production systems especially in middle-income countries

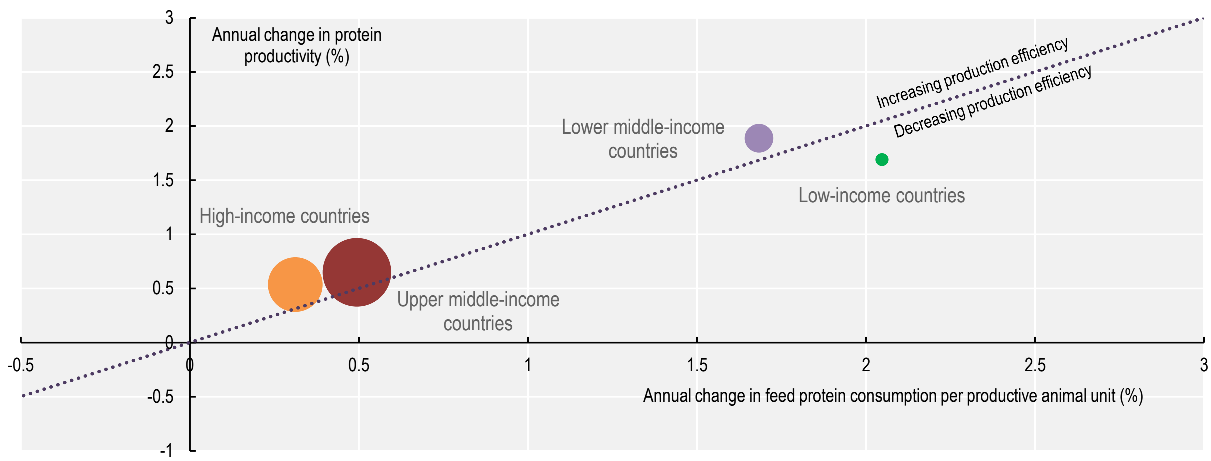
Over the projection period, total global inventories of cattle, sheep, pigs and poultry (aggregated in cattle-equivalent units) are projected to expand by 7%, whereas output of meat, dairy products and eggs (aggregated on a protein-basis) increases by 16.6%, indicating improvements in herd productivity. These trends are even more pronounced for lower middle-income countries, where livestock inventories are expected to increase by 10% and output by 43.6% by 2034. These continuing productivity improvements are supported by more intense feeding regimes, which, along with expanding animal herds, are projected to lead to a 15% increase in global feed consumption (on protein-equivalent basis).

Production efficiency varies globally due to differences in production technologies, livestock management and feeding practices and access to high-quality feed. Figure 1.8 shows the projected annual growth in feed protein consumption per productive animal unit compared to growth in productivity for non-ruminant livestock. This graph essentially depicts changes in feed protein input and animal protein output in pig and poultry production systems, with the diagonal line representing equal growth in both metrics. Points above the line indicate increasing efficiency, where animal protein production outpaces feed protein consumption, while points below the line indicate the opposite.

In lower middle-income countries, the shift towards more commercialized and feed-intensive production systems is expected to increase feed consumption per productive animal unit by 1.7% annually. This rate is nonetheless slower than the 2% growth in productivity, indicating improving total production efficiency in the non-ruminant livestock sector. A faster growth in the measured feed use intensity is projected for low-income countries indicating the continuing structural change from backyard to commercial operations thereby outweighing projected animal productivity growth. In upper middle- and high-income countries, the projected growth in feed use intensity is marginal and aligns more closely with developments in productivity. Advances in animal genetics, feed technology and a shift towards a higher proportion of poultry in the total livestock herd are leading to improvements in production efficiencies in these industrialized countries.

The projections highlight that ongoing adoption of sustainable practices and technologies is expected to further enhance livestock production efficiency globally. Innovations such as precision feeding, improved disease management, use of food waste as livestock feed, and optimised breeding programs are likely to contribute to more efficient use of resources and better overall productivity. These advances will play an important role in meeting the growing global demand for animal protein while minimising their environmental impact.

Figure 1.8. Annual changes in protein output and feed protein consumption in non-ruminant livestock systems



Note: The size of the bubbles refers to the non-ruminant production (pig meat, poultry and eggs) in total protein during the base period 2022-24.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

StatLink https://stat.link/c9n43w

1.3.4. Middle-income countries lead the expansion in biofuel use of primary agricultural commodities

Biofuels are liquid transport fuels derived from biomass and are used mostly in blends with fossil fuels to reduce GHG emissions and increase energy security. The production of biofuels creates additional demand for agricultural commodities. Maize and sugar products make up most of the feedstock for ethanol, while biodiesel production relies mainly on vegetable oils and used cooking oils, but the precise ranking varies from one biofuel-producing country to another (Table 1.1).

Table 1.1. Biofuel production from major feedstock

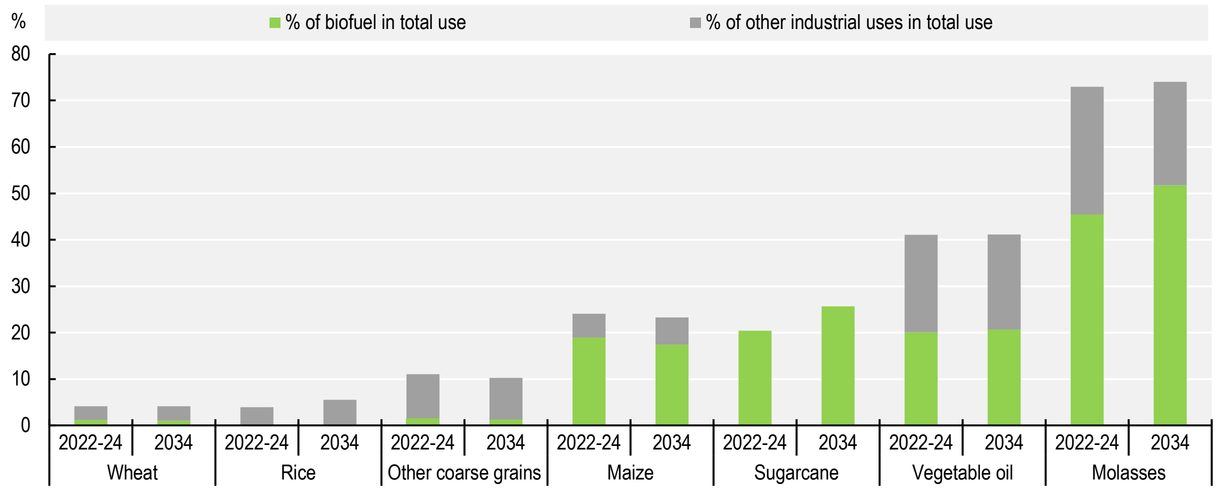
	Production #ranking in 2022-2024 (market shares)		Major feedstock used in base period 2022-2024	
	Ethanol	Biodiesel	Ethanol	Biodiesel
United States	#1 (45.7%)	#2 (22.3%)	Maize	Soybean oil, used cooking oils
European Union	#5 (5.3%)	#1 (29.3%)	Maize / wheat / sugar beet	Rapeseed oil / used cooking oils/palm oil
Brazil	#2 (25.3%)	#4 (11.7%)	Sugarcane / maize / molasses	Soybean oil / used cooking oils
China	#3 (8.3%)	#5 (4.3%)	Maize / cassava	Used cooking oils
India	#5 (5.4%)	#15 (0.3%)	Sugarcanes / molasses / rice/maize / wheat	Used cooking oils
Canada	#6 (1.4%)	#12 (0.9%)	Maize / wheat	Canola oil / used cooking oils / soybean oil
Indonesia	#19 (0.1%)	#3 (18.5%)	Molasses	Palm oil
Argentina	#8 (1%)	#8 (2.2%)	Maize / sugarcane / molasses	Soybean oil
Thailand	#7 (1.1%)	#7 (2.4%)	Molasses / cassava / sugarcane	Palm oil
Colombia	#15 (0.3%)	#9 (1.2%)	Sugarcane	Palm oil

Notes: #numbers refer to country ranking in global production; percentages refer to the production share of countries in the base period.
In the *OECD-FAO Agricultural Outlook 2025-2034*, biodiesel includes renewable diesel (also known as Hydrotreated Vegetable Oil or HVO), although these are different products.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Global demand for biofuel is projected to grow at an average 0.9% p.a., driven by increasing transport fuel demand and supportive domestic policies. Over the coming years, most biofuel consumption growth is projected to come from middle-income countries, particularly Brazil and India for ethanol, and Indonesia for biodiesel.

As biofuel demand continues to rise, the range of production methods utilising non-food biomass may change the use of key feedstock commodities (Figure 1.9). In the United States, a significant increase in the demand for vegetable oil and waste-based biofuels over the next decade may increase the supply of renewable diesel. However, concerns about fraud, particularly with biodiesel feedstock imports being falsely declared as waste-based, suggest that the United States may eventually impose restrictions on imports of these products. Furthermore, growth in biofuel use could come from sustainable aviation fuels (SAF), but their share remains insignificant in this baseline.

Figure 1.9. Share of biofuel and other industrial uses in total use of agricultural commodities



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

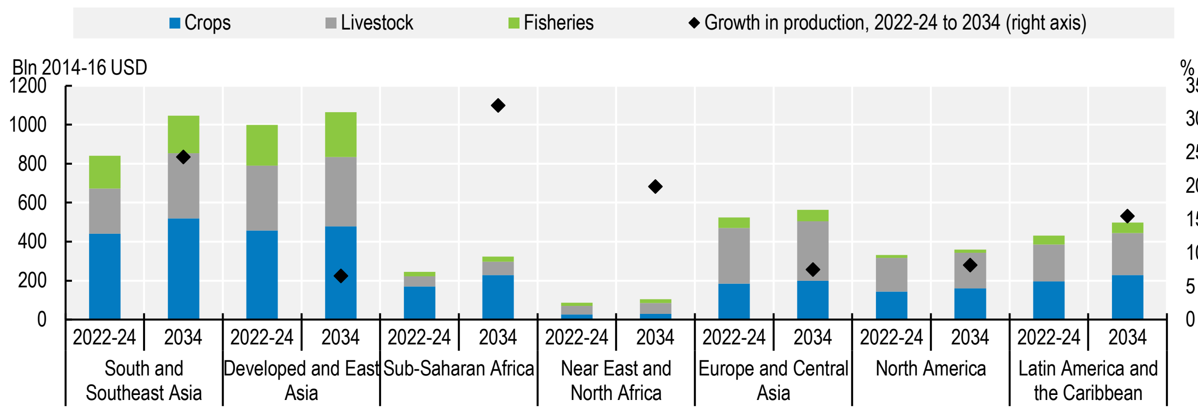
1.4. Production: Projected evolution for 2025-2034

1.4.1. Growing consumption and shifting dietary preferences towards animal-source foods are expected to drive investments in livestock and aquaculture and increase production

Over the next decade, the gross value of global agricultural production (measured in constant USD) is projected to increase by 14% to 3.96 trillion USD in 2034. Livestock production is expected to lead this growth with a 16% increase, followed by crops at 14%, and fish and other aquatic foods at 12%. Middle-income countries in the Developed and East Asia, South and Southeast Asia, Sub-Saharan Africa and Latin America and the Caribbean regions are expected to remain the primary sources of global agricultural expansion (Figure 1.10), contributing 83% of global output growth, up from 79% in the previous decade.

The Asia Pacific region comprises the Developed and East Asia, which includes China, and the South and Southeast Asia sub-region, which includes India. The whole Asia Pacific region is particularly crucial for future global agricultural production and is projected to contribute 54% of additional global output. India is expected to lead the growth in Asia Pacific, accounting for 40% of the region's increase, followed by China, which, despite a declining role, will still contribute significantly. A sizeable share of global agricultural output growth is also expected from Latin America and the Caribbean, although its significance will moderate. In Sub-Saharan Africa and the Near East and North Africa regions, significant production growth is anticipated, increasing their combined share of additional global output to 19%, up from 13% in the previous decade. Production growth prospects in the industrialised regions of North America and Europe and Central Asia are expected to be limited growth potential due to resource constraints and regulations, with growth in the latter mainly driven by countries in Eastern Europe and Central Asia.

Figure 1.10. Trends in global agricultural production



Note: Values are measured at constant USD of the period 2014-2016.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

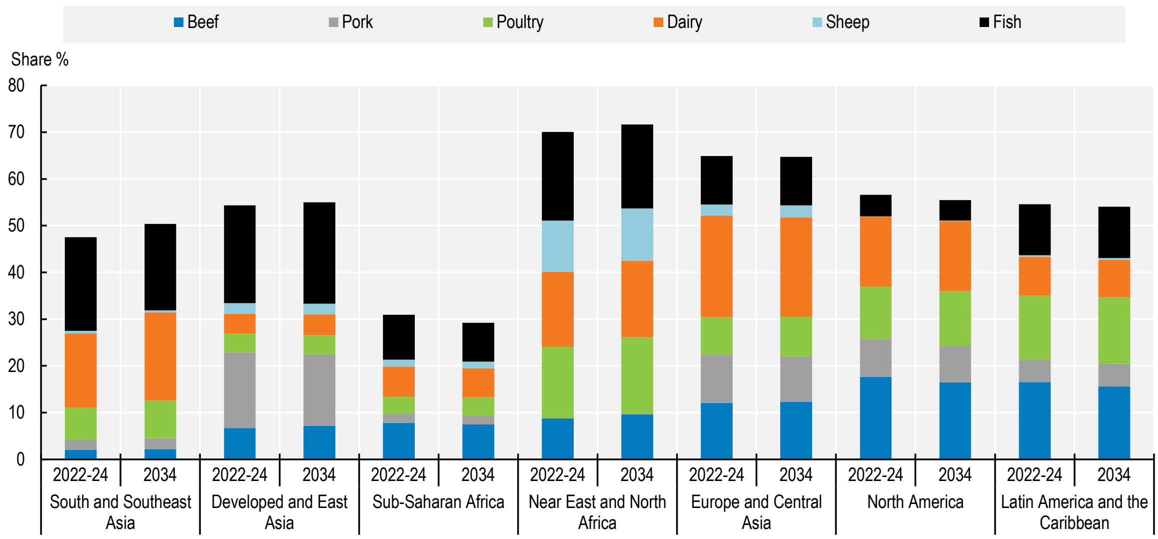
The share of livestock in total agricultural production is projected to increase in the middle-income countries of Asia and the Near East and North Africa (Figure 1.11). Higher domestic demand for animal proteins due to rising incomes and populations in these regions, along with export opportunities, is expected to attract increased investments in the livestock and fish sectors, boosting production. Even in regions such as Latin America and the Caribbean and Sub-Saharan Africa, where the share of livestock production is stable or slightly declining, strong overall production growth will mean increased livestock production over the next decade.

China, which is driving the developments in the Developed and East Asia region, is expected to maintain its current share of livestock production in total agricultural production. In contrast, India, which is driving the developments in the South and Southeast Asia region, is projected to increase its share of livestock in total agricultural production significantly, underpinned by substantial increases of fish, poultry and dairy production by 2034. Although crops currently dominate agricultural output in Sub-Saharan Africa, a significant overall production increase of 29% in the livestock sector is projected by 2034, with poultry, beef, and dairy sectors contributing the largest volumes. In the Near East and North Africa, poultry and dairy are expected to be the primary growth leaders.

In almost all regions, the share of fish and aquaculture in total agricultural production is slightly declining. Although the total volume continues to grow, a significant slowdown in fish and aquaculture production is projected due to diminishing productivity gains globally, stemming from stricter environmental regulations and reduced availability of optimal production sites.

Despite continued growth in livestock and aquaculture production in middle-income countries in Asia, Latin America and the Caribbean, and Africa, their growth potential is constrained because producers face limited access to advanced production technologies and receive fewer incentives due to low market prices, high input costs, and regulatory barriers. Addressing these challenges sustainably is crucial for realising the full growth potential of the livestock and aquaculture sectors in these regions.

Figure 1.11. Share of animal production in total agricultural production



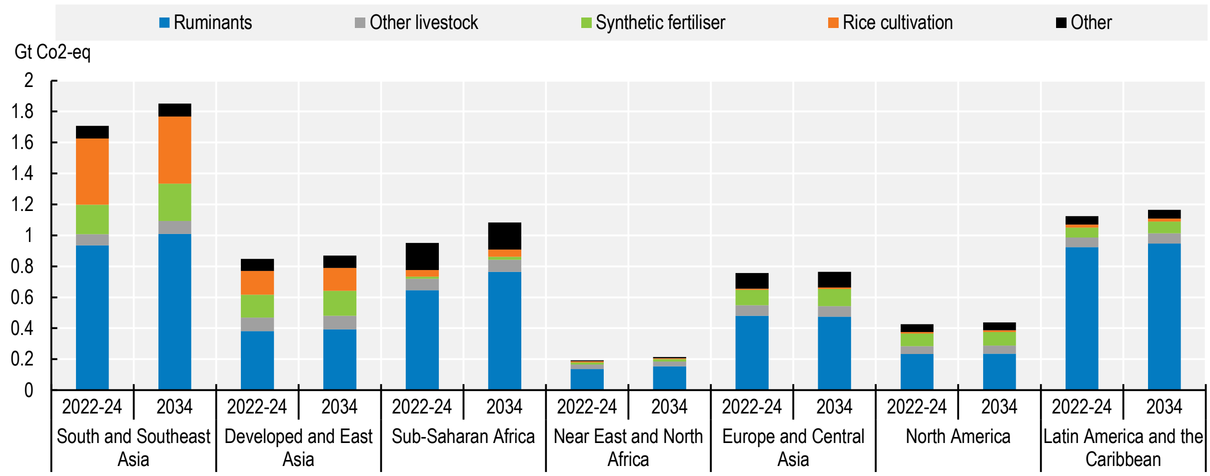
Note: Shares in animal production are based on production values measured at constant USD of the period 2014-16.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

1.4.2. Rising global agricultural and fish production, along with a shift towards higher animal production, is set to increase agricultural GHG emissions

Agriculture, forestry, and other land use (AFOLU) account for approximately 22% of global anthropogenic GHG emissions. These emissions are evenly split between direct on-farm emissions of methane and nitrous oxide, and indirect CO_2 emissions from land use, land use change, and forestry (LULUCF) due to agricultural expansion. The *Outlook* focuses solely on the direct emissions associated with on-farm production and projects them based on historical data from FAOSTAT, following the Intergovernmental Panel on Climate Change (IPCC) Tier 1 approach. This basic method applies emission factors to activities such as herd sizes, synthetic fertiliser application, rice cultivation per hectare, among others. While higher-tier methods that account for management practices would provide more precise estimates, they are beyond the scope of this *Outlook*.

Using this basic approach, the *Outlook* shows that the projected overall expansion of global agricultural and fish production, which will be partly based on growth in animal herds and croplands, particularly in middle-income countries, will increase direct GHG emissions over the next decade. Most of the projected increase is expected to occur in South Asia and Sub-Saharan Africa, where ruminant herds are expanding (Figure 1.12). By 2034, direct GHG emissions from agriculture in Sub-Saharan Africa and South and Southeast Asia are projected to increase by 14% and 8%, respectively. In contrast, emissions in industrialised Asia, North America and Europe and Central Asia will increase only marginally as ruminant production stagnates.

Figure 1.12. Direct GHG emissions from crop and livestock production by activity



Note: Estimates are based on historical time series from the FAOSTAT Climate Change: Agrifood systems emissions databases which are extended with the Outlook database.CO2 equivalents are calculated using the global warming potential of each gas as reported in the IPCC Sixth Assessment Report (AR6). Emission types that are not related to any Outlook variable (organic soil cultivation and burning savannahs) are kept constant at their latest available value. The category 'Other' includes direct GHG emissions from burning crop residues, burning savanna, crop residues, and cultivation of organic soils.
Source: FAOSTAT Emissions-Agriculture Database, http://www.fao.org/faostat/en/#data/GT, accessed December 2024; OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Sub-Saharan Africa has a population more than three times larger than that of North America and currently has over three times the beef cattle herd. However, its productivity, measures as output per animal, is only about one-tenth as high. Given the global impact of GHG emissions, prioritising low-yield regions for emission reduction efforts in the agriculture sector could bring substantial benefits. By reorienting ruminant farming and increasing productivity, fewer ruminants would be needed to produce the same or greater amount of animal protein, thereby reducing methane emissions from enteric fermentation and manure management. Such efforts would also improve livelihoods for rural communities where most ruminants are held. It should be emphasised that while cattle production in these regions is emission-intensive, the higher agricultural consumption in industrialised economies, particularly of livestock products, also contributes significantly to global direct agricultural GHG emissions. Therefore, addressing emissions requires a balanced approach that considers both production and consumption patterns globally.

Ruminants and other livestock production will account for about 70% of the projected global increase in direct agricultural GHG emissions, while synthetic fertilisers, another significant source of GHG emissions due to nitrous oxide release during fertilisation, are expected to contribute 28%. The *Outlook* does not account for GHG emissions from fertiliser production but including them would double their reported environmental footprint. Rice cultivation is another major source of direct agricultural GHG emissions as irrigated paddy fields emit substantial quantities of methane. However, the projected increase in rice production is expected to result mainly from yield improvements rather than expansion of paddy areas, thereby curbing emissions from rice cultivation.

It is important to note that while direct GHG emissions are a crucial component of AFOLU's environmental footprint, they are not the only factor. Incorporating other factors into the sustainability metrics, such as the sector's impact on water resources, soil health and biodiversity, and its ability to sequester carbon, and promote environmental resilience, would contribute to a more comprehensive understanding of agri-environmental issues. Such an approach would support analyses of broad-based policy options to address and improve the sector's environmental footprint beyond just focusing on GHG emissions.

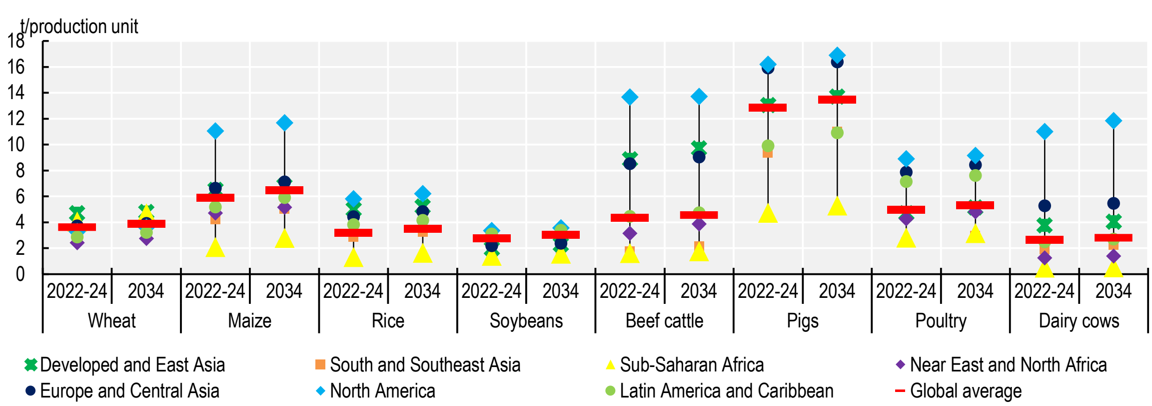
1.4.3. Global agricultural growth will be driven by productivity gains, reducing the carbon intensity of the sector, but large productivity gaps will remain

Assuming a continued transition to more intensive production systems in low- and middle-income economies, the projections show that 83% of global crop production growth will be attributable to yield improvements. Similarly, a considerable proportion of growth in livestock and fish production is expected to result from productivity gains, although herd expansions will also play a significant role. Gradual adoption of better breeding techniques, improved farm management practices, increased use of inputs such as fertilisers and chemicals, and improved access to veterinary services for livestock are anticipated to progressively increase agricultural productivity in low- and middle-income countries.

Given that production growth will largely be driven by productivity improvements rather than expansions in cultivated land and livestock herds, the carbon intensity of agricultural production is projected to decline across all regions over the coming decade. Sub-Saharan Africa and South Asia are expected to experience the most substantial decreases in GHG emissions intensity, the emissions produced per unit of output or activity, in spite of increasing levels of direct GHG emissions. This is because it is generally easier to reduce emissions in initially more emissions-intensive production systems than in regions where yields are higher and the marginal gains from reducing emissions are lower.

Despite the projected growth in agricultural productivity in many low- and middle-income countries, significant disparities relative to industrialised countries continue to exist. Figure 1.12 shows variations in yields across regions for selected crop commodities. Livestock and crop commodities such as maize and rice exhibit the widest spread in yields, due to differences in technologies and greater yield potential for these commodities. The *Outlook* does not project any significant changes in the distribution of yields over the next decade as shown in Figure 1.13.

Figure 1.13. Change in projected yields for selected commodities, 2022-24 to 2034



Note: Productivity is measured as tonnes of grain per area harvested for crops, tonnes of milk per cow for dairy, tonnes of meat per 100 productive animals for beef and pork, and tonnes of meat per 1 000 productive hens for poultry. Each symbol represents the average yield for a given commodity within a region. The red lines correspond to the global average per commodity.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

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While these disparities can be partly attributed to differences in agro-ecological conditions, gaps in access to finance, modern farming technologies, skilled labour and use of agronomic inputs are major contributing factors. To meet future food demand without increasing herd sizes, croplands and consequently agricultural GHG emissions, one potential pathway is to narrow existing technology gaps on currently reared herds and cultivated agricultural land, or more broadly, the sustainable intensification of agricultural systems. The FAO's Hand-in-Hand initiative discussed in Box 1.4 is an evidence-based, country-owned and led initiative to accelerate agricultural transformation with the goal of eradicating poverty, ending hunger and malnutrition, and reducing inequalities.

Box 1.4. The Hand-in-Hand Initiative: Transforming Agrifood Systems

The FAO Hand-in-Hand Initiative (HIH), launched in 2019, is designed to accelerate at-scale agri-food systems transformation and rural development by fostering targeted investments and partnerships. HIH encourages partnerships between its member governments and investors, creating national and regional investment opportunities. At the annual HIH Investment Forum, governments can present their agrifood investment priorities to drive food systems transformation in their countries.

Boosting agricultural productivity and reducing poverty and food insecurity

The HIH Initiative prioritises the world's most vulnerable regions, targeting investments where agricultural productivity and rural economies are weakest. HIH leverages advanced analytics and geospatial data to determine the areas where interventions will have the highest impact, ensuring that resources reach the communities most in need. The *OECD-FAO Agricultural Outlook* can serve as a guide in this process, providing economic projections and policy insights and identifying potential areas for action to support informed decision-making.

To increase productivity sustainably, the initiative promotes climate-smart agriculture, improved irrigation systems, and sustainable land management. These efforts ensure that technology gaps are addressed, enabling sustainable, locally driven solutions that contribute to long-term economic and environmental resilience. Some notable examples of productivity-enhancing projects include the following:

- In Ethiopia, the initiative supports investments in high-potential agricultural areas such as the Bulbula Agro-Commodity Procurement Zones in Eastern Oromia, where investments in fertilisers, seed varieties, and agricultural machinery are expected to significantly boost wheat production and marketing (FAO, 2022[17]).
- In Guatemala, territorial typologies developed through the HIH initiative have been integrated into the national public investment system and are now part of the government planning framework used to analyse all public investments, including the allocation of funds for irrigation and road infrastructure (FAO, 2024[18]).
- The HIH Southern Africa investment plan, valued at nearly USD 553 million, focuses on irrigation systems to expand agro-industrialisation and mechanisation, and to enhance market trade integration (FAO, 2024[19]).

Strengthening rural economies and market access

The HIH Initiative acknowledges the significance of economic development in rural areas. Mobilizing public-private partnerships, it strengthens agricultural value chains from production to processing and distribution. The *OECD-FAO Agricultural Outlook* complements this effort by providing forecasts on global growth patterns, helping policy makers align their agricultural strategies with global markets.

Promoting resilience and sustainability

Investments in renewable energy, agroforestry, and sustainable livestock management contribute to long-term sustainability. Efficient water and resource management are also priorities. Through soil conservation, reforestation efforts, and optimised irrigation techniques the initiative ensures productivity without depleting natural resources (FAO, 2024[20]).

A potential game-changer for global agriculture

When implemented by governments and partners including the private sector, banks, impact funds, global international financial institutions and international development partners, the HIH Initiative has the potential to reshape the future of global agrifood systems, making it more inclusive, productive and sustainable for future generations.

1.5. Scenario analysis: Achieving emission reduction and Zero-Hunger?

1.5.1. What are emission reduction technologies?

The agricultural sector is recognised not only as a contributor to Greenhouse gas (GHG) emissions but also as a potential source of solutions. GHG emissions from agriculture, primarily methane (CH_4), nitrous oxide (N_2O), and carbon dioxide (CO_2), arise from a wide range of activities, including enteric fermentation in livestock, manure management, rice cultivation, fertiliser application, and land-use changes. As global food demand continues to rise, the challenge lies in reducing the environmental impact of agricultural production while simultaneously ensuring food security (Section 1.4.2).

The 2024 *Outlook* report (OECD/FAO, 2024[21]) featured a stylised scenario that simulated the impact of halving food losses along supply chains and reducing food waste at the retail and consumer levels by 2030, in line with Sustainable Development Goal 12.3. The scenario projected a potential 4% reduction in global agricultural GHG emissions by 2030, with this reduction occurring fairly evenly across countries regardless of income level. It also anticipated a decrease in food prices, leading to increased food intakes in low-income countries (+10%) and lower-middle-income countries (+6%), ultimately reducing the number of undernourished people by 153 million (−26%) by 2030.

This year's *Outlook* explores an additional pathway for reducing the environmental impact of agricultural production while eradicating undernourishment globally, focusing on the large-scale adoption of emission reduction technologies (ERTs). In agriculture, ERTs encompass a broad range of innovations, tools, and practices designed to lower GHG emissions from farming systems without compromising productivity. These include both biological and technical interventions that address the main emission sources in crop and livestock systems. The following paragraphs provide examples of such ERTs currently being developed or implemented to reduce GHG emissions while maintaining or enhancing agricultural productivity.

In the livestock sector, ERTs primarily aim to reduce enteric methane emissions, improve feed efficiency, and enhance manure management systems. Diet management plays a central role, with strategies such as optimised grazing to enhance pasture yield and quality, improved forage digestibility and precision ration balancing supported by artificial intelligence. These approaches improve feed conversion efficiency and lower methane production during digestion. Feed additives such as 3-NOP and Bovaer, which are already authorised for use in the European Union, have proven effective in reducing emissions from ruminants, though their application remains challenging in the predominantly pasture-based systems in low- and middle-income countries. The use of seaweed in ruminant diets offers further potential, although more research is needed to assess long-term impacts and scalability. Reproductive management, disease prevention and treatment, as well as selective breeding can also significantly reduce methane emissions by enhancing feed-to-emissions performance.

Technologies for improved manure management offer another important opportunity for reducing emissions. Anaerobic digesters capture methane from stored manure and convert it into renewable biogas. Other technologies, such as solid-liquid separation, covered storage tanks, and optimised methods of manure application, help reduce direct methane emissions and nitrogen losses. Low-emission application techniques, such as dribble bars, have been shown to significantly reduce ammonia volatilisation and associated indirect emissions. However, in spite of their technical potential, these technologies have seen limited adoption in many regions. Barriers to their adoption include high upfront investment costs, inadequate infrastructure, and a lack of enabling policy frameworks or financial incentives. Consequently, farmers often lack the means or motivation to implement such practices, especially in areas with restricted access to credit or advisory services.

In crop production, ERTs focus on improving nutrient use efficiency, minimising soil disturbance, and enhancing soil carbon sequestration. Precision agriculture offers significant opportunities in this context, enabling the targeted application of inputs using GPS-guided equipment, real-time sensors and machine learning. Fertilisers and pesticides can be applied more accurately, reducing nitrous oxide emissions and limiting environmental runoff. Proper timing and methods of input application are also essential. Better synchronisation of fertiliser and manure use with crop nutrient demand, alongside the application of nitrification inhibitors and variable rate technologies, can substantially reduce emissions and nutrient losses.

In addition to input management, various soil and landscape practices contribute to emissions mitigation and carbon storage. Conservation tillage and no-till farming help retain soil organic carbon, while the use of winter cover crops and buffer strips reduces erosion and nitrogen leaching. In wetland areas, restoring peatlands and rewetting organic soils present high-impact opportunities for long-term carbon sequestration. Other innovative solutions, such as agrivoltaics, are being explored to integrate solar energy production with agricultural use.

Despite the broad range of available technologies, adoption remains limited, particularly in low- and middle-income countries. Obstacles include high initial costs, limited access to finance, insufficient policy incentives, and a general lack of awareness or technical support. In these countries, promoting low-cost, locally adapted practices—such as integrated nutrient and water management, organic matter recycling, agroforestry, and improved rotations—offers multiple co-benefits and serves as a practical entry point where access to capital-intensive solutions is limited.

1.5.2. Implementing emission reduction technologies in the Aglink-Cosimo model

As explained in Section 1.4.2, the *Outlook* focuses exclusively on direct GHG emissions from on-farm production. GHG emissions at historical periods are taken from FAOSTAT data, then projected using the IPCC's Tier 1 guidelines. In the baseline scenario, emissions are calculated by applying commodity-specific emission factors to a set of direct production activities, including enteric fermentation, manure management, rice cultivation, synthetic fertiliser application, manure applied to soils and manure left on pasture.

While more detailed (higher tier) reporting would enable more accurate emission estimates, the lack of the necessary data at the global level currently limits the scope for modelling how producers might adopt ERTs. Consequently, to assess the potential impact of ERTs in global agriculture through scenario analysis using the Aglink-Cosimo model, alternative approaches have been developed to incorporate supply-side mitigation dynamics.

Reducing emissions through the implementation of ERTs, while maintaining production levels, requires producers to make additional investments which can sometimes be substantial. The relationship between the cost of implementation and the amount of emissions reduced varies by region and type of farming activity. These relationships are normally captured through marginal abatement cost curves (MACCs), which represent the cost-effectiveness of different mitigation options.

The MACCs used in this analysis are derived from the Global Biosphere Management Model (GLOBIOM), developed by the International Institute for Applied Systems Analysis (IIASA) (IIASA, 2023[22]). GLOBIOM explores how agricultural and land use decisions affect GHG emission levels. Incorporating this information into Aglink-Cosimo allows the model to simulate how farmers might respond to financial incentives that make emissions more expensive. In such cases, producers are expected to adopt more efficient practices, such as improved feed, better livestock genetics, or upgraded equipment to reduce emissions without compromising output.

In practice, the emissions coefficient is the key variable adjusted in this scenario to reflect the possible reduction in emission intensity. These reductions represent the adoption of cleaner technologies and more efficient production systems. In the Aglink-Cosimo, this is implemented through emission coefficients that differ from the baseline, consistent with expected technological progress and structural change, though the underlying processes are not explicitly tracked due to the model's partial equilibrium structure. The GLOBIOM model provides the marginal abatement cost, modelled by a carbon price of USD 60 per tonne of CO_2 equivalent. This serves as a proxy to connect the updated emission coefficients with the associated production costs. In Aglink-Cosimo, this cost is applied on top of the other production costs, assuming producers bear the full burden.

1.5.3. Emission reduction technologies require lower productivity increases to achieve the Zero Hunger target in a sustainable manner

The scenario developed in the 2022 edition of the O*ECD-FAO Agricultural Outlook* (OECD/FAO, 2022[23]) outlined a pathway to end global hunger by 2030 while maintaining GHG emissions from agriculture within the emission envelopes consistent with limiting global warming to 1.5–2°C. The analysis assumed accelerated investment in agricultural productivity and improved market access, coupled with targeted support for low-income and food-insecure regions.

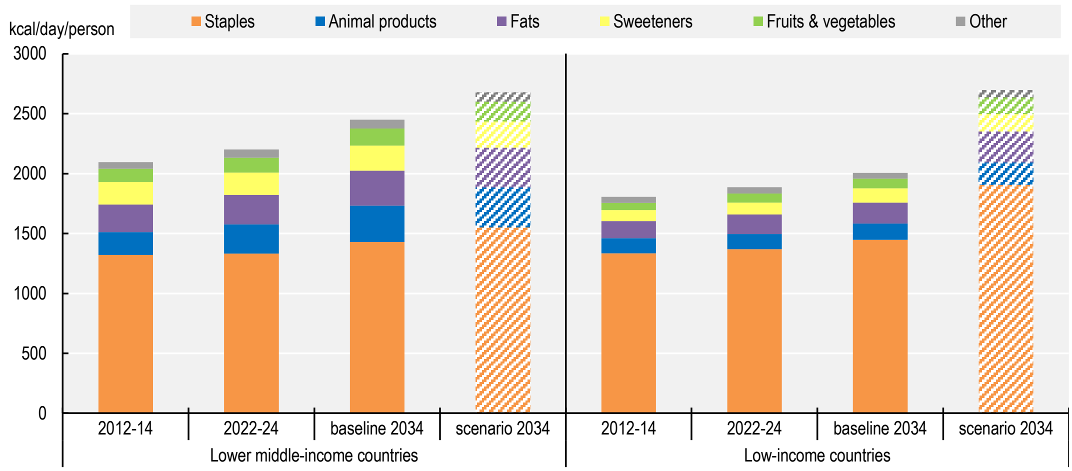
To meet these dual objectives, the 2022 scenario required a 28% increase in global agricultural productivity over the next decade, three times larger than what would be achieved under the projected baseline trend. This productivity gain was necessary to meet rising food demand, particularly in sub-Saharan Africa and South Asia, while avoiding the need to expand agricultural land use, a key driver of GHG emissions. Although the approach focused on increasing productivity, it did not consider the widespread adoption of ERTs on the production side.

Building on the 2022 scenario, this *Outlook* introduces an updated scenario analysis incorporating ERTs that can mitigate GHG emissions from agricultural production, aligned with the marginal abatement cost under a hypothetical carbon price of USD 60 per tonne of CO_2 equivalent. The integration of mitigation technologies significantly alters the production-side requirements for meeting the dual targets. With widespread adoption of these ERTs, the overall productivity increase required to sufficiently increase food availability across all household income groups to achieve Zero Hunger[6] and support a 7% reduction of GHG emission from the 2022-24 base period drops from 28% to 15% globally by 2034.[7]

The Zero Hunger target is reached by increasing average per capita income to the level sufficient to lower the Prevalence of Undernourishment (PoU) below the 2.5% threshold in all countries where it is projected above that level in the baseline. Food consumption in food-secure countries is assumed to remain as in the baseline. In lower-middle income countries, the necessary increase in average calorie intake to alleviate hunger is estimated at 10% between the baseline and the scenario. In low-income countries a 35% rise would be required. These assumptions are depicted in Figure 1.14.

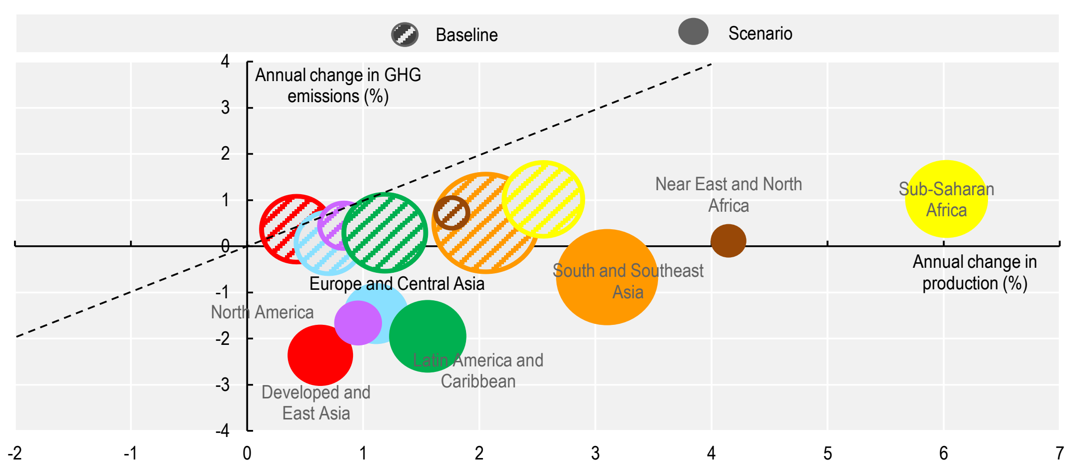
To achieve the Zero Hunger target, without assuming significant reductions in the inequality of access to food, a 10% increase in food production is necessary, especially in low- and lower-middle-income countries. To reduce the emissions from this additional production in order to achieve the targeted 7% reduction in global direct GHG emissions from on-farm production relative to current levels, productivity improvements and the widespread adoption of ERTs are needed. Figure 1.15 illustrates that the relative importance of these developments varies by region.

Figure 1.14. Average per capita food intake of main food groups (calorie equivalent) by country income group



Note: Estimates are based on historical food supply time series from the FAOSTAT Food Balance Sheets database which are extended with the Outlook database and adjusted to account for estimated distributional and household wastes. Products not covered in the Outlook are extended by trends. Staples include cereals, roots and tubers and pulses. Animal products include meat, dairy products (excluding butter), eggs and fish. Fats include butter and vegetable oil. Sweeteners include sugar and HFCS. The category 'Other' includes other crop and animal products.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Figure 1.15. Growth in agricultural production and GHG emissions 2022-24 to 2034, baseline versus scenario



Note: This figure shows projected annual growth in direct GHG emissions from agriculture together with annual growth in the estimated net value of production of crop and livestock commodities covered in the Outlook (measured in constant USD 2014-16 prices). The size of the bubbles corresponds to the level of agricultural GHG emissions in 2034. Estimates are based on historical time series from the FAOSTAT Climate Change: Agrifood systems emissions databases which are extended with the Outlook database. CO2 equivalents are calculated using the global warming potential of each gas as reported in the IPCC Sixth Assessment Report (AR6). Emission types that are not related to any Outlook variable (organic soil cultivation and burning savannahs) are kept constant at their latest available value. The category 'Other' includes direct GHG emissions from burning crop residues, burning savanna, crop residues, and cultivation of organic soils. The net value of production uses own estimates for internal seed and feed use.
Source: FAOSTAT Emissions-Agriculture and Value of Agricultural Production databases, http://www.fao.org/faostat/en/#data, accessed January 2025; OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

StatLink https://stat.link/ginytc

In regions comprising a high share of low-income countries (Sub-Saharan Africa, Near East and North Africa, and South-East Asia), the increase in production dominates. This is particularly evident in Africa, where GHG emissions continue to rise under the scenario compared to the current situation. The main reason is that meeting the Zero Hunger target in these regions requires a significant increase in production.

In contrast, in more food-secure regions (Europe and Central Asia, North America, Latin America and Caribbean, and Developed and East Asia), the effects of productivity gains and the adoption of ERTs are more prominent. This leads to an absolute reduction in GHG emissions.

1.6. Trade: Projected evolution for 2025-2034

1.6.1. Trade flows between exporting and importing regions to grow

Following the WTO Agreement on Agriculture in January 1995 and China's accession to the WTO in December 2001, trade in agri-food commodities experienced significant growth. The proportion of production traded for commodities covered in the *Outlook* increased from 16% in 2000 to 23% in the base period of 2022-24, reflecting a trade sector growing at a faster rate than agricultural production.

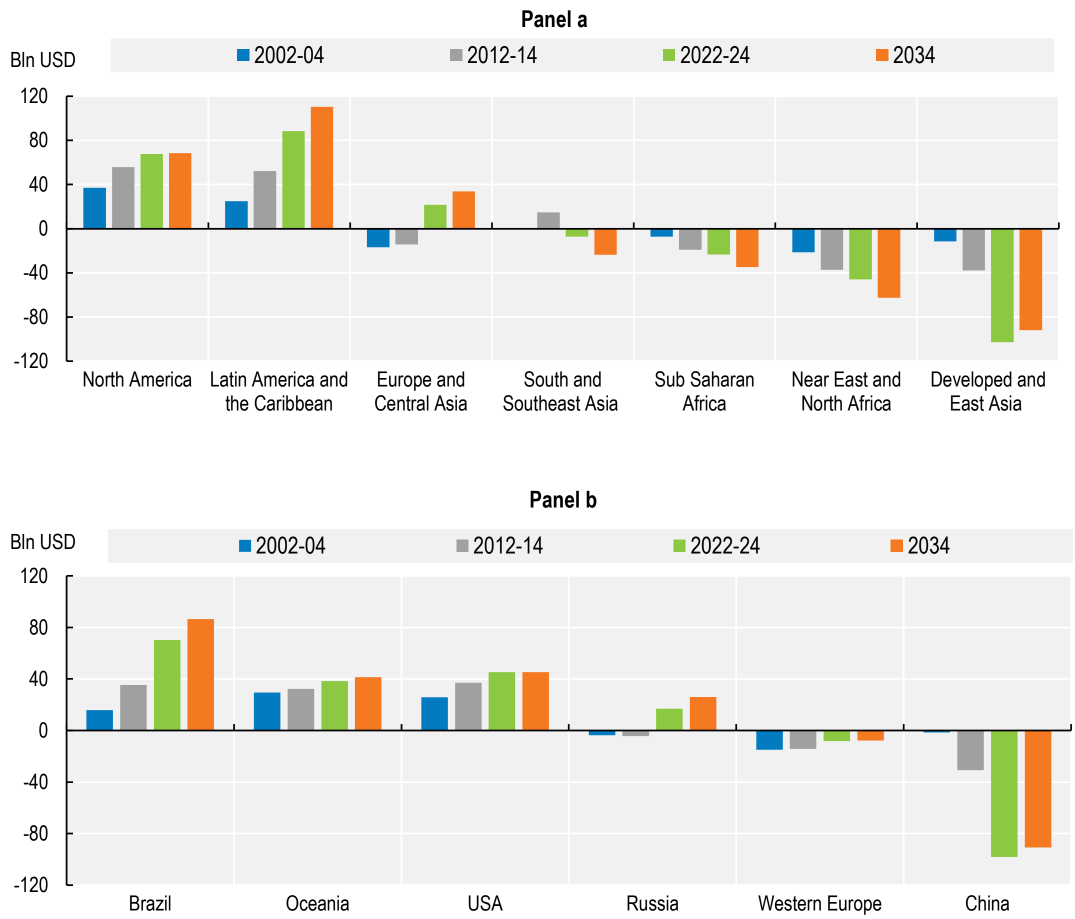
The global agri-food trade has also demonstrated remarkable resilience over the past several years despite facing numerous disruptions. The COVID-19 pandemic, geopolitical conflicts, trade protectionism, and supply chain bottlenecks have all posed significant challenges. Yet the sector has managed to adapt and continue functioning, highlighting its robustness and resilience. However, since 2019, the share of production traded has stabilised, fluctuating between 22% and 23%.

Given that agricultural production is often geographically separated from the regions where food and feed demand are projected to grow the most, well-functioning multilateral cooperation and a rules-based trading system remain essential. These mechanisms ensure that food can be efficiently distributed from surplus to deficit regions, thereby supporting global food security and rural livelihoods. Assuming international agricultural commodity markets remain well-functioning, the *Outloo*k projects that the share of consumed calories crossing international borders will stabilise at around 22%. This projection underscores the continued importance of international trade for the growth of the global agri-food sector and highlights the necessity of maintaining and strengthening current trade frameworks.

The increasing differentiation between agricultural commodity net-exporting and net-importing regions is expected to persist over the next decade (Figure 1.16). Net-exporting regions such as Latin America, North America, and Europe and Central Asia are anticipated to increase their surplus volumes. Key exporters in Latin America such as Brazil, Argentina, and Paraguay, have experienced substantial growth in exports over the past decade and are projected to continue generating surpluses, solidifying the region’s status as the world's leading agricultural exporter. North America is expected to maintain its position as the second-largest exporter, with agricultural net exports rebounding after falling from their peak in 2020 and stabilising at a lower level. The Europe and Central Asia region became a net exporter in 2014, following agricultural restructuring and development and resulting productivity improvements due to foreign and domestic investments in the Black Sea countries.

In contrast, regions with significant population growth and an expanding middle class are projected to see their net imports rise in proportion to their increasing consumption. In South and Southeast Asia, income-driven demand and population growth in the Philippines, Malaysia, India, Viet Nam, and Thailand have transformed the region from a net exporter a decade ago to a net importer in the base period. Over the medium term, countries such as the Islamic Republic of Iran, the Philippines, Indonesia, Malaysia, as well as least developed nations in the region will drive the region’s import demand. In Sub-Saharan Africa, where global agri-food markets are crucial for supporting the food security needs of its rapidly growing population, net imports of basic food commodities are projected to increase by 55% by 2034. Nevertheless, Africa is growing exporter of fruits (Box 1.5). In the Near East and North Africa region, imports are expected to expand while exports decline. Population growth and limited domestic production prospects stemming from resource constraints will contribute to an expected 34% increase in net imports by 2034.

Figure 1.16. Net agricultural trade of main agricultural commodities by region, in constant value



Note: Net trade (exports minus imports) of commodities covered in the Agricultural Outlook, measured in constant 2014-16 USD. Net trade figures include intra-regional trade but exclude intra-EU trade.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Box 1.5. The role of fruits in Africa

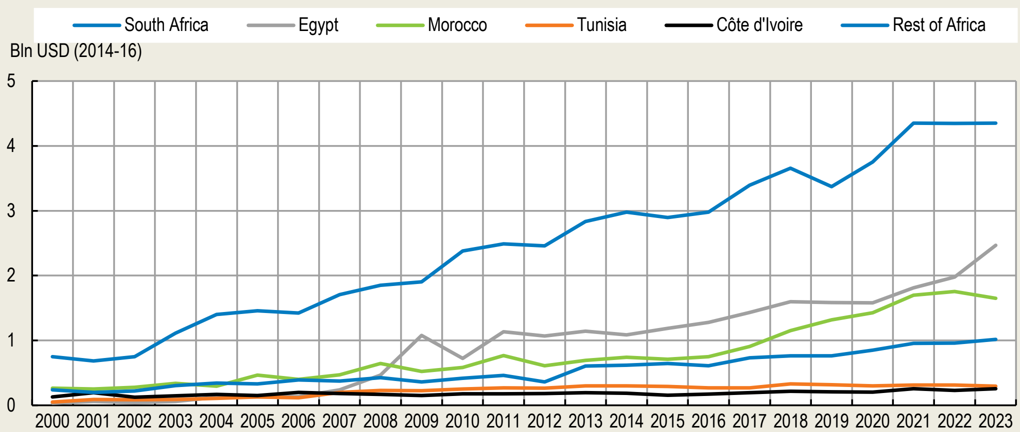
The fruit sector represents a critical source of nutrition and holds significant potential for income generation within an increasingly competitive global marketplace. The majority of fruit production in Africa is predominantly oriented towards domestic consumption. These fruits provide local populations a degree of access to essential micronutrients and dietary diversification albeit relatively limited, there has been a notable expansion in fruit trade in recent years.

Given the high economic returns per hectare associated with various fruit crops, sustainably developing this sector presents an opportunity to optimise the utilisation of the continent's limited resources and contribute to reducing Africa's trade deficit in essential food items. The sector can further strengthen food security by serving as a source of income for agricultural producers and improving household nutrition.

The most important fruits produced by both quantity and value are plantains and cooking bananas, which serve primarily as a staple due to their starchy qualities, followed by bananas. Leading fruit producing countries in Africa by production value include Algeria, South Africa, Egypt, Morocco and Nigeria.

Fruits traded within Africa vary substantially from those traded with external partners. Among African nations the most commonly traded fruits by value are apples, unspecified fruit juices, and bananas. In contrast, exports to non-African destinations are largely made up of citrus fruits and grapes, reflecting their higher unit values in export markets. This trend is driven almost entirely by an expansion in exports from South Africa, Egypt and Morocco, which have seen considerable growth over the past two decades (Figure 1.17).

Figure 1.17. Fruit exports from Africa



Source: FAOSTAT Trade Crops and livestock products database, http://www.fao.org/faostat/en/#data/TCL/, accessed April 2025.

Trends and prospects

According to the projections for banana and tropical fruit production detailed in Chapter 10 of this publication, the outlook for an increasing fruit production in Africa through 2034 is expected to be influenced by moderate expansion of cultivated area, coupled with persistently low productivity levels. Growth in consumption is expected to be only gradual due to limited income growth, environmental challenges, and geopolitical developments constraining consumer access and availability. The outlook for improved nutritional outcomes thereby appears uncertain.

Intra-African trade growth is expected to be facilitated by the African Continental Free Trade Area (AfCFTA) and the continuing trend of urbanization, which supports the development of formal values chains of fruits. In terms of market potential beyond the continent, South Africa is anticipated to continue benefiting from rising demand from the Near East, particularly Saudi Arabia and the United Arab Emirates (UAE), and increasingly also from markets in the Far East. Meanwhile, Morocco and Egypt are strategically positioned to meet the rising import demand from European markets. Growth is also expected for fruit exports from Kenya, in particular of avocados, in response to rising demand from world markets and investments into production expansion.

Key areas of development for further growth in the fruit sector across Africa include transportation infrastructure and cold chains maintenance. Challenges are particularly pronounced in landlocked countries, which face considerably greater difficulties in reaching international markets. Additionally, limited harvesting windows expose the sector to adverse weather risks further complicating production and marketing.

1.6.2. Trade plays a crucial role in enhancing food security, nutrition, and environmental sustainability

International agricultural trade plays a crucial role in balancing food deficits and surpluses across countries, stabilising food prices and providing consumers worldwide with more diverse and nutritious food. It also enables stakeholders across the agricultural and food industries to participate in global markets and agrifood value chains, thereby increasing their capacity to produce, earn income and purchase food.

In addition, by enabling the efficient exchange of products from regions with optimal production capabilities to areas of need and supported by environmental provisions and standards that promote sustainable agricultural practices in trade agreements, agricultural trade can promote more sustainable use of land, water, and other natural resources, reducing pressure on local ecosystems and lowering the sector's global carbon footprint. However, the net impact of international agri-food trade on the environment is uncertain as the relocation of production to regions with less stringent environmental standards and the transportation of agricultural goods over long distances can contribute to greater greenhouse gas emissions.

It is essential that the current trading framework evolves to ensure food security and improved nutrition for food deficit populations, while also being environmentally sustainable, so that the benefits of trade do not come at the expense of the natural environment. Box 1.6 summarises research on the link between trade, nutrition and environmental sustainability. While the social and economic dimensions are also critical to sustainability, they remain difficult to quantify or model. Addressing these challenges will require the development of new analytical approaches and methodologies which are not the scope of the Aglink-Cosimo model.

Box 1.6. The role of trade in enhancing food security, nutrition, and environmental sustainability

Trade is an integral part of agrifood systems, linking producers and consumers across the globe. It enables the movement of food from surplus to deficit regions, contributing to food security, stabilising prices, and diversifying diets.

International trade has played a key role in enabling this nutritional transformation. In 2023, the value of global food and agricultural trade had reached USD 1.9 trillion. The calories traded more than doubled between 2000 and 2023. The diversity of foods available for consumption has expanded significantly with countries now accessing an average of 225 food items—far more than the average 120 items produced domestically (FAO, 2024[24]). Trade thus allows countries with limited agroecological resources to complement their domestic production with nutritious food imports, supporting dietary quality and food security. Empirical analysis suggests that trade openness tends to reduce stunting in children under five, regardless of a country's income level.

However, trade can also contribute to increasing availability of energy-dense foods, high in fats, sugars and/or salt, although its effects on obesity are more heterogeneous and linked to national dietary patterns and food environments (FAO, 2024[24]). For strongly import-dependent countries, greater availability of ultra-processed foods through trade can accelerate shifts toward obesogenic diets.

Yet the environmental sustainability of the current trading model is not guaranteed. In low- and middle-income countries, rising incomes and shifting preferences are projected to increase the consumption of livestock and fish products over the next decade. At the same time, population growth will add pressure to meet higher aggregate protein demand. Livestock and aquaculture production are major contributors to greenhouse gas (GHG) emissions, and trade can amplify these impacts depending on where and how food is produced. However, emissions intensities vary significantly. As such, under certain conditions, trade can reduce global emissions by reallocating production to more efficient regions, particularly where transport-related emissions are relatively minor (Avetisyan, Hertel and Sampson, 2013[25]).

However, this outcome depends on several factors. Structural constraints, trade policies, and national preferences can prevent environmentally efficient trade flows from materialising. Moreover, trade openness can also drive resource-intensive production, deforestation, and biodiversity loss if sustainability safeguards are not in place (FAO, 2022[26]). The net effect of trade on the environment and nutrition is therefore context-dependent and often ambiguous.

Looking forward, policies that promote open and efficient global food markets, coupled with national regulations and sustainability standards, are essential. Regional trade agreements increasingly incorporate environmental provisions and promote voluntary certification schemes (FAO, 2022[26]). Aligning trade with environmental and nutrition goals will require investment in emissions-efficient production, better accounting of carbon footprints across value chains, and a nuanced understanding of when trade complements—or undermines—local food system resilience.

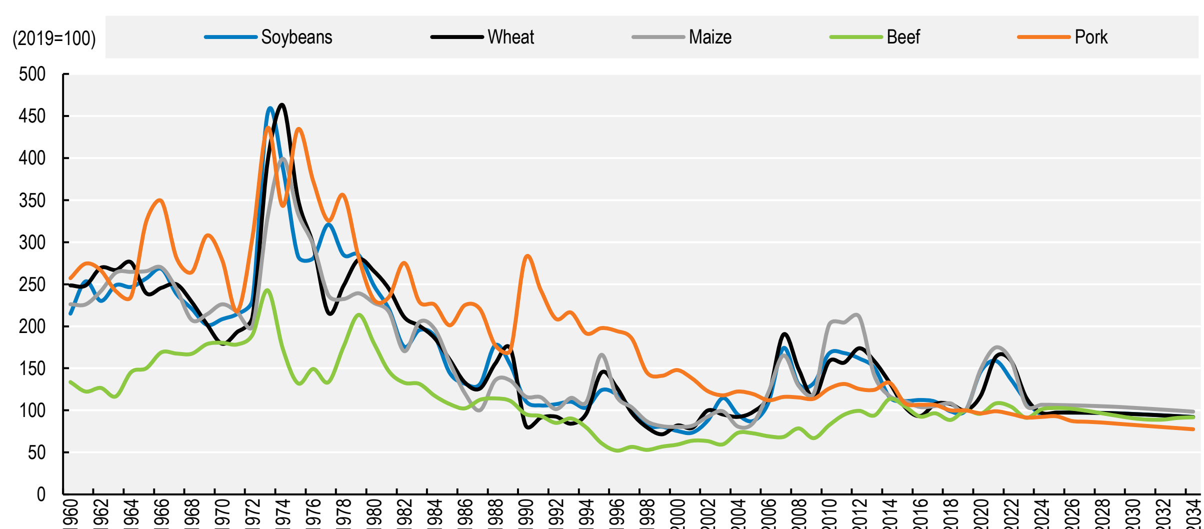
Note: Depending on FAO's Supply Utilization Accounts, food items refer to individual foods such as blueberries and potatoes or to broader aggregates such as frozen vegetables and chocolate products.

1.7. Prices: Projected evolution for 2025-2034

1.7.1. Continued long-term decline in real global agricultural commodity prices hinges on sustained investment in productivity improvements

The *Outlook* uses prices at key international ports as reference prices to clear global agricultural commodity markets. Real global agricultural commodity prices are projected to follow a long-term declining trend, consistent with the assumptions of ongoing productivity improvements and normal weather conditions, which are expected to lower the marginal cost of production for most agricultural commodities (Figure 1.18).

Figure 1.18. Long-term evolution of commodity prices, in real terms



Note: Historical data for soybeans, wheat, maize and beef from World Bank, "World Commodity Price Data" (1960-89). Historical data for pork from USDA QuickStats (1960-89).
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Sustained investments in biotechnology, mechanisation and precision agriculture to improve agricultural productivity are fundamental for realising the projected decline in real agricultural commodity prices. Without such investments, the sector may struggle to achieve the necessary productivity gains, potentially resulting in higher production costs and increased commodity prices.

It is also important to recognise that the actual impact of changes in international commodity prices on local producers and consumers varies significantly. Factors such as transport costs, local currency movements, trade policies, and the degree of integration of domestic markets into the global trading system determine whether and to what extent international price signals are transmitted to domestic markets, influencing local food prices. High transport costs, for example, can dampen the effect of global price changes, making them less noticeable to local producers and consumers while fluctuations in local currencies can either amplify or mitigate the impact of global price shifts. Understanding these dynamics is crucial for policy makers aiming to stabilize local food prices and ensure food security.

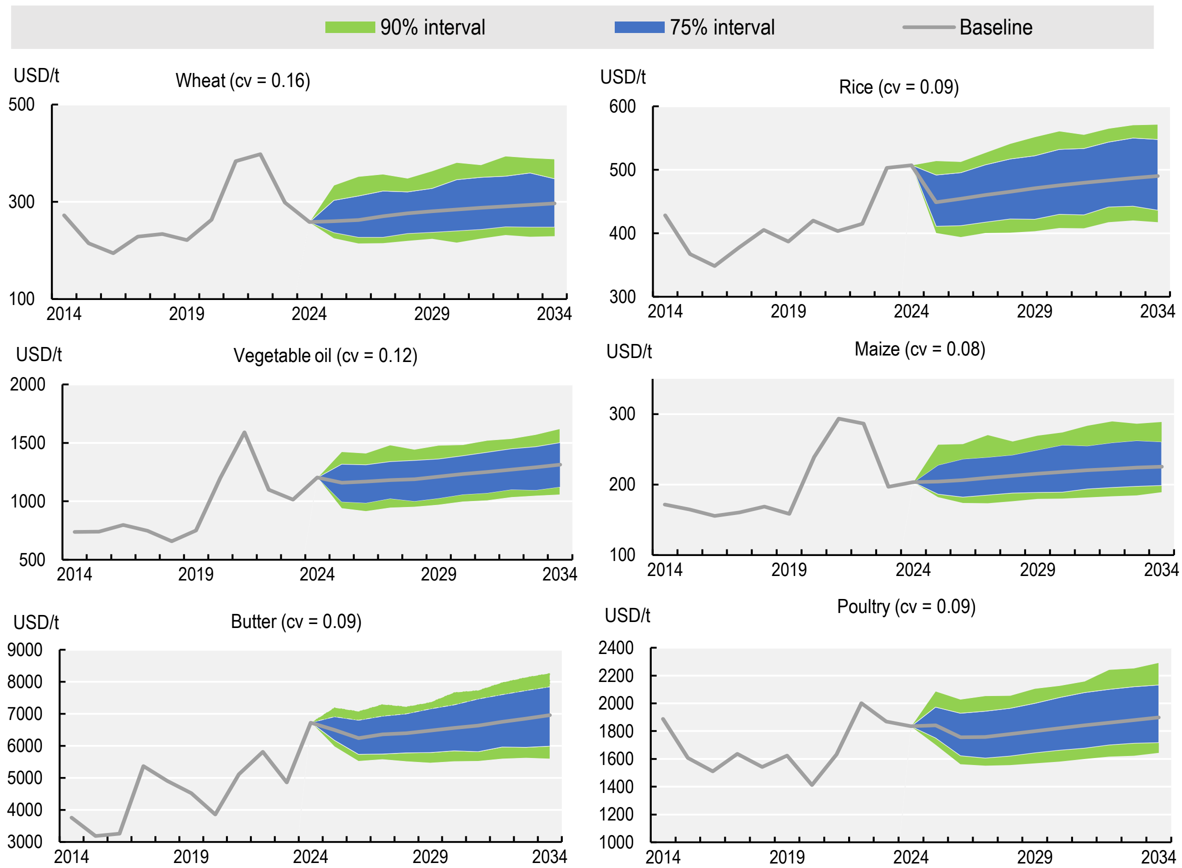
1.7.2. Stochastic simulations show the possible variation in price projections

Price projections presented in this *Outlook* result from the interplay of fundamental supply and demand factors under expected weather and yield trends, and specific macroeconomic and policy assumptions. While the *Outlook* is based on the best information available, there is an unavoidable degree of uncertainty attached to the projections and underlying assumptions. Examples of such uncertainties include extreme weather events, crop and livestock disease outbreaks, policy shifts, and geopolitical tensions, which may affect production and trade prospects and cause unexpected market volatility.

The risk of food price volatility is notably high due to the increasingly price inelastic global demand for food, especially in middle and high-income countries. This inflexibility means that even minor disruptions in supply can trigger disproportionately large price fluctuations, impacting food affordability for vulnerable populations who may already be struggling to meet nutrient needs. Consequently, social protection measures such as food subsidies, targeted financial aid and robust safety nets remain crucial in mitigating the adverse effects of food price swings. An enabling economic and political environment that prioritizes investments in local food production, adopts a more disciplined trade policy approach, and enhances the efficiency and resilience of food supply chains is also necessary.

To evaluate the impacts of deviations from projected trends, a partial stochastic analysis (PSA) was conducted on the baseline projections. This analysis simulates potential future variability of the main determinants of prices using observed past variability. It considers fluctuations in global macroeconomic drivers and specific agricultural crop yields but excludes variability due to animal diseases or policy changes. Aggregated results from multiple PSA simulations, shown in Figure 1.19, indicate a 75% probability of prices staying within the blue range in any given year, and a 90% probability of remaining within the green range. An extreme event causing prices to fall outside these ranges has a 40% probability of occurring at least once during the projection period. The PSA analysis equips policy makers with an understanding of potential fiscal exposure arising from social assistance payments due to high food prices or risks for farmer livelihood in the event of low prices.

Figure 1.19. Baseline and stochastic intervals for selected international reference prices



Note: Expected evolution of nominal prices under the baseline scenario of the Outlook (solid line) in relation to the stochastic outcomes shown in the blue 75% and green 90% confidence intervals.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

StatLink https://stat.link/0l4pnx

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Notes

[1] The *Outlook* uses the UN Medium-Variant projections from the 2024 Revision of the United Nations Population Prospects database.

[2] National GDP and per capita income assumptions are based on the IMF World Economic Outlook (October 2024) until 2029 and extended until 2034.

[3] In the *Outlook*, food consumption is measure as food availability net of estimated distributional waste.

[4] The Healthy Diet Basket is the global standard used by FAO to compute the cost and affordability of a healthy diet and is based on the average food group proportions and recommendations across national food-based dietary guidelines (FBDGs). It is identified to meet a dietary energy intake target of 2330 kcal/person/day.

[5] The scenario also projected a 4% reduction of global direct GHG emissions from agriculture. However, implementing measures to reduce food loss and waste would come with significant costs and require overcoming various challenges, such as the negative impact on producers' livelihoods due to decreased production and lower prices for their goods.

[6] In this scenario, "Zero Hunger" is achieved when the Prevalence of Undernourishment (PoU) (SDG indicator 2.1.1) is below 2.5% in every country. The PoU calculation is a function of average calorie availability (DES), minimum dietary requirements (MDER) and inequality of access to food (CV) in a country. DES and dietary patterns in a country are a function of per-capita income and evolve accordingly. Per-capita income is adjusted to the level needed to increase DES such that calorie availability is higher than MDER for 97.5% of consumers while also adjusting dietary patterns to remain consistent with income levels. CVs are projected to follow long-term decreasing trends in most countries and their values remain at baseline levels in the scenario.

[7] The two productivity increase figures are not fully comparable, as they are based on different base periods with varying initial productivity levels, and they project towards different target years. These differences, along with the inclusion of special technology in the 2025 scenario, should be noted as caveats when comparing the results.

2 Cereals

This chapter describes market developments and medium-term projections for world cereal markets for the period 2025-34. Projections cover consumption, production, trade and prices for wheat, rice, maize, and other coarse grains. The chapter concludes with a discussion of key risks and uncertainties which could have implications for world cereal markets over the next decade.

2.1. Projection highlights

Global cereal consumption growth is expected to be moderate, driven by a slower expansion in feed and biofuels uses. Food consumption of cereals is projected to rise by 1.1% p.a., reaching 1.28 bln t by 2034, mainly due to rising population in Asia and Africa. The growth in feed use will be led by livestock production expansion in Asia and the Americas.

A projected 1.1% annual growth in global cereal production, reaching 3.2 bln t by 2034, will be driven primarily by increasing yield rather than by an expansion of harvested areas. Cereal yields are expected to rise by 0.9% p.a., on average, driven by technology improvements and the wider adoption of improved seed varieties and enhanced agricultural practices, including optimized input and resource use.

Global trade in cereals will continue to expand in line with production. The share of production traded will remain slightly above the base period level of 17%. Most African and Asian countries–excluding major rice exporters–are expected to remain or become net cereal importers. This reflects not only disparities in natural resource availability, but also population and income growth driving demand beyond domestic supply capacity. Meanwhile, the Americas and parts of Europe are expected to further strengthen their role as key global suppliers.

In real terms, annual cereal prices are expected to decline over the projection period as productivity growth and efficiency gains reduce production costs. However, nominal cereal prices are expected to follow upward trends, due to assumed inflation.

Baseline projections are subject to uncertainties in the medium term, as the underlying assumptions about energy costs, weather conditions, geopolitical tensions, the import demand of the People's Republic of China (hereafter "China"), and trade policies may not materialise. Moreover, actual consumer food prices may not fully reflect trends in agricultural commodity prices, as processing costs and local market conditions can outweigh global price movements.

2.2. Current market trends

Monthly maize prices steadily increased from July 2024, reaching USD 221/t in February 2025, driven by a tightening global supply situation–marked by declines in both world production and stocks, particularly in Brazil–and strong demand for United States exports. Trade policy uncertainty and crop conditions for ongoing harvests in Argentina and Brazil also continue to influence global price movements.

Wheat prices were more volatile, fluctuating between USD 250 and 270/t, but generally decreased in the second half of 2024 and remained down year-on-year in February 2025. Despite tighter supplies in the Russian Federation (hereafter "Russia") and the European Union, the overall tone on prices is subdued reflecting strong competition between other exporters amidst reduced demand from various importers that had sufficient domestic supplies in 2024, such as China and Pakistan. Current seasonal supplies from Australia and Argentina are helping to offset the impact of adverse crop conditions and reduced exportable supplies in the European Union.

International barley prices resumed their long-term upward trend in 2024 and have steadily increased since September 2024 due to supply concerns in major exporting regions and favourable demand for non-food uses, such as animal feed and malting.

Having remained elevated for much of 2024, international rice prices have registered pronounced falls since October 2024, influenced by the repeal of export restrictions in India, prospective large harvests in northern hemisphere suppliers, slowing import demand in Indonesia, and currency depreciations against the United States dollar in major exporters.

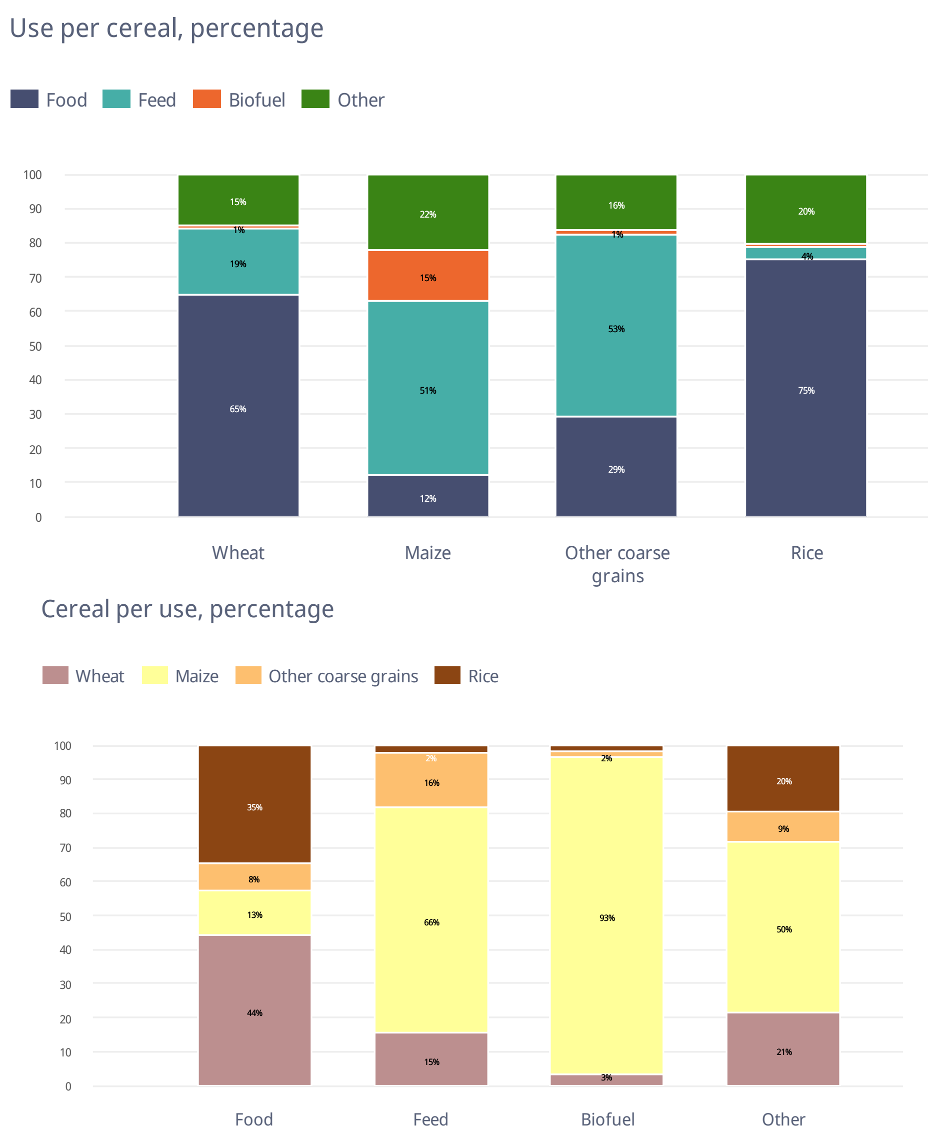
2.3. Market projections

2.3.1. Consumption

Asian countries will lead growth in demand for cereals

Cereal demand will continue to be dominated by food use closely followed by feed use. In 2034, 40% of all cereals will be directly consumed by humans, while 33% will be used for animal feed. Biofuels and other uses are projected to account for the remaining 27%. These shares, however, differ across the different cereal types. While wheat and rice are mainly used for food, feed use dominates in the case of maize and other coarse grains (Figure 2.1).

Figure 2.1. Global use of cereals in 2034



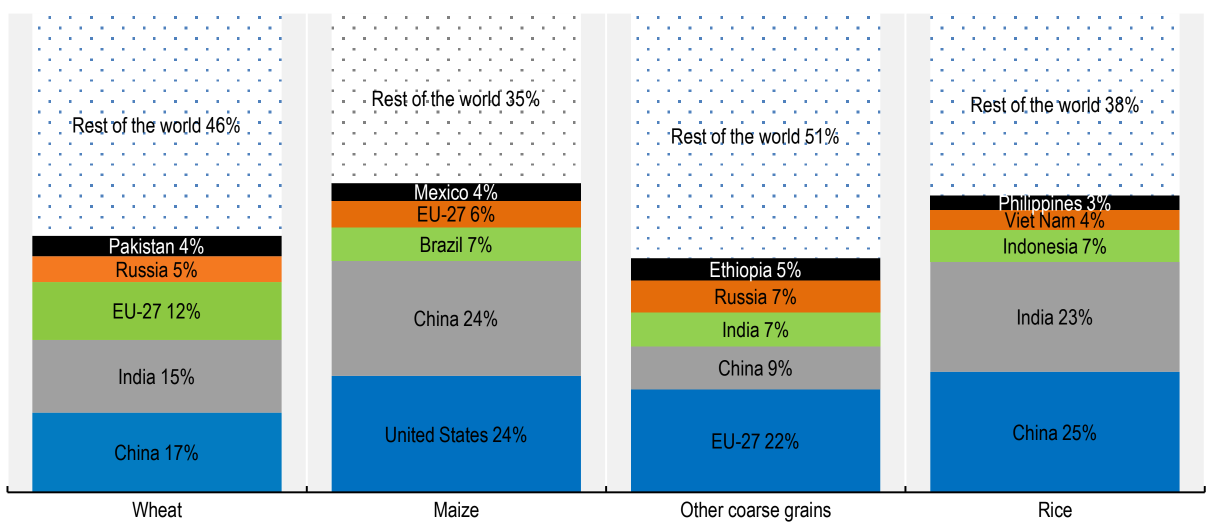
Note: How to interpret the graphs – 65% of total wheat consumption in 2034 will be food (left). 44% of total cereal-based food consumption will be wheat (right).
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Between 49% and 65% of global cereal consumption is projected to occur in the top five consumer countries for each commodity by 2034 (Figure 2.2), which is clearly less concentrated than production (Figure 2.4). Global use of cereals is projected to increase from 2.8 bln t in the base period to 3.2 bln t by 2034, driven mainly by higher food (+146 Mt) and feed use (+134 Mt). Asian countries will account for 54% of the total demand increase. Food consumption is expected to rise at a pace slightly higher than in the previous decade. The global increase in feed use is expected to be led by maize, followed by other coarse grains and wheat.

Wheat consumption is expected to be 11% higher in 2034 than in the base period. India and China are expected to account for 30% of this increase. Global use of wheat for food is projected to increase by 57 Mt but to remain stable at about 65% of total consumption. This growth is slightly lower compared to the previous decade in line with slowing growth in world population.

Globally, the increase in food consumption of wheat is driven by Asia, where wheat is the mainstay in diets for a large share of the population. In Africa, food use continues to expand beyond the traditional wheat consumers in North Africa, to Sub-Saharan Africa. Moreover, there is increasing demand for processed products that call for higher quality, protein rich wheat, produced in North America, Australia and, to a lesser extent, in the European Union and Russia. Countries in North Africa and Western and Central Asia, notably Egypt, Türkiye, and the Islamic Republic of Iran, will remain major consumers of wheat with high levels of per capita consumption. Global production of wheat-based ethanol is expected to decline by 6% from the base period level.

Figure 2.2. Global cereal demand concentration in 2034



Note: The presented numbers represent shares in world totals.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Rice is primarily consumed as food and is a major staple in Asia, Latin America and the Caribbean, and also increasingly in Africa. World total rice consumption is expected to increase by 1% p.a. over the projection period, compared to 1.1% p.a. during the last decade. Asian countries account for 69% of the projected increase, largely due to population rather than per capita food consumption growth (Table 2.1). The average per capita food use of rice is projected to increase by 0.8 kilograms from the base period level, driven mainly by Asia and Sub-Saharan Africa.

Global maize consumption is projected to increase by 1.3% p.a. compared to 1.7% in the previous decade. This increase is principally driven by increasing incomes that translate into higher feed demand, which is expected to remain at 50% of total maize consumption. Asian countries will account for 56% of the increase in feed consumption due to the rapid expansion and intensification of their livestock and poultry sectors. Globally, maize feed demand is expected to rise by 104 Mt to 709 Mt, at a slower pace than in the previous decade.

Table 2.1. Rice per capita food consumption

	kg/person/year		Growth rate (% p.a.)
	2022-2024	2034	
Africa	24.8	27.7	0.95
North America	10.4	10.8	0.50
Europe	6.4	6.8	0.22
Oceania	19.1	19.7	0.19
Latin America and Caribbean	25.2	24.9	-0.30
Asia	71.9	73.3	0.10
World	50.2	51.0	0.07

Note: The last column displays least-squares average annual growth rate, 2025-2034 (see glossary).
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Maize feed demand in China, a major maize consumer, is projected to increase by about 1% p.a., down from 2.5% in the previous decade. While livestock expansion and the rebuilding of herds after the outbreak of African Swine Fever (ASF) drove a recovery in domestic maize feed demand in recent years, China is expected to experience slower livestock sector growth, along with improved feed efficiency and a more diversified feed mix—developments supported by policy interventions aimed at enhancing self-sufficiency in feed supply.

The use of white maize as food is expected to increase primarily in Sub-Saharan Africa where population growth is strong. Food maize will remain an important staple, accounting for about a quarter of total caloric intake. Growth in food consumption of maize in African countries is expected at about 2.8% p.a.

Globally, maize use for biofuel production is expected to increase at a much slower rate than in the past two decades as national ethanol markets of key producers are constrained by biofuel policies. Brazil and India are projected to drive this increase.

World consumption of other coarse grains is projected to increase by nearly 33 Mt, or 1% p.a., over the next ten years, compared to -0.1% p.a. in the previous decade, driven by additional use in Africa and Asia. Consumption is expected to remain stable in high-income countries. The food share of total consumption is projected to increase from about 27% in the base period to 29% by 2034. Sub-Saharan African countries rely heavily on millet as a staple food due to its resilience to harsh weather and its adaptability to the region’s diverse climate conditions.

Compared to more perishable commodities, cereals tend to have relatively lower levels of food loss and waste. Most post-harvest losses still occur during transport and processing, while additional waste arises at the distribution stage (including retail) and household levels. Total food loss and waste in the cereal sector is projected to remain stable at the base-period estimate—19% of global cereal production. This highlights the need for combined strategies to mitigate these losses throughout the supply chain, that include technological advancements, infrastructure improvements, policy initiatives, and consumer education.

2.3.2. Production

Yield intensification sustains production growth

Over the past decade, the global harvested area of cereals expanded at an average annual rate of 0.33%. This growth is expected to slow down to 0.14% p.a. in the coming decade, adding a total of 16.2 Mha by 2034. Latin American and the Caribbean as well as Asian countries will account for 61% of this growth owing mostly to the availability of frontier land and land reclamation. Globally, wheat, maize and rice areas are projected to increase by 2%, 5% and 1% respectively from the base period, with other coarse grains areas rising marginally. Future agricultural land expansion is projected to be limited due to urbanisation and the implementation of environmental and sustainability policies, such as restrictions on deforestation, land-use change, and conservation of carbon-rich ecosystems. Increased global production is, therefore, expected to be driven by yield intensification.

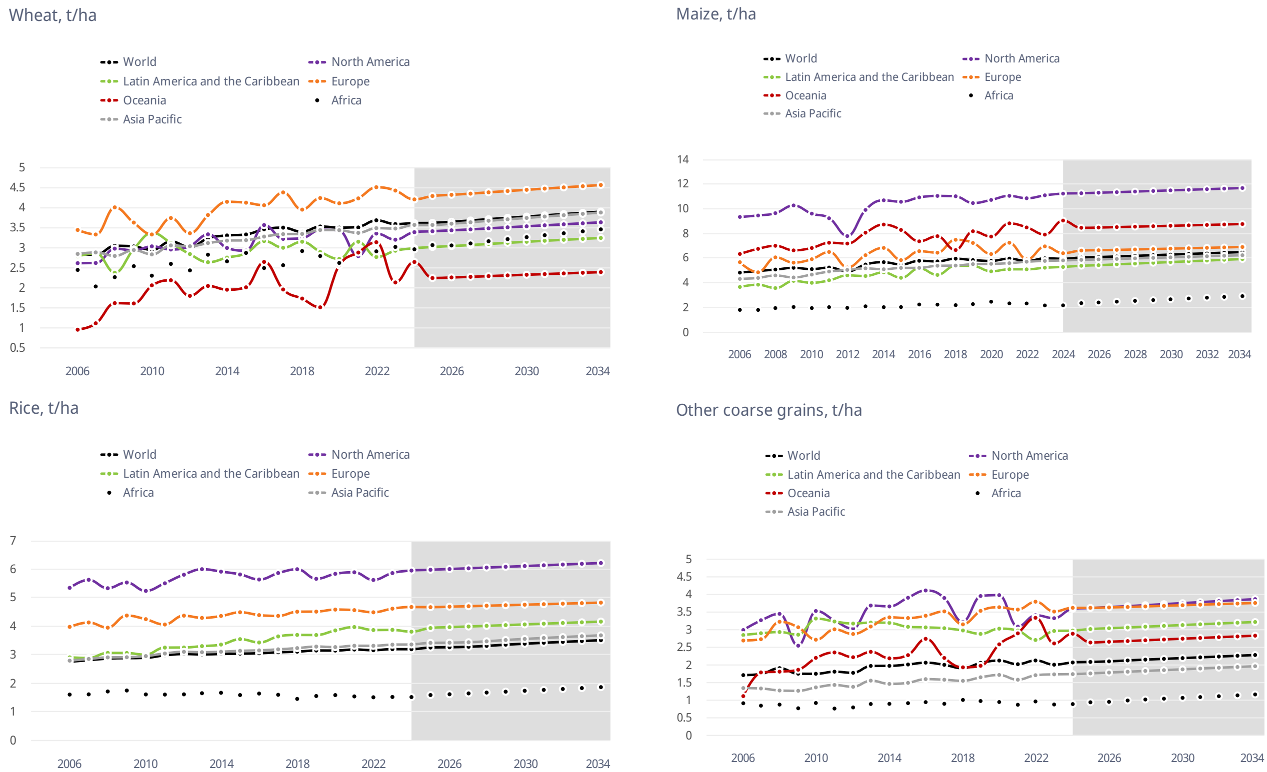
Global cereal yields are projected to rise by 0.9% p.a. in the next decade, up from 0.8% in the previous one, reaching a global average of 4.2 t/ha in 2034. Growth in cereal output will depend more and more on productivity gains, suggesting that improved technology, better farming practices, and more efficient input use will be critical to sustaining increased output. Global yields are projected to reach 3.9 t/ha for wheat, 6.5 t/ha for maize, 3.5 t/ha for rice, and 2.3 t/ha for other coarse grains by the end of the decade (Figure 2.3).

Despite increasing cereal yields, regional disparities are expected to persist, with no global convergence anticipated between higher- and lower-yielding regions. In high-yielding countries, yield growth is slowing, reflecting reduced marginal gains from existing technologies and increasing constraints from environmental policies. In lower-yielding countries, on the other hand, progress varies. Some benefit from rapid modernisation and targeted investment, whereas others remain vulnerable to productivity stagnation due to natural and structural constraints. Therefore, global food security will depend on whether policy interventions can bridge these gaps by ensuring that the most lagging regions gain access to the tools and technologies needed for sustained yield growth.

Total cereal production is projected to grow by around 1.1% p.a. as in the previous decade, reaching 3.2 bln t in 2034. Reflecting yield growth differences, low- and lower-middle-income countries are projected to achieve cereal production growth at a rate approximately 2.4 times higher than that of upper-middle- and high-income countries. This projection is based on anticipated yield improvements due to better access to modern farming techniques and inputs in lower-income regions. In higher-income countries, production increases will be more moderate due to already high productivity levels and limited opportunities for land expansion. Latin American and Caribbean countries are projected to achieve relatively high production growth (1.8% p.a.) due to increased investment in agricultural technology and infrastructure. In Africa, high production growth (2.3% p.a.) stems from strong yield improvements that reflect efforts to modernize agriculture. In North America, yield growth will sustain a production increase of around 0.6% p.a. as the harvested area will see only a modest expansion. Due to sustainability policies and land constraints, Europe is expected to see a stable agricultural landscape with a nearly unchanged–but more efficiently used–harvested area, a modest increase in yields, and an annual production growth of 0.8%. Oceania and Asia will see modest growth in total cereal production of 1.2% and 0.9% p.a. respectively.

Global wheat production is expected to increase by 74 Mt to 874 Mt by 2034, of which 42 Mt will be in Asia. India, the world’s third largest wheat producer, is expected to provide the largest share of the additional wheat, accounting for 29% of the global production increase, driven by yield improvements and area expansion in response to national policies to improve self-sufficiency. However, with continued population growth and rising domestic demand, India is projected to become a net importer by 2034. There will also be production expansion in Russia, Pakistan, Argentina, Canada, and the United States, which jointly account for roughly half of the total increase. China, India, and the European Union are projected to produce 46% of global wheat output in 2034 (Figure 2.4).

Figure 2.3. Regional cereal yields



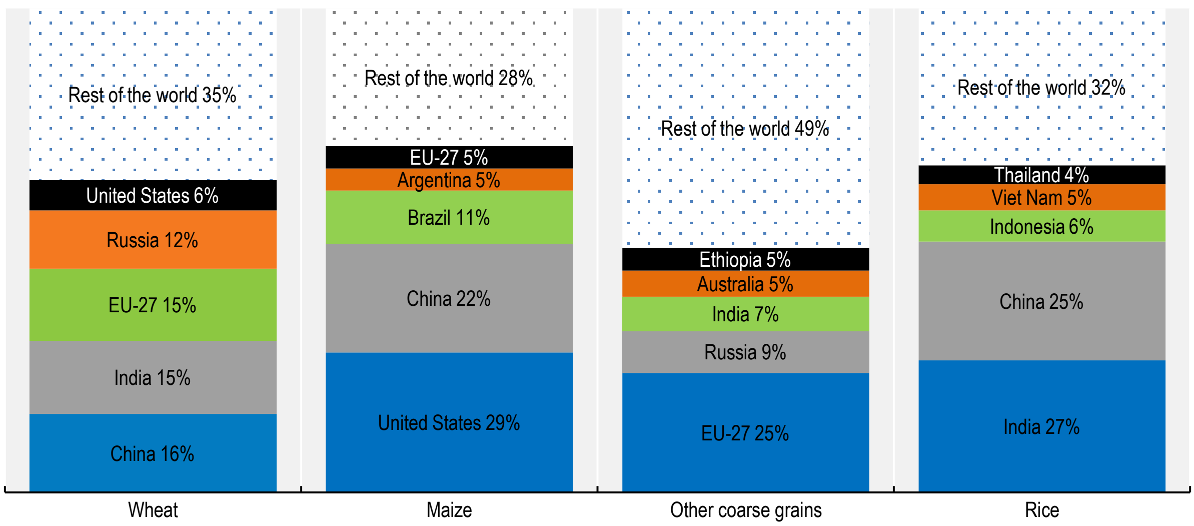
Note: The presented yields were calculated as total production divided by total harvested area in the corresponding region. In the rice panel, "Oceania" refers to Australia (i.e. Australia's rice yield is shown). Rice yields are expressed on a milled-rice basis.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Global maize production is expected to grow by 188 Mt to 1.4 bln t by 2034, with the largest absolute increases compared to the base period in the United States (33 Mt), Brazil (32 Mt) and China (27 Mt), responding to a rising global demand and favourable domestic policy environments. In Brazil, where second-cropped maize production responds to global demand and price signals during the domestic soybean harvest, the projected annual production growth exceeds the global average of 1.2%. Maize output is also projected to rise faster than the global average in Sub-Saharan Africa reflecting yield improvements.

Global rice production is expected to grow by 61 Mt and reach 598 Mt by 2034. Yield improvements in low- and lower-middle income countries are expected to drive this growth. Production expansion in Asian countries, which account for the bulk of global rice output, is expected to be robust. India, the world's largest rice producer by 2034, will account for 41% of this expansion, followed by the LDC Asian region, Viet Nam, Indonesia, the Philippines and Thailand (37% altogether). China is expected to increase production by 0.11% p.a., up from 0.06% in the previous decade. As in most major rice-producing countries, China's projected rice production growth is expected to come from higher yields, while harvested area declines slightly. This reflects ongoing efforts to phase out less productive land as part of broader efforts to improve the efficiency of rice production. Decreasing harvested areas of rice in China and Brazil will be offset by increases in African and other Asian countries. Production in upper-middle- and high-income countries is expected to increase only marginally, against the global average of 0.9% p.a.

Global production of other coarse grains–sorghum, barley, millets, rye, and oats–is projected to reach 330 Mt by 2034, up by around 33 Mt from the base period. African countries are expected to contribute 45% of this increase, driven by strong demand growth stemming from rapid population expansion, and the continued reliance on staple foods, which in turn incentivize higher local production. On a country basis, India (+4.1 Mt), Ethiopia (+3.2 Mt), and Nigeria (+2.7 Mt) will contribute the most. Output in the European Union and the United States is projected to increase by 2.3 Mt and 1.4 Mt, respectively, from the base period.

Figure 2.4. Global cereal production concentration in 2034



Note: The presented numbers represent shares in world totals.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

2.3.3. Trade

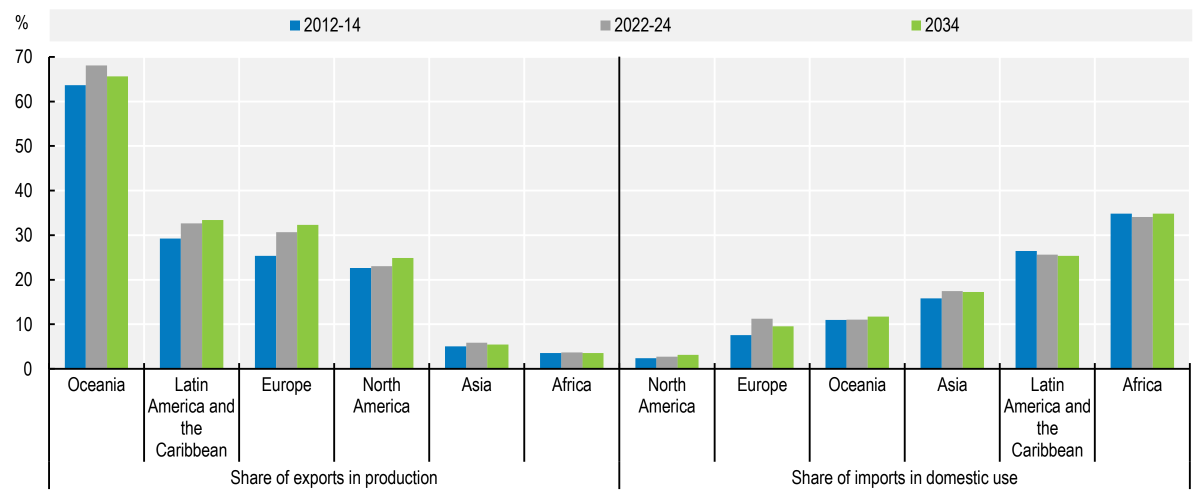
Moderate growth, shifting trade shares, and rising import demand

International trade in cereals, which accounts for about 17% of global production in the base period, is projected to increase marginally over the next decade. Traditionally, the Americas and Europe supply cereals to Asia and Africa, where demand for food and feed from rising populations and expanding livestock sectors is rising faster than domestic production. This buoyant trend is expected to continue over the next decade with world exports of cereals increasing by 14% in 2034 compared to the base period. Figure 2.5 illustrates how important cereal trade is relative to production and consumption. Trade volumes from Oceania are relatively low, but the share of grain exports is projected to account for nearly two-thirds of the region’s production by 2034. On the other hand, imports are projected to account for more than one-third of total domestic use in African countries.

Wheat exports are expected to grow by about 21 Mt to 226 Mt by 2034. Russia is expected to maintain its position as the leading exporter, accounting for a quarter of global exports by 2034 (Figure 2.6). Exports from the second largest wheat exporter, the European Union, are projected to increase by 1.4% p.a. from 2025 reaching 31.6 Mt in 2034, accounting for 14% of global trade. Exports from Canada and the United States are projected to remain competitive and account for 13% and 12%, respectively, of global trade by 2034. The United States, Canada, Australia and the European Union are expected to retain the higher quality protein wheat markets, particularly in Asia. While Russia plays a role in these markets, it is expected to remain more competitive in price-sensitive soft wheat markets, such as North Africa, Sub-Saharan Africa, and Western Asia. Imports by the North African and the Near East regions are set to slightly increase their shares of total wheat trade over the next decade.

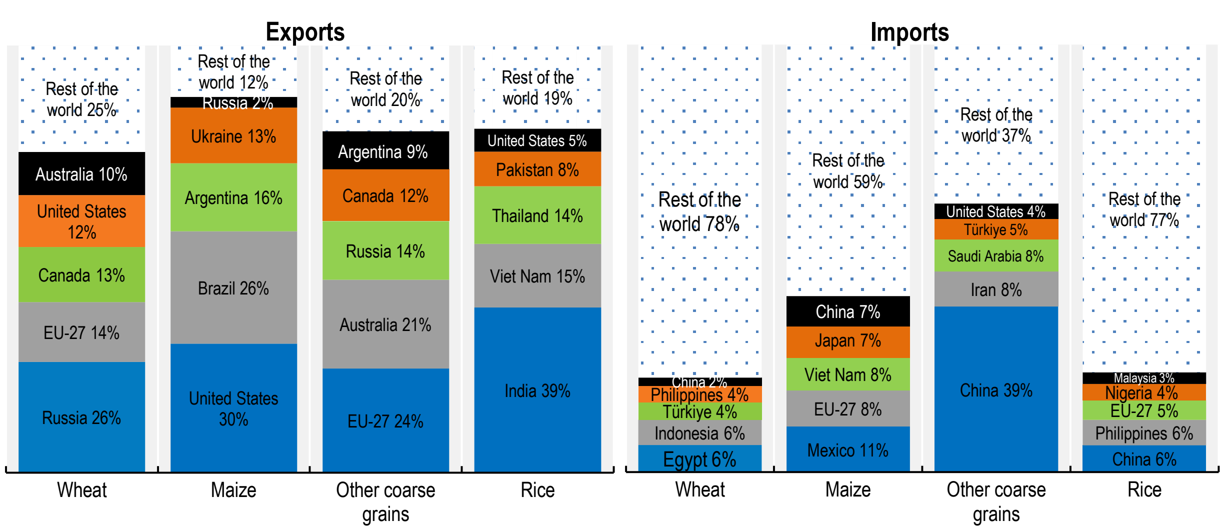
Maize exports are expected to grow by about 29 Mt to 210 Mt by 2034. The top four exporters–the United States, Brazil, Argentina, and Ukraine–will account for 91% of this increase. The United States is expected to remain the top maize exporter with a growth rate that is lower than the in the past decade and lower than the world average of 1.6% p.a. Brazil's exports, which benefitted from higher domestic yields and lower United States' exports in the base period, as well as from China's removal of non-tariff measures in 2023, will grow at a rate more than twice the world average. China's maize imports in 2034 are projected to decline by 20% from the base period level due to the country's strategic reserve and trade policy, increased domestic production, and feed diversification. The LDC Sub-Saharan African region is expected to remain virtually self-sufficient in maize, with white maize continuing to play a key role in food security as a mainstay of local diets. South Africa will remain a major regional supplier and continue to expand internationally, with its exports projected to reach about 5.6 Mt in 2034.

Figure 2.5. Cereal trade as a percentage of production and consumption



Note: The presented estimates include intra-trade except for the European Union.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Figure 2.6. Global cereal trade concentration in 2034



Note: The presented numbers represent shares in world totals.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The international trade volume of other coarse grains, dominated by barley and sorghum, is significantly smaller than for maize or wheat. Global exports are expected to increase by 6.2 Mt to reach 52 Mt in 2034. The top five exporters–the European Union, Australia, Russia, Canada and the United States–are projected to account for 80% of global trade by 2034, slightly up from the base period. China, the Islamic Republic of Iran, Saudi Arabia, and Türkiye will absorb 59% of global trade in other coarse grains by 2034.

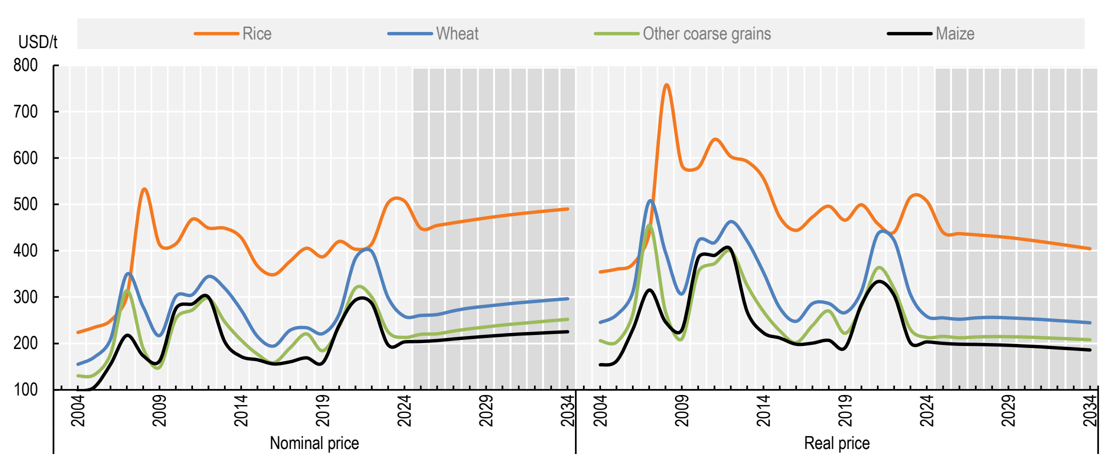
During the past decade, rice trade grew at 2.3% p.a. In this decade, growth is expected to slow down and increase by 1.5% p.a., with overall export volumes rising by 12 Mt to reach 65 Mt by 2034. Following the repeal of the rice export restrictions imposed in 2022 and 2023, India is expected to regain the export share it lost as a result. This is expected to cement India's role as the largest global rice exporter. The export share of the top five major rice exporters –India, Viet Nam, Thailand, Pakistan, and the United States, as a group– is also expected to rise, from 77% in the base period to 81% in 2034. Viet Nam and Thailand are projected to remain the second and third largest exporters by 2034 with above-average annual growth rates of 1.4% and 2%, respectively.

Historically, Indica rice has accounted for the bulk of rice traded internationally. However, demand for other varieties is expected to continue to grow over the next decade. Imports by China, the largest importer of rice during the base period, are expected to increase by 0.4% p.a. reaching 4.1 Mt in 2034. Imports in African countries, where growth in demand continues to outpace production growth, are projected to increase significantly, by 53% from the base period.

2.3.4. Prices

Following recent trends, nominal wheat prices are expected to stabilise around their medium-term trend and reach USD 296/t by 2034. Similarly, prices of maize and other coarse grains (measured by the feed barley price fob Rouen) are expected to return to their medium-term trajectories, reaching USD 225/t and USD 252/t, respectively (Figure 2.7).

Figure 2.7. World cereal prices



Note: Wheat – US wheat, No.2 Hard Red Winter, fob Gulf; maize – US Maize, No.2 Yellow, fob Gulf; other coarse grains – France, feed barley, fob Rouen; rice (milled) – FAO all rice price index normalised to India, indica high quality 5% broken average 2014-16. Real prices are nominal world prices deflated by the US GDP deflator (2024=1). Prices refer to marketing years.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The reference export price for milled rice (FAO All Rice Price Index normalised to India 5%) is also expected to decline further and stabilise on-trend as exportable supplies become less restricted than in recent years. Over the medium term, demand from countries in the Far East, Africa, and the Middle East is expected to grow but supply increases in exporters are expected to moderate the increase in nominal prices, which will reach USD 490/t by 2034.

Due to productivity improvements and supply growth, medium-term prices for wheat, maize, other coarse grains and rice are expected to decline when adjusted for inflation (in real terms).

2.4 Risks and uncertainties

A more uncertain geopolitical, environmental, and policy environment in the next decade?

Grain markets, more than many other commodities, have been significantly impacted by Russia's war against Ukraine due to the pivotal role of both these countries in global cereal markets. While tensions in cereal markets have eased somewhat and current market prices seem to reflect the reduced, albeit resilient, export expectations for Ukrainian cereals, these dynamics remain subject to uncertainty.

Several other factors not reflected in the current projections could impact cereal markets. The *Outlook* assumes on-trend production prospects, which are generally positive for the main grain-producing regions. However, extreme weather events and shifts in weather patterns could lead to highly volatile–and even redistributed–cereal yields and harvests, thereby affecting global supplies and prices.

The policy environment will be crucial. The focus on enhanced sustainability policies within the agricultural sector (e.g. the European Green Deal) as well as biofuel-favouring policies may tighten markets for cereals even more in the coming decade. China's policy measures aimed at boosting self-sufficiency and reducing reliance on imports could cause unpredictable shifts in its cereal demand and in global trade patterns, injecting price volatility before world cereal markets stabilise in a new "normal".

Alternative trade policies could also provoke market reactions and reshape trade flows, balances, and prices. An increasing reliance on grain imports by several countries–especially in the MENA region, as projected in this *Outlook*–would increase their vulnerability to persistent trade disruptions, which may not always be fully mitigated by domestic stocks or ramped-up production. A functioning and reliable trading system is, therefore, key for food security in such regions.

Finally, crop pests and animal diseases remain critical risk factors for global cereal markets, with potentially severe implications for supply stability and price volatility. ASF remained a significant concern throughout 2024, impacting feed grain demand in various regions. While the recent outbreak of highly pathogenic avian influenza (HPAI) in the United States has prompted substantial poultry culling, the full implications for feed demand are still unclear, and potential fluctuations cannot be ruled out.

3 Oilseeds and oilseed products

This chapter describes market developments and medium-term projections for world oilseed markets for the period 2025-34. Projections cover consumption, production, trade and prices for soybean, other oilseeds, protein meal, and vegetable oil. The chapter concludes with a discussion of key risks and uncertainties which could have implications for world oilseed markets over the next decade.

3.1. Projection highlights

Most oilseeds and oil crops (e.g. oil palm fruit) are either crushed or pressed into protein meal and vegetable oil. While about a quarter of their production by weight is used for direct human food consumption as vegetable oil, most is used as protein meal in animal feed. Only a small unprocessed amount is used for direct feeding. The main industrial use of vegetable oil is as feedstock for biomass-based diesel production.

The growth of food demand for vegetable oil is expected to remain strong. This will be driven by rising disposable income and population growth in middle-income countries and population growth in low-income countries.

The direct use of vegetable oil for biomass-based diesel, currently about 18% of global vegetable oil use, is projected to grow globally. This will be especially in Indonesia, Brazil and in the United States, in the form of hydrotreated vegetable oil.

The utilisation of protein meals as animal feed will align with the slower demand from key importers. The People's Republic of China (hereafter "China") is expected to reduce its feed consumption growth considerably, driven by improved feed efficiency combined with efforts to achieve lower protein meal shares in livestock feed rations.

Palm oil and rapeseed yields are projected to improve slightly, reversing a decline seen over the last decade in major producing regions.

Trade in oilseeds and oilseed products accounts for a higher share of production compared to other agricultural commodities. Production of soybeans is concentrated in the Americas and palm oil in South-East Asia.

Prices of vegetable oil and protein meals are expected to show diverging future developments. Vegetable oil prices are expected to remain relatively stronger due to sustained demand growth and slower production growth for palm oil and other oilseeds, whereas protein meal prices are expected to be relatively flatter, due to coupled supply and considerable slower demand growth.

Specific uncertainties for oilseeds and products are changing demand patterns and the extent of success in efforts to reverse declines in productivity. About 18% of vegetable oil is used as feedstock for biomass-based diesel and alternative developments in the biomass-based diesel industry directly affects vegetable oil demand projections. In terms of feed demand for protein meal, China might reduce the protein meal share in its animal feed more than currently anticipated. Oil palms and rapeseed experienced declining yields in major producing regions and the projections assume that the obstacles will be overcome, which might not materialise.

3.2. Current market trends

Nominal prices of oilseeds and oilmeals have remained subdued while vegetable oil prices have appreciated markedly

International prices for soybeans were weighed down by ample global supplies, while prices for other oilseeds have strengthened due to declining rapeseed and sunflower seed harvests in 2024/25 season. By contrast, world vegetable oil prices increased recently, as below-potential growth in palm oil outputs coincided with reduced crushing of rapeseed and sunflower seed. For oil meals, international protein meal quotations declined in recent months, driven by prospects of ample soymeal supplies following robust oil-driven crushing activities globally.

Global soybean production in 2024/25 is anticipated to expand by about 7% from the previous season resulting in the first season with a soybean production in excess of 400 Mt, mainly due to forecast output increase from South America. Overall favourable conditions coupled with continued area expansion in Brazil are expected to result in a record high harvest. World palm oil production is expected to increase marginally in 2025, largely driven by expectations of output recovery in Indonesia although production growth could be limited by subdued yields in Malaysia.

3.3. Market projections

3.3.1. Oilseed crush and production of vegetable oils and protein meal

Slowing global oilseed crush and limited growth in palm oil production

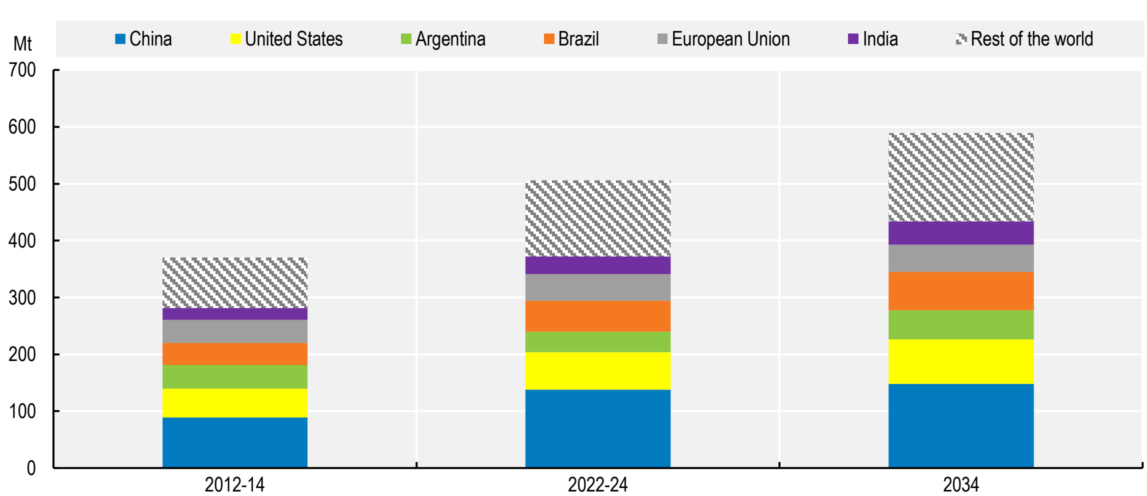
Globally, the crushing of soybeans and other oilseeds into meal (cake) and oil accounts for about 90% of total usage. The demand for crush will increase faster than demand for other uses, notably direct food consumption of soybeans (including for meat and dairy replacements), groundnuts and sunflower.

The crush location depends on transport costs, trade policies (e.g. different tariffs for oilseeds and products), acceptance of genetically modified crops, processing costs (e.g. labour and energy), and infrastructure (e.g. crushing facilities, ports and roads).

Soybean crush is projected to expand by 62 Mt over the Outlook period, significantly less than the 95 Mt in the previous decade. Most of the growth is expected to occur in Latin America in contrast to the previous decade where the expansion in soybean crush occurred mainly in China. Global crush of other oilseeds is expected to grow in line with production over the Outlook period and to occur more often in the producing country.

World production of protein meals from oilseed crush is dominated by soybean meal which accounts for more than two-thirds of world protein meal production. Production is concentrated in a small group of countries (Figure 3.1). In China and the European Union, most protein meal production comes from the crushing of imported oilseeds, primarily soybeans from Brazil and the United States. In the other important producing countries–Argentina, Brazil, India, and the United States–domestically–produced soybeans and other oilseeds dominate.

Figure 3.1. Oilseed crush by country or region



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Global vegetable oil production includes the oil part of the crush of oilseeds, including cottonseed, palm kernels and copra as well as palm oil. Coconut oil is mainly produced in the Philippines, Indonesia, and Oceanic islands. Palm kernel oil and coconut oil have important industrial uses. Cottonseed is a by-product of cotton ginning (Chapter 9). Global palm oil output has outpaced the production of other vegetable oils over the past decade. However, growth in palm oil production is expected to weaken due to increasing sustainability concerns and the aging of oil palm trees in Indonesia and Malaysia, which account for almost one-third of the world's vegetable oil production and for more than 80% of global palm oil production.

At the global level, palm oil supplies are projected to expand at an annual rate of 0.8%. Increasingly stringent environmental policies from the major importers of palm oil and sustainable agriculture norms (e.g. in line with the 2030 UN Agenda for Sustainable Development) are expected to slow the expansion of the oil palm area in Indonesia and Malaysia. This implies that production growth needs to come from productivity improvements, including an acceleration of replanting. Palm oil production in other countries is expected to expand more rapidly from a low base, mainly for domestic and regional markets. For example, Thailand is projected to produce 3.9 Mt by 2034, Colombia 2.1 Mt, and Nigeria 1.9 Mt. In several Central American countries, niche palm oil production is developing with global sustainability certifications in place from the outset, positioning the region to eventually reach broader export markets.

3.3.2. Vegetable oil consumption

Per capita food consumption of vegetable oil remains strong

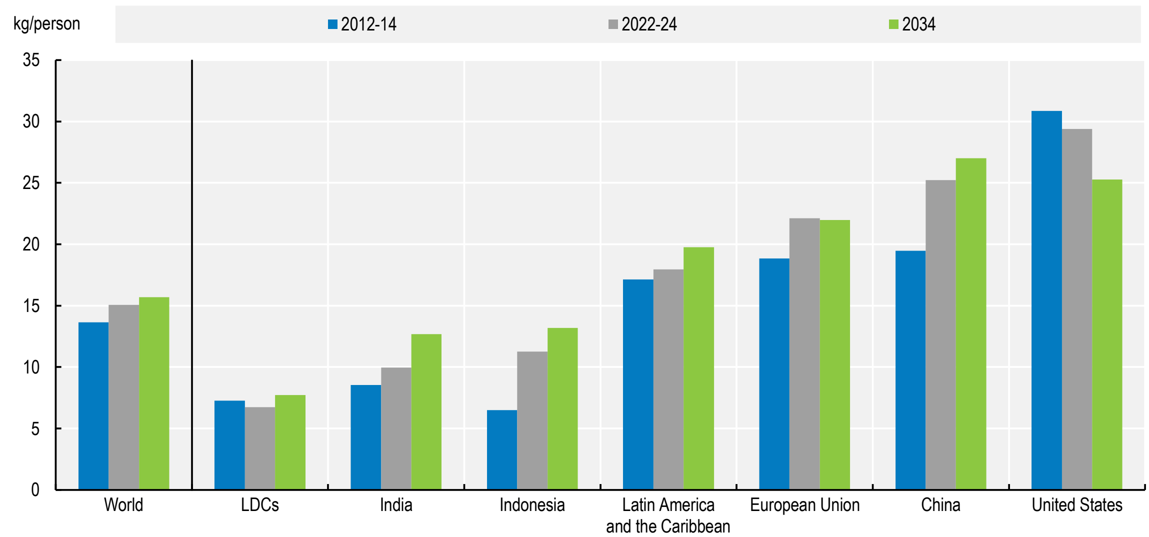
The two dominant uses of vegetable oil are food and food preparation (52%) and as biomass-based diesel feedstock (18%). A considerable share of the reported food consumption is used for frying rather than human intake which results in an amount of used cooking oil which can be used as feedstock for biomass-based diesel production. Vegetable oils are also used for cosmetics, varnishes, and increasingly in animal feed, especially for aquaculture.

Per capita consumption of vegetable oil for food is projected to increase (0.5% p.a.) due to strongly increasing food demand in lower middle- and low-income countries. In some emerging markets, the consumption of vegetable oil for food is set to reach levels comparable to those of high-income countries (Figure 3.2). By 2034, per capita food consumption is projected to reach 27 kg in China and Brazil, for example. In high-income countries the per capita consumption of vegetable oil is levelling off. In the case of the United States, the increasing role of alternative vegetable oil like olive oil and corn oil (not included in the *Outlook*) result in declining per capita food consumption.

India, the world's second largest consumer and leading importer of vegetable oil, is projected to sustain a per capita food consumption growth of 2.5% p.a., reaching 13 kg/person by 2034. This substantial increase will be the result of increases in the crushing of domestically produced oilseeds, supported by numerous government programmes to increase production. However, imports of mainly palm oil from Indonesia and Malaysia are expected to decline so as to rely less on vegetable oil imports.

With urbanisation and disposable income increases in low-income countries, dietary habits and traditional meal patterns are expected to shift towards greater consumption of processed foods that have a high content of vegetable oil. For least developed countries (LDCs), the per capita food demand for vegetable oil is projected to expand to 7.7 kg/person.

Figure 3.2. Per capita food consumption of vegetable oil in selected countries



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The global uptake of vegetable oil as feedstock for biomass-based diesel (about 18% of global vegetable oil use) is projected to increase more slowly at 0.7% p.a. over the next ten years, compared to the 7.7% p.a. increase over the previous decade when biofuel support policies took effect. The use of vegetable oil as feedstock for biomass-based diesel depends on the policy setting (Chapter 8) and the relative price development of vegetable oil and crude oil. In general, national targets for mandatory biomass-based diesel consumption are expected to increase less than in previous years.

In Indonesia, the growth in the use of vegetable oil to produce biomass-based diesel is projected to remain strong and reach 12.6 Mt by 2034 due to supportive domestic policies. In the United States, Hydrotreated Vegetable Oil (HVO) or Renewable Diesel is considered an advanced biofuel and is expected to drive the growth of United States biomass-based diesel production. On the other hand, it is expected that the use of vegetable oil as feedstock for biomass-based diesel in the European Union will shrink by 2.6% p.a. This is due in part to the increasing share of used oils, tallow, and other non-feed and non-food feedstocks used in the production of biomass-based diesel, which is also apparent in the United States and in China.

3.3.3. Protein meal consumption

Feed demand growth is slowing, shaped by developments in China

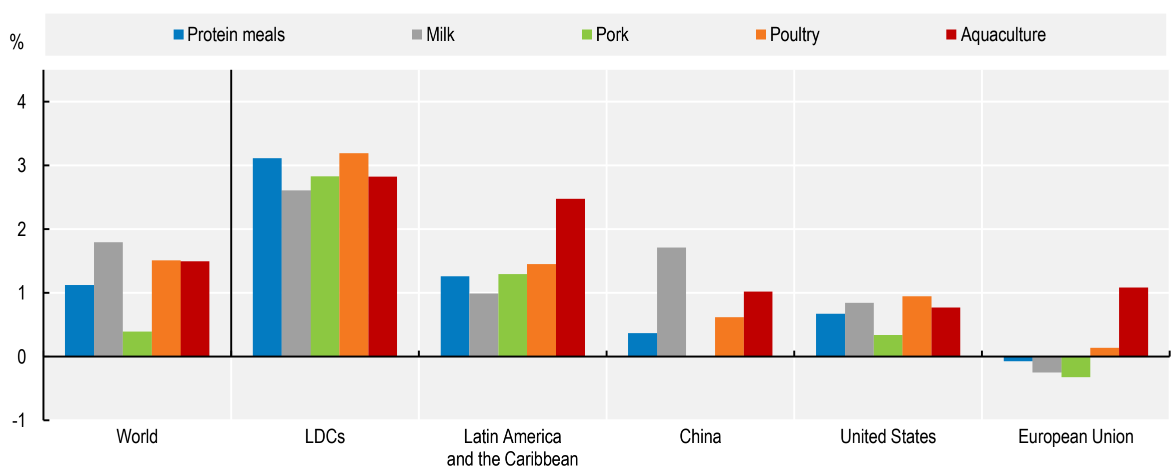
The protein meal content of soybeans is about 80% while for other oilseeds this share is 50-60%. Protein meal is almost exclusively used as feed and its consumption is projected to continue to grow at 1.1% p.a., considerably below the 2.4% p.a. seen in the last decade.

The link between feed use of protein meal and animal production is characterized by two offsetting trends. The intensification of animal production increases demand for protein meal, while greater feed efficiency leads to a reduction in protein feed per animal. Demand is also affected by the composition and size of livestock populations and the nature of animal production systems. The link between animal production and protein meal consumption is associated with a country's level of economic development (Figure 3.3). Lower income countries, which rely on backyard production, consume less protein meal, whereas higher-income economies which employ intensive production systems use higher amounts of protein meal. Because of a shift to more feed-intensive production systems in developing countries in response to rapid urbanisation and increasing demand for animal products, growth in protein meal consumption tends to exceed growth in animal production.

China accounts for more than a quarter of global protein meal demand and is therefore shaping global demand. Growth in China's demand for compound feed is expected to be slower than in the previous decade due to declining growth rates in animal production, especially pig meat, and the existing large share of compound feed-based production. The protein meal content in China's compound feed is expected to remain stable after it surged in the last decade but continues to exceed current levels in the United States and European Union.

In the European Union, and the United States, protein meal consumption is expected to grow at a slower rate (or decline faster) than animal production due to improving feeding efficiencies. In addition, in some member states of the European Union animal products, primarily poultry and dairy, are increasingly marketed by the large retail chains as produced without feed from genetically modified crops which also curbs demand for soybean meal.

Figure 3.3. Average annual growth in protein meal consumption and animal production (2025-34)



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

3.3.4. Oilseed production

Challenges remain for palm oil and rapeseed yield growth

The production of soybeans is projected to grow by 1.0% p.a., compared to 2.2% p.a. over the last decade. Yield increases will account for about 80% of that production growth. Soybeans' short vegetation period allows for double cropping, with maize in Brazil and wheat in Argentina, which accounts for a considerable share of projected harvested area expansion in Latin America.

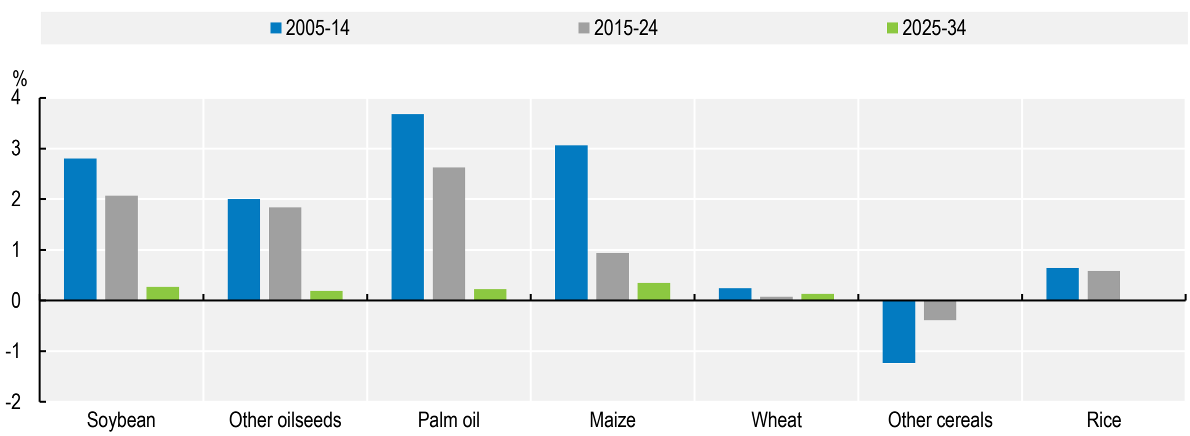
Brazil is the largest producer of soybeans and production is expected to grow at 0.8% p.a. over the next decade due to double cropping with maize, slightly more than in the United States, the second largest producer, at 0.5% p.a. The production of soybeans is projected to grow strongly elsewhere in Latin America, with Argentina and Paraguay producing 56 Mt and 13 Mt, respectively, by 2034. In China, soybean production is expected to continue to increase in response to reduced policy support for the cultivation of cereals, but at slower pace than in the previous decade. Soybean production is also expected to increase in India, the Russian Federation (hereafter "Russia"), Ukraine, and Canada.

The production of other oilseeds (rapeseed, sunflower seed, and groundnuts) is also projected to grow at a slower pace, at 1.1% p.a. compared to 2.7% p.a. over the previous ten years. China (a major producer of rapeseed and groundnuts) and the European Union (which mainly produces rapeseed and sunflower seeds) are the most important producers of other oilseeds, with a projected annual output of 42 Mt and 30 Mt, respectively, by 2034. Ukraine and Russia, major producers of rapeseed and leading producers of sunflower seed, are both expected to increase their production of other oilseeds beyond 20 Mt per year by 2034. Canada, the largest exporter of rapeseed, is projected to increase its production of other oilseeds by 0.9% p.a., to reach 19 Mt by 2034.

In the last two decades, area harvested of soybeans, other oilseeds and oil palms increased faster than for cereals (Figure 3.4). This growth in harvested area created pressure on other land uses and environmental resources. In the case of soybeans in Latin America, a considerable part of the expansion of harvested area is due to increasing double cropping of soybeans with maize or wheat. It is expected that the growth of harvested area of soybean, other oilseeds and oil palms will increase to only a limited extent.

Soybean stocks are projected to reach a stock-to-use ratio of almost 17% by 2034, which remains high compared to the past two decades, so harvest failures could quickly lead to market shortages.

Figure 3.4. Average annual change in harvested area for selected crops



Note: Please note that the usable data for Palm oil area starts only from 2008.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

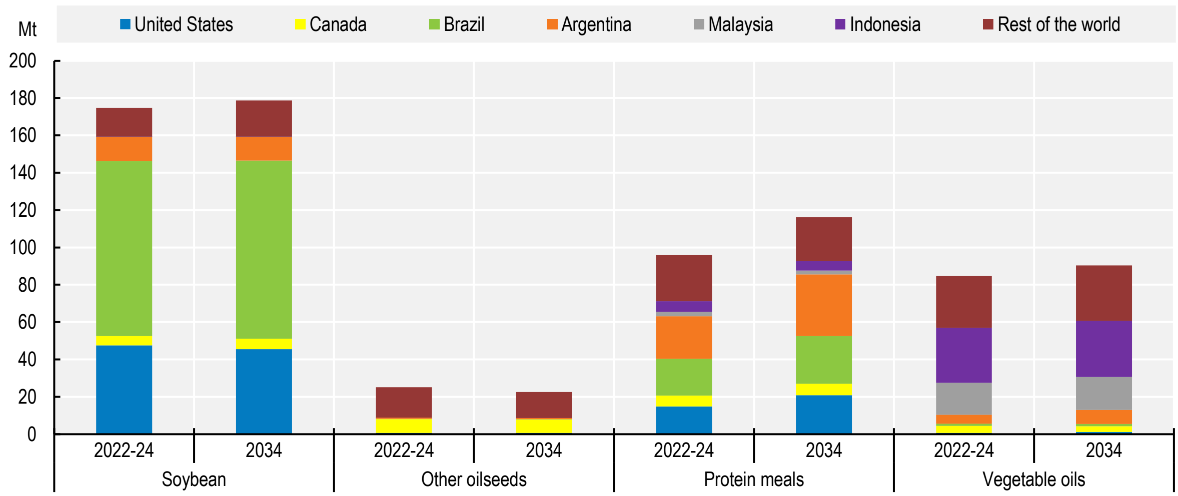
3.3.5. Trade

Trade is significant for oilseeds and products, but slowing down

Over 40% of world soybean production is traded internationally, a high share compared to other agricultural commodities. The expansion in global soybean trade is closely tied to the growth trend of soybean crush in importing countries. In China soybean crush growth is expected to slow down compared to the last decade and Chinese imports are projected to remain rather stable at about 107 Mt by 2034 (down from a growth of 3.4% p.a. in 2015-2024), accounting for about 60% of world soybean imports. Exports of soybeans originate predominately from Brazil and the United States. Brazil is the largest global exporter of soybeans with steady growth in its export capacity and is projected to account for 53% of total global exports of soybean by 2034 (Figure 3.5).

For other oilseeds, the internationally traded share of global production will decline to about 11% of world production since the two largest producers, China and the European Union, are net-importers. The main exporters are Canada, Australia, and Ukraine, which are projected to account for 65% of world exports by 2034.

Figure 3.5. Exports of oilseeds and oilseed products by country



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Vegetable oil exports, which amount to 34% of global vegetable oil production, continue to be dominated by a few players, notably Indonesia and Malaysia which account for about 53% of total vegetable oil exports. However, the share of exports in production is projected to contract slightly in these two countries as domestic demand for food, oleochemicals, and, especially, biomass-based diesel uses is expected to grow. India is projected to continue its strong growth in imports at 2.0% p.a., reaching 21 Mt by 2034, to meet increasing demand driven by population growth, urbanisation, and rising disposable incomes. At the same time, the Indian government is carrying out several initiatives to reduce its dependency on imports. These programmes aim at implementing farming techniques and services to strengthen and support domestic production.

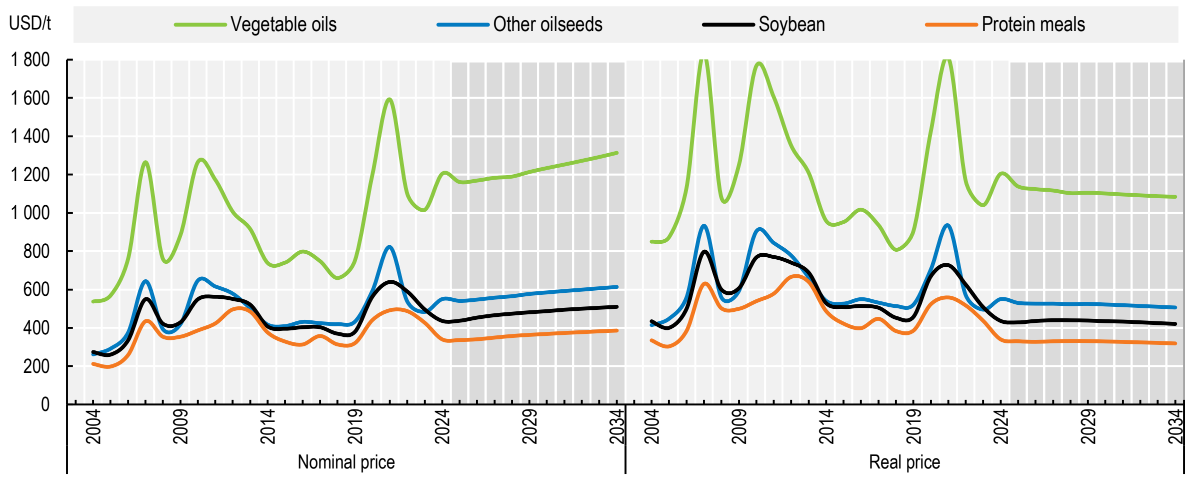
The projected growth in international trade of protein meal is 1.3% p.a. over the *Outlook* period and Argentina with its clear export orientation is expected to remain by far the largest meal exporter. The largest importer is the European Union, however its imports are expected to continue declining due to reduced domestic demand for protein meal. Asia, and particularly Southeast Asia with its increasing animal production, is expected to account for 79% of the global import growth in protein meal. As the domestic crushing capacity in Asian countries is not expected to keep pace with protein meal demand, the projected expansion of the livestock sector will be based on imported feed.

3.3.6. Prices

Real prices remain under pressure over the next decade

Oilseed and product prices are expected to increase slightly in nominal terms over the projection period, while declining in real terms (Figure 3.6). Due to the coupled production of meal and oil and the expected stronger demand for vegetable oil than protein meal, prices of vegetable oil are projected to rise compared to protein meal. This will also favour other oilseeds prices over soybeans as they contain higher shares of oil.

Figure 3.6. Evolution of world oilseed prices



Note: Soybeans, US, c.i.f. Rotterdam; Other oilseeds, Rapeseed, Europe, c.i.f. Hamburg; Protein meal, production weighted average price for soybean meal, sunflower meal and rapeseed meal, European port; Vegetable oil, production weighted average price for palm oil, soybean oil, sunflower oil and rapeseed oil, European port. Real prices are nominal world prices deflated by the US GDP deflator (2024=1).
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

3.4. Risks and uncertainties

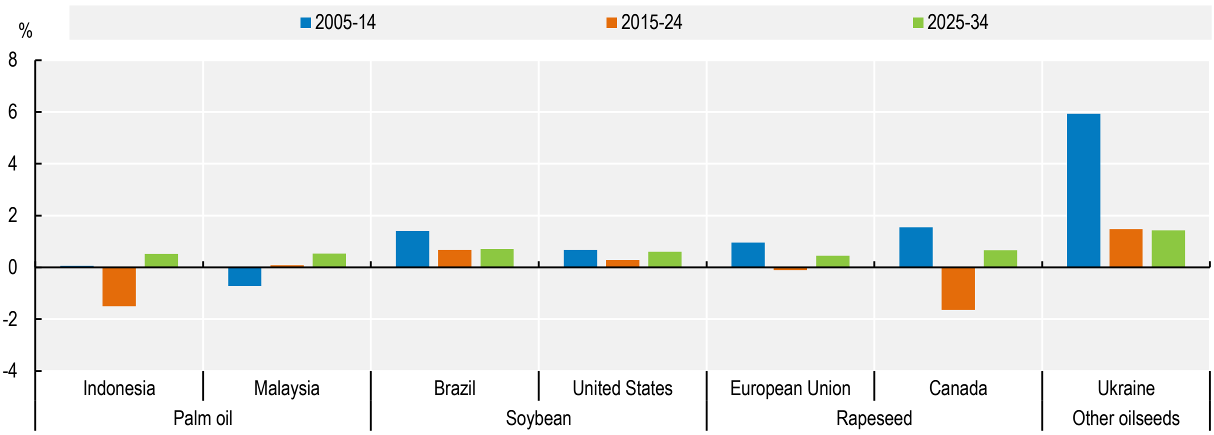
Environmental concerns influence global oilseed supply chains

The integration of environmental sustainability consideration into trade regulations could influence global oilseed and oilseed product trade. On the one hand the trade share of soybeans and vegetable oils at around 40% of production is considerably higher than for most other agricultural commodities. On the other hand, palm oil and soybeans are often mentioned when the link between agriculture and deforestation is discussed. Both products are included in the European Union deforestation regulation of 2023 (Regulation (EU) 2023/1115) as relevant products alongside cattle, cocoa, coffee, rubber and wood. The impact on global soybean and palm oil trade remains uncertain but could alter global oilseed and oilseed projections. In producing countries several measures to address these deforestation concerns, including certification of deforestation free production, have been implemented and increase in relevance for trade.

Due to the high trade share of soybeans and vegetable oils their projections are likely to be affected by any deviations from assumed projections trade regimes. Trade flows might shift either due to more beneficial trade conditions in bilateral agreements or due to trade frictions and restrictions.

Yields in major producer regions of palm oil and in some major rapeseed supplier countries have fallen or grown marginally during the last decade (Figure 3.7). There are many reasons for this development including: less productive land was brought into production due to a significant increase in production area; the ageing of oil palms, labour shortages especially in Malaysia, restrictions in the use of pesticides in the European Union; and shifting weather patterns. It remains uncertain how this will play out over the coming decade, but the lower projected area expansion limits the expansion of production into lower productive area over the *Outlook* period.

Figure 3.7. Average annual yield growth for palm oil and oilseeds



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The scope for increasing palm oil output in Indonesia and especially in Malaysia will increasingly depend on replanting and yield improvements rather than new area expansion. Nevertheless, replanted or new plantations of oil palms require three to four years to come into production. In recent years, growth in production has been sluggish given the low profitability of the sector and rising labour costs in Malaysia. There has been some replanting progress by major palm oil companies in Indonesia. In addition to the slowdown in yields, sustainability concerns will also influence the expansion of palm oil output as demand in developed countries favours deforestation-free oils and seeks sustainability certification for vegetable oil used as a biomass-based diesel feedstock and, increasingly, for vegetable oils entering the food chain. However, there are concerns about competing certification schemes in Malaysia and Indonesia.

The vegetable oil sector is driven by biofuel policies in the United States, the European Union, Indonesia, and Brazil, the four largest users of biomass-based diesel, given that about 18% of global vegetable oil supplies go to biomass-based diesel production. In Indonesia, attaining the proposed 30% biomass-based diesel mandate is doubtful given the need for government subsidies and possible medium-term supply constraints. In the United States Renewable Diesel or HVO currently receive considerable support in some states (e.g. California) that show strong production growth rates over the outlook period. In the European Union, policy reforms, reduction of overall diesel use and the emergence of second-generation biofuel technologies will likely prompt a shift away from crop-based feedstocks, assumed in the *Outlook* under fixed policy conditions. Globally, Sustainable Aviation Fuels (SAF) are expected to be a substantial use of biofuels but the timing of introduction remains largely uncertain and the *Outlook* does not include relevant quantities until 2034.

The development of animal production in China remains the major driving force for global protein meal demand and soybean trade. Overall, the development of meat demand is shaped by declining population and slower but still substantial economic growth. In addition, it is envisaged to replace pig meat by other animal protein with a likely reduction in the demand for protein meal. Protein meals compete in part with other feed components in the production of compound feed, so changes in cereal prices will prompt adjustments in the balance between compound feed ingredients and hence protein meal demand.

4 Sugar

This chapter describes market developments and medium-term projections for world sugar markets for the period 2025-34. Projections cover consumption, production, trade, and prices for both sugar crops (sugar beet and sugarcane) and the sweetener complex, including raw sugar, white sugar, molasses, and high fructose corn syrup (HFCS). The chapter concludes with a discussion of key risks and uncertainties which could have implications for world sugar markets over the next decade.

4.1. Projection highlights

Low- and middle-income countries across Asia and Africa are expected to drive the growth of global sugar demand, fuelled by sustained population and disposable income growth. Faster growth in per-capita sugar intake is anticipated in low-income countries, although it will remain well below the global average.

Moderate demand will prevail in other regions. In high-income countries, slower population growth and shifting consumer preferences, driven by health concerns about high sugar intake, result in stable sugar consumption. In countries like The People's Republic of China (hereafter "China") or Japan, where per capita consumption is relatively low, dietary preferences for low-sugar products will continue to prevail.

Sugar production is expected to expand, with sugarcane continuing to drive over 85% of total production. Brazil is projected to consolidate its position as the world's leading producer due to the expansion and replanting of its sugarcane plantations. Varietal improvements and higher extraction rates are expected to drive production increases in India and Thailand. The European Union will remain the main sugar beet producing region. However, competition for land use from other crops and the reduced availability of plant-protection products, which increases the risk of disease spread, are expected to limit sugar production.

Sugar crop-based ethanol production will continue to shape sugar markets. In Brazil, the allocation of sugarcane between its main uses—sugar and ethanol—is expected to continue in response to outlet optimization, though international sugar market conditions are anticipated to favour export-oriented sugar production. While in India, sugarcane-based ethanol production will be supported by the government measures to diversify the sector.

Exports are projected to be increasingly concentrated, while imports will remain more evenly distributed. Brazil is expected to reinforce its leading exporter position, followed by Thailand and India, with nearly 52%, 14% and 8% of global exports respectively in 2034. The global distribution of raw (61%) and white sugar (39%) trade is expected to remain stable over the outlook period. Import demand will originate in low- and middle-income countries in South Asia and Africa, driven by growing demand and limited production possibilities in these markets.

Sugar prices are expected to decline slightly over the *Outlook* period, although subject to many uncertainties, including extreme weather events, Brazil's dominance in the global sugar market, and fluctuations in the relative profitability of sugar compared to ethanol.

4.2. Current market trends

International prices of sugar have generally declined since the start of the 2024/25 season in October. In late 2024, good harvest progress and beneficial rainfall in key southern growing areas of Brazil weighed on prices. The start of the crushing season in India and Thailand exerted further downward pressure. The weakening of the Brazilian real against the United States dollar in the last quarter of 2024 also contributed to the decline in world sugar prices. However, concerns over a deteriorating production outlook in Brazil and India limited the decline and caused a strong price increase in February 2025.

World sugar production in the 2024/25 season is anticipated to be 3% lower than last year's bumper level, mainly due to expected reduced output in India and Brazil. In India, the decline is primarily attributed to reduced yields in major producing states, affected by prolonged dry weather conditions. Similarly, in Brazil, despite improved rains in late 2024, production is forecast down from the bumper level last year mainly due to earlier dry conditions and low precipitation in February and early March 2025. The decline in these countries is expected to more than offset a significant production rebound in Thailand, stemming from favourable weather conditions and an expansion in area triggered by attractive farm-gate prices. Larger sugar outputs are also seen in China and the European Union.

On the demand side, world sugar consumption is foreseen to remain close to its level in the previous season amid prospects for relatively steady global economic growth. The current production and consumption forecasts are expected to push the sugar market into a global production deficit.

With lower exportable availabilities from Brazil and India more than offsetting higher shipments from Thailand, world sugar trade in 2024/25 is predicted to contract compared to the previous season. Global import demand is anticipated to decline mainly reflecting lower imports from India compared to the record 3.6 Mt imported last season, as well as lower imports from the United States, Mexico and the European Union.

4.3. Market projections

4.3.1. Consumption

Over the next ten years, global sugar consumption is projected to expand by 1.2% p.a. and reach 202 Mt by 2034, driven by population and income growth.

Sugar, a fibre-free carbohydrate, is a common ingredient in numerous food and beverage products and represents a key source of energy in the human diet. High levels of sugar consumption are associated with health concerns and WHO recommends reducing the intake of free sugars (i.e. sugar added to foods during production or cooking including sugars found in honey, syrups, and fruit juices) to less than 10% of the total daily energy intake. All regions covered in this *Outlook*, except the Americas and Oceania, will see an increase in per capita intakes of caloric sweeteners,[1] but disparities will persist within regions. The largest increase will take place in the highly populated regions of South and Southeast Asia (Figure 4.1).

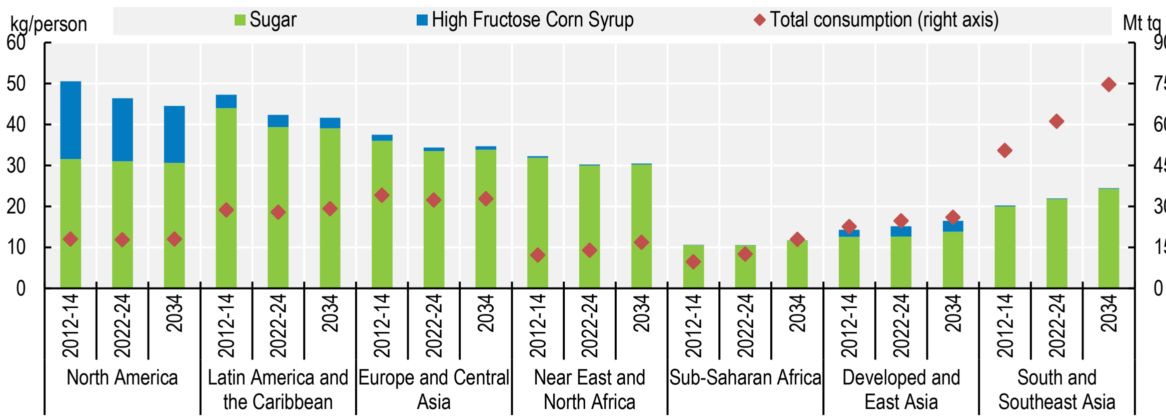
Global growth is mainly driven by Asia and Africa

With the projected rapid growth in population and income Asia and Africa are expected to contribute the most to the increase in global demand compared to the reference period, accounting for 64% and 29% of the world total growth, respectively. Dietary shifts driven by urbanisation and increasing disposable incomes are expected to be key drivers of the increase. However, by 2034, per capita consumption is anticipated to reach 15.6 kg in Africa and 21.2 kg in Asia, both below the projected world average of 23.1 kg/person.

In Asia, India is expected to contribute the most to the overall increase in sugar consumption, followed by Indonesia, Pakistan and then China. In these countries, except China, population growth and rising income are expected to sustain demand for processed food and beverage products over the next decade. In China, most of the demand growth is expected to come from smaller and less developed cities, while in larger, more developed cities, health concerns and government awareness campaigns are likely to slow growth. In terms of per capita food consumption, Asian LDCs are expected to be the main drivers of the region’s annual growth of 1.5% over the next decade.

Across Africa, Least Developed Sub-Saharan countries are expected to record the highest growth rate in per capita consumption, primarily due to projected increases in disposable income and higher spending on processed foods and beverages. Growth is also expected in North Africa. By contrast, in South Africa, the declining trend in per capita sugar consumption recorded in recent years–amid government measures to discourage its use, including the Sugar-Sweetened Beverage (SSB) taxation and public health campaigns–is expected to persist over the next decade; with many food manufacturers reformulating their products to reduce sugar content.

Figure 4.1. Trends in total consumption of caloric sweeteners



Note: Consumption is expressed on a tel quel basis (tq), see glossary of terms for definition.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Over the coming decade, Asia and Africa will remain the regions where the diet will include the greatest proportion of staple foods which are rich in carbohydrates, and the lowest proportion of caloric sweeteners, particularly in Sub-Sahara Africa.

Downward trends in caloric sweetener consumption are expected to continue across other traditionally high-consuming regions

Traditionally, the Americas, the Caribbean and European countries record the highest level of per capita sugar consumption with caloric sweeteners accounting for at least 12% of dietary carbohydrates and exceeding 20% in the United States in particular. Since 2010, caloric sweetener consumption in these countries has been trending downwards as awareness of their adverse health effects has increased. Over the next decade, the decline is projected to continue, although at a slower pace.

Compared to other regions, Latin America is expected to account for the highest level of sugar consumption. Over the past fifteen years, high per capita consumption levels have raised concerns about their negative health effects. In response, several countries, including Chile, Colombia, Ecuador, Mexico, Peru, and more recently Brazil, have introduced a tax on sugar-sweetened beverages intended to reduce soft drink intake. Some countries such as Argentina, Brazil, Colombia, Mexico and Peru have implemented mandatory front-of-package labelling to promote healthier product choices. Over the next decade, the region is projected to experience a decline in per capita total caloric sweetener consumption, led by Brazil, Argentina, Paraguay, Chile, Mexico and Peru.

During the last decade, Europe had the highest per capita intake and the second highest total sugar consumption level. For the past two decades, European countries have sought to take measures to avoid excessive sugar consumption, prompting the industry to reformulate the composition of its products and consumers to gradually adopt healthier diets. Over the next ten years, the region will experience the biggest decline in consumption among the regions covered in the *Outlook*. Although per capita sugar consumption in the European Union will remain the highest in the region, it is expected to see a continuing decline over the next decade, albeit at a slower pace than in the previous decade, a trend also observed in the United Kingdom and Switzerland. Conversely, per capita sugar consumption is expected to increase in Ukraine and some other European countries.

Per capita consumption levels are also projected to decline in high sugar-consuming countries such as Australia, New Zealand and Canada. However, this decline will be less visible in the United States as consumers will favour sugar-sweetened products over HFCS. In Japan and Korea,[2] minimal changes are expected, except for the decrease in volume caused by population decline.

The High Fructose Corn Syrup market will stabilise

High Fructose Corn Syrup, the other caloric sweetener, is used primarily in beverages as a substitute for sugar. Unlike sugar, it is a liquid product and therefore less easily traded. Global consumption will remain the domain of a limited group of countries with no major changes. The largest producer, the United States, will remain the main consumer but the debate surrounding whether HFCS poses a greater potential health risk than does sugar is expected to continue, and the downward trend in consumption that started in the mid-2000s is expected to continue: by 2034, HFCS is foreseen to represent 33% of the caloric sweetener consumption compared to 35% during the base period. HFCS production in the United States is projected to decline slightly to 6.3 Mt. Mexico is the third largest consumer (behind China) and the efforts of the government to reduce caloric sweetener consumption are expected to continue over the next ten years, leading to lower intake of HFCS sweetened soft drinks.

China, the world's second largest producer, is expected to see the biggest increase in consumption, although intake will remain low compared to Japan or Korea. Over the next decade, Chinese HFCS production is projected to increase and meet domestic demand (+0.2 Mt by 2034). No increase is foreseen in Japan and Korea with a consumption of about 5 kg/capita. In the European Union, HFCS will remain uncompetitive with sugar over the next decade, accounting for only one kg/capita in 2034.

4.3.2. Production

Sugar is a capital-intensive sector, characterized by substantial input costs, including energy to increase yield and sugar content. Remunerative domestic prices recorded in the early 2020s have encouraged investments in the sector and are expected to sustain further growth and development in the coming decade. Global sugar production is expected to increase by 15% over the *Outlook* period.

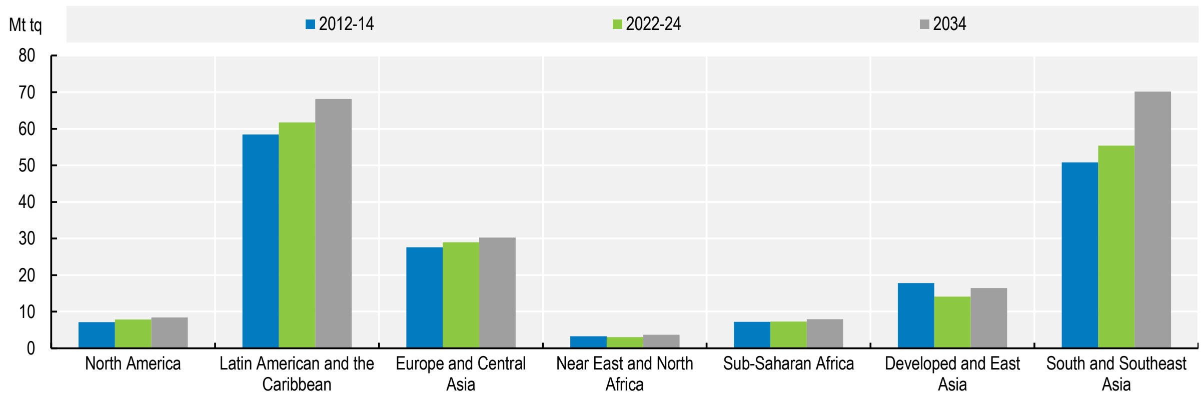
Global sugar production growth led by Asia

Global sugar production is expected to grow from 178 Mt during the base period to 205 Mt by 2034, 63% of which will come from Asia and 24% from Latin America.

Asia will become the leading region by 2034 producing about 42% of the world's output. India, Thailand and China are expected to provide the largest shares of the region's total sugar supply, increasing their sugar production by 8.7 Mt, 3.6 Mt and 2.0 Mt by 2034, respectively, compared to the base period (Figure 4.2). In India, the world's second largest sugar producer, the growth rate in sugar production is expected to be slightly lower than in the past decade due to slower sugarcane production growth and greater diversion to ethanol. In Thailand, where sugarcane is primarily used to produce sugar, sugar production is projected to increase, driven by higher sugarcane production and improved sugar extraction rates. In China, the efforts of the domestic sugar industry will be supported by domestic production support policies aimed at stabilising output and reducing reliance on imports.

By 2034, Latin America is expected to be the second largest sugar producing region, with Brazil as the world's leading supplier. Higher investments in plantations, combined with favourable weather conditions supported the recovery of the country's sugar industry from a prolonged financial crisis between 2017 and 2022. However, following this recovery, persistent dry weather and unprecedented wildfires during the summer of 2024 are anticipated to affect sugar production at the start of the *Outlook*. Nevertheless, supported by investments and assuming normal weather conditions, production is projected to recover in the coming years, with an additional 5 Mt of sugar expected over the next decade compared to the base period.

Figure 4.2. Sugar production by region



Note: data are expressed on a tel quel basis (tq), see glossary of terms for definition.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Africa is also expected to contribute more to global sugar supplies, with its share of production increasing mainly on account of Sub-Saharan African countries, along with a rising contribution from Egypt, the continent's largest sugar producer. Government support measures and foreign investments are expected to contribute to increased sugar production. Suitable conditions for growing sugarcane, potential for area expansion and lower costs of production, are expected to underpin the increase in production.

Production in OECD countries is foreseen to continue losing market share. In 2034, the region will represent 20% of the global market, compared to 22% in the base period. Although it will retain its position as the main producer of this regional market in 2034 (37%), the European Union's sugar production is expected to decline while higher supply is foreseen in the United States (+0.5 Mt) bolstered by several government policies that support the domestic industry.

Sugarcane to remain the main sugar crop, with growth driven by Brazil, Thailand and India

Sugarcane will continue to account for more than 85% of sugar crops. Over the *Outlook* period, global sugarcane production is projected to grow by 1.2% p.a. and reach 2 100 Mt by 2034. Brazil, India and Thailand are anticipated to contribute the most to the change in global output volume (+112 Mt, +90 Mt and +22 Mt, respectively). This mainly reflects relatively higher crop yields in India and Thailand, while area expansion is mainly expected in Brazil with an additional 1.2 Mha.

Brazil is the leading sugarcane producer, with half of its production used to produce ethanol. The allocation between the two is largely driven by market conditions, such as international sugar prices and domestic ethanol demand. However, government policies such as mandatory ethanol blending and incentives for biofuel production also play a key role in supporting ethanol use. The profitability of the sector in recent years, with high sugar prices, has encouraged investment in the sector. Over the next ten years, the adoption of more sustainable sugarcane cultivation practices is expected to enable the world's leading sugar exporter to meet market needs. Some area expansion is foreseen, and the share of area cultivated with sugarcane in total arable land availability (12.0% during the base period) will increase to 13% by 2034. Little improvement in yields is foreseen due to drier climatic conditions.

In India, the growth in sugarcane production is projected to stem mostly from higher crop yields, as area is not expected to expand given competition from other agricultural crops. Government support measures play a crucial role in sustaining sugarcane production. These measures include setting Fair and Remunerative Prices (FRP) to ensure farmers receive adequate compensation, providing financial assistance for the renovation of existing facilities, and supporting the development of improved sugarcane varieties. Additionally, the government collaborates closely with industry organisations, such as the Indian

Sugar Mills Association (ISMA), to improve sugarcane yield and sugar recovery rates. Similarly, in Thailand, sugarcane production over the next decade is also expected to come mainly from higher yields, supported by government initiatives aimed at improving cultivation practices and sustainability. The cultivation area is anticipated to remain relatively stable, sustained by attractive farm-gate prices that incentivize farmers to continue sugarcane farming. In China, sugar crops floor prices set by the government and import tariffs will continue to provide incentives for authorities in the main producing regions to support farmers and millers in modernising and maximising their yields in the short term. However, only moderate growth is expected as rising input costs and competition for land with other crops will slow these efforts in the years to come.

Prospects are less robust for sugar beet. Transforming this crop requires more energy than the production of sugar from sugarcane and this negatively impacts profit margins. Increases in beet production are anticipated mainly in Egypt, Türkiye, the United States, and China.

In Egypt, remunerative procurement prices, along with efforts to adopt improved seed varieties and to expand sugar beet processing capacities are expected to boost sugar beet production by 4 Mt when compared to the base period.

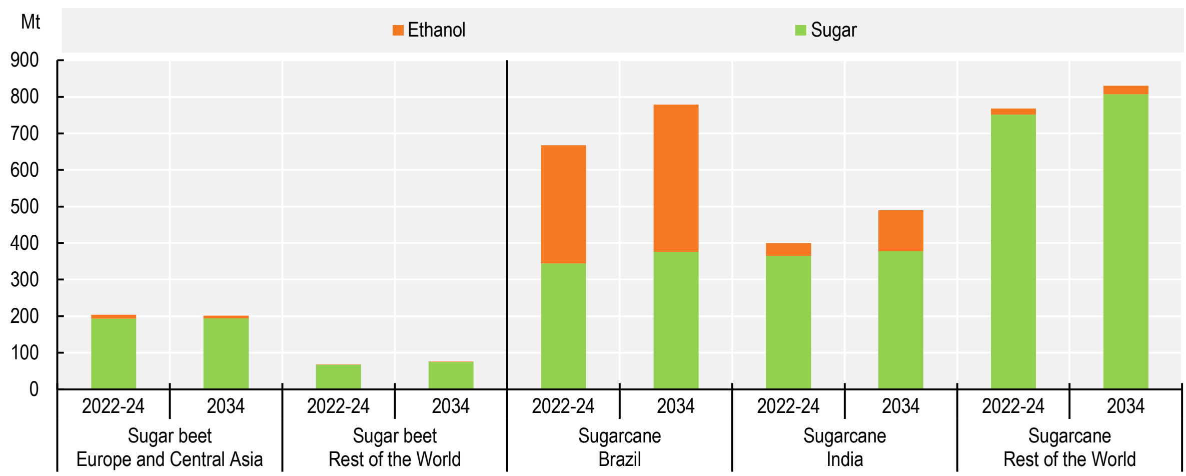
In the United States and China, where both sugar crops are grown, higher sugar beet yields will enable this crop to maintain its market share of 52% and 9% of total sugar crops, respectively.

In Europe, not much change is expected in Ukraine and Russian Federation (hereafter “Russia”) over the next decade. While in the European Union, high input costs related to other crops, the spread of the reed glasswing cicada—which affects the sugar content of the beet in some areas - and stricter environmental legislation on plant protection products, which increases the risk of the spread of new disease outbreaks, will encourage producers to switch to more profitable crops. In Türkiye, the world’s fourth largest producer of sugar beet, after European Union, Russia and the United States, sustained yield increases over the past decade—driven by improved seed quality and modernized production practices—are expected to support further growth in sugar production over the next decade.

Sugar crops will primarily continue to be used for producing sugar or ethanol

During the last decade, 81% of the world’s sugar crops were used to produce sugar, but this share is expected to decline to 77% by 2034. In the major sugarcane producing countries, support for biofuel production will influence the balance between the main uses of sugarcane, sugar or ethanol, especially since factories often have the built-in option to switch from one to the other. By 2034, Brazil and India are expected to remain the main producers with respectively 37% and 23% of the world's sugarcane, 24% and 19% of global sugar production and 75% and 21% of global sugarcane-based ethanol production (Figure 4.3). In Thailand, very little ethanol is produced directly from sugarcane as molasses or cassava are mainly used.

Figure 4.3. World production of sugar crops classified by their main uses



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Box 4.1. The role of the "Sugarcane Complex" in the bioenergy sector

Bioenergy is a renewable energy produced from various biomass sources, including wood, waste, and crops. Over the last decade, global energy production increased by about 14.5%, with bioenergy increasing by 18% during the same period and accounting for approximately 9% of the total energy supply by 2024. Among the different sources of bioenergy, fuelwood and vegetal residues make up about three-quarters of the total production, while bagasse and biofuels together account for around 15%. Bagasse is a cellulosic byproduct of sugarcane refinery, and while it is often regarded as waste, it can be used in producing cellulose-based products, feed and energy. Sugarcane juice and molasses are also used to produce ethanol through a fermentation process. The various sugarcane products and byproducts can be collectively termed as the "Sugarcane Complex" (SCC) and play an important role in the bioenergy sector.

The SCC is closely linked to the energy sector in major sugarcane producing countries like Brazil, India, and Thailand. Brazil's energy sector has relied on the SCC to produce energy and over the last decade 50% of sugarcane has been used directly in ethanol production. This share is expected to remain stable over the next decade. In Thailand the direct use of sugar cane in biofuels is very limited (below 3%) and is not expected to change. Ethanol production uses about 9% of India's sugar production and it is expected to increase to 22% by 2034. The rising production of ethanol can be attributed largely to policies supporting the use of domestically produced ethanol, which couple biofuel consumption and fossil fuel consumption, aiming at decarbonizing the transport sector. Additionally, governments have provided various types of support to promote domestic ethanol production, such as tax credits and support prices for feedstocks (see Biofuel chapter).

In addition to sugarcane-based ethanol, molasses and bagasse significantly contribute to energy production from the SCC. Over the last decade, the SCC complex accounted for 10-16% of Brazil's energy production and is expected to be close to 11% by 2034. In Thailand, the SCC's share in total energy supply increased from 7% to about 12% over the last decade, a figure that will remain constant by 2034. For India, the SCC's share of the total energy supply will increase slightly to 4.5% by 2034. The projected SCC's shares in energy production rely on the capacity of the countries to expand ethanol production and the domestic supply of bagasse. Assuming bioenergy from SCC grows more in line with sugarcane production projected in the *OECD-FAO Agricultural Outlook*, then total energy from the SCC would increase by 18% in Brazil, 48% in India and 30% in Thailand, indicating that SCC will remain a reliable and, in some cases, significant component of energy production.

Table 4.1. Selected indicators for the role of the Sugarcane Complex (SCC) in the energy sector

	Growth in total energy production		Growth in SCC energy production		SCC share in total energy production		
	2012-14 to 2022-24	2022-24 to 2034	2012-14 to 2022-24	2022-24 to 2034	2012-14	2022-24	2034
Brazil	37.3%	21.2%	-6.2%	18.2%	16.3%	11.1%	10.8%
India	36.4%	30.6%	65.0%	48.4%	3.3%	4.0%	4.5%
Thailand	-2.7%	58.6%	32.6%	29.9%	7.4%	12.1%	12.1%

Source: Own calculations based on FAOSTAT bioenergy, *IEA Energy Outlook 2024* and the *OECD-FAO Agricultural Outlook*.

From this perspective, sugarcane should be seen not only as a single product with a unique purpose but as a complex of several products meeting different needs, including food (sugar), feed (molasses and bagasse), cellulose production (bagasse), and energy (molasses, bagasse, and sugarcane juice). Being quite versatile, the SCC allows the sugar industry to diversify, thus providing more leverage to deal with uncertainties, i.e. ethanol may be used as a buffer when sugar prices are low.

The energy produced from the SCC in Brazil is nearly three times higher than the total energy consumption of the agricultural and forestry sector, and about four times higher in Thailand. In India, the surplus from SCC-based energy in relation to the energy consumption of the agricultural and forestry sector is nearly 27%.

In conclusion, the SCC has consolidated as a key element in ensuring a renewable and reliable source of energy, contributing to energy access and security.

Sources
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IEA (2024), *World Energy Outlook 2024*, IEA Publications, Paris, https://www.iea.org/reports/world-energy-outlook-2024.
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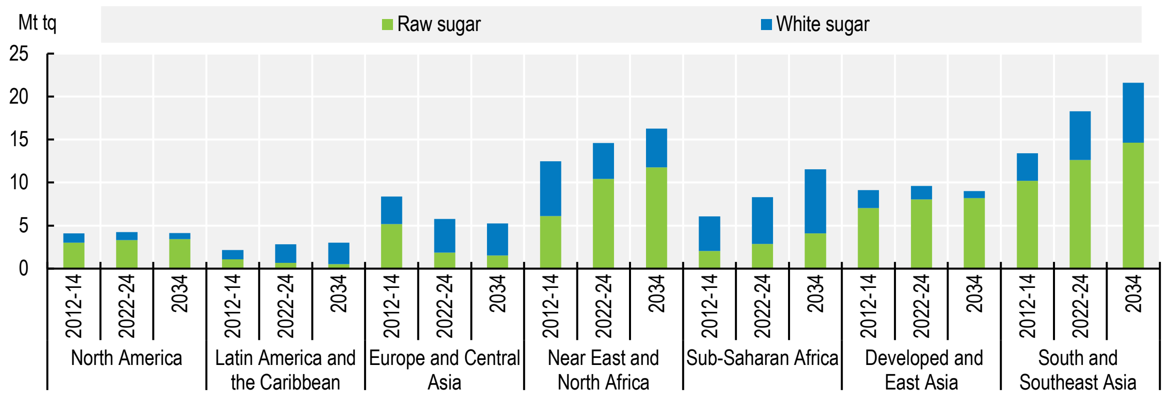
4.3.3. Trade

Sugar trade to remain robust over the Outlook period

Sugar will remain a highly traded product. Most trade will continue to be represented by raw sugar (61% in 2034), which is typically transported in bulk form and will be destined for refineries (Figure 4.4). Trade in refined sugar intended for human consumption is more costly, since it requires greater protection against moisture and contamination during handling and transportation. The overall balance of raw and white sugar trade is expected to remain stable over the outlook period.

Imports are foreseen to account for 35% of global consumption over the *Outlook* period. Asia and Africa will remain the world's largest gross importers, accounting for 58% and 29% respectively of global sugar imports. The growth in consumption in Least Developed Sub-Saharan African countries is expected to drive an increase in the share of imported white sugar for direct consumption. In Asia no significant changes are expected in terms of dependence on imports. Imports of raw sugar will continue to increase, mainly driven by key buyers, Indonesia and China, although China will reduce its dependency by 0.4 Mt.

Figure 4.4. Raw and white sugar imports by region



Note: Data are expressed on a tel quel basis (tq), see glossary of terms for definition.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

By contrast, in Indonesia, the slow growth in sugar production coupled with a sustained increase in consumption, is expected to drive a significant increase in imports, which are projected to grow by 3% p.a. over the outlook period.

A continued decline in sugar imports, mainly white, is expected over the coming decade in the European Union, as well as in Japan where the decline will primarily affect raw sugar. The United States is traditionally a sugar-deficit country where national policies will continue to foster domestic production and limit import flows.

On the export side, sugar markets are projected to remain highly concentrated, making them reliant on market developments in a limited number of countries. By 2034, the traditional three main sugar exporters are anticipated to account for about three-quarters of the market: Brazil (73% of raw, 21% of white), Thailand (10% of raw, 20% of white), and India (2% of raw and 18% of white). Brazil will remain by far the world's leading global supplier of raw sugar, and the main supplier of white sugar, along with Thailand and India. In India and Thailand, exports of white sugar are projected to maintain their larger share of total sugar exports, driven by higher returns from the white sugar premium. Australia will follow with about 7% of the raw sugar market.

At the start of the *Outlook*, Brazil is facing logistical bottlenecks at ports. Given the profitability of Brazil's exports in international markets and tightness in global sugar supplies, projects to develop storage, port and vessel infrastructures will continue. The lack of white supplies from Brazil, which prioritises raw exports at bulk terminals requiring fewer hygiene protocols, is expected to persist until 2034. Brazilian sugar exports are expected to increase by 5 Mt and reach 38 Mt in 2034, 21% of which will be white shipments compared to 14% during the base period.

Thailand's share of sugar exports is expected to increase from 10.8% with a volume of 7.2 Mt in the base period to 14.3% and reach 10.4 Mt by 2034. In India, sugar exports are expected to reach 6.0 Mt by 2034, up from 4.7 Mt in the base period.

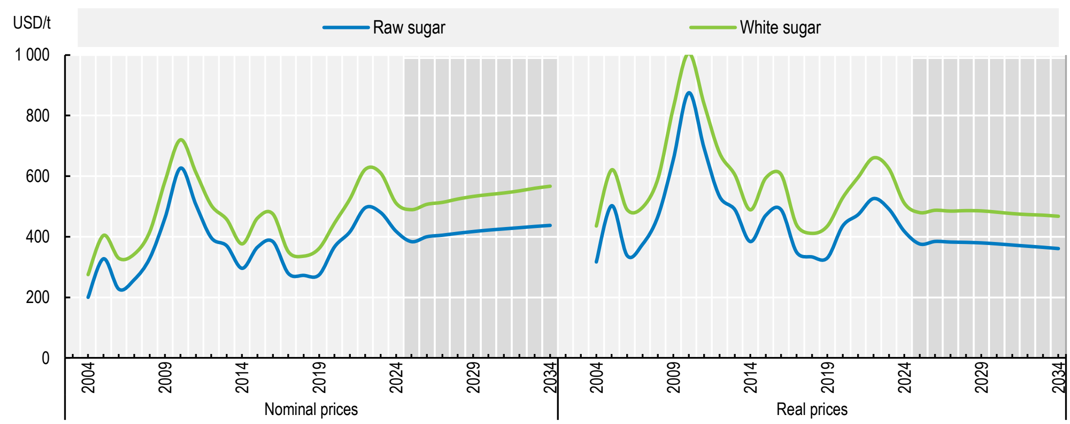
4.3.4. Prices

Sugar prices expected to fall in real terms

International sugar prices, in real terms, are projected to decline over the *Outlook* period, driven by sustained productivity gains, as described above. However, the downward pressure on prices is expected to be partially offset by constant real international crude oil prices, which would encourage the use of sugar crops for ethanol production, providing some price support for sugar.

Following a decline from recent high margins, the white sugar premium (difference between white and raw sugar prices) is anticipated to increase slightly in real terms over the *Outlook* period reflecting a tighter availability of white sugar in global exports relative to raw sugar.

Figure 4.5. Evolution of world sugar prices



Note: Raw sugar world price, Intercontinental Exchange contract No.11 nearby futures price; Refined sugar world price, Euronext Liffe, Futures Contract No. 407, London. Real sugar prices are nominal world prices deflated by the US GDP deflator (2024=1).
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

4.4. Risks and uncertainties

Alternative national policy developments affecting the relative profitability of sugar crops or a change in returns compared to alternative crops could influence planting decisions.

Disturbances in trade routes, freight costs, port handling and storage, and the availability of shipping containers could significantly alter the market *Outlook*. Similarly, any deviation of the white sugar premium from the assumed increase in this *Outlook* could also affect country decisions on refining capacity and delivery strategies.

Given that 24% of global sugar crops are foreseen to be used for ethanol production in 2034 compared to 18% in the base period, including 52% of the domestic crop in Brazil, the fluctuation of crude oil vis-à-vis sugar relative prices remains a major source of uncertainty. Any further shifts in ethanol policy could have a significant impact on the global sugar market.

Increased investments in research and development particularly in diversification opportunities such as biofuels and bioplastics, could influence market dynamics and affect the availability of sugar for export.

Government initiatives, such as India's National Bio-Energy Mission and Brazil's RenovaBio programmes, are already driving investments in sustainable sugarcane practices. However, while these measures contribute to the sustainability of the sector, they may also lead to higher production costs than assumed, particularly if compliance requires additional investments in technology, inputs, or certification processes, potentially impacting sugar prices in both domestic and global markets.

Notes

[1] Caloric sweeteners include sugar and high fructose corn syrup (HFCS) in this chapter.

[2] For FAO, “Korea” refers to the “Republic of Korea”.

5 Meat

This chapter describes market developments and medium-term projections for world meat markets for the period 2025-34. Projections cover consumption, production, trade and prices for beef, pig meat, poultry, and sheep meat. The chapter concludes with a discussion of key risks and uncertainties which could have implications for world meat markets over the next decade.

5.1. Projection highlights

Total growth in meat consumption is projected at 47.9 Mt over the next decade. Annual per capita consumption is projected to increase by 0.9 kg per capita/year edible retail weight equivalent (rwe) by 2034. In high-income countries, consumers are increasingly sensitive to animal welfare, environmental and health concerns, leading in some instances, per capita meat consumption to stagnate.

Improvements in breeding efficiency and slaughter yields are projected to mitigate the environmental impact of meat production. Globally, improved slaughter weights will account for 8%, 27% and 19% of the gains in bovine, pig meat and poultry meat production. With these productivity improvements and a greater share of poultry in meat production, greenhouse gas emissions are expected to rise by 6%, significantly less than the projected 13% growth in meat output over the coming decade.

Decreasing role of The People's Republic of China (hereafter "China") in meat imports is expected to shift global trade patterns. By 2034, China's share of global meat imports is set to decline from 20% in the base period to 16%. A reduced reliance on pig meat imports has led to curbed pork production in major exporters. A similar downward trend is evident in China's poultry imports. Global meat imports will grow by just 10% compared to 37% in the previous decade, with considerable downside risk if countries retrench on trade measures.

Real meat prices will return to their long-term trend. In the short term, nominal ruminant meat prices, and in particular bovine prices, are projected to rise more significantly as inventories are rebuilt, limiting growth in supply. In contrast, non-ruminant meat prices are expected to ease due to moderate production expansion and lower import demand by China. Although real feed costs are anticipated to decrease, other real operating costs will remain high, slowing the growth of meat supply. Over the medium term, real meat prices are projected to fall, influenced by slowing demand, reduced real feed costs, and continuous productivity improvements.

Recent animal disease outbreaks have highlighted the critical need for biosecurity collaboration in the meat industry. Animal disease outbreaks continue to disrupt the meat sector significantly, emphasizing the need for collaborative biosecurity to maintain industry sustainability. The continuous evolution and spread of animal diseases such as HPAI virus, ongoing ASF, resurgence of Foot and Mouth Disease (FMD), and the New World Screwworm (NWS) cast uncertainties for the medium term.

5.2. Current market trends

Expansion driven by poultry and beef with record exports from Brazil

In 2024, global meat production is estimated to have risen by 1.3%, reaching 365 Mt. This growth was led largely by poultry meat, with beef output increases also contributing, while pig and sheep meats production remained stable. Significant growth in meat production occurred in Australia, Brazil, the European Union, and the United States. Among these, Brazil registered the most significant expansion across all major meat categories, driven by strong global demand, supported by higher net returns due to a favourable exchange rate and lower feed costs as well as continued disease-free status.

Global meat exports recovered in 2024, rising by an estimated 2% to 40.2 Mt after two years of decline. Growth was fuelled by increasing import demand in the United States and Near East countries, encouraged by limited domestic supplies and higher demand for bovine and poultry meats. Countries such as The Philippines, United Arab Emirates, and Mexico also expanded imports, spurred by rising consumer demand and tariff adjustments allowing more imports. Brazil is poised to achieve a new record in bovine meat exports due to robust international demand, a favourable exchange rate and ample supply. Australia's meat exports are also expanding, aided by competitive prices and strong demand. By contrast, China reduced imports owing to increased domestic production and weaker domestic demand reflecting subdued consumer spending. FAO's meat price index increased modestly by 2.8% in 2024, averaging 117.3, as higher import demand was rationed to some extent by supplies from key meat-exporting countries.

5.3. Market projections

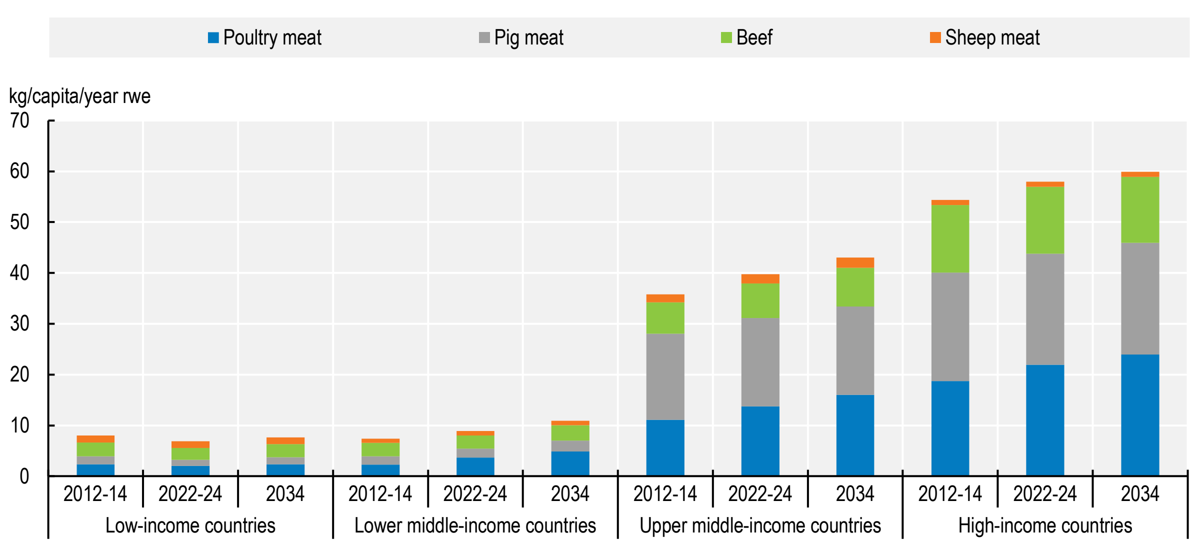
5.3.1. Consumption

Dominance of poultry consumption amidst diverse regional trends

Global poultry, sheep meat, beef, and pig meat consumption is projected to grow by roughly 21%, 16%, 13% and 5% respectively by 2034. Due to rapid population and income growth, 45% of global consumption growth will be located in upper middle-income countries. On a country basis, meat consumption growth, aside from China and India because of their vast population, is expected to be greatest in Brazil, Indonesia, the Philippines, the United States, and Viet Nam. The fast-growing population in Africa, rising from 1.5 billion to 1.8 billion over the next decade, will drive a substantial 33% increase in that region's meat consumption.

On a per capita basis, total meat consumption is projected to be just 3% higher reaching 29.3 kg per capita/year rwe. This is about half the growth witnessed in the previous decade. In most high-income countries (which accounted for 35% of global meat consumption but only 17% of the world's population in 2024), growth in per capita meat consumption will continue to slow (Figure 5.1). Consumers are shifting preferences – often reducing meats like beef and pork in favour of poultry. Higher-income consumers are increasingly attentive to animal welfare, environmental, and health attributes of food, which in some places is leading to stagnating or even declining per capita meat consumption. For example, in Canada and the European Union, the *Outlook* projects continued substitution of poultry in place of beef, pig, and sheep meat with stagnation in total meat consumption on a per capita basis.

Figure 5.1. Per capita meat consumption by income group and meat type



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Global poultry consumption is projected to reach 173 Mt ready-to-cook (rtc) by 2034, accounting for 62% of the additional meat consumed globally. The increase in poultry meat consumption in the last decade was driven by rising consumption in Asia, especially in China, India, Indonesia, Pakistan and Viet Nam. This trend is expected to continue, with rapid consumption growth also projected in other regions such as Brazil, Egypt, Mexico, the Philippines, and the United States. The global increase in protein from poultry meat consumption as a share of total protein from meat has been the main feature of the growth in meat consumption for decades, and this trend is expected to continue. By 2034, poultry meat will provide 45% of the protein consumed from all meat sources. This is due to several factors, notably its low cost (poultry remains the most affordable meat) and its favourable nutritional profile with a higher protein-to-fat ratio compared to other meats. Environmental considerations also contribute to the shift towards poultry meat, as the production of red meat is more resource-intensive and leads to higher greenhouse gas emissions. Poultry is, therefore, more appealing to sustainability-conscious consumers.

Pig meat consumption is projected to grow in all regions, except in China, the European Union, Japan and Switzerland, where consumption is already high, and health, environmental and societal concerns increasingly influence diets. Pig meat will be the third largest contributor to the total growth in meat consumption and is projected to reach 130 Mt carcass weight equivalent (cwe). However, global per capita pork consumption is projected to decline by 4% relative to the base period for the *Outlook* due to zero growth in per capita consumption in high-income regions, alongside a rapid population increase in regions where pork is not commonly consumed. In the Latin American region per capita consumption is projected to increase the most, by 1.3 kg/year rwe, due to favourable relative pig meat/beef prices. In other regions, per capita consumption is anticipated to grow less or even slightly decline such as in Asia, North America and the European Union.

Global beef consumption is projected to reach 84 Mt cwe over the next decade, remaining stable at around 6 kg per capita/year rwe. Most regions are projected to reduce their beef intake, except the Middle East and Asia where per capita beef consumption is expected to rise by about 0.62 and 0.61 kg/year rwe respectively by 2034. These increases are partly the result of a growing middle class and higher incomes leading to diets that include more beef. In contrast, Europe, North America and Oceania, which historically had high levels of beef consumption, are expected to see the most significant decrease in per capita consumption as beef prices move higher than those of substitutes and as concerns grow about the environmental impact of beef production, which is perceived as a significant contributor to greenhouse gas emissions.

While sheep meat consumption is a relatively small part of the global meat market, it remains an essential source of protein for many consumers in the Middle East and North Africa, where pig meat is not a substitute. Globally, the share of sheep meat in total meat protein consumption is expected to remain stable over the *Outlook*. Sheep meat consumption tends to be a traditional (cultural) food choice and in many markets, consumers are maintaining this preference. That said, consumers often choose beef or poultry when available and affordable, since those meats are more widely accessible and typically cheaper than sheep meat.

5.3.2. Production

Global meat production growth driven by Asia and Latin America

World meat production is projected to rise 13% or 46 Mt cwe to an estimated 406 Mt cwe by 2034. Over half (55%) of the growth in meat production will occur in Asia, led by a 15 Mt increase in poultry production. China's post-ASF recovery will account for nearly 10% of the global meat production increase, followed by significant contributions from India (8%), the United States (8%) and Viet Nam (7%). Latin America is expected to steadily expand its production share, underpinned by its competitive advantages in land, feed, and animal genetics. Africa contributes approximately 6% to global meat production and holds significant shares in certain sectors, accounting for 22% of global sheep meat and 10% of beef production. The continent's meat industry faces several challenges, including low economic growth, limited investment in agricultural development, environmental degradation, civil unrest in some areas, poor infrastructure, and inadequate veterinary services. Despite these obstacles, meat production–particularly poultry meat production–is gradually increasing.

Poultry will expand its dominance within the meat complex, accounting for 62% of the additional meat produced in the next decade. Driven by domestic demand, poultry production will expand most rapidly in upper middle-income countries. Poultry has advantages over other meats in terms of short production cycles, high feed conversion efficiency (yielding more meat per unit of feed), lower overall production costs, and the ability to be raised close to rapidly urbanising markets.

Nevertheless, several factors will constrain the growth of the sector. In particular, the incidence of HPAI outbreaks has been spreading. Higher densities of poultry production increase the risk of disease outbreaks and although improved surveillance and containment can limit impacts, they also raise industry costs (e.g. biosecurity investments, vaccination campaigns). Poultry production also faces environmental and health challenges, particularly regarding antibiotic use and animal welfare concerns.

Recovery from ASF in Asian countries is assumed to occur during the first half of the *Outlook* projection period, contributing to a recovery in pork production. Pig meat is expected to account for about 13% of the additional meat produced globally by 2034. Most of this increase will occur in the Asian ASF-affected regions such as Viet Nam where conversion from largely small-scale backyard holdings to large-scale commercial enterprises with higher biosecurity standards is taking place.

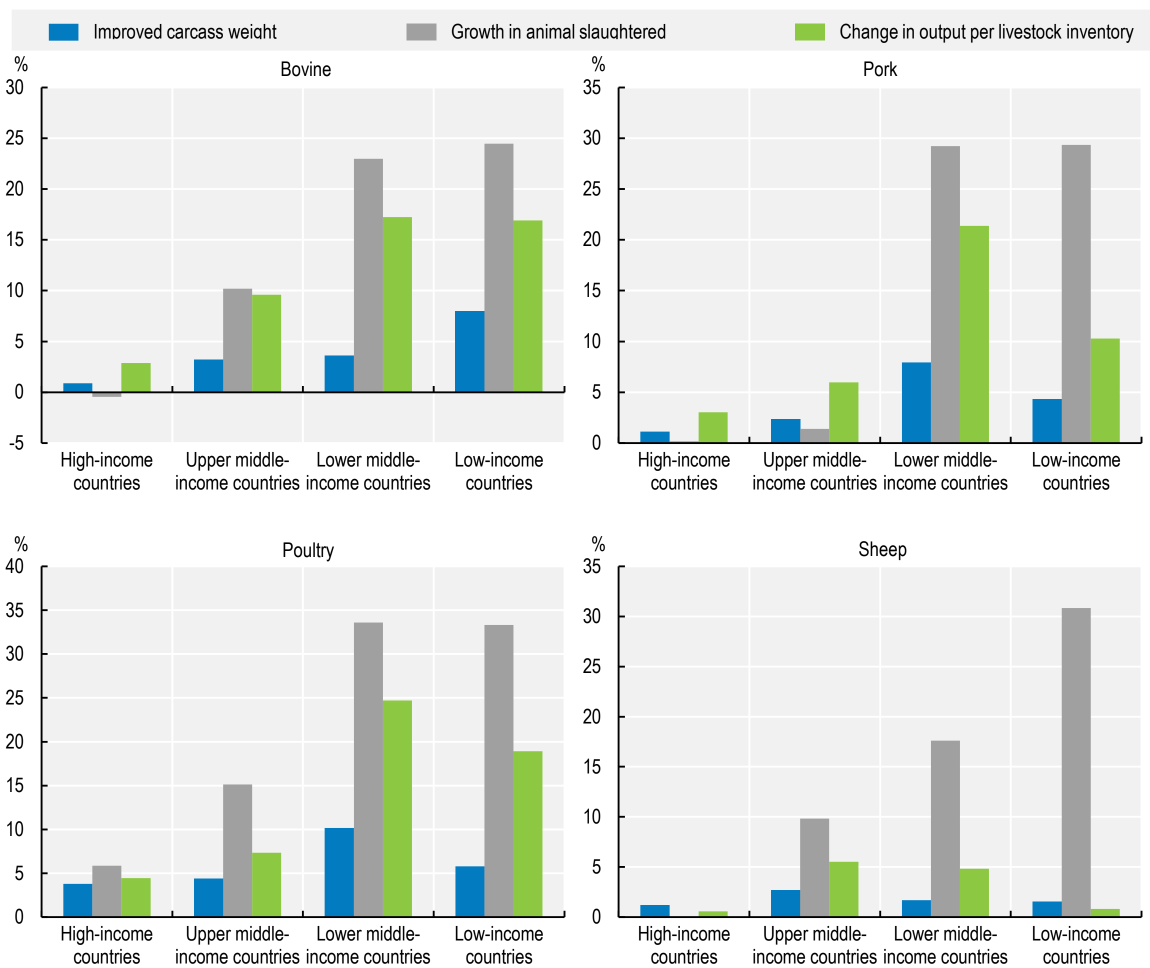
Beef production will rise over the medium term with heavier carcass weights, higher marketings, genetic improvements, and better herd management. Global output will reach 84 Mt cwe by 2034. The main contributor to this growth in global beef supply is China for its domestic consumption followed by India where investments in meat processing infrastructure, including export-oriented integrated meat processing plants are expanding capacity. India’s buffalo meat has a huge demand in the international market given its low price and the country is capitalizing on this by improving cold chain and processing facilities. While Australia, Canada and the United States beef herds continue their destocking phase at the start of the Outlook, rising prices will induce higher profitability and will trigger higher beef production over the remainder of the Outlook period.

Global sheep production is anticipated to reach 19 Mt cwe by 2034 an increase of 15% from the base period. This growth will come from flock rebuilding and higher lambing rates in response to favourable prices. China in particular will contribute 17% of the additional production as it increasingly turns towards sheep and goat breeding for meat (Wang et al., 2024[1]). Production in the European Union is projected to decrease in spite of production-coupled income support and favourable producer prices in the main sheep-producing Member States. Some countries in Southeast Europe are currently battling an outbreak of sheep and goat pox, which could dampen production over the *Outlook*. Competition for land in New Zealand, and its efforts to reduce GHG emissions may constrain flock size, in which case growth in output will rely on productivity gains. In Australia the sheep herd composition continues to shift toward breeds optimised for higher meat yield (as opposed to wool), as market incentives favour meat production.

Productivity growth is key driver for sustainable development of the meat sector

The global meat sector is facing increasing pressures on multiple fronts. In recent years, producers worldwide have contended with high input costs, increasingly stringent environmental and animal health regulations, and various disease outbreaks. Feed costs, which spiked in the early 2020s, have since moderated, but other operating and labour expenses continue to rise. In response, the sector is increasingly focused on raising productivity through improved breeding techniques, better herd and flock management and higher slaughter weights. These improvements are essential not only for cost management, but also for enhancing sustainability in the face of competitive pressures from alternative protein sources. Figure 5.2 illustrates how these productivity enhancements across various meat types and income groups are expected to lead to greater output efficiency, enabling more sustainable production practices that align with environmental goals. Particularly in upper and lower middle-income countries productivity gains will have a substantial impact on meat output. For example, for beef, increases in carcass weights are projected to account for 24% and 13% of the additional output in upper middle and lower middle-income countries respectively. Furthermore, the overall efficiency of the livestock system, as reflected in output per livestock inventory, is expected to improve by 10% and 17% in these groups. Similar improvements apply to the poultry and pigmeat sectors.

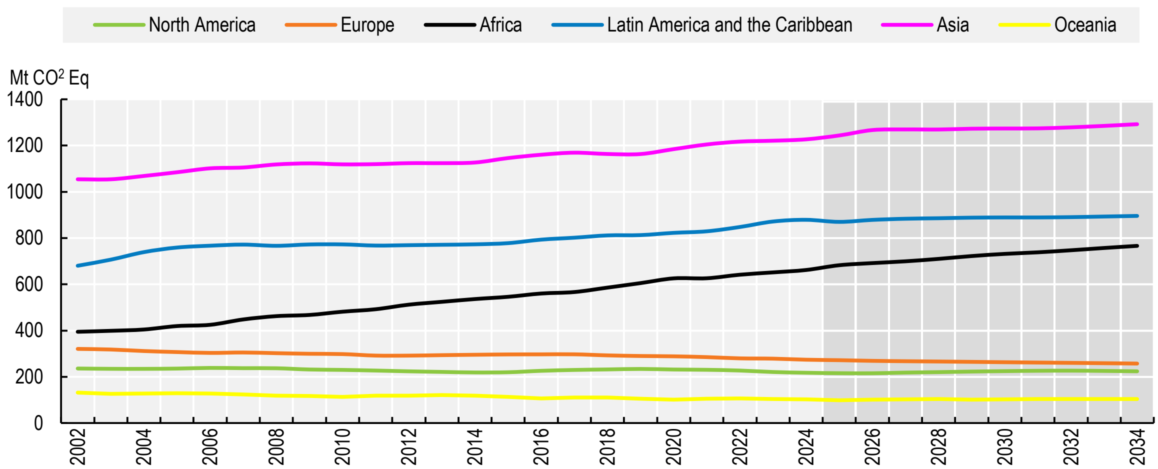
Figure 5.2. Projected changes in sectoral productivity indicators, 2034 vs base period



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The livestock sector faces rising scrutiny over its environmental footprint. GHG emissions from livestock are projected to rise by 6% from 3.4 Gt CO_2eq in the base period to 3.5 Gt CO_2eq by 2034 under baseline assumptions of no major changes in emission intensity per animal. The fastest growth in meat-related GHG emissions, in both absolute and relative term, is expected in Africa, where they will be 18% higher than in the base period. Emissions in Europe from meat production are expected to decline by 7% (Figure 5.3). This GHG emission increase is lower than the 13% increase of meat production due to the shift towards poultry production, and national initiatives aimed at promoting low-carbon livestock production. Most importantly, productivity gains help curb emissions growth by reducing the number of animals needed for a given level of output (Box 5.1). Emissions are closely tied to livestock inventories, so improving production efficiency is key to shrinking the sector's GHG emissions per unit of meat produced.

Figure 5.3. Strongest growth in GHG emissions from meat in Africa



Note: Estimates are based on historical time series from the FAOSTAT Climate Change: Agrifood systems emissions databases which are extended with the Agricultural Outlook projections. CO2 equivalents are calculated using the global warming potential of each gas, as reported in the IPCC Sixth Assessment Report (AR6).
Source: OECD calculations based on FAOSTAT-Emissions Totals, Statistical Division of the UN Food and Agriculture Organization (accessed December 2024). FAOSTAT Emissions-Agriculture Database, http://www.fao.org/faostat/en/#data/GT; OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

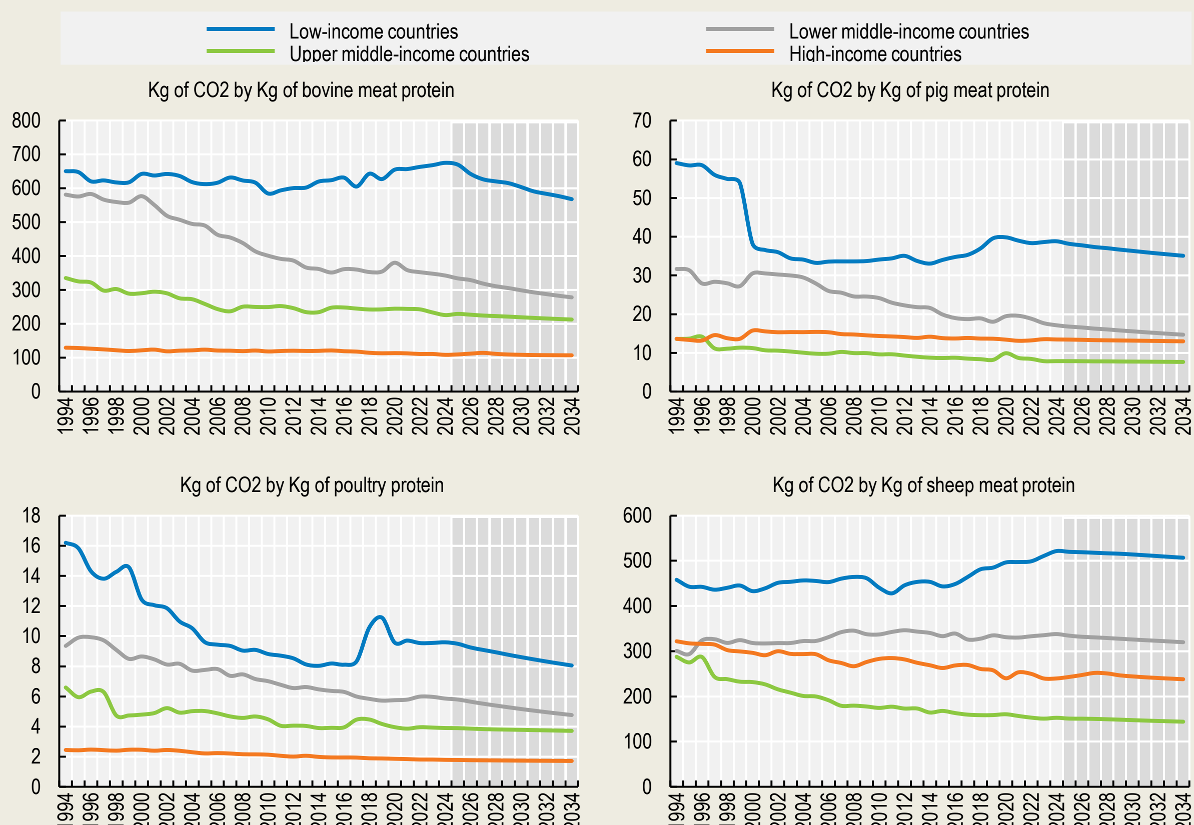
In addition, reducing meat supply chain losses could also temper the need for production increases and limit resource use. Estimates of food loss and waste (FLW) in the meat sector vary according to the measurement methodology used, but the baseline assumptions in the *OECD-FAO Outlook* model suggest about 13.5% of meat (in cwe) is lost at the processing stage, and a further 12.2% (in rwe) is wasted at the distribution and consumer level. Efforts to cut these losses through better cold chain management or consumer education to reduce waste, for example, could lower effective demand and thereby reduce the required production and environmental burden.

Box 5.1. Productivity growth and GHG emissions from livestock

The report "Pathways to lower emissions" (FAO, 2023[2]) outlines key factors influencing GHG emissions in the livestock system. It notes that in 2015, livestock systems emitted some 6.2 Gt of CO_2eq, comprising 12% of total anthropogenic GHG emissions. Cattle account for about 62% of livestock emissions, much greater that the combined sum of those from buffaloes, sheep, goats, pigs and chickens. The report suggests significant reductions in livestock's carbon footprint are achievable through targeted actions and investments. For instance, rumen modification (e.g. feed additives that reduce methane) and selective breeding for lower-emission animals can markedly cut emissions from enteric fermentation, which constitutes two-thirds of emissions from meat production. Enhancing productivity is also crucial as it increases the amount of meat produced per animal (through better genetics, health, and feed) and means fewer total animals are needed, which in turn lowers overall emissions. This is because emissions are closely tied to the size of animal inventories. Raising productivity per animal allows meat output to grow while keeping herd sizes (and thus emissions) lower than they would otherwise be. This is significant potential to improve management practices, particularly in low- and lower-income countries where productivity is low and livestock populations are large. However, it is important to distinguish between measures that can be implemented immediately and those requiring sustained investment and further development. In many of these countries, basic prerequisites–such as access to quality feed–may be lacking, limiting the applicability of some strategies. As such, while these interventions hold long-term promise, their implementation will depend on local capacities and infrastructure.

Historic trends and projections of GHG emissions per kg of livestock protein (by income group and species) illustrate these dynamics. Figure 5.4 shows that in nearly all cases, except in low-income countries, there has been a downward trend in GHG emissions per unit of meat protein. Emission reductions per protein unit in the last two decades have occurred at rates of -0.6% per year in high-income countries, -0.3% per year in upper-middle-income countries, and -1.6% per year in lower-middle-income countries and are expected to continue. Low-income countries experienced a rise (+0.6% per year) in emissions per unit of protein, highlighting opportunities for improvement expected to materialize during the *Outlook* period. The sizeable differences between income groups points to areas where productivity enhancements can substantially lower emission levels provided that enabling conditions are addressed.

Figure 5.4. Kilograms of CO_2-equivalent emissions per kilogram of livestock protein



Source: OECD calculations based on FAOSTAT-Emissions Totals, Statistical Division of the UN Food and Agriculture Organization (accessed December 2024). FAOSTAT Emissions-Agriculture Database, http://www.fao.org/faostat/en/#data/GT; OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

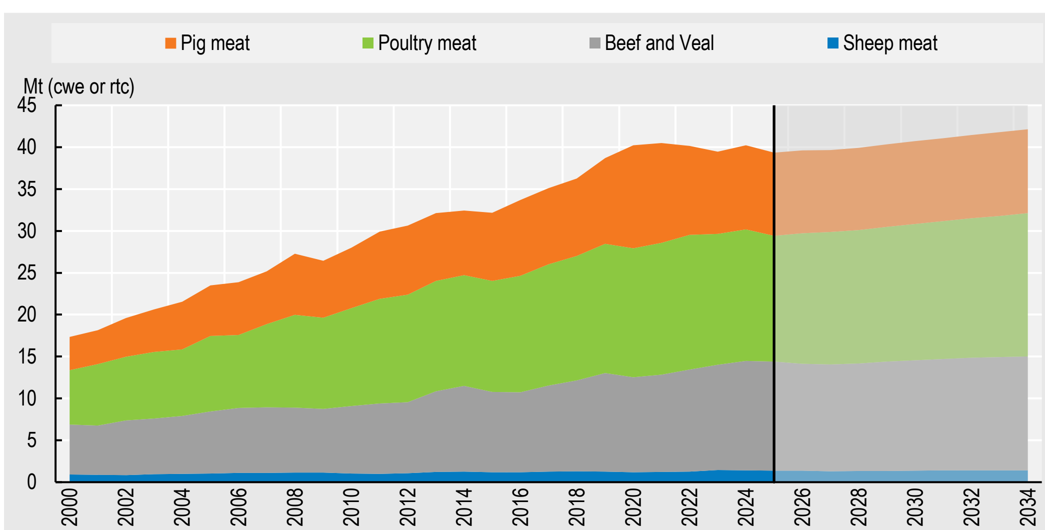
5.3.3. Trade

Shifting dynamics in global meat trade as China aim for higher self-reliance

Meat trade will decline slightly in the initial year of the *Outlook* with the recovery of China's meat sector following the increased import demand during its ASF outbreak. China's self-reliance policy will underpin its production of meat reducing the need for imports. After this initial fall, global meat trade will resume growth but at half the pace of the previous decade. Brazil, the European Union and the United States are expected to account for more than half (54%) of global meat exports by 2034, a combined share that remains stable over the *Outlook* period. Among major exporters, Argentina, Australia, Brazil, India, Thailand, and Türkiye are expected to see the most significant export growth, thanks to favourable prices and ample feed supplies. The European Union's global meat export share will continue its decline, which started in 2021, falling from about 19% to 13% by 2034, as European producers face higher costs to comply with environmental regulations.

Australia and New Zealand will continue to lead global sheep meat markets, increasingly focusing on high-value markets in Europe and North America. Australia is expected to increase lighter lamb exports (of higher value and requesting less labour as they are exported as whole carcasses) demanded by high-end restaurants at the expense of mutton, while in New Zealand, exports will slowly decline as land use shifts away from sheep farming partially offsetting gains in productivity. A similar trend is observed in Western Australia where live sheep exports by sea are falling steadily and expected to end in 2028 due to the Australian Government legislation phasing out live sheep exports. European and British sheep meat producers are facing issues such as animal diseases, and low profitability of their operations. The rising middle-class consumer in the Middle East is the main source of higher import demand.

Figure 5.5. Growth in meat trade expected to slow over the next decade



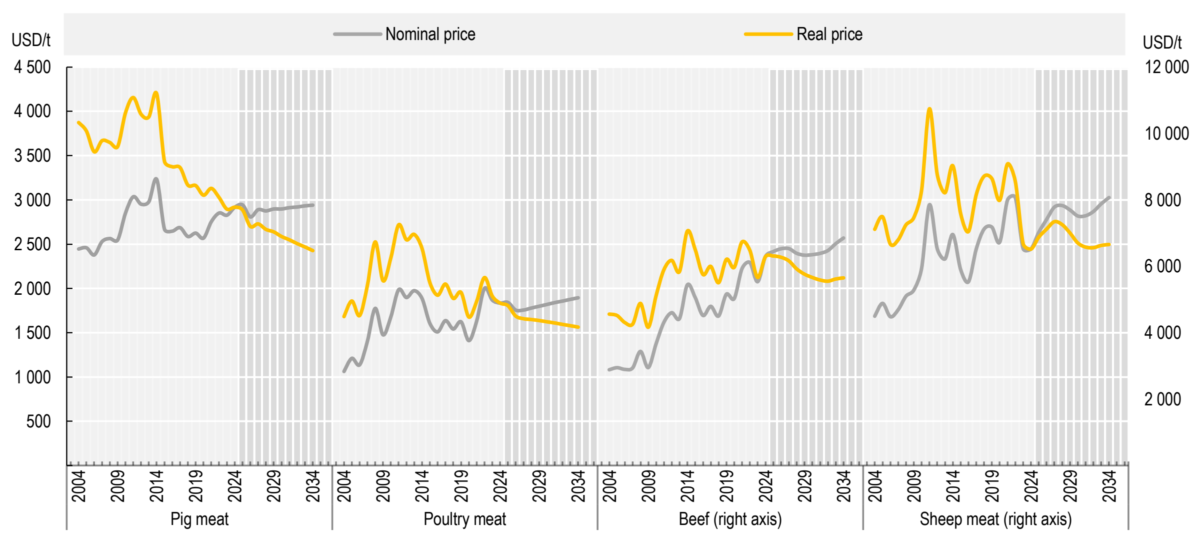
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

5.3.4. Prices

Divergence in ruminant vs. non-ruminant prices driven by productivity and market dynamics

At the start of the outlook period, nominal ruminant meat prices are projected to rise as cattle and sheep inventories are rebuilt, temporarily constraining supply growth and supporting higher prices (Figure 5.6).[1] By contrast, non-ruminant meat prices are expected to ease with moderate production expansion and reduced imports by China. Over the medium term, when adjusted for inflation, the *Outlook* projects that while real operating prices such as labour will remain stable, real meat prices are expected to decline from current levels. This decrease is due to reduced real feed costs and continuous improvements in productivity. In the case of ruminant meats, prices in real term are projected to peak around 2027 driven by herd rebuilding effort in both beef and sheep sectors. Following this peak, prices are projected to decline, ending the period at levels 8% lower than their base values. Non-ruminant real prices are projected to decline more steeply, ending nearly 20% below the base period. It is interesting to note the longer-term divergence in ruminant and non-ruminant price trends observed over the past two decades which is anticipated to be sustained over the *Outlook*. This divergence reflects differences in productivity growth suggesting that productivity gains have been greatest in pig and poultry production, and slower in cattle and sheep.[2] Projected lower prices for feed protein will also imply lower prices for poultry and pigmeat which use protein more intensely. The widening price gaps among meats underpins the shift in consumer demand toward more affordable non-ruminant meats.

Figure 5.6. World reference prices for meat—rising in nominal, but falling in real terms



Note: Real prices are nominal world prices deflated by the US GDP deflator (2024=1). United States: Meat of Swine (Fresh, Chilled, or Frozen), FOB export unit value, USD/t pw, Brazil: Meat and Edible Offal of Poultry (Fresh, Chilled, or Frozen), FOB export unit value, USD/t pw, Australia: 90CL Boneless Beef, FOB export prices to the United States, USD/t pw, New Zealand: Lamb Average FOB Export Value, USD/t pw.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

5.4. Risks and uncertainties

Biosecurity stands as a critical concern for the meat industry

The meat sector faces a multitude of uncertainties, chief among them being the evolution of animal disease outbreaks, shifts in environmental policies, changes in trade policies, rising economic uncertainties and changing consumer preferences concerning diet and health, and animal welfare.

In Europe, the recent reappearance of Foot-and-Mouth Disease (FMD), which had not seen a positive case since 2011, marks a resurgence of the disease in some EU Member States since the beginning of the year. FMD is one of the most economically devastating and challenging animal diseases to control. This resurgence underscores the vulnerability highlighted in this year's Outlook, which starts amid numerous animal disease outbreaks such as HPAI. The latest *EU Agricultural Outlook 2024-2035* (EC, 2024[3]). even assumes HPAI will become a year-round issue, challenging the viability of free-range poultry systems. In the United States, recent HPAI outbreaks in poultry caused egg shortages and record egg prices, underscoring how quickly disease shocks can hit markets. Diseases can disrupt production, trigger trade bans, and dampen consumer demand due to food safety concerns. While global supply impacts can be mitigated by shifting sourcing to disease-free exporters or by applying the World Organisation for Animal Health (WOAH) regional disease containment protocol,[3] the environmental impact of disease control, for example, the disposal of livestock and the cost of wasted resources, adds another layer of complexity to managing outbreaks. The risk of sudden losses and trade interruptions remains high.

Seasonal shocks, such as droughts and floods, can reduce feed grain harvests or water supplies, driving up production costs and constraining meat output. Increasing weather fluctuations will also affect on-farm productivity. Moreover, policies such as carbon pricing and manure management rules, or restrictions aimed at reducing GHG emissions from livestock could raise production costs. Compliance with such regulations might require investments that slow output growth. Emission reduction commitments in some countries may deliberately limit livestock expansion by capping herd sizes or incentivising lower-emission farming, for example, to curb emissions.

At the same time, consumer preferences in high-income markets are gradually shifting. Increasing numbers of consumers are choosing to reduce red meat consumption for environmental reasons. This growing environmental consciousness could translate into reduced demand for traditional meat products in wealthier markets, or greater demand for sustainably produced meat, both of which have implications for producers and exporters over the next decade.

A recent study featured in the journal *Nature Food* (Springmann et al., 2025[4]) examined the impact of varying tax rates on food to encourage dietary shifts that align with global policy objectives. The research suggests that raising taxes on meat and dairy products while lowering them on fruits and vegetables could change eating habits across Europe. If implemented, such measures could dampen meat demand growth.

Furthermore, public health concerns over antibiotic resistance are increasing, and there are pressures to reduce the use of antibiotics in animal agriculture. The use of antimicrobials for growth promotion was still reported by 20% of WOAH Members.[4] Regulatory moves to ban or restrict such practices, already in place some countries, could become more common, which may necessitate changes in livestock production systems (e.g. improved biosecurity and husbandry to prevent disease without drugs). While lowering antibiotic use in animals is beneficial for public health, it could raise production costs or temporarily impact productivity until alternative practices that optimising livestock productivity are adopted (Acosta et al., 2025[5]).

Finally, international trade plays a vital role in the meat sector, and changes in trade policies such as tariffs and trade bans can also significantly impact national and global markets. After several decades of more liberal trade, recent tendencies toward more protectionism could reduce trade and generally lower prices in international trade, as domestic prices increase with higher trade barriers.

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Notes

[1] In November 2024, the FAO Meat Price Index, which is the main source for updating the *OECD-FAO Agricultural Outlook* meat reference prices, was revised to enhance accuracy in reflecting key internationally traded meat products. This revision incorporates historical adjustments for the following specific prices: Brazilian poultry meat prices have been aligned with the definitions provided by the national government (Source: Comex Stat); Australian bovine meat prices are now derived from FOB values as reported by Meat and Livestock Australia (MLA); Australian ovine meat prices have been revised to focus on the heavy-weighted lamb product (Source: MLA), which better represents the export market; and New Zealand ovine meat prices have been updated to use the average lamb export value (Source: AgriHQ).

[2] See, for example, Zulauf, C. "Comparing Livestock Productivity Since 1993," *farmdoc daily* (9):96, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, 24 May 2019, https://farmdocdaily.illinois.edu/2019/05/comparing-livestock-productivity-since-1993.html.

[3] Currently, a country affected by ASF is not obliged to completely stop its exports if it takes the measures recommended by the WOAH.

[4] See https://www.woah.org/en/woah-urges-veterinary-authorities-and-the-animal-industry-to-live-up-to-their-commitments-regarding-the-use-of-antimicrobials-as-growth-promoters/.

6 Dairy and dairy products

This chapter describes market developments and medium-term projections for world dairy markets for the period 2025-34. Projections cover consumption, production, trade and prices for milk, fresh dairy products, butter, cheese, skim milk powder and whole milk powder. The chapter concludes with a discussion of key risks and uncertainties which could have implications for world dairy markets over the next decade.

6.1. Projection highlights

Dairy products continue to be highly valued by consumers as a key component of an overall healthy, balanced and nutritious diet. As income and population increase, more dairy products are expected to be consumed globally over the medium term.

Asia, particularly India and Pakistan, will continue to have the strongest growth in consumption of fresh dairy products. Further increases in cheese consumption are expected in Europe and North America.

Global milk production is expected to grow steadily, primarily driven by higher yields per animal. World milk production (81% cow milk, 15% buffalo milk, and 4% for goat, sheep and camel milk combined) is projected to grow at 1.8% p.a. over the next decade fuelled by increasing yields per animal, with growth in the number of cows expected to be moderate.

More than half of the growth in milk production is anticipated to come from India and Pakistan. Whereas milk production in the European Union, the second largest producer, is expected to slightly decline.

Environmental and health concerns are shaping the projections for the dairy sector. In some countries, dairy production accounts for a substantial share of overall greenhouse gas emissions (GHG), resulting in initiatives to adjust dairy technology with an aim to reducing such emissions.

Only a small share of milk is traded internationally mainly in the form of processed dairy products. Although milk production in the three major dairy exporters, New Zealand, the European Union, and the United States is expected to increase modestly, their exports are projected to jointly account for nearly 70% of global milk exports.

The gap between butter and skimmed milk powder prices is expected to persist throughout the projection period. This development is attributed to a relatively stronger demand for milk fat compared to non-fat milk solids on the international market. The fat and non-fat solid contents of milk changes only very slowly.

The dairy sector faces several uncertainties. In high-income countries plant-based replacements increase their uptake albeit from low levels, their market share might increase faster than assumed in the *Outlook*. Animal diseases are not assumed to constrain production significantly, but they can always cause disruption as the current transmission of avian influenza to dairy cattle highlights.

6.2. Current market trends

Dairy and milk prices increased in 2024 driven by higher butter prices

In 2024 the FAO Dairy Price Index increased driven by higher butter prices which reached a new high in mid-2024 and remained high thereafter. This increased the price spread between the fat and non-fat component of milk.

World milk production grew 1.1% in 2024 to about 950 Mt. In India and Pakistan, production increased by 3% to reach 227 Mt and 66 Mt respectively, but with little impact on the world dairy market as they export only marginal quantities of milk and dairy products. Among the three major exporters, production in 2024 increased in New Zealand and the European Union, but declined in the United States.

World dairy trade continued to decline in 2024 due to the considerably smaller import demand from The People’s Republic of China (hereafter “China”), especially for skim and whole milk powder (SMP & WMP). However, other major importers of dairy products—Saudi Arabia, Algeria, Indonesia and Mexico—increased their imports. Going forward, of the major exporters, the United States would be a beneficiary of any additional export demand due to constrained production growth in the European Union and New Zealand.

6.3. Market projections

6.3.1. Consumption

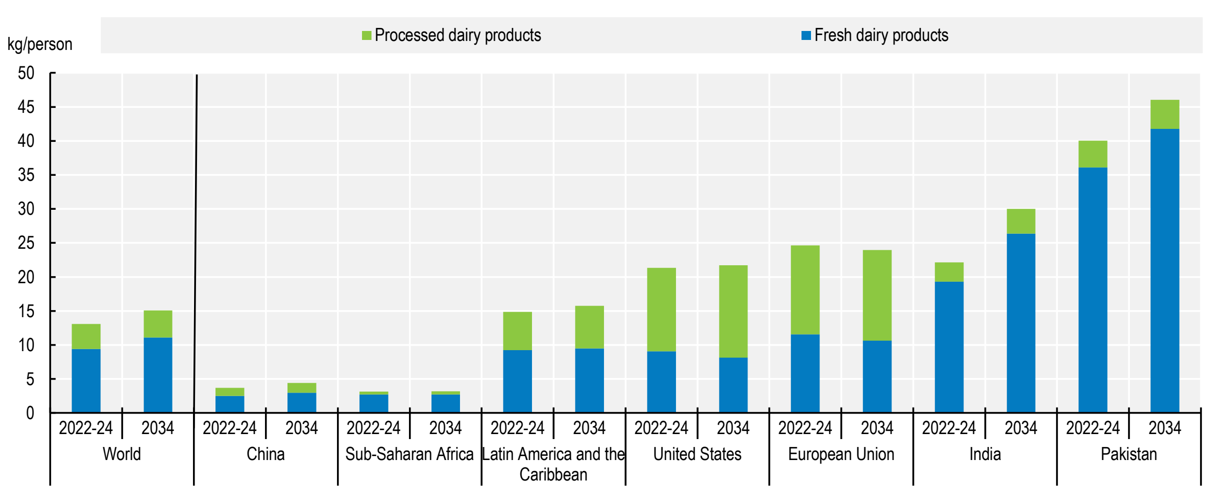
Strong demand in India and Pakistan is leading increased global dairy consumption

Although milk is a highly perishable product which must be processed shortly after collection, most milk is consumed in the form of fresh dairy products[1], including those fermented and pasteurised. The share of fresh dairy products in global consumption is expected to increase over the next decade due to stronger demand growth in India and Pakistan, which in turn is driven by income, urbanisation and population growth. World per capita consumption of fresh dairy products is anticipated to grow by 1.0% p.a. over the coming decade, primarily driven by higher per-capita income growth.

Milk consumption per capita (in terms of milk solids) varies widely across countries (Figure 6.1), driven by differing income levels and regional preferences. The most significant growth is expected in India and Pakistan, where milk solids consumption is expected to increase to 30 and 46 kg per capita, respectively. The average fresh dairy consumption per capita in China is significantly lower than in the European Union and North America but a strong increase is expected over the coming decade. In low- and lower middle-income countries most of the production is consumed in the form of fresh dairy products.

In Europe and North America, overall per capita demand for fresh dairy products is declining but the composition of demand has been shifting over recent years in favour of dairy fat such as full-fat drinking milk and cream. Plant-based dairy replacements are increasingly established and competing more with fresh dairy products than with processed dairy products.

Figure 6.1. Per capita consumption of processed and fresh dairy products in milk solids

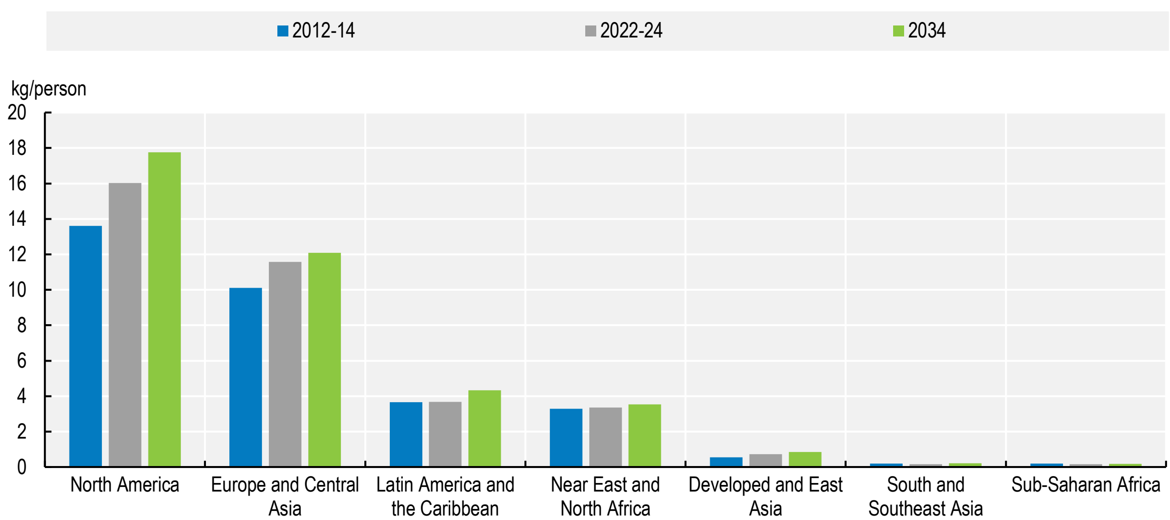


Note: Milk solids are calculated by adding the amount of fat and non-fat solids for each product. Processed dairy products include butter, cheese, skim milk powder and whole milk powder.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The share of processed dairy products, especially cheese, in overall consumption of milk solids is expected to be closely related to incomes, with variations due to local preferences, dietary constraints, and urbanisation. The largest share of total cheese consumption, the second most consumed dairy product, occurs in Europe and North America, where per capita consumption is expected to continue to increase over the projection period (Figure 6.2). Considerable cheese consumption in emerging markets is linked to the consumption of pizza and burgers. Butter consumption has seen a recovery in North America and Southeast Asia due to shifting preferences. In addition, per capita consumption of butter, especially in the form of ghee, continues to increase from already high levels in India and Pakistan, although consumption of processed dairy remains low.

The dominant use of SMP and WMP will continue to be in the manufacturing sector, notably in confectionery, infant formula, and bakery products. A small share of dairy products, especially SMP and whey powder, are used in animal feed. Whey powders are gaining prominence globally because of their use in the processing of nutritional products, especially of clinical, infant, and elderly preparations and as an import alternative for reconstituted fresh dairy products, such as milk and yogurt especially in Africa and other regions with limited milk production.

Figure 6.2. Per capita consumption of cheese in selected regions



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

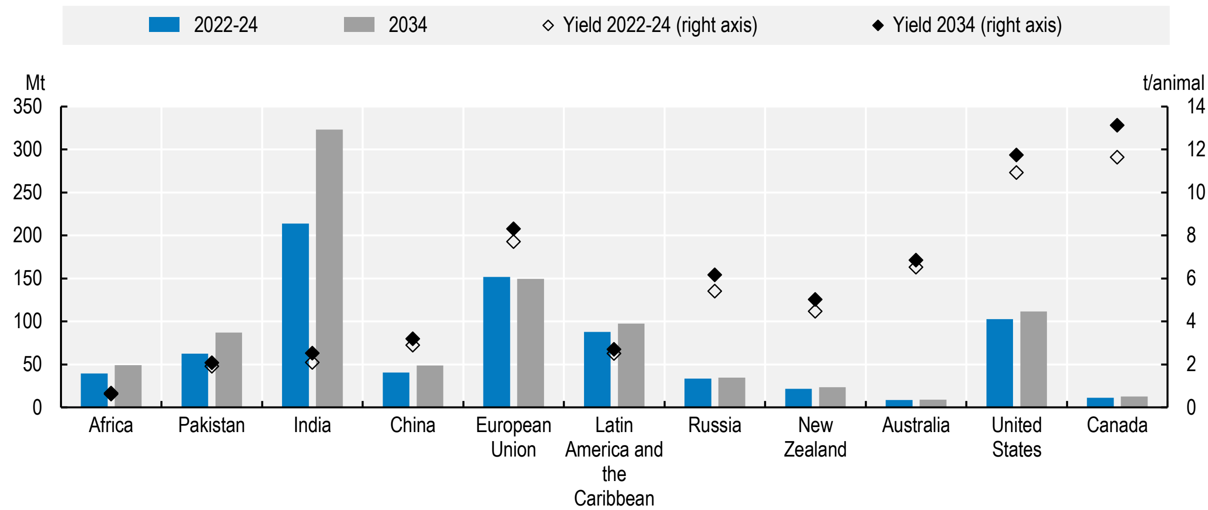
6.3.2. Production

Greater efficiency in milk production from yield growth

World milk production is projected to grow at 1.8% p.a. (to 1 146 Mt by 2034) over the next decade, faster than most other important agricultural commodities. Growth in the number of cows is expected to be moderate in North America and China, but strong in Sub-Saharan Africa and in major milk-producing countries such as India and Pakistan–where yields are low. Yields across the world are expected to grow steadily and to contribute more to production increases than herd growth over the next decade. This yield growth will be achieved through optimising milk production systems, improved animal health, greater feed efficiencies and improved genetics.

India is the largest producer of milk and is expected to achieve a continued strong production growth (Figure 6.3). Production is based on small operations connected to cooperatives for processing and distribution. This integration into wider supply chains is important for the value added by the dairy sector in India. The growth is expected to come from more milking cows and buffaloes as well as from yield increases.

Figure 6.3. Milk production and yield in selected countries and regions



Note: The yield is calculated per cow/buffalo.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

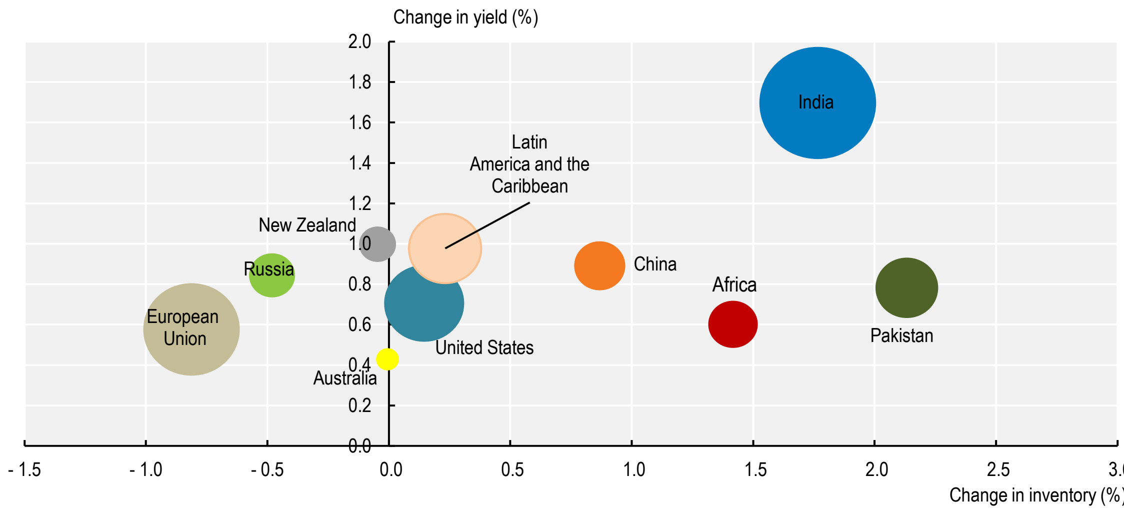
Production in the European Union is projected to stagnate with fewer dairy cows and slower yield growth. Production originates from a mix of grass- and feed-based production systems. A growing share of milk is expected to be organic or from other non-conventional production systems. At present, more than 10% of dairy cows are within, but not limited to, organic systems located in Austria, Denmark, Greece, Latvia, and Sweden. Germany, France and Italy have also seen an increase in organic dairy production. However, as organic yields are about 75% of those in conventional production systems and organic systems incur higher production costs, they need to command a substantial price premium to be profitable.

The average yields per cow in North America is four times higher than the global average, as their share of grass-based production is low, and feeding is focused on high yields from specialised dairy herds. Dairy herds in the United States and Canada are expected to remain largely unchanged and production growth to originate from further yield increases. As domestic demand is projected to remain stronger for milk fats, the United States will continue to expand SMP production, partly for export.

Although the share of New Zealand in world milk production is only 2%, it is the most export-orientated country. After expanding strongly, milk output growth has slowed down in recent years, and is projected to grow at 0.9% p.a. over the next decade. Milk production is mainly grass-based, and yields are considerably lower than in North America and Europe. However, the cost efficiency of grass management allows New Zealand to be competitive due to the focusing on milk yields per hectare. The main constraining factors for growth are land availability and increasing environmental restrictions (Zero Carbon Amendment Act of 2019 to the Climate Change Response Act of 2002). Nevertheless, a shift to more feed-based production systems is not likely.

Strong production growth is expected in Africa, mostly due to larger herds (Figure 6.4). These will usually have low yields, and a considerable share of milk production will come from goats and sheep. Most cows, goats and sheep graze, and are used for other purposes including meat production, traction, and as capital assets (savings). Additional grazing occurs on the same pasture, leading to a more intensive use which may lead to local over-grazing. Over the projection period, about a fifth of the global dairy cow and buffalo population is projected to be in Africa and to account for around 5% of world milk production.

Figure 6.4. Annual changes in inventories of dairy herd and yields between 2025 and 2034



Note: The size of the bubbles refers to the total cow milk production in the base period 2022-24.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

StatLink https://stat.link/gtbap7

Dairy is one of the agricultural sectors with an above average direct greenhouse gas emission. The International Dairy Federation (IDF) has been engaged in the reporting of dairy emissions for several years. To help the global dairy sector, from farming to processing, to have a robust benchmark for calculating carbon footprints for pre-competitive discussions and to make continued progress in both researching and applying new technologies in effectively reducing the sector's greenhouse gas emissions, IDF developed a common carbon footprint approach for dairy[2].

Globally, around 30% of milk will be further processed into products such as butter, cheese, SMP, WMP, or whey powder in the coming decade. However, there are notable regional differences. In high-income countries, most of the milk production is transformed into dairy products. Butter and cheese currently account for a large share of consumption of milk solids in Europe and North America due to the significant direct food demand for these products. SMP and WMP are largely produced for trade, for use in the food processing sector, notably in confectionery, infant formulae, and bakery products. In low and lower middle-income countries most of the milk production goes into fresh dairy products.

6.3.3. Trade

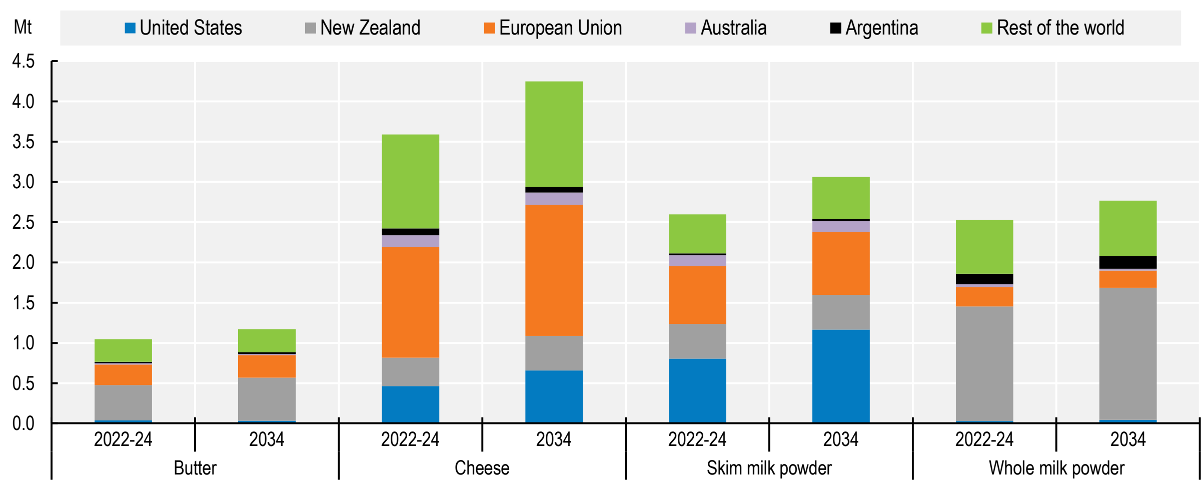
Milk is traded internationally mainly in the form of processed dairy products

Most dairy products are domestically consumed. Only a small share (less than 7%) of world milk production, is traded internationally, primarily due to its perishability and high-water content (more than 85%). About 50% of world production of WMP and SMP is traded since these products are often produced only to store and trade milk over a longer time period or distance. Fresh dairy products such as fermented milk products are traded in small amounts between neighbouring countries–Canada–and the United States, or the European Union and Switzerland, for example. An exception is imports of liquid milk by China from the European Union and New Zealand, made possible by Ultra-High Temperature milk and cream products capable of being shipped long distances, but also favourable Chinese freight rates in some cases.

World dairy trade is projected to expand over the next decade to reach 13.8 Mt in 2034, 12% higher than during the base period. Most of this growth will originate in the United States, the European Union and

New Zealand. These three exporters are projected to jointly account for around 64% of cheese, 69% of WMP, 73% of butter, and 78% of SMP exports in 2034 (Figure 6.5). Australia has lost market shares although it remains a notable exporter of cheese and SMP. Argentina is also an important exporter of WMP and is projected to account for 6% of world exports by 2034. In recent years, Belarus has become an important exporter, orienting its exports primarily to the Russian market due to the Russian embargo as of 2015 on several major dairy exporting countries.

Figure 6.5. Exports of dairy products by region



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

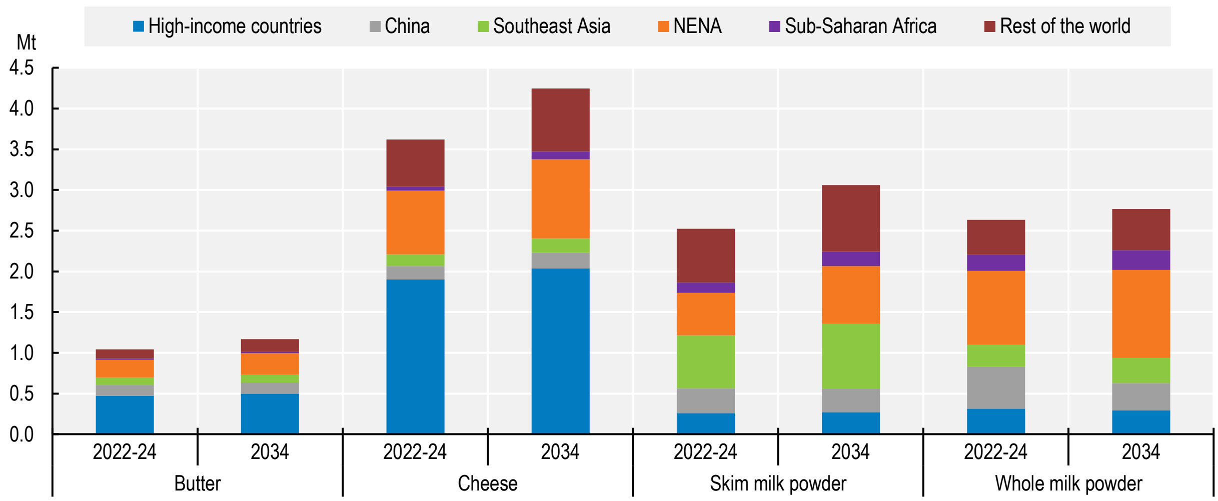
The European Union will continue to be the main world cheese exporter, followed by the United States and New Zealand. The United Kingdom, Russian Federation (hereafter "Russia"), Japan, Mexico and Saudi Arabia are projected to be the top five cheese importers in 2034. Since consumers value variety, these countries are often also exporters of cheese and international trade is expected to offer wider choices of cheeses in the domestic markets.

New Zealand remains the primary source for butter and WMP on the international market, and its market shares are projected to be around 46% and 59%, respectively, by 2034. China is the principal importer of WMP from New Zealand. The expected growth in domestic milk production in China will limit the growth in WMP imports.

The United States is expected to be the most dynamic large exporter over the next decade and to expand SMP exports especially. This would require growth in drying capacity beyond current investments. SMP imports are dispersed globally as it is often the easiest dairy product to trade for use in food processing.

Imports are spread more widely across countries, with the dominant destinations for all dairy products being the NENA, high-income countries, Southeast Asia, and China (Figure 6.6). China is expected to continue to be the world's major dairy importer. WMP imports into China are projected to represent 12% of global imports in 2034, a 7.5 percentage point drop from the base period. Africa is expected to increase its imports of WMP considerably over the next ten years. Per capita consumption of dairy products in China is relatively low compared to traditional markets, but there have been significant increases in demand over the past decade, with growth projected to continue. Most of its dairy imports are sourced from Oceania, although in recent years the European Union has increased its exports of butter and SMP to China.

Figure 6.6. Imports of dairy products by region



Note: NENA stands for Near East and North Africa. Saudi Arabia is included in NENA and therefore subtracted from high-income countries. Southeast Asia contains Indonesia, Malaysia, Philippines, Thailand and Viet Nam.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The global whey powder market is growing driven by rising demand for diets high in protein and animal feeding. Trade of whey powder is expected to increase over the medium term with China the top import market mainly for animal feed additives. The European Union is projected to remain the dominant exporter of whey powder, which together with the United States account for more than 40% of the world exports.

While some regions, such as India and Pakistan, are self-sufficient, total dairy consumption in Africa, Southeast Asian countries, and the Near East and North Africa (NENA) region is projected to grow faster than production, leading to an increase in dairy imports. As liquid milk is expensive to trade because of its high volume/value ratio, this additional demand growth is expected to be met by milk powders, where water is added for final consumption or further processing. Imports by the NENA region are expected to originate primarily from the European Union, while the United States and Oceania are expected to be the main suppliers of powders to Southeast Asia.

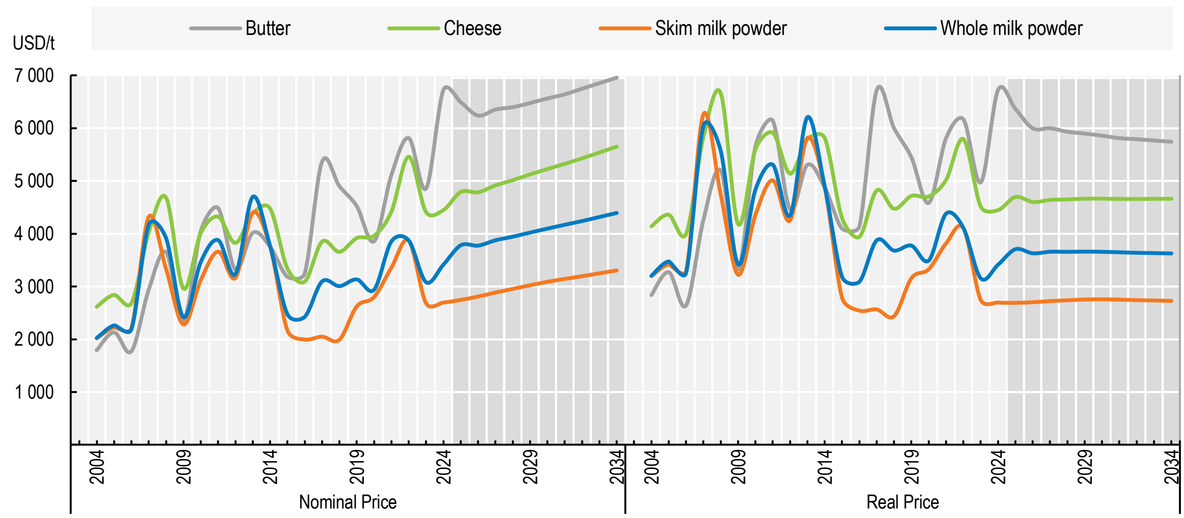
6.3.4. Prices

Nominal international dairy prices will gradually and slightly increase

International dairy prices are prices of processed products from the main exporters in Oceania and Europe. The two main reference prices are butter and SMP, where butter is the reference for milk fat and SMP for other milk solids. Milk fat and other milk solids together account for about 13% of the overall weight of milk, the remainder being water. Since 2015, the price of butter has increased considerably more than SMP. Increased demand for milk fat resulted in a price gap emerging between the two products and the price of butter will continue to be supported by stronger demand for milk fat compared to other milk solids on the international market. Therefore, the gap between the price of butter and SMP is assumed to remain a defining feature over the coming decade.

Prices of butter are expected to decline over the next two years as correction to the record annual butter prices in 2024. Thereafter, butter and SMP prices are foreseen to increase slightly in nominal terms over the projection period while maintaining their considerably different levels (Figure 6.7). World prices for WMP and cheese are expected to be affected by butter and SMP price trends, in line with the respective content of fat and non-fat solids.

Figure 6.7. Dairy product prices, 2004-34



Note: Butter, FOB export price, 82% butterfat, Oceania; Skim Milk Powder, FOB export price, non-fat dry milk, 1.25% butterfat, Oceania; Whole Milk Powder, FOB export price, 26% butterfat, Oceania; Cheese, FOB export price, cheddar cheese, 39% moisture, Oceania. Real prices are nominal world prices deflated by the US GDP deflator (2024=1).
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The strong historical volatility of international dairy prices stems from its small trade share, the dominance of a few exporters, and a widely restrictive trade policy environment. Most domestic markets are only loosely connected to those international dairy prices as fresh dairy products dominate consumption, and only a small share of milk is processed as compared to that which is fermented or pasteurised.

6.4. Risks and uncertainties

Environmental and health concerns are becoming more significant

More restrictive environmental legislation than currently assumed in the *Outlook* could have a strong impact on the dairy production projections. GHG emissions from dairy activities make up a significant share of total emissions in some countries, such as New Zealand and Ireland, and more stringent environmental policies and initiatives such as the Pathways to Dairy Net Zero launched in September 2021 by the dairy sector could affect the level and nature of dairy production to curb such emissions. The growing trend towards sustainable practices such as those related to water access and manure management are associated areas where policy changes could impact on dairy production. Nevertheless, stricter environmental legislation could also lead to innovative solutions that improve the long-term competitiveness of the sector. Overall, the global level of GHG emissions from dairy production will largely depend on efficiency gains in India and other countries with high cattle populations and extensive production. In addition, extreme weather events, already experienced in some countries and regions, could aggravate the viability of milk production in the affected countries.

Plant-based dairy alternatives (e.g. soybean, almond, rice, and oat drinks) have increased in popularity in many regions, especially in North America, Europe and East Asia. Available replacements have continued to expand beyond the more traditional options, branching into various sources from nuts, legumes and other crops. Key drivers of the expansion include health concerns and increasing consumer awareness of the environmental impact of dairy production, and lactose intolerance. The growth rates of plant-based replacements for dairy products are strong, albeit from a low base, although the evidence regarding their environmental impact and relative health benefits is contested. The growth of plant-based dairy alternatives could be both considerable faster that included here, but also limited which would result in a changing demand for dairy products.

Dairy trade flows could be substantially altered from the *Outlook* by changes in the trade environment. Modifications to existing trade agreements or the creation of new ones, could affect dairy demand and trade flows. In addition, India and Pakistan, the big dairy consuming countries, are not assumed to integrate into the international dairy market as domestic production is projected to expand fast enough to respond to growing home demand.

Another challenge faced by the sector is the risk of disease outbreak. The recent outbreaks of Avian Influenza in dairy cattle in the United States is a reminder of this threat: from March 2024 to March 2025 about 1 000 cases in 17 states were reported.[3] The risk of disease outbreaks has also been highlighted by three foot and mouth disease (FMD) outbreaks in the European Union in January and March 2025. As the world is increasingly inter-connected through trade, including trans-boundary movement of animals, animal disease could rapidly spread across the borders and disrupt dairy industry growth, which however, is not assumed to affect the industry in the *Outlook*.

Notes

[1] Fresh dairy products contain all dairy products and milk which are not included in processed products (butter, cheese skim milk powder, whole milk powder, whey powder and, for few cases casein). The quantities are in cow milk equivalent.

[2] International Dairy Federation. (2022), "The IDF global Carbon Footprint standard for the dairy sector", *Bulletin of the IDF* n° 520/2022, https://doi.org/10.56169/FKRK7166.

[3] HPAI Confirmed Cases in Livestock: https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/hpai-confirmed-cases-livestock.

7 Fish and other aquatic products

This chapter describes market developments and medium-term projections for world fish and aquatic products markets for the period 2025-34. Projections cover consumption, production, trade and prices. The chapter concludes with a discussion of key risks and uncertainties which could have implications for world fish and other aquatic products markets over the next decade.

7.1. Projection highlights

Consumption of aquatic animal foods is expected to increase globally, with Asia accounting for 75% of the growth, followed by Africa (15%), the Americas (11%) and Oceania (1%). Consumption in Europe is set to decline marginally.

Global apparent per capita consumption of aquatic animal foods is projected to increase, reaching 21.8 kg by 2034, up from 21.1 kg in 2022-2024, but trends vary across regions. Africa's per capita consumption is expected to decline, particularly in Sub-Saharan Africa, despite an increase in total consumption.

Global prices of fish and other aquatic products are anticipated to decline in real terms, with fish oil prices experiencing the largest drop (-26%) due to high recent prices caused by fishing restrictions in Peru and strong demand driven by the high price of vegetable oil.

Aquaculture will remain the main driver of growth in fisheries and aquaculture production, which is projected to reach 212 Mt by 2034. It is projected to account for over 85% of additional output, increasing its share to 56% of total production.

Global exports of aquatic animal foods will continue to grow but at a slower pace, led by Asia (mainly The People's Republic of China ‑ hereafter "China" ‑ and Viet Nam), while exports from Africa are expected to decline.

Fisheries and aquaculture face increasing uncertainties due to change in environmental conditions, trade tensions and evolving sustainability priorities. Changing environmental conditions are expected to negatively affect global production, though impacts will vary by region. Improved fisheries management could mitigate some effects. Additionally, trade policies due to geopolitical tensions, introduce further uncertainty. China's evolving policies, with a growing focus on sustainable development, will also be a key factor influencing production in the coming decade.

7.2. Current market trends

Global fisheries and aquaculture production rose to about 193 Mt in 2024, driven by growth in both aquaculture and capture fisheries.[1] Aquaculture production continued its upward trend, while capture fisheries recovered in 2024 after a marginal decline in 2023.

In 2024, the FAO Fish Price Index declined by 3.0%, reaching its lowest point in September before rebounding towards the end of the year. This marked the second consecutive annual decrease since the record high reached in 2022.

The volume of global trade in aquatic animal food products saw a slight increase in 2024, despite declines in imports from major markets such as the European Union and China. In China, increased aquaculture production was sufficient to reduce imports in spite of increased consumption. Fishmeal exports rebounded significantly in 2024, after a sharp decline in 2023 mainly due to lower production in Peru.

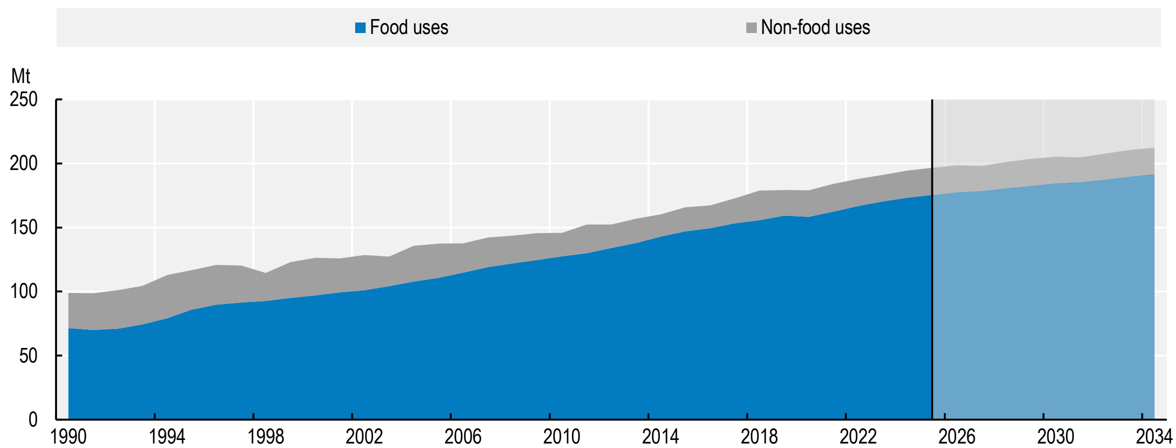
7.3. Market projections

7.3.1. Consumption

Global consumption of fish and other aquatic products to grow more slowly in the decade ahead

Global demand for aquatic products (including food and non-food uses) is projected to grow by 11% over the coming decade, well below the growth experienced over the last decade (24%). This is mainly due to an expected slowdown in demand growth in Asia (11% compared to 32% over the last decade). Demand for non-food uses of aquatic products, primarily for the production of fishmeal and fish oil, is expected to grow more slowly than demand for food uses (Figure 7.1). As a result, the share of total use allocated to food is projected to rise slightly, from 89% in the base period (average 2022-2024) to 90% by 2034.

Figure 7.1. World food and non-food uses of fish and other aquatic products



Note: Data are expressed in live-weight equivalent.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Focusing specifically on food uses, global demand is projected to increase by 13% over the next decade, with population growth expected to drive demand growth. Total apparent[2] consumption of fish and other aquatic foods is projected to reach 192 Mt (live weight equivalent) by 2034, an increase of 22 Mt compared to the base period (average of 2022-2024). Total apparent consumption is projected to expand in all regions except Europe, where marginal declines in per capita consumption and population are expected to limit growth. While Asia will remain the dominant source of additional demand, Africa is projected to experience the fastest growth rate, with total apparent consumption increasing by 24% by 2034, an acceleration compared to the previous decade when it was 20%. Asia will account for 73% of fish and other aquatic food products available for consumption by 2034. China on its own will account for 37% of that total. Global aquaculture will provide a growing share of fish and other aquatic products available for human consumption rising from 58% in the base period to 61% by 2034.

Over the next decade, global per capita consumption of aquatic foods is projected to grow by just 3.3%, a notable deceleration from the 12% growth recorded in the previous decade. And it is expected to reach 21.8 kg per capita per year, up from 21.1 kg in the base period. Per capita consumption is expected to rise across all regions, except in Europe where it is projected to be marginally down, and in Africa more particularly Sub-Saharan Africa, where population growth (+29%) is expected to outpace aquatic food supply (+23%)–highlighting the challenge of ensuring adequate food supply in the face of rapid demographic expansion.

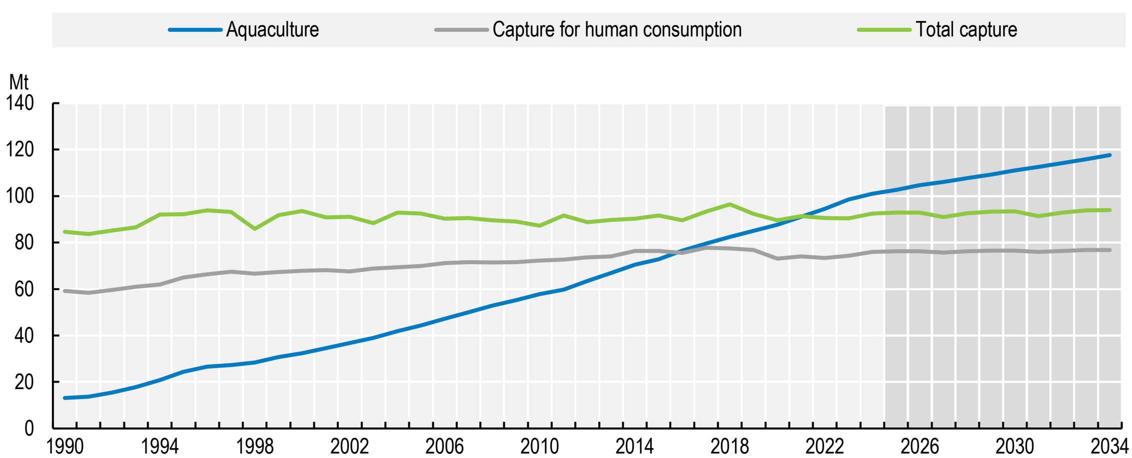
Fishmeal and fish oil are projected to represent 83% of the 21 Mt live weight of fish and other aquatic products utilised for non-food uses in 2034. The rest will serve other non-food uses such as ornamental fish, fingerlings and fry, bait, pharmaceutical inputs, or as direct feed for farming. Fishmeal is primarily used in diets for farmed animals, particularly farmed fish. By 2034, 84% of fishmeal will be consumed by the aquaculture sector as feed, compared to 78% in the base period. China, being the largest aquaculture producer, is also the largest consumer of fishmeal, projected to account for 42% of world fishmeal consumption by 2034. While fishmeal is predominantly used as feed in the aquaculture sector, fishmeal is not the main feed source in aquaculture. The difficulty of further increasing fishmeal production has driven the sector to increasingly rely on other feed ingredients. For example, oilseed meals have been increasingly utilised in aquaculture feed formulations. By 2034, the use of oilseed meals in aquaculture is expected to grow by 37% reaching 11 Mt, while fishmeal usage in aquaculture is projected to rise by 16% to 4.9 Mt compared to the base period. Consumption of fish oil is characterised by a competition between aquaculture and dietary supplements for human consumption. By 2034, 59% of fish oil is projected to be fed to farmed fish, in particular salmon, up from 54% in the base period. Norway and the European Union will remain the main consumers of fish oil, accounting for 16% and 15%, respectively of the world total in 2034.

7.3.2. Production

Aquaculture to drive production growth, but pace to slow significantly

Global fisheries and aquaculture production is projected to increase from 189 Mt (live weight equivalent) in the base period to 212 Mt by 2034. Although the total volume continues to grow, both the growth rate and the absolute increase are declining. Over the next decade, global fisheries and aquaculture production is expected to rise by 12% (+23 Mt), compared to a 24% increase (+37 Mt) in the previous decade. Aquaculture remains the main driver of overall expansion, despite its decelerating growth (Figure 7.2). Nonetheless, aquaculture's importance to total production continues to rise, and it is projected to account for 56% of global fisheries and aquaculture production by 2034, up from 52% in the base period.

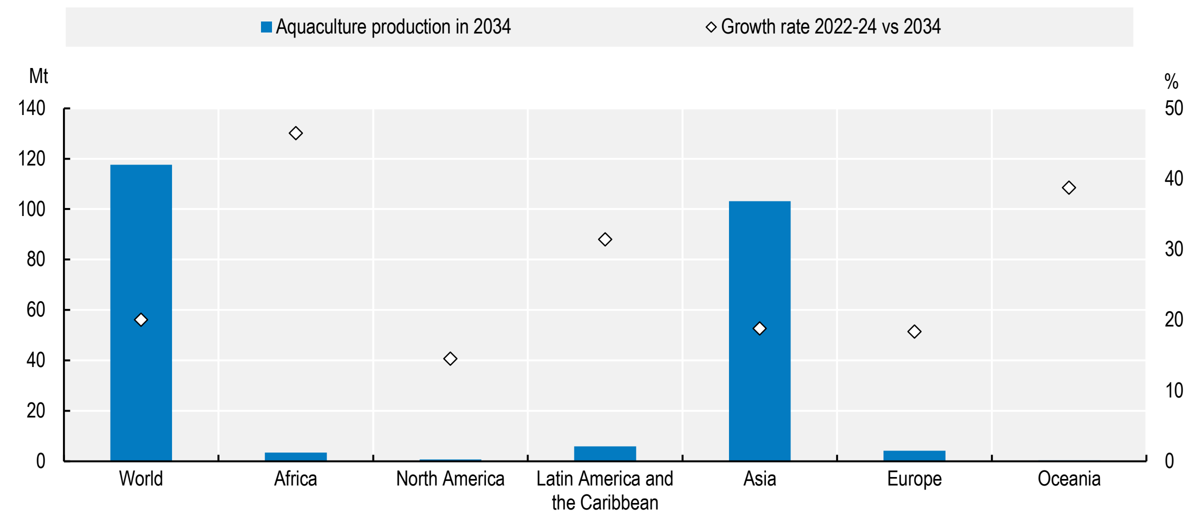
Figure 7.2. World aquaculture and capture fisheries production



Note: data are expressed in live-weight equivalent.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

By 2034, global aquaculture production, based on the harvest of farmed aquatic animals, is expected to reach 118 Mt, marking a 20% increase compared to the base period. While this still reflects solid growth, it is considerably slower than the 51% expansion observed in the previous decade. The projected slowdown is largely linked to diminishing productivity gains at the global level, originating from stricter environmental regulations and a reduced availability of optimal sites for production. Asia will continue to dominate global aquaculture, accounting for an estimated 88% of total output by 2034, a share only slightly lower than in the base period (Figure 7.3). While aquaculture production is projected to grow in nearly all countries and regions, Asia is expected to record one of the slowest growth rates over the outlook period. Nevertheless, the overall distribution will remain heavily concentrated in Asia. China will retain its position as the top aquaculture producer, although its share of global aquaculture production is projected to level off at around 53%. This reflects rapid growth in emerging aquaculture producers, particularly India and Viet Nam, which are expected to expand their contributions to global aquaculture production significantly.

Figure 7.3. Aquaculture production by region in 2034 and projected growth rates



Note: production data are expressed in live-weight equivalent.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

From a species perspective, strong aquaculture production growth is expected for shrimps and prawns (+38%), freshwater and diadromous fish excluding carp and tilapia (+29%) and salmonoids (+26%). However, for all species groups aquaculture production growth is expected to be significantly slower than in the previous decade.

Global capture fisheries production, based on the harvest of wild-caught aquatic animals, is projected to reach 94 Mt by 2034, representing a 3.2% increase compared to the base period. While part of this growth reflects the recovery from low anchoveta catches in Peru in 2023 due to stock management measures and the *El Niño* phenomenon, a gradual increase is expected over the outlook period, particularly in Africa and the Americas. While Asia will continue to account for just over half of global capture fisheries production by 2034, its share is expected to decline slightly as Africa and the Americas account for a larger share of total production. Modest growth in capture fisheries production will be driven by improvements in fisheries management, technological advancements, and reductions in discards and waste. However, short-term fluctuations may occur, such as the anticipated *El Niño* events in 2027 and 2031, which are expected to temporarily reduce catches in South America, resulting in a decline of around 2 Mt in global production during these periods.

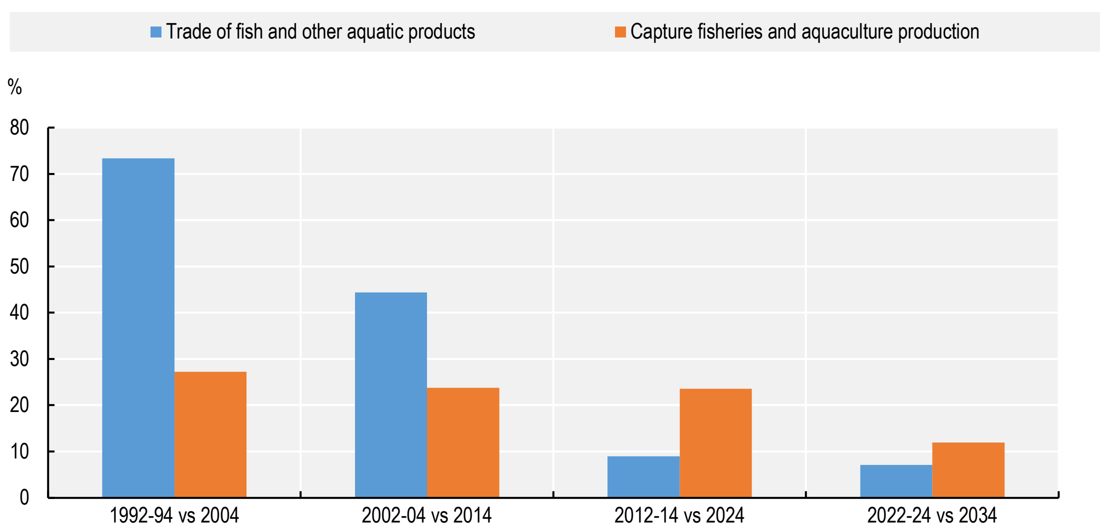
Over the next decade, the quantity of capture fisheries production that is reduced to fishmeal and fish oil is projected to show an upward trend compared to the previous decade, while fluctuating between 15.2 Mt in *El Niño* years and 17.1 Mt during peak fishing years. However, this remains well below the levels of the 1990s, when around 26 Mt of wild fish were used for fishmeal and fish oil production. By 2034, global production of fishmeal and fish oil is projected to reach 5.9 Mt and 1.5 Mt, respectively, reflecting a 12% increase for both compared to the base period. The use of fish residue and by-products in fishmeal production is expected to rise steadily, driven by the growing demand for fish fillets, which generates more residues. For fish oil, the share sourced from waste saw a significant increase in 2023 due to the sharp plunge in fish oil production in Peru–which is mainly derived from whole anchoveta. This rise in the proportion of fish oil production from waste has impacted the base period's figures, leading to a slower rise in the proportion sourced from waste over the outlook period. By 2034, approximately 31% of fishmeal is expected to come from waste, up from 29% in the base period.

7.3.3. Trade

Asia to continue dominating trade of fish and other aquatic products, but growth to moderate

Over the past decade, the growth of aquatic trade has lagged behind the expansion of capture fisheries and aquaculture production, marking a notable shift from the strong trade-driven trends seen since the 1990s. This relative slower pace is expected to persist over the outlook period (Figure 7.4). Nevertheless, aquatic trade remains a vital contributor of foreign exchange earnings, employment generation and global food security. Fish and other aquatic products, both for food and non-food uses, will continue to be extensively traded, with approximately 35% of global fisheries and aquaculture production projected to be traded by 2034 (31% excluding intra-EU trade). This underscores the sector's integration into global markets and its openness to international trade.

Figure 7.4. Comparing growth rates in global production and trade of fish and other aquatic products



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

World trade of fish and other aquatic products for human consumption is projected to be 7.1% higher in 2034 than in the base period. This represents a slowing down compared to the 9.0% growth observed in the previous decade. High transportation costs, slower expansion of capture fisheries and aquaculture production and a desire to fulfil domestic demand with local production in some key regions, are the main drivers behind this slowdown in growth. By 2034, exports of fish and other aquatic products for human consumption are projected to reach 46 Mt (product weight), up from 43 Mt in the base period.

Asia is expected to continue dominating aquatic trade, accounting for nearly half of total exports of fish and other aquatic products for human consumption by 2034. China alone will represent 19% of the total. Viet Nam is projected to experience the largest increase in exported volumes by 2034 after China, with its share rising from 7% in the base period to 9% by 2034. In contrast, Africa's exports are projected to decline by 12% by 2034 compared with the base period, reflecting a growing emphasis on meeting domestic demand.

Asia will remain the largest importing region, accounting for 42% of global imports of fish and other aquatic products for human consumption by 2034, although its import volumes are expected to grow only slightly

(+0.7%). China's import volumes are expected to decline by 2034, as domestic production increasingly caters to local consumer preferences amid a shrinking population, a trend also observed in Japan. Africa is forecast to experience the largest increase in imports (+27%), followed by the Americas (+11%), reflecting rising demand and insufficient domestic production capacity. In Europe and Oceania, imports of fish and other aquatic products for human consumption are projected to decline by 2034.

Exports of fishmeal are projected to rise by 8.0% relative to the base period, reaching 3.8 Mt (product weight) by 2034. Peru, the world's largest fishmeal exporter, is expected to record one of the highest growth rates over the outlook period, driven largely by a strong rebound from the unusually low export volumes recorded during the base period. In particular, 2023 saw a sharp decline, with exports falling by half compared to 2022. China will further strengthen its position as the dominant global fishmeal importer, accounting for 52% of total imports by 2034, up from 48% in the base period, reflecting the growing feed demand from its expanding aquaculture sector. As a result, fishmeal import volumes are projected to decline in most traditional importing countries, such as Norway and the European Union. Fish oil exports are projected to increase by 9.0% by 2034. Peru, Viet Nam, and the European Union will lead global exports of fish oil. In Viet Nam, exports of fish oil have surged in 2023 and 2024 and are projected to continue rising over the outlook period. However, this increase is suspected to primarily consist of used cooking fish oil exported to the United States, where it competes in price with used vegetable cooking oil. On the import side, the European Union, Norway and the United States will remain the primary markets.

7.3.4. Prices

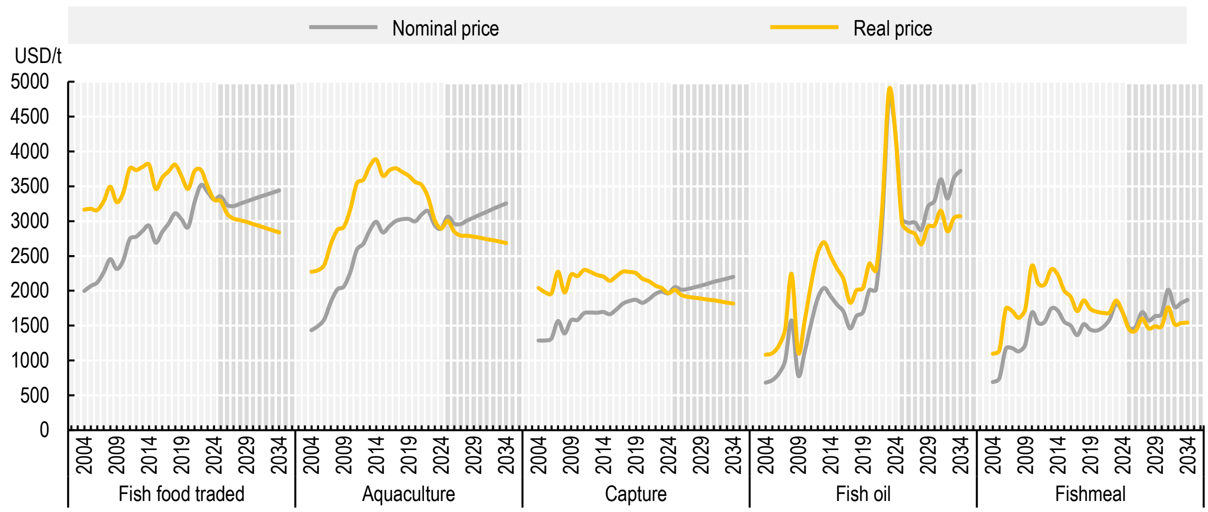
The prices of all products are expected to decline in real terms over the projection period

The prices of all product categories are expected to decline in real terms over the projection period, with the largest declines expected in fish oil (-26%, +0.8% p.a.) and traded fish products (-19%, -1.3% p.a.) (Figure 7.5). While the real prices in all groups are expected to decline until 2028, from 2029 onward the prices of fish oil and fishmeal are expected to grow slowly (with some fluctuations) while the prices of capture, aquaculture and traded fish products will continue to decline up to the end of the projection period. Relative to historic values, the real prices of capture, aquaculture, and traded fish products will remain low, while fish oil and fishmeal prices will be high, albeit lower than historic peaks (in 2023 for fish oil and 2012-14 for fishmeal).

In nominal terms, the prices for aquaculture and capture products are expected to rise by 8.7% (+1.0% p.a.) and 12% (+1.0% p.a.) respectively. However, in real terms prices are expected to fall by 13% in aquaculture and 10% in capture fisheries. In both cases, price declines are driven by production increases outstripping demand growth, competition from other protein sources, namely poultry, where prices are expected to decline over the projection period, and a general reduction in inflationary pressure. In aquaculture, the decrease in real prices is expected to be half as much as the previous decade, in part due to the substantial slowing of production growth in the outlook period. While in capture fisheries, the slow decline is in keeping with historic trends and is similar to the previous decade when prices declined by 12% in real terms.

Fish oil prices are expected to decline in both nominal (-7.5%, +2.7% p.a.) and real (-26%, +0.8% p.a.) terms, reflecting the unusually high prices in the base period. Fish oil prices experienced a 117% growth in nominal terms in the previous decade, but almost all this growth was between 2022 and 2023, when prices spiked due to supply constraints, caused by unusually low harvests of anchoveta in Peru and very high vegetable oil prices. As supply constraints continue to ease, the price of fish oil is expected to decline until 2028 in real terms before returning to its historic trend of slow growth driven by continuing strong demand from animal feed and human consumption. Prices will continue to fluctuate due to *El Niño* with declines expected in 2028 and 2032 as production rebounds.

Figure 7.5. World fish and other aquatic product prices



Note: Fish food traded: world unit value of trade (sum of exports and imports) of fish for human consumption. Aquaculture: FAO world unit value of aquaculture fisheries production (live weight basis). Capture: FAO estimated value of world ex-vessel value of capture fisheries production excluding for reduction. Fishmeal: 64-65% protein, Hamburg, Germany. Fish oil: N.W. Europe. Real price: US GDP deflator and base year = 2024.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Fishmeal prices are projected to increase in nominal terms (10%, +2.8% p.a.) and decline in real terms (-12%, +0.9% p.a.). However, the real term decline is significantly lower than in the previous decade when prices declined 24% from their historic peak in 2013-14. Prices are expected to continue declining in 2025 from the recent highs before settling into their historic pattern of remaining largely stable on average but with significant price movement due to *El Niño* driven impacts to anchoveta stocks.

7.4. Risks and uncertainties

Environmental change, shifting regulations and trade tensions could define production in the outlook period

Given their reliance on mobile resources and often fragile habitats, wild capture fisheries are susceptible to the environmental fluctuations. For instance, by mid-century, most countries are projected to experience a decline of over 10% in marine exploitable fish biomass particularly under the high emission scenario (Blanchard and Novaglio, 2024[1]) Short-term changes and extreme weather events - such as marine heat waves–are likely to have a greater impact on fisheries production over the outlook period than the longer-term warming trends. In particular, any difference in the expected intensity and duration of *El Niño* events will have large impacts on anchoveta production in Pacific, with knock-on effects on fish oil and fishmeal production and prices (FAO, 2024[2]). Additionally, there is some evidence that aquatic non-indigenous or invasive species have expanded into regions where previously they were not able to survive and reproduce, thereby challenging fisheries and aquatic ecosystems (Azzurro et al., 2024[3]). Changes in water availability and in environmental conditions can create challenges for aquaculture producers. The extent and intensity of these short-run impacts is a crucial source of uncertainty in the *Outlook* projections.

Importantly, improved fisheries management and adaptation planning can improve the resilience of the sector and mitigate some of the short- and long-term impacts of environmental changes. FAO's Blue Transformation supports vulnerable states by promoting sustainable, resilient, and inclusive blue food systems. It focuses on three key goals (FAO, 2023[4]): expanding sustainable aquaculture, improving fisheries management, and upgrading value chains, through science-based policies, innovation, and partnerships.

Changes in environmental conditions also introduce some regulatory uncertainty. Firstly, adaptation measures may have impacts on both aquaculture and fisheries production. In fisheries, flexible management may lead to the closure of fisheries to protect stocks in some areas or increases in production in others. While in aquaculture, production sites may be forced to move further offshore to reduce exposure to sea temperature changes, increasing costs and impacting production. Importantly, the nature of these impacts will depend on where the production is located and the type of production itself, introducing uncertainty into the projections. Secondly, policies implemented to mitigate greenhouse gas (GHG) emissions from aquatic production, may force both fishers and fish farmers to adjust production methods. Governments are beginning to use support policies to meet emission reduction goals, for example, but as yet little is known about the impacts of these policies on production or whether they can effectively reduce GHG emissions (OECD, 2025[5]). To address this uncertainty, precautionary integration of emission reduction and adaptation measures into fisheries and aquaculture management cycles is key (Bahri et al., 2021[6]); (Barange et al., 2018[7]), as well as due consideration of fisheries and aquaculture in national climate plans and strategies (Stanford Center for Ocean Solutions et al., 2024[8]).

The regulatory environment of fisheries and aquaculture is changing, and it is difficult to know what impacts these changes will have on production. In fisheries, the Fisheries Subsidies Agreement of the World Trade Organization (WTO), which disciplines certain types of subsidies that can contribute to overfishing, requires fewer than 20 additional country acceptances before it comes into force. When it does come into force, the agreement may impact the nature of production and the structure of fleets in some areas. The second, more ambitious, phase of negotiations is currently moving slowly but should this change in the projection period, the impacts on the fisheries sector could be significant.

In aquaculture, regulatory shifts may also have impacts on the nature of production and the speed of growth. In China, any shifts in the focus of aquaculture policy as part of the Fifteenth Five Year Plan (2026-2030) will have significant impacts given China's importance to global production. Beyond China, governments are increasingly focusing on aquaculture to meet a growing global demand for fish and other aquatic products, including by providing significant levels of government support to the sector. For example, across the European Union, the European Maritime Fisheries and Aquaculture Fund, allows members states significant leeway to direct their funding envelope toward aquaculture over the *Outlook* period. However, relatively little is known about extent, nature and effectiveness of government support to aquaculture, so how these policies change may impact production, and the value chain more generally, is not well understood, introducing uncertainty into the projections. To answer some of these questions, the OECD fisheries committee, has embarked on a new programme of work to classify and understand government support to aquaculture. To support countries in expanding their aquaculture sectors, the FAO Fisheries Committee endorsed in 2024 the Guidelines for Sustainable Aquaculture (FAO, 2025[9]), which offer a comprehensive framework to help policy makers and stakeholders responsibly expand and intensify aquaculture, balancing social, economic, and ecological well-being while increasing productivity and profitability.

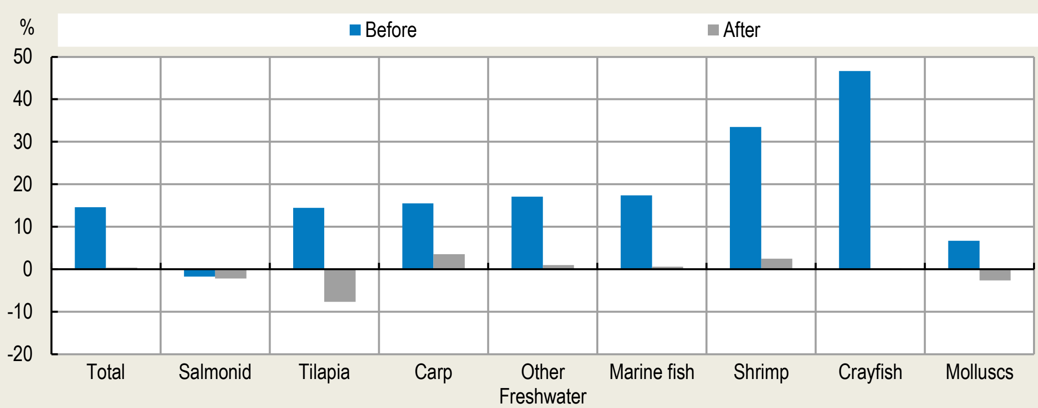
Fish and other aquatic products are highly-traded, with complicated multi-stage value chains spanning several countries. This makes then potentially sensitive to the impacts of escalating global trade tensions over the projection period. Trade policies that increase the costs and barriers to moving aquatic products around the globe will have unpredictable impacts on the availability of products in certain markets, prices and the structure of the value chains themselves. The extent and nature of these impacts are currently unknown, meaning they cannot be effectively captured in the projections introducing further sources of uncertainty.

Box 7.1. Addressing the underestimation of aquaculture production growth in the FAO Fish model

The FAO Fish model was developed in 2010 to generate the projections presented in the fish chapter of this publication and has been maintained and improved since then. In a recent assessment of the historical projections versus the actual trends in production, it was noted that the model tends to underestimate aquaculture production growth. Possible causes include underestimating growth in recent historical periods and inaccurate forecasts of exogenous variables. In order to eliminate these two potential issues, while replicating as much as possible the outlook procedure, all the aquaculture supply functions were calibrated using data from 2014 to 2017. This approach enabled the use of five years of historical data (2018-2022) to assess the accuracy of the forecasts produced by the supply functions. The dynamic simulation conducted prior to any model improvements clearly shows an underestimation of growth (Figure 7.6).

Seven improvements were introduced to the model. The first concerns the price used: since the Fish model operates at an all-species level, the evolution of the weighted average price may differ significantly from species-specific price trends. This was evident in the cases of Chinese freshwater crayfish and Peruvian shrimp and molluscs. The second improvement accounts for omitted interactions with other commodities or capture production, such as Chinese freshwater crayfish, which is primarily produced in integrated crayfish-rice farms, and Peruvian molluscs, which rely on natural seed sources.

Figure 7.6. Underestimation of aquaculture production after five years of simulation, 2022



Note: The chart compares the model's underestimation of aquaculture production after five years of simulation before and after updates were made to the model. 'Before' reflects the underestimation when no changes had been implemented, while 'After' shows the underestimation following model adjustments. In both cases, underestimation was calculated by comparing the model's output for 2022 to the final aquaculture production data for that year. Other freshwater mainly includes catfish, pangas and milk fish.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

The third improvement addresses outliers, which were isolated using dummy variables. These outliers could result from statistical errors or extraordinary events, such as the Early Mortality Syndrome (EMS) virus outbreak in shrimp or COVID-19. The fourth improvement tackled mismatches between the calibration period and the forecast period. Sudden shifts in the first year of the outlook, often missed by constant elasticity functional forms, were captured using variable elasticity functional forms, correcting 17 supply functions.

The fifth issue was an overestimation of feed costs, which could be partly due to the model's use of fixed feed conversion ratios (FCR) based on data from 2005 and 2006. According to Glencross et al. (2023[10]), FCRs for most species have only slightly decreased since then, with the largest reductions occurring between 1975 and 2000. While switching to variable FCRs did not give a significant improvement in the model's overall performance, it did improve feed consumption estimates.

Despite all these changes, the model still underestimated aquaculture production growth. The remaining missing factor seemed to be productivity gains (beyond the lower FCR) or new production areas. This was addressed by incorporating a time trend in 35 species-specific supply functions. Accounting for all these adjustments greatly improved the model's performance. The error in the 2022 global aquaculture production forecast was reduced from -15% (or -13.8 Mt) to -0.4% (or -0.4 Mt).

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Notes

[1] The term “fish and other aquatic products” refers to fish, crustaceans, molluscs and other aquatic animals, but excludes aquatic mammals, crocodiles, caimans, alligators, and aquatic plants.

[2] The term “apparent” refers to the amount of food available for consumption, which is not equal to the edible average food intake. The amount is calculated as production + imports – exports - non-food uses, +/- stocks variations, all expressed in live weight equivalent.

8 Biofuels

This chapter describes market developments and medium-term projections for world biofuel markets for the period 2025-34. Projections cover consumption, production, trade and prices for ethanol and biomass-based diesel (including the classical biodiesel, which makes up for the largest share of the complex, renewable diesel and sustainable aviation fuel, the latter two being drop-in fuels that can replace petroleum-based fuels). The chapter concludes with a discussion of key risks and uncertainties which could have implications for world biofuel markets over the next decade.

8.1. Projection highlights

Biofuels continue to play an important role as a renewable alternative to fossil transportation fuels. Global use of biofuels is expected to grow by 0.9% annually over the next decade, significantly lower than in the past.

In most high-income countries, biofuel growth is projected to slow due to stagnating fuel demand resulting from electric vehicle adoption and weaker policy support. In the United States the focus is expected to shift towards biomass-based diesel due to road and aviation fuel targets, with a projected 1% annual increase. Under Canada's Clean Fuel Regulations, however, biofuels use is projected to increase by 6% per year while in the European Union biofuel use is expected to decrease under Renewable Energy Directive (RED III).

Middle-income countries are expected to offset the slowdown of demand growth projected in high-income countries. Biofuel consumption is projected to grow by 1.7% annually, driven by increasing transport fuel demand, domestic energy security, fiscal goals, and emissions reduction commitments, with Brazil, Indonesia, and India leading this growth.

Most biofuel markets are anticipated to be largely self-sufficient. Countries with strong domestic production capacity, such as India, Indonesia and Brazil, will likely meet their own rising demand, limiting the expansion of global biofuel trade. The global share of biofuel production that is traded is expected to remain at 15% for biomass-based diesel and 8% for ethanol.

First-generation biofuels will continue to dominate the market, with ethanol largely produced from maize and sugar and biomass-based diesel primarily from vegetable oils such as soybean, rapeseed, and palm oil.

The future of biofuel markets expansion depends on complex policies, with increasing interest in advanced biofuels and sustainable aviation fuel. However, expanding production capacities remains challenging due to high investment costs. Sustainable feedstock supply will be critical as biofuels integrate into circular economy models in agriculture.

Biofuel prices eased in 2024 due to lower oil prices and ample feedstock supply. Real prices are projected to decline, but government support will remain necessary to offset higher production costs of biofuels compared to fossil fuels.

8.2. Current market trends

The growth of global biofuel consumption has been solid over the past decade, averaging 3.3% per annum. In 2024, this upward trend continued steadily, following the temporary decline experienced in 2020 due to the global economic slowdown. The recovery and expansion of biofuel consumption have been facilitated by multiple factors, including the easing of biofuel prices worldwide. Next to changes in tax policies, this price reduction has been largely driven by lower crude oil prices which have stimulated demand for transport fuels, as well as a decrease in feedstock costs which has helped lower biofuel production expenses. These economic conditions have maintained strong incentives for the continued adoption and potential scaling up of biofuel usage.

Notably, India has experienced the highest growth in biofuel consumption, fuelled by government policies promoting energy diversification and sustainability. Meanwhile, in North America, demand for renewable diesel remains particularly strong, contributing to the region's overall biofuel expansion. Governments across the globe have continued to support biofuel adoption through favourable policies, subsidies, and mandates, viewing biofuels as a critical tool for enhancing energy security and reducing greenhouse gas

(GHG) emissions. Additionally, technological advancements and increased investments in biofuel infrastructure have further contributed to market growth.

8.3. Market projections

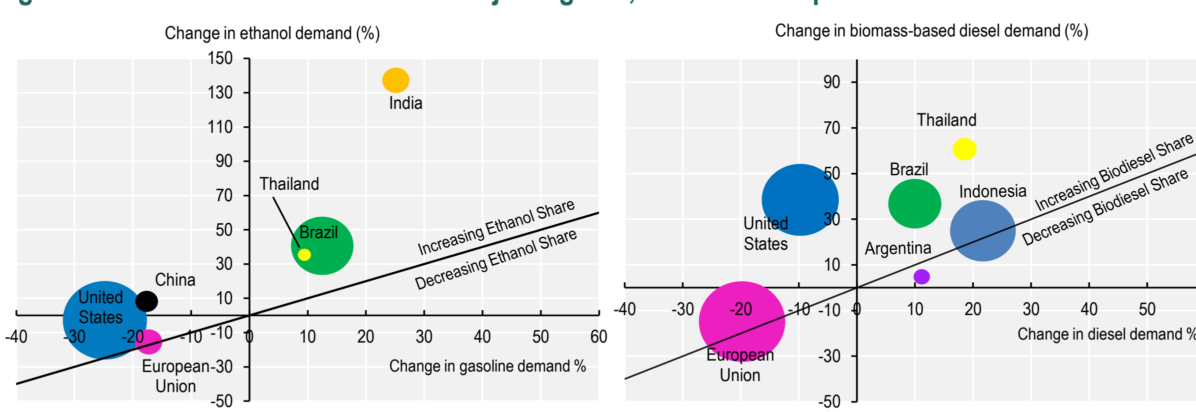
8.3.1. Consumption and production

Asian countries are driving biofuel supply and demand

Biofuel supply and demand projections are largely influenced by the future trajectory of overall fuel consumption, particularly because many biofuel mandates are set as a percentage of total fuel use. This *Outlook* relies on the IEA *World Energy Outlook 2024* as the primary source for global fuel demand projections. These projections are primarily based on assumptions regarding how economic growth translates into transportation fuel demand and other oil-derived goods. They also account for substitution effects, such as the increasing prevalence of electric vehicles (EVs), improvements in vehicle fuel efficiency, and the impact of international competition in the petrochemical sector. However, broader policy impacts, such as the European Union's Fit for 55 legislation, are not included in these projections. At the global level, these projections indicate that demand for gasoline-type fuels will decline at an average annual rate of 0.8% over the next decade, while biomass-based diesel consumption is expected to grow modestly by 0.2% per year. The projected decline in total fuel consumption is mainly concentrated in high-income countries, whereas in most other regions, overall fuel demand is anticipated to rise (Figure 8.1).

This *Outlook* expects a slower growth rate of biofuel consumption and production globally, both projected at 0.9% p.a. during the projection period. This is a fifth of the pace observed in the previous decade, primarily as result of reducing support policies in developed countries for conventional biofuels and declining total fuels use in some of these countries. With nearly two-thirds of the anticipated growth in biofuel demand expected to take place in emerging economies (Figure 8.2), notably in India, Brazil, and Indonesia, shifts in market shares are anticipated. In 2024, 55% of ethanol supply and demand is located in high income countries. However, it is anticipated that over the next decade, this share will decrease to 51%, with middle-income countries gaining prominence. An exception in this shift towards middle income countries is the biomass-based diesel development in North America, which accounts for two-thirds of global consumption growth.

Figure 8.1. Biofuel demand trends in major regions, 2034 vs base period 2022-24



Note: Shares calculated on demand quantities expressed in volume. The size of each bubble relates to the consumption volume of the respective biofuel in in the base period. Change in gasoline and diesel demand includes the biofuel components.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

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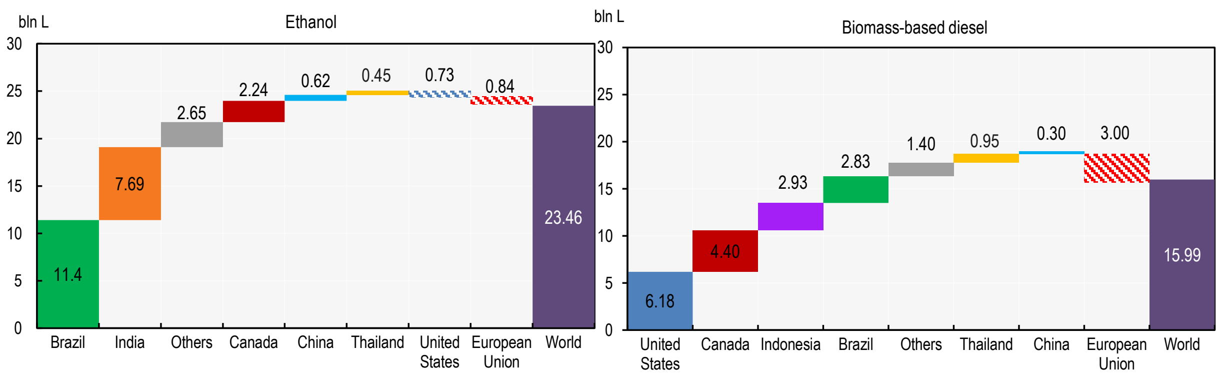
Figure 8.2. Regional contribution of growth in biofuel consumption, 2034 vs base period 2022-24



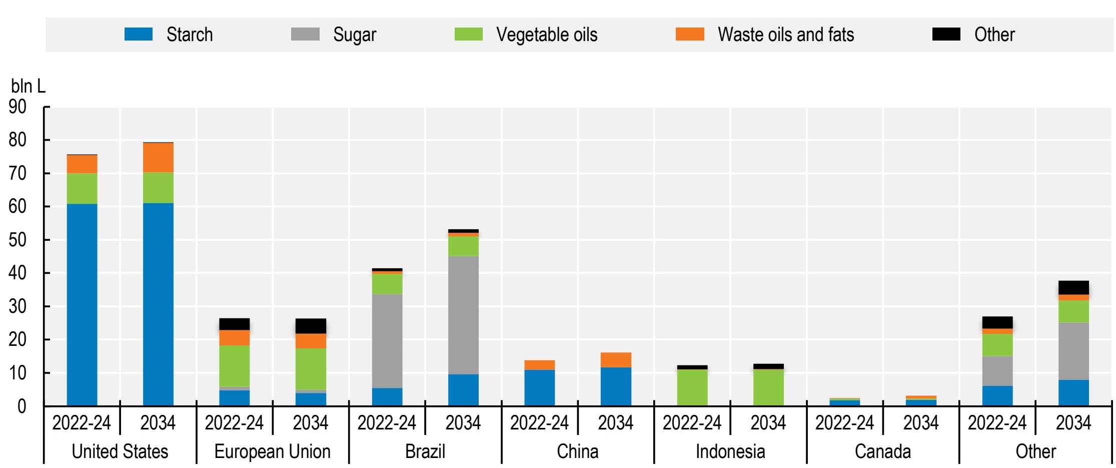
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

StatLink https://stat.link/adbrpf

Global ethanol and biomass-based diesel production are projected to increase to 155 bln L and 80.9 bln L, respectively, by 2034. In the base period, ethanol's total feedstock was made up of 60% maize, 22% sugarcane, 6% molasses and 2% wheat, with the remaining 10% being a mix of assorted grains, cassava, and sugar beets. Biomass-based diesel's total feedstock consisted of 70% vegetable oil and 24% used cooking oils and tallow which have recently gained importance (Box 8.1), with the other 6% being made up of non-edible oils and other waste.

Despite the increasing scrutiny of the sustainability of biofuel production witnessed in many countries, and notwithstanding significant variations in feedstock composition, conventional (or food-related) feedstocks are expected to remain predominant in the industry (Figure 8.3). While cellulosic feedstocks—such as crop residues, dedicated energy crops, or woody biomass—offer promising alternatives that avoid competition with food sources, these advanced feedstocks are not expected to experience a substantial increase in their share of total biofuel production.

Figure 8.3. World biofuel production from different feedstocks



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

United States

Biofuel policies in the United States are controlled by the Renewable Fuel Standard (RFS) programmes, the Inflation Reduction Act and various state policies. The programmes mandates a specific annual volume of renewable fuels to be blended into conventional transportation fuels. Current mandates were set for 2024 through 2026 by the Environmental Protection Agency (EPA). Due to the decline in gasoline consumption projected by the IEA, largely due to better vehicle efficiency and an increase in the number of electric vehicles, ethanol consumption is expected to decrease although the ethanol blend rate is expected to rise to 13% by 2034. However, petroleum refiner preference for renewable diesel in meeting EPA mandates and infrastructure limitations will constrain the expansion in use of fuels with greater ethanol inclusion. Furthermore, announced policies, if implemented as stated, could cause some disincentives to further growth of renewable diesel later in the projection period.

Maize is expected to continue as the primary feedstock for ethanol production, comprising 99% of production by 2034. Meanwhile, capacity for cellulosic ethanol production from non-food sources is assumed to grow gradually over the projection period, albeit from a low initial level. Despite the United States retaining its position as the largest ethanol producer globally, its share is projected to decline from 46% to 39%. Biomass-based diesel production is projected to increase by 1.68% p.a., to account for 27% of global production in 2034. This growth is propelled by increased consumption of renewable diesel, driven by rising targets in federal and state renewable fuel programmes, notably the low carbon fuel standard (LCFS) in California.

The European Union

The Renewable Energy Directive (RED) serves as the legal framework governing the advancement of renewable energy across multiple sectors, including transportation, within the European Union. This directive has undergone three significant revisions: initially amended under Directive (EU) 2018/2001 (RED II), and subsequently under Directive (EU) 2023/2413 (RED III). Under the RED, specific targets are set for the share of renewable energy within total energy consumption of each European Member state. This target is set at a minimum of 42.5% binding at EU level by 2030 - but aiming for 45%. Regarding biofuels, the RED originally included mandates for the blending of biofuels into conventional fuels, aiming to reduce GHG emissions and dependency on fossil fuels. Since RED II, there are limits for using feedstocks from food and feed crops, which restricts the expansion of agricultural feedstocks to be used in biofuel consumption. Moreover, biofuels have faced stricter sustainability criteria in response to concerns regarding their indirect land-use change (ILUC) effects, with clear rules defined to categorise high-risk ILUC feedstocks. While palm oil is not explicitly mentioned and can be certified for low-risk ILUC, it is the only feedstock that falls under the high-risk category under the current regulation. Additionally, RED III has raised the target for advanced biofuels from 3.5% to 5.5% by 2030. Supporting measures to reach this target include limitations on certain feedstocks, such as food crops, while incentivising the utilisation of advanced biofuels derived from waste or residues.

The anticipated reduction in transportation fuel use, is expected to reduce ethanol and biomass-based diesel consumption by -1.4% p.a. The biomass-based diesel content of diesel fuel is expected to rise from 10% to 11%, while the ethanol share in gasoline is projected to remain largely unchanged, increasing only slightly from 6.5% to 6.6%. Biomass-based diesel production is expected decrease accordingly and the share derived from palm oil is projected to decrease from 18% in the base period to 3% in 2034, due to sustainability concerns. The share of biomass-based diesel production from used cooking oils and fats is projected to increase from 24% to 28%.

Brazil

For many years, Brazil has had a large fleet of flex-fuel vehicles capable of operating on gasohol (gasoline-ethanol blend) or pure hydrous ethanol. The ethanol blend rate in gasohol varies between 18% and 27%, influenced by the price relationship between domestic sugar (the main feedstock) and ethanol. Since 2015, the mandated ethanol percentage stands at 27%. Over the next ten years, this blending mandate is expected to increase to 40%. The growth of biomass-based diesel's share in the Brazilian energy matrix has been driven by the mandatory blending with fossil diesel. Currently, the established percentage is 14%; which should increase to 15% in 2025—as approved by Brazil's National Energy Policy Council. A 15% blending mandate is assumed throughout the outlook period.

Unlike the United States and the European Union, total fuel consumption of gasoline and diesel is expected to increase in Brazil over the next decade, suggesting potential growth in biofuel blendings. Brazil is expected to maintain its position as the world's second-largest producer and consumer of fuel ethanol over the next decade. Ethanol consumption and production in Brazil are both projected to increase by 2.1% p.a., driven by the National Biofuels Policy (RenovaBio) programmes. Launched in 2017, the programmes play a pivotal role in fulfilling Brazil's commitments to reduce GHG emissions. While sugarcane is anticipated to remain the primary feedstock for ethanol production, maize usage has surged in recent years, rising from below 0.5 bln L before 2017 to almost 7 bln L in 2024. The *Outlook* projects that maize will continue gaining ground in the feedstock mix, reaching 9.6 bln L by 2034.

Indonesia

The implementation of B35 and B40 (Biomass-based diesel 35% and 40% blend) aims at reducing the country's dependency on imported fossil fuels, stabilising palm oil prices, reducing GHG emissions and sustaining the domestic economy as it accounts for nearly half a million jobs in the country. In recent years, biomass-based diesel production has steadily increased due to a national biomass-based diesel programme, which provides support to biomass-based diesel producers. This programme is financed by levies imposed on exports of various products including CPO, UCO and palm olein among others. The level of the export levies imposed is revised according to global market conditions on a regular basis and depends on a reference price. While recently the CPO fund has been depleted, the *Outlook* assumes producer prices will stay above USD 1 000 per tonne in nominal terms, allowing the replenishment of the CPO fund which will continue to subsidise domestic biomass-based diesel production. However, that amount combined with CPO exports constrained by production, may be only sufficient to achieve a blending rate of 31% (B31) over the projection period, instead of the announced B35 and B40. Based on these assumptions, biomass-based diesel production in Indonesia is projected to increase to about 15 bln L by 2034. Achieving B35 or B40 would require increasing support to biomass-based diesel producers and technically modifying diesel engines. Renewable diesel could overcome current technical limitations, but it would require additional investments and support at the expense of the CPO fund.

India

India has accelerated its ethanol production expansion aiming to achieve E20 (Ethanol 20% blend) by 2025. Recently, ethanol production increased significantly with sugar cane and grains accounting for the bulk of the increase, rather than the traditional feedstock, molasses. The *Outlook* assumes sugar cane will consolidate as the primary feedstock, followed by molasses. Cereals, particularly from degraded stocks, will supplement domestic production although in the medium term their role may be constrained by actual stock levels. Given the expanding gasoline demand, the blending target of E20 could be met in 2026. Ethanol production is expected to reach 15 bln L in 2034. While the outlook assumes that demand is driven by the current target of E20, there is sufficient production capacity and feedstock availability to meet a higher blending rate. However, achieving this would require lower feedstock prices to ensure the competitiveness and profitability of ethanol producers. Moreover, motor vehicle engines would need to be adapted to higher blending rates. Recently, the Government of India has established a partnership with Brazil, aiming at adopting new technology to implement higher blends. The limited supply of vegetable oil, for which India is a net importer, combined with high international prices, will remain the main constraint to any significant increase in biomass-based diesel production.

The People’s Republic of China

This *Outlook* assumes that the ethanol blending rate which was around 1.6% in recent years and increased to 2% in 2024 will increase to 2.5% in 2034. This increase cannot offset the projected decline in total gasoline usage, leading to a 0.4% annual decline in ethanol consumption over the next decade. Biomass-based diesel consumption, however, is projected to grow by 2% p.a. The *Outlook* assumes that only domestically produced feedstocks will be used.

Canada

The Canadian Clean Fuels Standard (CFS) which became law in 2022 promotes further use of biofuel in Canada by increasing incentives for the development and adoption of renewable fuels, technologies, and processes. CFS aims at a 15% reduction (below 2016 levels) in carbon intensity of transport fuels by 2030. Effective January 2023, 10% renewable content in gasoline and 15% in diesel are required. Subsequently, biomass-based diesel consumption in Canada more than doubled between 2023 and 2024. Plans for multiple new or expanded liquid biofuel facilities that would use primarily agricultural feedstocks have recently been announced across Canada. If these projects are completed as proposed, this could result in additional 5 bln L of biofuel capacity by 2034 (mainly for renewable diesel and sustainable aviation fuel). This *Outlook* assumes a more conservative increase of biomass-based diesel production to 2 bln L but a strong consumption increase to 5.9 bln L which would increase the current deficit of 1.2 bln L to 3.9 bln L. Ethanol consumption is expected to increase by 2 bln L and this increase is projected to be mainly covered by imports.

Argentina

In Argentina, the Biofuels Law of 2021 mandated a biomass-based diesel blending rate of 5% which can be reduced to 3% if high feedstock prices would distort fuel prices. In June 2022, the government passed a resolution to increase the biomass-based diesel mandate from B5 to B7.5 but allowing it to be temporarily increased as high as B12.5 to be able to react to diesel shortages. The *Outlook* assumes B7.5 as the blending target. With limited additional export possibilities, biomass-based diesel production is projected to stagnate over the next ten years.

The ethanol blending target has been maintained at 12% despite a push from bioethanol producers to have it increased to 15%. The *Outlook* assumes the rate will remain fixed and ethanol fuel use is projected to increase by 1.7% p.a. following the increase in total gasoline use.

Thailand

Despite the targets set in the Alternative Energy Development Plan (AEDP) for sugar cane (and indirectly molasses) and cassava, limited domestic availability is expected to constrain biofuels production. In addition, stagnating demand for fossil fuels will limit increasing demand for ethanol. On average, blending is expected to be around 14% over the *Outlook* period and production is projected to remain stagnant around 1.7 bln L over the next decade. Biomass-based diesel demand is expected to be supported by the mandatory blending with demand increasing to 2.7 bln L by 2034.

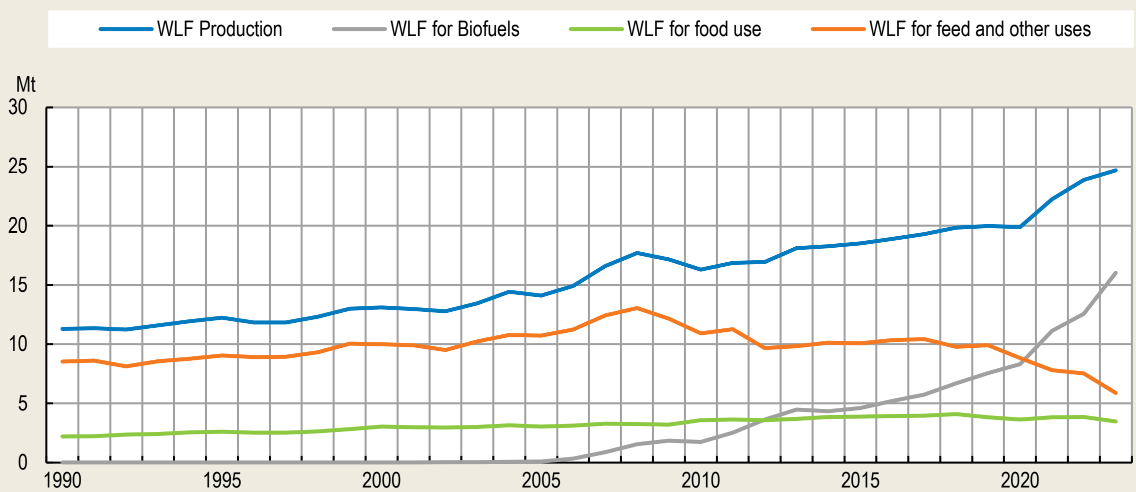
Colombia

Ethanol demand is projected to increase over the *Outlook* period in line with the recovery of gasoline demand. Over the medium term, the blending rate is projected to remain around 11%. Sugarcane will continue to be the main feedstock and by 2034 biofuel production will consume about 12% of sugarcane production versus about 8% in the base period, thus establishing ethanol as an important element in sustaining the Colombian sugarcane sector. The biomass-based diesel blending rate has been above 13% and is expected to remain so over the projection period.

Box 8.1. Why have waste oils and fats (WLF) become important biomass-based diesel feedstocks?

In recent years, waste oils (i.e. used cooking oils - UCO) and fats (i.e. tallow) (WLF) have gained significant importance as feedstocks for biomass-based diesel production. The growing demand for renewable diesel, particularly in regions with stringent environmental regulations, has driven this shift. Waste-based feedstocks are seen by some to offer several advantages over crop-based oils, including lower carbon intensity and reduced land-use impact, and have attracted greater policy support.

Figure 8.4. World supply and demand for waste oils and fats



Note: WLF stands for 'Waste oils and fats'.
Source: FAOSTAT, UN-COMTRADE, Aglink-Cosimo baseline 2024, Render magazine (for supply), USDA-NASS, US-EIA.

The rise in renewable diesel demand

One of the primary reasons for the increased use of WLF is the rapid growth in renewable diesel production. California is part of this transition, with its Low Carbon Fuel Standard (LCFS) playing a key role in incentivizing low-carbon fuels. Unlike traditional biodiesel, which has blending limitations, renewable diesel is a drop-in fuel that can replace petroleum-based diesel without modifications to engines or infrastructure. This has made it a preferred option for reducing emissions in the transportation sector. Policies such as the United States Renewable Fuel Standard (RFS) and the European Union’s Renewable Energy Directive III (RED III) have further accelerated the adoption of waste-based feedstocks.

Waste-based feedstocks vs. crop-based feedstocks

Crop-based feedstocks, such as soybean oil and palm oil, have been widely used for biofuel production. However, they carry higher emissions due to direct and indirect land-use changes and they compete with food production. In contrast, waste-based feedstocks like used cooking oils, tallow, and other animal fats are byproducts of food and agricultural industries. Many argue that since they do not require additional land or crops, their carbon intensity is significantly lower. Following this argument, they qualify for higher policy incentives, making them more economically attractive for biofuel producers.

Policy incentives and regulatory support

Several governments are promoting waste-based biofuels through subsidies, tax credits, and regulatory mandates. In the United States, tax incentives prioritize WLF over crop-based oils, while California's LCFS provides financial benefits for fuels with lower carbon intensity. The European Union is also taking measures to reduce reliance on high ILUC-risk biofuels. Under RED III, the European Union is phasing out palm oil-based biofuels by 2030, further boosting the demand for waste-based alternatives.

Challenges and market interconnections

Despite their advantages, WLF are not unlimited resources. Their availability is linked to the food industry, animal processing, and waste collection infrastructure. Additionally, competition exists between different uses of waste oils, such as in animal feed and industrial applications. Furthermore, the rising demand for WLF as biofuel feedstocks challenges the assumption that they are truly ILUC-free. As their value increases, it may incentivize greater production of the primary commodities they come from, such as vegetable oils and meat, indirectly driving higher resource use. This raises concerns that WLF demand could influence land use and agricultural production. Furthermore, concerns have been raised about fraudulent activities, such as mixing UCO with virgin palm oil to bypass sustainability regulations (Swanson, Arita, and Cooper, 2024) While data does not indicate widespread fraud, understanding these interconnections is crucial for balancing sustainability goals with economic feasibility.

Source: Swanson, A., S. Arita and J. Cooper (2024), "Controversies Surrounding US Imports of Used Cooking Oil for Biofuel Production", *ARE Update* 28(2), pp. 1-5, University of California Giannini Foundation of Agricultural Economics, https://giannini.ucop.edu/filer/file/1734628708/21199/.

Other countries

Other significant producers of ethanol include Paraguay, the Philippines, and Peru, where production is projected to reach nearly 0.8 bln L, 0.8 bln L and 0.3 bln L, respectively, by 2034. The blending rate in Paraguay is assumed to remain stable around 25% over the projection period given the limited supply of sugar cane, which cannot be entirely substituted by maize. Malaysia, the Philippines and Peru are also major biomass-based diesel producers, where production projections reach 2.1 bln L, 0.6 bln L and 0.2 bln L, respectively, by 2034. Other Asian countries, particularly Singapore, could increase production to reach around 0.9 bln L of biomass-based diesel from UCO in 2034. Unlike most countries where biofuels are domestically used to reduce GHG emissions and to reduce national dependency on imported oil, production of biomass-based diesel in Singapore is largely for export.

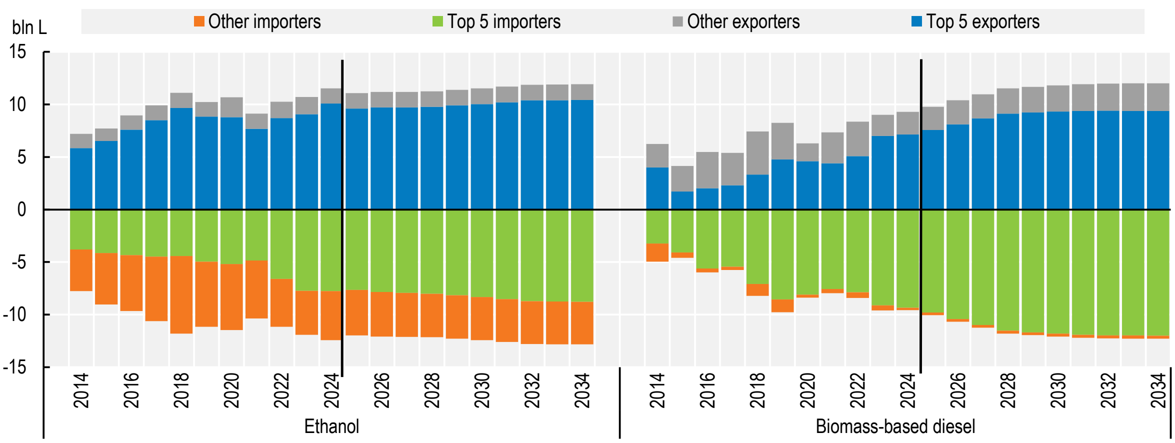
8.3.2. Trade

Global biofuel trade is expected to remain nearly constant

World ethanol trade is projected to increase from 11 bln L to 11.9 bln L by 2034, with total share of production decreasing from 8.8% to 8.2% by the end of the projection period. The United States and Brazil are expected to remain the main exporters of maize- and sugarcane-based ethanol. The export share of both countries together is expected to even increase from 75% today to 79% in 2034.

Globally, biomass-based diesel trade accounts for 13.5% of production and this share is projected to increase to about 14.8%. Indonesian biomass-based diesel exports fell dramatically in 2020 and have remained low since. Reflecting high domestic demand and reduced export opportunities to the European Union, Indonesia is not expected to return to international markets with significant biomass-based diesel exports. The top five exporters of biomass-based diesel—China, the United States the European Union, Canada and Malaysia—are projected to maintain a combined market share of 79% (Figure 8.5).

Figure 8.5. Biofuel trade dominated by a few global players



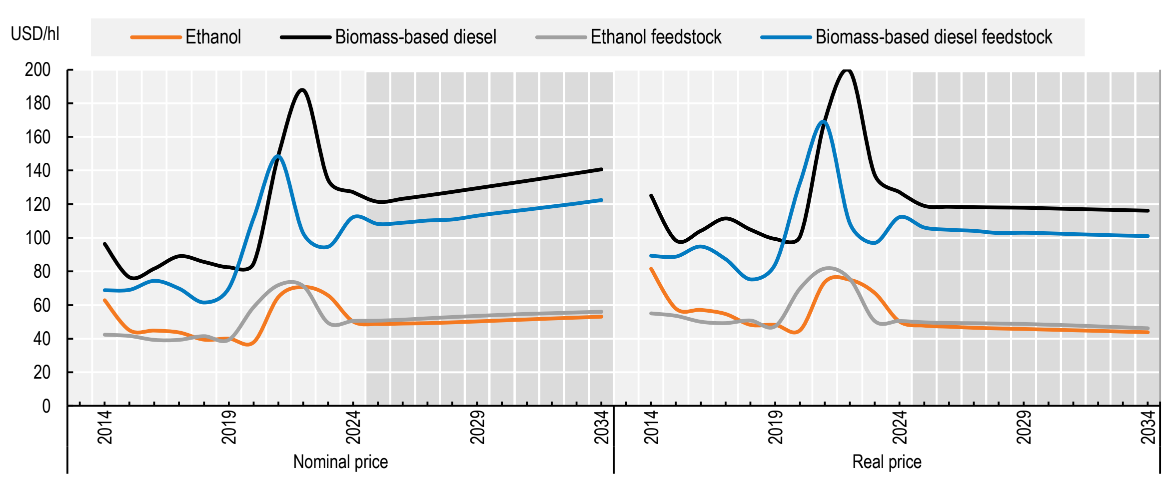
Note: Top five ethanol exporters in 2034: United States, Brazil, Pakistan, United Kingdom, European Union. Top five ethanol importers in 2034: Canada, Japan, United Kingdom, European Union, Colombia. Top five Biomass-based diesel exporters in 2034: China, United States, European Union, Canada, Malaysia. Top five Biomass-based diesel importers in 2034: Canada, United States, European Union, United Kingdom, Norway. Classification of biofuels by domestic policies can result in simultaneous exports and imports of biofuels in several countries.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

8.3.3. *Prices*

Prices in real terms are expected to decrease

Following their peak in 2022, nominal prices for both biomass-based diesel and ethanol declined through 2023 and 2024 primarily attributed to lower feedstock and oil prices. Subsequently, projections indicate a gradual increase in nominal biofuel prices up to 2034 in line with energy and feedstock prices. However, in real terms, ethanol and biomass-based diesel prices are anticipated to decrease over the next decade (Figure 8.6).

Figure 8.6. The evolution of biofuel prices and biofuel feedstock prices



Note: Ethanol: wholesale price, US, Omaha; Biomass-based diesel: Biodiesel Producer price, Germany, net of Biomass-based diesel tariff and energy tax. Real prices are nominal world prices deflated by the US GDP deflator (2024=1). As proxy for the Biomass-based diesel feedstock price, the world vegetable oil price is used and for ethanol a weighted average between raw sugar and maize is applied.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

8.4. Risks and uncertainties

Evolution of policies and relative prices are key

Uncertainties stem from the policy landscape, feedstock availability, and fossil fuel prices. Policy uncertainty includes fluctuations in mandate levels, enforcement mechanisms, investment in non-traditional biofuel feedstock, tax exemptions and subsidies for both biofuels and fossil fuels, as well as policies promoting electric vehicles (EVs) and sustainable aviation fuel (SAF) technology.

Fluctuations in fossil fuel prices directly impact the competitiveness of biofuels, often linked to subsidies for the sector. Volatility in oil markets tends to disrupt biofuels market structures as it may influence supporting policies, potentially leaving long-lasting effects. Additionally, uncertainty surrounds feedstock supply, as countries typically prioritise surplus commodities for biofuel production to safeguard food availability and security. While blending mandates are anticipated to drive biofuel production in emerging economies, recent price surges in cereal and vegetable oil markets have reignited debates on the ethical implications of fuel versus food production. Exploring advanced biofuels presents opportunities beyond conventional crops with cellulosic feedstocks such as agricultural residues and energy crops offering potential for expanded production without compromising food supplies. Waste-based feedstocks such as municipal solid waste and used cooking oil also offer alternatives, providing additional benefits for waste management.

The global EV stock has steadily risen since the mid-2000s, with over 20 countries committing to phase out internal combustion engine vehicle sales and eight countries plus the European Union pledging net-zero emission vehicles within the next 10-30 years. Governments worldwide have introduced EV deployment targets, purchase incentives, and supportive programmes to boost EV adoption and research. However, EV sales are currently stagnating in the United States compared to initial market reaction, possibly attributable to the slower than expected progress in infrastructure development. Moreover, recent discussions among countries concerning protection of domestic markets from imported EV to protect their domestic industry could increase the uncertainty about EV adoption. While SAF consumption and production are not modelled explicitly in the *Outlook*, any significant increase in their use in the long term may have an important impact on the use of advanced feedstocks, contingent upon technological advancements and supporting policies. Biofuels may also play an important role in the decarbonisation of the maritime shipping industry. Unforeseen technological advancements and regulatory changes in the transportation sector could significantly impact biofuel market projections. Countries are expected to implement policies promoting new technologies to reduce GHG emissions, introducing uncertainty into agricultural markets and influencing future biofuel demand. The private sector's response to these measures, particularly industries investing in EVs and SAFs, will shape biofuel usage trends over the coming decade and beyond.

9 Cotton

This chapter describes market developments and medium-term projections for world cotton markets for the period 2025-34. Projections cover consumption, production, trade and prices for cotton. The chapter concludes with a discussion of key risks and uncertainties which could have implications for world cotton markets over the next decade.

9.1. Projection highlights

Global use of raw cotton is projected to grow by 1.2% annually, driven by increasing textile demand in middle- and low-income countries. Asia will remain the primary hub for the processing of raw cotton, with expansion in Viet Nam, Bangladesh, and India fuelled by competitive labour and production costs. The People's Republic of China (hereafter "China") is expected to gradually lose its dominance in global cotton processing but it will remain the world's largest cotton processor by 2034, followed by India.

Global cotton production is expected to grow by 1.3% annually, primarily driven by yield improvements, reaching 29.5 Mt by 2034. Innovations in genetics and farming practices are also expected to help reduce the sector's carbon footprint. The faster growing production result in an expected increase in cotton stocks over the *Outlook* period which declined over the last ten years.

India is projected to surpass China as the world's largest cotton producer, as it is expected that India will considerably increase cotton yields from their current low levels. Brazil and the United States will follow at similar levels of production.

Global cotton trade is projected to grow steadily at 1.6% annually, reaching 12.3 Mt by 2034. While China is projected to remain the largest importer with about 3 Mt, the increase in global trade will be driven by rising imports into other Asian countries, particularly Bangladesh and Viet Nam, due to their limited domestic production capacity.

As major producers and exporters, Brazil and the United States are expected to meet the growing demand from Asian countries and will be the two largest exporters over the next decade.

International cotton prices are expected to decline slightly in real terms over the *Outlook* period, driven by competition from synthetic fibres and productivity gains in cotton farming.

A number of uncertainties could alter cotton market projections, altered macro-economic conditions and unforeseen shifts of consumer preferences toward sustainability, organic cotton, recycling and second-hand clothing. On the supply side, projections are subject to yield uncertainty related to systematic changes in growing conditions due to weather shifts, water availability, or pest infestations.

9.2. Current market trends

9.2.1. Global cotton production to recover sharply in 2024/25

Global cotton production in the 2024/25 (August/July) season is set to rebound after two consecutive annual declines, reaching its highest level in the past four seasons. The year-on-year increase is mainly driven by expectations of larger outputs in key producing countries. In China, generally favourable weather conditions benefitted crop yields, which are projected to recover sharply from the reduced level in 2023/24 and boost output. In Brazil and the United States, production growth is expected to result from an expansion in area, at the expense of competing crops like maize. These production gains are forecast to more than offset a likely decline in India, the world's second largest cotton producing country, due to a shift in area to more remunerative crops, including rice and pulses. Similarly, a reduction in area is expected to drive a production decline in Pakistan, while output is set to rebound for the second consecutive season in West African countries, following the drop in 2022/23 caused by a significant Jassids infestation.

Global cotton consumption in 2024/25 is forecast to increase slightly for a second consecutive year, recovering from a large contraction in 2022/23. The year-on-year increase is mainly driven by forecasts of higher cotton use in India, Bangladesh, Türkiye, and Viet Nam, offsetting a significant decline in Pakistan driven by the decline in output. In China, the largest cotton-spinning country in the world with mill use accounting for nearly a third of global consumption, cotton demand is projected at the 2023/24 level, reflecting the country's slow economic growth which constraints domestic demand growth for textile and apparel products.

International cotton prices have generally trended downwards since the second quarter of 2024, mainly pressured by strong production prospects for the 2024/25 season. Weaker global demand for textile and apparel and high stock levels have also contributed to the decline. Although global consumption is showing signs of recovery, production is forecast to exceed consumption in the current season, weighing on prices. Additionally, cotton continues to face stiff competition from man-made fibres (MMFs) – which are cheaper but less sustainable and derived from non-renewable resources.

World trade of raw cotton in 2024/25 is foreseen to remain close to its level in the previous season. On the supply side, Brazil is expected to surpass the United States as the world's largest cotton exporter for the second consecutive season, with rising shipments likely to offset the continued decline in United States exports. A significant increase in exports is also forecast from West African countries, supported by expectations of a larger crop. On the demand side, the sharp drop in imports anticipated in China, the world's largest importer, is forecast to be offset by a strong increase in purchases by Bangladesh, Viet Nam and Türkiye.

9.3. Market projections

9.3.1. Consumption

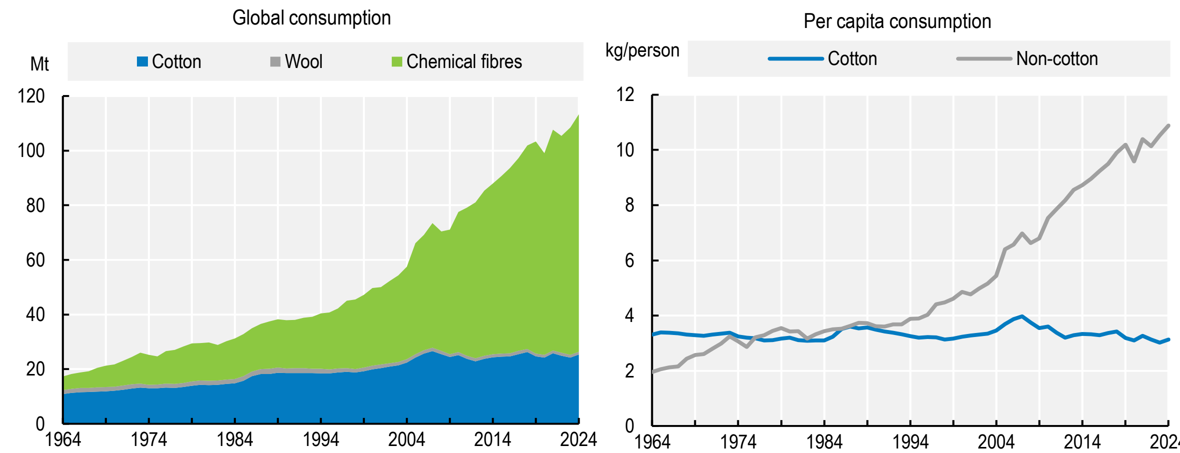
A moderate mill use growth is expected, mostly driven by the continued expansion of the Viet Nam and Bangladesh milling industry

Cotton consumption refers to the use of cotton fibres by mills to transform it into yarn. Cotton mill-use depends largely on two major drivers: global textile demand and competition from synthetic fibres. Over the past decades, global demand for textiles fibres has increased sharply, driven mainly by population and income growth, particularly in low-and middle-income countries. However, this expanding demand has been largely supplied by chemical fibres (Figure 9.1, left panel). The versatility of synthetic fibres and their competitive prices have encouraged the textile manufacturing industry to favour synthetic over cotton fibres. From the early 1990's, non-cotton fibres have gained solid ground in the textile industry. In 2024, the end-use market-share reached 77.6% for chemical fibres and only 22.4% for cotton. Likewise, per capita consumption of non-cotton fibres has strongly outpaced per capita consumption of cotton fibres and continues to increase strongly. In contrast, per capita consumption of cotton has remained stagnant over time and trended downwards in recent years (Figure 9.1, right panel).

The prospects for global cotton use rely mainly on its evolution in developing and emerging economies. Demand from these regions with lower absolute levels of consumption but higher income responsiveness is projected to exert upward pressure on global demand for cotton as the incomes and population of these countries are projected to increase. Global mill use is projected to grow by around 1.2% p.a. over the next decade, a moderate increase due to the slowdown in global economic prospects negatively affecting the demand for textiles.

The geographical distribution of demand for cotton fibres depends on the location of spinning mills, where natural and synthetic fibres are transformed into yarn. Traditionally, the spun yarn industry has been established predominantly in Asian countries, where conditions such as lower labour costs are favourable for the industry. China has been the world's leading cotton consumer since 1960.

Figure 9.1. Historical trends in consumption of textile fibres



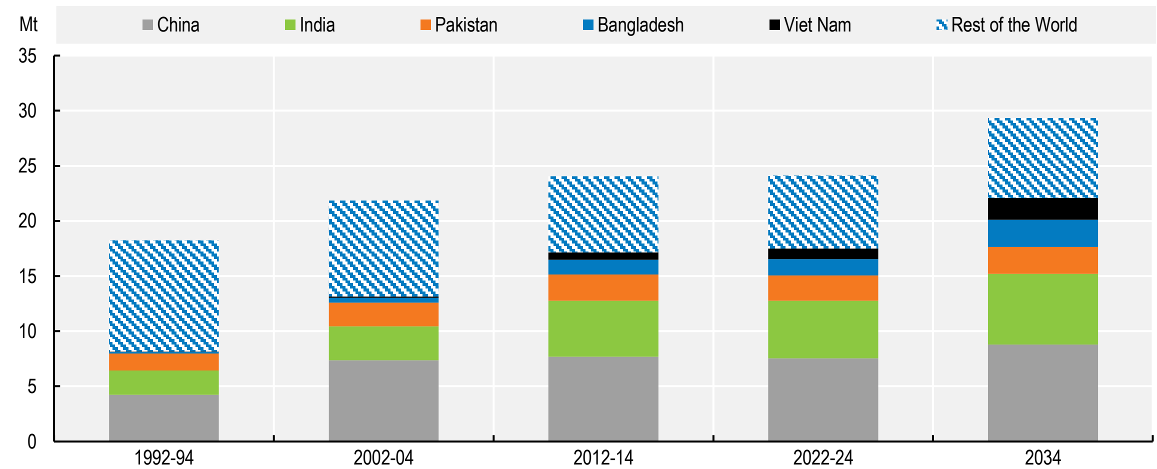
Source: ICAC World Textile Demand estimates, December 2024.

Higher labour costs and more stringent labour and environmental regulations led to a gradual decrease in China's cotton mill consumption since 2010. This decline was further exacerbated by the abolishing of the support price system in 2014. This contributed to a move to other Asian countries, notably Viet Nam and Bangladesh. While this trend is expected to persist over the decade, China is projected to retain its position as the world's largest cotton processing country.

In India, the world's second largest cotton processing country, the growing textile industry, supported by various government initiatives and foreign direct investment (FDI) inflows, is expected to result in continuous growth in cotton mill use, as the country's textile industry is predominantly cotton based.

Since the phase-out in 2005 of the Multi-Fibre Arrangement, which imposed fixed bilateral quotas on developing country imports into Europe and the United States, countries such as Bangladesh and Viet Nam have experienced strong growth of their textile industry based on an abundant labour force, low production costs, and government support measures. In the case of Viet Nam, this was supported by its accession to the World Trade Organization in 2007 and by FDI, notably by Chinese entrepreneurs. In addition, Free Trade Agreements (FTAs) including the ASEAN-China Free Trade Agreement (2004), the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP, 2018) and the EU-Viet Nam Free Trade Agreement (EVFTA, 2020) have facilitated greater market access to textile exports from Viet Nam. Similarly, in Bangladesh, foreign investments and FTAs, including Bangladesh's duty-free access to the European Union under the Generalized System of Preferences (GSP) and duty-free access to China since 2020, have boosted the country's textile industry, contributing to its emergence as a major global exporter of apparel, particularly knitted and woven garments. The expansion of textiles industries in Asian economies is expected to continue to boost mill consumption growth over the coming decade. Viet Nam will take the lead in annual growth of mill use at 2.7% p.a., followed by Bangladesh at 2.1% p.a. Nevertheless, China is expected to remain the largest cotton processing country in 2034 followed by India with consumption projected to grow by 0.3% and 1.3% p.a. respectively over the next decade.

Figure 9.2. Cotton mill consumption by region



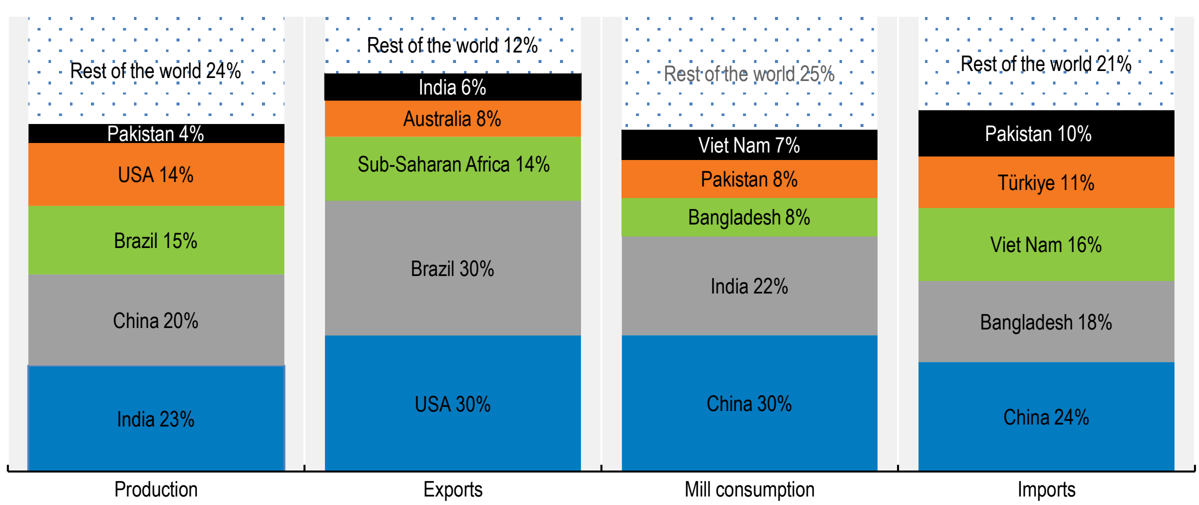
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook" OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

9.3.2. Production

Global production to grow with improved yields from technological advancements in genetics, precision agriculture, and sustainable practices

Cotton is grown in subtropical and seasonally dry tropical areas in both the northern and southern hemispheres, although most of the world's production takes place north of the equator. The leading producing countries are India, China, Brazil, and the United States. Jointly, these countries are expected to account for around 76% of global output in 2034 (Figure 9.3).

Figure 9.3. Global players in cotton markets in 2034



Note: Presented numbers refer to shares in world totals of the respective variable.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

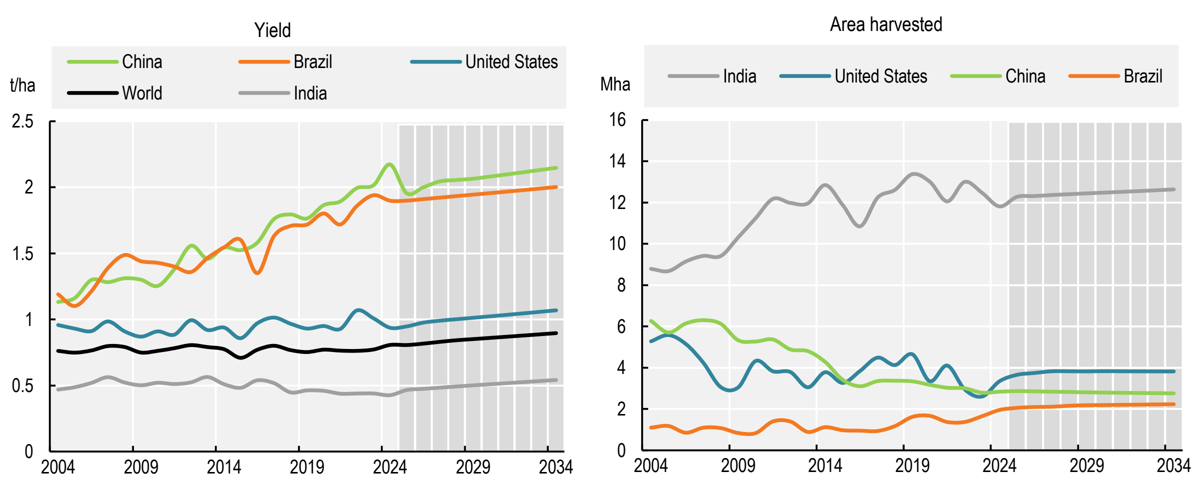
Global production of cotton is expected to grow steadily and reach 29.5 Mt by 2034, 20% higher than in the base period. The foreseen increase will mostly come from growth in the main cotton producers: India will account for about 30% of the global increase, followed by Brazil (27%), and the United States (23%).

Overall, gains in cotton production are predominantly driven by higher yields, and to a lesser extent, on expansion in area harvested.

Average global yields are projected to increase by 15% compared to the base period. Factors such as improvements in genetics, better agricultural practices, and digitalization supporting precision agriculture will contribute significantly to enhancing productivity and sustainability. In particular, smart irrigation systems can reduce water usage and energy consumption (MIT Office of Sustainability, 2023[1]). The use of sensors and GPS technology for fertiliser application ensures that crops receive the right amount of nutrients needed (International Fertilizer Association, 2019[2]). Additionally, drones and satellite imagery provide real-time monitoring of crop health, enabling more efficient application of water, fertilisers, and pesticides (Bhagwati Prasad, 2024[3]). Transitioning from traditional diesel-powered harvesters to electric or hybrid models can further reduce emissions and enhance sustainability during the harvesting process. Finally, the development and adoption of drought-resistant cotton varieties can reduce the reliance on irrigation. Similarly, genetically modified cotton varieties, which offer greater resistance to pests like bollworms, can reduce the need for chemical pesticides, contributing to more sustainable agricultural practices.

The yield gap between main producers in 2024 is projected to remain constant over the *Outlook* period. By 2034, yields in China and Brazil are projected to remain more than double the current world average yield of 0.8 t/ha, while in India, the largest cotton producer, yields are expected to continue below it. (Figure 9.4, left panel). Cotton area is projected to expand by 4% compared to the base period, with the highest growth occurring in Brazil (+34% compared to the base period) where the prospect of increasing exports encourages producers to invest in increasing the planted area.

Figure 9.4. Cotton yields and area harvested in major producing countries



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

Production in India is projected to grow by around 2% p.a. over the next decade, mainly on account of yield improvements rather than area expansion, since cotton already competes for land with other crops, such as soybeans and pulses. Raw cotton productivity has remained stagnant in recent years and is among the lowest globally. Cotton is traditionally grown on small farms, which limits the adoption of intensive farming technologies. Furthermore, farmers in India allocate more row space between plants to accommodate the passage of a bullock and cultivator for weed control purposes, reducing plant density and overall yield potential. To address this, researchers are promoting high-density planting systems, which involve closer plant spacing to maximize yields and enable mechanised harvesting. Pest-resistant genetically modified (GM) cotton, including Bt cotton, has also helped reduce pest-related yield losses and dependency on chemical pesticides, leading to increased productivity and cost savings. Meanwhile, drought-tolerant cotton varieties, developed through conventional breeding, are also being promoted to sustain yields in water-stressed regions. Federal and state government agencies, along with research institutions, are actively engaged in cotton varietal development and integrated pest management to enhance productivity in the sector. Based on these considerations, the *Outlook* assumes a high yield growth potential at 1.7% p.a. over the next decade, enabling India to surpass China as the world's largest cotton producer by 2034.

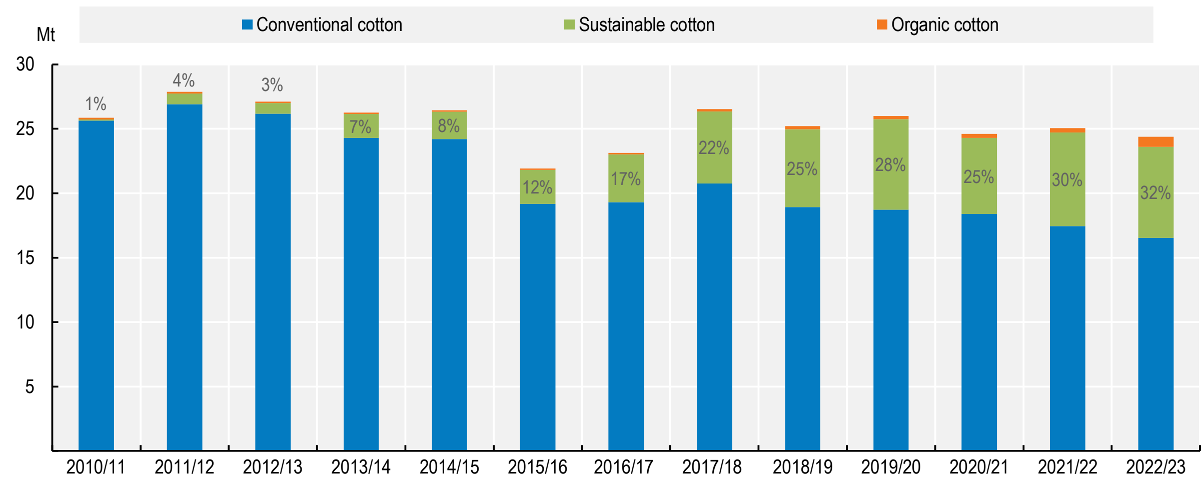
Chinese cotton is currently produced with the highest global yield (2.1 t/ha average in 2022-24), which is more than double the world's average. Over the past two decades, the cotton area in China has been declining, mostly due to changing government policies. Nevertheless, this trend seems to have slowed down since 2016. It is expected that the cotton area will decrease by 0.4% p.a. during the *Outlook* period, against a 2% decline in the past decade, while cotton production is expected to remain stable thanks to consistently higher yields.

In Brazil, cotton is grown in part as a second crop in rotation with soybeans or maize. Recently, output has strongly grown in the main cultivation areas such as Mato Grosso, where 72% of Brazilian cotton is currently harvested. Cotton output is foreseen to increase by 1.5% p.a. Production gains are mostly coming from higher yields due to the increased use of genetically engineered (GE) seeds and fertilisers. Recent investments in cotton-growing capacity and the acquisition of new equipment (planters, pickers, and ginning capacity) are expected to boost production in the coming years. Due to strong competition with other crops, mainly soybeans for second crop, the planted area depends significantly on the profitability of cotton compared to other commodities.

Sustainability issues play an important role and will impact cotton markets in the medium-term. In a context of growing concerns over the effects of extreme weather events and socio-environmental considerations, new initiatives have been introduced to promote sustainability along the supply chain. In the season 2022/23, the market share of virgin cotton covered by programmes recognised by the 2025 Sustainable Cotton Challenge (Textile Exchange, 2024[4]) reached 29% of global cotton production (Figure 9.5). Among the existing standards, Better Cotton, a not-for-profit organisation, dominates globally at around 22% of all cotton in the season 2022/23. Alternative strategies promote better agricultural practices to reduce GHG emissions and provide guidance to textile brands and retailers to source their cotton inputs from recognised and certified sustainable producers. It is expected that demand for more sustainable cotton will continue to rise, driven by commitments from brands and awareness among young populations. Therefore, growing trends towards consumption of more sustainable cotton products will likely boost cotton production in countries such as Brazil, where the entire cotton output already complies with the sustainability standards. In India and Pakistan, cotton programmes accounted for 28% and 40% of total cotton production in 2022/23, respectively. It is expected that the Sub-Saharan region will also benefit from higher compliance with sustainability standards, with programmes such as Cotton Made in Africa (CMIA) playing a key role. However, its equivalency agreement with Better Cotton ended in December 2022 and in November 2023 the Regenerative Cotton Standard (RCS) was launched to further promote sustainability. While RCS is still in its early stages, CMIA remains a major contributor to sustainable cotton in the region.

The share of organic cotton in world cotton production has only exceeded 1% since 2021/22 and accounted for 3.2% of world cotton production in season 2022/2023, suggesting a growing demand in the next decade.

Figure 9.5. Evolution of global sustainable and organic cotton



Source: Author's calculations based on Textile Exchange Materials market report 2024.

9.3.3. Trade

Viet Nam and Bangladesh will drive trade growth over the next decade

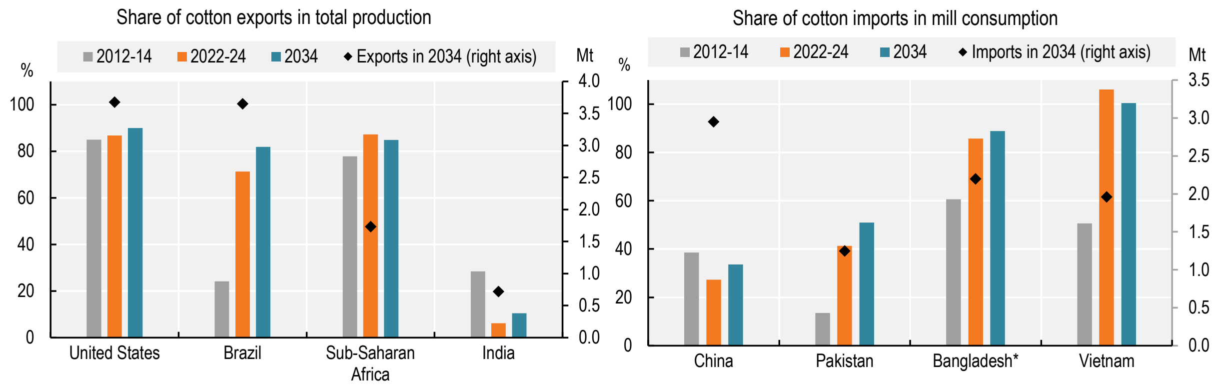
World cotton trade is projected to expand steadily over the next decade by 1.6% p.a. and reach 12.3 Mt in 2034. This growth is driven by the increasing demand for textiles in Asian countries, particularly Viet Nam and Bangladesh, where mill use is expanding rapidly. Meanwhile, China is projected to maintain nearly fixed import levels of 2.9 Mt (Figure 9.6, right panel) and remain the world's largest importer. Growth in raw cotton imports is projected to be strong in Viet Nam and Bangladesh (+2.8% p.a. and +2.4% p.a. respectively).

The United States and Brazil will compete closely as the world's largest exporters of raw cotton in 2034. Exports from the United States have decreased in recent years due to extreme weather conditions affecting production, and Brazil took over as the world's largest cotton lint exporter in the 2023/24 season. By 2034, the United States and Brazil are projected to account for nearly equal shares of global cotton exports, at approximately 30% each.

Brazilian exports are expected to grow strongly over the next decade, benefitting from major investment in improving its port infrastructure and logistics capabilities. As a result, raw cotton exports are expected to increase by 2.6% p.a. reaching 3.6 Mt by 2034, roughly level with the United States. Sub-Saharan Africa as a whole, where cotton is an essential export crop, follows behind (Figure 9.3) with 14% of global exports in 2034.

Sub-Saharan African exports are projected to continue growing at around 1.1% p.a. in the coming decade, representing more than 80% of its production (Figure 9.6 left panel), with South and Southeast Asia being the major export destinations. However, the textile and apparel industry is expanding in countries such as Ethiopia and Benin, supported by FDI flows and government investments. Access to preferential trade agreements, including the European Union's Generalized Scheme of Preferences (GSP), further supports the industry's growth in these countries. In the long run, the increase in mill use may affect the net export status of Sub-Saharan Africa.

Figure 9.6. Trade as a percentage of cotton production and mill consumption



Note: * Includes mill consumption and imports from other countries such as Cambodia, Myanmar, Bhutan and Nepal.
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

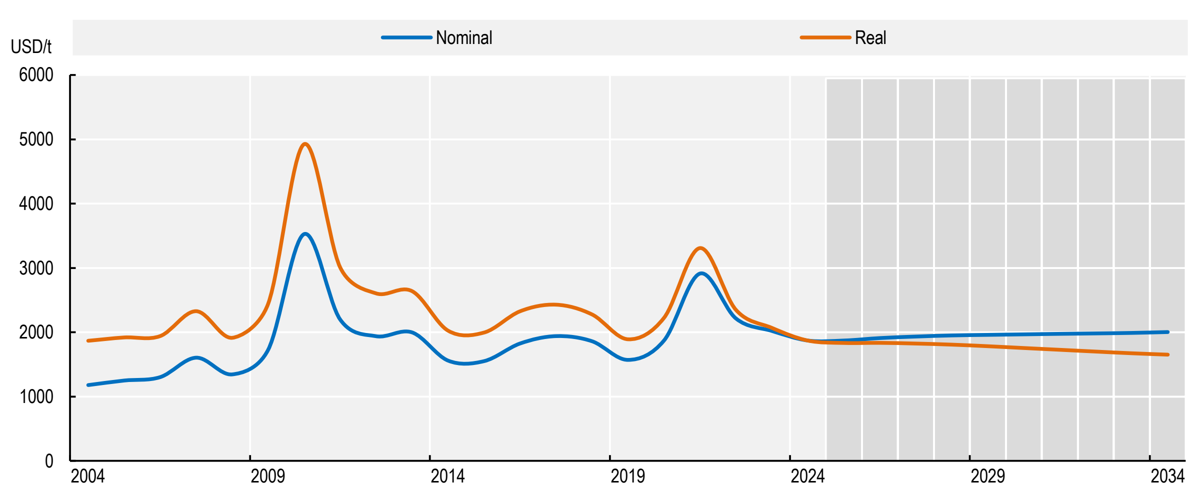
9.3.4. Prices

International cotton prices to decline in real terms over the medium-term

International cotton prices in real terms are projected to trend slightly downward in the medium term (Figure 9.7). Prices will continue to be influenced by competition from man-made fibres along with changes in consumers preferences and productivity gains.

From the early 1970s, when polyester became price-competitive, cotton prices tended to follow polyester prices. For example, cotton prices were only 6% above polyester staple fibre prices between 1972 and 2009. Since 2010, however, cotton prices have been on average around 77% above the polyester price and around 100% in more recent years, in nominal terms.

Figure 9.7. World cotton prices



Note: Real prices are nominal world prices deflated by the US GDP deflator (2024=1). The reference cotton price is the Cotlook price A index, Middling 1 1/8", CFR far Eastern ports. Data shown represent the marketing year average (August/July).
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

9.4. Risks and uncertainties

Regulatory shifts and innovation as key challenges shaping the cotton sector

Key drivers of per capita textile demand in emerging economies, notably economic expansion and urbanisation, will continue to exert substantial influence on cotton fibre demand. Additional demand trends affecting projections encompass the growing adoption of recycling in the textile sector. Notably, recycled cotton, which had an estimated production of 0.3 Mt in 2023 compared to 24 Mt of newly produced cotton, is expected to experience significant growth in the coming years (Textile Exchange, 2024[4]).[1] In particular, pre-consumer cotton waste from garment and fabric mills presents a significant opportunity for more efficient recycling, contributing to a lower carbon footprint for the textile sector. Moreover, increased competition from synthetic fibres and evolving consumer preferences towards athleisure apparel present significant hurdles to cotton demand. However, the adoption of sustainability norms offers potential stimulation to cotton demand amid mounting environmental concerns.

Harvest losses, due to pest infestations and weather variations, and supply chain disruptions, such as transportation bottlenecks or trade restrictions, can also negatively affect cotton production and limit market availability.

Regulatory frameworks promoting sustainability, traceability, and labelling standards are reshaping the global cotton landscape, reflecting a growing consumer preference for eco-friendly products. Policies such as the Ecodesign for Sustainable Products Regulation (ESPR), the Product Environmental Footprint (PEF) and the Strategy for Sustainable Circular Textiles in the European Union exemplify initiatives driving this shift. Furthermore, policy measures that affect consumption, such as initiatives by some East African countries to reduce second-hand clothing imports to boost local textile industries, have the potential to bolster cotton consumption and encourage value addition within Africa. However, it is important to ensure that the adoption of these standards benefits smallholder cotton growers by improving their livelihoods.

The transition towards a circular economy, characterised by recycling and the growing second-hand market, presents both challenges and opportunities for the cotton industry. The included assumption of the Outlook is a slow transition. While recycling initiatives hold promise for resource efficiency, they may disrupt traditional supply chains and alter demand patterns for raw cotton. Furthermore, issues associated with social, economic, and environmental sustainability, such as the Strategy for Sustainable Circular Textiles in the European Union, are gaining prominence among consumers, industry stakeholders, and policy makers globally. External factors, including the US-China dispute and the Uyghur Forced Labor Prevention Act,[2] further complicate matters, resulting in disruptions along the supply chain.

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MIT Office of Sustainability (2023), *Smart irrigation technology covers “more crop per drop”*, https://sustainability.mit.edu/article/smart-irrigation-technology-covers-more-crop-drop. [1]

Textile Exchange (2024), *Materials Market report*, https://textileexchange.org/knowledge-center/reports/materials-market-report-2024/. [4]

Notes

[1] Please note that the data cited here refers to mechanically recycled cotton only and that chemically recycled cotton is excluded.

[2] The Uyghur Forced Labour Prevention Act forbids the import of goods produced in China’s Xianjiang region. The importer must clearly prove that the merchandise coming from this region was not produced with forced labour.

10 Other products

This chapter provides a market overview and description of the current market situation for roots and tubers (i.e. cassava, potato, yams, sweet potato, taro), pulses (field peas, broad beans, chickpeas, lentils), and banana and major tropical fruits (mango, mangosteen and guava, pineapple, avocado, and papaya) markets. It also provides the medium term (2025-34) projections for production, consumption and trade for these products and describes the main drivers shaping these projections.

10.1. Roots and tubers

10.1.1. Market overview

Roots and tubers are plants that yield starch derived from either their roots (e.g. cassava, sweet potato and yams) or stems (e.g. potatoes and taro). They are destined mainly for human consumption (as such or in processed form) and, like most other staple crops, can also be used for animal feed or industrial processing, notably in the manufacturing of starch, alcohol, and fermented beverages. Unless they are processed, they are highly perishable once harvested due to their low dry-matter content (20 to 40%). This limits the opportunities for trade and storage and makes roots and tubers a particularly important commodity in terms of food loss and waste.

Within the roots and tubers family, potato dominates in worldwide production, with cassava a distant second. Potato is the fourth most important food crop after maize, wheat and rice. This crop provides more calories, grows more quickly, uses less land, and can be cultivated in a broad range of climates. However, potato production, which forms the bulk of the root and tuber sectors in high-income countries, has been stagnating over the last decade, with growth in production falling well below that of population.

Output of cassava is growing three times faster than potatoes and about one and half times faster than population. Cultivated mainly in the tropical belt and in some of the world's poorest regions, cassava production has almost doubled over two decades. Once considered a subsistence crop, it is now seen as a commodity and key for value-addition, rural development and poverty alleviation, food security, energy security, and for bringing important macroeconomic benefits. These factors are driving rapid commercialisation of this crop and major investments in upscaling the processing of cassava, both which have contributed significantly to its global expansion.

10.1.2. Current market situation

The largest producing regions of roots and tubers in the base period are Asia (118 Mt) and Africa (97 Mt). In Sub Saharan Africa, roots play a significant role as a staple crop. Globally, about 143 Mt are used as food, 44 Mt as feed, and 22 Mt for other uses, mostly biofuel and starch. As the perishable nature of these crops prohibits significant international trade in fresh produce, countries tend to be self-sufficient. About 20 Mt are currently traded internationally, mostly in processed or dried form. Thailand is the leading exporter, followed far behind by Viet Nam, and the People's Republic of China (hereafter "China") is the main destination.

Global production of roots and tubers reached 265 Mt (dry matter) in the base period (2022-24). About 7 Mt has been added annually in the past years and consumed mainly as food. The prices of roots and tubers (measured by the Cassava Thailand export unit value) decreased in 2024 as Chinese demand was lower. Thailand production and exports were affected by the decreasing demand in China, but also by *El Niño*-induced drought and cassava mosaic virus.

10.1.3. Main drivers for projections

Producing cassava requires few inputs and affords farmers greater flexibility in terms of timing the harvest as the crop can be left in the ground well after reaching maturation. Cassava's tolerance to erratic weather conditions, including drought, makes it an important part of adaptation strategies. Compared to other staples, cassava competes favourably in terms of price and diversity of uses. In the form of High-Quality Cassava Flour (HQCF), cassava is increasingly targeted by governments in Africa as a strategic food crop which does not exhibit the same levels of price volatility as other imported cereals.

Mandatory blending with wheat flour, e.g. in Nigeria, helps reduce the volume of wheat imports, thereby lowering import costs and conserving foreign exchange. The drive towards energy security in Asia, combined with mandatory blending requirements with gasoline, has led to the establishment of ethanol distilleries that use cassava as a feedstock. With regard to trade, processed cassava manages to compete successfully in the global arena, e.g. with maize-based starch and cereals for animal feeding applications.

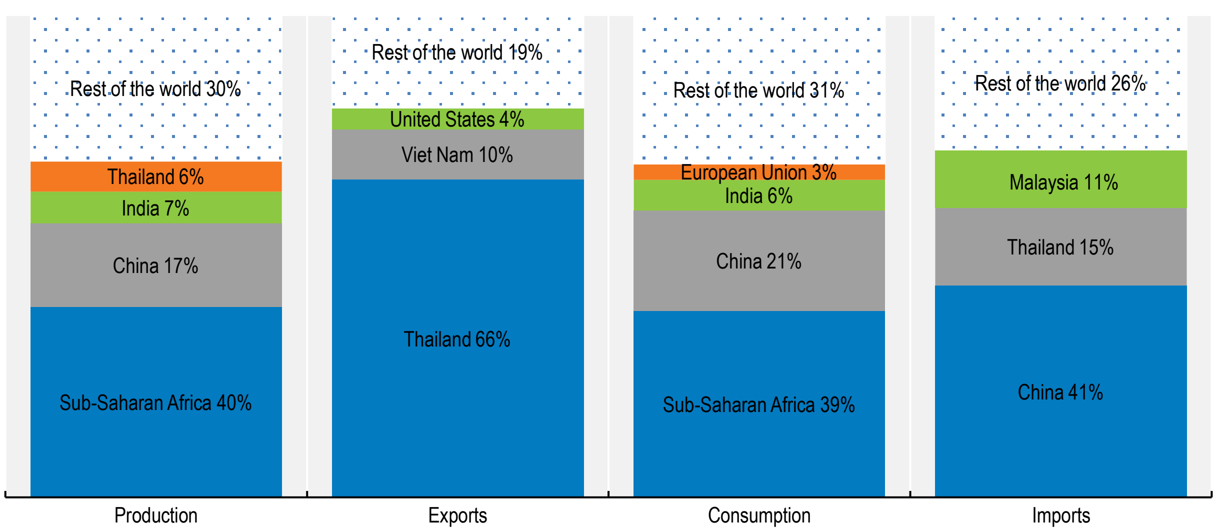
Potatoes are mostly used for food and are a substantial component of diets in high-income regions, particularly in Europe and North America. As overall food intake of potato in these regions is very high and may have reached saturation, the scope for consumption increases to outpace population growth remains limited. However, low-income regions provide some growth momentum to potato production at the world level.

Global sweet potato cultivation has declined in recent years, mostly due to a sharp decline in acreage (which shows no sign of abating) in China, the world's foremost producer. Food demand largely defines the growth potential of sweet potato and other less prominent roots and tuber crops given the limited commercial viability for diversified usage. Consequently, consumer preferences along with prices play important roles in shaping consumption.

10.1.4. Projection highlights

World production and utilization of roots and tubers is projected to increase by about 25% over the next decade. Production growth in low-income regions could reach 3% p.a. whilst an annual growth of only 0.4% is expected in high-income countries. Global land use is projected to increase by 6 Mha to 71 Mha, but there will be some regional shifts. African countries are expected to increase their cultivation area, while reductions are projected for Europe and America. Production growth is mainly attributed to investments in yield improvements in Africa and Asia, and, to a lesser extent, an intensification of land use in Africa.

Figure 10.1. Global players in roots and tubers markets in 2034



Note: Presented numbers refer to shares in world totals of the respective variable
Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

By 2034, an additional 2.6 kg/capita per year of root crops will enter diets at the global level, driven mostly by consumers in Sub-Saharan Africa where per capita intake of roots and tubers could reach 48 kg per year, up from 43 kg/capita. Biofuel use, albeit from a low basis (4% of use), is expected to grow by 17% over the next ten years driven by the Chinese biofuel industry. Feed and other industrial use will remain significant, with growth of about 24% and 18% respectively, over the *Outlook* period.

International trade in roots and tubers comprises about 8% of global market production. Over the medium term, this share is expected to remain constant. Exports from Thailand and Viet Nam are growing and are expected to reach a combined total of 19 Mt, mainly to supply the growing biofuel and starch industries in China.

After a decrease in 2024 partly due to lower demand in China, prices of roots and tubers are projected to follow a similar path to cereal prices in the medium term given the substitutability between roots and tubers and cereals on food and feed markets; namely, an increase in nominal prices but a decline in real terms.

10.2. Pulses

10.2.1. Market overview

Pulses are the edible seeds of plants in the legume family. Eleven types are commonly recognized.[1] They provide high levels of protein, dietary fibre, vitamins, minerals, phytochemicals, and complex carbohydrates. Apart from their contribution to calorie intake, pulses help to improve digestion, reduce blood glucose, minimise inflammation, lower blood cholesterol, and reduce chronic health issues such as diabetes, heart disease, and obesity. However, their consumption levels differ from region to region depending on dietary preferences and availability. Compared to other crops, pulses have a low contribution to total food wastage. Pulses can be stored for extended periods without spoiling or reductions in nutritional quality. This characteristic helps minimise the risk of food waste caused by spoilage and makes pulses a wise option for households facing food insecurity.

Cultivation of pulses has a long tradition in almost all regions of the world. For centuries, legumes have played a fundamental role in the functioning of traditional agricultural systems. Pulses are critical to improve soil health through biological nitrogen fixation, increased soil organic matter, and the disruption of pest and disease cycles when used in rotation or intercropping systems. These benefits are especially relevant in smallholder contexts, where improving soil fertility with limited external inputs is key to sustainability and productivity. Prior to 2000, global production of pulses stagnated due to the widespread disappearance of traditional crop rotation systems in low-income countries. Production was further hampered by their weak resilience to diseases due to lack of genetic diversity, limited access to high-yield varieties, and limited policy support to pulses growers. The sector began to recover in the early 2000s and has since seen an average annual increase of about 3% globally, led by Asia and Africa. These two regions combined accounted for more than two-third of the 22 Mt production increase in the past decade.

Global per capita consumption of pulses started to decline in the 1960s (Figure 10.2) as slow growth in yields pushed up prices. Income growth and urbanization shifted preferences away from pulses as human diets became richer in animal proteins, sugar, and fats. Nevertheless, pulses have remained an important source of protein in low-income countries, and average global per capita food consumption has increased to about 7 kg/year to date. This growth has been driven mainly by income gains in countries where pulses are an important source of protein, particularly in India where vegetarians account for about 20-40% of the population, but also in Ethiopia where per capita consumption of pulses is the highest.

Pulses can be processed into different forms such as whole pulses, split pulses, pulse flours, and pulse fractions like protein, starch and fibre. The flour and fractions have diverse applications in industries related to meat and snack foods, bakery and beverages, and batter and breading.

10.2.2. Current market conditions

India is by far the largest producer of pulses, accounting for about 29% of global production in the base period. Canada, China and the European Union are the next largest producing countries, with around 5% of global production. The Asian market accounts for 51% of all consumption but only about 44% of production, making it the most significant import destination. About 20% of global production is traded internationally with Canada (24% of global trade) by far the largest exporter and China the largest importer (13% of global trade). Africa has further expanded its production and consumption in the past decade and has remained largely self-sufficient.

In 2024, the global pulses consumption reached a volume of 101 Mt, after an average annual growth of 2% p.a. during the previous decade. This growth was led by Asia and Africa. World trade volumes were registered at 20.7 Mt, 1.5 Mt higher than in 2023. This growth was fuelled by increases in Canadian production and exports in 2024, as good returns and favourable conditions have raised both yields and area harvested. Most of the Canadian exports were destined to India which has temporarily lifted import restrictions for pulses to keep food price inflation under control. International prices for pulses, approximated by the Canadian field pea price, have continued to fall from their peak value of 2021 to USD 276/t in 2024.

10.2.3. Main drivers for projections

As pulses are associated with various health benefits and represent an important meat substitute due to their high protein content, health and environmentally conscious consumers are increasingly integrating them into their daily diets, which in turn is propelling the growth of the global pulses market. Rapid urbanisation, changing lifestyles, and hectic work schedules are also making healthy snack foods popular amongst the working population, and pulses are increasingly used in the processing of ready-to-eat (RTE) food products.

The health and environmental benefits attributed to pulses are major reasons for governments of pulses-producing countries to provide assistance to farmers and thus supporting growth of the market. Support for pulses production plays an important role in the Protein Strategy of the European Union where pulses are a major ingredient in products such as meat substitutes. Depending on the future dynamics of demand for such products, this could significantly change the future importance of pulses in the agricultural production mix.

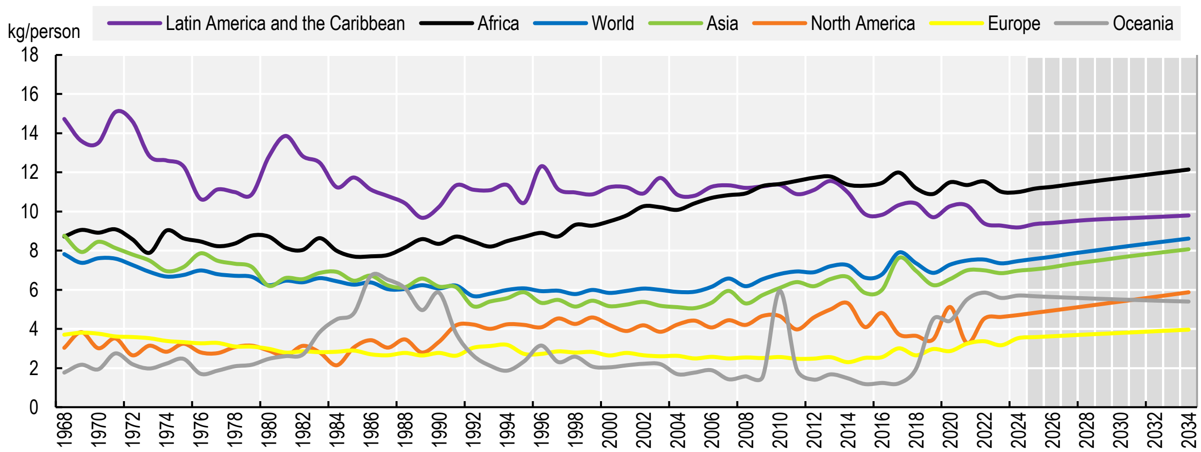
10.2.4. Projection highlights

Pulses are expected to regain importance in diets in many regions of the world. This *Outlook* foresees this global growth to continue and projects global average annual per capita food use to increase to 8.6 kg by 2034. Per capita food consumption is projected to increase in almost all regions over the coming decade, with the largest increase expected in North America (+2.2% p.a.) (Figure 10.2). Nevertheless, in contrast to other commodities per capita consumption of pulses in North America at 5.9 kg/person in 2034 remains considerably below the world average of 8.6 kg/person.

Global supply is projected to increase by 26 Mt. Around 40% of this increase is expected to come from Asia, particularly India, the world's largest producer. Sustained yield improvements are projected to raise India's domestic production by an additional 8 Mt by 2034. India has introduced high-yielding hybrid seeds, supported mechanization, and implemented a minimum support price aimed at stabilising farmer's income. In addition, the central government and some state governments have included pulses in their procurement programmes, although not with the same geographical coverage as for wheat and rice.

This expected production expansion is driven by the assumption of continued intensification of pulses production systems due to improved yields and intensified land use. About half of production growth can be attributed to land use intensification during the projection period, and the remaining half to yield improvements. Particularly in Africa, a combination of area expansion and yield growth is estimated to add about 0.9 Mt annually to the region's production.

Figure 10.2. Per capita food consumption of pulses per continent



Source: OECD/FAO (2025), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), http://data-explorer.oecd.org/s/1hc.

This *Outlook* assumes that growth will be sustained by increased intercropping of pulses with cereals, especially in Asia and Africa where smallholder farmers represent a large share of producers. The projected yield improvements for pulses will continue to lag behind those for cereals and oilseeds because in most countries pulses tend to be overlooked in the development of high-yielding varieties, improved irrigation systems, and agricultural support policies.

World trade in pulses grew from 14 Mt to 20 Mt over the past decade and is projected to reach 23 Mt by 2034. Canada will remain the main exporter of pulses, with volumes expected to grow from 4.9 Mt at present to 5.7 Mt by 2034, followed by Australia and Russian Federation (hereafter “Russia”) with 2.4 Mt and 1.9 Mt of exports by 2034, respectively.

International prices in nominal terms are expected to decrease further in 2025 then increase slightly over the coming decade, while real prices will decline.

10.3. Bananas and major tropical fruits

Bananas and the four major fresh tropical fruits–mango, pineapple, avocado and papaya – play a vital role in agricultural markets, especially in securing the nutrition and livelihoods of smallholders in tropical countries. In recent decades, rising incomes and changing consumer preferences in emerging and high-income markets, alongside improvements in transport and supply chain management, have facilitated fast growth in both consumption and international trade in these commodities.

Global production of bananas and major tropical fruits generates some USD 122 billion in revenues to support producers. Although only approximately 14% of global banana production and 8% of global major tropical fruit production are traded in international markets, the two commodity groups respectively generate around USD 11.5 billion and USD 13.8 billion per year in export revenues (provisional 2024 figures). In exporting countries, which are mostly low- or middle-income economies, production and trade revenues can weigh substantially in agricultural GDP, particularly for tropical Latin American countries. For instance, bananas represented about 17% of agricultural GDP and 39% of agricultural export revenue in Ecuador in 2022, while combined exports of pineapples and bananas accounted for some 40% of agricultural export revenue in Costa Rica. As such, trade in bananas and major tropical fruits can generate significant export earnings.

10.3.1. Bananas

Market situation

Preliminary data for 2024 indicate that global banana trade continued to be impacted by lower supplies due to adverse weather and the spread of plant pests and diseases. Developments among key trade partners varied significantly, with some exporting countries benefitting from favourable conditions while others faced challenges. Colombia, India, and Viet Nam reported higher production in the first eight months, driven by increased investments and favourable weather. In contrast, Costa Rica, the Dominican Republic, Ecuador, Guatemala, and Mexico experienced reduced export supplies due to adverse weather, including excessive rainfall and tropical storms. The spread of plant diseases, most importantly the devastating spread of the Banana Fusarium Wilt Tropical Race 4 (TR4) disease in the Philippines and its alarming presence in the Bolivarian Republic of Venezuela and Peru, further continued to cause production losses as well as financial strain from the substantial costs associated with disease prevention.

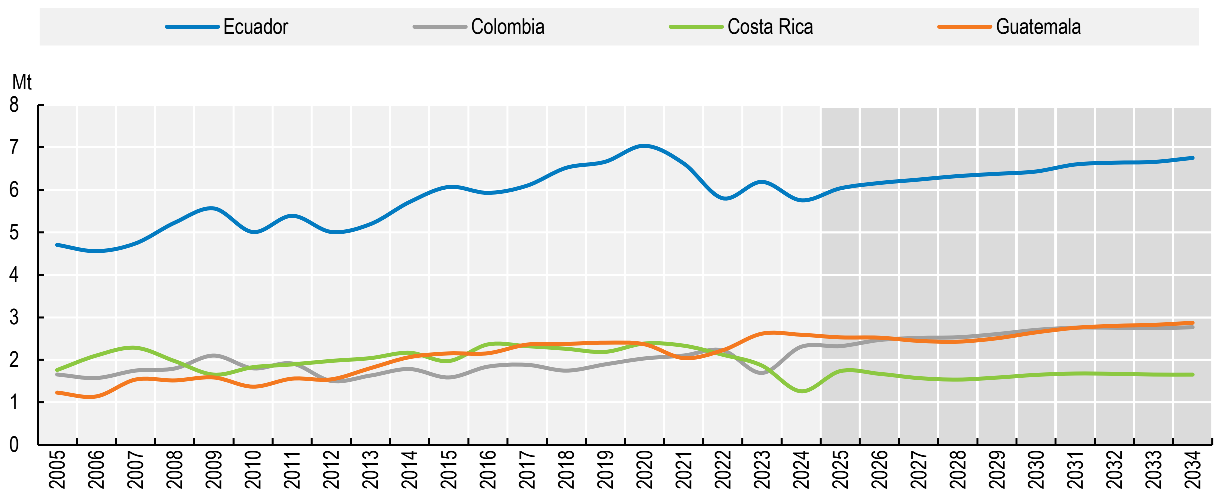
Producers also faced challenges from unfavourable exchange rates, as the depreciation of the United States dollar in the first half of the year led to lower earnings in local currencies, compounding high production costs. High interest rates further pressured economic activity in both domestic and importing markets. Import demand for bananas remained steady in developed markets, with bananas benefitting from their affordability amid inflation. However, average import unit values declined in 2024, with decreases of 2% in the European Union and 23% in the United States, reversing the previous two years' price increases and increasing pressure along the value chain. The industry's outlook remains challenging, with low margins hindering producers' ability to manage high costs and environmental threats.

Projection highlights

Assuming normal weather conditions and no further spread of banana plant diseases, global banana production is expected to reach 166 Mt by 2034, from 139 Mt in the base period. As per capita demand for bananas is becoming increasingly saturated in most regions, growth in global production and consumption is expected to be primarily driven by population dynamics. In line with slowing world population growth, the current baseline projections expect world production and consumption of bananas to expand at a moderate 1.4% p.a. over the outlook period. At the same time, in some emerging economies – principally in India and China – income growth is anticipated to stimulate changing health and nutrition perceptions and support demand for bananas beyond population growth. Accordingly, Asia, the current top producing region, is anticipated to remain so at a quantity share of just over 50%, with India projected to reach an output of 45 Mt and a per capita consumption of 28.1 kg by 2034, from 24.9 kg in the base period.

Production in the top exporting region, Latin America and the Caribbean, is projected to grow at 0.8% p.a. and reach 37 Mt by 2034, supported by rising demand from key markets, most importantly the European Union and the United States. With economic pressures expected to continue in 2025 and potentially beyond, demand for bananas is likely to be supported by the fruit's relative affordability. The largest exporters from the region–Ecuador, Guatemala, Colombia and Costa Rica–are likely to benefit from this growth, provided that output can be shielded from the adverse effects of erratic weather events and disease outbreaks. Rising demand from the European Union and the United Kingdom is further expected to benefit exports from Africa, which are projected to expand at 1.9% p.a. over the outlook period–led by Ivory Coast–to reach a total quantity of approximately 0.7 Mt in 2034. Rising import demand from China, where domestic production growth is likely to remain relatively slow, is assumed to be an additional factor driving production growth in Latin America and the Caribbean, and importantly also in emerging Asian suppliers Viet Nam and the Lao People's Democratic Republic, which may jointly export some 0.9 Mt by 2034. Against this background, world exports of bananas are projected to reach some 21.8 Mt by 2034.

Figure 10.3. World banana outlook: Exports of bananas by the four major LAC exports



Source: FAO Secretariat.

10.3.2. Mango, mangosteen and guava

Market situation

Global exports of mango, mangosteen and guava[2] grew to approximately 2.5 Mt in 2024, an increase of 3% from the previous year. Higher exports of mangosteen from Thailand, as well as of mangoes from emerging suppliers Ecuador and Egypt, were the main driving factor behind this. In terms of export quantities by type at the global level, mango accounted for around 85% of global shipments and mangosteen for around 15%. Guava continued to display a statistically negligible availability in import markets, mainly due to its lesser suitability for transport.

Total global import quantities of fresh mangoes, mangosteens and guavas rose by 4% to 2.4 Mt in 2024. The United States and the European Union remained the leading global importers, with expected import shares of 24% and 14%, respectively. In both markets, consumer demand for mangoes reportedly remained solid, driven by a mounting nutritional awareness of the assumed health benefits of these fruits. However, import growth in the United States was impeded by a low availability of supplies from Mexico, while exports to the European Union were greatly hindered by logistical difficulties, especially a scarcity of vessel space and high costs for air freight. Overall, imports into the United States contracted by some 1% in 2024, to approximately 0.56 Mt. Imports into the European Union dropped by 15% in 2024, to some 0.34 Mt. In both markets, lower supplies against unimpeded demand resulted in strongly rising unit values at the import stage. Meanwhile, imports by China, the third leading global importer of mangoes, mangosteens and guavas in recent years, grew by 16% in 2024, to approximately 0.34 Mt.

Projection highlights

Global production of mangoes, mangosteens and guavas is projected to increase at 2.8% p.a. over the next decade, to reach 86 Mt by 2034, from 62 Mt in the base period. Growth in mango production will mainly respond to income-driven growth in demand in producing countries, further supported by population dynamics. Asia, the native region of mangoes and mangosteens, will continue to account for some 70% of global production in 2034. This will be primarily due to strong growth in domestic demand in India, the leading producer and consumer of mangoes globally, with rising incomes and associated shifts in dietary preferences being the main drivers. Mango production in India is projected to account for about 36 Mt in 2034, or 42% of global production, destined largely for local, informal markets. As such, India is projected to experience increases in per capita consumption of 1.2% p.a. over the outlook period, reaching 23.1 kg in 2034, compared to 18.5 kg in the base period, while average per capita consumption in Asia overall is expected to reach 13.6 kg in 2034, compared to 10.6 kg in the base period. By contrast, in Mexico and Thailand, the leading exporters, production growth will primarily be driven by expanding global import demand. Exports are anticipated to reach an 18% share of production in Mexico by 2034, and 29% in Thailand. However, at projected production quantities of 3.3 and 1.7 Mt in 2034, respectively, Mexico and Thailand will account for comparatively small shares in global production.

Global exports of mangoes, mangosteens and guavas are projected to reach 3.3 Mt in 2034, compared to 2.4 Mt in the base period, on account of higher procurements from the United States, China, and the European Union. Mexico, the leading supplier of mangoes, is expected to benefit from further growth in import demand from its major market, the United States, provided no import tariffs are imposed by the United States on mangoes originating in Mexico. Under this assumption, Mexico would hold a 20% share of world exports in 2034. Shipments from Thailand, almost exclusively mangosteens, will cater mainly to rising import demand from China, while supplies from Peru and Brazil, will be mostly mangoes destined for the European Union. While Thailand is projected to account for a share in global exports of 16% by 2034, Brazil and Peru are expected to hold some 12% and 7%, respectively. China, whose per capita mango, mangosteen and guava consumption of 2.8 kg in the base period is relatively low compared to other Asian countries, is expected to experience a rise in imports of 4% p.a., to some 0.7 Mt in 2034. This will be mainly due to a strong, income-driven increase in Chinese import demand for mangosteen, as domestic production of this fruit is projected to remain low in China.

10.3.3. Pineapple

Market situation

Based on preliminary trade data, global exports of pineapples grew by approximately 4% in 2024, to 3.3 Mt, driven largely by higher supplies from Costa Rica and the Philippines, the world's leading exporters with market shares of around 65% and 21%, respectively. Shipments from Costa Rica accordingly rose by some 3% in 2024, to about 2.1 Mt. In terms of leading destinations, pineapple shipments from Costa Rica continued to be almost exclusively destined for the United States and the European Union, where demand reportedly remained firm.

Preliminary trade data point to an increase in global imports of pineapples of around 5% in 2024, to approximately 3.1 Mt. According to industry information, demand in the United States and the European Union continued to be firm. While supplies from the main global supplier, Costa Rica, increased for the second year in a row, industry sources reported that this was not enough to satisfy demand in 2024, especially in the European Union, causing indicative average import unit values in both key destinations to increase.

Aided by relatively stable sales in the hospitality sector, imports by the United States grew by some 4% in 2024, to 1.2 Mt. Similarly, imports by the European Union, the second largest importer, rose by some 4%, to approximately 0.8 Mt, still some 10% below their previous five-year-average. Estimates thereby suggest that the United States procured about 39% of global export supplies in 2024, and the European Union some 26%.

Projection highlights

Over the next decade, global production of pineapple is projected to grow at 1.2% p.a., on account of a 0.6% p.a. expansion in harvested area to reach 37 Mt in 2034, from 30 Mt in the base period. Asia is expected to remain the largest producing region accounting for 44% of global production, with sizeable production in the Philippines, Indonesia, China, India and Thailand. Cultivation in Asia will continue to largely cater to domestic demand and is projected to grow solidly in response to changing demographics and income growth, especially in India, Indonesia and China. Similarly, pineapple production in Latin America and the Caribbean, the second largest producing region at a projected 34% of world production in 2034, will be primarily driven by the evolving consumption needs of the region's growing and increasingly affluent population. Only Costa Rica and the Philippines, two important global producers and exporters, are anticipated to see additional export stimulation from rising import demand, with exports projected to account for approximately 73% of fresh pineapple production in Costa Rica and 21% in the Philippines in 2034.

Global exports of fresh pineapple are set to grow at 0.5% p.a., to 3.7 Mt in 2034, predominantly driven by demand from the United States and the European Union. With projected imports of 1.3 Mt in 2034–equivalent to a 36% global share–the United States is expected to remain the largest importer. The European Union is expected to account for some 26% of global imports. In both key markets, demand is assumed to benefit from continuously low unit prices and, to some degree, from the introduction of more premium novelty varieties. Rising import demand from China, where consumption growth has been outpacing production expansion in recent years, is expected to additionally drive expansion in global exports. At growth of 4.9% p.a., China is projected to reach import quantities of some 0.37 Mt per year by 2034, with supplies primarily sourced in the Philippines.

10.3.4. Avocado

Market situation

Global exports of avocado were estimated to have expanded by a moderate 2% in 2024 to around 2.8 Mt, in stark contrast to the near 11% expansion seen in 2023. Lower supplies from Mexico and Peru, the two leading exporters, which jointly supply some 65% of total traded quantities, were the main reason behind this. Preliminary data and information meanwhile indicate that exports from several other origins, notably Israel, Kenya and South Africa, expanded.

Global imports of avocados were estimated to have remained virtually unchanged from the previous year at approximately 2.8 Mt. While demand in the two major import markets, the United States and the European Union, continued to be firm, higher growth in imports was impeded by the difficult supply situation seen in Mexico and Peru. As a result, imports by the United States, which accounted for some 42% of global imports in 2024, contracted by some 3% in 2024 to approximately 1.2 Mt. In the face of high demand, which outstripped growth in supplies, available monthly trade data for the period January to August 2024 show a year-on-year increase in the average United States import unit value of 30%, to USD 3 148 per tonne. Imports into the European Union, meanwhile, were expected to rise by some 4% in 2024, to approximately 0.79 Mt. In view of the production difficulties in Peru, import demand in the European Union was catered for mainly by Israel and South Africa.

Projection highlights

Avocado has the lowest production volume among the major tropical fruits but has experienced the fastest expansion in output in recent decades and is expected to remain the most rapidly growing over the outlook period. Ample and rising global demand, high returns per hectare and lucrative export unit prices continue to be the main drivers of this growth, stimulating investments in area expansion in both major and emerging production zones. By 2034, production is therefore projected to grow at 2.1% p.a. and reach 14 Mt p.a.–nearly three times its level in 2015. While new growing areas have been emerging rapidly, avocado production is likely to remain concentrated in a small number of regions and countries. The top four producing countries–Mexico, Colombia, Peru and the Dominican Republic–are projected to expand production substantially over the coming decade, together accounting for some 53% of global production in 2034. Output in Mexico, Colombia and Peru is set to increase by between 25% and 35% from base period levels. Consequently, about 64% of avocado production is expected to remain in Latin America and the Caribbean.

Avocado is on track to become the most traded major tropical fruit in quantity, overtaking pineapples towards the end of the outlook period and reaching 4 Mt of exports by 2034. The total value of global avocado exports would thus reach an estimated USD 9.7 billion in constant 2022-2024 value terms, thereby placing avocado as one of the most valuable fruit commodities. Despite increasing competition from emerging exporters, Mexico is expected to retain its leading position in global exports at a 45% quantity share in 2034. This will be supported by output growth of 1.6% p.a. over the coming decade and continued growth in demand in the United States. Exports from Peru, the second leading exporter, will account for some 18% of global shipments, with supplies mainly catering for rising demand from the European Union.

The United States and the European Union, where consumer interest in avocados is fuelled by the fruit's claimed health benefits, are expected to remain the main importers with 42% and 28% of global imports in 2034, respectively. However, imports are also set to rise in the United Kingdom, Canada, China and some countries in the Middle East, on account of rising incomes and/or changing consumer preferences. Similarly, in many producing countries, per capita consumption of avocados is expected to rise with income growth, notably in Colombia, Mexico and Indonesia.

10.3.5. Papaya

Market situation

Preliminary trade data indicate a contraction in global exports of papayas by an estimated 1% in 2024 to some 0.365 Mt. Exports from Mexico, the largest global exporter of papayas, grew only moderately by some 1% to 0.2 Mt. Industry sources reported that adverse weather conditions, including cooler than normal temperatures, limited both the quantity and quality of supplies. Virtually all Mexican papaya exports are destined for the United States. However, the bulk of Mexican papaya production continued to be for domestic consumption.

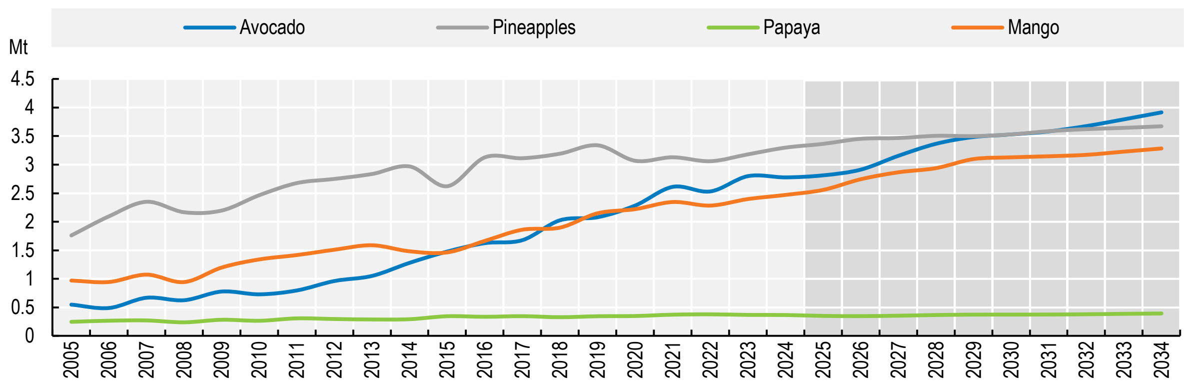
Preliminary data further suggest that global imports contracted by 1% in 2024, to approximately 0.35 Mt. The United States remained the largest importer globally, accounting for an estimated quantity share of 61% in 2024. Available data indicate that imports by the United States declined by approximately 1% in 2024 to some 0.21 Mt. Industry sources stated that while demand for papayas in the United States remained solid, growth was hindered by the supply shortages experienced in Mexico. The second leading importer globally continued to be the European Union, albeit with a much lower share in world imports of only an estimated 9% in 2024. Consumer awareness of papaya in the European Union generally remains low mostly due to the fruit's fragility in transport which renders a significant expansion in this market difficult to attain.

Projection highlights

Global papaya production is projected to rise by 1.9% p.a. to 17 Mt in 2034 from 14 Mt in the base period. As the share of exports in production is particularly low for papayas, at some 2% in the base period, production of this fruit is mostly driven by domestic demand due to population and income growth. Asia, the top global producer, is expected to have the strongest production expansion with its share of world production set to rise to 59% by 2034 from 56% in the base period. India, the world's largest producer, is projected to increase production at a rate of 2% p.a., retaining a share of global output of 36% by 2034. Income and population growth will be the main factors behind this rise, with Indian per capita consumption of papayas expected to reach 4 kg in 2034, up slightly from 3.7 kg in the base period. In Indonesia, production is projected to grow by 1.3% p.a. over the outlook period primarily on account of increasing domestic demand as per capita incomes are expected to grow at 3.7% p.a.

Global exports will predominantly be shaped by production expansion in Mexico and higher demand from the key importers. At an expected average annual rate of 1.4%, global exports of papayas are projected to reach just under 0.4 Mt by 2034. A major obstacle to a significant expansion in international trade has so far been the fruit's high perishability and sensitivity in transport which make produce problematic to supply to distant destinations. Innovations in cold chain, packaging and transport technologies promise to facilitate a broader distribution of papaya, particularly in view of rising consumer demand for tropical fruits in import markets.

Figure 10.4. World major tropical fruit outlook: Global exports of the four major tropical fruits



Source: FAO Secretariat.

10.3.6. Uncertainties

The outlook for global production, trade and consumption of bananas and major fresh tropical fruits is subject to several uncertainties. Elevated costs of living, high interest expenses and exchange rate fluctuations threaten to hinder demand in domestic and import markets, especially for consumers in poorer economic strata. Given the typically high unit values and high income and price elasticities of demand for tropical fruits, changes in consumer incomes or prices can dramatically affect demand. Geopolitical uncertainties that may result in the disruption of established trade relationships, changing tariffs and potentially have large effects on domestic and global markets are of further concern.

On the supply side, the effects of global warming are resulting in a higher occurrence of droughts, floods, hurricanes and other natural disasters which render the production of bananas and major tropical fruits increasingly difficult and costly. Given the perishable nature of tropical fruits in production, trade and distribution, environmental challenges and insufficient infrastructure continue to jeopardise international production and supply. This is a particularly acute difficulty since the vast majority of tropical fruits are produced in remote, informal settings where cultivation is highly dependent on rainfall, prone to the adverse effects of increasingly erratic weather events and disconnected from major transport routes.

In the face of rising temperatures, more rapid and severe spreads of plant pests and diseases are being observed, as in the case of the spread of Banana Fusarium Wilt. The currently expanding strain of the disease, Tropical Race 4 (TR4), poses particularly high risks to global banana supplies as it can affect a much broader range of banana and plantain cultivars than other strains. Furthermore, despite recent breakthroughs in the engineering of resistant varieties, no effective fungicide or other eradication method is currently available. According to official information, TR4 is currently confirmed in 22 countries, predominantly in South and Southeast Asia, but also in the Middle East, Africa, Oceania and Latin America. An assessment of the potential economic impact of the TR4 disease on global markets showed that a further spread of TR4 would, inter alia, entail considerable loss of income and employment in the banana sector in the affected countries as well as significantly higher consumer costs in importing countries.[3]

Notes

[1] Pulses types: dry beans, dry broad beans, dry peas, chickpeas, cow peas, pigeon peas, lentils, Bambara beans, vetches, lupines and minor pulses (not elsewhere specified).

[2] International commodity classification schemes for production and trade do not require countries to report the fruits within this cluster separately, thus official data remain sparse. It is estimated that, on average, mango accounts for approximately 75% of total production quantity, guava for 15% and mangosteen for the remaining 10%.

[3] An alternative simulation was run in 2019 to assess the potential economic impact of the Banana Fusarium Wilt Tropical Race 4 disease on global banana production and trade. The results of this scenario were published in the November 2019 issue of FAO's biannual publication *Food Outlook* (http://www.fao.org/3/CA6911EN/CA6911EN.pdf).

Annex A. Glossary

Aquaculture	The farming of aquatic organisms including fish, molluscs, crustaceans, aquatic plants, etc. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding and protection from predators. Farming also implies individual or corporate ownership of the stock being cultivated. For statistical purposes, aquatic organisms that are harvested by an individual or corporate body that has owned them throughout their rearing period contribute to aquaculture, while aquatic organisms that are exploitable by the public as a common property resource, with or without appropriate licenses, are the harvest of capture fisheries. In this *Outlook*, data relating to aquatic plants are not included.
African Swine Fever (ASF)	ASF is a highly contagious hemorrhagic disease of pigs, warthogs, European wild boar and American wild pigs. It is not a human health threat. The organism that causes ASF is a DNA virus of the Asfarviridae family. (For more information on this topic: https://www.woah.org/en/disease/african-swine-fever/).
Avian Influenza (AI)	AI is a highly contagious viral infection which can affect all species of birds and can manifest itself in different ways depending mainly on the ability of the virus to cause disease (pathogenicity) on the species affected (for more information on this topic, see https://www.woah.org/en/disease/avian-influenza/).
Base period	The 2022–2024 historical average, serving as a reference level for comparisons.
Baseline	The set of market projections used for the *Outlook* analysis, also used as benchmark to analyse the impact of different economic and policy scenarios. A detailed description on how this baseline was generated is provided in the methodology section.
Biofuels	In the wider sense, biofuels can be defined as all solid, fluid or gaseous fuels produced from biomass. More narrowly, the term comprises fuels that replace petroleum-based road-transport fuels. Ethanol is produced from sugar crops, cereals and other starchy crops, and can be used as an additive to, in a blend with, or as a replacement of gasoline. Biodiesel is produced mostly from vegetable oils, but also from waste oils and animal fats. There are two major forms of biodiesel: fatty acid methyl esters (FAME) and hydrogenated vegetable oil (HVO).
Biomass	Biomass is defined as any plant matter used directly as fuel or converted into other forms before combustion. Included are wood, vegetal waste (including wood waste and crops used for energy production), animal materials/wastes and industrial and urban wastes, used as feedstock for producing bio-based products. In the context of the *Outlook*, it does not include agricultural commodities used in the production of biofuels (e.g. vegetable oils, sugar or grains).
Blend wall	The term blend wall refers to short run technical constraints that act as an impediment to increased biofuel use in transportation fuels.
Bt cotton	A transgenic cotton variety that contains one or more foreign genes derived from the bacterium Bacillus thuringiensis. Bt cotton is resistant against some insect pests, but the fibre of BT cotton plants is shorter than that of traditional varieties.
Caloric sweeteners	Defined as sucrose and high fructose syrup.
Capture fisheries	Capture fisheries refer to the hunting, collecting and gathering activities directed at removing or collecting live wild aquatic organisms (predominantly fish, molluscs and crustaceans) including plants from the oceanic, coastal or inland waters for human consumption and other purposes by hand or more usually by various types of fishing gear such as nets, lines and stationary traps. The production of capture fisheries is measured by nominal catches (in live weight basis) of fish, crustaceans, molluscs and other aquatic animals and plants, killed, caught, trapped or collected for all commercial, industrial, recreational and subsistence purposes. It should be noted that in this *Outlook* data relating to aquatic plants are not included.

Carcass Weight Equivalent (cwe)	A commonly used measure of meat production, referring to the weight of livestock carcasses, including bones and other components, but excluding head, hide,blood,and some internal organs. Conversion may varies by region, species, and processing practices.
Cereals	Defined as wheat, maize, other coarse grains and rice (milled).
Common Agricultural Policy (CAP)	The European Union's agricultural policy, first defined in Article 39 of the Treaty of Rome signed in 1957.
Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)	CPTPP is a trade agreement between Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, and Viet Nam. It was signed in March 2018 and came into force for the first six countries in December 2018.
COVID-19	COVID-19 is the infectious disease caused by the most recently discovered coronavirus. This new virus and disease were unknown before the outbreak began in Wuhan, China, in December 2019. COVID-19 is now a pandemic affecting many countries globally.
Decoupled payments	Direct payments which are not linked to current production of specific commodities or livestock numbers or the use of specific factors of production.
Developed and developing countries	See summary table for country grouping in the *Agricultural Outlook*.
Direct payments	Payments made directly by governments to producers.
Domestic support	Refers to the annual level of support, expressed in monetary terms, provided to agricultural production. It is one of the three pillars of the Uruguay Round Agreement on Agriculture targeted for reduction.
El Niño- Southern Oscillation	*El Niño*-Southern Oscillation (ENSO) refers to periodic but irregular variations in wind and sea surface temperatures in the tropical eastern Pacific Ocean. ENSO consists of a warming phase known as *El Niño* and a cooling phase known as *La Niña*, and occurs typically at intervals of two to seven years. The abnormal warm ocean climate conditions of *El Niño* are accompanied by higher local rainfall and flooding, and massive deaths of fish and their predators (including birds).
Emission reduction technologies	In agriculture, emission reduction technologies (ERTs) encompass a broad range of innovations, tools, and practices designed to lower greenhouse gas emissions from farming systems without compromising productivity. These include both biological and technical interventions that address the main emission sources in crop and livestock systems.
Enteric fermentation	A natural part of the digestive process in ruminant by which carbohydrates are broken down by microorganisms into simple molecules for absorption into the bloodstream of an animal, producing methane as a by-product.
Ethanol	A biofuel that can be used as a fuel substitute (hydrous ethanol) or a fuel extender (anhydrous ethanol) in mixes with petroleum, and which is produced from agricultural feedstocks such as sugar cane and maize. Anhydrous alcohol is free of water and at least 99% pure. Hydrous alcohol contains water and usually has a purity of 96%. In Brazil, this ethanol is being used as a gasohol substitute in flex-fuel vehicles.
Export subsidies	Subsidies given to traders to cover the difference between internal market prices and world market prices, such as the EU export restitutions. The elimination of agricultural export subsidies is part of the Nairobi Package adopted at the WTO's Tenth Ministerial Conference in December 2015.
Farm Bill	In the United States, the Farm Bill is the primary agricultural and food policy tool of the federal government.
Feed Conversion Ratio (FCR)	A measure of an animal's efficiency in converting feed mass into increases in weight gained by the animal.
Fertiliser	Fertilisers provide essential nutrients for maintaining agricultural crop yields and quality, and for growth in production. The three most important nutrients are nitrogen (N), phosphorus (P), and potassium (K).
Flexible-fuel vehicles (FFVs)	Vehicles that can run on either gasohol or on hydrous ethanol.
Foot and Mouth Disease (FMD)	FMD is the most contagious disease of mammals and has a great potential for causing severe economic loss in susceptible cloven-hoofed animals (https://www.woah.org/en/disease/foot-and-mouth-disease/). International animal trade is linked to the FMD-status according to the World Organisation for Animal Health (WOAH).

Fresh dairy products	Fresh Dairy Products contain all dairy products and milk which are not included in the processed products (butter, cheese skim milk powder, whole milk powder and for some cases casein and whey). The quantities are in cow milk equivalent.
G20	The G20 is an international forum made up of 19 countries and the European Union, representing the world's major developed and emerging economies. Together, the G20 members represent 85% of global GDP, 75% of international trade, and two-thirds of the world's population. Originally bringing together finance ministers and central bank governors, the G20 has evolved into a forum to address broader global challenges.
Gasohol	Fuel that is a mixture of gasoline and anhydrous ethanol.
Highly Pathogenic Avian Influenza (HPAI)	A severe form of Avian Influenza (AI) that can cause high mortality in poultry and significant disruptions to production and trade. AI is a highly contagious viral infection which can affect all species of birds and can manifest itself in different ways depending mainly on the ability of the virus to cause disease (pathogenicity) on the species affected. AI viruses are classified into two categories: – LPAI (Low Pathogenic Avian Influenza): typically causes mild or no clinical signs. – HPAI (Highly Pathogenic Avian Influenza): causes severe disease and high mortality, particularly in poultry.
High Fructose Sweetener (HFS)	Starch-based sweetener extracted mainly from maize (high fructose corn syrup or HFCS).
Inflation Reduction Act (IRA)	The Inflation Reduction Act (IRA) was signed into United States law in 2022. The IRA targets include domestic energy security, climate change and rural areas, impacting farming, biofuels and fertiliser production.
Intergovernmental Panel on Climate Change (IPCC)	The IPCC is the United Nations body for assessing the science related to climate change. In its comprehensive assessment reports, the IPCC notably examines the Agriculture, Forestry and Other Land Use (AFOLU) sector due to its significant contribution to GHG emissions, mainly carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). GHG emission metrics are used to express emissions of different greenhouse gases in a common unit, and aggregated GHG emissions are stated in CO_2 equivalent (CO_2-eq) using the global warming potential with a time horizon of 100 years. AFOLU CO_2 emissions fluxes are mainly driven by land use, land-use change, and forestry (LULUCF) activities, and account for about half of total net AFOLU emissions. Enteric fermentation from ruminant animals is the main source of CH_4 emissions, while NO_2 emissions are dominated by organic and synthetic fertiliser use.
Intervention stocks	Stocks held by national intervention agencies in the European Union as a result of intervention buying of commodities subject to market price support. Intervention stocks may be released onto the internal market if internal prices exceed intervention prices.
Isoglucose	Isoglucose is a starch-based fructose sweetener, produced by the action of the glucose isomerase enzyme on dextrose. This isomerisation process can be used to produce glucose/fructose blends containing up to 42% fructose. Application of a further process can raise the fructose content to 55%. Where the fructose content is 42%, isoglucose is equivalent in sweetness to sugar.
Least squares growth rate	The least-squares growth rate, r, is estimated by fitting a linear regression trend line to the logarithmic annual values of the variable in the relevant period, as follows: Ln(xt) = a + r × t and is calculated as [exp (r) – 1]. Therefore, projected annual growth rates in this report refer to least-squares average annual growth rates from 2025 to 2034.
Live weight	The weight of meat, finfish and shellfish at the time of their capture or harvest. In the case of fish products it is calculated on the basis of conversion factors from landed to nominal weight and on rates prevailing among national industries for each type of processing.
Manure management	Practices involved in the handling, storage, treatment, and disposal of animal feces and urine, which can impact nutrient management, methane emissions, and the environment.
Market access	Governed by provisions of the Uruguay Round Agreement on Agriculture which refer to concessions contained in the country schedules with respect to bindings and reductions of tariffs and to other minimum import commitments.
Marketing year	It is common to compare crop production across "marketing years," which are defined so that one season's harvest is not artificially split up across different calendar years. In this *Outlook*, international marketing years are mostly defined starting with their harvest in major supply regions, as follows: • Wheat: 1 June; 1 October in Australia

	• Cotton and pulses: 1 August • Maize: 1 September; 1 March in Australia • Other coarse grains: 1 September; 1 November in Australia • Sugar, soybeans, other oilseeds, protein meal, vegetable oils: 1 October; 1 November in Australia. Whenever the text refers to, for example, the marketing year 2024, this is short for 2024/25 for the above commodities. For all other commodities, the marketing year is equal to the calendar year except for meat and dairy products in New Zealand and beef and dairy products in Australia: year ending June 30.
Other coarse grains	Defined as barley, oats, sorghum and other coarse grains in all countries except Australia where it includes triticale, and in the European Union where it includes rye and other mixed grains.
Other oilseeds	Defined as rapeseed (canola), sunflower seed, and groundnuts (peanuts).
Protein meals	Defined as soybean meal, groundnut meal, rapeseed meal, sunflower meal, coconut meal, cottonseed meal and palm kernel meal.
Purchasing Power Parity (PPP)	Purchasing power parities (PPPs) are the rates of currency conversion that eliminate the differences in price levels between countries. The PPPs are given in national currency units per US dollar.
Reed glasswing cicada	Insects infecting some plants like sugar beet with bacterial pathogens that cause the Stolbur disease and the Syndrome Basses Richesses (SBR) (Syndrome of Low Sugar Contents).
Renewable Energy Directive (RED)	EU directive legislating binding mandates of 20% for the share of renewable energy in all Member States' energy mix by the year 2020, with a specific target of 10% for the renewable energy share in transport fuels.
Renewable Fuel Standard (RFS and RFS2)	A standard in the United States for renewable fuel use in the transport sector in the Energy Act (EISA). RFS2 is a revision of the RFS program for 2010 and beyond.
Retail weight equivalent (rwe)	Retail weight equivalent of a product, referring to the estimated edible portion available to consumers after processing, trimming, and packaging. It excludes bones, inedible parts, and significant processing losses. Conversion may varies by region, species, and processing practices.
Roots and Tubers	Plants that yield starch, either derived from their roots (e.g. cassava, sweet potato and yams) or stems (e.g. potatoes and taro). They are destined mainly for human food (as such or in processed form) but can also be used for animal feed or for manufacturing starch, ethanol and fermented beverages. Unless they are processed, they become highly perishable once harvested, which limits opportunities for trade and storage. Roots and tubers contain large amounts of water: all quantities in this publication refer to dry weight to increase comparability.
Rumen Manipulation	Techniques used to alter the microbial ecosystem in the rumen (a compartment of the stomach in ruminants) to improve feed efficiency and reduce methane emissions.
Scenario	A model-generated set of market projections based on alternative assumptions than those used in the baseline. Used to provide quantitative information on the impact of changes in assumptions on the outlook.
Stock-to-use ratio	The stock-to-use ratio for cereals is defined as the ratio of cereal stocks to its domestic utilisation.
Stock-to-disappearance ratio	The stock-to-disappearance ratio is defined as the ratio of stocks held by the main exporters to their disappearance (i.e. domestic utilisation plus exports). For wheat, the eight major exporters are considered, namely the United States, Argentina, the European Union, Canada, Australia, Russian Federation, Ukraine, and Kazakhstan. In the case of coarse grains, United States, Argentina, the European Union, Canada, Australia, Russian Federation, Ukraine, and Brazil are considered. For rice Viet Nam, Thailand, India, Pakistan and the United States enter this ratio calculation.
Sugar	Sucrose produced from sugar beet and sugarcane.
Support price	Prices fixed by government policy makers in order to determine, directly or indirectly, domestic market or producer prices. All administered price schemes set a minimum guaranteed support price or a target price for the commodity, which is maintained by associated policy measures, such as quantitative restrictions on production and imports; taxes, levies and tariffs on imports; export subsidies; and/or public stockholding.
Tariff-Rate Quota (TRQ)	A two-tier tariff regime where imports within the quota enter at a lower ("in-quota") tariff rate while a higher ("out-of-quota") tariff rate is used for imports above this level, As part of the Uruguay Round Agreement on Agriculture, certain countries agreed to provide minimum import opportunities for products they had previously protected by tariffs.

Tel quel basis	Weight of sugar, regardless of its sucrose content (measured by polarisation).
Vegetable oils	Defined as rapeseed oil (canola), soybean oil, sunflower seed oil, coconut oil, cottonseed oil, palm kernel oil, groundnut oil and palm oil.
World Trade Organization (WTO)	Intergovernmental organisation regulating international trade, providing a framework for negotiating trade agreements, and acting as dispute resolution process. The WTO was created by the Uruguay Round agreement and officially commenced in 1995.

Annex B. Methodology

This annex provides information on how the projections in the *Agricultural Outlook* are generated. First, it provides a general description of the different elements and timeline of the process leading to the agricultural baseline projections and the *OECD-FAO Agricultural Outlook* publication each year. Second, it discusses the consistent assumptions made on the projections of exogenous macroeconomic variables. Third, it provides reference to the underlying Aglink-Cosimo model. Finally, it explains how a partial stochastic analysis is performed with the Aglink-Cosimo model.

The generating process of the agricultural baseline projections

The projections presented in the *Agricultural Outlook* are the result of a process that brings together information from a large number of sources. The projections rely on input from country and commodity experts, and from the OECD-FAO Aglink-Cosimo model of global agricultural markets. This economic model is also used to ensure the consistency of baseline projections. Significant expert judgement, however, is applied at various stages of the *Outlook* process. The OECD and FAO Secretariats publish in the *Agricultural Outlook* a unified and plausible assessment of the future developments of the main agricultural commodity markets given the underlying assumptions and the information available at the time of writing.

The starting point: Creation of an initial baseline

The historical data series for the consumption, production, trade[1] and international prices of the various commodities covered in the *Outlook* are mainly drawn from OECD and FAO databases. These databases are largely based on national statistical sources. For each publication, the baseline generating process begins in November of the year preceding the projected decade and ends in February of the current year. It should reflect the situation at the end of the preceding year, i.e. the end of 2024 for the current edition. Starting values for the likely future development of agricultural markets are developed separately by OECD for its member states and some non-member countries and by FAO for all remaining countries.

- On the OECD side, an annual questionnaire addressed to national administrations is circulated in November to obtain countries' expectations of the medium term developments of their agricultural sector , as well as insights on the current status or recent changes of domestic agricultural policies.
- On the FAO side, the starting values for the country and regional modules are developed through model-based projections and consultations with FAO commodity specialists.

Macroeconomic factors obtained from external sources, such as the International Monetary Fund (IMF), the World Bank and the United Nations (UN), are also used to complete the view of the main economic forces determining market developments.

This part of the process is aimed at creating a first insight into possible market developments and at establishing the key assumptions which condition the *Outlook*. The main macroeconomic and policy assumptions are summarised in the first section of the Trends and Prospects chapter and in specific commodity tables. The sources for the assumptions are discussed in more detail further below.

As a next step, the OECD-FAO Aglink-Cosimo modelling framework is used to facilitate a consistent integration of the initial data and to derive an initial baseline of global market projections. The modelling framework ensures that at a global level, projected levels of consumption match with projected levels of production for the different commodities, subject to minimised trade imbalances. The model is discussed below.

In addition to quantities produced, consumed and traded, the baseline also includes projections for nominal prices (in local currency units) for the commodities concerned.

The initial baseline results are then reviewed:

- For the countries under the responsibility of the OECD Secretariat, the initial baseline results are compared with the questionnaire replies. Any issues are discussed in bilateral exchanges with country experts.
- For country and regional modules developed by the FAO Secretariat, initial baseline results are reviewed by a wider circle of in-house and international experts.

Final baseline

At this stage, the global projection picture starts to emerge, and refinements are made according to a consensus view of both Secretariats and external experts. On the basis of these discussions and updated information, a second baseline is produced. The information generated is used to prepare market assessments for cereals, oilseeds, sugar, meats, dairy products, fish, biofuels and cotton over the course of the *Outlook* period.

These results are then discussed at the annual meetings of the Group on Commodity Markets of the OECD Committee for Agriculture in March, which brings together experts from national administrations of OECD countries as well as experts from commodity organisations. Following comments by this group, and data revisions, the baseline projections are finalised.

The *Outlook* process implies that the baseline projections presented in this report are a combination of projections and experts knowledge. The use of a formal modelling framework reconciles inconsistencies between individual country projections and establishes global market equilibria, with prices determined through the balancing of global supply and demand. The review process ensures that judgement of country experts is brought to bear on the projections and related analyses. However, the final responsibility for the projections and their interpretation rests with the OECD and FAO Secretariats.

The *Agricultural Outlook* delves into the finale baseline projections to provide an overview as well as more detailed analyses of the world agricultural markets over the medium term. The report is discussed by the Senior Management Committee of FAO’s Department of Economic and Social Development and the OECD’s Working Party on Agricultural Policies and Markets of the Committee for Agriculture in May, prior to publication. In addition, the *Outlook* will be used as a basis for analyses presented to the FAO’s Committee on Commodity Problems and its various Intergovernmental Commodity Groups.

Sources and assumptions for the macroeconomic projections

The *Outlook* uses the Medium Variant set of estimates from the United Nations Population Prospects database for the population data used for all countries and regional aggregates. For the projection period, the medium variant set of estimates was selected for use from the four alternative projection variants (low, medium, high and constant fertility). The UN Population Prospects database was chosen because it represents a comprehensive source of reliable estimates which includes data for non-OECD developing countries. For consistency reasons, the same source is used for both the historical population estimates and the projection data.

The other macroeconomic series used in the Aglink-Cosimo model are real GDP, the GDP deflator, the private consumption expenditure (PCE) deflator, the Brent crude oil price (in US dollars per barrel) and exchange rates expressed as the local currency value of USD 1. Historical data for these series in OECD countries as well as Brazil, Argentina, the People's Republic of China and the Russian Federation are consistent with those published in the *OECD Economic Outlook* No. 116 (December 2024). For other economies, historical macroeconomic data were obtained from the IMF, *World Economic Outlook* (October 2024). Assumptions for 2025 to 2034 are based on the projections of the IMF *World Economic Outlook*, October 2024, extended with growth rates from the Oxford Economic model for outer years.

The model uses indices for real GDP, consumer prices (PCE deflator) and producer prices (GDP deflator) which are constructed with the base year 2010 value being equal to 1. The assumption of constant real exchange rates implies that a country with higher (lower) inflation relative to the United States (as measured by the US GDP deflator) will have a depreciating (appreciating) currency and therefore an increasing (decreasing) exchange rate over the projection period, since the exchange rate is measured as the local currency value of USD 1. The calculation of the nominal exchange rate uses the percentage growth of the ratio "country-GDP deflator/US GDP deflator".

The oil price used to generate the *Outlook* until 2023 is taken from the short-term update of the *OECD Economic Outlook* No. 116 (December 2024). For 2024, the annual average daily spot price is used, while the December average daily spot price is used for 2025. For the remainder of the projection period, the reference oil price used in the projections is assumed to remain constant in real terms.

The underlying Aglink-Cosimo model

Aglink-Cosimo is an economic model that analyses supply and demand of world agriculture. It is managed by the Secretariats of the OECD and the Food and Agriculture Organization of the United Nations (FAO), and used to generate consistent baseline projections presented in the *Agricultural Outlook* and policy scenario analysis.

Aglink-Cosimo is a recursive-dynamic, partial equilibrium model used to simulate developments of annual market balances and prices for the main agricultural commodities produced, consumed and traded worldwide. The Aglink-Cosimo country and regional modules cover the whole world. The OECD and FAO Secretariats in conjunction with country experts and national administrations are responsible for developing and maintaining the projections. Several key characteristics are as follows:

- Aglink-Cosimo is a "partial equilibrium" model for the main agricultural commodities, as well as biodiesel and bioethanol. Other non-agricultural markets are not modelled and are treated exogenously to the model. As non-agricultural markets are exogenous, hypotheses concerning the paths of key macroeconomic variables are predetermined with no accounting of feedback from developments in agricultural markets to the economy as a whole.

- World markets for agricultural commodities are assumed to be competitive, with buyers and sellers acting as price takers. Market prices are determined through a global or regional equilibrium in supply and demand.
- Domestically produced and traded commodities are viewed to be homogeneous and thus perfect substitutes by buyers and sellers. In particular, importers do not distinguish commodities by country of origin as Aglink-Cosimo is not a spatial model. Imports and exports are nevertheless determined separately. This assumption affects the results of analysis in which trade is a major driver.
- Aglink-Cosimo is recursive-dynamic, and outcomes for one year influence those for the next years (e.g. through herd sizes or dynamic yield expectations). Aglink-Cosimo models ten years into the future.

The modelling framework is regularly improved to develop the *Outlook's* capacity to reflect future market developments and to provide an enhanced analysis of beyond market outcomes (e.g. food security, land use and environmental outcomes).

As of the 2022-2023 *Outlook* cycle, the Secretariats have explicitly incorporated the use of the three main mineral fertilisers (Nitrogen, Phosphorus and Potassium) into the yield equations that determine the supply of crop commodities. This new feature separates the costs of fertilisers from those of other production inputs (energy, seeds, machinery, labour and other tradable and non-tradable inputs). Historical data series for fertiliser use per crop has been developed by combining existing information on total use from FAOSTAT with per crop estimates from the International Fertilizer Association.

Food loss and waste has been incorporated into the 2022-2023 cycle of the *OECD-FAO Agricultural Outlook*. Section 1.4 of the chapter “Trends and Prospects” provides a detailed overview of the definitions, global estimates and drivers of food loss and waste. In terms of implementation in the data and Aglink-Cosimo model, three shares have been added to account for food loss and waste at the retail and household levels. As a result, three different values for food use of agricultural commodities are now available: food availability, which accounts for the decrease in the quantity of food along the food supply chain occurring from post-harvest, slaughter or catch up to but not including the retail level; food consumption, derived by subtracting retail food waste from food availability and serving as the main reference value used throughout the report and tables; and food intake, which represents the quantity after accounting for household waste.

In 2024, the Secretariat adopted a standardised template for animal production to enhance the Aglink-Cosimo model's functionality. The revised meat supply component now separates meat output into animal marketing numbers and average carcass weights, allowing for a better grasp of sectoral productivity trends. This update facilitates a more integrated approach by closely linking total animal inventory with marketing activities and aligning production systems, breeding improvements, and feed intensities with animal weight. Additionally, the revision standardized the calculations for projecting meat production, including returns per head, feed and pasture costs, and their connections to alternative land uses.

Furthermore, a comprehensive review of the model's elasticities has been conducted. These adjustments ensure a more uniform response in meat production across the various meat types and regions, effectively aligning output with animal inventories and weights. These changes are expected to enhance the reliability of short and medium-term responses in meat production.

The latest detailed documentation of Aglink-Cosimo model is available on the official website of the *Agricultural Outlook* www.agri-outlook.org.

The model used to generate the fish projections is operated as a satellite model to Aglink-Cosimo. Exogenous assumptions are shared and interacting variables (e.g. prices for cross-price reactions) are exchanged. The fish model went through substantial revision in 2016. The aggregated aquaculture supply functions of 32 components of the model were replaced by 117 species-specific supply functions with specific elasticity, feed ration and time lag. The main species covered are salmon and trout, shrimp, tilapia, carp, catfish (including Pangasius), seabream and seabass, and molluscs. A few other minor productions such as milkfish were also included. The model was constructed to ensure consistency between the feed rations and the fishmeal and fish oil markets. Depending on the species, the feed rations can contain a maximum of five types of feed; fishmeal, fish oil, oilseed meals (or substitutes), vegetable oil and low protein feeds like cereals and brans.

The methodology of stochastic simulations with Aglink-Cosimo

The partial stochastic analysis highlights how alternative scenarios diverge from the baseline by treating a number of variables stochastically. The selection of those variables aims at identifying the major sources of uncertainty for agricultural markets. In particular, country specific macroeconomic variables, the crude oil price, and country- and product-specific yields are treated as uncertain within this partial stochastic framework. Apart from the international oil price, four macroeconomic variables are considered in all countries: the consumer price index (CPI), the gross domestic product index (GDPI), the gross domestic product deflator (GDPD) and the US-Dollar exchange rate (XR). The yield variables considered contain crop and milk yields in all modelled regions.

The approach applied to determine the stochastic draws of these variables is based on a simple process which captures the historical variance of each single variable. The three main steps of the partial stochastic process are briefly explained below.

(i) The quantification of the past variability around the trend for each macroeconomic and yield variable separately

The first step is to define the historical trend of stochastic variables. Often a linear trend does not represent adequately observed dynamics. Consequently, a non-linear trend is estimated by applying a Hodrick-Prescott filter, which seeks to separate short-term fluctuations from long-term movements.[2] The filter is applied to the yield time series directly and to year-on-year changes for macro variables.

(ii) The generation of 1 000 sets of possible values for the stochastic variables

The second step involves generating 1 000 sets of possible values for the stochastic variables. For each year of the 2025-2034 projection period, one year of the historical period 1995-2024 is drawn. The relative deviation between the actual variable value of that year and the respective trend value estimated in step (i) is then applied to the value of the variable in the actual projection year. All variables thereby receive the value of the same historical year. The process, however, handles macro variables separately from yields, as they are not strongly correlated.

(iii) The execution of the Aglink-Cosimo model for each of these 1 000 possible alternative sets of values (uncertainty scenarios)

The third step involves running the Aglink-Cosimo model for each of the 1 000 alternative “uncertainty” scenarios generated in step (ii). When both macroeconomic and yield uncertainty were included, this procedure yielded 98% successful simulations in this *Outlook*. The model does usually not solve all stochastic simulations as the complex system of equations and policies may lead to infeasibilities when exposed to extreme shocks in one or several stochastic variables.

Notes

[1] Trade data for regions, e.g. the European Union or regional aggregates of developing countries, refer only to extra-regional trade. This approach results in a smaller overall trade figure than cumulated national statistics. For further details on particular series, enquiries should be directed to the OECD and FAO Secretariats.

[2] The filter was popularised in the field of economics in the 1990s in Robert Hodrick and Edward C. Prescott (1997), "Postwar US Business Cycles: An Empirical Investigation", *Journal of Money, Credit, and Banking*, Vol. 29 (1), pp. 1–16, JSTOR 2953682.

OECD-FAO Agricultural Outlook 2025-2034

The *OECD-FAO Agricultural Outlook 2025-2034* provides a comprehensive assessment of the ten-year prospects for agricultural commodity and fish markets at national, regional, and global levels.

Key trends include rising consumption of animal-source foods, mainly by a growing, more affluent and urbanised population in middle-income countries. Global agricultural and fish production is expected to increase by 14% over the next decade, mainly enabled by productivity growth, particularly in middle-income countries. Productivity gains will contribute to reducing emission intensity and limit the expected increase of direct agricultural greenhouse gas emissions to 6%.

Scenario simulations indicate that the elimination of undernourishment globally by 2034 can go hand in hand with a reduction of greenhouse gas emissions by 7% if combined investments are made in emission-reduction technologies and in a 15% productivity increase in agriculture.

A rules-based trade system remains essential for global food security and rural livelihoods. Real international reference prices are expected to maintain a slightly declining trend, pressuring smallholders to improve productivity in order to stay competitive.

More information can be found at www.agri-outlook.org.

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