Food security in a warming world

Who is at risk, why and what comes next?

Ritu Bharadwaj, N Karthikeyan and Balakrishnan Ananda Kumar

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Foreword by Abdihakim Ainte

In fragile and conflict-affected countries, climate change is already reshaping the realities of food security. In Somalia, repeated droughts and floods are disrupting agricultural production, pastoral livelihoods and local markets, pushing vulnerable communities closer to crisis with each successive shock. When climate impacts intersect with fragility, limited fiscal space and ongoing humanitarian pressures, the risks to food security become far more severe.

This report provides valuable new evidence on how climate change could further intensify these pressures across countries. By expanding the analysis to 162 countries, including many fragile and vulnerable contexts, it highlights how rising temperatures and increasing climate variability are likely to deepen existing inequalities in food systems.

For countries facing fragility, strengthening food security is inseparable from strengthening resilience. Investments in climate-resilient agriculture, water systems, early warning and anticipatory social protection will be critical to protecting livelihoods and preventing climate shocks from escalating into humanitarian crises. As climate risks grow, ensuring that fragile states have the support and resources needed to build resilient food systems must become a global priority.

Abdihakim Ainte

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Office of the Prime Minister, Federal Government of Somalia

Foreword by His Excellency Ambassador Adão Soares Barbosa

Climate change is increasingly undermining the foundations of food security in the world's most vulnerable countries. For Least Developed Countries (LDCs), this challenge is particularly acute. Many of our economies depend heavily on climate-sensitive sectors such as agriculture and fisheries, while structural constraints, including limited fiscal space, weak infrastructure and thin social protection systems, reduce our ability to absorb and recover from climate shocks.

The analysis presented in this report provides important new evidence on how climate risks are reshaping food security outcomes across countries. The findings show that food security risks intensify as global temperatures rise. Even under a 1.5°C warming scenario, food security indicators in many low-income and fragile countries begin to deteriorate, with far more severe impacts under higher warming pathways.

These findings also highlight a fundamental issue of climate justice. The countries projected to experience the greatest declines in food security are among those that have contributed the least to global greenhouse gas emissions. Yet they face the most immediate consequences through declining agricultural productivity, rising food prices and increasing disruptions to livelihoods.

Safeguarding food security in LDCs will require stronger international cooperation and sustained investment in resilience. This includes scaling up climate-resilient food systems, strengthening anticipatory social protection and ensuring that early warning systems are linked to early action. Global initiatives and platforms addressing hunger, poverty and climate risks must prioritise support for the countries where food security risks are rising fastest.

H.E Ambassador Adão Soares Barbosa

Chair of the Least Developed Countries (LDC) Group

Special Envoy/Ambassador at Large for Climate Affairs,
Ministry of Foreign Affairs and Cooperation, the Government of Timor-Leste

Foreword by Renato Domith Godinho

GLOBAL ALLIANCE AGAINST HUNGER AND POVERTY

Climate change is rapidly becoming one of the most powerful drivers of hunger and food insecurity across the world, particularly in countries where poverty, fragility and limited fiscal space already constrain resilience.

This report provides important new evidence on food security outcomes across 162 countries, exploring how climate impacts are likely to deepen existing inequalities in food systems, with the most severe consequences seen in the most vulnerable countries. Its findings align with the landmark Belem Declaration on Hunger, Poverty, and Human-Centered Climate Action, issued at COP30 and endorsed by 49 countries and the European Union. The declaration is the first high-level political document to explicitly recognise that addressing the unequal distribution of the human impacts of climate change requires a fundamental shift in the approach to climate action. It calls for scaling up three priority areas within climate finance, national climate strategies and research: adaptive social protection; resilience for smallholder producers; and the creation of sustainable livelihood opportunities for peoples living in forest regions and other sensitive ecosystems.

The Global Alliance against Hunger and Poverty, consolidating both climate and development actors, is well-positioned to support those goals by championing country-led programmes that combine climate-responsive social protection, sustainable agriculture and investment in local capacities.

Scaling-up evidence-based and ambitious programmes like these is more essential than ever. The challenges faced by countries are heightened by spreading instability, which raises hunger risks through disruptions to energy, fertiliser and food supply chains. Expanding social protection, investing in resilient food systems and ensuring that vulnerable countries have access to adequate finance and technical support will be critical to safeguarding food security in a warming and increasingly unstable world.

Renato Domith Godinho

Director, Global Alliance against Hunger and Poverty Support Mechanism

Abbreviations

CRI	Climate Risk Index
FAO	Food and Agriculture Organization of the United Nations
FCAS	Fragile and conflict-affected states
FSI	Food Security Index
GDP	Gross domestic product
HSNP	Hunger Safety Net Programme
ILO	International Labour Organization
INFORM	Index for Risk Management
IPC	Integrated Food Security Phase Classification
IPCC	Intergovernmental Panel on Climate Change
LDCs	Least developed countries
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
PSNP	Productive Safety Net Programme
SIDS	Small Island Developing States
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WASH	Water, sanitation and hygiene
WHO	World Health Organization

Summary

Climate change is steadily weakening the foundations of food security. Increasing temperatures, erratic rainfall and more frequent extreme weather events — such as drought, floods and storms — disrupt crop yields, decrease livestock productivity and deplete fish stocks, reducing food availability. Price rises, combined with damaged infrastructure and social inequalities, make food less accessible. Climate-induced health issues and water stress worsen malnutrition and diminish the effectiveness of food use. And as shocks repeat, they erode the buffers households and systems need to recover, turning short-term stress into long-term fragility. Although increasing everywhere, these risks are felt most severely in countries and communities with the least capacity to cope, particularly fragile and conflict-affected states (FCAS), least developed countries (LDCs) and Small Island Developing States (SIDS).

Most measures used in food security analysis capture only part of the picture. Some — such as prevalence of undernourishment — focus on calorie adequacy, while others combine undernourishment with child outcomes and mortality. Crisis tools, such as the Integrated Food Security Phase Classification, are essential for operational decisions but not designed to provide a consistent, cross-country structural view that can be linked to forward-looking climate scenarios. And several composite indices do not cover the countries where risk is most concentrated.

To address this gap, we constructed a new Food Security Index (FSI) for 162 countries. Our objective was to unpack the climate–food nexus by assessing performance across four distinct pillars: availability, access, utilisation and sustainability. By separating the constraints of supply (availability) from purchasing power (access), health and sanitation (utilisation) and the ability to withstand shocks (sustainability), this approach allows us to see not just which countries are food insecure, but also why, allowing us to develop policy and programmatic responses to address them.

Findings

The baseline results show that food insecurity is unevenly spread. The global average FSI score is 6.74 on a 0–10 scale, but the gap between top and bottom is wide, with 30 countries scoring below 5, and 47 above 8.

When we look across country groupings, the structural nature of the deficits is clear. Developed countries perform strongly across all pillars (average 8.68), reflecting universal basic services and institutions that keep markets and safety nets functioning during stress, while developing countries score an average of 6.91. At 6.40, SIDS sit just below the global average of 6.74, scoring higher on sustainability and lower on availability. This fits what we see in practice, as small islands face food security problems due to narrow production base and high import dependence.

The lowest average scores are concentrated in LDCs (5.13) and FCAS (4.29), where constraints create a compounding effect across pillars. The value of food imports relative to export earnings in FCAS is around 328%, compared with just 51% in other developing countries. This makes food supply highly sensitive to price spikes and currency fluctuations.

Availability was the lowest-scoring pillar in 73 countries and, while total calorie supply is often adequate, diet composition and production volatility remain major issues.

Access tracks enabling conditions. While electricity access is near-universal in developed economies, it drops to around 65% in LDCs and 62% in FCAS. Internet use falls even more sharply — to 47% and 39%, respectively — limiting households' ability to connect to markets during shocks.

Utilisation showed the widest spread (0.27–9.79). With maternal mortality far higher in FCAS and LDCs (402 and 311, respectively, per 100,000) than in developed countries (8 per 100,000) and sanitation risks, such as open defecation, prevalent, nutrition outcomes can lag even when food is physically present.

Sustainability is the second-most common constraint. Tail risks — such as conflict intensity and drought frequency — are heavily concentrated in countries that already have the weakest coping capacity.

Regression, risk and resilience

We ran cross-country regressions to test how economic capacity and climate exposure — measured through per capita gross domestic product (GDP) and the Climate Risk Index, respectively — relate to the overall FSI and each pillar. The

pattern showed that higher income is associated with stronger food security, while higher climate risk is associated with weaker food security. But climate risk is not evenly distributed across pillars.

- **Sustainability** and **utilisation** are the most climate sensitive. A 1 point increase in climate risk is associated with a 0.84 point reduction in sustainability and a 0.81 point reduction in utilisation. This suggests early climate damage is often first apparent in water, sanitation and hygiene systems, the disease burden, health access and the buffers that prevent repeated crisis cycles.
- **Access** is also highly sensitive. A 1 point increase in climate risk is associated with a 0.71 point reduction in access, consistent with shocks translating quickly into price spikes, lost work and market disruption.
- **Availability** erodes more gradually. A 1 point increase in climate risk is associated with a 0.43 point reduction in food availability. This is lower than the other three pillars, suggesting a steadier decline.

The regression also shows the limits of GDP as a shield. Higher income is strongly associated with better availability and utilisation but less so with sustainability. So, although growth improves some aspects of food security, it does not automatically build the buffers needed to manage climate volatility, especially where hazard exposure and fragility remain high.

Projections under warming scenarios

Using the regression relationships, we projected how food security could shift under 1.5°C, 2°C and 4°C warming scenarios. The results show that warming does not reduce food security evenly across countries; damage is concentrated where underlying constraints are already severe and coping capacities are weak.

In FCAS, the average FSI score falls by around 9% under 1.5°C warming, and almost 39% under 4°C warming. LDCs follow a similar pattern, with a decline of around 24% under 4°C warming, compared with around 6% for developed countries. The gap widens because countries start with different base conditions and have different capacities to absorb shocks without cascading losses.

This is driven by structural constraints. In low-income countries, about 57% of employment is in agriculture, compared with 3% in high-income countries, so climate shocks hit food availability and household income more directly. Safety net coverage is also thinner, leaving households with less support when prices increase, crops are damaged or livelihoods lost.

These projections also raise climate justice issues. Those projected to face the largest food security deterioration are the least responsible for global warming. Low-income countries contribute less than 1% of global carbon dioxide emissions, while high- and upper-middle-income countries contribute more than 80%. SIDS have contributed around 0.5% of historic emissions, yet face high structural risks linked to import dependence and external shocks.

Addressing these challenges

The response cannot be framed around agricultural production alone. A more systemic change is required, to:

- Build anticipatory, shock-responsive social protection that can scale before households resort to destructive coping strategies
- Keep delivery systems — including payment systems, registries and last-mile delivery — functioning during shocks, especially where insecurity and climate-induced displacement can disrupt access
- Link early warning to early action through pre-agreed triggers and protocols that activate support before markets and nutrition outcomes deteriorate
- Secure predictable early finance for high-risk countries.

Rather than respond after situations deteriorate, the world must get ahead of loss. And to slow the widening gap in warming scenarios, the global system must align around a common vision. Platforms like the G20's Global Alliance Against Hunger and Poverty and the G7's Apulia Food Systems Initiative are a good start, but only if they move quickly to deliver what they have promised. A practical next step is for a small set of high-risk countries to define an integrated resilience package, with clear triggers, delivery routes, early finance and a short set of pillar-level indicators that can track early deterioration. The Global Alliance can then broker matchmaking between these packages and finance/technical support to help address funding gaps.

1

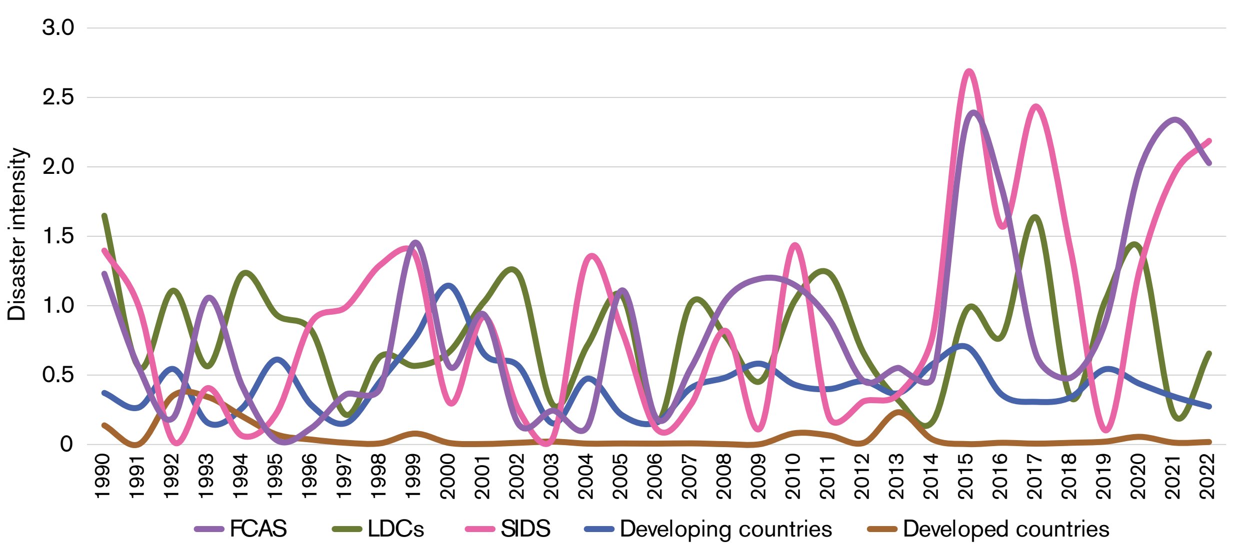
Climate impacts and systemic food security risk

1.1. Unequal burden across countries

Climate change is driving an increase in the frequency, intensity and compounding nature of climate-related shocks. Confirmed as the warmest year on record, global average temperatures in 2024 were around 1.55°C higher than the 1850–1900 baseline, and exceptional ocean heat amplified extremes across regions (WMO, 2025). The Intergovernmental Panel on Climate Change (IPCC) synthesis report highlights with high confidence that even small increments of additional warming significantly increase the likelihood and intensity of hot extremes, heavy rainfall events and drought intensity in some regions (IPCC, 2021).

These impacts are already showing up in the scale of losses. Global losses from natural disasters reached an estimated US$320 billion in 2024, making it one of the costliest years on record (Munich Re, 2025). But while risk is rising everywhere, the burden is not shared evenly. Between 1970 and 2021, weather-, climate- and water-related disasters caused an estimated US$4.3 trillion in economic losses and more than two million deaths — around 90% of it in developing countries (WMO, 2023). This is due not just to their higher exposure to hazards, but also to their lack of coping capacity. Many of these countries have weak infrastructure, low safety net coverage and constrained public finances for dealing with increasing climate risks.

Figure 1. Disaster intensity, by country development and vulnerability status (1990–2022)



Source: Author calculation based on data from EM-DAT (EM-DAT, n.d.)

Figure 1 illustrates this uneven burden, showing that while the disaster intensity trend has increased universally, FCAS, SIDS and LDCs are most exposed. Comparing this disaster intensity with the long-term decadal average before 1990 shows that disaster intensity in FCAS nearly tripled in 1960–1990 (0.30) and 1991–2022 (0.84). LDCs and SIDS started from a much higher baseline and have remained consistently exposed, with average disaster intensity around 0.8 and 0.9, respectively, across these periods. In developing countries, disaster intensity almost doubled from 0.28 to 0.53, while in developed countries, it remained low but still tripled, from 0.02 to 0.06. These figures suggest that risks are rising everywhere, but are most severe where resilience and coping systems are weakest, such as in LDCs, SIDS and FCAS.

The impacts of these disasters are felt most at community level, where climate risks are becoming a threat to daily survival. This is often first experienced in food security, because crops and livestock rely on stable weather, and people rely on roads, markets and income to access food. So, when disasters intensify, they do not just damage assets in the short term; they also disrupt production and cut off access to food, weakening food security at its foundations.

1.2. The four pillars of food security

Food insecurity for vulnerable communities typically manifests in two timeframes. Some effects are immediate — for example, a flood can wipe out a harvest or cut off access to markets. Others, such as heat stress, build over time, reducing productivity, weakening incomes and eroding coping capacity.

The World Food Summit definition frames food security as a situation where all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets dietary needs and food preferences for an active and healthy life. In practice, food security is understood through four interlinked pillars (WFS, 1996; Box 1).

Box 1. The four pillars of food security

Food security is commonly understood through the following four pillars:

Availability: the supply of food from domestic production, imports, food stocks and food assistance. Availability depends on agricultural productivity, storage capacity and distribution systems.

Access: the economic, physical and social ability to obtain food. Access includes affordability (income levels and food prices), access to markets and services, and social factors such as discrimination and exclusion.

Utilisation: the proper consumption and biological use of food. Utilisation depends on diet quality, food safety, clean water, sanitation, healthcare and nutritional knowledge, as well as factors that affect nutrient absorption.

Sustainability: the ability to maintain availability, access and utilisation over time. Sustainability involves managing risks from natural hazards, climate change, price volatility and conflict, and ensuring households can withstand and recover from shocks.

Source: FAO (2006)

Unpacking the four pillars is important because climate shocks rarely affect food security through a single channel. Rather, they tend to hit several aspects across these pillars at once, with the dominant constraint differing by country.

Extreme heat, drought, floods and storms reduce yields, damage crops close to harvest and increase post-harvest losses, creating immediate pressures on **availability**. The frequency of sudden food production losses has increased since at least the mid-20th century (IPCC, 2022). Climate change has reduced global agricultural total factor productivity (a measure of agricultural efficiency) by around 21% since 1961, eroding underlying productivity and slowing gains over time (Ortiz-Bobea et al., 2021). These pressures are not limited to crops. Ocean warming has reduced the sustainable potential for fishery catches of several marine fish and shellfish by an estimated 4.1% globally between 1930 and 2010, constraining supply for countries and communities that rely heavily on fish for food and livelihoods (IPCC, 2022).

When production falls or supply routes are disrupted, food prices can increase suddenly, particularly in import-dependent markets. This weakens **access**, both through affordability and physical access when infrastructure and transport networks are damaged. A growing body of evidence is also linking climate shocks directly to inflation dynamics, with one study finding that higher temperatures increase food inflation persistently over the following year, rather than being fully reversed in subsequent months (Kotz et al., 2024). This becomes important because the same price increase has different consequences depending on household budgets and purchasing power. In 2022, over 2.8 billion people were unable to afford a healthy diet, with the affordability gap most severe in low-income countries (FAO et al., 2024). Access challenges are compounded when climate shocks reduce incomes and disrupt jobs, especially in agriculture and informal labour markets. By 2030, more than 2% of total working hours globally — equivalent to around 80 million full-time jobs — could be lost each year due to heat stress; with higher losses in South Asia and West Africa (ILO, 2019). And when households lose earnings at the same time as prices rise, food insecurity can increase quickly.

As well as affecting whether people eat, climate shocks also change what they eat. When prices rise, households often switch to cheaper, less diverse diets, which can worsen micronutrient deficiencies and child malnutrition, affecting **utilisation**. At the same time, climate-related extremes can increase disease burdens (including waterborne diseases), reducing nutrient absorption so that even where calories are available, nutrition outcomes can deteriorate. The impacts of climate-related extremes on food security, nutrition and livelihoods are particularly acute for people living in sub-Saharan Africa, Asia, small islands and parts of Central and South America, and for small-scale food producers globally (IPCC, 2022).

Climate change also weakens **sustainability** by increasing volatility and disrupting the systems that move and store food, such as roads, ports, storage facilities, cold chains and market infrastructure. As a result, similar hazards can produce different outcomes depending on logistics capacity, governance and institutional systems.

The current gap in understanding of food security impacts is due to the most widely used measures capturing only part of these impacts. Some indicators, such as the prevalence of undernourishment, focus mainly on calorie adequacy (FAO et al., 2024). Others, such as the Global Hunger Index, combine undernourishment with child anthropometric outcomes and mortality (von Grebmer et al., 2023). Crisis classification tools, such as the Integrated Food Security Phase Classification (IPC), are essential for operational decision making and communicating severity (IPC, 2021a), but are not designed to provide a consistent cross-country, pillar-level picture that can be linked to climate impacts and used for forward-looking scenarios. Composite indices, such as the Global Food Security Index, add useful structural information for the countries they cover (Economist Impact, 2022) but are not built to isolate how climate impacts are shifting each of the four pillars across countries and warming pathways.

This paper unpacks the climate–food nexus by constructing a new FSI for 162 countries across the four pillars and using it to:

- Show where countries stand today on each pillar and overall
- Assess how climate impacts and GDP are associated with each pillar and the overall index, and
- Project how food security shifts under three warming scenarios (1.5°C, 2°C and 4°C).

We also disaggregate results by key country groupings, including development and vulnerability status, income, and region.

2

Developing the Food Security Index for 162 countries

Presenting the global baseline status of food security by calculating FSI scores for 162 countries, this section aims to show where food insecurity is concentrated today and how that picture changes when we look separately at availability, access, utilisation and sustainability. This is important because the constraints driving food insecurity are not the same everywhere, and the responses that can help address them depend on which pillar is weakest. These differences can be obscured when we rely on an overall food security measure.

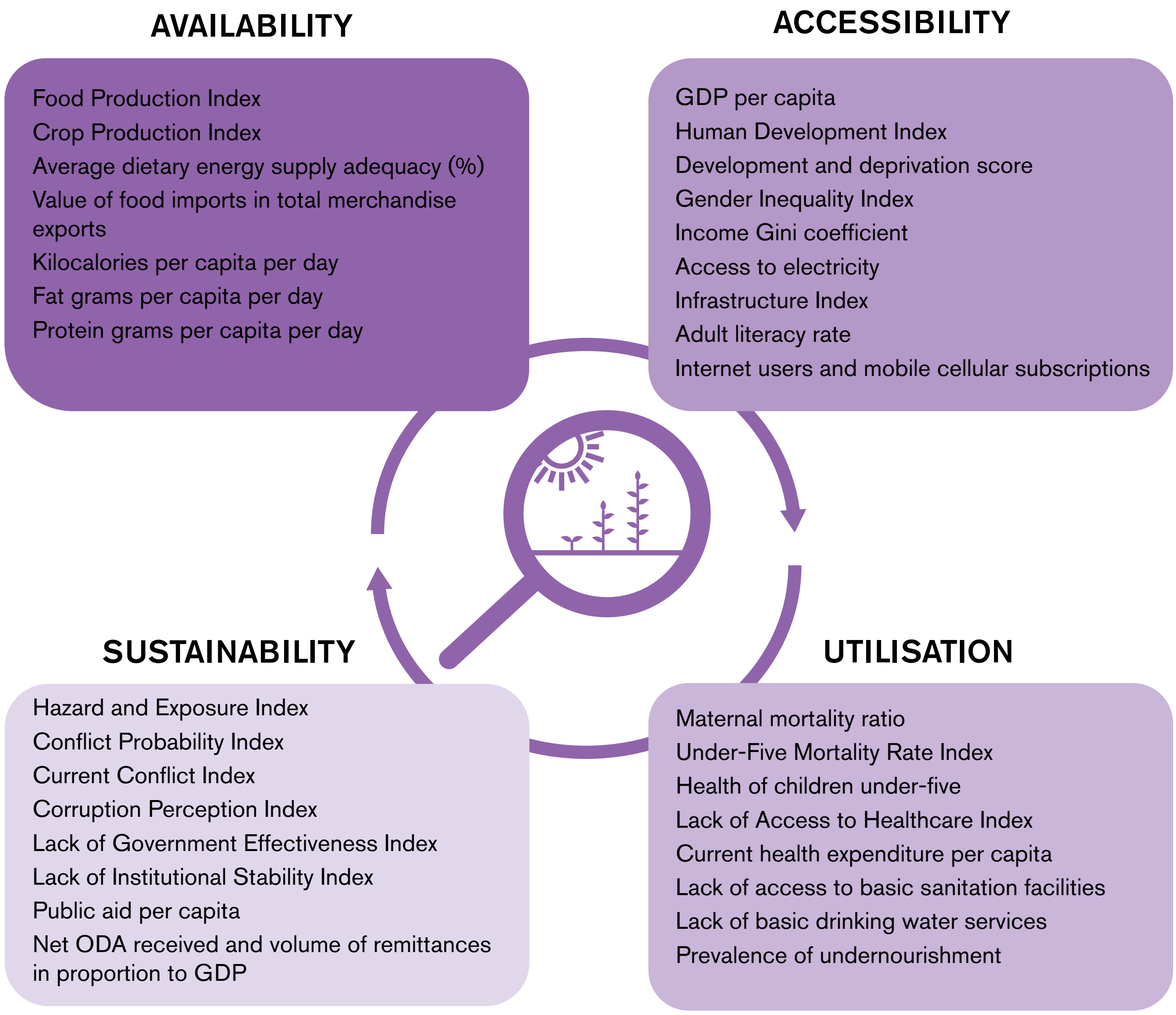
After presenting the FSI, its indicators and pillar indices, we examine patterns and trends in overall FSI scores and scores across the four pillars, and how these vary by level of development and vulnerability, income and region, using maps and group comparisons to highlight where the main constraints are prevalent. We also present the top and bottom performers, focusing on which pillars drive their position. This can provide useful insights for addressing the drivers of food insecurity.

2.1. The FSI and its indicators

We built the FSI to provide a simple but more complete baseline of food security across countries. Many cross-country measures focus on one part of food security or do not provide consistent coverage across the four pillars for a wide set of countries. This becomes a practical limitation when these measures do not cover the countries that are most exposed to food insecurity and climate risk, including LDCs, SIDS and FCAS. The FSI presented in this paper addresses that gap by bringing together comparable indicators across 162 countries, using a single four-pillar framework.

The FSI follows the four pillars of food security used widely in the literature and by the Food and Agriculture Organization of the United Nations (FAO): availability, access, utilisation and sustainability. For each pillar, we selected a set of indicators that capture the main constraints countries face, drawing on established international datasets, including the Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness and the European Commission's Index for Risk Management (INFORM), FAO Food Balance Sheets, and World Bank, United Nations Development Programme (UNDP), World Health Organization (WHO) and United Nations Children's Fund (UNICEF) datasets. Figure 2 summarises the indicators we used for development and analysis under each pillar. **Availability** focuses on food supply and adequacy (including production and dietary energy supply). **Access** captures economic and enabling conditions that shape affordability and the ability to obtain food (including income, inequality and basic infrastructure). **Utilisation** reflects nutrition and the conditions that shape biological use of food, including health, mortality, and water, sanitation and hygiene (WASH) variables. **Sustainability** captures exposure to shocks and the broader capacity to absorb and recover, including hazard exposure, conflict risks and institutional and economic factors.

Figure 2. Indicators used to build and analyse the four pillars of food security across 162 countries



To build the index, we first normalised all indicators to a common scale so we could combine variables measured in different units. For indicators where higher values represent worse outcomes (such as undernourishment or child mortality) we applied an inverse transformation to ensure higher scores consistently reflect better food security outcomes. We then constructed a pillar score for each country by aggregating the indicators within that pillar and finally combined the four pillar scores into an overall FSI score, rated from 0 (worst) to 10 (best). We applied equal weighting across the four pillars to keep the approach transparent and comparable, while ensuring the overall index reflects performance across all dimensions rather than being driven by any single pillar. Full methodological detail on the FSI construction is provided in Appendix 1.

2.2. The pillar indices

Figure 3 presents the overall FSI scores for 162 countries. These range from 1.29 to 9.26, with a global average of 6.74. FSI strength is uneven across countries, with 30 scoring less than 5 and 47 scoring more than 8. This shows that food insecurity is concentrated rather than evenly spread and that the baseline risk profile is shaped by a relatively small set of low-scoring countries.

Although the FSI combines the four pillars into a single measure, it should be interpreted alongside the pillar maps (see Figure 4) because countries do not perform evenly across all four dimensions. The average gap between a country's strongest and weakest pillar is about 2 points, although in 20 countries, it exceeds 3 points. This is important because the overall FSI can look similar across countries that face very different constraints.

Figure 3. Overall FSI scores across 162 countries

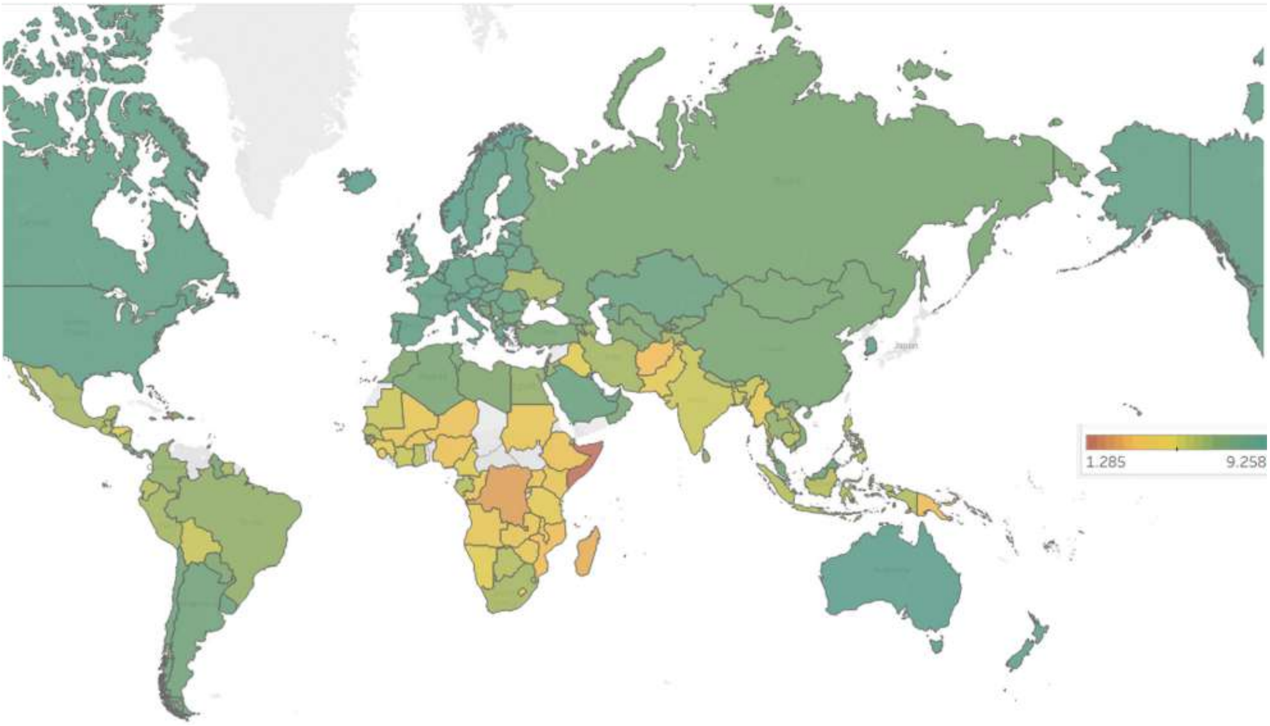
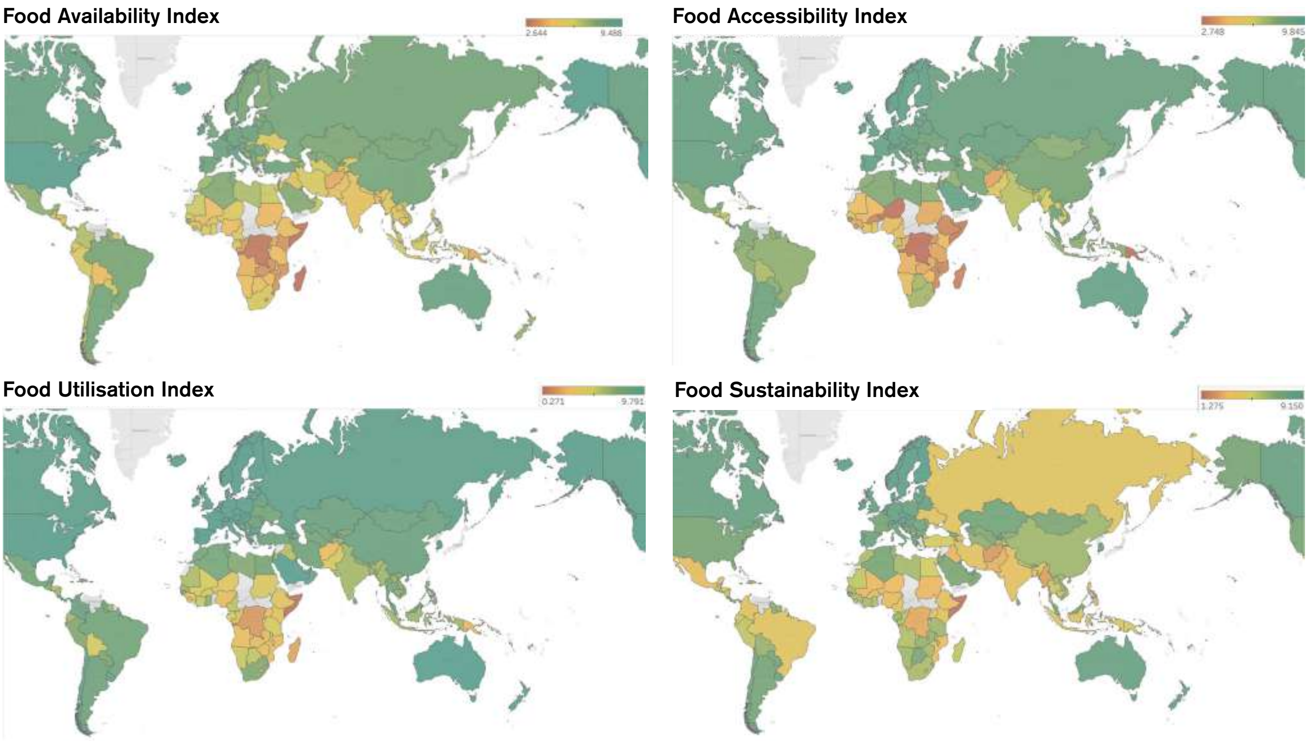


Figure 4. FSI scores across the four pillars: availability, access, utilisation and sustainability



On average, countries score higher on access and utilisation, and lower on availability and sustainability. Across the 162 countries, the mean scores are: 7.35 for access, 7.16 for utilisation, 6.41 for sustainability and 6.31 for availability. Availability is the lowest-scoring pillar in 73 countries, followed closely by sustainability, in 62. Considering food security across the four pillars (see Figure 4), several patterns stand out.

Availability reflects whether food is physically present and adequate. This is the most common constraint across countries, with around 22% scoring less than 5 for this pillar. The underlying indicators help explain why. Across all 162 countries, the normalised dietary energy supply indicator (kilocalories per capita per day) averages 7.56, showing that energy adequacy is not the main issue. The average scores for fat and protein intake (5.17 and 5.94, respectively), however, are noticeably lower and more uneven. Crop Production Index scores vary more sharply, from about 54 to

190, and Food Production Index scores range from 71 to 177, pointing to wide differences in production capacity and volatility. Agriculture stress probability measures also vary substantially (median 0.10, upper quartile 0.18, maximum 0.60), highlighting that in many contexts, availability is shaped less by total calories, and more by diet composition and vulnerability to fluctuations in production levels.

Access captures whether households can obtain food, and is shaped by purchasing power, inequality and enabling conditions (infrastructure, services and connectivity). The average access score is 7.35, with nearly half the 162 countries scoring above 8. It is the weakest pillar for only six countries, indicating that many countries have made progress on basic service access even when other pillars remain constrained. Basic service indicators — such as access to electricity (8.85), safe drinking water (8.98) and sanitation (7.92) — are relatively high on average, while indicators linked more directly to deprivation and affordability pressures are lower and more uneven. For example, development and deprivation (6.27) and inequality (6.30) pull the access pillar down in many contexts, and connectivity indicators, such as mobile cellular users (5.60), are also uneven.

Utilisation captures whether food translates into nutrition outcomes and is shaped by diet quality, health and WASH conditions. The average utilisation score is 7.16, but this pillar also shows the widest spread (0.27–9.79), matching health and nutrition outcomes across countries. The supporting indicators illustrate this unevenness. Prevalence of undernourishment ranges from 2.4–51.3% and health system capacity varies sharply. Health expenditure per capita ranges from about US$56–12,474 and maternal health outcomes show similarly wide dispersion. Basic sanitation-related risks are highly skewed. The share of people practising open defecation is near 0 in many countries but increases to around 65% in some. These patterns help explain why utilisation can lag even where calories are available, because the limiting factor is often health, WASH conditions and the ability to convert food into nutrition.

Sustainability reflects whether food systems can withstand shocks and avoid repeated disruption over time. With an average score of 6.41, it is the weakest pillar in 62 countries, making it the second-most common binding constraint after availability. The supporting indicators show why sustainability is such a differentiating factor. Hazard exposure scores vary widely (0.5–9) and drought recurrence is also uneven (median 1, upper quartile 4.8, maximum 10). Conflict-related pressure is heavily concentrated: the median current conflict intensity score is 0, but in the most affected settings it reaches 10, and the probability of highly violent conflict ranges up to 1. Displacement is similarly skewed. In many countries, the number of internally displaced people is 0, but the maximum exceeds 9 million. These tail risks matter for food security because they can turn a moderate baseline position into acute instability when shocks hit repeatedly or when conflict and displacement disrupt markets and delivery systems.

Taken together, the analysis of the pillar profiles helps explain what is driving food insecurities across countries and regions.

2.3. FSI patterns and trends

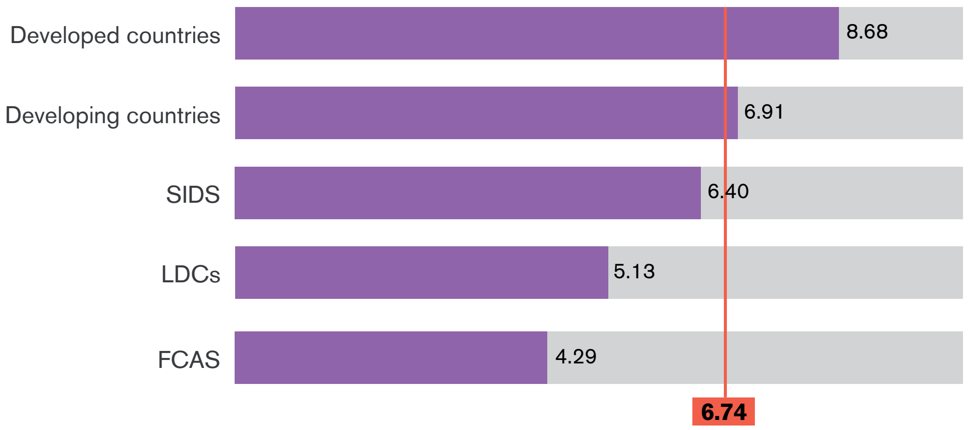
To understand where food insecurity is concentrated, we present the FSI results using three types of country grouping:

- **Development and vulnerability status:** including developed and developing countries as well as three structurally vulnerable groups — LDCs, as designated by the United Nations (UN), SIDS (a UN-recognised group of small island and low-lying coastal countries with high exposure and import dependence) and FCAS, where conflict and weaker institutions shape risk and recovery
- **Income:** using the World Bank country income categories — low-, lower-middle-, upper-middle- and high-income countries
- **Region:** to show how food security clusters geographically.

2.3.1 By development and vulnerability status

In Figure 5, we show how the overall FSI scores differ across countries in different development and vulnerability groups. At 8.68, developed countries have the highest average FSI score, followed by developing countries, at 6.91. With an average score of 6.40, SIDS are just below the global average of 6.74. LDCs and FCAS have the lowest scores, at 5.13 and 4.29, respectively. Well below the global average, this shows that food insecurity is concentrated in contexts where structural constraints and exposure to shocks overlap. While scoring slightly higher, SIDS are also below the global average, highlighting different types of vulnerability linked to structural exposure (small size, import dependence and high sensitivity to climate and external price shocks).

Figure 5. Average FSI scores, by development and vulnerability group

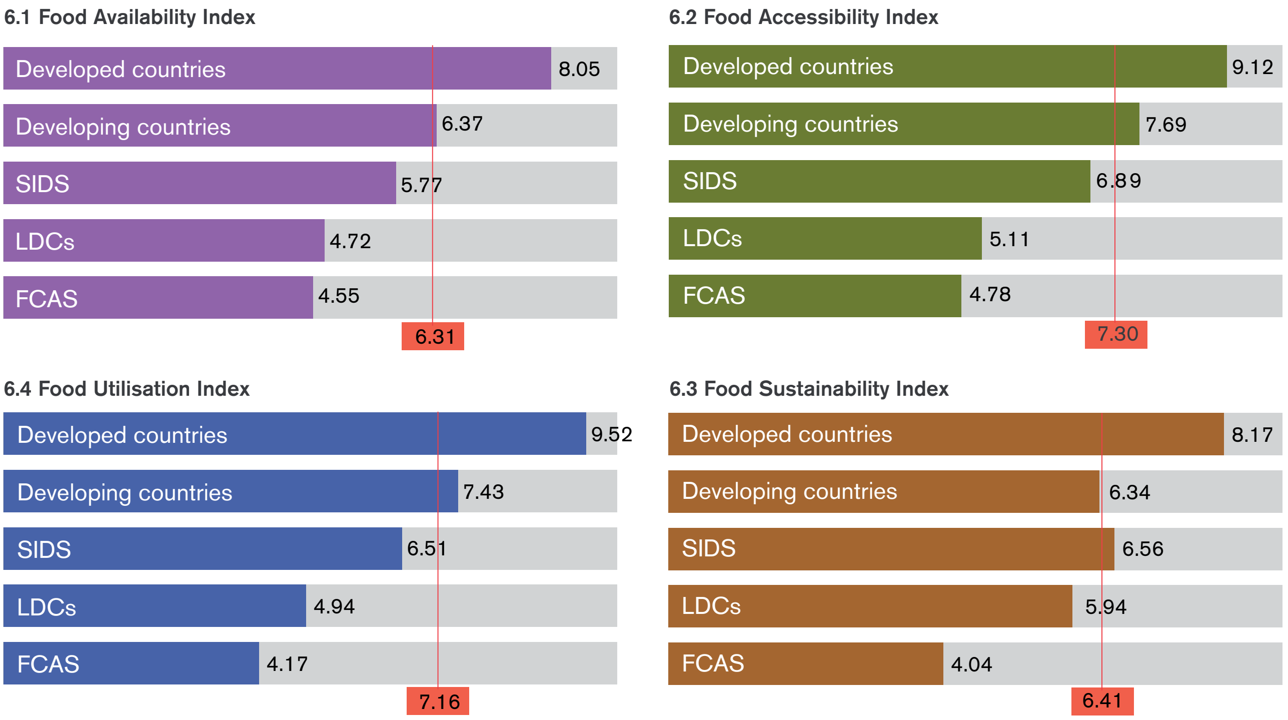


Note: the red lines in each figure mark the global averages.

Looking at the results by pillar (see Figure 6) helps explain what is driving this gap. Developed countries perform strongly across all four pillars: availability (8.05), access (9.12), utilisation (9.52) and sustainability (8.17). In FCAS, on the other hand, weaknesses are broad based, with scores low across all pillars: availability (4.55), access (4.78), utilisation (4.17) and sustainability (4.04). The pattern is similar for LDCs, where availability (4.72), access (5.11), utilisation (4.94) are also low, but sustainability is higher (5.94) than FCAS. This difference is important because it shows how fragility and conflict add another layer of disruption and risk on top of structural development constraints.

SIDS are between developing countries and LDCs across most pillars, but the pattern is worth flagging. Their availability score (5.77) is lower than the developing country average (6.37) and below the global benchmark (6.31). Their access (6.89) and utilisation (6.51) are also below developing country averages (7.69 and 7.43, respectively). At the same time, SIDS perform relatively better on sustainability (6.56), which is higher than both developing countries (6.34) and the global benchmark (6.41). This is consistent with what we see in practice. Many SIDS have relatively stable governance and institutions but their food systems remain structurally exposed because supply chains are narrow, import dependence is high and external shocks transmit quickly into volatile market prices and availability.

Figure 6. Average FSI scores across the four pillars, by development and vulnerability groups



The supporting indicators can help interpret these differences. On **access**, the gap tracks basic enabling conditions. Electricity access is close to universal in developed countries (100%), but averages around 65% in LDCs and 62% in FCAS. Internet use falls from about 92% in developed countries to 47% in LDCs and 39% in FCAS, and adult literacy drops from around 99% in developed countries to 71% in LDCs and 63% in FCAS (World Bank, no date-a). These constraints shape whether households can earn, trade and reach markets and services, especially during shocks.

On **utilisation**, the gaps reflect health, nutrition and WASH conditions. Maternal mortality per 100,000 is far higher in FCAS (402) and LDCs (311) compared with developed countries (8), while prevalence of undernourishment in FCAS (21%) and LDCs (19%) dwarfs developed countries (2%). Sanitation risks are also evident, with open defecation close to 0 in developed countries but averaging 16–18% in LDCs and FCAS. These differences help explain why utilisation remains weak even when food is present.

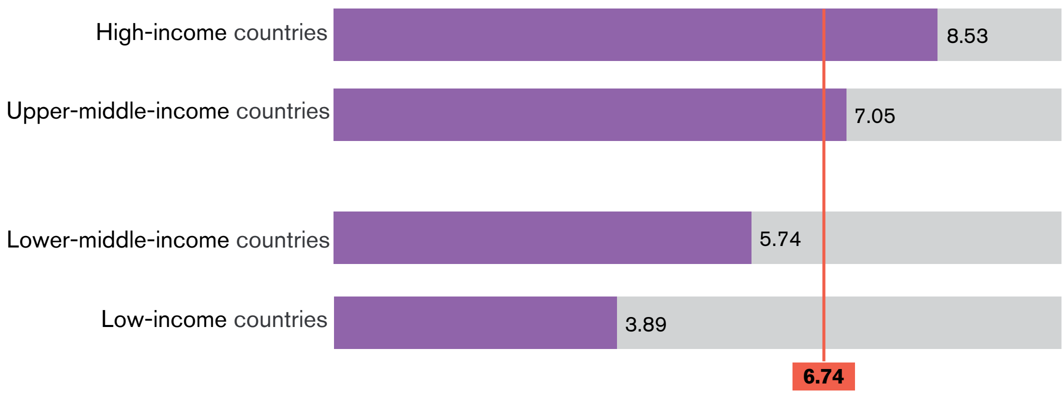
On **sustainability**, the FCAS present a different picture. Conflict intensity and displacement are much higher, and average displacement levels are in a different order of magnitude (around 1.37 million internally displaced people in FCAS compared with 20,000 in LDCs and 13,000 in developed countries). Sitting alongside higher drought frequency and higher recent shocks, this helps explain why FCAS scores are low across all indicators that shape markets, service delivery and coping capacity.

Production potential alone does not translate into **availability** in practice. Some vulnerable groups may not have the lowest production indices — for example, LDCs and FCAS have relatively high average food and crop production indices — but score poorly on availability because diets are less adequate and more exposed to disruption. Import dependence is also a stress point. The value of food imports relative to export earnings is far higher in FCAS (328%) than in LDCs (74%) or other developing countries (51%), making food supply and affordability much more sensitive to price spikes, exchange rate fluctuations and logistics disruption. Irrigation coverage is also far lower in FCAS (1.4% of arable land equipped for irrigation) than in other groups, reinforcing vulnerability to climate variability.

2.3.2 By income

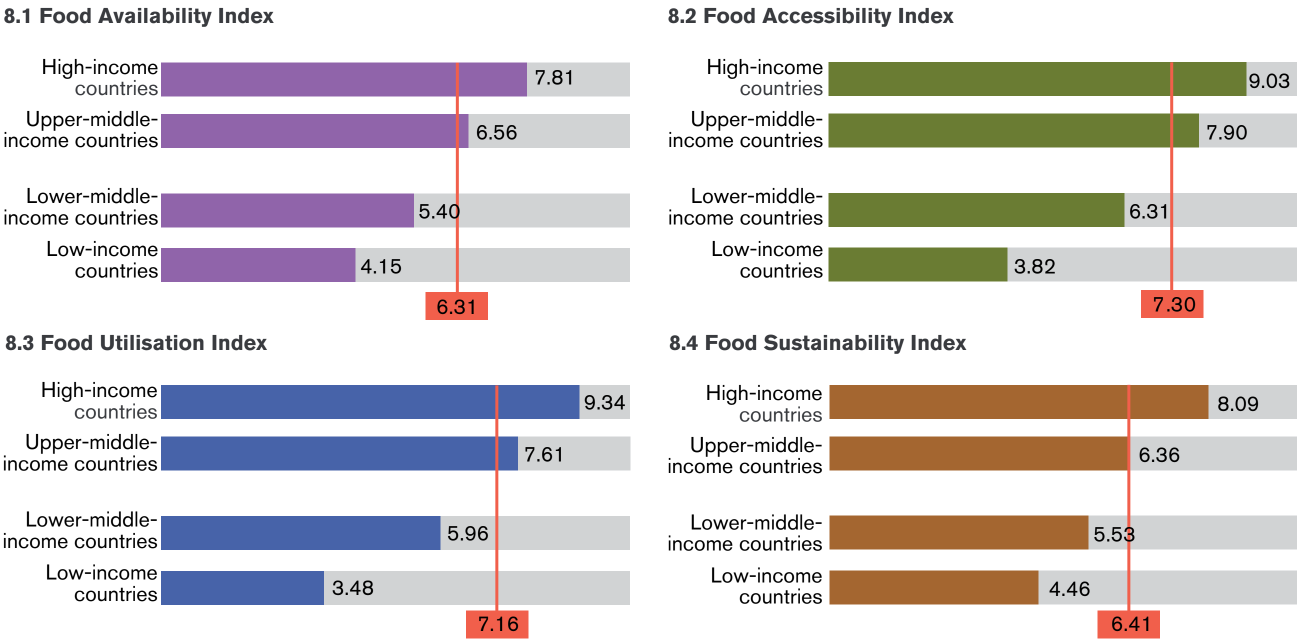
Presenting the FSI scores by income levels, Figure 7 shows an even wider difference across country income groups. Average FSI scores rise from 3.89 in low-income countries to 5.74 in lower-middle-income countries, 7.05 in upper-middle-income countries and 8.53 in high-income countries.

Figure 7. Average FSI scores, by country income group



Looking at the results by pillar (see Figure 8) shows that the largest jumps are in access and utilisation, where infrastructure, services and household purchasing power play a direct role. Between low- and high-income countries, access rises from 3.82 to 9.03, utilisation from 3.48 to 9.34, availability from 4.15 to 7.81 and sustainability from 4.46 to 8.09. The steepness of the jumps for access and utlisation suggest that sustainability is shaped not only by income, but also by hazard exposure, institutions and the ability to manage shock.

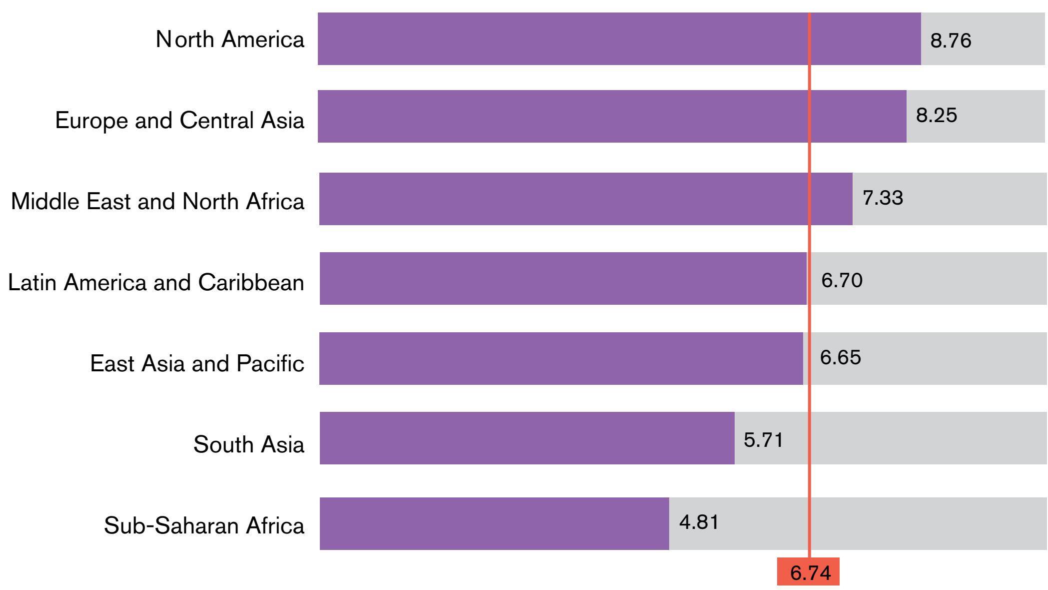
Figure 8. Average FSI scores across the four pillars, by country income group



2.3.3 By region

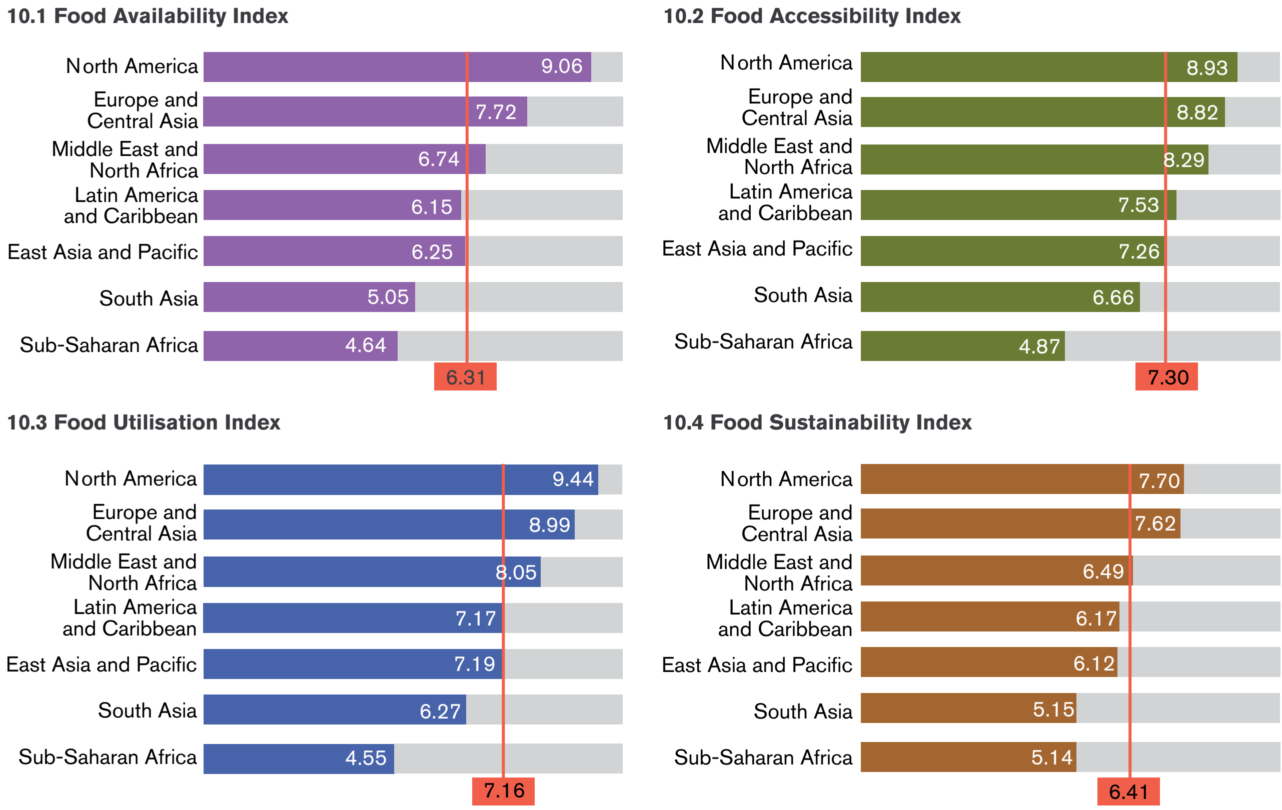
Figure 9 shows how FSI scores vary by region. North America and Europe and Central Asia have the highest average FSI scores, at 8.76 and 8.25, respectively, followed by the Middle East and North Africa (7.33). Latin America and the Caribbean (6.70) and East Asia and Pacific (6.65) are close to the global average of 6.74. The lowest regional averages are in South Asia (5.71) and sub-Saharan Africa (4.81).

Figure 9. Average FSI scores, by region



Looking at results by pillar (see Figure 10) helps explain these regional differences. Scores for sub-Saharan Africa are low across all four pillars (availability 4.64, access 4.87, utilisation 4.55, sustainability 5.14) and it has the lowest overall score. South Asia performs relatively better on access (6.66) and utilisation (6.27) but remains constrained on availability (5.05) and sustainability (5.15). Middle East and North Africa performs strongly on access (8.29) and utilisation (8.05) but is weaker on sustainability (6.49), which is consistent with the role that conflict risk and weak governance can play in shaping volatility.

Figure 10. Average FSI scores across the four pillars, by region

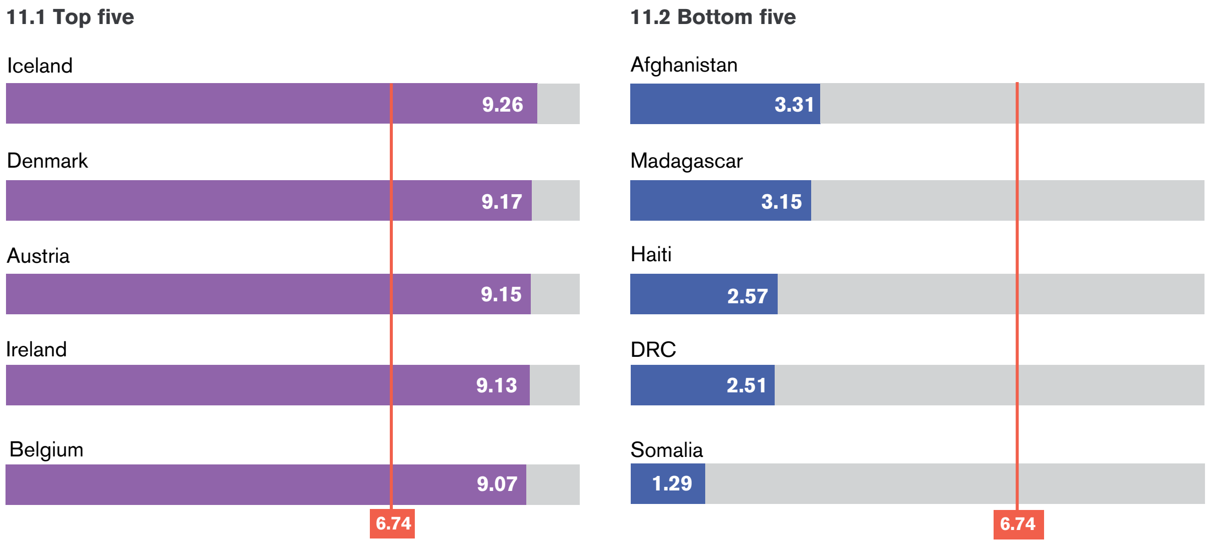


The patterns across pillars and country groups show that the baseline picture is not driven by a single constraint. In some contexts, the binding constraint is availability and diet adequacy. In others, it is affordability and market access, or stability and coping capacity. Presenting the baseline across both pillars and country groups helps show not only where food insecurity is concentrated, but what is driving the FSI scores.

2.4. Top and bottom performers

This section presents the overall top and bottom performers in the FSI to understand what being food secure looks like in practice and what tends to push countries into persistent food insecurity. This is not to imply that the top performers have no food insecurity or that the bottom performers are defined only by crisis. Rather, the comparison helps us pick out the enabling conditions that keep food systems functioning (availability, purchasing power, services and stability) and the kinds of constraint that tend to compound when those systems come under stress. Although this section only covers the overall FSI results, a full pillar-by-pillar breakdown is available in Appendix 2.

Figure 11. Global top- and bottom-performing countries in the FSI



In the overall ranking (see Figure 11), the top five performers are Iceland, Denmark, Austria, Ireland and Belgium. Along with higher incomes, the common characteristics across these countries are a combination of stable institutions, strong public services and the ability to absorb shocks without them translating quickly into household hunger. Denmark is a good example of resilience on the **availability** pillar. It has a large, export-oriented food and agriculture sector: in 2023, it exported around US$14.2 billion in consumer-oriented agricultural products, reflecting strong capacity in food production and processing as well as reliable market systems (USDA Foreign Agricultural Service, 2023). Across the other top performers, even when countries import a share of what they consume, high purchasing power, functioning logistics and strong safety nets reduce the likelihood that supply disruptions could translate into widespread food insecurity.

The pattern in the bottom five — Afghanistan, Madagascar, Haiti, Democratic Republic of Congo (DRC) and Somalia — is much more structural. Food insecurity in these countries is at the intersection of weak purchasing power, disrupted markets and services, repeated shocks and limited coping capacity. As well as facing food constraints, these countries are dealing with conflict and insecurity, displacement, fragile service delivery and high exposure to climate hazards, which together make availability and access fragile and expensive for households. Country-specific drivers also capture the nature of the constraints.

- Beyond conflict and climate shocks, a key structural issue in Somalia is its reliance on imports for basic staples, with around 90% of wheat imports sourced, for example, from Russia and Ukraine (FAO, 2022). This kind of dependency means that currency movements, shipping or logistics disruptions and international price spikes can translate very quickly into household hunger, especially in a context already shaped by insecurity and weak coping capacity. IPC analysis released in February 2025 projected that 4.4 million people (23% of the population) would face acute food insecurity by June 2025 (IPC, 2025b). This underscores how quickly households can be pushed into crisis when rainfall and prices move in the wrong direction.
- A combination of reduced purchasing power, constrained livelihoods and repeated shocks means that **Afghanistan** continues to be among the countries facing large-scale acute food insecurity, with approximately 15.8 million people affected. Food insecurity is closely tied to economic stress and climatic variability, particularly following the impacts of multi-year droughts and limited humanitarian funding (WFP and FAO, 2025).
- Food insecurity in Haiti is driven by a mix of import dependence, high prices and conflict that disrupts supply chains. In 2024, 5.41 million people were assessed to be in high levels of acute food insecurity and 2 million in emergency conditions; affordability pressure was extreme, with households spending up to 70% of their income on food (IPC, 2024). This signals extreme pressure on affordability even before considering the impact of violence on markets and transport.
- In the Democratic Republic of Congo, conflict and displacement are central to understanding persistent low performance. In 2023, there were around 6.9 million internally displaced people (IOM, 2023). At this scale, displacement and insecurity disrupts food systems by reducing agricultural output, increasing reliance on markets at a time when they are becoming less reliable and weakening both household coping options and humanitarian delivery.
- Madagascar's low FSI score can be attributed to repeated climate shocks and long-standing development constraints that affect rural livelihoods and nutrition outcomes. In practice, this tends to show up through high sensitivity of food production to rainfall variability and prolonged shocks translating into undernutrition and reduced dietary quality over time, particularly in already poor areas.

The following sections analyse the top and bottom performers across the three types of country grouping to show how the drivers of stronger or weaker food security outcomes vary by context.

2.4.1 By development and vulnerability status

Figures 12 and 13 show the top and bottom five countries within the development and vulnerability group, with the global average line (6.74) as a reference point. This reference is important because it shows how wide the spread is within each category and what better performance looks like in practice, even when countries face very different structural constraints. Although this section only covers the overall FSI results, a full pillar-by-pillar breakdown is available in Appendix 2.

Figure 12. Top five countries, by development and vulnerability group

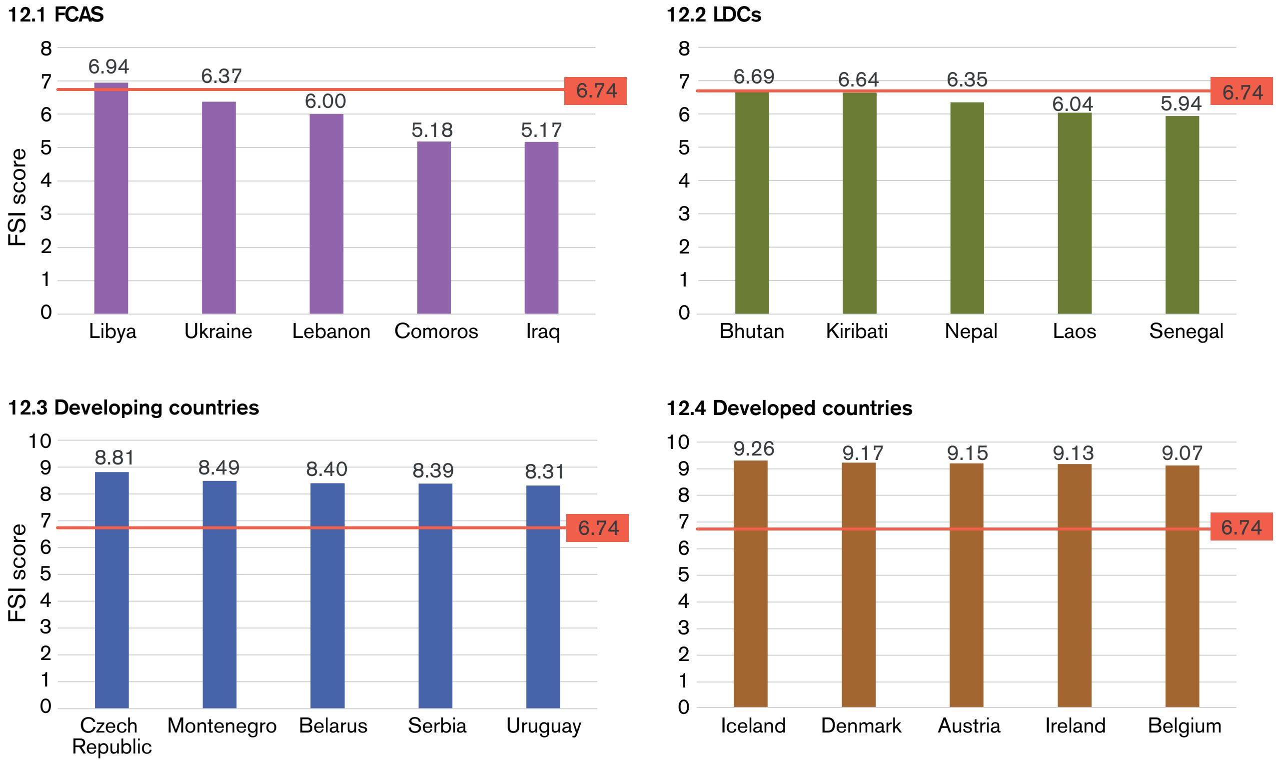
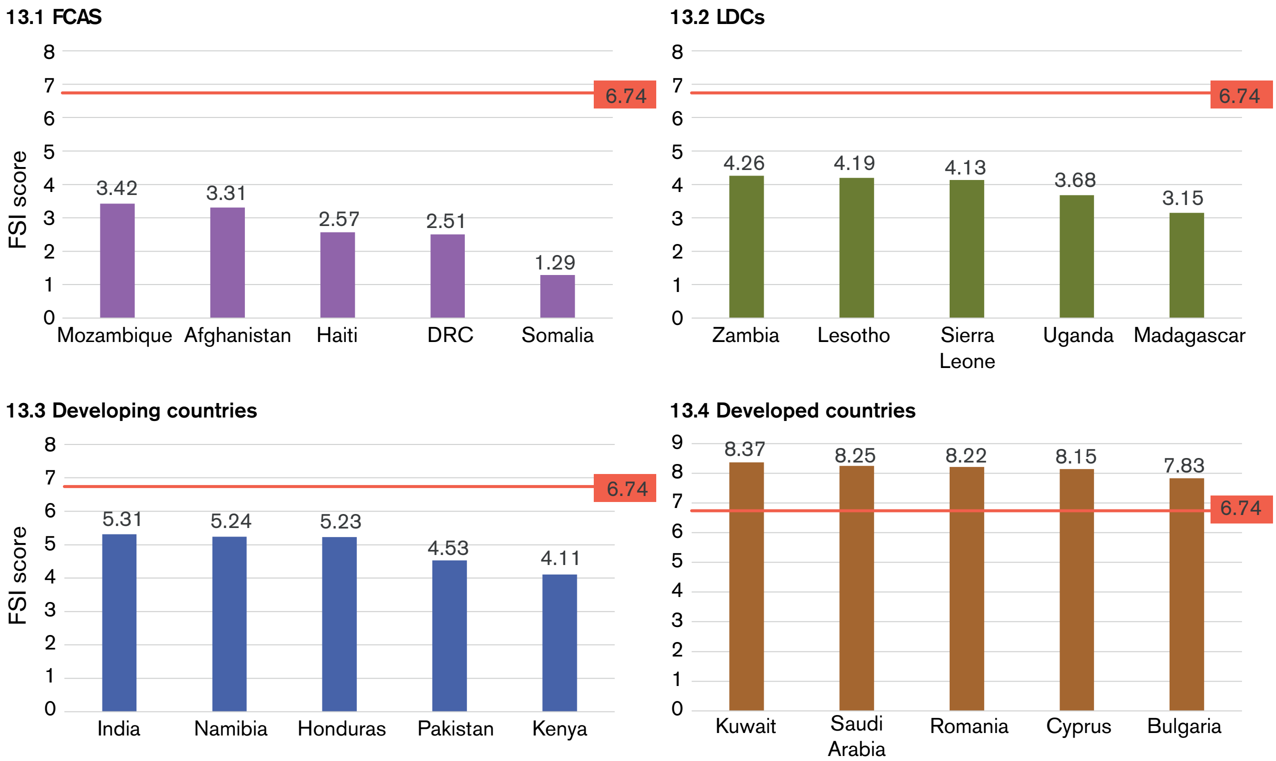


Figure 13. Bottom five countries, by development and vulnerability group



FCAS: for FCAS, the spread is wide and the bottom tail is the most severe. The top five FCAS performers (see Figure 12.1) are Libya (6.94), Ukraine (6.37), Lebanon (6.00), Comoros (5.18) and Iraq (5.17). In many FCAS contexts, better performance often reflects baseline capacity (including pre-crisis service reach and purchasing power) rather than absence of risk; and those conditions can deteriorate quickly if conflict escalates, markets fragment or currencies collapse.

The bottom five FCAS performers (see Figure 13.1) are Mozambique (3.42), Afghanistan (3.31), Haiti (2.57), Democratic Republic of Congo (2.51) and Somalia (1.29). In all of these countries, insecurity and weak systems intersect with climate hazards and economic stress, creating repeated food crises.

LDCs: within LDCs, the top five (see Figure 12.2) — Bhutan (6.69), Kiribati (6.64), Nepal (6.35), Laos (6.04) and Senegal (5.94) — are not 'food secure' in the same way developed countries are. But they show that, even with structural constraints, some LDCs perform closer to the global average by strengthening basic services and reducing the most severe health and nutrition outcomes over time.

At the same time, these better scores can mask high structural exposure. Kiribati is a good example. As a small island country, it is heavily dependent on imported staple foods and faces high costs of living. Households here can spend around 46% of their income on food (KNSO et al., 2021), underlining how quickly food security can deteriorate when prices rise or shipping is disrupted.

The bottom five LDC performers (see Figure 13.2) — Zambia (4.26), Lesotho (4.19), Sierra Leone (4.13), Uganda (3.68) and Madagascar (3.15) — illustrate how outcomes deteriorate when chronic deficits combine with repeated shocks. For example, a prolonged drought in the south of Madagascar (described as the worst in decades) resulted in over 1 million people facing high levels of acute food insecurity and very large child malnutrition burdens (IPC, 2021b).

SIDS: SIDS are slightly below the global average in aggregate (see Figure 5), but the more important point is the type of exposure. Their small production bases, high import dependence and vulnerability to external shocks (such as shipping disruption, price volatility or storms) create different types of vulnerability compared with other country groups. This means SIDS can sometimes look as though they are performing fine on day-to-day access and services, but can tip quickly when supply chains or tourism earnings are disrupted.

Developing countries: in the developing countries group (see Figure 12.3), the top five are Czech Republic (8.81), Montenegro (8.49), Belarus (8.40), Serbia (8.39) and Uruguay (8.31). These are countries that sit below the developed category, but tend to have strong everyday fundamentals, such as functioning markets, relatively broad service access and (in some cases) strong domestic production or export earnings that support food availability and affordability.

The bottom five in this group (see Figure 13.3) are India (5.31), Namibia (5.24), Honduras (5.23), Pakistan (4.53) and Kenya (4.11). They show how lower performance is often due to compounding pressures, such as persistent poverty and inequality, which mean that nutrition burdens do not fall quickly and repeated climate or economic shocks keep pushing households back into food stress.

Developed countries: in the developed country group (see Figure 12.4), the top performers are Iceland (9.26), Denmark (9.17), Austria (9.15), Ireland (9.13) and Belgium (9.07). This is due to a combination of strong baseline development outcomes, near-universal basic services and institutions that keep markets, safety nets and systems working even when there is stress.

It is important to note that the FSI scores of the bottom five developed countries — Kuwait (8.37), Saudi Arabia (8.25), Romania (8.22), Cyprus (8.15) and Bulgaria (7.83) — are still high (see Figure 13.4). In these countries, the issue is rarely about availability in the absolute sense; it is more about what kind of vulnerability remains even in high-income settings, particularly dependence on external supply and exposure to global price or logistics volatility, alongside affordability pressures and uneven access for some population groups. For example, Saudi Arabia imports around 80% of its food, reflecting structural production constraints in arid environments and the importance of stable trade and logistics (World Bank, 2024b; USDA Foreign Agricultural Service, 2025).

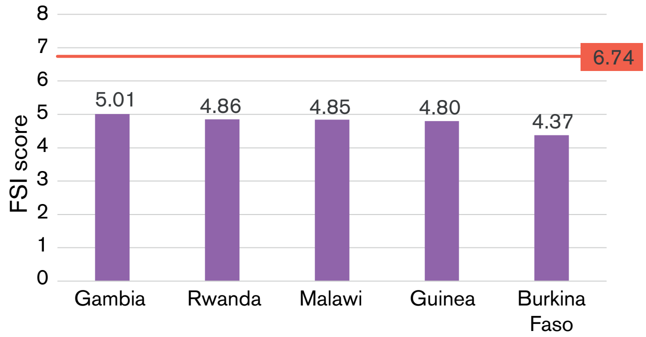
Across these groups, the patterns show that the better performers tend to be countries where basic systems keep working and households have some buffer, in the form of income, functioning markets, services or safety nets. The worst performers are typically those where multiple risks overlap, so that shocks translate quickly into lost livelihoods, high prices, disrupted markets and worsening nutrition, especially where conflict and displacement compound the issue.

2.4.2 By income

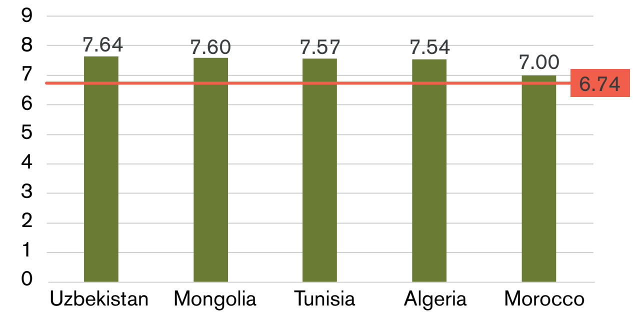
Figures 14 and 15 show the top and bottom five countries within each of the World Bank country income categories. This understanding is helpful because it separates the income effect (purchasing power, infrastructure and services) from the other forces that still shape food security, such as conflict, climate stress and import dependence. Although this section only covers the overall FSI results, a full pillar-by-pillar breakdown is available in Appendix 2.

Figure 14. Top five countries, by income group

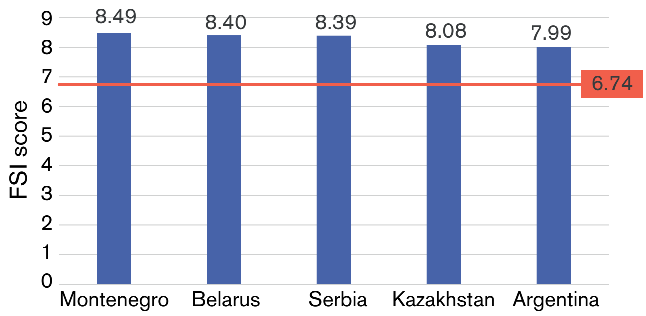
14.1 Low-income countries



14.2 Lower-middle-income countries



14.3 Upper-middle-income countries



14.4 High-income countries

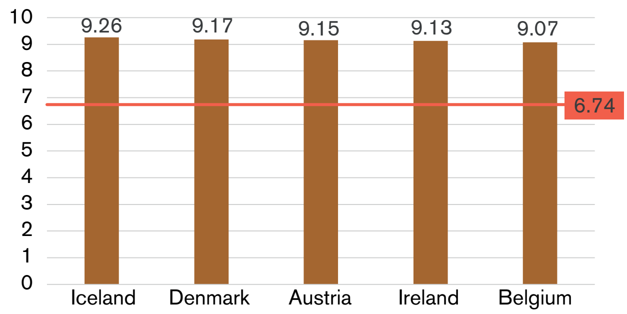
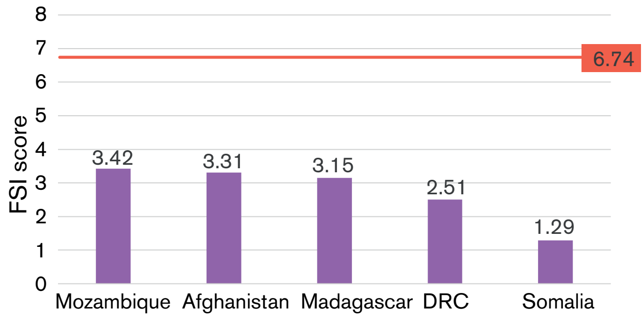
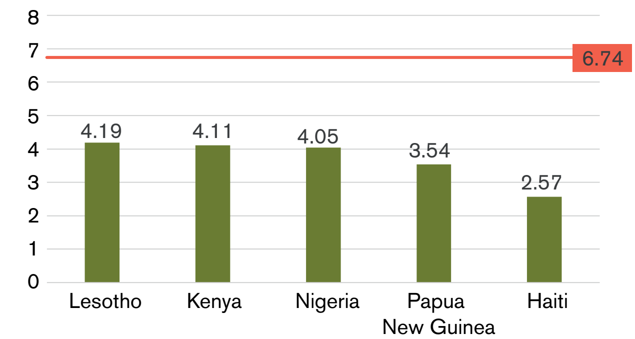


Figure 15. Bottom five countries, by income group

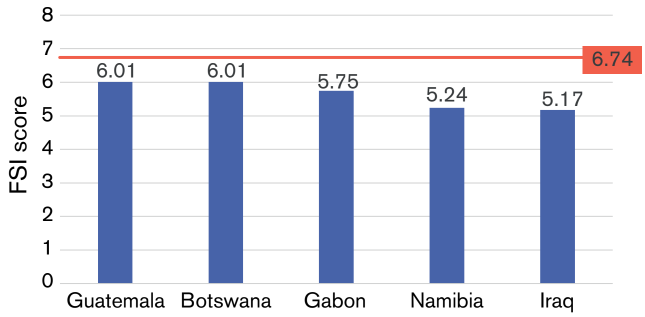
15.1 Low-income countries



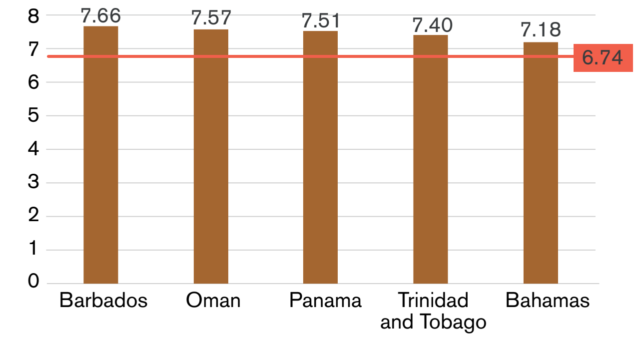
15.2 Lower-middle-income countries



15.3 Upper-middle-income countries



15.4 High-income countries



The top five high-income countries are the same as the top performers in the developed country group, while most of the bottom five low-income countries overlap with the weakest FCAS performers (see Section 2.4.1). Where this income lens adds value is in the lower-middle- and upper-middle-income country groups, where countries can appear similar on income, but diverge sharply on food security outcomes.

Low-income countries: the top five low-income countries (see Figure 14.1) are the Gambia (5.01), Rwanda (4.86), Malawi (4.85), Guinea (4.80) and Burkina Faso (4.37). Even the better performers in this category are well below the global average of 6.74, showing that low-income status comes with structural limits that are difficult to fully offset. Still, the gap between the top and bottom is meaningful. In the underlying dataset used for this index, the top five low-income countries average around 19.5% for prevalence of undernourishment, compared with 36.6% in the bottom five and their average internet use is also higher (29% vs 16%), which tends to track market access, information access and household resilience.

The bottom five low-income countries (see Figure 15.1) — Mozambique (3.42), Afghanistan (3.31), Madagascar (3.15), Democratic Republic of Congo (2.51) and Somalia (1.29) — are contexts where income constraints are compounded by conflict or insecurity and repeated climate shocks, which is why there is overlap with the FCAS and LDCs discussed in Section 2.4.1. What stands out is how often import dependence and disrupted markets appear alongside fragility. Somalia is a clear example, where high dependence on wheat imports translates into low domestic availability and price stress for communities.

Lower-middle-income countries: the top five lower-middle-income-countries — Uzbekistan (7.64), Mongolia (7.60), Tunisia (7.57), Algeria (7.54), and Morocco (7) — are all above the global average (see Figure 14.2) but arrive to this point along different pathways. In the underlying dataset, these countries all have very low average undernourishment (3.5%) and strong basic access conditions (electricity access is close to universal across this group), which helps explain why their overall scores sit well above other lower-middle-income peers. At the same time, several of these countries, especially in North Africa, remain structurally exposed through cereal import needs — for example, Morocco imports about 6.3 million tonnes of wheat (2024/25) and Algeria, around 9 million tonnes (USDA Foreign Agricultural Service, 2024). This shows that a high FSI score does not mean low exposure, particularly when global price fluctuates or shipping disruptions hit.

In the bottom five lower-middle-income-countries (see Figure 15.2) — Lesotho (4.19), Kenya (4.11), Nigeria (4.05), Papua New Guinea (3.54) and Haiti (2.57) — constraints are shaped by compounding pressures, such as high poverty and inequality, climate stress and in several cases, insecurity and market disruption. Kenya is a useful example of how climate shocks can quickly overwhelm coping capacity: during the 2023 drought, around 5.4 million people faced a 'crisis or worse' situation (IPC, 2023) showing how household food access can deteriorate when drought conditions persist.

Upper-middle-income countries: the top five upper-middle-income-countries — Montenegro (8.49), Belarus (8.40), Serbia (8.39), Kazakhstan (8.08) and Argentina (7.99) — sit in a different band (see Figure 14.3). This group combines relatively strong service coverage and human development profiles, with countries like Kazakhstan and Argentina showing stronger production and export potential that supports domestic availability and foreign exchange. In the underlying dataset, this top five group has very low average undernourishment (2.6%) and under-five mortality (6 per 1,000), which is consistent with stronger utilisation outcomes and more stable access.

The bottom five upper-middle-income countries — Guatemala (6.01), Botswana (6.01), Gabon (5.75), Namibia (5.24) and Iraq (5.17) — show how income status does not fully protect against food insecurity pressures (see Figure 15.3). The spread here is smaller than in low-income groups, but the underlying conditions differ. This group has much higher average undernourishment (19%) and under-five mortality (32 per 1,000) than the top five, pointing to lingering nutrition and health burdens even where average incomes are higher. Iraq also appears in the FCAS group, reinforcing the point that fragility and instability can depress outcomes even at upper-middle-income levels.

High-income countries: in the high-income group, the top five (see Figure 14.4) — Iceland (9.26), Denmark (9.17), Austria (9.15), Ireland (9.13), and Belgium (9.07) — are the same countries highlighted under the developed group (see Figure 12.4). The bottom five high-income countries (Barbados (7.66), Oman (7.57), Panama (7.51), Trinidad and Tobago (7.40) and Bahamas (7.18) — are still above the global average but serve as a useful reminder that high income does not remove structural exposure. Many of these countries are SIDS, where the issue is less about absolute scarcity and more about import dependence, small domestic production bases and price sensitivity. Barbados, for example, imports around 80–87% of the food it consumes (OECD and IDB, 2024), which can translate into affordability and stability risks when global prices rise or supply chains are disrupted.

Across the four income categories, our assessment of the outliers explains how food security goes beyond affordability. The lowest performers are typically countries where income constraints are reinforced by conflict or insecurity and repeated shocks, while several middle-income cases show that import exposure and affordability pressures can drive weaker outcomes even when income improves. The pillar-by-pillar breakdown (see Appendix 2) can help further unpack where those pressures show up most strongly in the index.

2.4.3 By region

Figures 16 and 17 show the top and bottom five countries within each region. This can help us understand where food security outcomes are clustered geographically and how much variation sits within the same region. It also helps avoid overgeneralising, as some regions have a strong ceiling, with many countries above the global average, while others have a long tail, with multiple countries sitting far below the global average. As with other country groups, we have only presented the overall FSI scores here. A pillar-by-pillar breakdown is available in Appendix 2.

Figure 16. Top five countries, by region

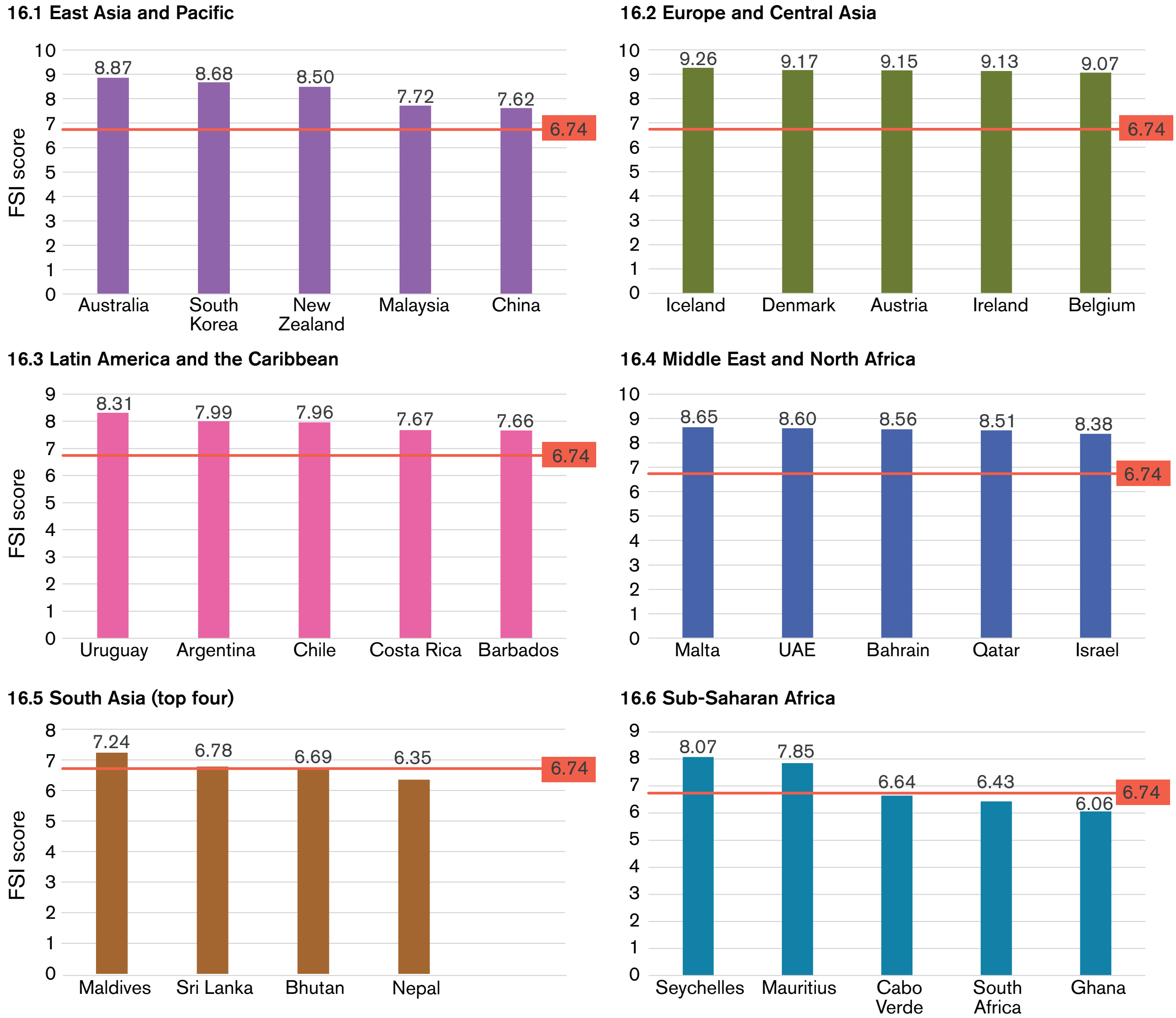
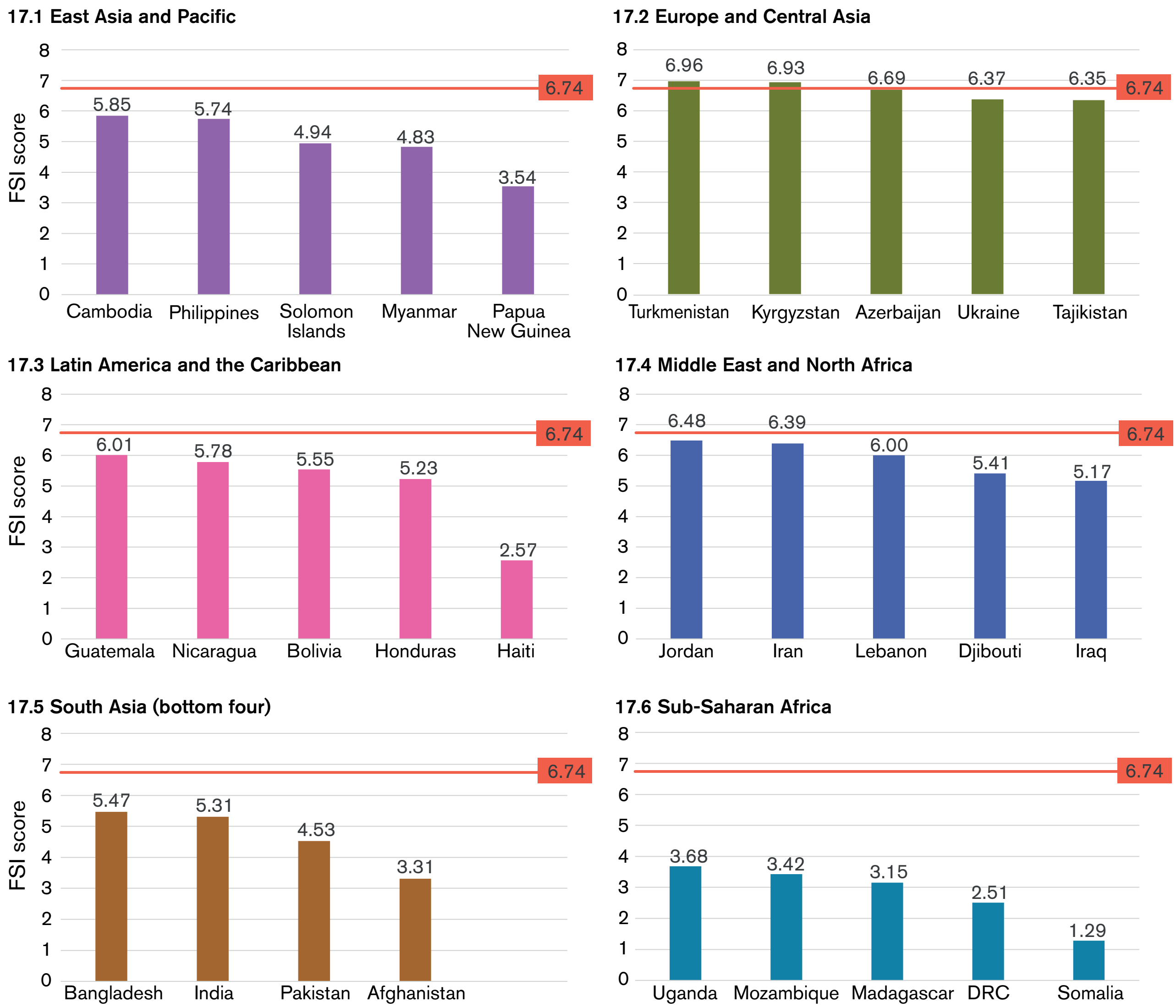


Figure 17. Bottom five countries, by region



East Asia and Pacific: in this region, there is a clear split between high-performing economies and a bottom group where nutrition and resilience constraints are more visible. The top five (see Figure 16.1) — Australia (8.87), South Korea (8.68), New Zealand (8.50), Malaysia (7.72) and China (7.62) — are comfortably above the global average. In broad terms, these countries combine stronger purchasing power, higher service coverage and (for several) a stronger domestic production and logistics base that helps keep food systems stable even when global markets tighten.

In the bottom five (see Figure 17.1) — Cambodia (5.85), Philippines (5.74), Solomon Islands (4.94), Myanmar (4.83) and Papua New Guinea (3.54) — the pattern is guided by constraints such as higher poverty and vulnerability, pockets of persistent malnutrition and greater exposure to shocks, including climate events and, in Myanmar's case, conflict-related disruption. Papua New Guinea stands out because its score is not just below the regional average but far below the global line, which is consistent with SIDS contexts, where geography, service gaps and fragility in delivery systems can combine to keep food security uneven even when food is available in the country.

Europe and Central Asia: the top five countries (see Figure 16.2) — Iceland (9.26), Denmark (9.17), Austria (9.15), Ireland (9.13) and Belgium (9.07) — are the ones that sit at the top of the global FSI distribution (see Figure 11). This is driven by strong baseline conditions, including high basic service coverage, strong institutions and systems that keep functioning under stress.

At the other end (see Figure 17.2), the bottom five — Turkmenistan (6.96), Kyrgyzstan (6.93), Azerbaijan (6.69), Ukraine (6.37) and Tajikistan (6.35) — are mostly close to the global average line (6.74). So, it is less about extreme scarcity and more about why some countries cannot translate national-level capacity into consistent food security outcomes. In several cases, this reflects a mix of affordability constraints, governance and market functioning issues, and for Ukraine, the sharp disruption associated with war. This also explains why Ukraine can show up among the higher performers within FCAS yet still sit towards the lower end within its region: its baseline capacity is higher than many FCAS, but the shock is severe.

Latin America and the Caribbean: the top five (see Figure 16.3) — Uruguay (8.31), Argentina (7.99), Chile (7.96), Costa Rica (7.67) and Barbados (7.66) — are all above the global average. This group has a mix of relatively strong agricultural production capacity (particularly Uruguay and Argentina), stable service access (Chile and Costa Rica) and comparatively stronger institutions and social systems for the region.

The bottom five (see Figure 17.3) — Guatemala (6.01), Nicaragua (5.78), Bolivia (5.55), Honduras (5.23) and Haiti (2.57) — have a completely different set of issues guiding their position. Haiti is also a consistent bottom performer across the other classifications (FCAS and lower-middle-income countries). The scores of the other bottom performers (Guatemala, Nicaragua, Bolivia and Honduras), although not as low as Haiti's, are still below the global average, which is consistent with a cluster of challenges around poverty, inequality, exposure to storms or drought in parts of Central America and nutrition outcomes that can remain stubborn even where national averages look mid-range.

Middle East and North Africa: in this region, import dependence and water availability constraints are critical, even in high-income settings, and political instability can quickly translate into price and access volatility. The top five (see Figure 16.4) — Malta (8.65), United Arab Emirates (UAE) (8.60), Bahrain (8.56), Qatar (8.51) and Israel (8.38) — are all well above the global average, reflecting stronger purchasing power and service access, alongside the ability (in most cases) to buffer domestic markets through imports and fiscal space.

The bottom five (see Figure 17.4) — Jordan (6.48), Iran (6.39), Lebanon (6), Djibouti (5.41) and Iraq (5.17) — highlight the weak points of this region. Lebanon is an example of how macroeconomic collapse can translate directly into food insecurity: during the 2023/24 crisis, food price inflation was extremely high and there was a sharp rise in poverty (World Bank, 2024a). Djibouti has a very high reliance on imported food and persistent nutrition stress; it imports around 90% of its food, which makes availability and affordability highly sensitive to global prices, shipping and foreign exchange constraints, and serious acute malnutrition is an ongoing concern (WFP, 2024). Iraq's appearance in the FCAS group (see Figure 12.1) and in the bottom five in the region reinforces the point that fragility and conflict-related risks can keep countries below the regional average even when they have natural resource wealth.

South Asia: South Asia's chart is shaped by its smaller number of countries, so we have focused on the top and bottom four in this region. The top performers (see Figure 16.5) are Maldives (7.24), Sri Lanka (6.78), Bhutan (6.69) and Nepal (6.35). Bhutan and Nepal also appear as strong performers in the LDC group, which is consistent with progress on basic services and human development relative to the LDC baseline.

The bottom performers (see Figure 17.5) — Bangladesh (5.47), India (5.31), Pakistan (4.53) and Afghanistan (3.31) — are all below the global average, with Afghanistan in the most severe position. Afghanistan also appears repeatedly in the bottom groups elsewhere (see Figures 13 and 15), and nutrition stress is deep, particularly for young children. Nearly 3.7 million children under five are projected to suffer from acute malnutrition through 2026, including 942,000 cases of severe acute malnutrition (IPC, 2025a). An important point here is scale. Because India, Pakistan and Bangladesh have very large populations, even mid-range index scores can translate into very large absolute numbers of people who are nutritionally vulnerable or pushed into food stress during shocks.

Sub-Saharan Africa: this region has the sharpest contrast between a small set of higher performers and a deep bottom tail. Three of the top five (see Figure 16.5) — Seychelles (8.07), Mauritius (7.85), Cabo Verde (6.64), South Africa (6.43) and Ghana (6.06) — are SIDS. Cabo Verde is a useful reminder that import dependence does not automatically produce low food security outcomes: despite importing around 80% of its food, it can still perform around (or above) the global average because its services, logistics and access systems function more reliably.

The bottom five countries in the region (see Figure 17.5) — Uganda (3.68), Mozambique (3.42), Madagascar (3.15), Democratic Republic of Congo (2.51) and Somalia (1.29) — also appear in the bottom five across the other country classifications (see Figures 13 and 15). This is a clear case of compounding risks with conflict and displacement, repeated climate shocks, weak delivery systems and limited fiscal space to absorb price spikes.

Two things stand out when we place the regional results next to the earlier country groups. First, the consistent top performers are concentrated in regions where high income and strong systems are common (especially Europe and Central Asia) and they remain top performers no matter how we regroup the data. Second, the consistent bottom performers are heavily concentrated in both regional and FCAS contexts, and show up repeatedly because the same risks keep compounding: insecurity, displacement, repeated shocks, weak institutions and limited buffers. So, the regional lens strengthens the outlook presented by other country groups. It tells us where food insecurity is clustering geographically and helps show how much of the global pattern is driven by a relatively small number of countries stuck in a cycle of repeated crises, with many appearing multiple times across the different classifications.

3

Food insecurity in a warming world

Climate change directly affects all four pillars of food security. Increasing temperatures, erratic rainfall and more frequent extreme weather — such as droughts, floods and storms — disrupt crop yields, reduce livestock productivity and deplete fish stocks, making food less **available**. Price rises, combined with climate-damaged infrastructure and social inequalities, make food less **accessible**. Climate-induced health issues and food safety concerns compromise the effectiveness of food **utilisation**, and fluctuating food supplies and incomes undermine the **sustainability** of food systems.

In this section, we move from what food security looks like today to what is shaping it and, in particular, how climate shocks interact with economic conditions to either protect or erode food security. This is important because climate risk no longer creates occasional disruptions that countries can bounce back from quickly. Rather, it puts more frequent stress on crops, livestock, water, transport and prices, with those pressures landing hardest where incomes are low, markets are thin and public systems struggle to respond quickly.

We have presented our analysis of how climate impacts availability (production and supply), access (purchasing power and prices), utilisation (nutrition and health) and sustainability (the ability to absorb shocks without sliding into crisis). We now use this analysis to test the strength of these relationships before interpreting what it implies for future risk, including the way rising hazard frequency and intensity can compound existing vulnerabilities and make food insecurity more persistent.

3.1. Economic resilience, climate risks and food security

Climate impacts already affect livelihoods and food systems in ways that directly weaken food access and nutrition, and these pressures rise quickly as warming increases. Climate change could push more than 100 million people into poverty by 2030, largely through impacts on agriculture, health and labour productivity — pathways that can directly influence food insecurity (Hallegatte et al., 2016). Heat stress is another impact pathway and productivity losses could reach the equivalent of around 80 million full time jobs by 2030 (ILO, 2019), with the highest impacts in regions where work is more exposed to climate-sensitive sectors and adaptive capacity is low. Climate change already contributes to food and nutrition impacts in many regions, and risks will escalate as warming increases (Bezner Kerr et al., 2022).

In this section, we present our analysis on the extent to which income (as a proxy for economic resilience) helps countries sustain food security and how much climate risk brings it down. This analysis is important because two countries can have very similar overall FSI levels for different reasons. One may be constrained mainly by low purchasing power and weak services, while another may be doing fine today but could be highly exposed to climate shocks, which can quickly destabilise availability and access. To make that distinction clearer, we have used a cross-country regression approach that provides the direction and strength of the relationship between economic capacity, climate risk and food security outcomes (see Box 2 and Appendix 1 for details on methodology).

Box 2. Assessing how GDP and climate risk affect food security

After constructing the FSI for 162 countries, both overall and by pillar, we used a cross-country regression approach to examine how food security outcomes are associated with economic conditions and climate risk. Our purpose was not to establish that GDP or climate risk can explain everything, but to understand whether the relationship is strong and consistent enough to help interpret patterns in the index and guide the discussion on vulnerability.

For each pillar and the overall FSI, we estimated a separate regression using GDP per capita and the Climate Risk Index (CRI) as explanatory variables. We estimated the models using ordinary least squares on a cross-sectional dataset (one observation per country), using the same independent variables across all five models so results remain comparable across the pillars. The GDP coefficient provides a simple way of interpreting the extent to which higher income levels are associated with stronger food security outcomes, while the climate risk coefficient captures the average direction and magnitude of association between climate risk exposure and food security performance, holding GDP constant.

We used standard goodness of fit and significance tests (including the F-statistic and R^2) to assess model performance and standard t-tests to assess coefficient significance. We then used the regression results to project future food security under warming scenarios.

To illustrate what different warming pathways could mean for food security outcomes, we used scenario-specific CRI values consistent with 1.5°C, 2°C and 4°C warming. We then adjusted each country's observed overall FSI score (and pillar scores) using the estimated marginal effect of climate risk from the regression. This is a partial effect approach that keeps non-climatic characteristics constant, so the projections isolate the climate risk channel.

In practice, this means we:

- Start from each country's observed index score (baseline)
- Calculate the change in CRI between the baseline and each warming scenario
- Apply the estimated CRI coefficient to adjust the baseline score under each scenario
- Bound projected values to stay within the index range (0–10).

The scenario results should be read as illustrations of how food security could shift as climate risk increases, rather than precise forecasts. Full model specification, diagnostics and the projection formula are available in Appendix 1.

3.2. Analysis by pillar

In this section, we present a pillar-by-pillar analysis, as the overall FSI score can obscure underlying weaknesses. Running the regression separately for availability, access, utilisation and sustainability helps us see where climate risk and economic capacity have stronger influence and where they matter less. We also use the regression relationships to explore how different warming pathways (1.5°C, 2°C and 4°C) could shift each pillar in practice. Figures 18 and 19 show how the overall FSI scores and results by pillar shift under different warming scenarios.

Figure 18. Average overall FSI scores and scores by pillar, under different warming pathways

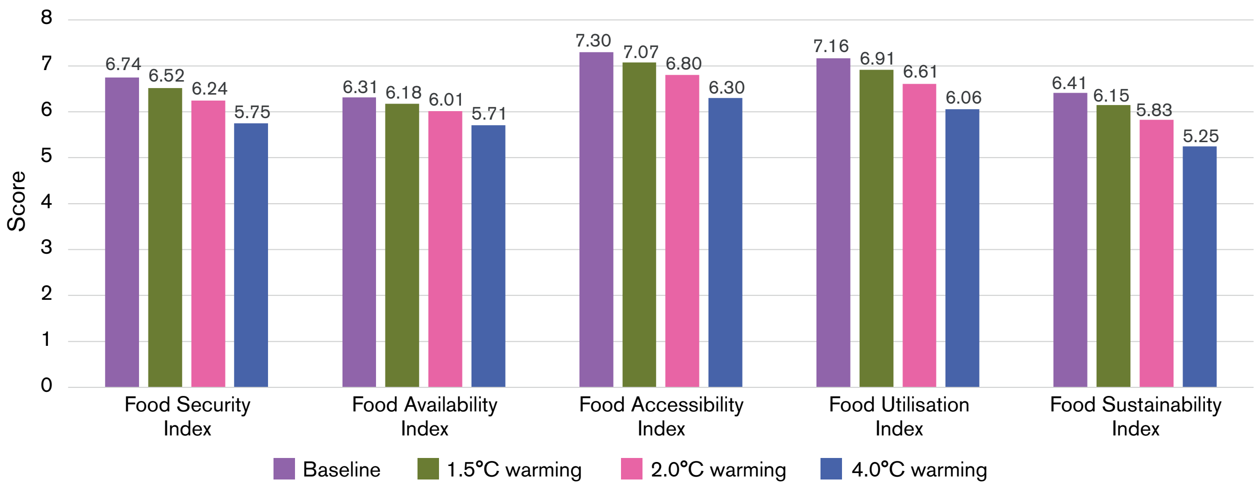
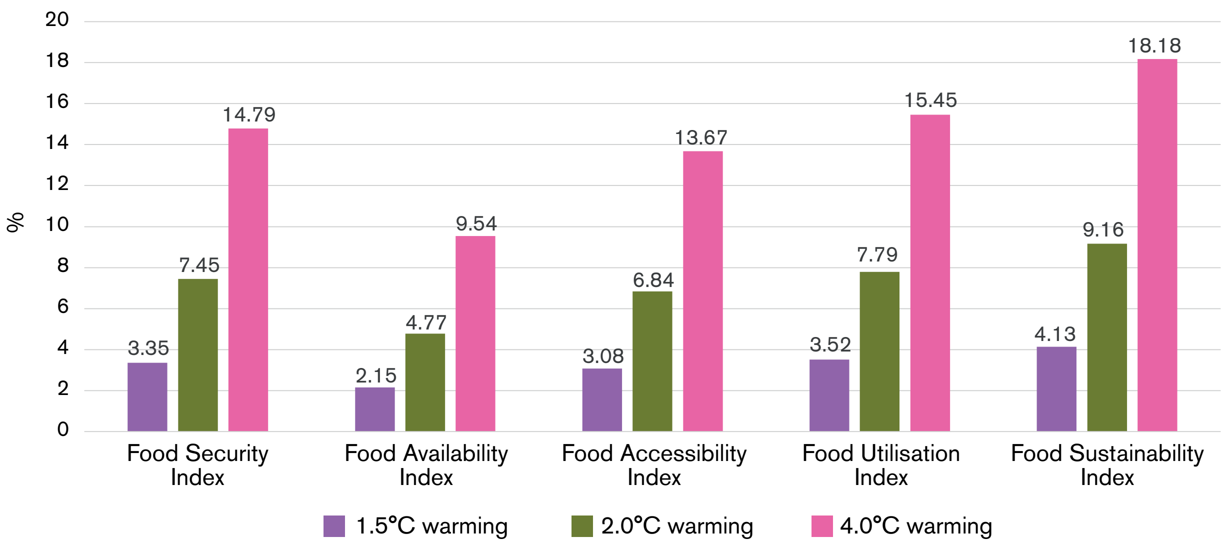


Figure 19. Percentage change in overall FSI scores and scores by pillar, under different warming pathways



3.2.1 Availability

The regression results show that climate risks pull the availability score down, while higher income levels lift it up. The results show that a 1 point increase in CRI is associated with around a 0.43 point reduction in the food availability score.[1] At the same time, each additional US$1,000 of GDP per capita is associated with roughly a 0.26 point increase in the availability score. In other words, both factors matter, but in opposite directions. In this model, GDP and climate risk together explain just over half of the cross-country variation in availability ($R^2 = 0.53$).

The interpretation means that drought, floods and heat extremes can directly reduce yields, damage livestock systems and interrupt harvesting and distribution. Climate change has already reduced food security and slowed the growth of agricultural productivity over recent decades, with negative impacts concentrated in mid- and low-latitude regions, so climate-related extremes are already exposing millions of people to acute food insecurity (IPCC, 2023).

The warming scenarios help translate this regression relationship into a more tangible picture of what would happen if temperatures keep rising. In Figure 18, the global average Food Availability Index falls from 6.31 (base) to 6.18, 6.01 and 5.71 at 1.5°C, 2°C and 4°C, respectively. Figure 19 shows the same pattern in percentage terms, where availability declines by about 2.15%, 4.77% and 9.54% at 1.5°C, 2°C and 4°C, respectively, relative to the base. This shows that availability does not collapse immediately; rather, it deteriorates steadily and cumulatively as warming increases.

This is consistent with what we see in global evidence on climate and agricultural production. Cross-country estimates show systematic yield deterioration as temperatures rise, with wheat yields in particular declining by around 6% per 1°C of warming in global analyses and similar effects reported for other major crops (Zhao et al., 2017). FAO's global assessment of disaster impacts also estimates very large losses to crops and livestock over recent decades, with drought a major driver and cereal losses equivalent to tens of millions of tonnes per year (FAO, 2023). This type of repeated disruption can gradually erode availability, even when markets are functioning.

What this implies for policy and planning is that managing availability risks in the long run requires a focus not just on production trends, but also on resilience of irrigation, storage, transport, market connectivity and producers' ability to recover from shocks. The regression suggests that higher incomes provide protection — partly because they finance infrastructure, technology and buffers — but climate impacts remain visible even after accounting for GDP, so we cannot consider availability as solved even in higher-income or higher-capacity settings, nor treat it merely as a farm sector issue in lower-income or lower-capacity settings.

1 All point increases and reductions are on a 0–10 scale.

3.2.2 Access

For access, the climate risks are more evident. In our regression, a 1 point increase in the CRI is associated with around a 0.71 point reduction in the access score, while each additional US$1,000 of GDP per capita is associated with roughly a 0.18 point increase in access. The model explains a large share of the cross-country variation in access (R^2 = 0.61), which shows that it is a structural issue.

What this means in practice is that climate risk shows up in food access through pathways that hit households quickly, such as price spikes, lost incomes, disrupted markets and weakened supply chains. That is exactly what the global evidence base has also been warning about. More frequent and intense climate hazards already contribute to food and water insecurity, including through rising food prices and reduced household incomes, especially in places where livelihoods are climate sensitive and safety nets are thin.

When we translate the regression signal into warming pathways (see Figures 18 and 19), access deteriorates steadily as warming increases. The Food Accessibility Index shifts from a base value of 7.30 to 7.07, 6.80 and 6.30 — equivalent to about 3.1%, 6.8% and 13.7% deterioration — under 1.5°C, 2°C and 4°C, respectively. It shows that even in the lower warming range, the impact on access is not negligible; and under higher warming, it becomes large enough to reshape the overall distribution of country performance, because access is where shocks convert into lived food insecurity, based on who can buy food, at what price and with what stability.

The implication for interpretation is that economic capacity provides some protection for access, as higher incomes, stronger labour markets and more fiscal space can help households absorb shocks and governments stabilise markets. But it does not offset climate exposure. In the regression, the climate coefficient is roughly four times the size of the GDP coefficient in absolute terms (0.71 vs 0.18), which helps explain why countries can look acceptable on access in normal years and deteriorate sharply when heat, drought, floods or cyclone seasons disrupt livelihoods and supply chains. That is also why recent food security monitoring shows how domestic food price inflation and affordability pressures are often intensified by weather shocks and compounding crises (Rother et al., 2023; WFP and FAO, 2025).

3.2.3 Utilisation

Food security is not only about whether food is available or affordable, but whether people can eat well, absorb nutrients and avoid the health shocks — unsafe water, disease and heat stress — that turn a diet shock into malnutrition. That is why we see such a strong relationship between utilisation, climate risk and economic capacity in the regression results.

The regression explains a large share of the cross-country variation in the utilisation pillar (R^2 = 0.616). A 1 point increase in the CRI is associated with around a 0.81 point reduction in the utilisation score, while each additional US$1,000 of GDP per capita is associated with roughly a 0.25 point increase in the utilisation score.

When we translate these relationships into warming pathways, the deterioration is visible even under lower warming; and it accelerates as warming increases. In the scenario results, the utilisation score drops from 7.16 (baseline) to 6.91, 6.61 and 6.06 — equivalent to declines of about 3.5%, 7.8% and 15.5% — under 1.5°C, 2°C and 4°C, respectively. So, the pressure on utilisation starts early and deepens quickly under higher warming scenarios.

This pattern is consistent with the way climate impacts translate into nutrition outcomes in practice. Climate hazards disrupt water and sanitation, increase diarrhoeal disease and other infections, and raise heat stress, reducing the body's ability to absorb nutrients and increasing the risk of wasting and other forms of acute malnutrition. Climate change is already driving widespread adverse impacts on food and water security and human health (IPCC, 2023), and avoiding the worst climate impacts could prevent around 250,000 additional climate-related deaths per year between 2030 and 2050, mainly from malnutrition, diarrhoea, heat stress and malaria (WHO, 2014).

Protecting food utilisation under climate change cannot be treated as a downstream health issue. Rather, it needs to sit at the core of resilience planning — for example, through climate-resilient WASH services, stronger primary healthcare and disease surveillance, heat health measures and nutrition programmes that can scale during shocks. Otherwise, even where food remains available, climate stress will continue to show up as worsening malnutrition and long-term losses in human development and productivity.

3.2.4 Sustainability

Longer-term fragility shows most clearly under the sustainability pillar, which captures whether food systems can hold up as shocks become more frequent, supply chains and markets can keep working during stress, and countries have enough buffers (ecological, institutional and economic) to avoid sliding during recurring crises.

The regression results show that a 1 point increase in the CRI is associated with around a 0.84 point reduction in the sustainability score. By contrast, each additional US$1,000 of GDP per capita is associated with only about a 0.10 point increase in sustainability. Both relationships are statistically strong, but what stands out is the balance of influence. Under this pillar, climate risk dominates the trend. The model also explains a very large share of cross-country variation ($R^2 = 0.86$), which suggests that across countries, differences in sustainability are closely tied to the combination of climate exposure and economic capacity.

When we translate those relationships into warming pathways, the sustainability score falls from a base of 6.41 to 6.15, 5.83 and 5.25 at 1.5°C, 2°C and 4°C, respectively. It shows that there is early weakening even under 1.5°C, and by 4°C, the sustainability score drops by 1.16 points (about 18%).

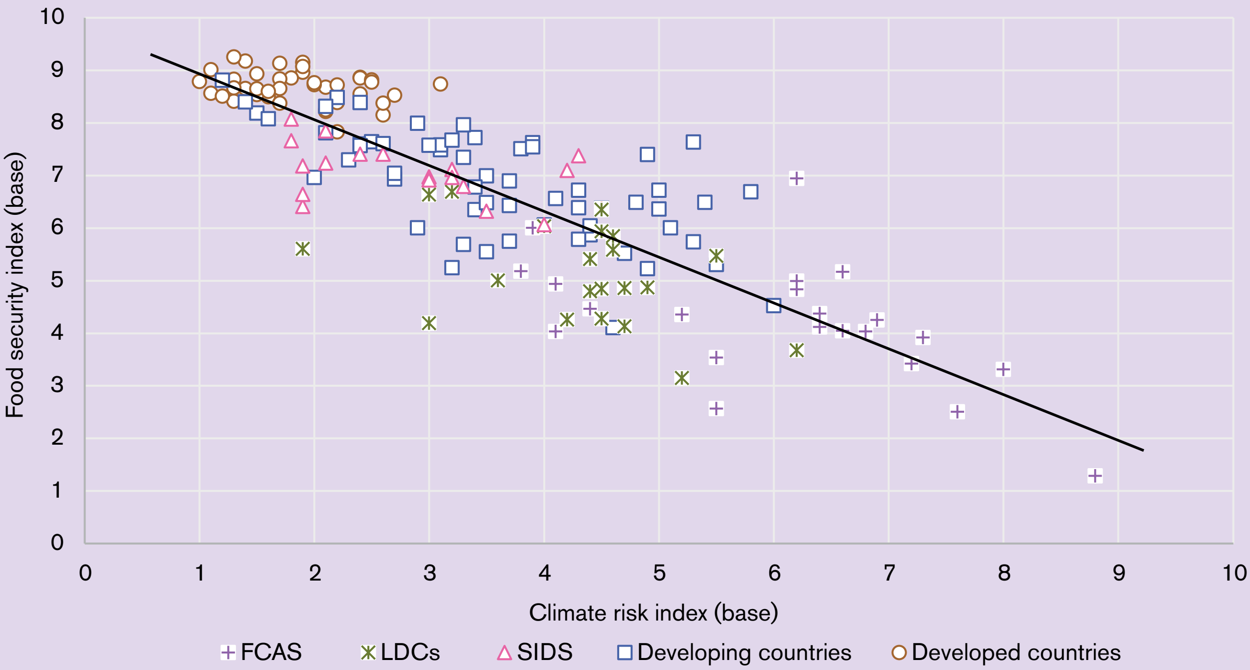
Analysis shows that the impact on this pillar is due to compounding stress — for example, through production volatility, disrupted trade and logistics, higher price instability, pressure on water systems, and knock-on effects across regions through markets and supply chains. The climate impacts are expected to be felt not just through harvest outcomes but also through transport bottlenecks, input markets and trade dependencies, especially where systems rely on a narrow set of commodities or infrastructure. This is also why the adaptation conversation will become important for this pillar. Practical mechanisms that can protect sustainability as shocks intensify include diversifying production systems, strengthening local and regional food systems, improving water and land management, and reducing loss and waste.

Across the four regressions and scenario projections, the trend clearly shows that climate risk is associated with weaker food security outcomes in every pillar, but the system does not weaken evenly. The first impacts show up most clearly in sustainability and utilisation, followed by access, while availability declines more gradually. That is visible in the coefficients as well as the scenario shifts. On the regression side, a 1 point increase in the CRI is associated with around a 0.43 point reduction in availability, but a much larger reduction in access (–0.71), utilisation (–0.81) and sustainability (–0.84). Although higher income helps across all the pillars, it is less of a buffer where climate risks increase. GDP's association is strongest in availability and utilisation and weakest in sustainability, which is the part of the system most exposed to volatility and repeated shocks. The warming scenarios also show that the biggest early declines are in sustainability (–4.13%) and utilisation (–3.52%), compared with access (–3.08%) and availability (–2.15%) under 1.5°C, and this gap widens further at 4°C.

Box 3. What the FSI–CRI correlation shows

Figure 20 plots countries' FSI scores against the CRI. The relationship clearly shows that as climate risk rises, food security tends to fall. But more noticeable is where different country groups are on this curve. Developed economies cluster in the 'safer' corner of the graph — that is, high food security with low climate risk. Developing countries are more spread out across the middle, showing that some can buffer climate risk better than others. But LDCs and FCAS are much more visible in the high-risk part of the distribution and many of them are in the zone where climate risks are high and food security outcomes are already weak. This shows the compounding effect of development deficit, fragility, conflict and climate risks. Countries starting from a more fragile and lower development baseline have less capacity to absorb shocks before their food systems tip into crisis.

Figure 20. Correlation between CRI and overall FSI scores

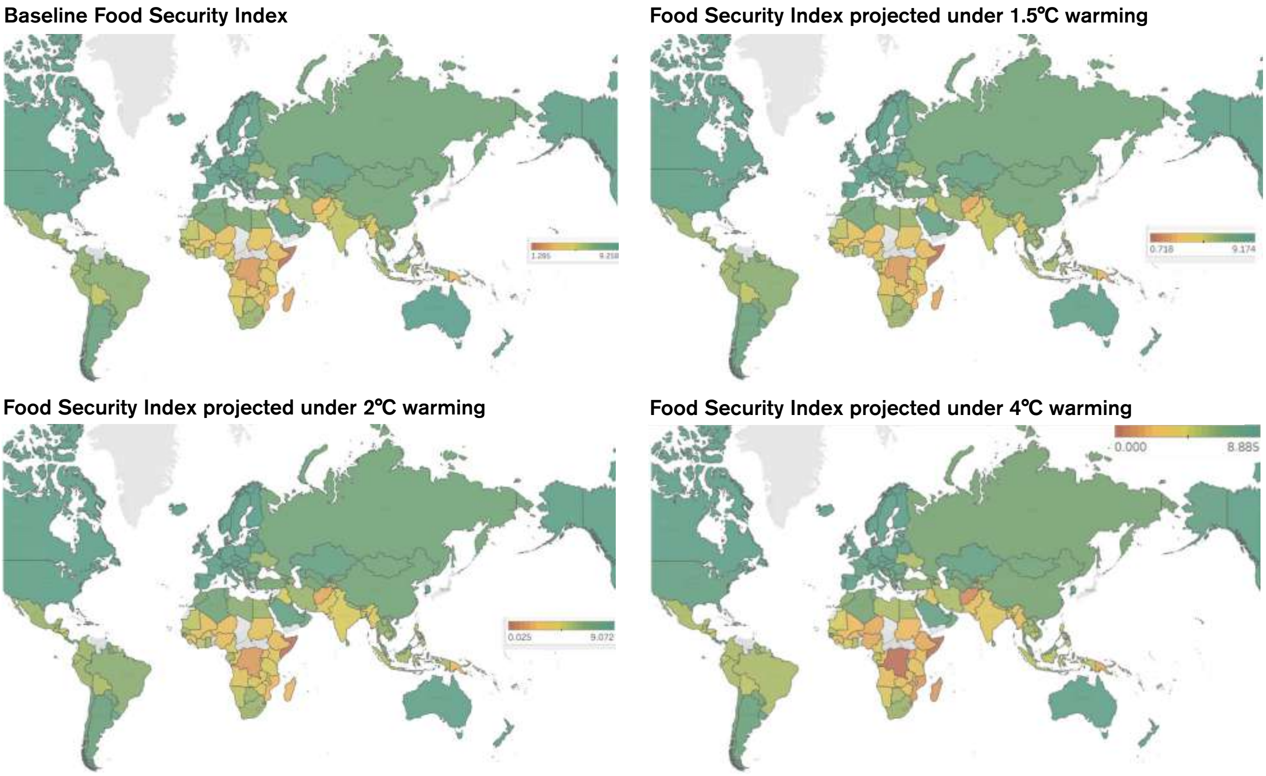


This correlation helps explain why, in the warming scenarios, risk concentrates in the same places, which coincides with countries where climate exposure is high and institutional and economic buffers are low. In other words, higher warming does not spread food insecurity evenly. It deepens it first and most sharply in the countries that are already on the lower end of the climate risk and food security curve.

3.3. FSI patterns and trends under three warming scenarios

Moving on from the drivers of food security outcomes, we will now examine what different warming pathways could mean for countries' FSI scores. Building on the regression results, which showed that climate risk is strongly and negatively associated with food security, while income is positively associated, this section presents how overall FSI scores could shift under 1.5°C, 2°C and 4°C warming, and where these risks are likely to be concentrated. Figure 18 presents the baseline global FSI distribution and projected FSI scores under each warming scenario.

Figure 21. Baseline and projected FSI scores under three warming scenarios



Note: the projections are based on a partial effect approach. For each country, we started from the observed FSI scores and adjusted these using the regression estimate for climate risk and the scenario-specific change in climate risk under 1.5°C, 2°C and 4°C warming. See Appendix 1 for more details on methodology.

Figure 21 shows that the broad spatial pattern remains consistent across scenarios. Countries with higher baseline food security continue to cluster in North America, Europe and Oceania, while lower FSI scores remain concentrated across large parts of sub-Saharan Africa and South Asia. What changes with warming is the distribution around this pattern. Under 1.5°C warming, the map already shows a downward shift in several countries that start from lower baseline levels, while countries with higher baseline scores generally see smaller changes. Under 2°C warming, this downward shift becomes more visible, with more countries moving into lower FSI bands, and the global minimum dropping sharply compared with the baseline. By 4°C, the lower end weakens further and the overall range compresses slightly at the top (the maximum falls modestly), suggesting that warming affects both ends of the distribution but with a much larger effect on countries that are already closer to the lower end.

These scenario projections are grounded in the regression results. The regression model explains a large share of cross-country variation in overall food security (R^2 - 0.755). Climate risk has a strong negative association with food security, as a 1 point increase in the CRI is associated with around a 0.72 point reduction in the overall FSI score. At the same time, higher income is associated with better food security. A US$1,000 increase in GDP per capita is associated with about a 0.20 point increase in the overall FSI score. So, both climate risk and GDP are relevant, but climate risk has the larger statistical weight in the model (standardised β is much larger in magnitude for CRI than for GDP), which is why the maps show the biggest shifts where climate risk increases under the higher warming scenarios.

3.3.1 By development and vulnerability status

Figure 22 shows how the average FSI score shifts for countries in different development and vulnerability groups under 1.5°C, 2°C and 4°C warming. Figure 23 presents the same results as percentage changes from the baseline, which helps compare the scale of change across groups.

Figure 22. Baseline and projected average FSI scores, by country development and vulnerability group

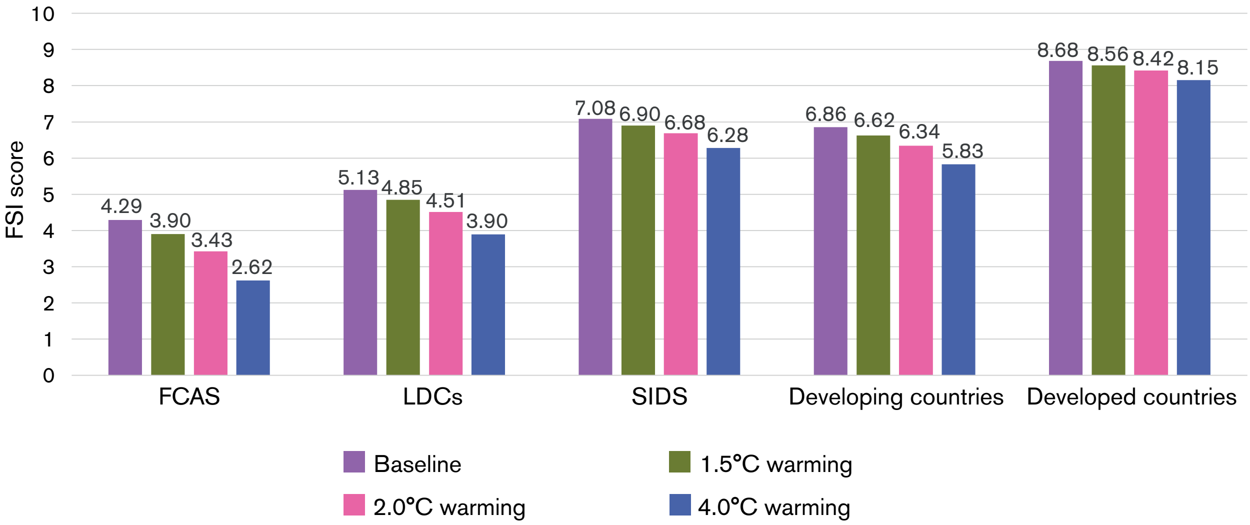
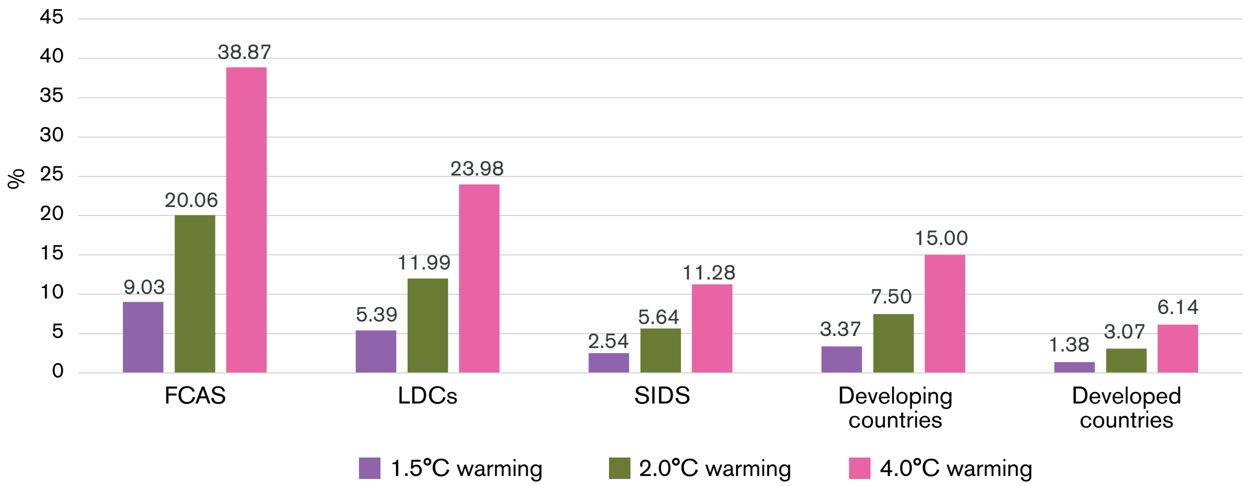


Figure 23. Percentage change between baseline and projected average FSI scores, by country development and vulnerability group



Two patterns stand out from Figures 22 and 23. First, the ranking across groups does not change. Developed countries remain the highest-scoring group, followed by developing countries, then LDCs, and FCAS are consistently the lowest. What changes is the distance between them. The gap between developed countries and FCAS widens from 4.39 points in the baseline (8.68 vs 4.29) to 5.53 under 4°C warming (8.15 vs 2.62), showing that warming amplifies an already uneven baseline.

Second, the deterioration starts earlier and is much steeper in FCAS and LDCs. Under 1.5°C warming, the average FSI score falls from 4.29 to 3.90 in FCAS (a drop of 0.39 points, or 9.03%), compared with 5.13 to 4.85 in LDCs (0.28 points, or 5.39%). In developing and developed countries, the average drop is smaller, from 6.91 to 6.69 (3.18%) and 8.68 to 8.56 (1.38%), respectively. This tells us that the first-order impacts of higher climate risk show up most clearly in contexts that are already at the bottom of the baseline distribution.

Under 2°C warming, the differences are more pronounced. FCAS fall to 3.43 (a 20.06% decline), while LDCs fall to 4.51 (an 11.99% decline). Developing and developed countries decline by 7.06% and 3.07%, respectively. Under 4°C warming, the divergence is largest. FCAS fall by 38.87% overall (4.29 to 2.62), compared with 23.98% for LDCs (5.13 to 3.90), 14.12% for developing countries (6.91 to 5.93) and 6.14% for developed countries (8.68 to 8.15). Under 4°C warming, the proportional decline in FCAS is around six times the rate in developed countries.

Climate change could put an additional 8–80 million people at risk of hunger by mid-century, with impacts concentrated in sub-Saharan Africa, South Asia and Central America (IPCC, 2022). On the production side, each 1°C increase in global mean temperature is associated with an average 6% reduction in global wheat yields (in a scenario without potentially buffering carbon dioxide fertilisation or effective adaptation), reinforcing why availability and affordability pressures can rise as warming increases (Bezner Kerr et al., 2022).

3.3.2 By income

Figure 24 presents the average FSI scores for countries grouped into the World Bank's four income categories, under the baseline and 1.5°C, 2°C and 4°C warming scenarios. Figure 25 shows the same results expressed as percentage changes from the baseline, which makes it easier to compare the scale of deterioration across country income groups.

Figure 24. Baseline and projected average FSI scores, by country income group

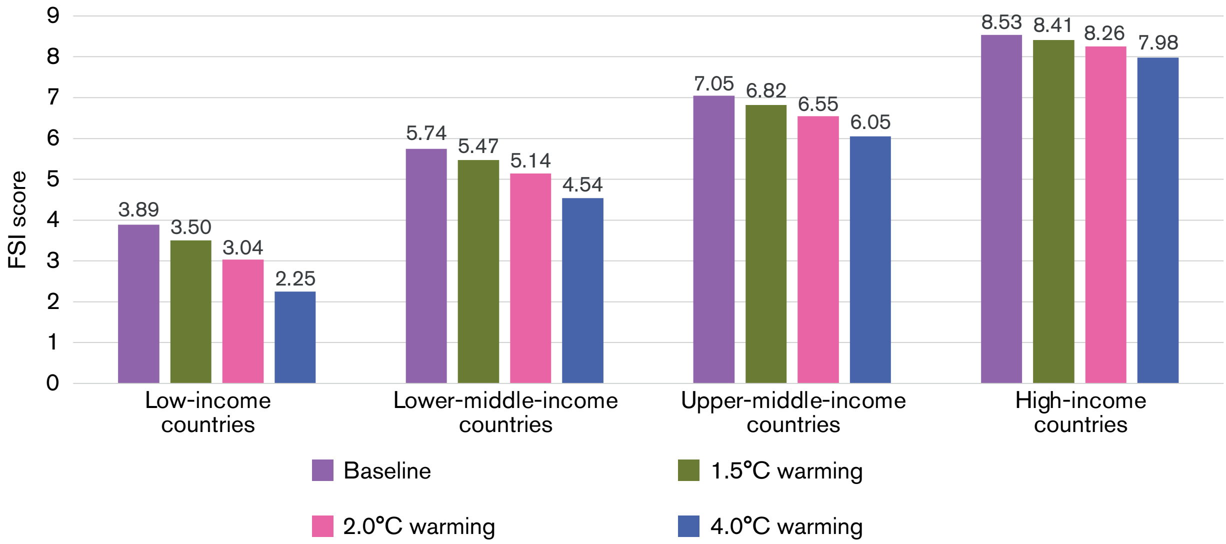
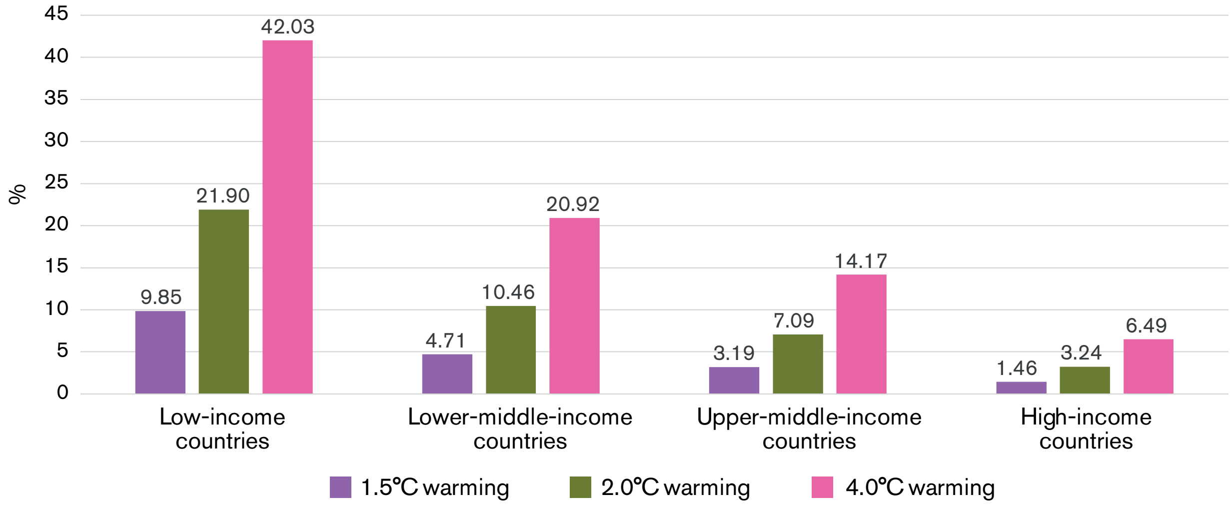


Figure 25. Percentage change between baseline and projected average FSI scores, by country income group



Three things stand out from analysis of Figures 24 and 25. First, warming widens the distance between groups. Under the baseline, low-income countries start at 3.89, while high-income countries start at 8.53. Under 4°C warming, the average for low-income countries falls to 2.25, while the high-income average falls to 7.98. This increases the gap between the two groups from 4.64 points in the baseline to 5.73 points under 4°C warming and shows the spread between the top and bottom of the distribution.

Second, the proportional decline is much higher at lower income levels and the divergence is visible already under 1.5°C warming, when the average FSI score falls by 9.85% in low-income countries, compared with 1.46% in high-income countries. Under 2°C warming, the decline in low-income countries increases to 21.9%, compared with 3.24% for high-income countries. Under 4°C warming, the gaps are much higher, with low-income countries declining by 42.03%, compared with 6.49% for high-income countries. So, while the worsening of FSI scores is progressive across all income groups, it is concentrated at the bottom.

Third, the absolute shifts are meaningful even where the percentages differ. Between the baseline and 4°C warming, the low-income group falls by around 1.6 points (from 3.89 to 2.25), while the high-income group falls by around 0.6 points (from 8.53 to 7.98). The proportional impacts are larger for low-income countries partly because they start from a much lower baseline and have less room to absorb additional stress.

This pattern aligns with two structural differences that matter for how countries in different income categories experience shocks. In low-income countries, a much higher share of livelihoods is typically tied to agriculture — for example, employment in agriculture is 57% in low-income countries, compared with 3% in high-income countries (World Bank, no date–b). Agriculture also accounts for a much larger share of GDP in low-income countries (approximately 26% on average) than in high-income countries (about 1%) (World Bank, no date–c). This means that increases in climate hazards and variability are more likely to affect both food availability and household purchasing power. In parallel, lower-income countries often have less coverage and fiscal space to buffer shocks through social protection. Around three-in-four people in low-income countries and more than half of those in lower-middle-income countries do not have the safety net of social protection coverage (World Bank, 2024c). This can explain why the same increase in climate risk can translate into larger average shifts in overall food security outcomes for lower-income countries compared with higher-income countries.

3.3.3 By region

Figures 26 and 27 present likely changes to average overall FSI scores by region under the three warming scenarios.

Figure 26. Baseline and projected average FSI scores, by region

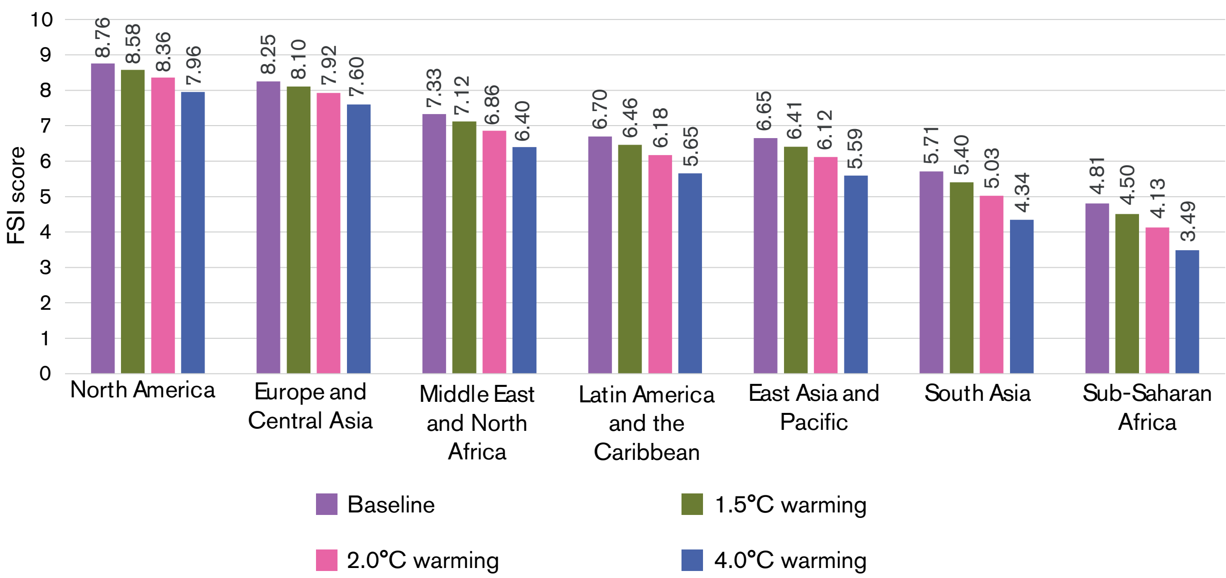
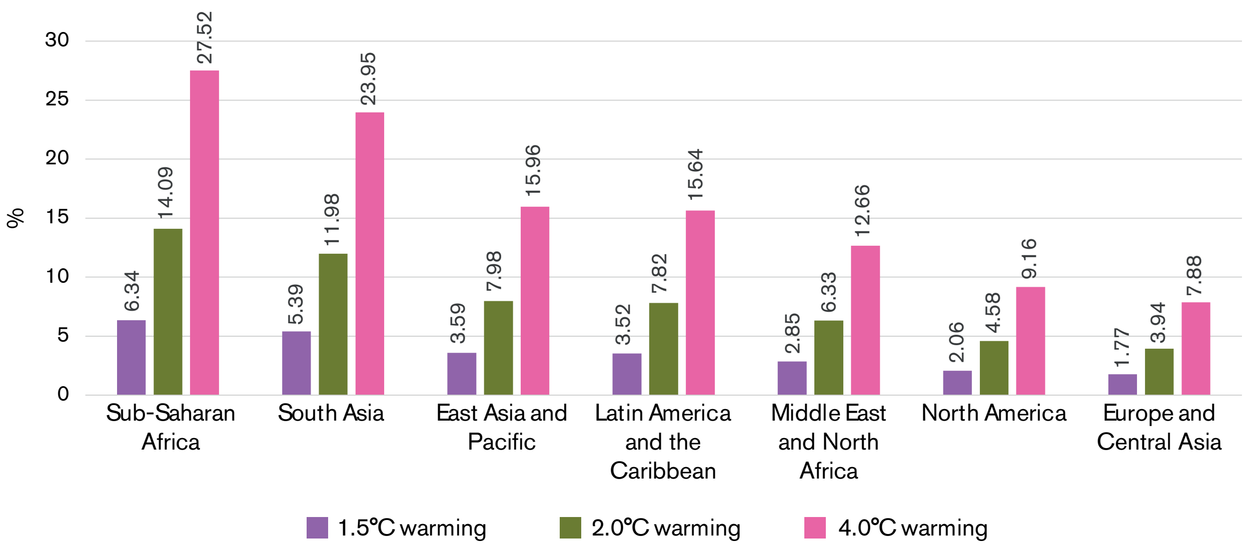


Figure 27. Percentage change between baseline and projected average FSI scores, by region



What stands out from Figures 26 and 27 is that the scale of decline differs sharply across regions and widens the gap between countries with a lower baseline FSI score and those that started higher.

At the baseline, North America (8.76) and Europe and Central Asia (8.25) sit at the top, followed by Middle East and North Africa (7.33). Latin America and the Caribbean (6.70) and East Asia and Pacific (6.65) sit close to the global average, while South Asia (5.71) and sub-Saharan Africa (4.81) remain the lowest. Under warming, all regions see declines, but the absolute and relative drops are largest in the regions that start lower. Under 4°C warming, sub-Saharan Africa falls from 4.81 to 3.49 and South Asia, from 5.71 to 4.34. By contrast, North America declines from 8.76 to 7.96 and Europe and Central Asia from 8.25 to 7.60.

In terms of percentage decline, even under 1.5°C warming, sub-Saharan Africa shows the largest decline (6.34%), followed by South Asia (5.39%). These reductions deepen quickly as warming increases. Under 4°C warming, this increases to 27.52% and 23.95%, respectively. Regions that start from stronger baseline conditions also deteriorate, but more gradually. In Europe and Central Asia, the decline is 1.77% under 1.5°C warming and 7.88% at 4°C warming, while in North America, it is 2.06% under 1.5°C warming and 9.16% under 4°C warming.

The regional results suggest that warming would increasingly concentrate risk in regions where baseline food security is already constrained, particularly where climate hazards, rainfed agriculture dependence and limited buffers are prevalent.

This pattern is consistent with the wider literature, which finds that climate change is projected to increase the population at risk of hunger in mid-century, with impacts concentrated in sub-Saharan Africa, South Asia and Central America (IPCC, 2022), and Africa has the highest food insecurity burden, with hunger levels rising there even as trends improve in other regions (FAO et al., 2024).

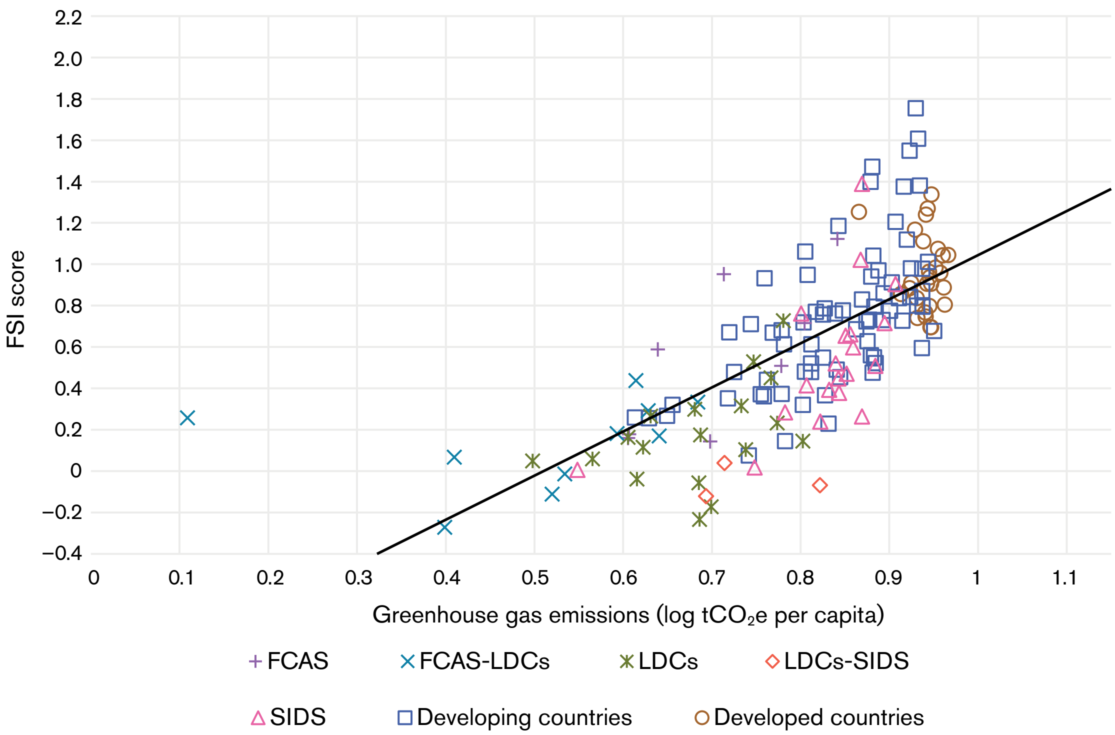
3.3.4 Risk concentration and climate justice

Across the three country groupings — development and vulnerability status, income and region — the results show the gap widens most visibly in FCAS, LDCs, low-income countries, sub-Saharan Africa and South Asia as warming increases. This shows up clearly in the group averages. Under 1.5°C warming, FCAS and low-income countries already see sizeable declines (FCAS 9.03%; developed countries 1.38%), and under 4°C warming, the losses are much larger (FCAS 38.87%; low-income countries 42.03%; developed countries 6.14%; high-income countries 6.49%). This suggests that higher warming would increasingly compound constraints that are already present, such as limited fiscal space, weaker safety nets, infrastructure gaps and a lower ability to absorb repeated shocks.

When we consider these scenario-driven declines alongside historical greenhouse gas emissions, it becomes clear that those who are least responsible for global warming are projected to experience the largest food security impacts, while those who are most responsible experience smaller average declines. Low-income countries contribute less than 1% of global carbon dioxide emissions, while high- and upper-middle-income countries together contribute more than 80%, and average per-capita emissions in high-income countries are more than 30 times higher than in low-income countries (Ritchie, 2018). In wider emissions accounting, LDCs account for around 1.1% of global carbon dioxide emissions from fossil fuels and industrial processes (UNCTAD, 2022) while SIDS have contributed around 0.5% of historic global carbon dioxide emissions and contributed about 1% of annual carbon dioxide emissions in 2012 (UN-OHRLLS, 2015). Yet, in the scenario results, these country groups and regions face the largest percentage deterioration in food security as warming increases.

Figure 28 plots greenhouse gas emissions against FSI scores for countries in different development and vulnerability groups.

Figure 28. Correlation between FSI scores and greenhouse gas emissions, by country development and vulnerability group



Reinforcing this pattern, the graph shows that the countries with higher emissions cluster at higher food security levels, while many of those with the lowest FSI scores cluster at low emissions levels. This does not imply that high emissions cause higher food security. Rather, it shows that the countries projected to face the largest climate-related deterioration in food security are the ones that have contributed least to the problem.

4

Recommendations for protecting food security against systemic climate risk

This report shows that countries do not face the same food security constraints. In some, the key constraint is availability, while in others, it is access and affordability, or utilisation and sustainability. The regression and warming scenario analysis shows that the earliest and most pronounced deterioration is expected in sustainability and utilisation, followed by access, while availability is expected to decline more gradually but steadily. Risks are also concentrated in FCAS, LDCs and low-income countries, and in sub-Saharan Africa and South Asia, where food security is already constrained and buffers to tide over crisis are thin.

As a result, the response cannot be framed solely around agricultural production. Rather, it should focus on the wider architecture that keeps food systems functioning under stress. In practical terms, protecting food security under climate change will require policies that reduce volatility, prevent repeated crisis cycles and scale support early rather than after losses have accumulated. This section sets out recommendations that protect all four pillars and suggests priority adaptation actions for key country contexts, including FCAS, LDCs, SIDS and import-dependent economies.

4.1. What needs to shift across systems to protect all four pillars

Build anticipatory, shock-responsive social protection as a first line of defence

The first signs of food insecurity are often a loss of purchasing power and worsening diets. As such, social protection needs to be ready before a crisis escalates; scaling it up once food insecurity is already visible is too late. Governments should therefore move away from ad hoc emergency responses and towards systems that can spot risk early, expand quickly and protect households before they start skipping meals, selling productive assets or forgoing healthcare.

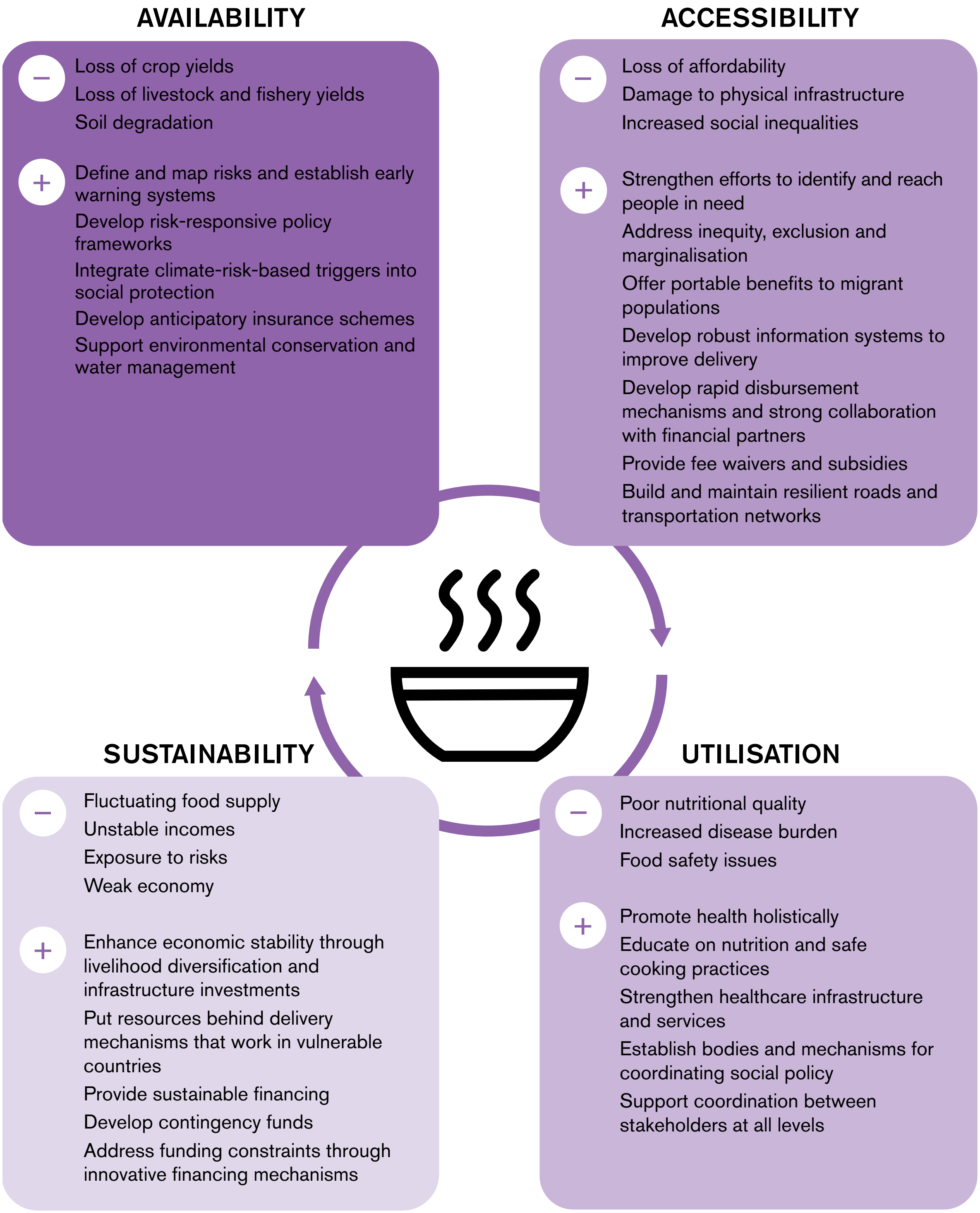
Country experience shows how this can work in practice (see Figure 29). Ethiopia's Productive Safety Net Programme (PSNP) helps households maintain living standards through drought and avoid distress coping strategies, and Kenya's Hunger Safety Net Programme (HSNP) also helps beneficiaries maintain consumption during drought. In Bangladesh, anticipatory cash transfers ahead of floods show how early support can protect food access before prices rise and livelihoods are disrupted (World Bank, 2025).

For this approach to work at scale, governments need:

- Climate risk-informed pre-identification and targeting (including displaced and mobile populations in FCAS)
- Instruments that can expand quickly: cash top-ups, food or in-kind support, nutrition-linked transfers, wage employment, and so on
- Clear rules for scale-up so expansion is triggered by risk signals rather than delayed discretionary decisions.

It is also important for humanitarian actors to align with these systems to avoid parallel targeting, and for donors and international financial institutions to back them with predictable scale-up finance.

Figure 29. Approach to enhancing food security through anticipatory social protection



Strengthen delivery systems that keep support, services and markets functioning during shocks

Social protection cannot act as a safety net if delivery systems fail when shocks hit. Governments must therefore treat delivery capacity as a food security investment. For this, they may need to improve:

- Information and targeting capacity, through updated registries, transparent eligibility rules and grievance mechanisms that reduce exclusion
- Last-mile delivery and disbursement, by making arrangements with financial partners and service providers to ensure that support continues even when roads are disrupted, markets are inaccessible or the security situation deteriorates.

Country experience shows how this can work in practice. For example, India's JAM (Jan Dhan accounts, Aadhaar ID and mobile phones) trinity shows how digital delivery can ensure inclusion, reduce delays and prevent leakages — in this case, reaching over 400 million beneficiaries with direct cash transfers (World Bank, 2025). Similarly, Cambodia's IDPoor database, which is linked to mobile payments, shows how pre-existing registries can accelerate outreach during crisis (Chhoeung et al., 2022). In FCAS contexts, delivery also needs to be both portable and flexible so displaced communities can access it in new locations. India's One Nation One Ration Card — which allows beneficiaries to access rations anywhere, reducing the risk that migrants lose support when they move — shows how portability can work at scale (Government of India, 2023).

Link early warning to early action through clear triggers and protocols

Deterioration is expected to begin early in sustainability and utilisation, so waiting for crisis indicators to worsen can increase losses. To avoid this, governments can carry out risk mapping and forecasting, establish pre-agreed triggers linked to predefined actions and clearly define who will act, when and what resources they can draw on, across meteorological agencies, disaster management bodies, social protection agencies and line ministries.

Country experience shows how this can work in practice. In Bangladesh, early warnings have reduced losses when forecasts are linked to response (Teku and Tariku, 2026), Ethiopia's PSNP uses drought indicators to scale support (Tenzig and Conway, 2023) and Kenya's HSNP increases transfer values and coverage when drought conditions are triggered (Mwakipesile et al., 2026). Donors and humanitarian agencies can reinforce this by aligning finance and operations to agreed triggers, to support action before prices spike or livelihoods collapse.

Secure predictable finance and protect fiscal space for early action and recovery

Early action needs finance that is available early. The highest declines in food security are expected in FCAS, LDCs and low-income countries, where fiscal space is thin and shocks can force delayed response and reactive borrowing. Prearranged, layered financing can help address these constraints, combining contingency funds for rapid response with social protection programme funds and trigger-based risk financing instruments, such as insurance.

Regional risk pooling through the Caribbean Catastrophe Risk Insurance Facility shows how quick payouts after extreme events can support stabilisation and recovery (CCRIF SPC, 2024). But such mechanisms can only be effective if they can move fast. As such, treasuries, insurance companies, other payment providers and service delivery actors will need to pre-agree coordination mechanisms to allow rapid disbursement without increasing leakage or exclusion.

4.2. What to do differently across each pillar

Strengthen availability: resilient production, storage and supply chains

Availability is expected to decline more steadily than the other pillars, but it may become harder to protect as warming increases and shocks compound. To address risks in future warming scenarios, governments will need to ensure resilience across the entire supply chain, not just in production. Agriculture ministries, research agencies and extension services can drive planned resilience in farming systems through drought-resistant crops, climate-smart practices (such as minimising soil disturbance to trap carbon, agroforestry, and alternate wetting and drying in rice cultivation to reduce methane emissions while saving water), irrigation (where feasible) and watershed management to reduce drought and flood losses. Public works and productive safety net programmes can help finance land development and water management infrastructure. India's Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) shows how a large public works platform can support water harvesting, soil conservation and land development with longer-term resilience gains (Kaur et al., 2019).

Availability can also be impacted if people cannot store or move food during shocks. To address this risk, public investment and private operators can work together to expand climate-resilient storage and warehousing, cold chains where relevant and local aggregation systems that can reduce post-harvest losses and smooth seasonal shortages and price hikes. In import-dependent contexts, trade ministries, port authorities, central banks and major importers will need to plan for disruptions by diversifying suppliers and routes, maintaining strategic reserves, predefining emergency procurement and logistics protocols, and increasing port and road resilience.

Protect access: affordability, incomes and market connectivity during shocks

Access can become an issue when food prices rise while incomes fall, and markets can become unreachable. Social protection agencies and finance ministries will therefore need to set up mechanisms that can scale fast. Early, shock-responsive cash and food transfers are some of the fastest ways to protect access when designed for rapid expansion.

Where labour markets are climate-sensitive, public works and livelihood support can stabilise incomes while also building useful assets. India's MGNREGS shows how employment guarantees can reduce distress coping strategies, such as selling assets, and stabilise income during climate stress (Bharadwaj et al., 2021). But access also depends on whether markets remain reachable, so transport and infrastructure agencies need to be part of food security planning — for example, through resilient roads, market infrastructure, last-mile connectivity and practical contingency arrangements for disrupted routes.

Safeguard utilisation: nutrition, health and climate-resilient WASH

Food utilisation scores often deteriorate early because shocks increase disease burdens, disrupt water and sanitation, and push households into less diverse diets. Health, nutrition and WASH agencies need to plan together to create a resilient system.

Nutrition support should be responsive to shocks, with surge capacity for maternal and child nutrition and the ability to add nutrition top-ups through transfer systems if risks rise. Brazil's Bolsa Família shows how social assistance can improve welfare and nutrition over time (Rasella et al., 2013). Education and school feeding programmes can also be useful for building nutrition during crisis, stabilising diets when households cut meal frequency and diet diversity, and supporting local supply chains. Ghana's School Feeding Programme, for example, protects children's diet quality and supports domestic producers through local procurement (CERFAM et al., 2024).

WASH and primary healthcare continuity must sit inside food security planning, which should also consider climate-resilient water supply, sanitation continuity, disease surveillance and heat health measures. Uganda's targeted health interventions to reduce malaria show how early health action can reduce climate-sensitive disease stress during shocks (Friends of the Global Fight et al., 2021).

Build sustainability: reducing volatility and preventing repeated crisis cycles

To ensure sustainability, planning and finance agencies can reduce volatility by building in buffers and redundancy — for example, across domestic supply and imports — including infrastructure, such as storage, transport links, ports and basic services.

Locally led approaches can also ensure stability as local governments and community institutions can anchor risk reduction in systems that people can maintain over time, such as community-managed water systems, forest and watershed governance and locally managed contingency mechanisms, such as grain banks.

4.3. How priorities differ by country context

FCAS: maintain minimum food system function under conflict and displacement

In FCAS, conflict and displacement often weaken sustainability, which impacts access and utilisation through disrupted markets, lost incomes and service and institutional collapse. The near-term aim in these contexts should therefore be ensuring basic service continuity. Social protection agencies and humanitarian partners will need to invest in portability of access to basic services for displaced communities and flexible delivery. Where markets are still working, cash and vouchers can be used to protect access, while investing in locally led approaches for health and WASH can support better nutrition outcomes.

LDCs and low-income countries: scale buffers and delivery capacity

In LDCs and low-income countries, deterioration starts early because baseline food security is already constrained and buffers to cope during crises are thin. In these contexts, the priority should be investing in systems that help reach people early with meaningful support, by updating social registries, setting transparent inclusion rules, and establishing both grievance systems that can reduce exclusion and payment systems that deliver quickly. This can include digital delivery where it works, backed by last-mile outreach and community validation.

SIDS: manage import dependence and logistics exposure

In many SIDS, food security risks are often the result of narrow supply chain base and high import dependence. Shipping disruption, port damage, tourism revenue collapse and global price spikes can quickly translate into shortages and affordability stress. Trade ministries, port authorities, logistics operators and finance institutions therefore need to work together to improve port resilience, storage and cold chains, where relevant, contingency shipping arrangements and emergency procurement protocols to reduce disruption. If import costs rise, households will need protection though cash top-ups, vouchers and targeted subsidies that reach vulnerable groups without creating permanent backslide.

4.4. What the international system needs to do differently

Shift from reactive crisis response to pre-financed early action

Climate funds need to set up prearranged financing mechanism windows that release support to vulnerable countries when thresholds (such as rainfall deficits, vegetation stress, cyclone trajectories, heat stress or staple price spikes) are reached, with triggers and disbursement rules that work through government and humanitarian channels. Although regional risk pools and insurance-linked instruments can add value, they need to be designed to provide liquidity early enough to stop shocks from cascading into prolonged food crises.

Align climate, humanitarian and development finance around the four pillars

Food insecurity cuts across climate, humanitarian and development mandates, but financing still sits in separate funds and siloes, leading to a partial response. Finance can be aligned more practically by organising it around the needs of each pillar. This requires a shift in funding towards the following priority areas:

- **Availability:** production resilience and storage/logistics
- **Access:** shock-responsive transfers, income protection and market connectivity
- **Utilisation:** nutrition, primary healthcare and climate-resilient WASH
- **Sustainability:** early warning linked to action, contingency finance and measures that reduce volatility and repeat crisis cycles.

This will also require support to be bundled — for example, by packaging anticipatory cash with nutrition and WASH support and market continuity planning — rather than funding each initiative as a standalone response.

Strengthen data, accountability and learning through pillar-level tracking

Food insecurity is often managed as an emergency response, partly because tracking does not cover all the drivers. As a result, available data do not always show which pillar is impacted first, how fast, and through what pathways, especially under compounding climate stress. Pillar-level tracking can make the problem more actionable by showing whether deterioration is driven by purchasing power and market access, nutrition and WASH breakdown, or repeated disruption that can erode sustainability. Data will also need to link directly to operational decisions, including triggers, scale-up protocols and financing rules.

5

Next steps

The analysis presented in this paper shows that climate-driven food shocks are expected to increase, with the earliest damage showing up in the parts of the system that keep people well-nourished and able to recover (sustainability and utilisation) before availability collapses. That is why action on food security must be less about 'responding better' and more about getting ahead of loss, using systems that can absorb shocks without repeatedly resetting livelihoods and nutrition outcomes.

The global political architecture is starting to recognise this issue. The G20's Global Alliance Against Hunger and Poverty was launched to bring countries and partners around a shared set of solutions and support, rather than create another standalone initiative. It is designed as an open platform that helps match demand (country priorities) with supply (policy options, technical support and finance), including through a policy basket and support mechanism. The G7 Apulia communiqué also signalled a push to scale and coordinate, including launching the G7 Apulia Food Systems Initiative and supporting the design of financing mechanisms for shock-driven food crises that can provide rapid finance ahead of severe crisis.

5.1. Immediate priorities

The urgent priority is to **make these platforms work for high-risk countries**. That means four near-term priorities.

Enable early action finance: donors, international financial institutions and climate funds need to back country systems with prearranged finance that releases when agreed thresholds are met, instead of waiting for post-shock funding appeals. The G7's proposed shock-driven facility is the kind of instrument that can help if it is built around speed, trigger clarity and predictable disbursement.

Stop treating nutrition, WASH and primary healthcare separately from food security: the global discourse still defaults to basic minimum calories and production, but the food security deterioration pathway in our analysis shows why utilisation is expected to deteriorate early. The Declaration on Sustainable Agriculture, Resilient Food Systems and Climate Action, endorsed by 160 countries at the 28th UN Climate Change Conference in the United Arab Emirates, pushed countries to integrate food systems into climate plans, giving a mandate to connect food systems action with adaptation and resilience finance. This shows that the UN climate change conference is one place where countries can prioritise this agenda.

Align country delivery and global support around a small set of minimum requirements: in FCAS and high-risk, low-income settings, these are: predictable support that reaches people (including mobile and displaced populations); functioning markets and supply routes; nutrition, WASH and health services that do not collapse during shocks; and finance that moves early enough to prevent cascading coping losses. Humanitarian agencies can add the most value by aligning their own targeting and delivery with government systems, rather than building parallel systems, and by helping to stress-test delivery under insecurity.

Make the Global Alliance Against Hunger and Poverty a coordination hub: a practical next step is for the alliance to broker a shortlist of priority country solution packages (starting with FCAS and LDCs, where food security deterioration is fastest), link them to G7 Apulia Food Systems Initiative support and other pipelines and publish what is funded and unfunded to ensure gaps are visible and can be supported though climate and other sources of finance.

5.2. Medium-term priorities

The next steps (within 12–18 months) include:

- A small group of high-risk countries (particularly FCAS and LDCs) define one integrated package each, with triggers, delivery route, financing source and a short set of pillar-level indicators to track early deterioration
- International financial institutions, donors and climate funds agree common indicators for triggered disbursement, so countries do not have to negotiate new rules during every shock
- The Global Alliance Against Hunger and Poverty convenes matchmaking rounds that link these packages to finance and technical support, and reports progress publicly
- G7 and G20 processes help ensure rapid pre-crisis liquidity (not just post-crisis response) and fiscal space, including debt-related solutions where shocks repeatedly destabilise budgets.

If we can collectively agree to these recommendations, global systems and alliances can respond to food security constraints in a timely manner.

Appendix 1. Methodologies

A1.1. Analytical framework

We assessed food security using a four-pillar framework consistent with FAO and widely adopted food security literature. The four pillars were:

Availability: the Food Availability Index captures the physical presence of food at national level, reflecting production capacity and supply adequacy. We normalised and aggregated indicators related to food production and supply using the arithmetic mean.

Access: the Food Access Index reflects households' economic and physical access to food, capturing purchasing power and access-enabling conditions. We aggregated normalised indicators using the arithmetic mean.

Utilisation: the Food Utilisation Index captures nutritional absorption and biological utilisation of food, reflecting health, nutrition and sanitation conditions. We aggregated normalised indicators using the arithmetic mean.

Sustainability: the Food Sustainability Index reflects the food systems' ability to withstand shocks over time, including climate and environmental risks. We normalised and aggregated indicators that captured exposure and resilience using the arithmetic mean.

We first quantified each pillar-specific index and then aggregated the four indices to construct the composite FSI using the following geometric mean:

$FSI_i = (Availability_i \times Access_i \times Utilisation_i \times Sustainability_i)^{\{1/4\}}$

A1.2. Variables used

We drew data from INFORM indices, FAO Food Balance Sheets, the World Bank, UNDP Human Development Index, WHO and UNICEF for 162 countries. We normalised raw values via the $X/\max(X)$ method, dividing each country's value by the dataset maximum, producing scores from 0 (worst) to 10 (best). We reversed higher-is-worse indicators, such as the INFORM availability score, under-5 mortality and undernourishment prevalence (typically 10 – X on 0–10 scales) before normalisation. Table A1 lists the variables used.

Table A1. Variables used in the FSI, by pillar

Availability	Access	Utilisation	Sustainability
Food Production Index	GDP per capita	Under-5 mortality rate (per 1,000 live births)	Hazard and Exposure Index
Crop Production Index	Human Development Index	Prevalence of undernourishment (%)	Conflict Probability Index
Average dietary energy supply adequacy (%)	Development and deprivation score	Maternal mortality ratio	Current Conflict Index
Value of food imports in total merchandise exports (kilocalories per capita per day)	Gender Inequality Index	Immunisation Coverage Index	Most recent Hyogo Framework for Action scores (index)
Fat grams per capita per day	Income Gini coefficient	Health of children under 5	Lack of Government Effectiveness Index
Protein grams per capita per day	Access to electricity (% of population)	Lack of Access to Healthcare Index	Lack of Institutional Stability Index
	Infrastructure Index	Current health expenditure per capita	Corruption Perception Index
	Adult literacy rate	People using at least basic sanitation services (% of population)	Public aid per capita (US$)
	Internet users (% of population)	People using at least basic drinking water services (% of population)	Net official development assistance received (% of gross national income)
	Mobile cellular subscriptions (per 100 people)		Volume of remittances (in US$) as a proportion of total GDP (%)

A1.3. Normalisation of indicators

To ensure comparability across indicators measured in different units, we normalised all variables to a 0–10 scale using the ratio-to-maximum (*X*/max(*X*)) method. For each indicator *X*, we computed the normalised score for country *i* as:

$$X_i^* = 10 \times \frac{X_i}{\min(X)}$$

where:

- X_i is the observed value for country
- max(X) is the maximum observed value of the indicator across all countries
- X_i^* is the normalised indicator value.

For indicators where higher values represent worse food security outcomes (such as undernourishment, child wasting and food losses), we applied the inverse transformation:

$$X_i^* = 10 \times \frac{\min(X)}{X_i}$$

This ensured that higher normalised scores consistently represent better food security outcomes across all indicators.

A1.4. Pillar index construction

We formed pillar indices by computing the arithmetic mean of normalised variables within each sheet. For **availability**, we used INFORM food availability (reversed), kilocalories per capita per day, fat grams per capita per day, and protein grams per capita per day. For **access**, we averaged Human Development Index, INFORM development/deprivation and inequality scores, plus access to electricity, internet, mobile subscriptions, basic sanitation and drinking water (% population). For **utilisation**, we included under-five mortality (reversed), undernourishment prevalence (reversed), INFORM utilisation and immunisation scores (reversed), and healthcare expenditure (US$ based on purchasing power parity). For **sustainability**, we aggregated reversed INFORM scores for natural hazards, human hazards, institutional effectiveness and economic dependency.

A1.4.1. Composite FSI calculation

The overall FSI for each country equals the unweighted arithmetic mean of the four pillar indices (each 0–10), producing a final score from 0 (worst) to 10 (best). This equal-weighting approach treats pillars as complementary dimensions, enabling cross-country comparisons while maintaining transparency in the $X/\max(X)$ normalisation. Within each food security pillar, we aggregated the normalised indicators using the **geometric mean** to capture the multidimensional and non-substitutable nature of food security.

For pillar P with n indicators, we calculated the pillar index for country i as:

$$P_i = \left(\prod_{j=1}^{n} X^*_{ij}\right)$$

where X^*_{ij} denotes the normalised value of indicator j for country i.

The use of the geometric mean penalises unbalanced performance and prevents strong performance in one indicator from fully compensating for weaknesses in others.

A1.5. Regression analysis

Following the construction of the four pillar indices and the composite FSI, we undertook regression analysis to examine the association between food security outcomes, economic development and climate risk.

A1.5.1. Model specification

For each pillar index and the composite FSI, we estimated a separate cross-country regression model using GDP per capita and the CRI as explanatory variables. The general model specification is:

$Y_i = \alpha + \beta_1 GDPpc_i + 2\ \beta_2 CRI_i + \varepsilon_i$

where:

- Y_i denotes the food security outcome for country i, represented alternatively by the Food Availability Index, Food Access Index, Food Utilisation Index, Food Sustainability Index or the composite FSI
- $GDPpc_i$ is per capita GDP measured in thousands of US$
- CRI_i is the CRI capturing countries' exposure and vulnerability to climate-related hazards
- α is the intercept
- ε_i is the error term.

We estimated the models using ordinary least squares on a cross-sectional dataset covering multiple countries. We regressed each dependent variable (in the pillar indices and composite FSI) separately on the same set of independent variables to ensure comparability of results across food security dimensions.

The coefficient on GDP per capita (β_1) captures the association between economic development and food security outcomes, with higher values expected to be positively associated with improved food security. The coefficient on the CRI (β_2) reflects the relationship between climate-related risks and food security, with higher climate risk expected to adversely affect food security outcomes.

We assessed model performance using the F-statistic to test overall model significance and the coefficient of determination (R^2) to test explanatory power. We used standard t-tests to evaluate the statistical significance of individual coefficients.

A1.6. Projection of FSI scores under climate change scenarios

A1.6.1. Climate scenario framework

To assess the potential impact of climate change on food security outcomes, we incorporated three scenario-based projections of climate risk consistent with the IPCC warming pathways: 1.5°C, 2°C and 4°C warming scenarios. We derived scenario-specific values of the CRI using the INFORM Risk Framework, reflecting projected increases in climate-related hazards under different levels of global warming.

A1.6.2. Baseline and scenario-specific climate risk

For each country, we used an observed (baseline) CRI, corresponding to current climate conditions and scenario-specific CRI values, corresponding to the 1.5°C, 2°C and 4°C warming scenarios. We treated these scenario-specific CRI values as exogenous climate shocks, while holding all non-climate structural characteristics of countries constant.

A1.6.3. Projection methodology

The FSI projections under climate scenarios were based on the estimated marginal effect of climate risk obtained from the regression analysis. Rather than re-estimating the indices mechanically, the approach applied partial-effect adjustments to observed index values, thereby preserving observed country-specific baselines.

For each food security outcome Y — including the four pillar indices and the composite FSI — we computed scenario-adjusted values as:

$$Y_{i,s}^{adj} = Y_i^{obs} - \beta_{CRI}\,(CRI_{i,s} - CRI_i^{obs})$$

where:

- Y_i^{obs} is the observed index value for country i
- CRI_i^{obs} is the observed CRI
- $CRI_{i,s}$ is the CRI under climate scenario s
- β_{CRI} is the estimated regression coefficient associated with CRI
- $Y_{i,s}^{adj}$ is the scenario-adjusted index value.

This formulation ensures that when the scenario-specific CRI equals the observed CRI, the adjusted index equals the observed value, and that changes in the index are driven solely by changes in climate risk implied by the scenario.

In the scenario projections, we held GDP per capita and other non-climatic determinants constant at their observed values. Isolating the climate channel in this way allowed us to interpret the FSI projected changes in climate-induced effects rather than combined effects of economic or policy changes.

Since the FSI are bounded measures, we truncated projected values that fell below 0 at 0 to preserve interpretability, ensuring all projected indices remained within the feasible range of the index scale.

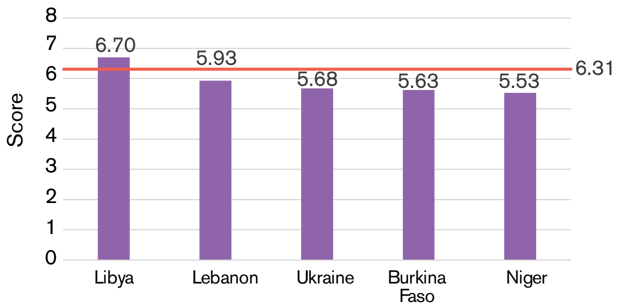
The resulting scenario-adjusted indices represent counterfactual food security outcomes under alternative climate risk conditions, relative to observed baselines. These projections do not represent precise forecasts but rather illustrate the direction and magnitude of potential climate impacts on different dimensions of food security under varying levels of global warming.

Appendix 2. Top and bottom performing countries, by pillar

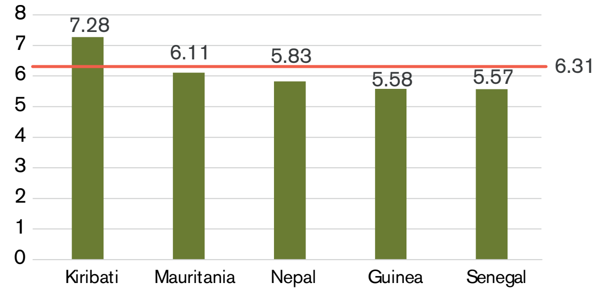
A2.1. By development and vulnerability status

Food Availability Index: top five

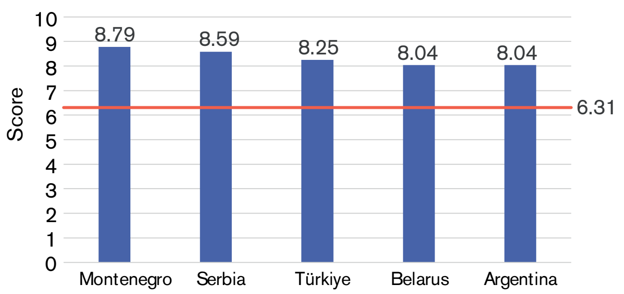
FCAS



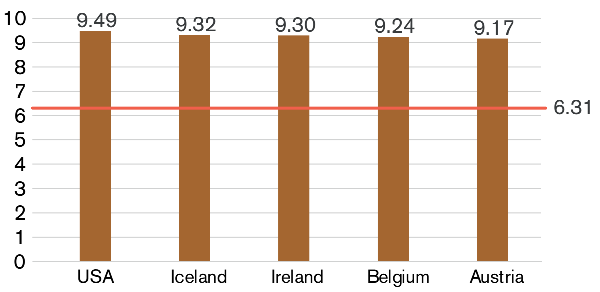
LDCs



Developing countries

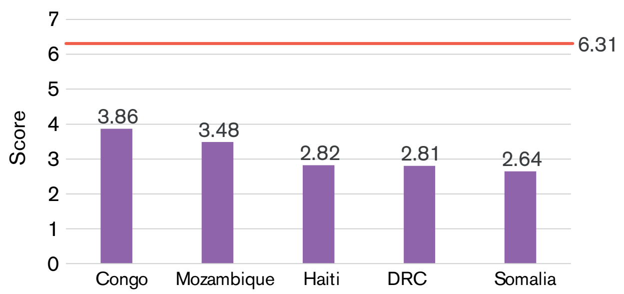


Developed countries

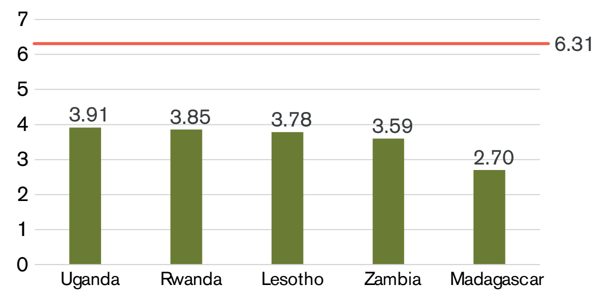


Food Availability Index: bottom five

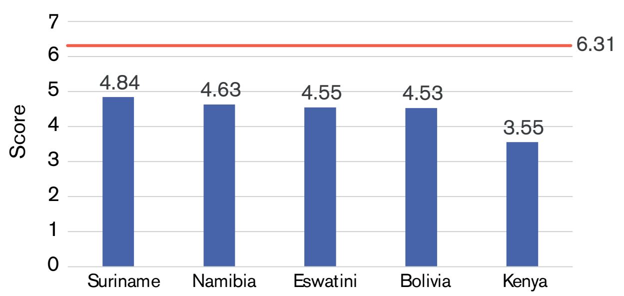
FCAS



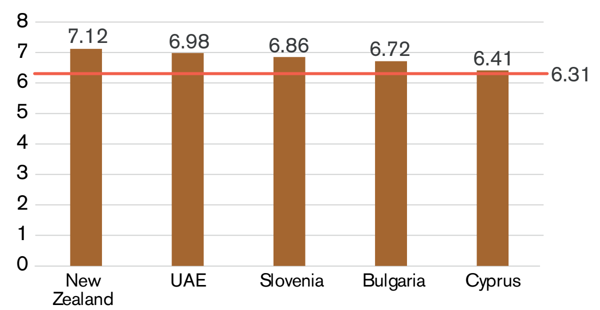
LDCs



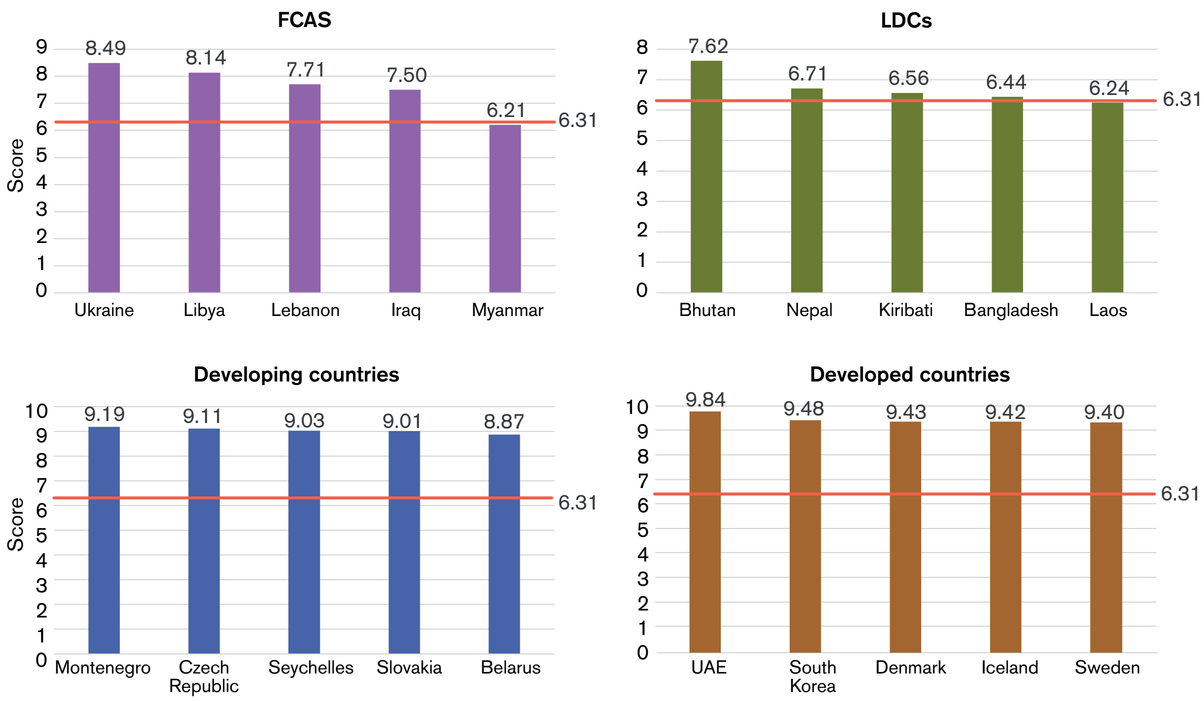
Developing countries



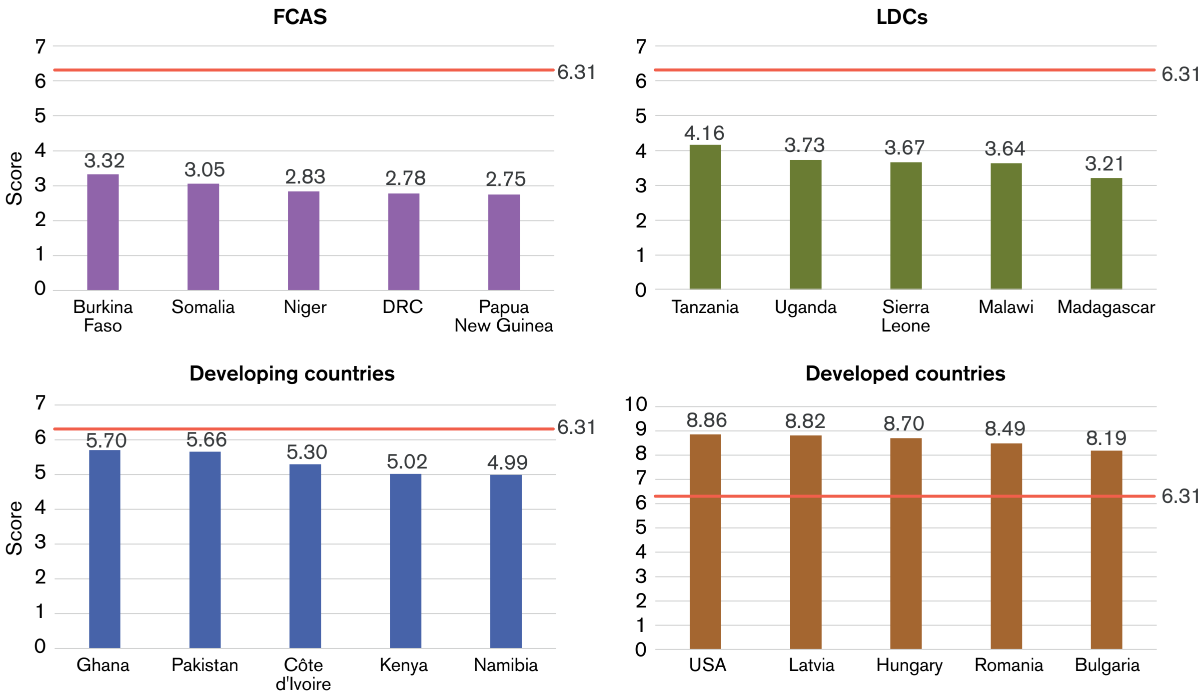
Developed countries



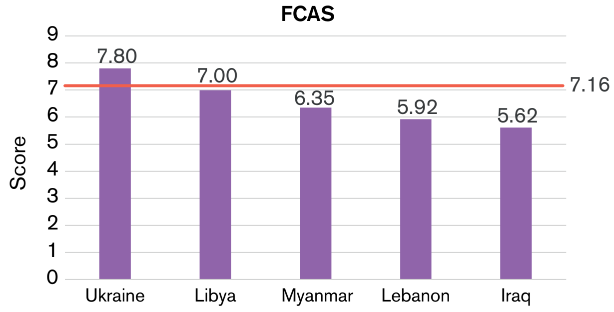
Food Accessibility Index: top five

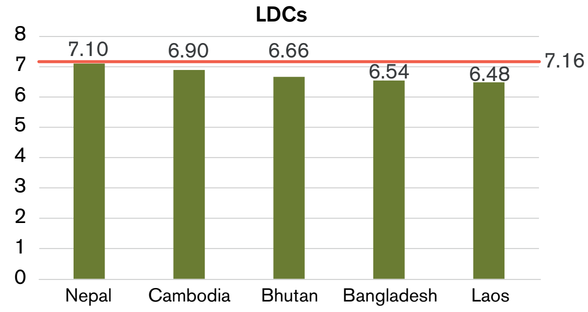


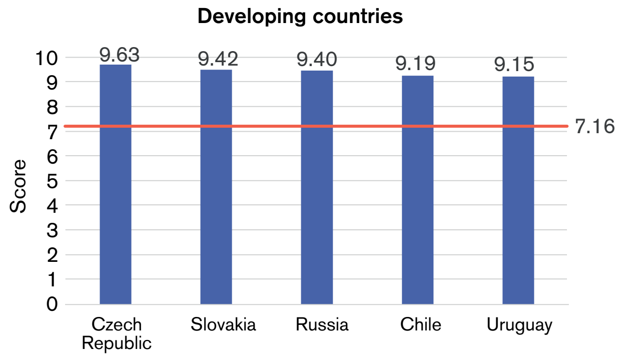
Food Accessibility Index: bottom five

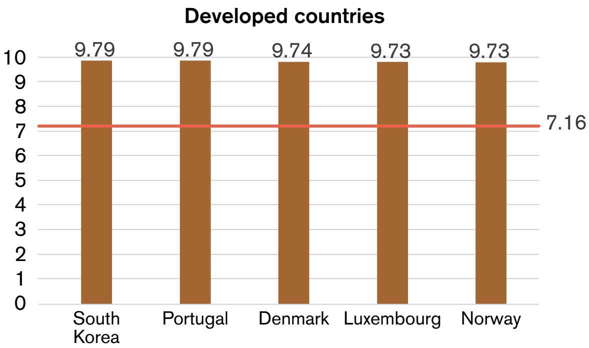


Food Utilisation Index: top five

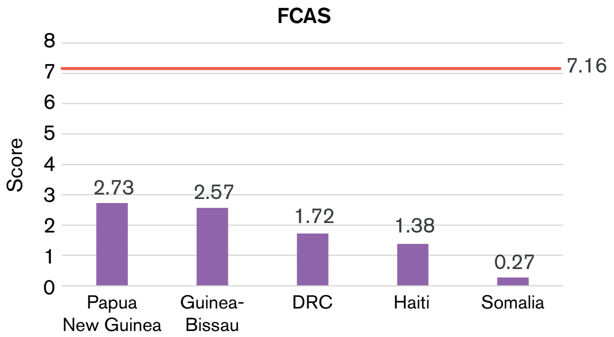


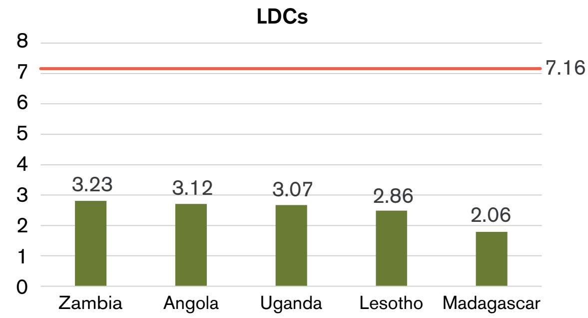


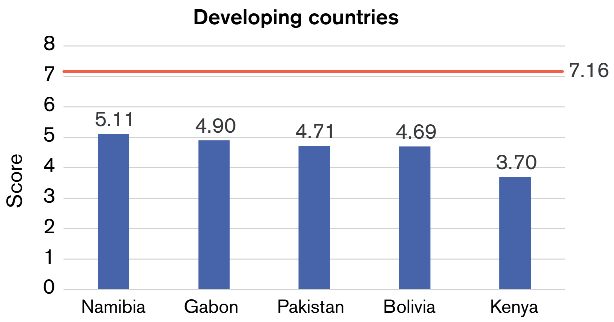


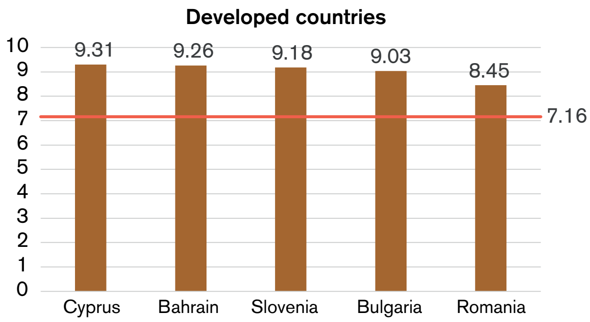


Food Utilisation Index: bottom five

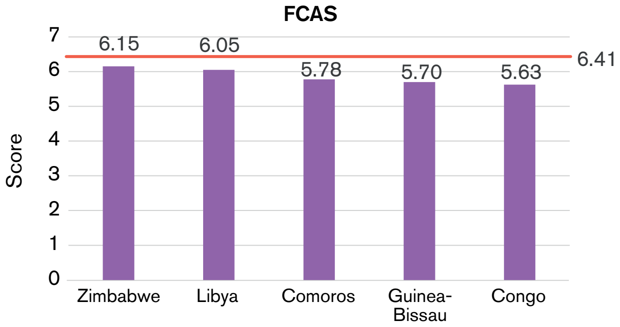


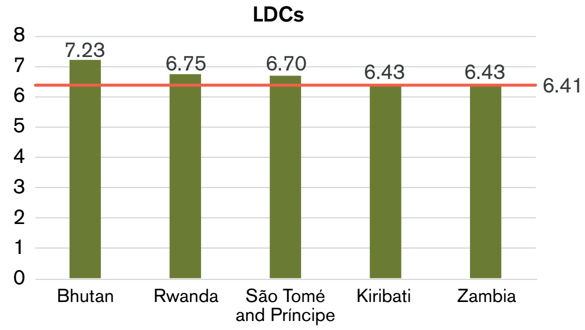


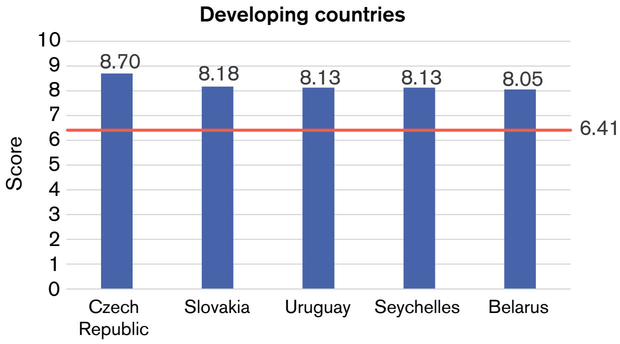


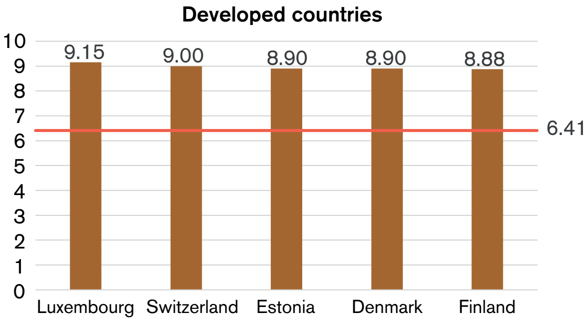


Food Sustainability Index: top five

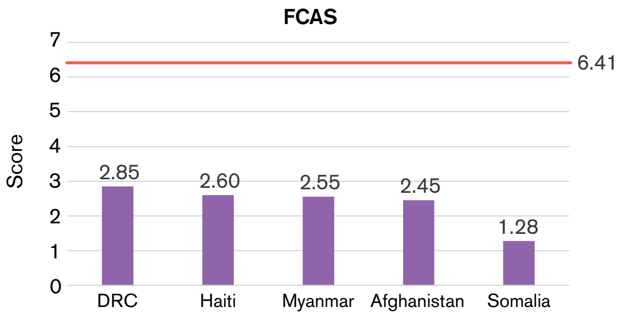


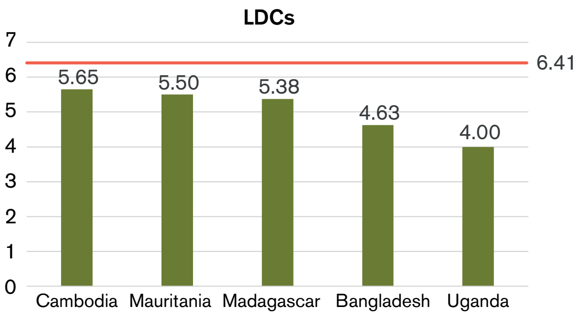


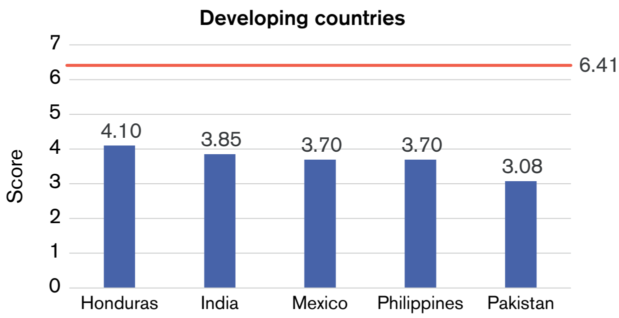


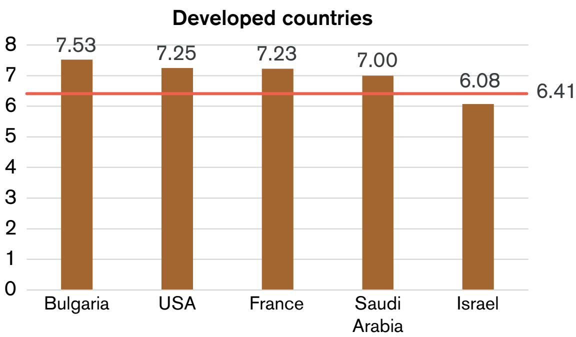


Food Sustainability Index: bottom five





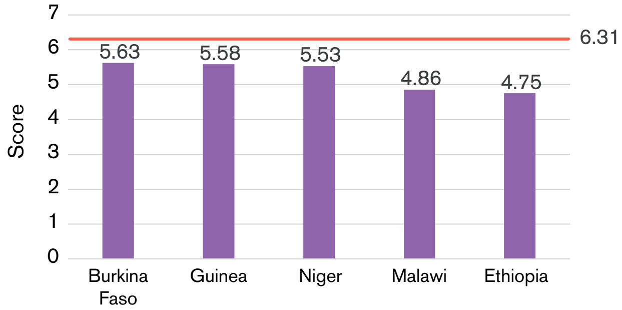




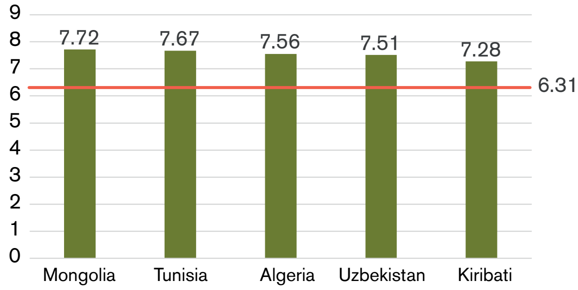
A2.2. By income

Food Availability Index: top five

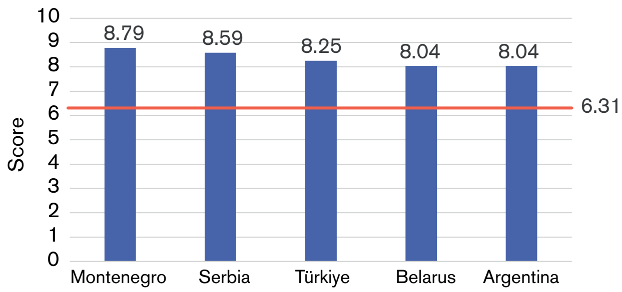
Low-income countries



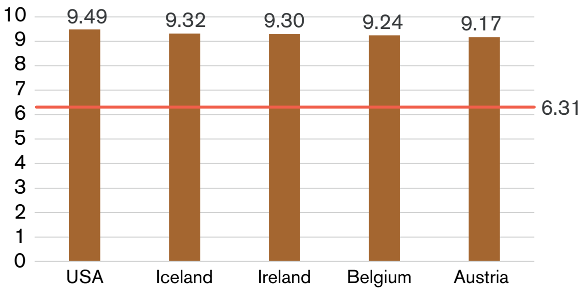
Lower-middle-income countries



Upper-middle-income countries

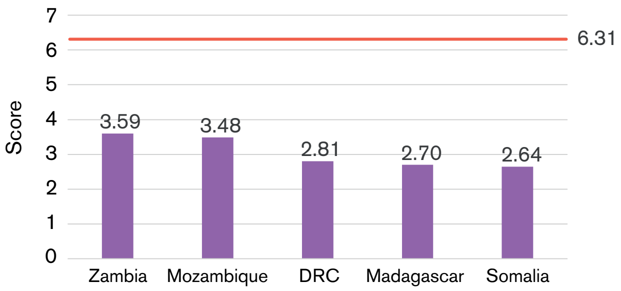


High-income countries

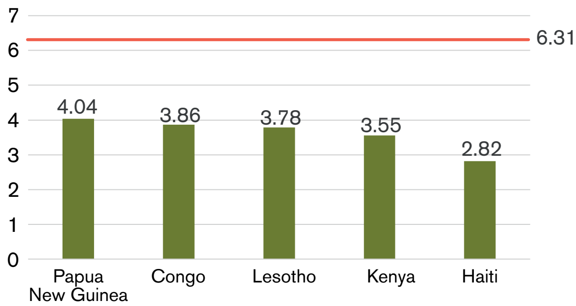


Food Availability Index: bottom five

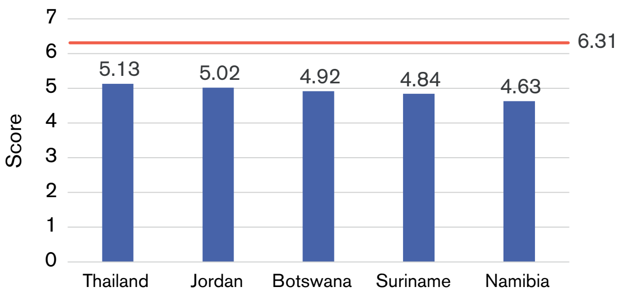
Low-income countries



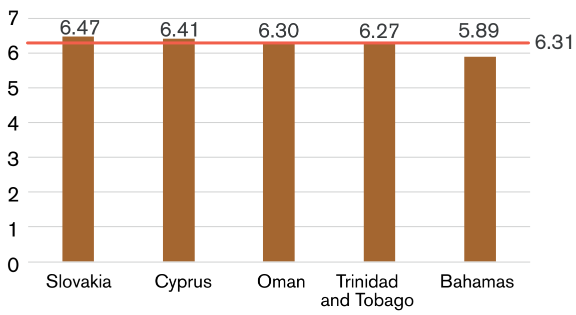
Lower-middle-income countries



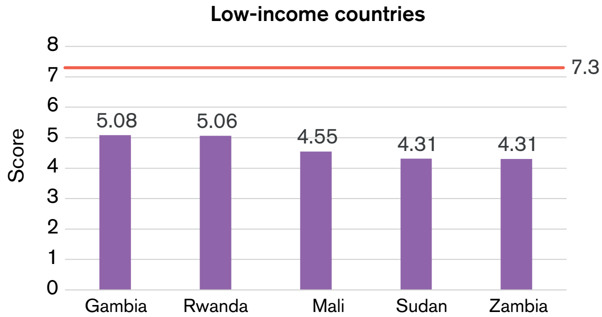
Upper-middle-income countries

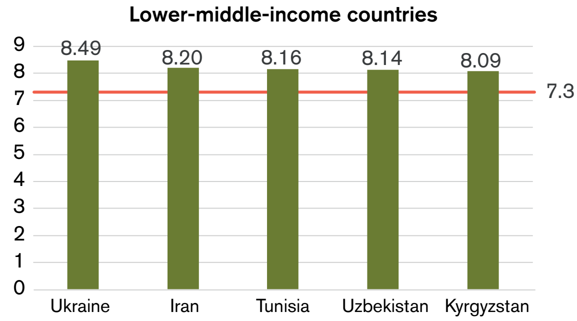


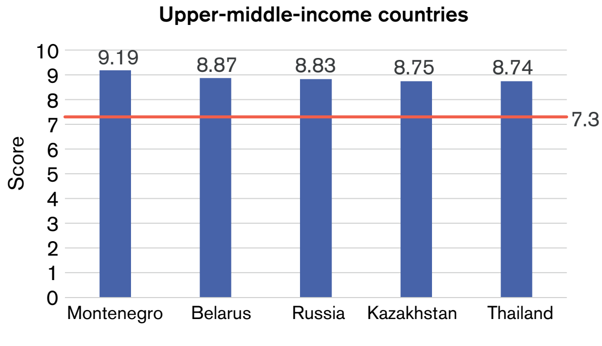
High-income countries

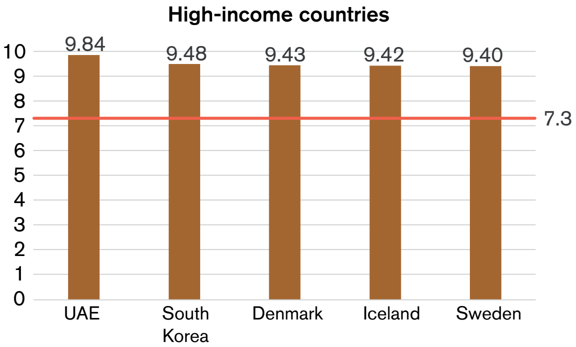


Food Accessibility Index: top five

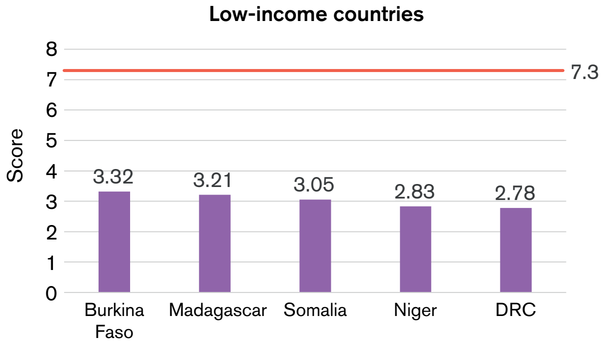


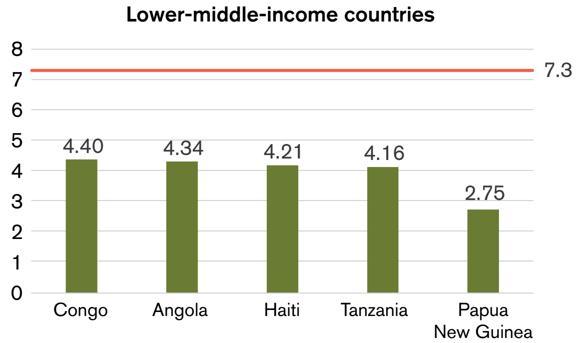


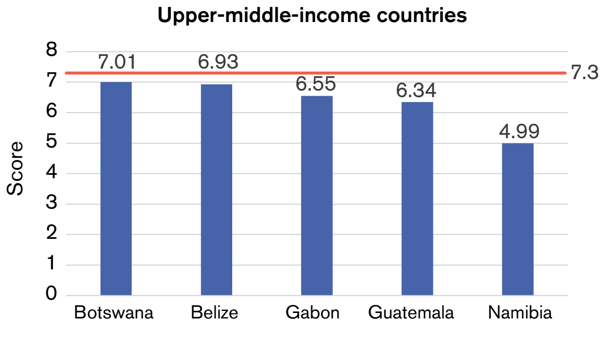


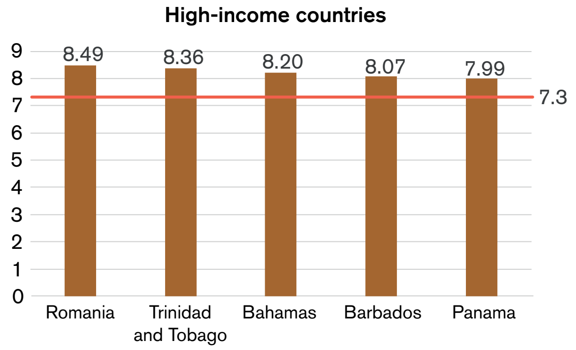


Food Accessibility Index: bottom five



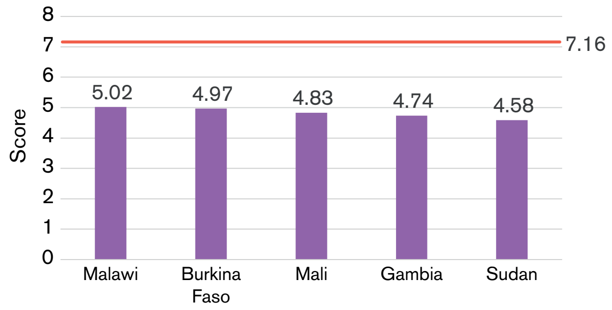




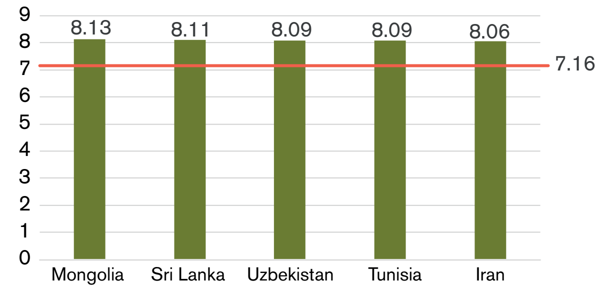


Food Utilisation Index: top five

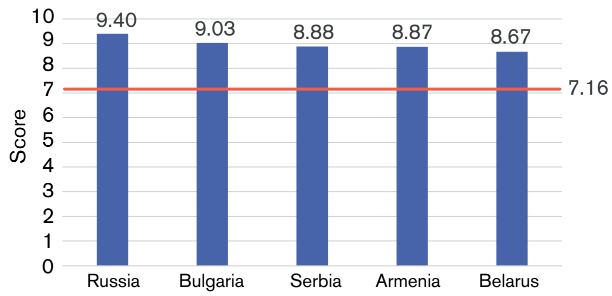
Low-income countries



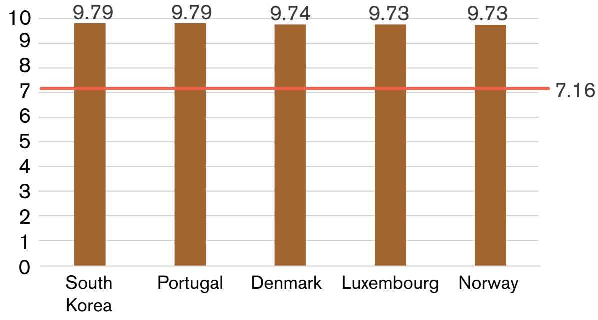
Lower-middle-income countries



Upper-middle-income countries

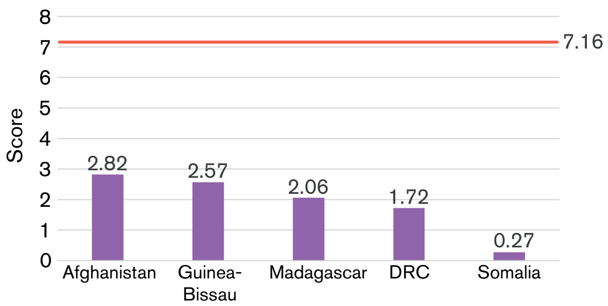


High-income countries

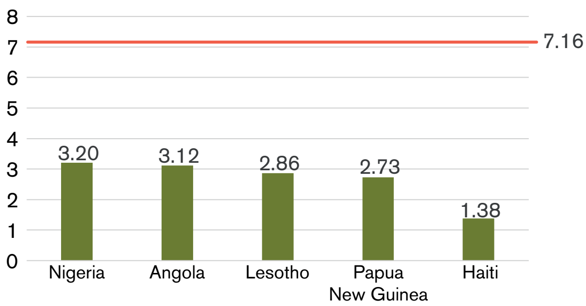


Food Utilisation Index: bottom five

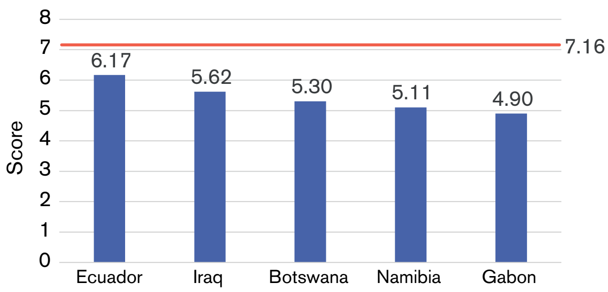
Low-income countries



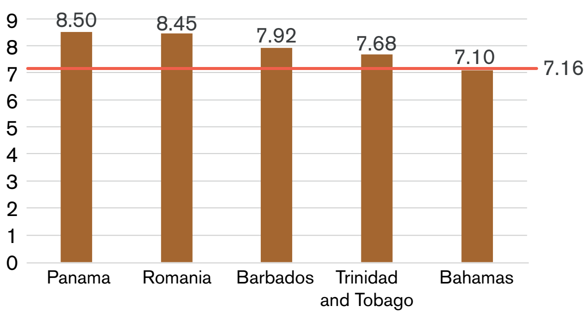
Lower-middle-income countries



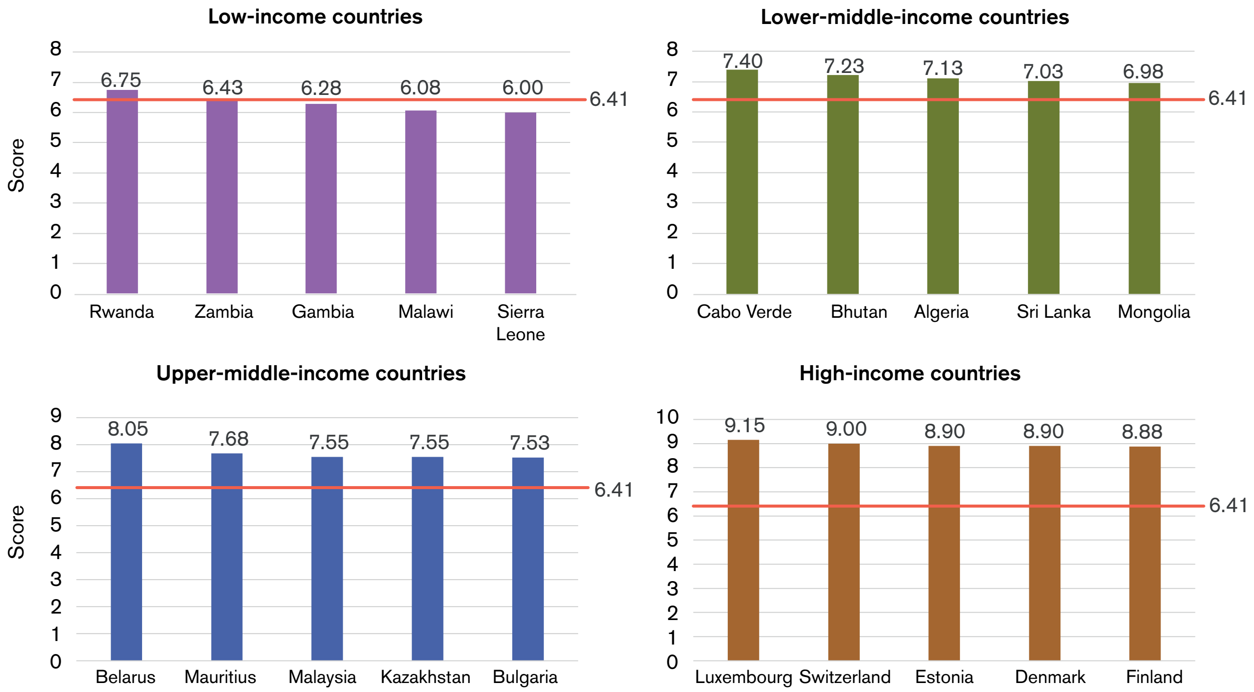
Upper-middle-income countries



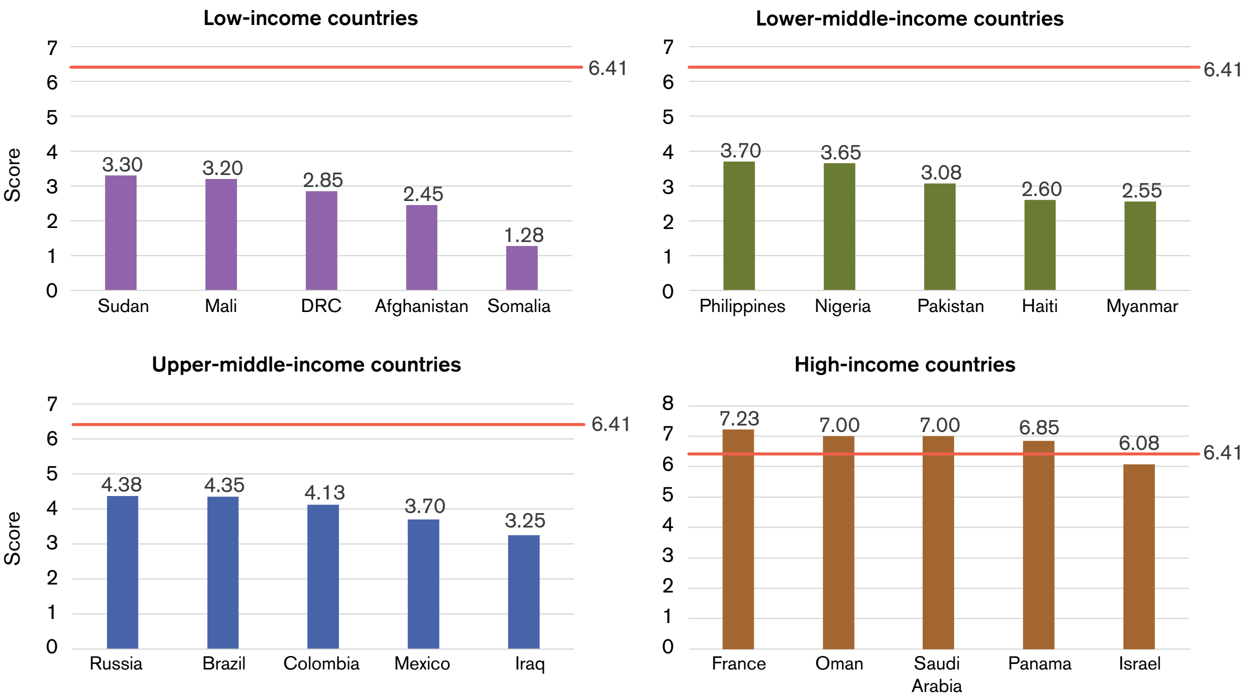
High-income countries



Food Sustainability Index: top five

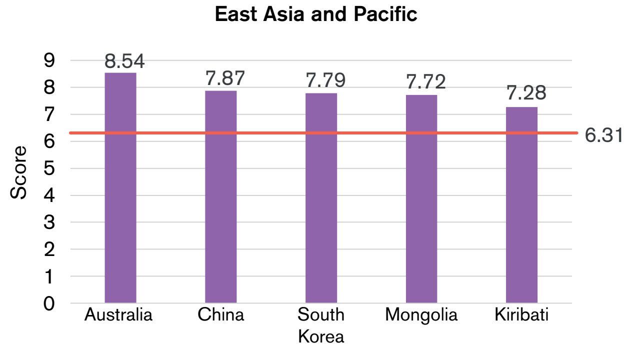


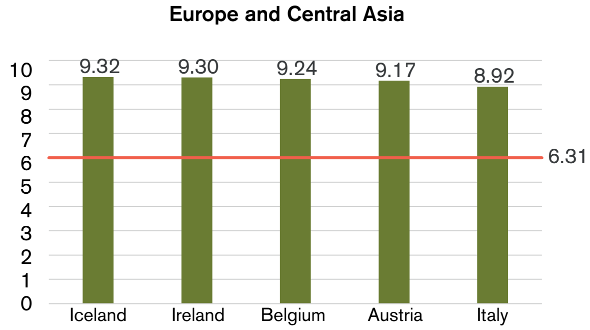
Food Sustainability Index: bottom five

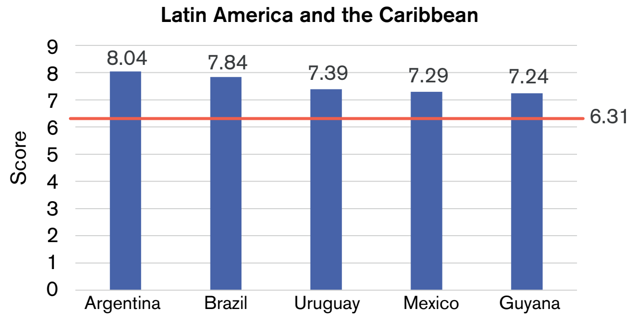


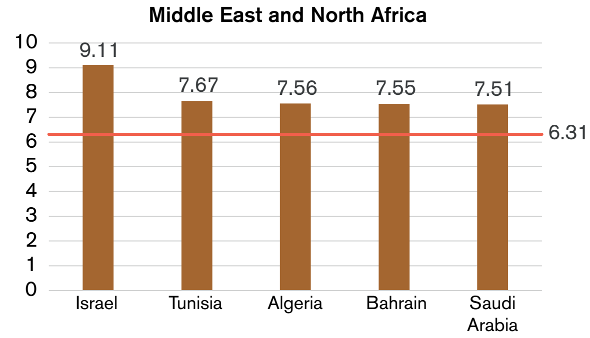
A2.3. By region

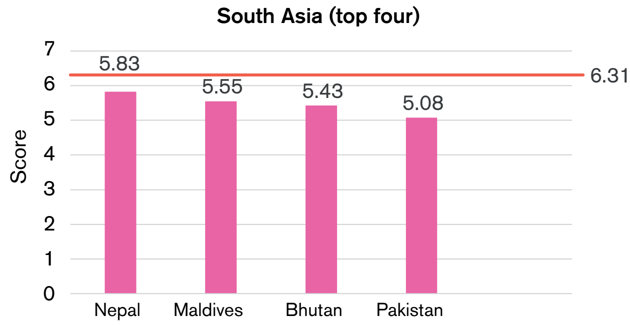
Food Availability Index: top five

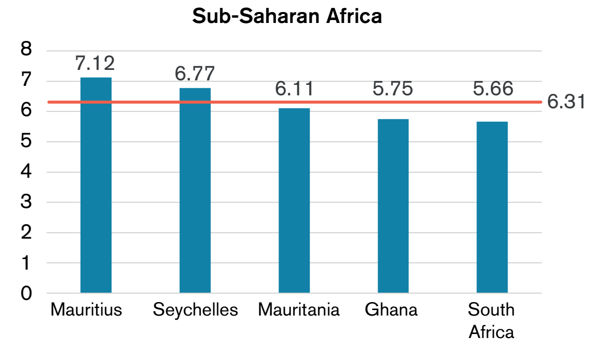




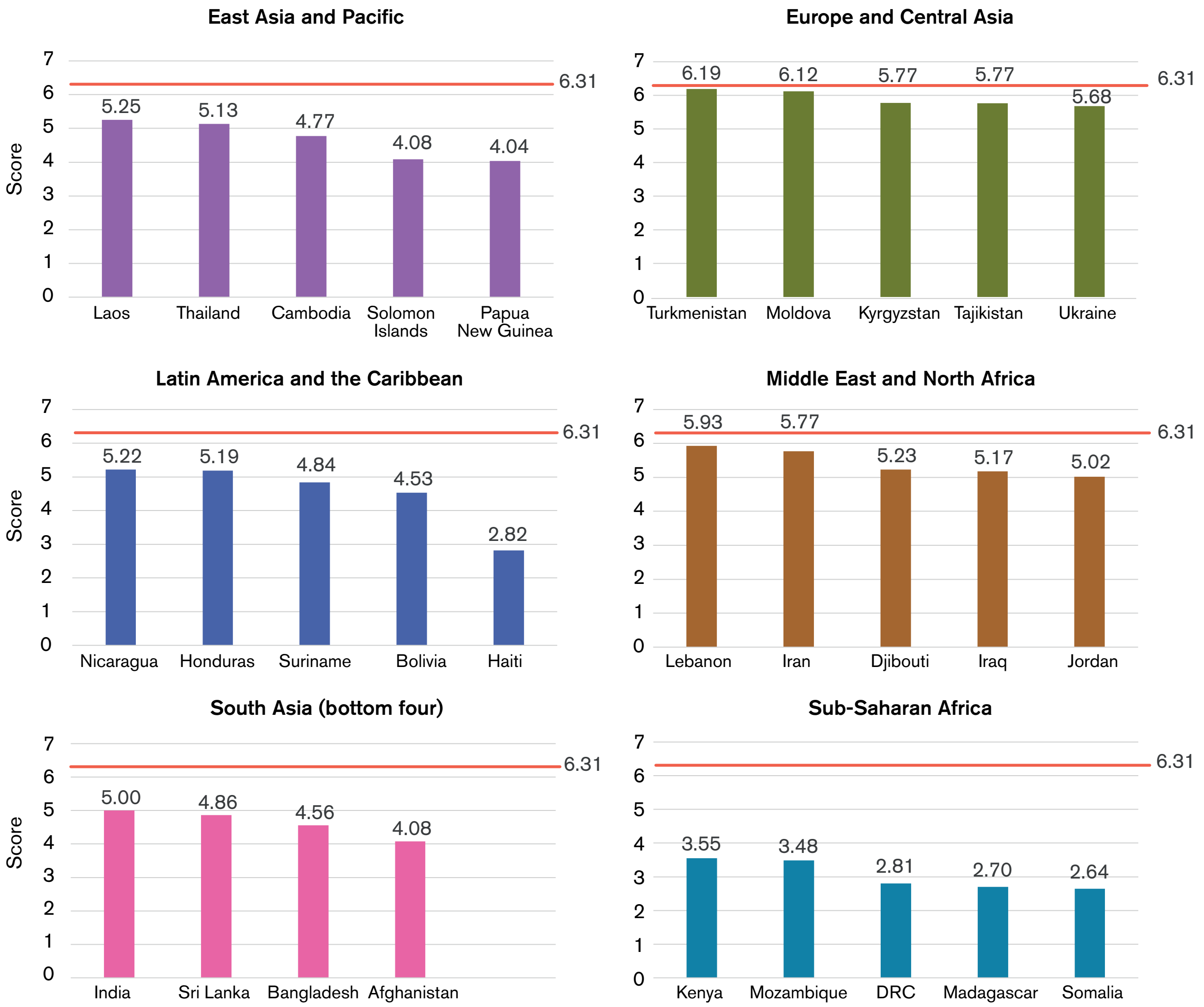






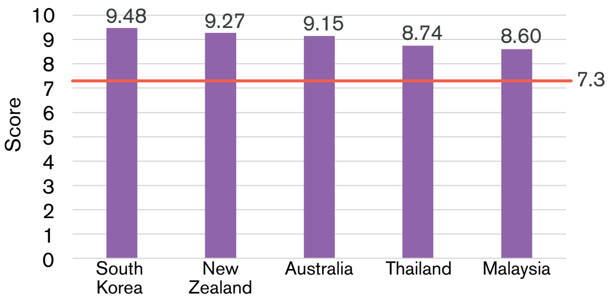


Food Availability Index: bottom five

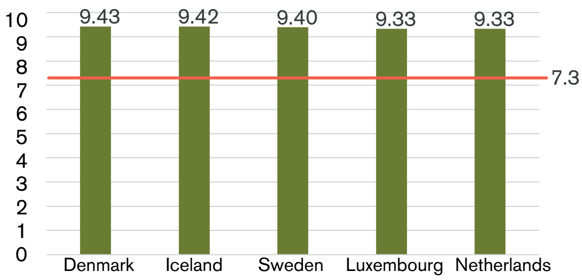


Food Accessibility Index: top five

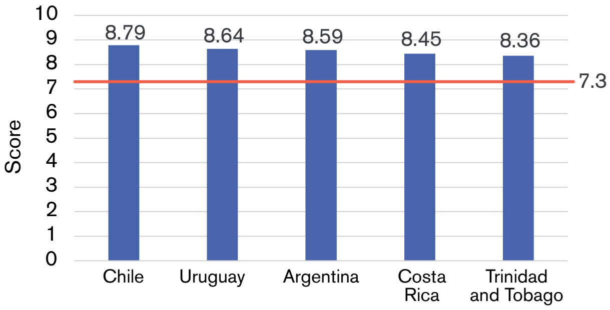
East Asia and Pacific



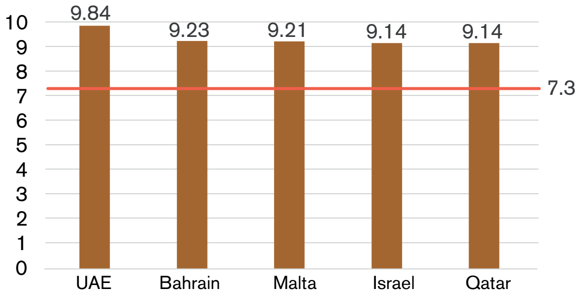
Europe and Central Asia



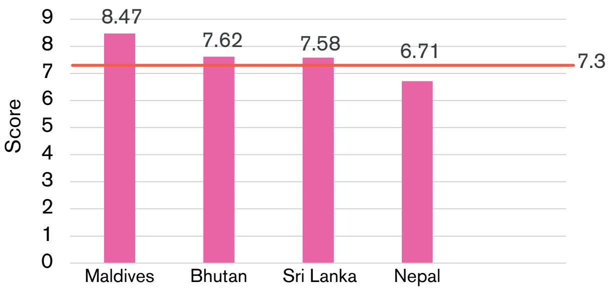
Latin America and the Caribbean



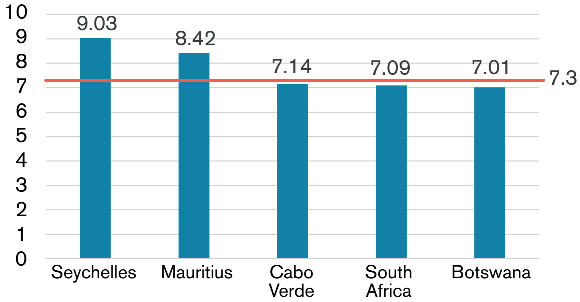
Middle East and North Africa



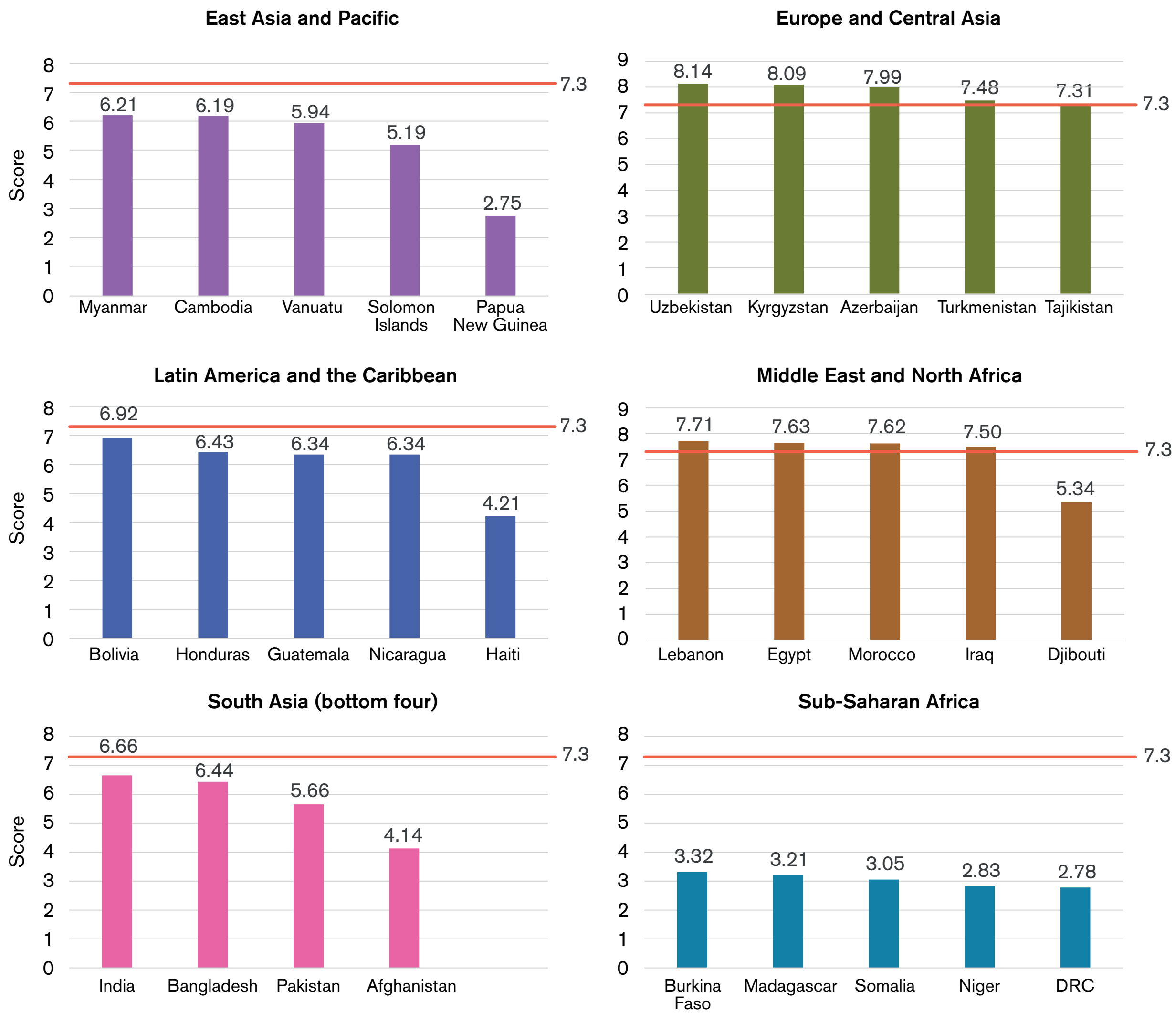
South Asia (top four)



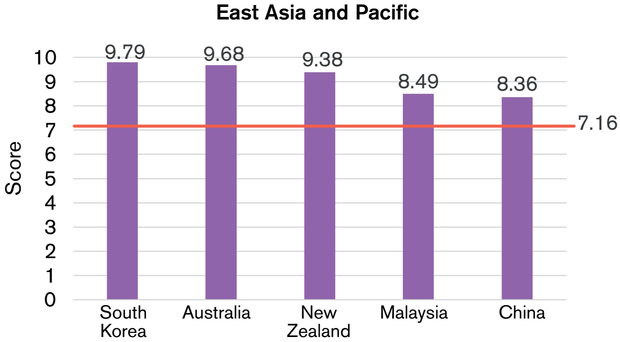
Sub-Saharan Africa

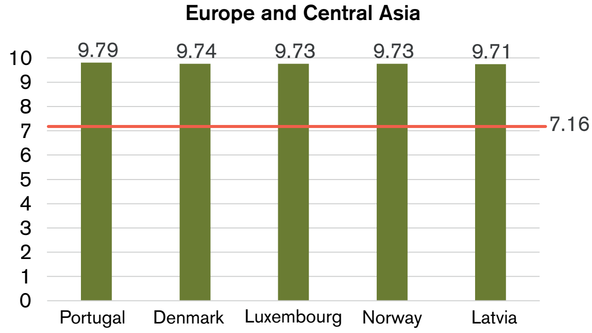


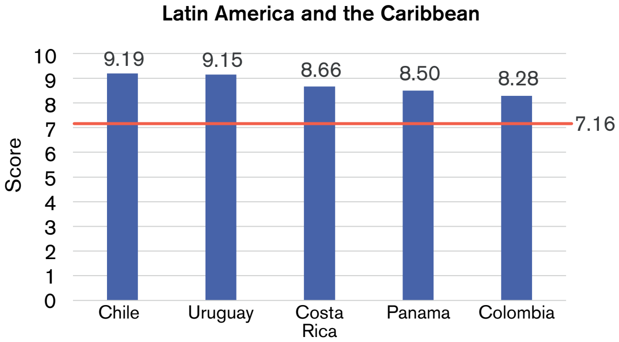
Food Accessibility Index: bottom five

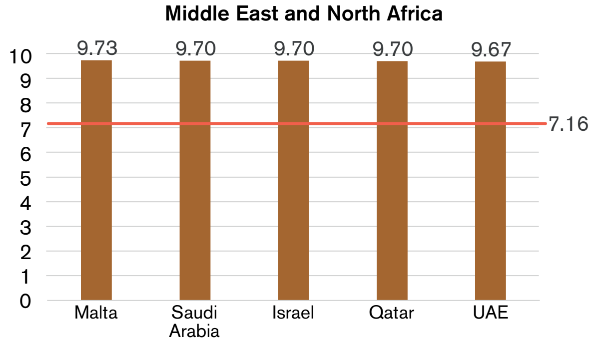


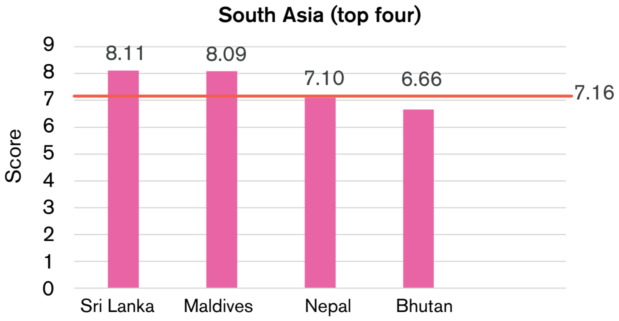
Food Utilisation Index: top five

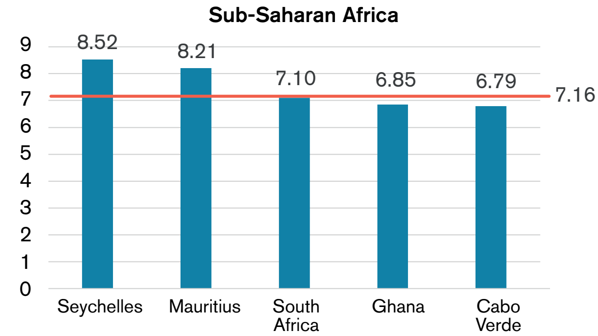




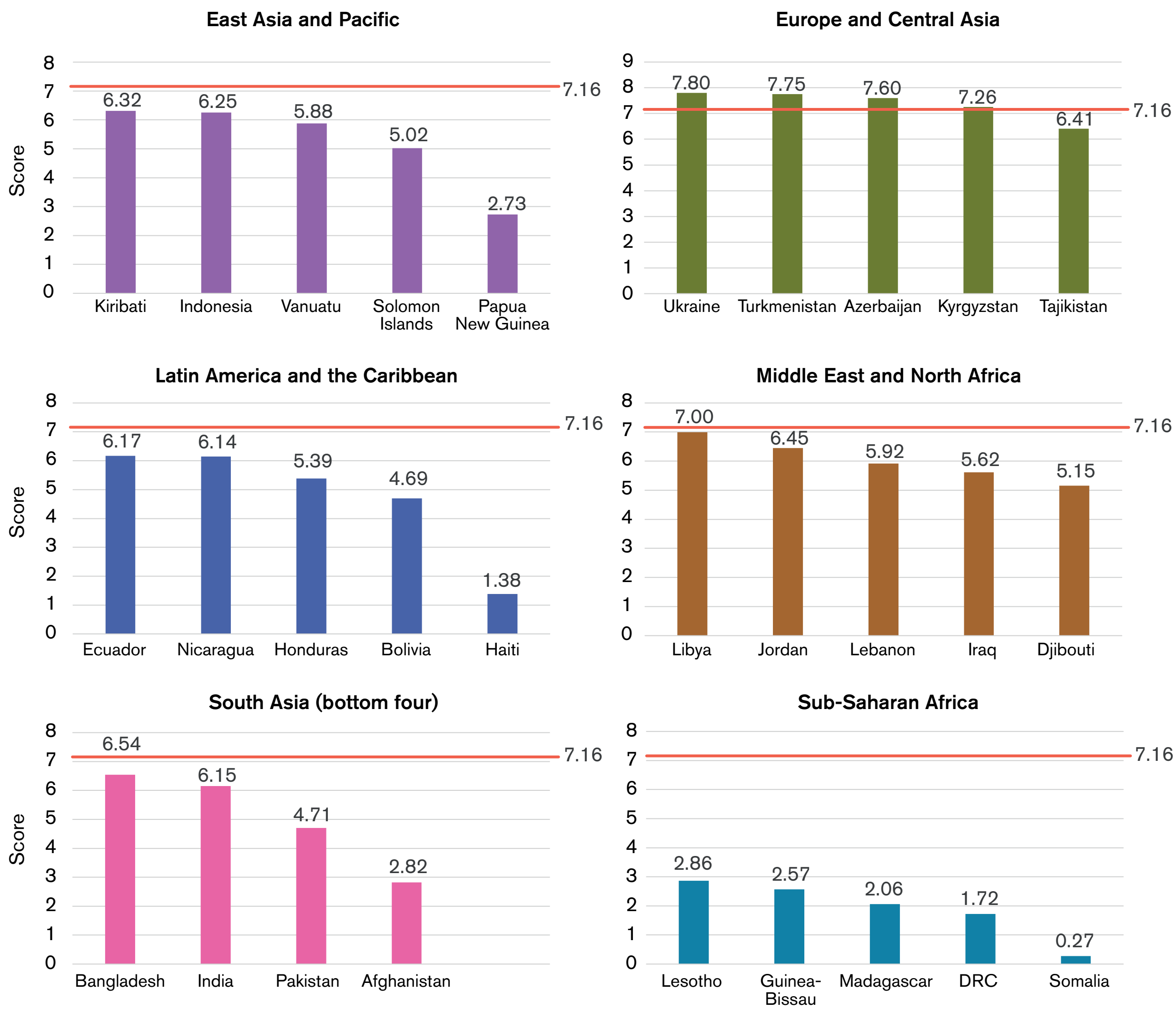




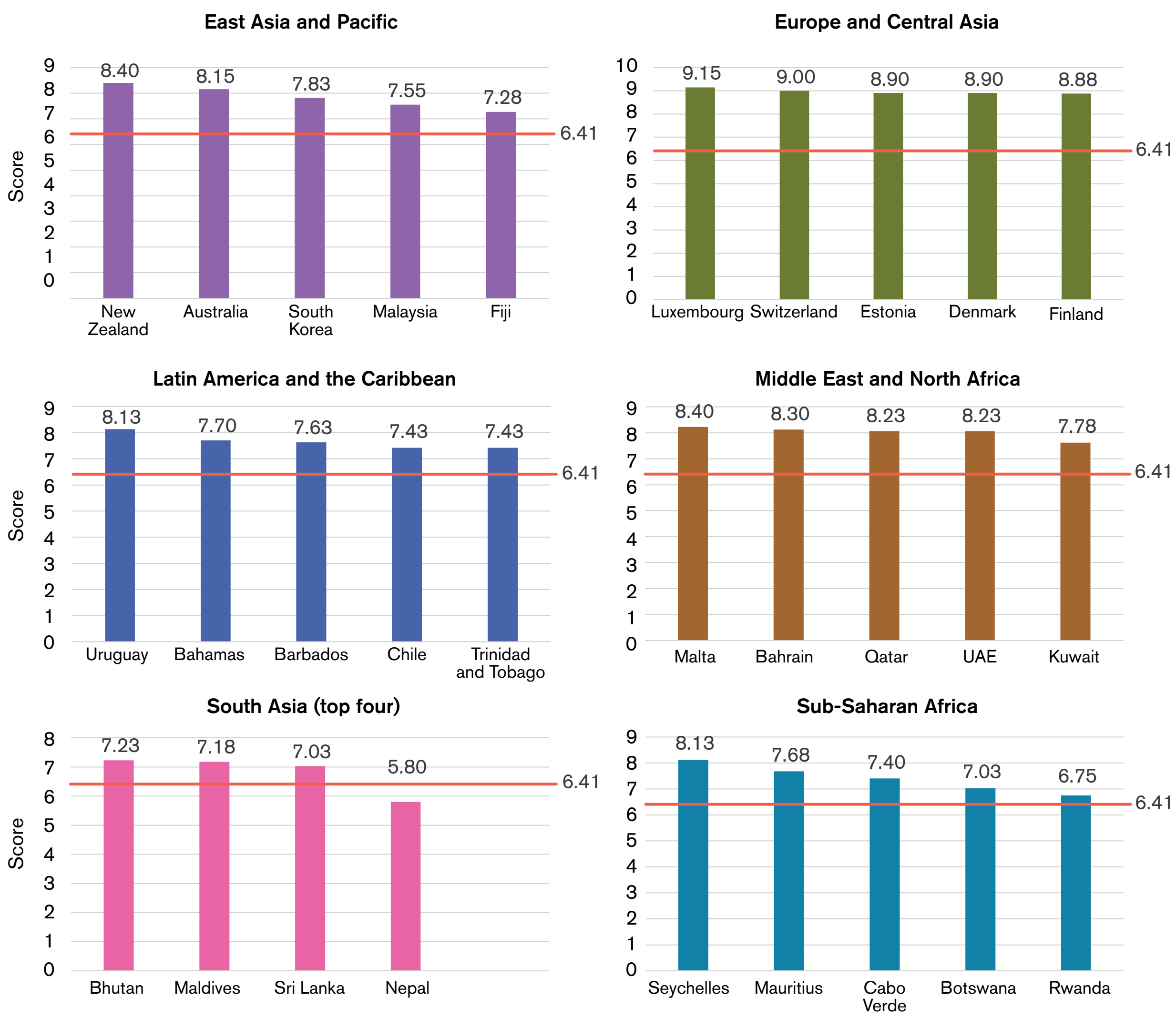




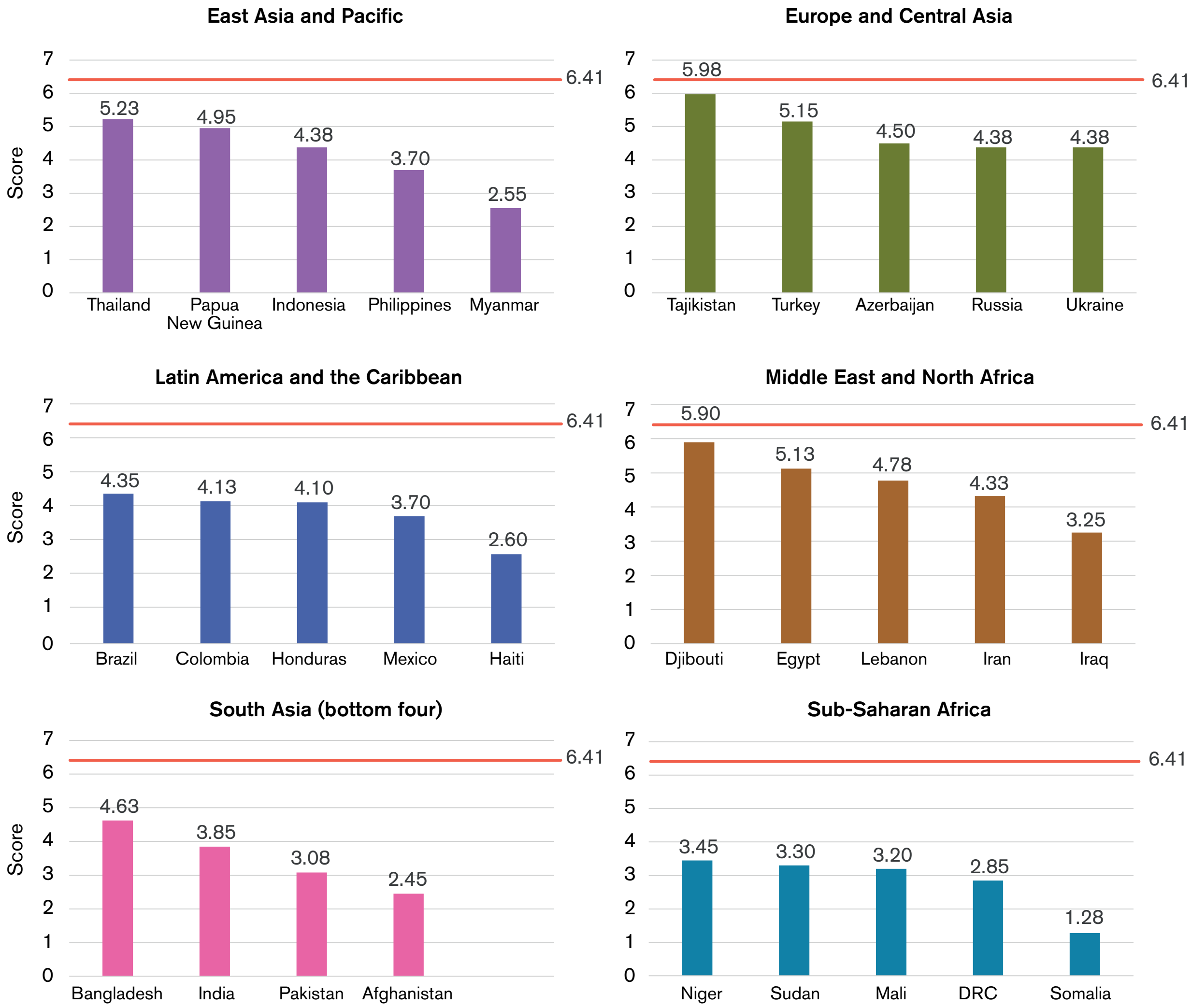
Food Utilisation Index: bottom five



Food Sustainability Index: top five



Food Sustainability Index: bottom five



References

Bezner Kerr, R, Hasegawa, T, Lasco, R, Bhatt, I, Deryng, D, Farrell, A, Gurney-Smith, H, Ju, H, Lluch-Cota, S, Meza, F, Nelson, G, Neufeldt, H and Thornton, P (2022) Food, fibre, and other ecosystem products, in Pörtner, H.-O. et al. (eds) *Climate change 2022: impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge and New York, pp.713–906. doi:10.1017/9781009325844.007.

Bharadwaj, R, Hazra, S, Reddy, M, Das, S and Kaur, D (2021) Connecting the dots: climate change, migration and social protection. IIED, London. www.iied.org/20591iied

Caribbean Catastrophe Risk Insurance Facility and Development Insurer (CCRIF SPC) (2024) Annual report 2023–2024.

Centre of Excellence against Hunger and Malnutrition (CERFAM), World Food Programme (WFP), Economic Community of West African States (ECOWAS) and School Meals Coalition (2024) Home-grown school feeding in West Africa: a landscape analysis.

Chhoeung, N, Chrea, S and Nguyen, N (2022) Cambodia's Cash Transfer Program during COVID-19. Asian Development Bank Institute, Tokyo. doi:10.56506/RRMZ8095.

Economist Impact (2022) Global Food Security Index 2022: strengthening food systems in a vulnerable world. The Economist Group, London.

EM-DAT (no date) EM-DAT The International Disaster Database — Centre for Research on the Epidemiology of Disasters (CRED), University of Louvain, www.emdat.be. Accessed 25 February 2026.

Food and Agriculture Organization of the United Nations (FAO) (2006) Food security. Policy brief, issue 2. Agricultural and Development Economics Division. Rome.

FAO (2022) Information note: the importance of Ukraine and the Russian Federation for global agricultural markets and the risks associated with the war in Ukraine. Food and Agriculture Organization of the United Nations, Rome.

FAO (2023) The impact of disasters on agriculture and food security 2023: avoiding and reducing losses through investment in resilience. Food and Agriculture Organization of the United Nations, Rome.

FAO, IFAD, UNICEF, WFP and WHO (2024) The state of food security and nutrition in the world 2024: financing to end hunger, food insecurity and malnutrition in all its forms. FAO, Rome. doi:10.4060/cd1254en.

Friends of the Global Fight, Malaria No More and the UN Foundation (2021) How can we end malaria? Lessons from around the world.

Government of India (2023) Economic survey 2022–23: social infrastructure and employment. Ministry of Finance.

Hallegatte, S, Bangalore, M, Bonzanigo, L, Fay, M, Kane, T, Narloch, U, Rozenberg, J, Treguer, D and Vogt-Schilb, A (2016) Shock waves: managing the impacts of climate change on poverty. World Bank, Washington DC. doi:10.1596/978-1-4648-0673-5.

International Labour Organization (ILO) (2019) Working on a warmer planet: the impact of heat stress on labour productivity and decent work. Geneva.

International Organization for Migration (IOM) (2023) DRC: displacement figures reach record high of 6.9 million. Press release, 30 October.

Integrated Food Security Phase Classification (IPC) (2021a) Integrated Food Security Phase Classification technical manual version 3.1: evidence and standards for better food security and nutrition decisions. Rome.

IPC (2021b) Madagascar: acute food insecurity and acute malnutrition situation April 2021 - September 2021 and Projection for October - December 2021, www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1154855/. Accessed 25 February 2026.

IPC (2023) Kenya: acute food insecurity situation February 2023 and projection for March–June 2023, www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1156210/. Accessed 25 February 2026.

IPC (2024) Haiti: acute food insecurity situation August 2024–February 2025 and projection for March–June 2025, www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1157971/. Accessed 25 February 2026.

IPC (2025a) Afghanistan: acute malnutrition situation June 2025–September 2025 and projection for October 2025–May 2026, www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1159817/. Accessed 25 February 2026.

IPC (2025b) Somalia: IPC acute food insecurity and acute malnutrition analysis: April–June 2025.

IPCC (2021) Climate change 2021 – the physical science basis. Working Group I Contribution to the Sixth assessment report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge. doi:10.1017/9781009157896.

IPCC (2022) Summary for policymakers, in H-O Pörtner et al. (eds) *Climate change 2022: impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth assessment report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, pp.3–33.

IPCC (2023) Climate change 2023: synthesis report. Contribution of Working Groups I, II and III to the Sixth assessment report of the Intergovernmental Panel on Climate Change, Geneva.

Kaur, N, Agrawal, A, Steinbach, D, Panjiyar, A, Saigal, S, Manuel, C, Barnwal, A, Shakya, C, Norton, A, Kumar, N, Soanes, M and Venkataramani, V (2019) Building resilience to climate change through social protection: lessons from MGNREGS, India. IIED, London. www.iied.org/10197iied

KNSO, Pacific Community and FAO (2021) Food consumption in Kiribati: based on analysis of the 2019/20 household income and expenditure survey. Kiribati National Statistics Office, Tarawa, Kiribati.

Kotz, M, Kuik, F, Lis, E and Nickel, C (2024) Global warming and heat extremes to enhance inflationary pressures, *Communications Earth & Environment*, 5(1), pp.1–11. doi:10.1038/s43247-023-01173-x.

Munich Re (2025) Climate change is showing its claws: the world is getting hotter, resulting in severe hurricanes, thunderstorms and floods, 1 September.

Mwakipesile, G, Mwinuka, L and George, W (2026) A needs-based model for cash transfer value determination: towards equitable cash assistance in drought-prone regions [version 1; peer review: awaiting peer review], *F1000Research*, 15(94). doi:10.12688/f1000research.176631.1.

OECD and IDB (2024) Caribbean development dynamics 2025, OECD Publishing, Paris. doi:10.18235/0013313.

Ortiz-Bobea, A, Ault, TR, Carrillo, CM, Chambers, RG and Lobell, DB (2021) Anthropogenic climate change has slowed global agricultural productivity growth, *Nature Climate Change,* 11(4), pp.306–12. doi:10.1038/s41558-021-01000-1.

Rasella, D, Aquino, R, Santos, CA, Paes-Sousa, R and Barreto, ML (2013) Effect of a conditional cash transfer programme on childhood mortality: a nationwide analysis of Brazilian municipalities, *The Lancet*, 382(9886), pp.57–64. doi:10.1016/S0140-6736(13)60715-1.

Ritchie, H (2018) Global inequalities in CO_2 emissions. Our World in Data, 16 October.

Rother, B, Sosa, S, Debbich, M, Castrovillari, C and Prifti, E (2023) Global food crisis update—recent developments, outlook, and IMF engagement. International Monetary Fund. doi:10.5089/9798400238086.068.

Teku, D and Tariku, GD (2026) Effectiveness of early-warning systems and disaster risk reduction for rural food security under hydro-meteorological hazards in Sub-Saharan Africa: A systematic review, *International Journal of Sustainable Development & World Ecology*, 33(1), pp.101–122. doi:10.1080/13504509.2025.2595056.

Tenzig, J and Conway, D (2023) Does the geographical footprint of Ethiopia's flagship social protection programme align with climatic and conflict risks? Grantham Research Institute on Climate Change and the Environment, Working Paper 399. London School of Economics.

UNCTAD (2022) The least developed countries report 2022: the low-carbon transition and its daunting implications for structural transformation. United Nations, Geneva.

UN-OHRLLS (2015) Small Island Developing States in numbers: climate change edition 2015. United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, New York.

USDA Foreign Agricultural Service (2023) Denmark: exporter guide. US Department of Agriculture, Washington DC.

USDA Foreign Agricultural Service (2024) Grain and feed update: Morocco. US Department of Agriculture, Rabat.

USDA Foreign Agricultural Service (2025) Retail foods annual: Saudi Arabia.

von Grebmer, K, Bernstein, J, Wiemers, M, Reiner, L, Bachmeier, M, Hanano, A, Gitter, S, Larocque, G and Fritschel, H (2023) 2023 Global Hunger Index: the power of youth in shaping food systems. Welthungerhilfe and Concern Worldwide, Bonn and Dublin.

WFP and Food and Agriculture Organization (FAO) (2025) Hunger hotspots: FAO-WFP early warnings on acute food insecurity, November 2025 to May 2026 outlook. Italy.

World Bank (no date-a) World development indicators, https://databank.worldbank.org/source/world-development-indicators. Accessed 28 October 2024.

World Bank (no date-b) World development indicators: employment in agriculture (% of total employment) (modeled ILO estimate), https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS. Accessed 25 February 2026.

World Bank (no date-c) World development indicators: agriculture, forestry, and fishing, value added (% of GDP), https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS. Accessed 25 February 2026.

World Bank (2024a) Lebanon poverty and equity assessment 2024: weathering a protracted crisis. Washington DC.

World Bank (2024b) Saudi Arabia: macro poverty outlook.

World Bank (2024c) The state of social protection and jobs: overview. Washington DC.

World Bank (2025) State of social protection report 2025: the 2-billion-person challenge. Washington DC. doi:10.1596/978-1-4648-2156-1.

World Food Programme (WFP) (2024) Djibouti annual country report 2023. Rome.

World Food Summit (WFS) (1996) Declaration on World Food Security. Rome. www.fao.org/4/w3613e/w3613e00.htm

World Health Organization (WHO) (2014) Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva.

World Meteorological Organization (WMO) (2023) Atlas of mortality and economic losses from weather, climate and water-related hazards (1970–2021). Geneva.

WMO (2025) State of the global climate 2024. World Meteorological Organization, Geneva.

Zhao, C, Liu, B, Piao, S, Wang, X, Lobell, DB, Huang, Y, Huang, M, Yao, Y, Bassu, S, Ciais, P et al. (2017) Temperature increase reduces global yields of major crops in four independent estimates, *Proceedings of the National Academy of Sciences*, 114(35), pp.9326–31. doi:10.1073/pnas.170176211.

Related reading

Bharadwaj, R, Karthikeyan, N and Chaliha, S (2025) Climate resilience through social protection: the economic case for early action. IIED, London. www.iied.org/22668iied

Bharadwaj, R, Karthikeyan, N and Mitchell, T (2024) Food security in changing climates: social protection must respond to unfolding crises. IIED, London. www.iied.org/22516iied

Bharadwaj, R, Mitchell, T, Karthikeyan, N, Raj, N, Chaliha, S, Abhilashi, R, Chinnaswamy, K, B, R, Deulgaonkar, I, Chakravarti, D and McCabe, T (2023) Delivering anticipatory social protection: country readiness assessment. IIED, London. www.iied.org/21896iied

Bharadwaj, R, Mitchell, T and Karthikeyan, N (2023) Anticipatory Social Protection Index for Resilience — ASPIRE. IIED, London. www.iied.org/21901iied

Knowledge Products

Research Report

March 2026

Climate change; Policy and planning

Keywords:
Loss and damage, fragile and conflict affected states (FCAS), debt sustainability, food security, climate finance

Climate change is steadily weakening the foundations of food security: reducing food availability, making food less accessible, worsening malnutrition and diminishing the effectiveness of food use. And as shocks repeat, it turns short-term stress into long-term fragility. These pressures are felt most severely in countries and communities with the least capacity to cope. Yet, most measures used in food security analysis capture only part of the picture and some indices do not cover the countries most at risk. To address this gap, we constructed a new Food Security Index (FSI) for 162 countries, which assesses performance across four distinct pillars: availability, access, utilisation and sustainability. This approach allows us to see not just which countries are food insecure, but also why, allowing us to develop policy and programmatic responses to address them.

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