Global Panel
on Agriculture
and Food Systems
for Nutrition

# Food systems and planetary goals: two inseparable policy agendas

**Food systems have no viable future without delivering on climate change and planetary goals – but conversely, these cannot be delivered without addressing unsustainable food systems that continue to damage the health of the planet and people. This brief highlights the extent to which current action to transform food systems falls far short of what is required to avoid major impacts in the future. Fundamental changes in approach are proposed to address the current situation. These have the potential to cause a cascade of wider benefits, for health and wellbeing, economic growth, poverty and equity, environmental sustainability and climate change.**

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# Preface

Food systems in low- and middle-income countries are facing an existential threat because of escalating climate change, and a host of other environmental factors that are threatening their ability to function. There is now a very real risk that the average global temperature will rise more than 1.5°C above pre-industrial levels in the next five years, with much greater increases possible in the longer term. Deforestation is continuing despite global targets to halt it by the end of the decade. Irreversible biodiversity loss continues apace, along with pollution of land and water, and reductions in soil health.

Food systems are already failing to cope – around three billion people cannot afford healthy diets today. However, the situation could become considerably worse, for example if climate tipping points are breached in the years ahead. The stark reality is that there is no viable future for our food systems unless these crises affecting the planet's environmental systems are urgently addressed.

The idea for this policy brief arose in 2023 when the Global Panel convened a major meeting of experts and policymakers at Windsor Castle in the UK. This explored the many environmental threats facing global food systems. But it also exposed the contribution that those same food systems are making to environmental decline. Food systems are a major cause of climate change through their greenhouse gas emissions. They are also driving biodiversity loss and pollution. And they are operating unsustainably beyond planetary boundaries.

This policy brief sets out to do two things. It reviews the scale of the threats facing food systems, particularly in low- and middle-income countries. In so doing, it exposes how those threats could impact food systems and hunger, and also economic development. It makes clear what needs to be done at a systemic level to transform the increasingly damaging relationship between food systems and the environment. Action is proposed at national and local scales, based on intergovernmental consensus. LMICs have most to lose; however, all countries need to act without delay.

**Sir John Beddington**
Chair
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# Foreword

The last five years have brought to the fore the challenges arising from our demands for the goods that the land provides, and there are further enormous challenges ahead. Emerging diseases, such as COVID-19, are made more likely through climate change and land-use change; extreme weather is increasingly disrupting agriculture and livelihoods; and the conflict in Ukraine has emphasised the geo-strategic importance of productive agricultural land to the global food supply. Together, more fragile agriculture, a more disruptive climate, and more geo-political tensions and competition all make food system change politically more important than ever.

Changing food systems for the better has the potential to tackle a range of social and environmental challenges: biodiversity loss, pollution from agriculture, climate change, equitable access to health-enhancing and nutritious diets, and, of course, food insecurity. Each of these challenges can be addressed with long-term and strategic planning for changes to the global food system, as well as through analysis of how the global food system interacts with local food systems. This requires more than a sustainability transition for agriculture across the world. It calls for a broader effort to address *what agriculture produces* – diversifying and increasing the supply of pulses, vegetables and fruit; how it is grown – making farming systems more sustainable, going beyond simply increasing efficiency; *where agriculture happens* – including protecting biodiverse and more pristine habitats; and *how much agriculture should produce* – a sufficiency rather than an excess that increases waste and caloric consumption.

Low- and middle-income countries are the most exposed both to climate change and through economic marginalisation to its wider impacts, such as those that result from changes in global market prices. Whilst there is much that domestic policymakers in those countries can do to address the 1.5+ agenda – as highlighted in this paper – they are also subject to drivers from higher income countries and more powerful economies. These drivers include those arising from globalisation, from debt accumulation and through aid budgets. The onus is therefore on richer and poorer countries to work together to deliver food system transformation, especially on behalf of the world's poorest.

We very much welcome this policy brief which has been produced by the Global Panel on Agriculture and Food Systems for Nutrition. It highlights the many risks of inaction and makes clear proposals for redressing the currently worsening situation. It is essential that world leaders and all relevant policymakers act decisively on the messages therein.

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# Executive summary

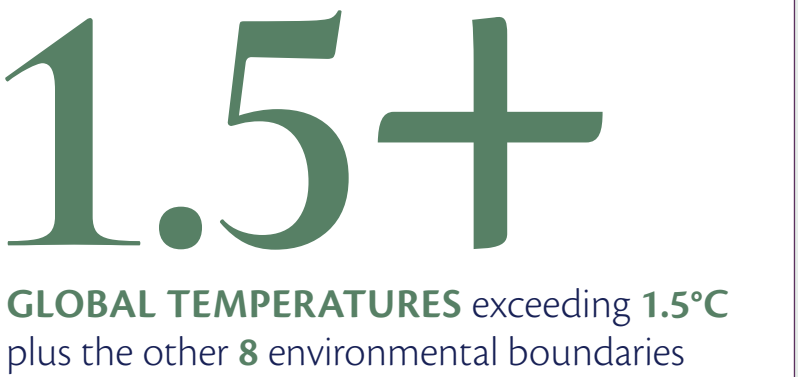
This brief focuses on two critical policy themes which are interlinked, viewing them through the lens of low- and middle-income countries (LMICs). The first is the global imperative to deliver on the '1.5+' agenda: that is, to address climate change alongside challenges associated with other planetary boundaries (see Box 1).[1] The second theme concerns growing calls for food system transformation. Food systems are failing to provide affordable healthy diets for three billion people and are important drivers of climate change and many other forms of environmental degradation. Actions are needed to address these policy agendas simultaneously to achieve the goals embedded in both. In other words, one cannot be achieved without success in the other.

There are three key conclusions. The first is that it is essential that all nations prioritise delivering on the 1.5+ agenda: all have critical roles to play. Failure to do so would lead to all countries being severely impacted, with LMICs most at risk. Second, policymakers need to align their national food system transformation pathways with the wider 1.5+ agenda: there is no viable future for food systems without delivering on 1.5+, and 1.5+ cannot be delivered without addressing the shortfalls in food systems. Third, this linked-up agenda has the potential to yield a cascade of wider benefits not just globally but also at the national level, for economic growth, equity, health outcomes, environmental sustainability, and greater stability. However, capturing mutual benefits requires the international community to work together to foster an environment to support change, share appropriate financing and technology innovation, and work concretely at sub-national levels to implement change.

This brief is intended primarily to support policymakers in LMICs: those already committed to food system transformation, but also those focused on wider policy agendas for jobs and growth, human and planetary health, gender equity, and poverty. However, there are also important implications for high-income countries (HICs), which have a particular responsibility to lead in areas such as climate change mitigation, as well as stakeholders involved in international policy processes, including the private sector. Recent policy developments are reviewed, recognising some welcome steps but also noting that most countries are falling far short of what is required. Specific recommendations are made, identifying necessary high-level changes in approach, as well as barriers that need to be addressed. Finally, the concluding section looks to COP28 and beyond, and the opportunities to catalyse action.

*Box 1.* The '1.5+ Target' applied to food systems

This target entails food systems playing a central role in the global effort to limit global temperature rise to 1.5°C, *and* the requirement for food systems to transform so that they become sustainable and operate within a further eight planetary boundaries: biodiversity loss, land-use change, freshwater use, ocean acidification, stratospheric ozone, global Phosphorous and Nitrogen cycles, chemical pollution, and atmospheric aerosol loading.[1]



# 1. Background – recent policy developments

**The IPCC, and past climate COPs, have failed to put food system transformation at the centre of efforts to address climate change and environmental degradation.**
Policy fora can play a key role in informing international policy priorities and in driving change. While the COP process has included some attention to agriculture and land use as contributors to harmful planetary outcomes, it has yet to adequately highlight the contribution of the entire food system (i.e., beyond the farm gate) to GHG emissions and environmental degradation. This is a substantial failure of policy. Roughly 6Gt out of the world's 16.5Gt of greenhouse gas (GHG) emissions come from pre- and post-farmgate food system activities.[2]

**The 2021 UN Food System Summit (UNFSS) was an important step in reframing global thinking on what food systems need to deliver over the coming decades.**
Food systems must no longer focus – as they have for half a century – on delivering calories as cheaply as possible. The UNFSS process supported growing agreement on the urgent need to transform food systems so that they contribute to making healthy diets accessible for all, while being affordable and sustainable. The sustainability dimension brings planet-wide environmental challenges into the equation. Sustaining human health requires nutrient-rich foods to be consumed in balanced diets, and those foods must be produced and distributed in ways that do not negatively impact the natural resource base on which we all depend. Furthermore, since food systems contribute around one-third of all greenhouse gas emissions because of the ways in which they currently function, changing how they operate will be key to global efforts to keep temperature rises to within 1.5°C while tackling other planetary boundaries associated with environmental degradation.

**There is increasing recognition by leaders of LMICs that food system transformation needs to deliver much more than an increase in food production.**
For example, the Comprehensive African Agriculture Development Programme (CAADP) framework for agricultural transformation "underscores the role of food systems transformation in facilitating the achievement of all the 20 goals of Agenda 2063."[3] These Africa-wide goals look beyond those enshrined in the Sustainable Development Goals (SDGs) in that they emphasise sustainable economic growth, biodiversity, conservation, and sustainable natural resource management.[4] Food systems are also seen as engines for creating jobs: for example, on current trends, food systems in Ethiopia, Malawi, Mozambique, Tanzania, Uganda and Zambia will provide more than 70% of total jobs in those countries by 2025.[30] All of these are in addition to goals for healthy and well-nourished citizens and gender equality.

### *Box 2.* Rwanda as an African exemplar[48]

Rwanda is pressing ahead with its food systems strategy and implementation plan. The aim is to define actionable and pragmatic sets of investment areas that will catalyse food system transformation. The success of Rwanda's approach is founded on a range of factors, including: political leadership and drive; embracing change right across food systems, including influencing demand for healthy, sustainable diets; and cross-government recognition that food system transformation will deliver on multiple Sustainable Development Goals – such as nutrition and health, climate change and the environment, livelihoods and equity. Careful analysis of the challenges specific to Rwanda has informed the detailed design of the transformation pathways.[57]

Six game-changing solutions have been identified:[5]

1. Nutritious food programmes;
2. Food loss and waste management;
3. Inclusive markets and food value chains;
4. Sustainable and resilient food production systems;
5. Inclusive financing and innovative investments; and
6. Effective mainstreaming of youth and women in food systems.

An implementation model has been drawn up, as well as 14 indicative priority programmes – to address critical areas raised during the UN Food System Summit (UNFSS) dialogues. The emphasis is on developing new delivery mechanisms, rather than creating new structures.

**But the ambition of the national commitments made at the UNFSS Summit was mixed.**

110 countries submitted commitments in national pathways to transform their food systems. However, a recent study commissioned by the Global Panel has shown that: i) overall the commitments of high-income countries focus more on what those nations are already doing, or have done in the past, ii) low- and middle-income countries were more likely to have commitments on proposed new actions, and iii) many commitments amounted to incremental improvements, and therefore lacked the truly transformative change that is required. A higher proportion of commitments in HICs concerned issues such as climate change adaptation and mitigation, as well as targeting nature-positive outcomes. Overall, there was insufficient emphasis on influencing demand; food choices (for those who can afford to make them) can be a powerful driver of change towards improving the sustainability and carbon footprint of food systems, as well as engendering healthy, affordable diets. However, there are exceptions to this somewhat mixed picture. In Africa, Rwanda provides an example which demonstrates both high ambition and some progress (see Box 2).[5]

**Progress in implementing food system transformation commitments has been limited.**

Developing and implementing a strategy for food system transformation remains a significant challenge for policymakers in many countries, despite the many sources of advice and guidance which are available.[31, 65] Since 2021, action to implement national commitments has been severely constrained by a number of factors. LMICs have been particularly affected by the lingering impacts of the COVID-19 pandemic, and by droughts, floods and pests, as well as local conflict, security threats from terrorism and displaced people. The problems facing many LMICs have been further compounded by impacts arising from the crisis in Ukraine which include disruptions in supply chains, very substantial rises in the cost of agricultural inputs such as energy and fertilisers, and more recently, the growing debt crisis linked to rises in global inflation. This succession of overlapping crises has diverted policy focus from the longer-term food-system transformation agenda. The impact of indebtedness has further constrained the ability of LMICs to resource intended actions. Taken together, the lack of resilience in food systems in a world that is increasingly volatile and uncertain is now a systemic factor that is impacting the ability of LMICs to transform their food systems.

# 2. Food system transformation and the 1.5+ planetary agenda

The limited recent progress outlined above argues the need for policymakers to find ways to accelerate the changes needed to achieve truly transformational change in food systems – and to deliver against the goals in '1.5+'. While the issues inherent in 1.5+ are generally global in nature (for example, climate change and ocean acidification) they develop differently in different localities. Drawing on country case examples, this section explains why the environmental issues inherent in 1.5+ are especially important for LMICs.

## 2.1 Climate change mitigation

Global temperature rise may exceed 1.5°C in the next few years. It is estimated that there is now a 66% likelihood that the annual average near-surface global temperature between 2023 and 2027 will be more than 1.5°C above pre-industrial levels for at least one year.[58] While such a rise might be temporary, it sends a clear warning signal to world leaders. Also, the window for limiting global temperature rise to 1.5°C in the longer term is closing rapidly. Indeed, that goal is now considered to be unattainable without unprecedented – and arguably unrealistic – reductions in greenhouse gas emissions over the next eight years.[7] Indeed, the 2022 Sixth Assessment Report (AR6) of the IPCC report argued (with high confidence) that the rise in weather and climate extremes has already led to irreversible impacts as natural and human systems are pushed beyond their ability to adapt.[6]

The transformation of food systems has a critical role to play in reducing greenhouse gas emissions, given that food systems account for around one third of the global total.[60] However, actions on food systems are failing to deliver reductions in GHGs at anything like the scale required. Estimates indicate that global food systems need to reduce their GHG emissions by 40-70% by 2050 to play their part in limiting global warming to 1.5°C.[6] Instead, food system emissions are projected to increase by between 60 and 90% between 2010 and 2050; that increase will happen in the absence of dedicated measures, and if current trends continue with respect to population growth and dietary changes towards more animal source foods, especially in LMICs.[7] The 2022 UN Emissions Gap report argued that updated national pledges made since COP26 "made a negligible difference to predicted 2030 emissions... Policies currently in place point to a 2.8°C temperature rise by the end of the century. Implementation of the current pledges will only reduce this to a 2.4 to 2.6°C temperature rise by the end of the century, for conditional and unconditional pledges respectively."

> "We must stay within 1.5 degrees...for us in Africa there's no place for us on the equator in a world where temperatures rise by more than 1.5 degrees. Even now we are struggling."
>
> **Dr Agnes Kalibata**[10]

The 2022 UN Emissions Gap report[7] showed that while emissions from agriculture have only slightly increased over the last two decades, emissions from the food supply chain have dramatically increased.[8,9] Efforts to reduce emissions in food systems must therefore look beyond the farm gate and not be restricted to actions relating solely to food production and land-use change.

The 2022 IPCC AR6 report makes clear that every incremental rise above 1.5°C will really matter in terms of impacts, and LMICs are likely to be the most affected (see Boxes 3 and 4). Worse still, as temperatures rise above 1.5°C so the risks of breaching tipping points increase (see Box 5). The concern here is that global climate and environmental systems could switch into a different state with profound knock-on effects in terms of extreme weather patterns affecting farmers, sea-level rise threatening coastal communities, or the collapse of vital ecosystem services. Moreover, certain tipping points may be irreversible for decades if not millennia. It therefore makes sense for all countries to factor in implications for GHG emissions when making choices in their food system transformation. However, it is recognised that this may be challenging for the poorest countries struggling with other pressing priorities.

### *Box 3.* Bangladesh and climate change

According to the Global Climate Risk Index, Bangladesh is among the countries most vulnerable to climate change. It is facing risks of sea-level rise, greater soil salinity and increasing frequency of severe weather events. The country is heavily dependent on agricultural production: it is vital that resilience to climate change, as well as other forms of environmental degradation, is built into efforts to transform and strengthen its food system.[50]

### *Box 4.* The threat of climate change to Africa – key data[6]

The 2022 IPCC ARC report comprehensively sets out the severe effects climate change is already having on populations in Africa, with worse to come.

- ***Economic development:*** One estimate suggests gross domestic product (GDP) per capita for 1991-2010 in Africa was on average 13.6% lower than if climate change had not occurred. Impacts manifest largely through losses in agriculture, as well as tourism, manufacturing, and infrastructure. Across nearly all African countries, GDP per capita is projected to be at least 5% higher by 2050 and 10-20% higher by 2100 if global temperature rise is held to 1.5°C compared with 2°C.

- ***Hunger:*** By 2050, a change of 1.2 to 1.9°C from 1990 will have increased the number of the continent's undernourished by 25-95%[11] (central Africa +25%, east Africa +50%, southern Africa +85% and west Africa +95%).

- ***Agriculture:*** Agricultural productivity growth has been reduced by 34% since 1961 due to climate change, more than in any other region. Global warming above 2°C will result in yield reductions for staple crops across most of Africa compared to 2005 yields (e.g., 20-40% decline in west African maize yields).

- ***Livestock:*** Rangeland net primary productivity is projected to decline by 42% for west Africa by 2050 at 2°C global warming.

- ***Environmentally induced migration:*** Climate change is projected to increase migration, especially internal and rural to urban migration (high agreement, medium evidence). With 1.7°C global warming by 2050, 17-40 million people could migrate internally in sub-Saharan Africa, increasing to 56-86 million for 2.5°C (>60% in west Africa) due to water stress, reduced crop productivity and sea-level rise. This is a lower-bound estimate excluding rapid-onset hazards such as floods and tropical cyclones.

Source: IPCC 2022 AR6 Report. (Chapter 9)

## *Box 5.* Temperature thresholds and uncertainty ranges of tipping points[12]

| Impact scale | Type | Tipping point | Temperature threshold (°C) | |
|---|---|---|---|---|
| | | | Central estimate | Range |
| Global | Cryosphere | Greenland Ice Sheet collapse (irreversible for millennia if forcing reversed (high confidence)) | 1.5°C | 0.8 – 3°C |
| Global | Cryosphere | West Antarctic Ice Sheet collapse (irreversible for decades to millennia if forcing reversed (high confidence)). High confidence in the potential for abrupt change. | 1.5°C | 1 – 3°C |
| Global | Ocean-atmospheric circulation | Labrador-Irminger Seas/SPG Convection collapse | 1.8°C | 1.1 – 3.8°C |
| Regional | Biosphere | Low-latitude coral reefs die-off | 1.5°C | 1 – 2°C |
| Regional | Cryosphere | Boreal Permafrost abrupt thaw | 1.5°C | 1 – 2.3°C |
| Regional | Cryosphere | Barents Sea Ice abrupt loss | 1.6°C | 1.5 – 1.7°C |
| Regional | Cryosphere | Mountain Glaciers loss | 2°C | 1.5 – 3°C |

Adapted from: OECD (2022), Climate Tipping Points: Insights for Effective Policy Action, OECD Publishing, Paris, in turn adapted from references [61,62]

Note: Literature-based temperature threshold estimates, including a central estimate and an uncertainty range for crossing of key tipping elements of the climate system. Central estimate column colour codes: red and orange denote respectively central global warming thresholds are within the Paris Agreement range of 1.5-2°C, and within temperature range in line with current policies (2-4°C). Range column colour codes: red denotes that current warming is already within uncertainty range, and orange that levels are in line with the Paris Agreement range, within uncertainty range. Information on potential to cause abrupt change and irreversibility, including timescales, and timescales from IPCC AR6 (Lee, 2021)[62] Table 4.10. IPCC confidence levels of potential to cause abrupt change reflect the author team's judgement about the validity of the findings by an evaluation of evidence and agreement.[62]

## 2.2 Marine and inland water resources

Water bodies are a vital source of food for the world's growing population and a major driver of jobs and growth. Collectively these resources underpin 'the Blue Economy' which is so vital for many LMICs. For example, food from the sea is produced from wild fisheries and species farmed in the ocean (mariculture), and currently accounts for just 17% of the global production of animal source foods, although the percentage is much higher in coastal communities.[13] Estimates indicate that edible food from the sea could feasibly increase by 21-44 million tonnes by 2050, a 36-74% increase compared to current yields, although it is important that such increases are achieved through sustainable management of fish stocks, and through sustainable practices in the case of aquaculture. This represents 12-25% of the estimated increase in all animal protein needed to feed 9.8 billion people by 2050. By contrast, inland waters produce around 37% of global fish production, compared with 63% from marine sources. Lakes and rivers are an essential source of protein, micronutrients, vitamins, and fats for diets, particularly in LMICs, where more than 60 million people rely on them for their livelihood.[14]

However, the latest IPCC report (AR6) concluded that climate change has already caused substantial damages, and increasingly irreversible losses, in terrestrial, freshwater and coastal and open ocean marine ecosystems[6] (high confidence – see Box 6). The extent and magnitude of climate change impacts are larger than estimated in previous assessments (high confidence). Widespread deterioration of ecosystem structure and function, resilience and natural adaptive capacity, as well as shifts in seasonal timing have occurred due to climate change (high confidence).[6] All of these create profound threats to food supply as well as livelihoods and sustainable economic development through the Blue Economy.

Oceans constitute the world's largest ecosystem, but are severely threatened by overfishing, acidification, eutrophication, and ocean warming. Food system concerns are central to addressing many of these issues. For example, runoff of pesticides, herbicides and fertiliser is a major source of pollution[63] in oceans and inland water systems, and the GHG emissions of food systems are a major driver of ocean acidification and ocean warming.

Looking to the future, rapidly growing countries such as Nigeria have recognised that there is considerable potential to capitalise on the multiple opportunities and benefits offered by aquaculture.[49] Sustainable, well-managed aquaculture can contribute to the resilience of food systems, enhance the quality of diets and the health of populations through improved nutrition, and provide a major source of employment and earnings to burgeoning populations.[15] However, realising these benefits will depend on collective commitment – public and private – to repair the damage that has already occurred in water bodies, and in using them sustainably.

### *Box 6.* The threat to marine resources: key data[6]

Rising CO2 levels and climate change are already destroying marine biodiversity, reducing lake productivity, and changing animal and vegetation distributions (high confidence):

- Impacts include repeated mass coral bleaching events in east Africa, and poleward (marine species) shifts in geographic distributions.
- At 2°C, roughly 36% of freshwater fish species are vulnerable to local extinction, and over 90% of east African coral reefs are projected to be destroyed by bleaching.
- The area of Lake Chad in Africa has plummeted from 26,000 square kilometers in 1963 to less than 1,500 square kilometers today, with severe consequences for the lake's ecosystem and local populations.

Source: IPCC 2022 AR6 report. (Chapter 9)

## 2.3 Biodiversity loss

Biodiversity loss is among the top global risks to society (see Box 7). The planet is now facing its sixth mass extinction, with consequences which will affect all life on Earth, both now and for millions of years to come.[16] The Kunming-Montreal Global Biodiversity Framework[17] was signed by 188 countries at COP15 in 2022 and constitutes a historic development. This underlined the importance that so many countries attach to biodiversity, and the dire situation that so many species are facing. The loss of biodiversity matters crucially to food production. For example, it has been estimated that the economic value of agricultural losses due to large-scale changes in pollinator populations amounts to 1-2% of global GDP.[18]

The global food system remains the principal driver of biodiversity loss, and without reform, this loss will continue to accelerate.[19] The conversion of natural ecosystems for crop production or pasture has been the principal cause of habitat loss, in turn reducing biodiversity. Intensified agricultural production degrades soils and ecosystems, driving down the productive capacity of land and necessitating even more intensive food production to keep pace with demand. Growing global consumption of cheaper calories and resource-intensive foods aggravates these pressures. In most countries, current food production continues to depend heavily on the use of inputs such as fertilisers, pesticides, energy, land and water, and on unsustainable practices such as monocropping (see Box 8) and heavy tilling. This has reduced the variety of landscapes and habitats, and threatens populations of birds, mammals, insects and microbial organisms, as well as crowding out many native plant species.

Recognising the many ways in which global food systems affect biodiversity, the Kunming-Montreal Global Biodiversity Framework established a number of targets whose delivery will rely on changes to food systems – for example, on the sustainable management of agriculture, aquaculture and fisheries, reducing excess nutrients and pesticide use, halving global food waste and significantly reducing over-consumption.

### *Box 7.* Biodiversity loss: key data[6]

Biodiversity loss is projected to be widespread and is increasing substantially with every 0.5°C increase above present-day global warming (high confidence):

- In Africa, above 1.5°C, half of assessed species are projected to lose over 30% of their populations or area of suitable habitat.
- At 2°C, between 7 and 18% of terrestrial species assessed are at risk of extinction.
- Above 2°C, risk of sudden and severe biodiversity losses becomes widespread in west, central and east Africa. Climate change is also projected to change patterns of invasive species spread.
- Coral reefs, for example, are projected to decline by a further 70 to 90% at a global average warming of 1.5°C above pre-industrial levels, or by more than 99% if warming reaches 2°C.

Source: IPCC 2022 AR6 report (Chapter 9)

### *Box 8.* Agrobiodiversity in Vietnam

In Vietnam, just five crops cover more than 75% of agricultural land: rice, maize, rubber, coffee and cassava.[51] Together these account for one-third of the country's total greenhouse gas emissions.

Further destruction of ecosystems and habitats will threaten our ability to sustain human populations. Reform will rely on implementing measures to address the biodiversity finance gap, estimated at US$ 700 billion per year, while phasing out or reforming subsidies that harm biodiversity by at least US$ 500 billion per year.[20]

## 2.4 Protecting and enhancing environmental resources

Virtually all the food we consume depends on agricultural production involving environmental systems which are coming under increasing stress. LMICs are seeing vital natural resources being depleted, and environmental services degraded. Attention here is focused on three issues which have particularly strong links to food systems and agriculture: deforestation, water scarcity, and soil quality. However, other linkages between food systems and the environment are also vitally important – notably the effect of food production on pollution of land and water bodies.

***Deforestation*** is continuing apace across the world. Ten million hectares are lost each year (equivalent to the area of Portugal), of which just half is offset by new planting.[21] The World Bank estimates that about 3.9 million square miles (10 million square km) of forest have been lost between 2000 and 2016 alone.[22] Despite progress in countries such as Indonesia (see Box 9) and Malaysia, and despite international commitments to end deforestation by the end of the decade, global tropical primary forest loss worsened by 10% in 2022 compared to 2021. The single biggest direct cause of tropical deforestation is conversion to cropland and pasture, mostly for subsistence – i.e. growing crops or raising livestock to meet daily needs.[23] Although subsistence activities have dominated agriculture-driven deforestation in the tropics to date, large-scale commercial activities are playing an increasingly significant role. In Indonesia, the conversion of tropical forest to commercial palm tree plantations to produce bio-fuels for export is a major cause of deforestation on Borneo and Sumatra.

***Water scarcity*** is a growing problem for many countries. Today, 3.2 billion people live in agricultural areas with high to very high water shortages or scarcity, of whom 1.2 billion people – roughly one-sixth of the world's population – live in severely water-constrained agricultural areas.[24] One assessment in LMICS in 2020-21 found that across assessed regions, prevalence of water insecurity was highest in sub-Saharan Africa (36.1%) and lowest in Asia. Among the full sample, an estimated 14.2%, or approximately 436 million of the 3.06 billion adults represented by this sample, were classified as water insecure (IWISE scale scores of ≤12). This prevalence was heavily influenced by China's low water insecurity prevalence and large population.[52,59]

Populations in drylands are projected to double by 2050. In Africa, 95% of agriculture relies on rainfall for water, according to the United Nations Environment Programme (UNEP). The World Bank notes that it is very likely that by 2100 the total availability of water in Africa could decline by more than 10%. Food production plays a major role in this developing picture: globally, 72% of all water withdrawals are used by agriculture.

Water scarcity will severely affect urban populations. An additional 350 million people living in urban areas are estimated be exposed to water scarcity from severe droughts at 1.5°C warming, and 410.7 million at 2°C warming.

A further challenge for policymakers lies in the future variability of rainfall and river discharge: in Africa, this amounts to around -50% to +50% relative to long-term historical means.[6] Extreme hydrological variability is projected to progressively amplify under all future climate change scenarios relative to the current baseline, depending on region (high confidence). Projections of numbers of people exposed to water stress by the 2050s vary widely – including both decreases/increases which differ by hundreds of millions, with higher numbers for increases – with disagreement among global climate models on the major factor driving these large ranges.

***Soil quality*** is vital for healthy sustainable diets. About 95% of our food nutrients come from soils, which have a natural capacity to provide nutrients to support crop growth.[25] Nutrient imbalance has been identified as a major threat affecting soil health globally.[26] According to the United Nations Convention to Combat Desertification, the impact of soil degradation could amount to US$ 23 trillion in lost food, ecosystem services and income worldwide by 2050. In Africa, nutrient depletion alone accounts for US$ 1 billion to US$ 3 billion per year in natural capital losses, according to findings by the New Partnership for Africa's Development (NEPAD).[11] The major causes of this soil degradation are unsustainable agricultural practices, overgrazing, deforestation, and improper land use.[27] The situation is aggravated by low use of fertilisers by farmers. Decades of nutrient mining have depleted soil fertility, putting the region's food security at risk.[28]

Conversely, there are soils in which excessive additions of nutrients have led to soil, air, and water pollution and serious adverse effects on terrestrial and aquatic biodiversity. Estimates indicate that globally, around 115 million tonnes of nitrogen are applied to crops each year, of which nearly two thirds – 75 million tonnes – is wasted and becomes a pollutant. Similarly, over a half of phosphorus applied (14 million tonnes out of 25 million) is wasted.[29]

### *Box 9.* Deforestation in Indonesia

While there has been a steady increase in deforestation globally, in 2021 Indonesia reduced primary forest loss for the fifth straight year, with a decline of 25% compared to 2020. In 2022, Indonesia updated its national climate plan (NDC) with a commitment to reduce emissions in its forest and land-use sector to become a net carbon sink by 2030.[52]

**25%** reduced primary forest loss for the fifth year with a **decline of 25%** compared to 2020

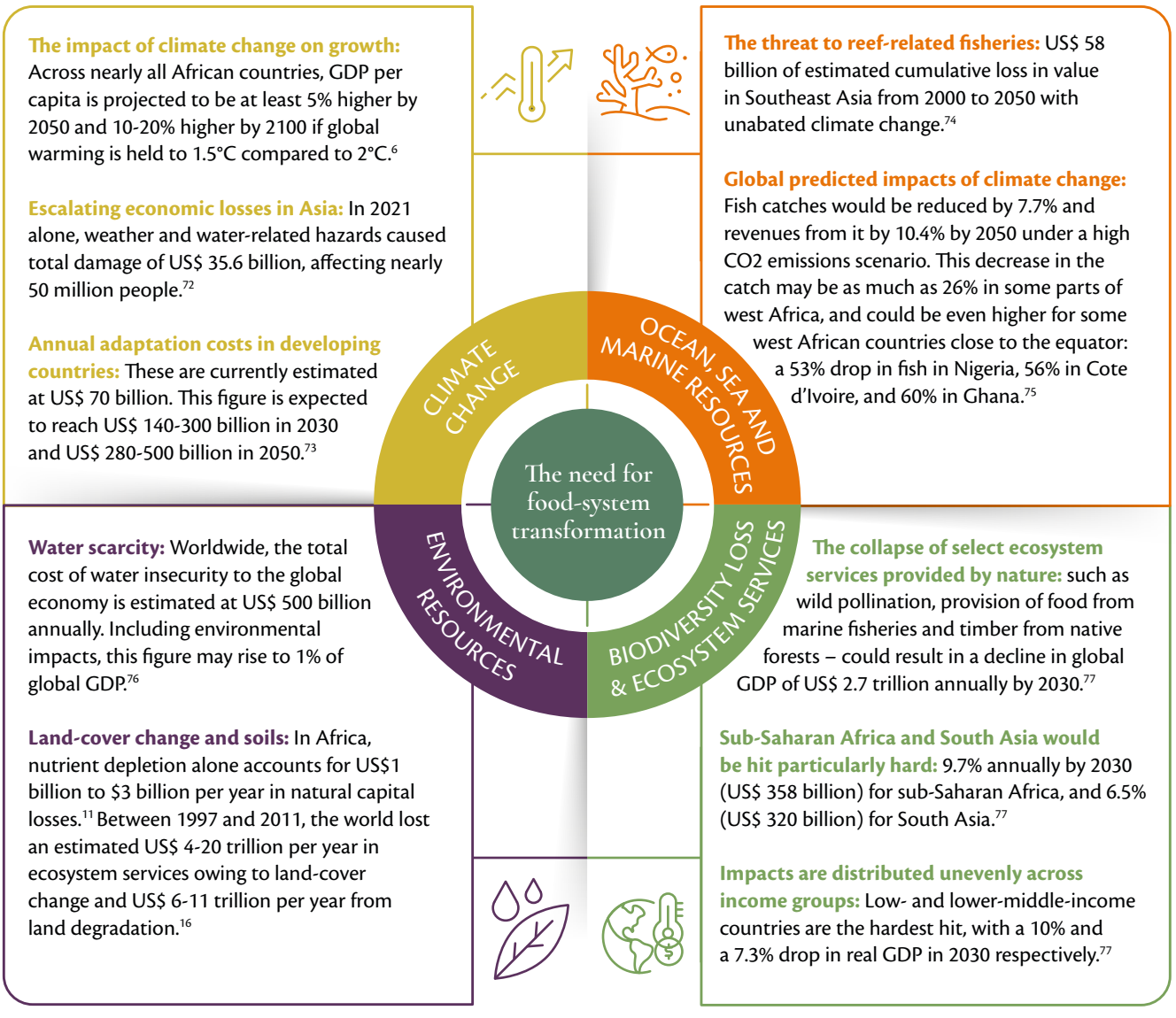
## 2.5 Drawing the threads together – combining the food systems transformation and 1.5+ agendas

The message for policymakers is that there is no viable future for food systems – or for the survival of populations – unless climate change and the current degradation of the planet's environmental services and resources are addressed and reversed. There are many causes for the worsening environmental situation, but it is clear from Section 2 that today's unsustainable food systems are a major factor, if not the dominant cause in some instances. It is therefore essential that food systems play a central role in delivering the 1.5+ agenda through their transformation.

All countries stand to lose from failure, but LMICs will bear the brunt of these impacts sooner and more intensely than many other parts of the world. Figure 1 illustrates the scale of the economic impacts that could result. It is therefore very much in the interest of all countries, including LMICs, to take action. Every incremental change in global temperature rise matters, and every effort is needed to avoid tipping points being breached.

Inevitably, embracing the 1.5+ agenda will add additional goals and challenges into food system transformation pathways at a time when many LMICs are struggling to address food insecurity and deliver sustainable, healthy diets. The Global Panel acknowledges the scale of the task ahead, particularly for LMICs which are heavily resource-constrained. The next section therefore provides advice on how this might be achieved – by how food system transformation is approached, by addressing barriers to change, and by actions which can deliver positive impacts across multiple policy domains.

### Figure 1. Examples of economic impact associated with climate change and environmental degradation



However, the additional 'costs' involved in food system transformation to embrace the 1.5+ agenda also need to be weighed against diverse benefits that will accrue. Importantly, many of these extend far beyond addressing hunger and the deepening environmental crisis. The following provide just a few examples:

- ***Driving economic growth and jobs.*** According to 2017 data, farming generates about 68% of rural income in Africa, and about half of rural income in South Asia.[47] Looking ahead, opportunities are being created throughout food systems, including manufacturing, marketing, transportation, and food preparation. In Africa, food systems could create a trillion-dollar food market – and even more jobs – by 2030.[30] These opportunities are being driven by changes in diets, rising consumer demand and urbanisation, supported by investments in infrastructure and rapidly evolving technology. The key opportunity is for policymakers to support growth throughout the food value chain, focusing on the quality of jobs and the inclusion of women and youth.[30]

- ***Addressing inequity affecting the poor.*** Inadequate and unhealthy diets can impair both the physical and mental development of children and consign them to a lifetime of disadvantage, through reduced earning potential and poorer health.[31] Today one in three children are undernourished, and two in three children under two live on poor diets.[32] It will be impossible to address such inequity unless food systems are transformed to deliver sustainable and affordable, healthy diets for all.

- ***Health and wellbeing.*** Today's unhealthy diets are simultaneously harming both the health of people and the planet. Poor diets are driving an epidemic of overweight and obesity, diabetes and cardiovascular disease, causing increasing strain on health budgets and loss of economic productivity. For example, approximately 80% of the 463 million adults living with diabetes worldwide are in LMICs.[33] Also, it is estimated that the absolute global economic burden of diabetes could increase from US$ 1.3 trillion in 2015 to more than US$ 2 trillion by 2030.[34]

# 3. Using the 1.5+ agenda to accelerate food systems transformation (and vice versa)

High-income countries (HICs) have a particular responsibility to act on climate change mitigation and the other environmental dimensions of the 1.5+ agenda, as they are responsible in large part for climate change, as well as being major contributors to environmental degradation more generally. However, Section 2 has outlined the critical value of LMICs also embracing the 1.5+ agenda and factoring environmental concerns into their plans for food system transformation – not least as they themselves are likely to be most at risk, both from failures in environmental systems, and from further impacts as global temperatures rise further.

At the level of individual countries, actions throughout the food system will be important. However, every country's food system is globally embedded in increasingly complex trade and market relationships – which are influenced, in turn, by global stakeholders, and by policies in HICs relating to trade, agriculture and food. There is therefore an urgent need for systemic action globally and regionally, based on intergovernmental consensus, to 'frame' actions at national and local scales.

In taking forward the 1.5+ agenda, the following high-level changes in approach will be essential. (Note: detailed implementation actions – for example relating to specific farming practices and their costings – are beyond the scope of this brief but are also important and will also need to be pursued without delay).

- **Targets need to be established and agreed for all dimensions of the 1.5+ agenda – for the environment, for the global climate and for people.** This builds on the power of the climate change targets established in Paris and more recently the landmark biodiversity agreement at the COP15 in 2022. Political aspirations articulated in the past three years must be transformed into realistic plans for delivery. Transparent metrics to assess progress need to be developed to monitor and assess progress. In the case of ocean resources, such metrics should be combined with strengthened global policy governance – this is critical to protect ocean resources in LMIC contexts with limited institutional and maritime enforcement capacity.

- **Food system transformation needs to be explicitly embedded in Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs).** It is a mistake to consider food system transformation in isolation. In view of its central importance to addressing climate change, it needs to be directly linked to national strategies and plans aimed at meeting international obligations and targets. Equally, food system transformation needs to be incorporated into strategies to address other critical environmental targets – for example the Global Methane Pledge to reduce methane emissions (compared to 2020 levels) by at least 30% by 2030; the new framework for action under the UN Convention of Biological Diversity; and the Glasgow Leaders Declaration on Land Use and Forests, which aims to reduce deforestation to zero by 2030.

- **Bold action is now essential for reducing GHGs: incremental change is no longer an option.**[7] Broad-based economy-wide transformation is needed to limit global warming to well below 2°C, preferably 1.5°C. As food systems are one of the biggest source of emissions globally, their transformation needs to be placed at the heart of climate change mitigation strategies.

  Targeting methane (CH4) reductions offers multiple gains. CH4 is a particularly potent climate forcer which is relatively short lived, and which has a global warming potential many times that of CO2: climate gains are possible from changes relating to livestock, rice, aquaculture and rangelands in particular. The Global Methane Alliance is already developing actionable CH4 mitigation plans in many countries.[66]

  HICs need to take the lead in climate change mitigation measures in view of their GHG emissions today and historically. However, taken together, emissions from food systems in some middle-income countries are also substantial and these countries also need to act where possible – small differences in global temperature rise could have a big effect on LMIC outcomes. For LMICs which may be resource-constrained, identifying interventions that will deliver multiple gains, as well as low- or zero-cost actions should be a priority (see Box 10). More generally, they could usefully focus on cost-effective, evidence-based policy bundles – factoring in the multiple benefits of enhanced diets for health, jobs, resilience, and the environment when making choices.

- **Much more emphasis on measures *throughout* the food system – and beyond the farm gate in particular offers better returns when pursuing the 1.5+ agenda.** This is especially important when targeting reductions in GHGs, but is also important in the drive towards the sustainability of food systems as well as pursuing the goal of universal access to healthy diets. Commitments made at the UNFSS and elsewhere are evidence of the need for a shift in political thinking at regional, national, and local levels in favour of this broader approach.

- **Increased emphasis is needed on demand-side actions.** Influencing consumers in their food choices to reduce waste and over-consumption is a relatively low-cost strategy for governments, which can deliver appreciable environmental benefits. Similarly, encouraging consumers to choose foods that have been sustainably produced and with lower carbon footprints can be a powerful influence to drive change in businesses in the food sector. The Kunming-Montreal Global Biodiversity Framework includes specific targets around influencing consumer behaviour with respect to their food choices. However, it is important that when encouraging consumers to change their food choices, the outcome also improves the healthiness of diets – or at the very least does not worsen nutritional outcomes.

  It has been estimated that a shift towards sustainable, healthy diets would help reduce health and climate change costs by up to US$ 1.3 trillion.[35] The resulting dietary improvements can also contribute to much wider benefits – in terms of better population health, more productive workforces, lower healthcare costs, higher educational attainment and equality.

- **Leaders in LMICs need to urgently plan for the worst – that 1.5° could be breached before 2050.** In 2022, UNEP declared that there was no viable pathway to keeping global warming to 1.5°C. Redoubling action on adaptation is especially pressing for countries in Africa: currently, temperature rises here are 0.3°C per decade (compared with 0.2°C in other parts of the world).[7] Further substantial support from the global community will be essential to help LMICs prepare for this eventuality.

- **Policymakers need to build improvements in terms of resilience into their pathways to food system transformation.** Unless food systems can adapt to a more turbulent world, efforts to address long-term targets around 1.5+, as well as nutrition and health, risk being constantly derailed by successive crises.

- **There may be merit in establishing a leadership group in the 1.5+ space.** In a related policy environment, the Beyond Oil and Gas Alliance (BOGA)[36] has demonstrated how a small number of countries and stakeholder can lead the way, show others what can be achieved and inspire others to act.

While the case for embracing the 1.5+ agenda is beyond doubt, there are several factors which, if not addressed, will impede progress in food systems transformation:

- **The private sector needs to be persuaded and incentivised to play a leading role.** There are deep-rooted tensions between the business models operating today within the food system, and the changes that are necessary. For example, food systems are still failing to provide the healthy, affordable diets that are currently beyond the reach of three billion people and a major driver of environmental degradation and biodiversity loss. Governments and businesses need to proceed in partnership to address these issues, recognising that the food system comprises a myriad of entities from micro and small enterprises to large-scale commercial, multinational businesses.

  Harnessing the skills and resources of the private sector presents a major opportunity. The global food system is projected to grow from US$ 2.5 trillion in 2022, to nearly US$ 5.2 trillion by 2029 (US$ 1 trillion in Africa).[37,78] In this context, multilateral stakeholders should be mobilised to provide risk management instruments such as guarantees to encourage private sector investments, especially in LMICs.

  Businesses are increasingly voicing their commitment to change, as evidenced at the UNFSS[38] and more recently at COP27.[39,40] However, the private sector needs to be held to account on those commitments – past evidence for action in the absence of regulation is, at best, mixed.[31] Large food companies continue to focus too much of their business on ultra-processed products which are high in sugar, salt and fat, and/or unsustainably produced. Food sector businesses should publish progress towards clear and meaningful targets to help governments weigh the balance they should strike between incentives and regulation.

- **Governments need to address the fundamental mismatch which has developed between the incentives and support given to food producers to meet development imperatives around food insecurity on the one hand, while on the other hand insufficient focus is given to implications for climate, nutrition and wider environmental factors.** Public sector support for the former is estimated at around US$ 570 billion per year.[41] In the case of biodiversity loss, it is estimated that subsidies worth at least US$ 500 billion per year act in ways that harm biodiversity. More generally, support to agricultural producers is heavily biased towards measure that are harmful for both the environment and human health.[56] The scale and nature of the planetary challenges over coming decades are fundamentally different to those of the recent past. A reset in policies for public sector and institutional support is now overdue. For example, new modelling, commissioned by the Global Panel, and other work by the FAO and the World Bank, has shown how repurposing subsidies could provide better outcomes in terms of nutritional health, environmental outcomes, and economic growth.

However, it should be recognised that not all countries provide large fiscal support to their agriculture and agrifood systems. This is particularly the case for many LMICs. Therefore, the debate on domestic repurposing needs to be linked to the need for international support for countries with limited fiscal scope. Furthermore, achieving this will necessitate close collaboration with international financial institutions (IFIs), the United Nations (UN), and donor agencies to establish a feasible and practical transformation plan which aligns with each country's shared vision.[67,68]

- **It is in the interest of all countries to take steps to manage the tensions that are now prevalent between focusing on the short-term crises and shocks affecting food systems and maintaining progress on the long-term goals in the 1.5+ agenda.** So called 'poly-crises' threaten to constantly derail the latter. There is no easy answer to this; however, it reinforces the need to build resilience into food systems as an integral part of the food system transformation. In addition, certain principles are suggested to guide decisions: actions to address immediate shocks and crises should not prejudice or close off options for addressing longer-term 1.5+ goals; it will be important to weigh the benefits of improved food system resilience against the costs; and there is a need to plan for protecting the poor during the food system transition process as well as during shocks.

- **Food system transformation (aimed at 1.5+) needs to be placed at the heart of wider policy agendas – across governments, and in international policy processes.** This brief has highlighted how the delivery of food system transformation for 1.5+ is essential to delivering on major policy agendas including equality, environment, and health. However, food systems are too often an 'add on' consideration for those agendas, if they are included at all. This omission acts as a brake on the progress that could potentially be realised. Integrating food system transformation with policy agendas beyond the direct concerns of food systems will open up opportunities to realise synergies, leverage wider resources, and unlock political impetus. Leadership from the top is needed to secure this cross-government alignment and co-ordination. But to make it effective on an ongoing basis, there is a clear case to designate a cabinet-level food systems focal point to act as a central point of coordination; collaborating with relevant ministries to monitor and drive the transformation of food systems towards sustainability and improved health outcomes.

- **Much more finance, and better targeted finance, is needed for LMICs to enable them to undertake food system transformation for 1.5+.** In Africa, for example, increased funding for climate change adaptation of food systems in LMICs would provide vital resources in support of the African Union's Green Recovery Action Plan.[42,43]

  Overall, only 3% of global climate finance goes to sub-Saharan Africa (US$ 20 billion in 2020, with US$ 2 billion from the private sector) while annual average climate finance needs for

Africa are estimated at US$ 127 billion between 2020 and 2030.[70] For example, it has been estimated that an additional US$ 4.6 billion per year is needed for Ethiopia alone to fund measures aimed at achieving a transformation to deliver a sustainable food system, with more needed to build resilience for the longer term.[44] At present, HICs are committed to providing US$ 100 billion per year to LMICs for climate change mitigation and adaptation, although this is under-delivering by around US$ 17 billion each year.[45]

In the case of biodiversity, the COP15 Biological Diversity Convention has a target to mobilise by 2030 at least US$ 200 billion per year in domestic and international biodiversity-related funding from all sources – public and private. It also aims to increase total biodiversity-related international financial resources from developed countries to developing countries, as well as countries with economies in transition, to at least US$ 20 billion per year by 2025, and to at least US$ 30 billion per year by 2030.[17] However, these figures are small compared to an estimate of the overall biodiversity finance gap, estimated at US$ 700 billion per year. At the very least, action is needed to deliver on all existing commitments and targets.

- **Much more research is needed into 'what works' in terms of delivering food system transformation aimed at delivering the multiple targets embedded in the 1.5+ agenda.** Such research should be context-specific, recognising that individual countries face different challenges and constraints, and may need to resolve different trade-offs. For instance, would intensifying environmental programmes, including efforts to curtail GHG emissions and protecting biodiversity, affect production and food systems outcomes, and vice versa? Having clarity on these potential trade-offs will help develop frameworks which countries could use to evaluate policy options and maximise the impacts and effectiveness of transformation trajectories. Being guided by science and evidence is essential to help ensure the limited resources of LMICs are utilised to best advantage. And it will give confidence to policymakers to act boldly and incisively, particularly where the necessary measures are controversial, or opposed by powerful vested interests.

## *Box 10.* Recommendations to deliver food system transformation

Choosing actions to deliver transformed food systems along with other 1.5+ planetary goals to address dietary health and food insecurity, climate change, and wider environmental degradation is not only possible, but in some cases, can be achieved at relatively low cost (i.e., not requiring capital intensive investments). In all cases, choices made will depend on individual circumstances, but the following recommendations are provided to guide decision makers:

**Influencing consumer demand:**

- ***Promoting diversity in diets.*** This has the potential to promote dietary health and so reduce pressure on healthcare systems and contribute to climate change adaptation by promoting resilience through diversity of food sources.

**Making the best use of resources within food systems:**

- ***Implementing measures to match agricultural inputs much more closely to the requirements of crops.*** These include water, fertiliser, pesticides, and herbicides. These measures could have diverse environmental benefits, while potentially improving the efficiency and productivity of farmers.
- ***Targeting existing finance.*** Linking credit and insurance to the adoption of low carbon agriculture practices is an efficient strategy to minimise GHG emissions in LMICs. Regenerative agriculture and aquaculture are key entry points to alleviate pressure on land and other environmental resources.
- ***Repurposing subsidies for agriculture.*** Recent work commissioned by the Global Panel and others have shown that this can create multiple benefits for dietary health, the environment, and economic growth.[46] Influencing consumer food choices (to drive demand for sustainably produced foods) as well as directly incentivising sustainable food production and food system practices need to be considered.

**Governance and decision making:**

- ***Updating food-based dietary guidelines to include environmental factors – to guide policy across government.*** Further benefits will flow through their use by consumers.
- ***Connecting and leveraging different parts of government.*** Policy agendas across diverse parts of government stand to benefit from transforming food systems for people and the planet: health, equity, growth, and poverty alleviation. Coordinating and leveraging their effort can promote synergies, efficiencies, and benefits.
- ***Targeting the entry points for food systems policies that will deliver across multiple domains of 1.5+ as well as nutrition.*** The relationship between nutrition and the various dimensions of the 1.5+ agenda can be better understood by looking at entry points in each component of food systems, from ecosystems to consumer behaviour. A recent review undertaken by the FAO provides a useful starting point.[71]
- ***Rebuilding of overfished stocks though improved global fisheries management.*** This remains crucial to restore ecosystems to a healthy and productive state and protect the long-term supply of aquatic foods. Besides increasing production substantially it could raise the contribution of marine fisheries to the nutrition, economic growth, and well-being of coastal communities.

**Innovations in food systems transformation:**

- ***Reducing post-harvest losses and consumer food waste.*** Overall, an estimated third of production is lost post-harvest.[31] Reducing these losses will lower greenhouse gas emissions and save environmental resources by not having to grow food for consumption twice. It will save on the costs of agricultural inputs such as seeds, energy and fertiliser. And it will also engender efficiency in businesses throughout the food chain. One study showed that halving food loss and waste in Bangladesh, Kenya and Nigeria would result in increases in GDP of between 1.1 and 2%, with up to 13 million people being lifted out of poverty overall. More generally, investing in cold chains as well as capacity building are both likely to be important in LMIC settings.[64]
- ***Innovations which focus on sustainable production and food system practices.*** These could deliver on both climate change adaptation and resilience building. Such innovations should seek to address, for example: excessive use of mono-cropping; heavy tilling; overuse of inputs such as pesticides and fertilisers; overgrazing; overfishing; and large-scale commercial activities for export.
- ***Increasing the production of under-utilised crop species.*** This presents an important approach to diversifying crop systems and diets, increasing nutrient availability and protecting agricultural land from further degradation.[53,54,55] The development and use of improved seed varieties (such as heat tolerant wheat varieties, and high-iron beans) will also be important.
- ***Innovations across food systems to promote sustainability while creating new high-quality jobs.*** These include: the use of novel materials, processes, and new energy sources. Technologies such as no till, biological fixation and integrated crop, livestock and forest systems can significantly reduce the emission of GHGs in a given food system.

## *Box 11.* COP28 – a key opportunity for progress

COP28, as part of a series of international events and a process of COPs, offers a key opportunity for world leaders to agree a policy framework that will influence and drive transformational change in food systems to deliver on 1.5+, thereby harmonising efforts to address environmental degradation and climate change with those seeking to improve nutritional health. The Global Panel encourages world leaders to raise their levels of ambition, and to act to catalyse truly transformational change.

At a strategic level, it is critically important for food systems to be viewed within the context of the wider economic system and the political economy. More specifically, it is essential to adopt a systemic approach to incentivising food system transformation which is integrated into wider economic growth strategies.

The following need to be affirmed and agreed at COP28, specifically to benefit LMICs who will be most affected by climate change:

1. Redouble efforts to limit global warming to the minimum possible. This means a commitment to finally establishing viable pathways to keeping below 1.5 degrees. It means a commitment for all parts of governments to work together. And it means placing food systems transformation at the heart of pathways.

2. Build resilience of food systems to climate change and other environmental stresses, targeting the poorest and most vulnerable communities.

3. Reform subsidies and incentives that are acting as barriers to the reform of food systems in pursuing the 1.5+ agenda.

4. Facilitate trade and development policies that promote more sustainable food systems , and better access of populations to affordable, healthy diets.

5. Reaffirm and deliver on existing international financial commitments and significantly increase finance and investment from public and private sources. Finance for climate adaptation in LMICs needs to be a priority.

## 4. Conclusions

Action is now beyond urgent and overdue. Global food systems are facing an existential threat; there is no viable future unless escalating climate change is addressed, and unless the degradation of so many of the Earth's environmental systems is halted and reversed. However, at the same time, food systems themselves are a major driver of greenhouse gas emissions as well as biodiversity loss, pollution, and deforestation – together these comprise the so-called '1.5+' agenda. Hence, achieving 1.5+ goals requires a transformation of food systems.

Food system transformation must be at the heart of climate change and planetary health goals. HICs have responsibility specifically to act to reduce GHG emissions from food systems, in view of those countries' major influence on driving climate change. However, it is in the interests of all countries – both HICs and LMICs – to act to limit further environmental degradation and its impacts on food systems, and to minimise the risk of environmental tipping points being crossed. The prospects for success can only be enhanced by HICs and LMICs working together in a spirit of cooperation and mutual understanding. LMICs will need much more assistance in adapting to climate change, and in addressing environmental degradation more generally.

Opportunities to intervene to prevent a sustained global temperature rise above 1.5°C are diminishing. Indeed, that level may be temporarily breached in the next five years, with severe implications for food systems, particularly in countries in equatorial Africa and parts of Asia. The next 5-10 years will also be critical in slowing and reversing the present catastrophic decline in the planet's wider environmental systems. Some environmental impacts are already irreversible – such as the loss of certain species. And some environmental tipping points, if breached, could take decades or even millennia to reverse.

Success in transforming the world's food systems would create a cascade of benefits, not just globally but also at the national level, for economic growth, equity and poverty, the physical and mental development of children, health, environmental sustainability, and greater geo-political stability. In view of the far-reaching implications of so many policy agendas, it is essential that political will at the highest level is explicitly and publicly aligned with integrating national and global efforts to address climate change and environmental degradation on the one hand, together with food system transformation on the other.

This message is closely aligned with the efforts of the UN Food and Agriculture Organization (FAO) to develop a roadmap to deliver on many Sustainable Development Goals through the transformation of food systems, and to call on all nations to set an ambitious course for change. Moreover, events such as the 2023 G20 meeting in India and the forthcoming COP28 meeting in Dubai offer substantial opportunities for world leaders to demonstrate their vision and leadership. In the case of COP28 (see Box 11) it is hoped that food systems transformation will, for the first time, occupy a central position in the COP deliberations. The UAE government has an exceptional opportunity to demonstrate its vision and leadership and ensure that the necessary actions are set in motion to help secure the future of the entire planet – and its populations.

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