



**Exploring new, evolving
and neglected topics at the
intersection of food systems,
climate change and nutrition**
A literature review

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Executive summary

Food systems, climate, and nutrition are closely intertwined with common yet complex multidirectional pathways that link drivers, actions and outcomes across all three areas. Food systems affect our nutrition by directly influencing the accessibility of affordable, appealing, diverse and nutritious foods, with maternal, infant and young child diets most at risk. At the same time, current food systems are a key driver of environmental degradation, and climate change is further exacerbating populations' vulnerability to malnutrition. Many of the negative effects of climate change on nutrition outcomes are mediated through its effects on components of the food system.

This literature review aims to foster joined-up strategic decision-making across the climate, nutrition and food sectors that will accelerate coherent policy, funding and programming to improve the health of people and planet. We want to create an appetite for addressing barriers and missed opportunities by providing an overview of recent, evolving and neglected topics in this area. This builds on two previous scoping reviews conducted by Emergency Nutrition Network (ENN) in 2021 and 2022 on food systems, nutrition and climate change. In this literature review, 135 publications were analysed for key findings and emerging themes. The analysis was supported by the use of the High Level Panel of Experts (HLPE) Framework (**Figure 1**). Preliminary results were discussed with reviewers from the African Population and Health Research Center (APHRC) and the UN-Nutrition Secretariat, who also subsequently reviewed the written product.

Part 1 introduces the readers to the linkages between food systems, climate and nutrition. **Part 2** of this report grounds readers in the intersections of food systems, climate change, and nutrition, which have gained traction since the Food Systems Summit in 2021. **Part 3** delves into two areas that are currently neglected and yet are of critical importance: i) leveraging sustainable food systems to prevent malnutrition, and ii) establishing sustainable food systems in conflict-affected settings. **Part 4** reflects on ways forward, with the aim of fostering joined-up strategic decision-making across the climate, nutrition and food sectors that will accelerate coherent policy, funding and programming.

Part 2

2.1. What are new topics?

Key areas of focus that have established themselves in the years since the Food Systems Summit, 2021 through to 2023, include **focusing on 'all forms of malnutrition'** (stunting/wasting/underweight, micronutrient deficiencies and overweight/obesity). Coupled with climate change, this is creating a 'global syndemic', with the same populations most affected by climate change as by malnutrition. It is also now clear that **climate impacts on nutrition and food security are gendered**, with the effects of climate change disproportionately affecting women and girls. Furthermore, **infants, young children and pregnant women are most vulnerable, both to malnutrition and to the effects of climate change**. Food insecurity is as prevalent in peri-urban and urban areas as it is in rural areas, while food purchase patterns mean the affordability of healthy diets is important in all contexts. **Interlinkages are growing across urban, peri-urban and rural areas. However, global solutions need contextualisation and tailoring to the setting**, to reflect the diversity of food systems at the national and local level. Policies and programmes need to be needs-based and locally driven, with greater attention to equity-sensitive solutions.

2.2. What's evolving?

The literature review revealed several trends that are still evolving. **Climate change adaptation strategies need to both minimise the negative impact of climate shocks and be sensitive to their impacts on nutrition outcomes**. Although this relationship is as yet poorly understood, multisectoral climate adaptation can be an effective approach to reducing climate-related risks to food and nutrition security if appropriate strategies are selected. There is also increasing **recognition of trade-offs in the transformation to sustainable food systems that nourish both people and planet**. There is a need for increased evidence and understanding of the complex decisions and compromises that must be made to balance competing objectives. Furthermore, the **integration of food systems, climate, and nutrition can create co-benefits**, and this requires more systematic and intentional cross-sectoral efforts. Meanwhile, **moving beyond short-term measures to build greater resilience** is a key strategy for building the capacity of food systems to ensure a steady supply of safe and sufficient food, particularly for low- and middle-income countries (LMICs). There is also increasing recognition of the **interdependence of water and food systems, their relationship with climate change, and the role in nutrition**.

Part 3

Previous work by ENN has identified two areas within the food systems arena which are currently neglected but are of critical importance: i) leveraging sustainable food systems to prevent malnutrition and ii) establishing sustainable food systems in conflict-affected settings.

3.1. Leveraging sustainable food systems to prevent malnutrition: Fundamental to the prevention of malnutrition is ensuring good nutrition and access to a healthy, balanced diet across the lifecycle. As food systems determine the quantity, quality, diversity and nutritional content of what we eat, it is essential that all components of food systems are leveraged to ensure accessible, affordable and desirable nutritious food is available to all in a sustainable way. This literature review revealed a wealth of proposed solutions to address malnutrition across the various components of sustainable food systems. One solution is creating **a stronger, more coherent policy environment** to increase the availability and affordability of nutrient-dense foods, and establishing food safety, marketing and labelling regulations to protect children from ultra-processed foods. This includes strengthening the integration of nutrition within national policies, budgets and programmes, and putting in place more equitable trade and fiscal policies. Meanwhile, **mitigating the impact of climate change on food systems, as a key driver of malnutrition**, requires a focus on local-level interventions to improve nutrition diversity and the resilience of agricultural systems, as well as mitigating the negative impact of climate on care

practices and health environments. **Nutrition-sensitive agriculture is a key action within food systems to increase food availability and accessibility.** Impacts on nutrition outcomes are greatest when they are combined with women's empowerment and behaviour change communication, with more sustained implementation and with interventions that are tailored to the specific needs and context. **Scaling up the use of indigenous crops, whilst preserving food sovereignty and indigenous knowledge,** can increase nutrient content and dietary diversity, while at the same time offering co-benefits in terms of climate-resilient agriculture for smallholder farmers and women's empowerment. **Breastfeeding has benefits across climate and food systems, as well as nutrition and health.** Stronger protection and promotion of optimal breastfeeding is a key action to counter detrimental effects of commercial milk formula on the food system, while at the same time bringing huge nutrition and health benefits. Transforming food systems to prevent malnutrition faces challenges. For one, there is **limited evidence of what works, and often the 'how' is missing.** Additionally, many widely implemented interventions are not well researched. **The affordability of nutrient-dense foods is another key challenge,** with healthy diets being four times more expensive than a 'calorie-sufficient' diet. **The nutrition transition presents another key challenge.** In LMICs, informal markets remain a key source of food for children, but with the nutrition transition they are increasingly providing less nutritious options, which are energy-dense and nutrient-poor, with additional concerns around food safety.

The following actions are recommended:

1. Support the wider sharing of practical examples of how and how not to transform food systems to prevent malnutrition.
2. Strengthen the enabling environment for the protection and promotion of breastfeeding.
3. Leverage the opportunities of global initiatives promoting a multisectoral approach.
4. Make market mechanisms more favourable for improved complementary feeding.
5. Improve understanding of the consumer acceptability, sustainability and overall impact of innovations and technology.
6. Apply lessons learned from strengthening the supply chain around specialised nutrition products to food systems more broadly.

3.2. Establishing sustainable food systems in conflict-affected settings: Almost every aspect of food systems is disrupted by conflict. Such disruptions tend to result in food insecurity, with children born in conflict-affected environments twice as likely to be malnourished as children living in stable settings. Conflict affects food systems indirectly, through its impact on health, energy and transport systems, and displacement. It also directly affects the entire food system, from production to transportation, and it impacts food environments and food markets. People's coping mechanisms are impacted, which further influences their food choices. Meanwhile, climate acts as a so-called 'threat multiplier' in fragile contexts.

This literature review identified numerous proposed practices to limit the impact of conflict on food systems. The most commonly identified practices include **providing in-kind food to populations in need,** as an essential life-saving intervention. **Resilience-focused interventions that take into account conflict, gender, nutrition, and climate aim to make food systems more resilient to shocks and conflicts.** These could be cash transfers, climate-smart and nutrition-sensitive agricultural interventions, and community-based approaches to promote social cohesion and institutional capacity building. Furthermore, **smaller-scale, contextually based, localised solutions that take into account local capacities, local perspectives and local existing response mechanisms** were identified by the review as ways to limit the impact of conflict on food systems. Examples are adopting climate-smart approaches and technologies, small-scale infrastructure investment in markets, and community-based approaches that help build relationships and social cohesion, such as home gardening and women's empowerment

initiatives. Finally, **early warning systems are vital for anticipating food crises** and to inform future practices. Prioritising interventions to avert acute food insecurity can act as a powerful mechanism if it is linked to clear actions and commitments.

Challenges remain in establishing sustainable food systems in conflict-affected settings. A key barrier is that **humanitarian donor funding for interventions tends to be short-term**, in contrast to the general recognition that food system transformation in conflict-affected settings requires a timeframe of at least eight years or more. There is **limited understanding of the effectiveness of interventions in different contexts, as well as their strengths and limitations**. Most research focuses on food assistance, cash and voucher assistance programming, and some smaller-scale interventions, rather than broader interventions that are focused on shifting or linking food systems more closely with security and peace efforts (for example, relating to business ecosystems or engaging multisectoral stakeholders). Meanwhile, **food assistance approaches have also faced scrutiny** as at times they have failed to effectively distribute food to the most vulnerable, have negatively impacted local agriculture, have undermined capacity building and economic development, and have created aid-dependent economies.

The following actions are recommended:

1. Strengthen the development of sustainable, resilient food systems in conflict-affected environments.
2. Further explore smaller-scale, contextually based practices, involving communities themselves (and women in particular) in their design and implementation.
3. Document more examples of the disruption of food systems in other contexts of fragility (such as economic, social, institutional or climatic-related fragility) beyond conflict-affected settings.
4. Consider how food systems in conflict-affected settings will likely look in years to come, and support a full range of programme approaches to make the entire food system in conflict-affected areas more functional, resilient and sustainable.
5. Do more to link climate change, peace and food systems in conflict-affected settings.
6. Build an understanding of how humanitarian assistance impacts local food systems and communities.

Part 4

The literature review sparks some reflections to consider regarding the way forward, for actors involved in nutrition, climate, and food systems action:

1. We need to future-proof: it is not enough to just respond to today's drivers and conditions, we must prepare for fast-changing scenarios.
2. We cannot afford to wait for the perfect solutions before we start acting. We need to fast-track applying the existing evidence base in different contexts.
3. The nutrition and health sector should be included in climate action and decision-making. Climate policies directly affect nutrition outcomes and health systems.
4. Nutrition programmes must become more climate conscious. At the same time, their contribution to climate change must be reduced.
5. Nutrition, food systems, and climate actors need to collect and share more stories of how change has happened. We need to understand what works in different contexts and what are the practical, do-able actions for integrating actions, navigating trade-offs and building co-benefits. Niche neglected areas, such as sustainable food systems for preventing malnutrition, and within fragile and conflict settings, require greater consideration in order to overcome challenges and advance positive environmental and nutritional outcomes.

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Acronyms

AAPHRC African Population and Health Research Center

ENN Emergency Nutrition Network

FAO United Nations Food and Agriculture Organization

HLPE High Level Panel of Experts

LMICs Low- and middle-income countries

NCDs Non-communicable diseases

SUN Scaling Up Nutrition

WASH Water, sanitation and hygiene

WHO World Health Organization



Part 1

Introduction

1.1. Why you should read this review

We intend to foster joined-up strategic decision-making across the climate, nutrition, and food sectors that will accelerate coherent policy, funding and programming to improve the health of people and planet. A baseline assessment in late 2023 confirmed that nutrition, food systems, and climate actors continue to speak in different languages, missing opportunities to reach across the silos to join up their approaches in more cross-cutting strategic policy and programming (GAIN 2023). We want to create an appetite for addressing these barriers and for facilitating the mitigation of these interconnected challenges.

This paper complements and builds on previous work ENN conducted in 2021 and 2022. *Food Systems and How They Relate to Malnutrition in Low- and Middle-Income Countries* (ENN 2021) helped the nutrition community navigate the complexities of the food systems agenda, and *Nutrition and Climate Change – Current State of Play* (ENN 2022) examined the linkages between nutrition and climate change. These two scoping reviews highlighted gaps in understanding how sustainable food systems can be leveraged to prevent undernutrition, as well as gaps in evidence in exploring sustainable food systems in fragile and conflict-affected environments.

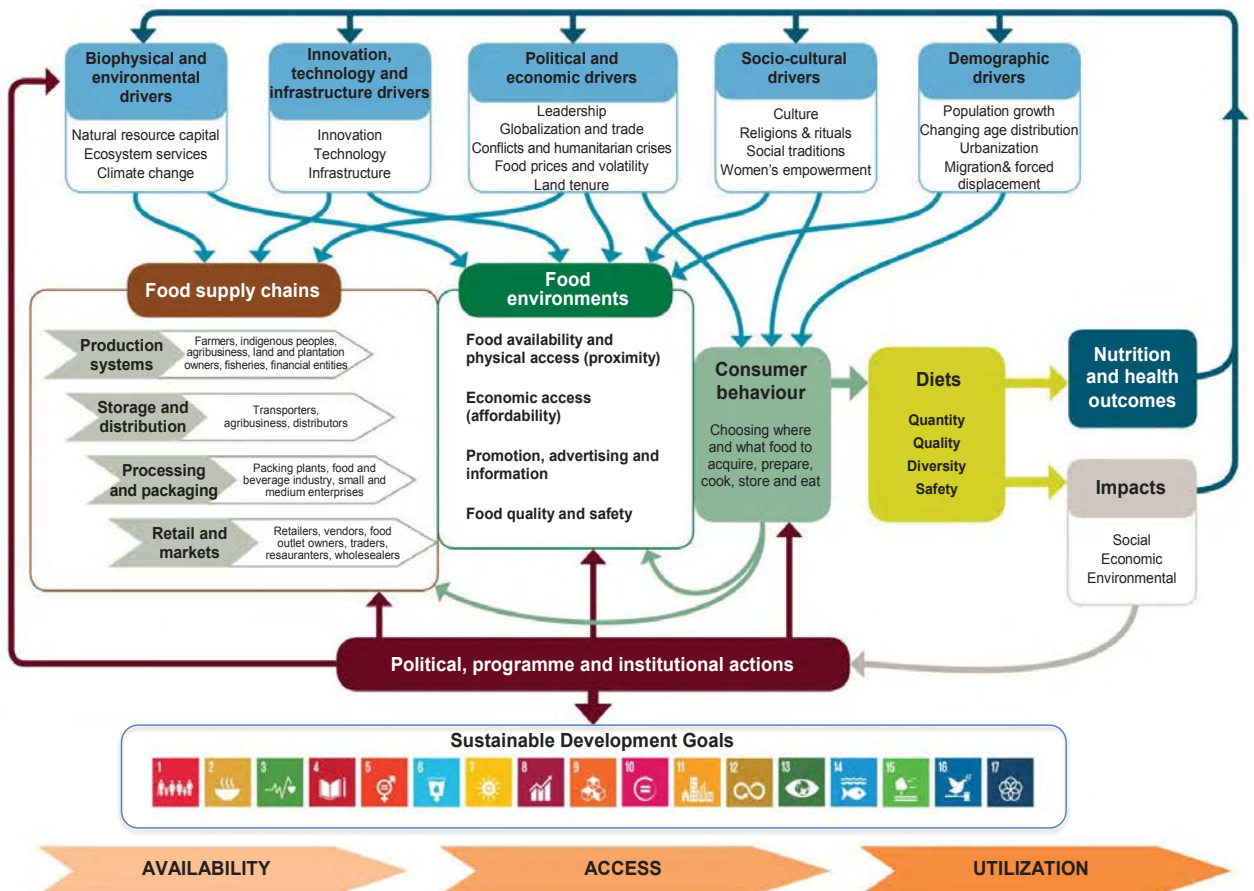
This literature review is aimed at strategic decision makers in non-government organisations, United Nations agencies, donors, academics, and think tanks, primarily in the nutrition field but with the hope of reaching and being relevant for climate and food system actors as well. **Part 2** grounds readers in the intersections of food systems, climate change, and nutrition, which have gained traction since the Food Systems Summit in 2021. This field is currently being established, at record speed, which means it is quite challenging to stay abreast of developments. **Part 3**

delves into two areas that are currently neglected and yet are of critical importance: i) leveraging sustainable food systems to prevent malnutrition, and ii) establishing sustainable food systems in conflict-affected settings. **Part 4** reflects on ways forward, with the aim of influencing future thinking, programming and funding.

1.2. Methods

The literature review included peer-reviewed publications and grey literature reports. To deepen the resource pool a snowball approach was also used, whereby references lists from identified published studies and grey literature were reviewed to identify any further potentially relevant studies. The snowball approach was particularly useful for the topic of prevention, where a lack of overlap between the food system literature and the 'prevention' of malnutrition literature was revealed. Publications reviewed from a food systems lens tended to refer to 'improving' or 'addressing' malnutrition, and did not capture interventions that are more commonly delivered through health systems, such as complementary feeding with an added food component. Thematic analysis was applied to the selected literature. For deeper dives into the prevention of malnutrition and conflict settings, the HLPE Food Systems Framework (**Figure 1**) was used to further analyse the literature according to the different components within the food system, in order to map the findings across the entirety of the food system. Preliminary results were presented and discussed with reviewers from APHRC and the UN-Nutrition Secretariat, who also subsequently reviewed the written draft. The Annex presents the methods in more detail.

Figure 1. Conceptual framework of food systems for diets and nutrition



Source: HLPE 2017



1.3. Linking food systems, climate, and nutrition

Navigating and managing the interplay between food systems, climate change, and nutrition is part of the foundation for the longer-term well-being of societies. Both the World Health Organization (WHO) and the Intergovernmental Panel on Climate Change agree that malnutrition will be the greatest contributor to climate change-associated morbidity and mortality (Lieber et al. 2022). The recent 2023 Lancet Countdown report on health and climate change noted that one of the 11 priority actions to deliver a healthy, thriving future is to improve equitable access to affordable, culturally relevant, low-carbon diets that meet nutritional needs (Romanello et al. 2023).

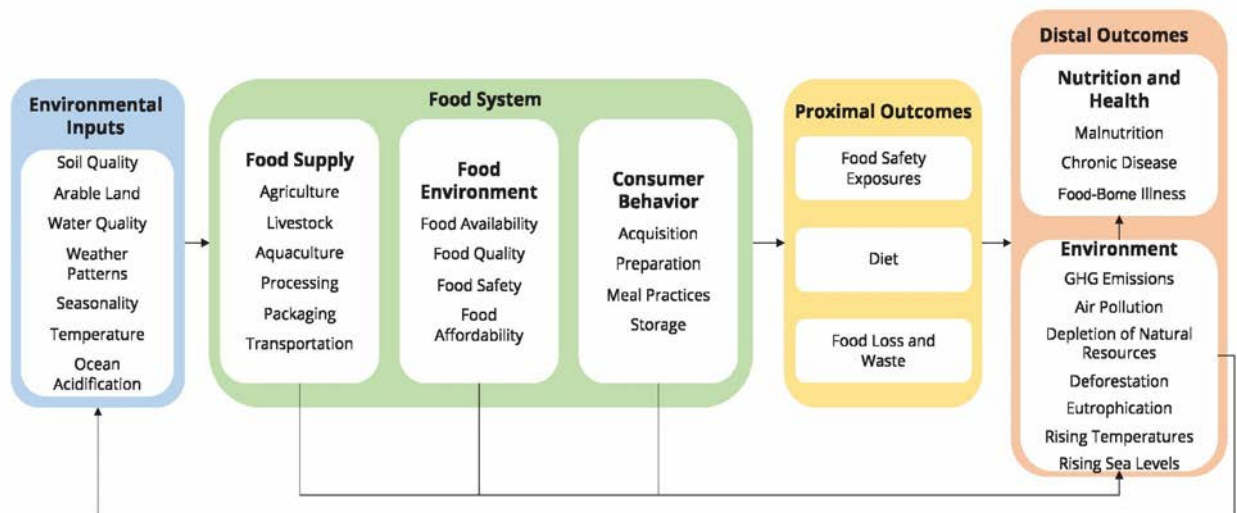
Progress has been made in reducing malnutrition globally, including a one-third decline in the proportion of children affected by stunting. However, large numbers remain affected by undernutrition, while overweight and obesity are on the rise. In 2022, 148.1 million children under age five worldwide (22.3%) were affected by stunting, an estimated 45 million children under five (6.8%) were affected by wasting, and 37 million children under five were living with overweight globally, an increase of nearly 4 million since 2000 (UNICEF/WHO/World Bank 2023). Sustainable transformations of food systems have recognised huge potential to address this continued high burden of malnutrition. In particular, food systems have a direct influence on maternal, infant and young child feeding (maternal diets, commercial infant milk and complementary feeding), which in turn are a key driver of preventing malnutrition. **Figure 2** illustrates how the climate and food systems influence nutrition outcomes.

The food systems are one of the core pathways to both nutrition and climate impact (FAO 2023b). Climate change negatively affects food systems by impacting soil fertility, rain patterns, crop yields, and nutrient composition, leading to a reduction in macro and micronutrients in the global food supply. These changes, compounded by indirect impacts, such as increased pests, contribute to spoilage and food safety hazards, and pose challenges to human nutrition, especially when considering the additional complexities introduced by pandemics (Owino et al. 2022). Climate

change can also disrupt food supply chains and transportation, impacting food price volatility and access to foods. Many consequences of climate change threaten food security and diet quality, thereby exposing vulnerable populations across continents to multiple forms of malnutrition. It is the poorest people in all societies, and the populations in LMICs, which are likely to suffer the most from exposure to climate shocks, to unsustainable food systems, and to the livelihood threats posed by ill-health and nutrition (FAO et al. 2023). And it is often the populations that are most exposed to climate shocks who are also most vulnerable to malnutrition.

The intersection between climate change, food systems, and nutrition is not adequately recognised or resourced, despite the evidence and the political attention, as witnessed at the United Nations Food Systems Summit (2021) and Stocktaking Moment (2023), the Nutrition for Growth Summit (2021), and the United Nations General Assembly (2023). COP27 placed food systems firmly on the global climate change agenda, while COP28 built on that momentum and for the first time ever had a day dedicated to health (although attention to the issue of nutrition was mostly limited to the discussion of healthy sustainable diets). Nutrition security is poorly addressed by current climate change initiatives (Macheka et al. 2022). Furthermore, investment by donors and non-government organisations alone is not sufficient to address these challenges (Camber Collective 2023). Governments need to be enabled to put into place measures that protect their environment and people.

Figure 2. Food systems and the environment for nutrition



Source: Fanzo et al. 2021



Part 2

What are new and evolving topics related to linking food systems, climate and nutrition?

Linking sustainable food systems and climate with nutrition outcomes is one of the most exciting and fastest moving areas in sustainable development. The fast pace of change is compounded by the fact that this is an intersectoral area, meaning that each step forward in one sector has implications for the others. Add increasing climate urgency and political attention and you have a field that is establishing itself as it goes. This can make it incredibly difficult to navigate the jungle and understand how things are evolving. This literature review presents the focus areas and topics that have developed in the years since the Food Systems Summit, from 2021 through to 2023.

2.1. What are new topics?

2.1.1. A focus on 'all forms of malnutrition'

The face of malnutrition has changed in recent decades. Despite gains made in reducing the prevalence of wasting and stunting rates in LMICs (HLPE 2023), there is a growing burden of all forms of malnutrition, including undernutrition (stunting, wasting, and underweight), micronutrient deficiencies, overweight and obesity (Fanzo 2023). Most countries are going through a rapid transition phase, with persistent undernutrition and rising obesity, and increasing disparities mean that LMICs are carrying a higher burden of malnutrition (Saavedra 2022). This transition is occurring in all age groups, not just children, and is even manifesting in utero, linked to maternal health and nutrition and resulting in, for example, low birth weight infants. Fuelling

this rise in overweight and obesity is the nutrition transition, which is defined by high consumption of ultra-processed foods and significant reductions in physical activity, as a result of widespread economic and related demographic changes. The combination of climate change and all forms of malnutrition is creating a perfect 'Global Syndemic' that affects most of the people in every country and in every region worldwide (Swinburn et al. 2019) and is acknowledged to present two of the greatest threats to planetary and human health (Bakker et al. 2021).

What now?

Despite the established evidence on the nutrition transition that populations and countries are going through, collective responses to treat and prevent multiple forms of malnutrition are still not reflected in programming, funding streams and mechanisms. The silos formed around the different types of malnutrition need to be dismantled in order to reflect the realities of individuals and populations who experience them simultaneously or at different life stages, as well as to facilitate the leveraging of food systems to address nutritional concerns. Complex and interconnected drivers, outcomes and stakeholders require collaboration between experts in undernutrition, overweight, non-communicable diseases (NCDs), the environment, climate and agriculture (Fanzo et al. 2021).

2.1.2. Climate change impacts on nutrition security and food security are gendered

Women's susceptibility to the adverse impacts of climate change, malnutrition, and food insecurity is a multifaceted issue, which is deeply rooted in systemic gender disparities. The intricate web of challenges that women face means they are often more prone to vulnerability. The intersectional nature of these challenges emphasises the urgency of collaboration and alignment to advance gender equality and the empowerment of women (Bowen 2021). Due to factors like poverty and social marginalisation, the ramifications of climate change disproportionately affect women and girls (Lieber et al. 2022, Bakker et al. 2021), and these changes in turn further exacerbate existing gender inequalities (CFS 2023). Women are more vulnerable to the adverse impacts of climate change on food systems since they have limited access to land, resources, information and decision-making. The strain of climate change on women's daily responsibilities – for example, as smallholder farmers – can affect their ability to provide proper care for their infants and young children, thereby increasing the risk of undernutrition (Bakker et al. 2021).

Meanwhile, gender disparities in access to good nutrition persist. Discriminatory societal norms and poverty often hinder women and girls' ability to access and consume healthy diets. Increased



nutritional needs, due to menstruation, pregnancy and breastfeeding, further increase their vulnerability to malnutrition, while the nutritional status of women during critical stages like pre-pregnancy, pregnancy and breastfeeding significantly influences the survival, as well as the cognitive and physical development, of their children (CFS 2023). Persistent gender gaps in food security and malnutrition remain, regardless of a country's income level, emphasising the far-reaching impact of these inequalities (HLPE 2023). Transforming food systems requires ensuring women's participation and empowering women to make strategic life choices (Bakker et al. 2021). However, women encounter systemic marginalisation and discrimination across all dimensions of food systems. Compared to men, they face unequal access to, and control of, resources, experience a gender pay gap, endure unsafe working conditions, and are burdened with unpaid and unrecognised roles in both domestic and care work (CFS 2023). Structural constraints and discriminatory laws further restrict their access to financial services, perpetuating their vulnerability. Gender inequalities undermine development, and women and girls' empowerment in food systems is crucial for nutrition, preserving health, food security and resilience building (European Parliament 2022).

What now?

Addressing gender imbalances is no longer an optional addition to climate action and sustainable food system transformation. Collaborative efforts across agreements and policies are imperative. Dismantling obstacles to women's participation in local climate adaptation initiatives and building gender equity into the food system needs to occur. Building gender equality and sustainability through policy and social reforms is possible by, for example, increasing women's representation in leadership and decision-making and increasing women's participation in managing natural resources. Supporting civil society organisations that bring women's voices into decision-making and policy development will help ensure that climate policies meet the specific needs of women and girls. Redistributing care work and ensuring women farmers have equal access to productive resources can increase the productive capacity of women in agriculture, increasing nutrition security.

2.1.3. Infants, young children and pregnant women have compounded vulnerabilities

Infants, young children and pregnant women stand at the intersection of compounded vulnerabilities, facing the perils of climate change, malnutrition and food insecurity. Climate change fosters optimal conditions for infectious diseases and diminishes household food security. It can lead to population displacement, increased labour migration and heavier female workloads. This has severe consequences for nutritionally vulnerable populations, notably pregnant and lactating women, infants and small children, who bear the brunt of these trends (Fanzo et al. 2021). The youngest demographic group, particularly those aged one to two years, emerges as the most susceptible to the impacts of climate change, possibly as a result of shifts in feeding practices (Lieber et al. 2022).

What now?

Addressing climate change, nutrition and the sustainability of food systems in tandem is a potent strategy for safeguarding the well-being of the most vulnerable populations. This calls for more investment in, and design of, policies and programmes to trial how we can best address infants', young children's and pregnant women's vulnerabilities across a variety of contexts. Transforming food systems, starting with ensuring optimum first foods for young children, should be the priority because of the longer-term effects on child growth and health (Agostoni et al. 2023), alongside supporting the enabling environment for breastfeeding, as a climate-neutral practice, with the broader goal of mitigating climate-related vulnerabilities and promoting child health. Further research is needed: for example, on the effects climate change may have on the micronutrition status of populations (Fanzo et al 2021) and vulnerable groups, such as pregnant women and their in utero infants.

2.1.4. Interlinkages are growing across urban, peri-urban and rural areas

Urbanisation is fundamentally reshaping the dynamics of climate, nutrition, and food systems, presenting both challenges and opportunities on a global scale. Projections indicate that nearly 70% of the world's population will live in cities by 2050 as populations continue to migrate towards urban centres, with population displacement and labour migration increasingly caused by climate change. Population pressure and urbanisation are major trends affecting diets (Fanzo 2023) and, contrary to common perception, food security is no longer solely a rural concern. For example, research has shown that growing urbanisation in Africa, traditionally a rural setting, will change consumption patterns and increase the environmental footprint (Camber Collective 2023). Almost half of the global population resides in peri-urban and rural areas, the connectivity between these zones is increasing, and the prevalence of moderate to severe food insecurity in urban and peri-urban areas often mirrors or surpasses that in rural regions. The conventional belief that purchase patterns between urban and rural areas differ significantly is challenged by new evidence that highlights the increasing importance of the affordability of a healthy diet in peri-urban and rural households (FAO et al. 2023). In addition, a challenge lies in understanding and improving food environments in order to promote healthy diets amidst the evolving dynamics of urbanisation and food systems worldwide (Kennedy et al. 2020).

What now?

The dichotomies of rural and urban food systems and nutrition profiles are no longer as distinct as they once were. Strengthening urban–rural linkages is imperative to achieve sustainable food systems with positive nutrition and environmental outcomes (UN-Nutrition 2023). The policy landscape needs to explicitly account for this reality. Nutrition and food security actors must break down the divide between rural and urban programming. We need to shift away from focusing only on food availability and increase our focus on the affordability and cultural acceptability of healthy choices in urban, peri-urban and rural settings.



Photo credit: Rani George, 2018/Unsplash

2.1.5. Global solutions need contextualisation

Context-specific, tailored approaches to building sustainable food systems, rather than implementing nutrition interventions within existing filtering systems, are crucial for improved climate and nutrition outcomes (Camber Collective 2023). We need equity-sensitive solutions, recognising the importance of tailoring interventions to the unique circumstances of each setting (UN-Nutrition 2023). We need equity-informed policies and programmes that are based on principles such as adaptability to context, a focus on agency, and addressing power imbalances (HLPE 2023). This underscores the complexity of developing universal solutions for diverse contexts. Details on how actions could be implemented within different settings often remain vague (Caleffi et al. 2023) and yet existing examples underscore the significance of contextualising interventions to provides lessons for others to learn from. For instance, Geyik (2023) points out that providing an optimal food basket at the national level, without exceeding climate boundaries, is feasible. However, the priorities for LMICs may differ – they may seek to rely on trade, rather than solely increasing national supply, for effective climate mitigation – and these national realities need to be taken into account. Another example is the move away from international healthy diet references to national food-based dietary guidelines (Owino et al. 2022). This shift recognises the importance of tailoring dietary recommendations to the specificities of national food systems, reflecting the diversity of eating habits and the availability of food in different countries.

> **What now?**

There needs to be more representation of low- and middle-income contexts in the documented learning of what is working and not working, in order to support contextualisation efforts and nationally led change. To build context-appropriate sustainable food systems that protect and restore environmental and nutritional well-being, we know that policies and solutions need to be country-driven and needs-based. To establish priorities and make investments, there needs to be better guidance on how theory and practice translates into different contexts. For example, the nutrition community needs to work with climate and environmental specialists to understand how healthy sustainable diets affect the environment in more localised contexts (Fanzo et al. 2021).

> **2.2. What's still evolving?**

In the last few years, the importance of sustainable food systems and climate change action have been placed firmly on sustainable development agendas. Theory, practice and politics have been moving rapidly. In this part of the literature review, we capture the areas that are emerging front and centre at the intersection of nutrition, food systems, and climate change.

2.2.1. Climate change adaptation and nutrition

Climate change adaptation strategies adopted by communities in response to climate change shocks can have profound impacts on nutrition outcomes. Strategies to minimise negative effects of climate change must also be sensitive to food and nutrition needs (Bakker et al. 2021), in order to avoid negative nutrition and health outcomes. The bidirectional relationship between climate change mitigation/adaptation measures and nutrition interventions underscores the need for an integrated approach, taking into account the resilience of food systems and the well-being of vulnerable populations (Bakker et al. 2021; Nissan et al. 2022; Tirado et al. 2022). The relationship between climate adaptation strategies and nutrition security remains poorly understood, with conclusive studies lacking (Macheka et al. 2022). Even when effective climate adaptation approaches to reduce climate-related risks to food and nutrition security have been identified – such as agroecological local food systems and nutrition-sensitive social protection – they are rarely considered together (Tirado et al. 2022). Furthermore, gender imbalances create obstacles for women's participation in local climate adaptation initiatives, and when addressing these imbalances it is critical to not affect breastfeeding, the timely provision of complementary foods, and other childcare responsibilities (Bakker et al. 2021; Tirado et al. 2022).

> What now?

We need to understand better the impact of climate change adaptation strategies on nutrition outcomes. To support this, we should evaluate the impact of climate adaptation strategies on nutrition security. We need to ensure adaptation contributes positively to the well-being of vulnerable populations, prevent negative consequences, and optimise adaptation so as to have the best impact on nutrition security. This requires better understanding of the crucial components in selecting and identifying suitable climate adaptation strategies in relation to their effects on nutrition security (Bakker et al. 2021). Furthermore, international organisations that work on food systems and malnutrition need to have policies that build in climate mitigation/adaptation and resilience, which is something that is currently lacking (Camber Collective 2023).

2.2.2. Trade-offs in the transformation to sustainable food systems

As the global community grapples with the urgent need for sustainable food systems for environmental and social well-being, the recognition of trade-offs has emerged as a crucial consideration. Trade-offs refer to the complex decisions and compromises that must be made to balance competing objectives, often with conflicting economic, environmental and social implications. For example, there can be hugely significant policy trade-offs between agriculture policies focused on cheap staples and policies aimed at supporting higher intake of nutrient-rich foods; between fiscal policies that facilitate the profitability of food companies and the affordability of healthy diets for citizens; and between a vision for human and planetary health and a vision of increased aggregate economic growth (Global Panel 2020).

The first step in addressing trade-offs is to understand them comprehensively. Food systems involve a myriad of interconnected activities. Decisions made at any stage of the food supply chain have far-reaching implications for consumer choices, dietary patterns and nutritional outcomes



(Pretorius et al. 2021). The competing economic and political interests of various stakeholders, coupled with the absence of effective global governance mechanisms, complicate the decision-making process (Kennedy et al. 2020) of national policy-makers and consumers alike. A further significant challenge arises when decision makers lack a full assessment of the activities within food systems and their potential negative impacts; i.e., hidden costs that are not reflected in market prices, such as greenhouse gas emissions, water use, and land-use change, as well as health and social costs (FAO 2023a). Quantifying these hidden costs is a challenging task due to numerous data gaps, but it is crucial for evidence-based decision-making on which actions are best to take in given contexts (FAO et al. 2023). Ongoing investments in developing methods to uncover the hidden costs, such as the True Cost Accounting method (FAO 2023A), will enable mapping and quantification of food systems, leading to a stronger evidence base for addressing trade-offs. This is imperative in order to accelerate sustainable development, particularly in low-income countries, where these hidden costs can account for a significant share of the gross domestic product (FAO 2023a). Evidence-based policy-making is essential for addressing trade-offs effectively (Kennedy et al. 2020). This applies not only to government policies and resource allocation but also to private sector retail strategies and household food choices (Webb et al. 2023).

What now?

Understanding and addressing trade-offs are key to sustainable development. We need to support governments and other actors in countries where the institutional and resource capacities are limited to build up the data needed to make informed choices and develop appropriate policies. We need to ensure the nutrition of individuals and communities is at the centre of decision-making priorities, considering that most poor people around the world are already unable to access minimally adequate diets just in terms of calories and micronutrients. The affordability of healthy sustainable diets needs to be a guiding factor to support individuals to not only meet their basic nutritional needs, but to also enable them to consume healthy and sustainable food items.

2.2.3. Capitalising on co-benefits

The integration of climate change, food systems, and nutrition actions and policies can create co-benefits and is identified as a top priority for transitioning food systems (GLOPAN 2020), while also providing one solution to two of our biggest barriers to sustainable development (FAO 2023b). A departure from siloed thinking and action is required, through a shift to collaboration and synergy between climate change and nutrition initiatives (Bakker et al. 2021). However, existing policy-making structures often operate in silos, hindering effective cross-sectoral collaboration (UN-Nutrition 2023). Legislators and government ministries and agencies with different areas of expertise and different priorities should be engaged to achieve co-benefits for nutrition. They should strive to amplify the voices of traditionally marginalised populations, such as youth, women and indigenous people, to ensure that the needs of the most vulnerable populations are met (UN-Nutrition 2023). Practical approaches for achieving co-benefits include improving governance, leveraging governmental resources, and enhancing access to finance in LMICs to drive transformative change (Global Panel 2023). Strong leadership to address policy distortions and greater integration of climate thinking, planning, action and finance to open up new opportunities can drive through the necessary changes (Global Panel 2020; GAIN 2023). To achieve this, decision makers require evidence of challenges and potential synergies so as to develop policies with co-benefits for nutrition and the environment (UN-Nutrition, 2023). Global-level evidence is emerging in understanding the role of food systems, such as the Centre for Food Policy Research's "45 Actions to Orient Food Systems towards environmental sustainability: co-benefits and trade-offs", which helps provide some global guidance to help inform decision-making. Recent developments, as seen in the 2023 FAO report "Revealing the true cost of food to transform agrifood systems", will further support these efforts to better understand the co-benefits and trade-offs at national and local levels (FAO 2023a).

> **What now?**

The prospect of environmental and nutrition co-benefits is tangible. There are numerous possibilities to create more environmentally sustainable food systems that have positive benefits for both nutrition and the environment. However, achieving co-benefits between environmental outcomes and diets/nutrition will often require investing in systematic and intentional efforts from the outset with a long-term perspective prioritised over short-term gains. Materialising co-benefits between environmental outcomes and diets/nutrition cannot be left to chance. We need data and motivation to recognise potential synergies and collaborate on implementation (Caleffi et al. 2023). To enable this, climate and nutrition actors need to be enabled to speak the same language. In some instances, the different communities use different terms to talk about the same thing, in other instances they lack a common understanding. In order to meaningfully collaborate, actors need common definitions, concepts and metrics (Fanzo 2023; GAIN 2023).

2.2.4. Moving beyond short-term measures to building resilience

In addressing the negative impacts of major drivers contributing to hunger and malnutrition, building greater resilience is a key strategy (FAO et al. 2021). This can include the capacity of food systems to ensure a steady supply of safe and sufficient food, not only during periods of normalcy but also in the face of disruptions and shocks (Fanzo et al. 2021). It can also include building climate resilience that addresses current or expected climate variability. Particularly for LMICs lacking the necessary resources to address various crises, building resilience is not just a priority: it is also a necessity (Global Panel, 2023), so that the long-term prospects for sustainable development and well-being are not compromised (FAO et al. 2021). It is essential to plan for long-term targets, avoiding short-term actions that could impede progress (Global Panel 2023). Recognising the diverse environmental and social settings in which food production occurs, solutions for achieving sustainability, reduced vulnerability, and increased resilience will inevitably vary (Bakker et al. 2021). One example of addressing multiple drivers contributing to hunger and malnutrition is crop and livestock diversification. This provides protection against heat and water stress, and even more so against pests and diseases, and thus increases climate resilience. Diverse production increases dietary diversity, which provides key micronutrients and improves nutritional status. Furthermore, intentionally involving women in diversification, because they are more likely to have knowledge of traditional varieties and practices, breaks down barriers to their participation in creating a more sustainable food system (Bakker et al. 2021). While short-term yields might be lower, the longer-term benefits of improved nutrition, mitigation and adaptation to climate change, as well as improved gender equity, are significant.

> **What now?**

As we build more sustainable food systems, we need to ensure they are capable of operating at two speeds. We must respond to immediate needs and short-term shocks, without neglecting the longer-term restructuring of food systems that is needed to pro-actively respond to some of the trends outlined here, such as climate change, rapid urbanisation, and the increasing burden of obesity (Webb et al. 2023). This calls for investments and policies that prioritise building resilience and responding to immediate needs within the same frameworks and initiatives, not as two independent and parallel goals.

2.2.5. Water's critical role in food systems, climate change and nutrition

Traditionally, the link that has been highlighted between climate change and nutrition is the food system, perhaps because food insecurity has been seen as almost synonymous with malnutrition. However, the interdependence of water and food systems, their relationship with climate change, and the role of water in nutrition necessitates consideration of both water and

food systems in addressing nutrition and climate change (FAO 2023b). The dynamics of natural water cycles are being altered by environmental changes, such as land-use shifts, biodiversity loss, and urbanisation, exacerbating the challenges faced by food systems (Ringler et al. 2023). Water plays a pivotal role in shaping nutrition, through its influence on consumption, food security, and disease burden. Access to reliably clean and sufficient amounts of water is not only essential for nutrition but also plays a critical role in primary food production, safe food processing, and overall food safety. Over 70% of freshwater withdrawals are dedicated to agriculture, underscoring the integral connection between water and food systems (Ringler et al. 2023). Changes in water availability and consumption patterns pose a threat to food security and nutrition, with implications for water scarcity and pollution affecting vulnerable populations, particularly food producers (Ringler et al. 2023). The impacts of climate change on water systems extend to infectious and waterborne diseases, compounding the risk of malnutrition. Climate-induced shifts create optimal conditions for the spread of infectious diseases, with an increase in waterborne diseases, especially in rapidly growing urban areas (FAO 2023b). Climate change, with increased flooding and precipitation, and rising temperatures, is projected to elevate the burden of diarrheal diseases in low-income regions (Owino et al. 2022). The absence of water, sanitation and hygiene (WASH) facilities contributes to infectious diseases, exacerbating undernutrition and perpetuating poverty (Sena 2021).

> **What now?**

Recognising water as a fundamental element in both food and health systems is imperative for addressing the complex challenges posed by climate change and ensuring global nutrition security. We need comprehensive strategies that acknowledge and address these interdependences. Sustainable land and water management, coupled with climate change mitigation, are essential for achieving nutrition goals (Sena 2021). The burgeoning collaborations between the WASH and nutrition communities are essential for mitigating the immediate risks posed to nutrition and health status. But we need to go further and to also work upstream, with agricultural policies and practices, and climate mitigation and adaptation, to secure water supplies for both a productive food system and a healthy population.





2.3. Recommendations

The following recommendations offer suggestions for how the nutrition, climate, and food systems communities can take further steps to allocate funds, create policy, and implement and apply learning within the topics set out above, which were identified from the literature review. The recommendations that draw directly on the “What now?” sections are summarised as follows:

1. Break down the silos around the different types of malnutrition, reflecting the realities of individuals and populations in leveraging food systems to address nutritional concerns.
2. Dismantle obstacles to women’s participation in local climate adaptation initiatives and at the same time build gender equity into the food system. Mitigate the potentially negative effects that these increased responsibilities could have on breastfeeding, the timely provision of complementary foods, and other childcare responsibilities, which are mostly shouldered by women.
3. Invest in, and design more, multi-dimensional policies and programmes to trial and learn how to address climate change, nutrition, and the sustainability of food systems in tandem. This needs to be at scale and across a variety of contexts, as it is a potent strategy for safeguarding the well-being of the most vulnerable populations and advancing social health and development on a global scale.
4. Strengthen urban–rural linkages in the policy landscape. Break down the divide between rural and urban programming to achieve sustainable food systems with positive nutrition and environmental outcomes.
5. Ensure greater representation of low- and middle-income contexts in the learning on how theory and practice translate into different contexts to support nationally led change to establish priorities and make investments.
6. Evaluate the impact of adaptation strategies on nutrition security to ensure adaptation contributes positively to the well-being of vulnerable populations and can be optimised so as to ensure the best impact on nutrition security, and also to better understand the components that are crucial in selecting and identifying more suitable climate adaptation strategies, given specific contextual environments, in relation to their effects on nutrition security.
7. Support governments in countries where the institutional and resource capacities to effectively understand, navigate and address trade-offs are limited, while ensuring that setting the right pricing of food items enables agency to navigate trade-offs at the individual and household level.
8. Create more co-benefits between environmental outcomes and diets/nutrition by investing in systematic and intentional efforts from the outset. Co-benefits cannot be left to chance.
9. Capacitate climate and nutrition actors to speak the same language, using common definitions, concepts and metrics.
10. Prioritise investments and policies for restructuring food systems that prioritise building resilience and responding to immediate needs within the same frameworks and initiatives, not as two independent and parallel goals.
11. Develop comprehensive strategies that address the interdependence of water and food systems, their relationship with climate change, and their role in nutrition.



Part 3

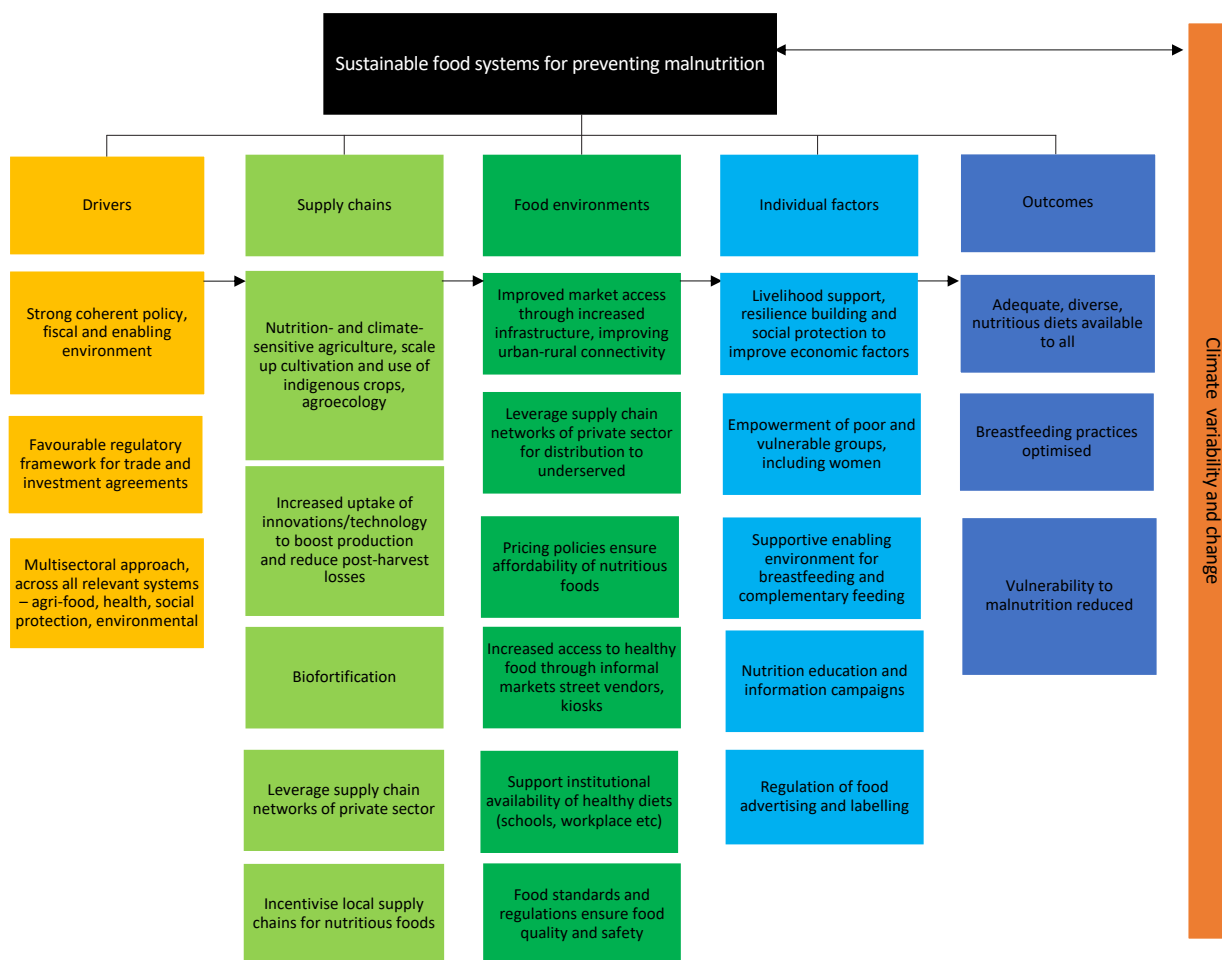
What is neglected?

This section builds on previous work by ENN which highlighted gaps in evidence in relation to two key aspects linking food systems, nutrition and climate change: i) leveraging sustainable food systems to prevent malnutrition, and ii) establishing sustainable food systems in conflict-affected settings. Given the critical importance of these two areas, separate literature reviews and analyses were conducted on each, identifying key themes, challenges and recommendations for the way forward.

3.1. Leveraging sustainable food systems for prevention of malnutrition

Malnutrition, in all its forms, includes undernutrition (wasting, stunting, underweight), inadequate vitamins or minerals, overweight, obesity, and resulting diet-related NCDs (WHO 2023). Fundamental to the prevention of malnutrition is ensuring good nutrition, through access to a healthy balanced diet across the lifecycle. Healthy diets do not automatically lead to improved nutritional status, given the role of other contributing factors (e.g., infectious diseases, physical activity) but they are nevertheless necessary to achieve it. As food systems determine the quantity, quality, diversity and nutritional content of what we eat, it is essential that all components of food systems are shaped/leveraged to promote/support the availability and accessibility of appropriate, affordable and desirable nutritious food, to enable better diets and nutrition outcomes. In particular, food systems have a direct influence on maternal, infant and young child feeding (maternal diets, breastfeeding, commercial milk formula and complementary feeding commodities), which in turn are a key driver of preventing malnutrition. **Figure 3** illustrates how components of sustainable food systems can be leveraged to prevent malnutrition. Achieving this requires working with all the different stakeholders involved: individuals and companies who produce, store, process, market and consume food, as well as government, civil society organisations, researchers, and development practitioners who design the policies, regulations, programmes and projects that shape the system.

Figure 3. Sustainable food systems for the prevention of malnutrition



Source: Authors

Notably, the literature review revealed a lack of overlap between the food systems literature and the literature related to the ‘prevention’ of malnutrition. Publications reviewed from a food systems lens were orientated towards ‘improving’ or ‘addressing’ malnutrition, with few focused on specific nutrition interventions that are more commonly delivered through the health system, such as complementary feeding with an added food component.

3.1.1. Promising practices within sustainable food systems for preventing malnutrition

The literature review revealed a wealth of proposed solutions to addressing malnutrition across the various components of sustainable food systems. Highlighted below are some of the more common themes and promising practices.

A stronger, more coherent policy environment

There are many factors that shape food systems, including environmental, economic, socio-cultural, demographic and political and institutional drivers (see **Figure 1**). The need for a stronger and more coherent policy environment was by far the most common factor arising from the literature search, in terms of the number of papers. This includes strengthening the integration of nutrition within national policies, budgets and programmes across the range of relevant sectors; e.g., agriculture, health and social protection. Promising examples from Ethiopia and Nigeria show that nutrition-relevant policy focused on undernutrition and micronutrient deficiencies, mainstreamed across sectors, can enhance capacity to adopt healthy diets, but needs to be backed with effective implementation at the local level (Lecoutere et al. 2021). This requires

constraints in systemic factors and operational challenges to multisectoral programming to be addressed, as well as aligning to communities' needs (Warren and Frongillo 2017).

Other policy areas with promise that were frequently cited in the reviewed literature:

- Strengthening the implementation of the Code of Marketing Breastmilk Substitutes to protect optimal breastfeeding practices. In Viet Nam, for example, intensive efforts, including banning advertising of commercial milk formula and extending paid maternity leave, increased exclusive breastfeeding rates from 20% to 62% in five years (cited by Branca et al. 2019).
- More equitable trade and fiscal policies to increase the availability and affordability of nutrient-dense foods, particularly in marginal areas. For example, the introduction of subsidies for pulses in selected Indian states had a small but statistically significant effect on household dietary protein intake (Chakrabarti et al. 2018).
- Food safety, marketing and labelling regulations to protect children from ultra-processed foods. An example of food labelling regulations is Mexico's front-of-pack warning labels, introduced in 2020. These aim to support consumers with different levels of literacy to easily understand the nutritional content of products and to be able to discriminate between a healthy and unhealthy product, and thereby to make more informed choices (Villaverde et al. 2023).
- Enhancing women's rights and empowerment. When women have greater control over resources, children's health and nutrition improve at a faster rate (World Bank 2007). In rural Tanzania, a nutrition-sensitive agroecological intervention was shown to improve children's diets and household food security, alongside improvements in indicators of women's empowerment and well-being (Santosa et al. 2021).

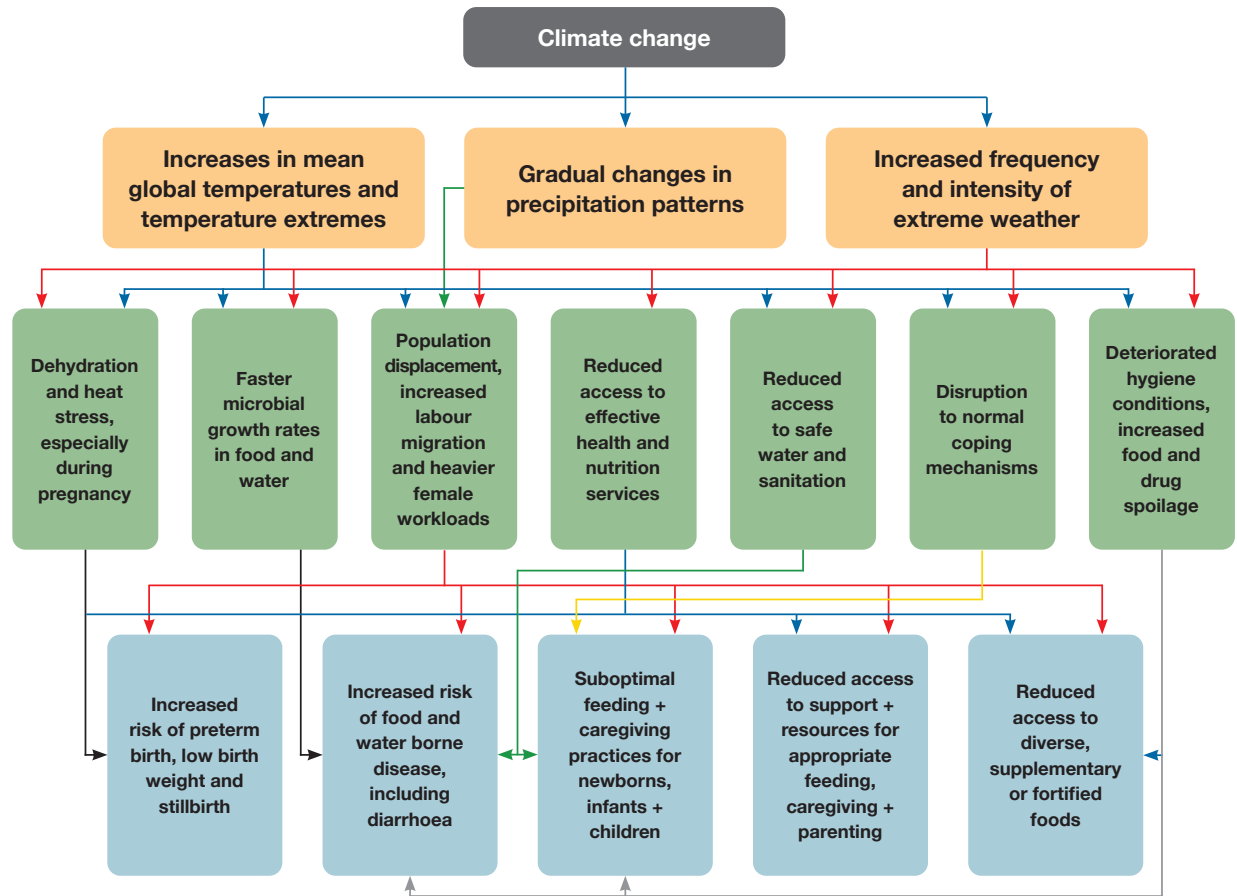
Mitigating the impact of climate change

Mitigating the impact of climate change on food, health and care systems was another key theme emerging from the literature review. Increasing evidence shows that the effects of climate change (especially rising temperatures and lowering rainfall patterns) have a negative impact on child nutritional status. These effects are primarily mediated via the food pathway, through reductions in crop yields and nutritional quality, but also through care (**Figure 4**) and health pathways to malnutrition.



Photo credit: Rawpixel

Figure 4. Summary of the impacts of climate change on care and feeding practices, and resulting consequences for human health and nutrition



Source: ENN 2022

Sustainable food systems require malnutrition and climate change to be addressed in parallel. Recent modelling by Geyik et al. (2023) shows that the world's nutrient gap, in terms of energy, protein, iron, zinc, vitamin A, vitamin B12 and folate, can be closed without exceeding global climate targets and without major changes to national food baskets through increased production and trade of vegetables, eggs, roots and tubers. Climate-resilient food systems are required, with a focus on local-level interventions, to improve nutrition diversity and the resilience of agricultural systems, as well as to mitigate the negative impact of climate on care practices and health environments (ENN 2022). Climate information services have the potential to support early warning, help target the delivery of prevention interventions for at-risk populations, and reduce climate-related disruption during their implementation (Nissan et al. 2022). Increasing coherence is required between national nutrition, agricultural, and climate policies (Morgan and Fanzo 2020).

Nutrition-sensitive agriculture

In terms of food availability and accessibility, nutrition-sensitive agriculture, including crop and/or animal source production, is one of the key actions in transforming food systems to prevent malnutrition. Opportunities to adopt climate-smart agriculture approaches and techniques, such as agroecology, and soil and water conservation, are considered to be crucial. For example, agroecology conserves resources and biodiversity by working with local ecosystems, depending on the specialist local knowledge of small-scale producers. It not only benefits the environment and makes farming more resilient but it can also have positive impacts on the food security and nutrition of households in LMICs (Bezner Kerr et al. 2021). Evidence for the effectiveness of nutrition-sensitive agriculture on improving nutrition outcomes remains mixed, with effects

greatest when nutrition behaviour change communication and women's empowerment activities are included (Ruel et al. 2018). In terms of preventing wasting, a review of the evidence suggests that impacts are likely to be greater when interventions increase the production of micronutrient-rich foods, along with foods that are high in energy or protein, and when they are implemented for at least four years (USAID Advancing Nutrition 2023). There is some evidence supporting the use of biofortified crops as part of food systems in reducing micronutrient deficiencies in farmer households (Huey et al. 2022). Interventions require a tailored approach to fit the specific context and the needs of the target population (Sharma et al. 2020).

Indigenous crops

The potential of indigenous crops was another key theme emerging from the literature review. Many indigenous crops have a higher nutritional value than more dominant staples. For example, finger millet, fonio and teff have higher iron contents than maize and rice, as well as higher amino acid contents (IFPRI 2023a). Strengthening value chains for indigenous crops provides the opportunity for achieving co-benefits across more sustainable food systems. Improving the availability and affordability of foods made from indigenous crops increases nutrient content and dietary diversity, while at the same time offering benefits in terms of climate-resilient agriculture for smallholder farmers and women's empowerment (since women play a significant role in the production and conservation of indigenous crops) (Mabhaudhi et al. 2018). One challenge is that the attributes of indigenous crops, such as nutrient density, are often negated due to poor yields and poor management practices (Talabi et al. 2022), but with increased awareness among stakeholders, innovation, and a favourable policy environment, indigenous crops have great potential in the prevention of malnutrition. Also important is food sovereignty and indigenous knowledge, which support the production and consumption of food in sustainable, resilient and biodiversity-protecting ways, taking into account seasonality and natural cycles within surrounding ecosystems. As one example, the value of sharing indigenous knowledge was demonstrated in a series of case studies from different countries, including India, Kenya and Sri Lanka (Kennedy et al. 2022).

Breastfeeding – co-benefits for climate, food systems and nutrition

Breastfeeding has benefits across climate and food systems, as well as nutrition and health. Feeding an infant fully for six months with commercial milk formula instead of breastfeeding



Photo credit: Humanitarian photographer working for UN Agencies

is estimated to generate between 226 and 288kg of CO₂ (Smith et al. 2023). By contrast, breastfeeding substantially mitigates greenhouse gas emissions. The stronger protection and promotion of optimal breastfeeding is also identified as a key action for countering the detrimental effects of a small part of the global food system: the commercial milk formula industry (Pope et al. 2021). Furthermore, opportunities exist for including and funding interventions supporting breastfeeding under carbon offset schemes, such as the United Nations Clean Development Mechanism (Smith et al. 2023).

Breastfeeding protects against undernutrition and can reduce the risk of developing overweight and diet-related NCDs later in life. It can also protect mothers against some forms of cancer and other NCDs. While these health benefits of breastfeeding are well documented, there remains limited evidence on the effectiveness of regulatory and policy measures to promote breastfeeding, including banning the advertising of commercial milk formula and extending paid maternity leave, in preventing malnutrition. Regulatory frameworks remain weak, with relatively few countries enacting national legislation that is substantially aligned with the Code of Marketing Breastmilk Substitutes (WHO 2022).

3.1.2. Challenges facing the transformation of food systems for preventing malnutrition

As mentioned above, many solutions are proposed to address malnutrition through ensuring sustainable food systems, but challenges remain.

Limited evidence on how and what works

One key challenge that emerged from the literature review is that evidence is currently limited on what works in terms of the proposed solutions focused on food systems in preventing malnutrition. Although more than 2,000 studies have been identified on the effect of food systems on food security and nutrition outcomes in LMICs (Moore et al. 2021) many widely implemented interventions are not well researched. What exists tends to be at a small scale and of a poor quality, with mixed or inconclusive results (Lane et al. 2023; Lecoutere et al. 2021). As just one example: a stronger and more coherent policy environment was one of the most common promising solutions identified in the literature review, but a strong evidence base is required to guide policy decision-making and, as yet, evidence on many of the policy areas suggested – e.g., pricing policies, regulation and labelling – is sparse (Lane et al. 2023; Westbury et al. 2021).

For the prevention of wasting, in particular, the evidence base for a food system approach is limited and mixed (ENN et al. 2021; ENN 2023; USAID Advancing Nutrition 2023). There is some evidence for the positive impact of complementary feeding interventions that include a food component in preventing wasting, but this is small. There is stronger evidence for the provision of specialised foods, such as small-quantity lipid nutrient supplements, but questions remain about the cost effectiveness, and crucially the sustainability, of such products compared to locally produced fortified complementary foods. The WHO guideline on the prevention and management of wasting and nutritional oedema (acute malnutrition) in infants and children under five years emphasises the use of local foods to manage moderate wasting, and notes that many children with moderate wasting, and particularly many of those living in severely food insecure settings, do not need commercially prepared specialised foods to recover from moderate wasting. This recommendation reinforces the need to focus on local foods first when designing interventions to prevent wasting, and to promote the use of locally produced, rather than commercially produced, complementary foods.

Alongside the limited evidence base, another key theme that emerged from the literature review is a lack of understanding of the 'how': contextual examples of how the various proposed interventions can be implemented successfully for the prevention of malnutrition. For example, practically, how can we leverage the supply chain networks of the private sector to improve access to and the availability of nutritious foods, which are critical for preventing malnutrition in marginalised communities?

Affordability of nutrient-dense foods

The affordability of nutrient-dense foods is identified as another key challenge. Healthy diets are four times more expensive as a 'calorie-sufficient' diet (Ritchie 2021), and, for example, high prices are negatively associated with consumption of eggs among infants and young children (Morris et al. 2018). In Egypt, more than 70% of households reporting a reduction in chicken and egg consumption cited price increases as a main reason, while for those cutting back on meat consumption, 85% cited price increases (Abay et al. 2022). In general, food price inflation has been shown to be correlated with undernutrition. In 2022, when food inflation was particularly high, a 5% increase in real food prices raised the risk of developing wasting by 9% and of severe wasting by 14% (Headey and Ruel, 2022). These risks applied to both young infants and older children, suggesting both a prenatal as well as food pathway. Food inflation during pregnancy and the first year after birth also increased the risk of stunting in children aged two to five years. Affordability is as important for rural and peri-urban areas as it is for urban areas as food purchases are surprisingly high in rural and peri-urban areas (FAO et al. 2023). Better understanding is needed of how trade policy affects the price and availability of nutrient-rich foods across rural markets for vulnerable communities. With limited implementation to date, there is also limited evidence on the effect of healthy food subsidies in LMICs.

The nutrition transition

A recurrent theme of many papers is that in LMICs informal markets (kiosks, markets, street vendors) remain a key source of food for children and, with the nutrition transition, these are increasingly providing less nutritious options (FAO et al. 2023), with additional concerns around food safety (WHO & FAO 2022). While 'healthy street food' is a potentially promising innovation in the food environment, there are hardly any examples of this, and therefore there is hardly any evidence of its effectiveness (Westbury et al. 2021). One small-scale study in urban Nigeria found that customers of an intervention called Veg-on-Wheels, selling washed, pre-cut, and cooled green leafy vegetables, appreciated the quality, hygiene and healthiness of its products (cited by Lecoutere et al. 2021).

3.1.3. Recommendations

The following key suggestions to transform and leverage sustainable food systems to prevent malnutrition are aimed at prompting nutrition, climate, and food systems communities to take further steps to fund, create policy, and implement and apply learning. Based on the analysis of promising practices and existing challenges set out above, the recommendations are as follows:

- 1. Support the wider sharing of practical and local examples of how to, and how not to, transform food systems to prevent malnutrition.** The challenges section highlights the lack of understanding around practical and feasible approaches, as well as the limited evidence on what works. That said, the lack of evidence in the literature should not take away from the many actions, initiatives and momentum around transforming food systems for preventing malnutrition, which need to be shared more widely to advance progress.
- 2. Strengthen the enabling environment for the protection and promotion of breastfeeding.** This includes strengthening policy and regulatory frameworks, which in many countries remain inadequate, thereby 'allowing' the expansion of the commercial milk formula industry (Baker et al 2021; Branca et al 2019). Making the carbon footprint of not breastfeeding more visible has the potential to support and highlight for policy-makers the co-benefits breastfeeding has for health, nutrition and the environment, and therefore to bolster commitment to creating a stronger enabling environment.
- 3. Leverage opportunities in global initiatives promoting a multisectoral approach.** For example, the Global Action Plan (GAP) on wasting (UNICEF et al. 2021) calls for increased focus on the prevention of wasting through a multisectoral approach. For each of the four GAP outcome areas, key priority actions related to food systems are identified. Furthermore, the

costed national road maps developed by 22 countries present an opportunity for positioning food systems as central to the prevention of wasting, with renewed attention and investment in tailored approaches at country level (Fracassi et al. 2023). For example, analysis of costed road maps from eight Sub-Saharan African countries showed that all countries prioritised interventions relating to nutritious food value chains, with the aim of increasing the availability and accessibility of nutritious foods to improve the dietary quality of women of reproductive age and children. Emphasis was placed on animal source foods, fruits and vegetables. Other prioritised interventions across the eight countries included food safety, food fortification and biofortification (Fracassi et al. 2023). Opportunities also arise through the Scaling Up Nutrition (SUN) Movement. SUN multisectoral platforms already exist in many countries, at national and subnational level. Such platforms and implementation experience can be leveraged to support multisectoral approaches to ensuring more sustainable food systems.

4. Make market mechanisms more favourable for improved complementary feeding.

Children, particularly those aged zero to 24 months, are a relatively vulnerable consumer group, with unique nutritional needs but without a direct voice in the market. As a result, there is weak demand or incentive for the food industry to produce and deliver appropriate recommended complementary foods for this group. Opportunities arise in terms of private sector initiatives that source local inputs for locally produced fortified products but experience demonstrates that this is relatively expensive and subject to price and supply fluctuations. The costs of creating consumer awareness, building sustainable demand and distribution to vulnerable, rural populations, are high (Lecoutere et al. 2021). To date, a lack of good-quality studies means evidence on the effectiveness of locally produced fortified foods in preventing malnutrition is weak. Public–private partnerships may offer opportunities for leveraging private sector initiatives but currently there are few viable models of how to do this in practice, given the many barriers, including lack of trust, vested interests, and weak demand (Kennedy et al. 2020). One interesting example from the literature was the use of community-based grain banks in Ethiopia, where caregivers of children who used the locally produced complementary food appreciated the low price, local sourcing, and quality of the product. They also reported positive effects on children’s weight and health (Roche et al. 2017).

5. Improve understanding of the consumer acceptability, sustainability and overall impact of innovations and technology. These innovations include improvements in storage and cold chain to reduce post-harvest losses and food waste, innovations to improve food availability, such as hydroponic plants, edible insects and aquatic plants, as well as the use of technology to develop biofortified foods and to enhance often poor yields of indigenous crops. All these show promise and more work needs to be done to increase their uptake.

6. Apply the lessons learned from strengthening the supply chain around specialised nutrition products to food systems more broadly. Earlier work by ENN (ENN 2021) highlighted how the supply chain around specialised nutrition products, such as ready-to-use therapeutic food, is a microcosm of wider food systems and requires similar transformations to contribute to the prevention of malnutrition in a more sustainable way. More information on this topic was not uncovered during this literature review but the topic remains relevant in that addressing shortfalls through shorter supply chains, local production and more efficient product regulation can provide lessons for food systems more broadly. There are also opportunities in terms of further exploring the efficacy of plant-based formulations for specialised nutrition products that offer a more climate-friendly solution, with the potential for greater coverage (Sato et al. 2021; Akinmoladun et al. 2023).

3.2. Establishing sustainable food systems in conflict-affected settings

Food systems within fragile and conflict-affected settings – those with high levels of institutional and social fragility and/or those affected by violent conflict – face unique challenges and pressures (World Bank 2023). The majority of the literature exploring food systems in fragile and conflict-affected settings focuses on areas that are prone to, or affected by, conflict, in comparison to other types of institutional and social fragility. Given this discovery, this literature review narrowed the focus to conflict-affected contexts. In order to transform food systems in conflict-affected settings so as to adequately nourish people, while also considering climate change and impact, we need to understand what makes these settings unique, and how we can work within that context.

What are the unique characteristics of food systems in conflict-affected settings?

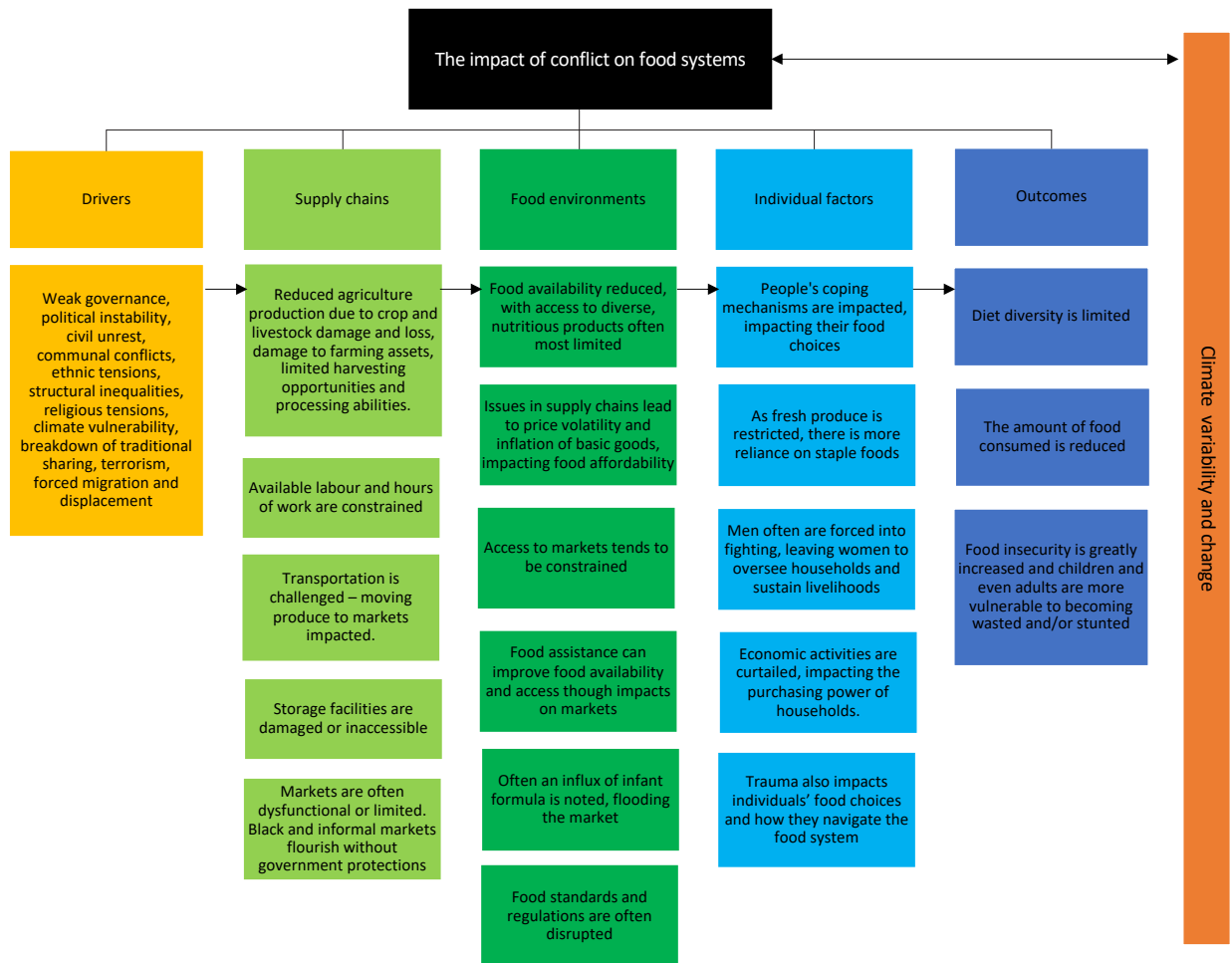
According to the literature, food systems in conflict-affected settings tend to be characterised by a high degree of informality, structural weaknesses and vulnerability to shocks (Delgado & Smith 2021). This is as a result of almost every aspect of food systems being disrupted by conflict (FAO, IFAD et al. 2021; HLPE 2022). Such disruptions tend to result in food insecurity, which is a principal legacy of conflict (Messer & Cohen, 2007). In 2022, it was estimated that 117.1 million people were acutely food insecure (as measured by the Integrated Food Security Phase Classification (IPC)), largely as a result of conflict (FSIN and Global Network Against Food Crises 2023). Additionally, children born in conflict-affected environments were found to be twice as likely to be malnourished as children living in stable settings (HLPE 2022). Conflicts are also a major contributor to displacement and forced migration, which further negatively impact food systems, straining food availability and access, both in the areas migrants leave behind and in host communities (HLPE 2022; Vos & Wilson 2020).

The specific ways in which food systems are impacted during conflict situations are often unique, contextually based and localised (Kemmerling 2023). **Figure 5** provides a summary of some of the impacts that conflict can have on food systems. The capacity of communities and households to cope with threats to their livelihoods are specific to each setting as the many underlying causes of food insecurity and conflict interact in different combinations (Delgado & Smith 2021). Furthermore, the impacts of conflict on the food system are gendered (Patel et al. 2023). Conflict's impacts bear down unequally on women and girls at every stage of the food value chain, as men are typically forced into fighting, which puts greater responsibility in the hands of women in regard to sustaining livelihoods and maintaining family responsibilities (CFS 2023; Quak 2018). Additionally, small vendors are often women, and they face a combination of targeted violence, rising food prices, and the inability to obtain food to sell. Armed conflict can also result in women being forced to stop trading due to reduced movement of both food and people (Patel et al. 2023; CFS 2023).



Photo credit: Chalabala

Figure 5. A summary of the impacts of conflict on food systems



Source: Authors

Conflict affects food systems indirectly, through its impact on health, energy and transport systems, and displacement as a result of conflict can remove people from their customary markets and means of production (HLPE 2022). Conflict leads to decreased local production and agricultural outputs, limited harvesting and processing abilities, reduced available labour, transport limitations, dysfunctional markets, and fractured infrastructure. Such factors impact food environments as they lead to unpredictable food supplies, increased demand (which can lead to price volatility), and limited food diversity options (WFP 2020; Patel et al. 2023; Mercy Corps 2021; Adelaja & George 2019; Adong et al. 2021). Research exploring food systems within conflict settings has tended to focus mainly on the impacts on agriculture (Quak 2018) – this is perhaps because in conflict-affected countries, approximately 60% of people currently live in rural areas and rely on agriculture (Delgado & Smith 2021). There is currently little published literature on conflicts in urban contexts and how food systems are impacted in such environments.

In most conflict-affected contexts, food markets continue to exist, although they require actors to work differently due to high risks and insecure situations. Markets have to navigate broken local institutions, limited supply of produce, tremendous price volatility and an influx of emergency assistance, including infant formula products, that can further impact their success (Quak 2018). Additionally, weakened governments are less able to implement measures to protect markets, such as rationing and price controls (HLPE 2022). Import and export restrictions and economic sanctions introduced as a result of conflict can also affect markets (Hänke et al. 2023). The impact of such factors can lead to conditions in which informal and black markets flourish, which, while serving

an important function, can exacerbate households' exposures to risks, as small-scale producers lack access to insurance, credit and cash flows (Delgado & Smith, 2021). On the demand side, people's coping mechanisms are impacted, which further influences their food choices, and, as fresh produce is limited, there is a greater reliance on staple foods and food assistance (HLPE 2022).

All such factors diminish food access and can lead to consumers shifting to less nutritious diets, increasing their risk of food insecurity and malnutrition (Tranchant et al. 2019).

What happens to food systems when conflict and climate change co-exist?

Climate is a so-called 'threat multiplier' in fragile contexts (Läderach et al. 2021). Conflict is increasingly influenced by, and contributes to, climate extremes, environmental degradation, and natural resource shortages, which further impact food systems (Hänke et al. 2023). As conflict intersects with the urgent challenges posed by the climate crisis, the escalation of extreme weather events, spread of infectious diseases, and heightened competition for resources, such as land and water, contribute to an even worsening state of food insecurity (HLPE 2022).

Climate change contributes to unpredictable harvests and discourages investments in subsequent seasons, due to weather-related phenomena like severe droughts and floods. Climate change also drives transitions away from traditional farming, as cash crops become more profitable, and cereal grains offer easier cultivation, with reduced future investment. These climate-induced disinvestments further hinder local food production (Patel et al. 2023). The instability of food supplies created by shocks and climate change pressures can also lead to price volatility (Pingali 2017), which increases food insecurity (WHO 2019). Conversely, conflict-induced shifts to bush products, like firewood and charcoal, can worsen environmental degradation and amplify the impacts of climate change on agriculture. Additionally, competition over natural resources, such as water and land, even among communal groups that are not involving armed actors, can lead to conflict and further increase food prices (Patel et al. 2023).

3.2.1. What are some of the common practices to address sustainable food system challenges in conflict-affected settings?

Numerous practices have been proposed in the literature as a way of limiting the impact of conflict on food systems, with many practices focusing on supporting the availability of, and access to, food. The focus tends to be on shorter-term, life-saving humanitarian actions to improve immediate food security. Additionally, due to the contextual nature of how conflict impacts food systems, a number of locally based solutions have been highlighted in various contexts. Practices that address both the impacts of conflict and climate change have focused typically on climate-smart, nutrition-sensitive agricultural interventions, to build the resilience of the food system. Below are four of the most common types of practices to address food system challenges in conflict-affected settings that emerged from the literature review.

Food assistance interventions

Actions to mitigate the negative effects on food systems in conflict settings have often centred around humanitarian food assistance approaches. Providing in-kind food to populations in need has been noted to be an essential life-saving intervention, focusing on improving the food consumption of conflict-affected communities, with the potential to contribute to peace if it is implemented well (Kemmerling 2023). Short-term food assistance also aims to support the most vulnerable, such as displaced persons, children, and pregnant and nursing women, and has been found to have a positive impact on household expenditure, food consumption and even children's height (Tranchant et al. 2019).

Resilience-focused interventions

A number of interventions have focused on making food systems more resilient to shocks and conflicts, with a focus on being conflict-sensitive, nutrition-sensitive, gender-sensitive and climate

change-sensitive (Hiller et al. 2014; HLPE 2022; WFP 2020; Hänke et al. 2023). Such interventions include the following:

- Livelihood interventions that promote re-engagement in productive economic activities, such as through cash transfers and social protection mechanisms.
- Climate-smart, nutrition-sensitive agricultural interventions, such as crop diversification, the promotion of indigenous crops, water conservation strategies, enhancing climate information services, using hydroponic technology, developing resilient agrifood value chains, agroforestry, solar-powered food storage, soil and water conservation technologies, and improving crop and livestock resilience.
- Community-based approaches that aim to foster social cohesion, including women's empowerment initiatives.
- Interventions that contribute to the building of institutional capacity and local actors in the food system, improving governance and entrepreneurship.

Much of the literature on resilience-based interventions focuses on livelihood interventions, such as cash and voucher assistance and social safety net programmes, which allow people to purchase food themselves while simultaneously supporting local markets (ODI 2015; GLOPAN 2020). Cash transfers, although not a panacea for ending malnutrition, have proven to be low-cost, easy to administer, and capable of increasing recipients' purchasing power, while supporting local markets (Hänke et al. 2023; Pingali 2017). Evidence from fragile contexts, including Ethiopia, Iraq and Syria, indicates that cash transfers and agricultural asset transfers can improve food security and dietary diversity (Hänke et al. 2023), although it must be noted that such interventions require a functioning – or at least partially functioning – market in order to be effective.

Additionally, longer-term programmes with a core focus on resilience building have been proposed to build sustainable food systems (Mercy Corps 2021). This requires investment in a multi-year model that stimulates the local economy through innovation and market-based incentives, increases the private sector's access to finance and international markets, improves the business ecosystem, and contributes to boosting consumers' purchasing power (Mercy Corps 2021). Such mechanisms include adapting financing models, protecting markets to encourage private sector investment, and investing in disaster risk reduction planning (Mercy Corps 2021).

Smaller-scale, contextually based and localised solutions

A variety of smaller-scale interventions across the food system are also employed, according to the literature, to enable a tailored, contextually based and localised approach to strengthening the food system, with the potential to also tackle climate change. These activities aim to take into account local capacities, local perspectives, and local existing response mechanisms, and can be refined based on the recovery trajectory of households and communities to ensure that they fully recover from such shocks (Adong et al. 2019; Kemmerling 2023).

These solutions encompass the following:

- Adopting, climate-smart agriculture approaches and technologies, where feasible in conflict settings, such as those listed above, but at a local, contextual level, including promoting the use of indigenous crops and the use of home and community gardens.
- Market-focused solutions, including small-scale infrastructure investment, building the capacity of small businesses, and supporting integrated markets.
- Facilitated community-based approaches that help build relationships and social cohesion, improving aspirations, confidence and trust. Some examples include supporting refugees' access to land and livelihoods, as well as supporting host community and refugee linkages (GLOPAN 2020; Hänke et al. 2023; Kemmerling 2023; World Bank 2021; Patel et al. 2023; Mercy Corps 2021; Delgado & Smith 2021).

Early warning systems to inform further practices

Early warning systems are vital for anticipating food crises and prioritising interventions to avert acute food insecurity, and can act as a powerful mechanism if used to trigger clear actions and commitments (HLPE 2022). Early warning mechanisms, such as the Famine Early Warning Network (FEWS NET),¹ have advanced over the past decades to be able to better predict and manage food crises and inform disaster risk reduction strategies and mitigation efforts (Kemmerling 2023). However, while the gap between forecasting tools and anticipatory/mitigation actions has reduced, many challenges are still noted, particularly in inaccessible areas, where data cannot be captured due to insecurity (FAO 2023c). Additionally, as one paper has noted, trust in the accuracy of data is vital to reduce risk aversion and encourage early interventions (Funk et al. 2023).

While government-led information systems are improving, further work needs to be done to link sectoral information systems, particularly those of agriculture, food security and health, to inform decision-making and action (FAO 2023c). The ability to link sectoral information systems is crucial as it allows for the leveraging of subsequent anticipatory and disaster preparedness-focused interventions across multiple systems in order to safeguard nutrition and enable swift decision-making to mitigate the impacts of conflict (Standing Together for Nutrition 2023).

3.2.2. Challenges facing sustainable food systems in conflict-affected settings

The focus on sustainable food systems has garnered substantial focus in recent years but the question of whether this can be truly achieved in conflict-affected contexts has yet to be fully explored. While some of the practices noted above aim to build the resilience of food systems to adapt in light of conflict, there remain gaps in building resilience at the household level. One of the barriers to more resilient, sustainable food systems in conflict-affected areas is that humanitarian donor funding for interventions tends to be short-term, in contrast to the general recognition that food system transformation towards sustainable and resilient food systems in conflict-affected settings requires a timeframe of at least eight years or more (Quak 2018).

While many common practices have been identified, there is limited understanding of the effectiveness of such interventions in different contexts, as well as of their strengths and limitations. Most of the research is focused on the impact and effectiveness of food assistance, cash and voucher assistance programming, and some of the smaller-scale interventions, such as home gardens, rather than the broader interventions focused on shifting, for example, business ecosystems, engaging multisectoral stakeholders or linking food systems more closely with security and peace efforts. Additionally, documented examples of what has made some longer-term programmes more resilient than others is lacking. The role of the private sector in supporting food system improvements in areas of conflict is also limited, based on the literature identified in this review.

Food assistance approaches have also faced scrutiny for at times failing to effectively distribute food to the most vulnerable, negatively impacting local agriculture, undermining capacity building and economic development, and creating aid-dependent economies (Queiroz 2021). Moreover, the majority of humanitarian assistance relies on external supply chains and provides monotonous food supplies, which do little to promote diversified diets (George et al. 2021). Concerningly, a recent systematic review highlighted that humanitarian and food aid efforts in conflict zones can, at times, exacerbate conflict dynamics, rather than mitigating violence (Queiroz 2021).

3.2.3. Recommendations

The following key suggestions regarding establishing and leveraging sustainable food systems for improved nutrition outcomes in conflict settings are aimed at prompting nutrition, climate, and food systems communities to take further steps to allocate funds, create policy, and implement and apply learning. Based on the analysis of promising practices and the existing challenges discussed above, the recommendations are as follows:

- 1. Strengthen the development of sustainable, resilient food systems in conflict-affected environments.** Making the concepts of sustainability and resilience viable in conflict-affected countries will require a focus on the entire food system, including (but not limited to) food production. It will further require longer-term financing that overcomes the current funding silos across the humanitarian, development, peace and climate change sectors. While involving governments can sometimes be challenging in areas of conflict, it is essential for effective multisectoral actions and is an element that appears to be lacking in the literature. Concrete documented examples are needed of how resilience and components of sustainability have been incorporated into longer-term programmes, to build the evidence base and to better advocate for long-term, multisectoral financing for resilient food systems in fragile and conflict-affected settings.
- 2. Further explore smaller-scale, contextually based practices, involving communities themselves (and women in particular) in their design and implementation** (WHO 2019). The smaller-scale, contextually based practices listed above could be prioritised, with a focus on 'do-able' actions in areas of conflict. Additionally, these examples need to be documented by countries themselves to enable them to tell their stories of how change has happened, rather than relying on external actors – as in much of the current literature. Much of this documentation already exists at country-level and it is often only a matter of improving access to it and disseminating it further to enable learning for other similar contexts. Food system changes can only be sustained by bringing together global and local knowledge and sharing challenges and best practices (FAO 2018).
- 3. Document more examples of the disruption of food systems in other contexts of fragility** (such as economic, social, institutional or climatic-related fragility) beyond conflict-affected settings. In years to come, it is likely that more and more countries will fall into the category of fragile, given the impact of climate change and global economic pressures. We need more research and documentation on how food systems might be impacted in such contexts to inform best practices to overcome challenges and build a sustainable food system.
- 4. Support a full range of programme approaches to make the entire food system in conflict-affected areas more functional, resilient and sustainable.** While current vulnerability is a strong indicator of future vulnerability, over time the geographic distribution of risk is likely to shift, considering population growth, urbanisation, migration, socioeconomic growth, and the likelihood that we will see a higher prevalence of compounding events and cascading risks (WHO 2019; Mehrabi et al. 2022). Consider how food systems in conflict-affected settings will likely look in years to come. While the focus on agriculture and rural settings seems appropriate currently, it is unlikely to be this way in the future, and analysing and improving all components of food systems in conflict areas beyond just agriculture is essential (WHO 2019).
- 5. Do more to link climate change, food systems, and peace in conflict-affected settings.** Food security and peace are inextricably linked, and resilience, in light of climate change, offers further mechanisms to strengthen both. At present, in contrast to policy alignment, humanitarian, development, peace, and climate change objectives compete for primacy and resources (Läderach et al. 2021). Many opportunities thus remain to strengthen linkages and partnerships to address climate change, peace, and food security simultaneously.
- 6. Build an understanding of how humanitarian assistance impacts local food systems and communities.** While humanitarian assistance has undeniably saved many lives, it needs to become more effective in rebuilding and strengthening food systems, and, for this, long-term funding is required (GLOPAN 2020).




Part 4

Reflections on moving forward

This literature review has highlighted the diversity and complexity of addressing climate and nutrition concerns while building a more sustainable food system. In light of the pace of action in this space, the emerging trends of today will soon be the old news of tomorrow. At the same time, some topics and some contexts are still neglected. We must both base decisions on evidence and learning (Webb et al. 2023) while simultaneously ensuring that gaps are highlighted and examined. This extensive literature review sparks some reflections on the way forward, with the aim of influencing future thinking, programming and funding:

- 1. We need to future-proof our solutions to keep them relevant for tomorrow and not just today.** It is not enough to just respond to today's drivers and conditions: we must predict and prepare for fast-changing scenarios. Interventions and policies need to be future-proof, as we are already facing challenges that will only get worse.
- 2. We cannot afford to wait for the perfect solutions before we start acting.** The evidence base might not be perfectly established and verified in all areas; however, there is lots of knowledge, and some good practice, both established and emerging, and we need to fast-track applying it in different contexts. We cannot afford to wait for all action to lead to controlled and entirely known outcomes. We must trust in making decisions based on the knowledge we have already gained, and we must continue to improve that decision-making process with new knowledge as it is produced.
- 3. The nutrition (and health) sector should be included in climate action and decision-making.** The link between climate and nutrition is clear. Climate policies directly affect nutrition outcomes and health systems. There needs to be increased representation of nutrition



(and health) priorities and needs within climate dialogues to ensure that climate action positively impacts the nutritional status of the world's population.

- 4. Nutrition programmes must become more climate conscious. At the same time, their contribution to climate change must be reduced.** Considering the fluctuations in nutrition outcomes with a changing climate, nutrition programming needs to be flexible and adaptable to deal with both rapid and persistent changes to the climate: for example, using climate forecasting to target nutrition interventions to at-risk populations and seasonal nutrition programming to respond to increasing climate-affected seasonal fluctuations in malnutrition. At the same time, the nutrition sector needs to map and minimise the climate and environmental impact of nutrition interventions, such as long supply chains, waste, procurement policies, and other interventions, learning from the climate-friendly health sector initiatives.
- 5. Nutrition, food systems, and climate actors need to collect and share more stories of how change has happened.** We need to understand what works in different contexts and what are the practical do-able actions for integrating actions, navigating trade-offs and building co-benefits. This often requires intentional planning from the start so that funding, time and expertise are available for research and learning. Dedicated investments in learning are required for niche neglected areas, such as sustainable food systems for preventing malnutrition, and fragile and conflict settings.

References

- Abay, K., Karachiwalla, N., Kaurdi, S. and Salama, Y. (2022). *Food price shocks and diets among poor households in Egypt*. IFPRI. <https://www.ifpri.org/blog/food-price-shocks-and-diets-among-poor-households-egypt>
- Adelaja, A. & George, J. (2019). Effects of conflict on agriculture: Evidence from the Boko Haram insurgency. *World Development*, 117, 184-195. <https://doi.org/10.1016/j.worlddev.2019.01.010>
- Adong, A., Kornher, L., Kiptoo Kirui, O. & van Braun, J. (2021). Conflict exposure and food consumption pathways during and after conflict: Evidence from Northern Uganda. *World Development*, 146. <https://doi.org/10.1016/j.worlddev.2021.105636>
- Agostoni, C., Baglioni, M., La Vecchia, A., Molari, G. & Berti, C. (2023). Interlinkages between Climate Change and Food Systems: The Impact on Child Malnutrition—Narrative Review. *Nutrients*, 15(2), 416.
- Akinmoladun, O.F., Bamidele, O.P., Jideani, V.A. et al. (2023). Severe Acute Malnutrition: The Potential of Non-Peanut, Non-Milk Ready-to-Use Therapeutic Foods. *Curr Nutr Rep*, 12, 603–616. <https://doi.org/10.1007/s13668-023-00505-9>
- Baker, P., Santos, T., Neves, P. A., Machado, P., Smith, J., Piwoz, E., et al. (2021). First-food systems transformations and the ultra-processing of infant and young child diets: The determinants, dynamics and consequences of the global rise in commercial milk formula consumption. *Maternal & child nutrition*, 17(2), e13097.
- Bakker, S., Macheka, L., Eunice, L., Koopmanschap, E., Bosch, D., Hennemann, I. and Roosendaal, L., (2021). Food-system interventions with climate change and nutrition co-benefits: A literature review. Wageningen University & Research. Report WCDDI-21-153.
- Bezner Kerr, R., Madsen, S., Stuber, M., Liebert, J., Enloe, S. et al. (2021). Can agroecology improve food security and nutrition? A review. *Global Food Security*, 29, 100540. <https://doi.org/10.1016/j.gfs.2021.100540>
- Bowen, K.J., Murphy, N., Dickin, S., Dzebo, A. & Ebikeme, C. (2021). Health synergies across international sustainability and development agendas: pathways to strengthen national action. *International Journal of Environmental Research and Public Health*, 18(4), 1664.
- Branca, F., Lartey, A., Oenema, S., Aguayo, V., Stordalen, G. A., Richardson, R. et al. (2019) Transforming the food system to fight non-communicable diseases. *BMJ*, 364, l296 doi:10.1136/bmj.l296
- Caleffi, S., Hawkes, C., Walton, S. (2023). *45 actions to orient food systems towards environmental sustainability: co-benefits and trade-offs*. Centre for Food Policy, City, University of London.
- Camber Collective (2023). *Climate Change, Food Systems, and Nutrition: Challenges and Opportunities for Children's Health in Sub-Saharan Africa*.
- Chakrabarti, S., Kishore, A., & Roy, D. (2018). Effectiveness of food subsidies in raising healthy food consumption: public distribution of pulses in India. *American Journal of Agricultural Economics*, 100(5), 1427-1449.
- Committee on World Food Security (CFS) (2023). *Voluntary guidelines on gender equality and women's and girls' empowerment in the context of food security and nutrition 2023*.
- Delgado, C & Smith, D. 2021. *Global Hunger Index: Hunger and Food Systems in Conflict Settings*. Stockholm International Peace Research Institute.
- ENN (2021). *Food Systems and How They Relate to Malnutrition in Low- and Middle-Income Countries: Scoping Brief*.
- ENN (2022). *ENN Nutrition and Climate Change – Current State of Play: Scoping Review*.
- ENN (2023). *The prevention of wasting with interventions that address food and feeding-related needs: an evidence synthesis*. ENN and the World Food Programme (WFP).
- ENN and the Programme and Policy Sub-Working Group of the WaSt TIG (2021). *Best practice in Preventing Child Wasting within the Wider Context of Undernutrition. A Briefing Note for policy makers and programme implementers*. ENN.
- European Parliament (2022). Resolution on Addressing Food Security in Developing Countries; *Official Journal of the European Union* (2022), P9_TA(2022)0287.
- Fanzo, J., Bellows, A. L., Spiker, M. L., Thorne-Lyman, A. L., & Bloem, M. W. (2021). The importance of food systems and the environment for nutrition. *The American Journal of Clinical Nutrition*, 113(1), 7–16. <https://doi.org/10.1093/ajcn/nqaa313>

- Fanzo, J. and Miachon, L. (2023). Harnessing the connectivity of climate change, food systems and diets: Taking action to improve human and planetary health. *Anthropocene*, 42, 100381.
- FAO (2018). *Sustainable food systems: Concept and framework*. <https://www.fao.org/3/ca2079en/CA2079EN.pdf>
- FAO, IFAD, UNICEF, WFP and WHO. (2021). *The State of Food Security and Nutrition in the World 2021. Transforming food systems for food security, improved nutrition and affordable healthy diets for all*. FAO.
- FAO, IFAD, UNICEF, WFP and WHO. (2023). *The State of Food Security and Nutrition in the World 2023. Urbanization, agrifood systems transformation and healthy diets across the rural–urban continuum*. FAO. <https://doi.org/10.4060/cc3017en>
- FAO (2023a). *The State of Food and Agriculture 2023. Revealing the true cost of food to transform agrifood systems*.
- FAO (2023b). *Climate action and nutrition – Pathways to impact*.
- FAO (2023c). *International Workshop Food Security in Complex Emergencies: building policy frameworks to address longer-term programming challenges. Meeting Report. Tivoli, Italy, 23-25 September*.
- Fracassi, P., Daget, M., Seo, S., and D'Angeli, R. (2023) Preventing Child Wasting in Africa's Dryland: An Exploratory Review of the Enabling Environment in 8 Sub-Saharan Countries Using a Food Systems Lens. *Food and Nutrition Bulletin*, 44(2S), S32–S44
- FSIN and Global Network Against Food Crises. (2023). *2023: Global Report on Food Crises: Joint Analysis for Better Decision*. GRFC 2023. <https://www.fsinplatform.org/sites/default/files/resources/files/GRFC2023-high-res.pdf>
- Funk, C., Harrison, L., Segele, Z., Rosenstock, T., Steward, P., Anderson, C. L. et al. (2023). Tailored forecasts can predict extreme climate informing proactive interventions in East Africa. *Earth's Future*, 11, e2023EF003524. <https://doi.org/10.1029/2023EF003524>
- GAIN (2023). *Accelerating Action and Opening Opportunities. A Closer Integration of Climate and Nutrition. 2023 I-CAN Baseline Assessment*.
- George, J.; Adelaja, A. (2021). Forced Displacement and Agriculture: Implications for Host Communities. *Sustainability*, 13, 5728. <https://doi.org/10.3390/su13105728>
- Geyik, Ö., Hadjikakou, M., Bryan, B.A. (2023). Climate-friendly and nutrition-sensitive interventions can close the global dietary nutrient gap while reducing GHG emissions. *Nat Food*, 4(1), 61–73. doi: 10.1038/s43016-022-00648-y
- Global Panel on Agriculture and Food Systems for Nutrition (GLOPAN). (2020). *Strengthening food systems in fragile contexts*. <https://www.glopan.org/resources-documents/>
- Global Panel (2023). *Pursuing food systems transformation despite financial constraints*. Policy Brief No. 18. Global Panel on Agriculture and Food Systems for Nutrition.
- Global Panel (2020). *Future Food Systems: For people, our planet, and prosperity*. Global Panel on Agriculture and Food Systems for Nutrition.
- Hänke, H., Bratz, A., Griebel, S., Koottummel, J., Verkuijl, H. (2023). Food systems transformation in fragile contexts, a practitioner's perspective. *Frontiers in Sustainable Food Systems*, 7. <https://www.frontiersin.org/articles/10.3389/fsufs.2023.1107411>
- Headey, D. D., Ruel, M. T. (2022). *Food inflation and child undernutrition in low and middle income countries*. IFPRI Discussion Paper 2146. International Food Policy Research Institute (IFPRI). <https://doi.org/10.2499/p15738coll2.136457>
- Hiller, S., Hilhorst, T., & Weijts, B. (2014). *Value chain development in fragile settings*. IS Academy. <https://edepot.wur.nl/342676>
- HLPE (2017). *Nutrition and Food Systems*. FAO. <http://www.fao.org/3/a-i7846e.pdf>
- HLPE (2022). *Critical, Emerging and Enduring Issues for Food Security and Nutrition: A note by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security*. July 2022.
- HLPE (2023). *Reducing inequalities for food security and nutrition*. CFS HLPE-FSN.

- Huey, S. L., Krisher, J. T., Bhargava, A., Friesen, V. M., Konieczynski, E. M., Mbuya, M. N. N. et al. (2022). Review of the Impact Pathways of Biofortified Foods and Food Products. *Nutrients*, 14(6), 1200. <https://doi.org/10.3390/nu14061200>
- IFPRI (2023a). *Bringing back neglected crops: A food and climate solution for Africa*. <https://www.ifpri.org/blog/bringing-back-neglected-crops-food-and-climate-solution-africa>
- IFPRI (2023b). *The Power of Partnership: 3 Ways to Support Food Security in Fragile and Conflict-Affected States*. <https://egyptssp.ifpri.info/2023/05/21/the-power-of-partnership-3-ways-to-support-food-security-in-fragile-and-conflict-affected-states/>
- Kemmerling, B., Schetter, C., Wirkus, L. (2023). Addressing Food Crises in Violent Conflicts. In J. von Braun, K. Afsana, L.O. Fresco, M.H.A Hassan (Eds.) *Science and innovations for food systems transformation*. Springer. https://doi.org/10.1007/978-3-031-15703-5_12
- Kennedy G., Wang Z., Maundu P., Hunter D. (2022). The role of traditional knowledge and food biodiversity to transform modern food systems. *Trends in Food Science & Technology*, 130, 32–41. <https://doi.org/10.1016/j.tifs.2022.09.011>
- Kennedy, E., Webb, P., Block, S., Griffin, T., Mozaffarian, D., Kyte, R. (2020). Transforming Food Systems: The Missing Pieces Needed to Make Them Work. *Curr Dev Nutr*, 5(1), nzaa177
- Läderach, P., Ramirez-Villegas, J., Prager, S., Osorio, D., Krendelsberger, A., Zougmore, R. et al. (2021). The importance of food systems in a climate crisis for peace and security in the Sahel. *International Review of the Red Cross*, 103(918), 995–1028. doi:10.1017/S1816383122000170
- Lane, C., Storhaug, I., Engelbert, M., Cordova-Arauz, D., Snilstveit, B., Rolker, H.B. et al. (2023). *Food systems and nutrition: Describing the evidence 2000 to 2023*. 3ie Evidence and Gap Map Report 25. International Initiative for Impact Evaluation (3ie). <https://doi.org/10.23846/EGM025>
- Lecoutere, E., van den Berg, M., de Brauw, A. (2021) *Effective food systems innovations: An inventory of evidence from Bangladesh, Ethiopia, Nigeria, Viet Nam and other low- and middle-income countries*. IFPRI discussion paper 02022.
- Lieber, M., Chin-Hong, P., Kelly, K., Dandu, M. and Weiser, S.D. (2022). A systematic review and meta-analysis assessing the impact of droughts, flooding, and climate variability on malnutrition. *Global Public Health*, 17(1), 68–82.
- Mabhaudhi, T., Chibarabada, T.P., Chimonyo, V.G.P., Murugani, V.G., Pereira, L.M., Sobratee, N. et al. (2018) Mainstreaming Underutilized Indigenous and Traditional Crops into Food Systems: A South African Perspective. *Sustainability* 11(1), 172. doi: 10.3390/su11010172. PMID: 37681213; PMCID: PMC7615043
- Macheka, L., Mudiwa, T., Chopera, P., Nyamwanza, A. and Jacobs, P. (2022). Linking Climate Change Adaptation Strategies and Nutrition Outcomes: A Conceptual Framework. *Food and Nutrition Bulletin*, 43(2), 201–212.
- Mehrabi, Z., Delzeit, R., Ignaciuk, A., Levers, C., Braich, G., Baja, K. et al. (2022). Research priorities for global food security under extreme events. *One Earth*, 5 (7), 756–766. <https://doi.org/10.1016/j.oneear.2022.06.008>
- Messer, E. and Cohen, M.J. (2007). Conflict, Food Insecurity and Globalization. *Food, Culture and Society*, 10, 297–315.
- Mercy Corps (2021). *Resilient Food Systems: Making Food Systems Work in The World's Most Fragile Places*. https://www.mercycorps.org/sites/default/files/2021-09/Mercy-Corps_UNFSS-Resilient-Food-Systems-policy-brief.pdf
- Morgan, A.E., Fanzo, J. (2020). Nutrition Transition and Climate Risks in Nigeria: Moving Towards Food Systems Policy Coherence. *Curr Environ Health Rep*, 7(4), 392–403. doi: 10.1007/s40572-020-00292-3
- Morris, S. S., Beesabathuni, K., & Headey, D. (2018). An egg for everyone: Pathways to universal access to one of nature's most nutritious foods. *Maternal & Child Nutrition*, 14, e12679.
- Moore, N., Lane, C., Storhaug, I., Franich, A., Rolker, H., Furgeson, J., Sparling, T. & Snilstveit, B. (2021). *The effects of food systems interventions on food security and nutrition outcomes in low- and middle-income countries*, 3ie Evidence Gap Map Report 16. International Initiative for Impact Evaluation (3ie). <https://doi.org/10.23846/EGM016>
- Nissan, H., Simmons, W. and Downs, S.M. (2022). Building climate-sensitive nutrition programmes. *Bulletin of the World Health Organization*, 100(1), 70.
- Overseas Development Institute (ODI) Center for Global Development (2015). *Doing cash differently: How cash transfers can transform humanitarian aid*. ODI London.

- Owino, V., Kumwenda, C., Ekesa, B., Parker, M.E., Ewoldt, L., Roos, N. et al. (2022). The impact of climate change on food systems, diet quality, nutrition, and health outcomes: A narrative review. *Frontiers in Climate*, 4, 941842. doi: 10.3389/fclim.2022.941842
- Patel, R., Gleason, K., Polzin, S., Ripamonti, D., Garvey, A., Dowd, C. (2023). *Conflict and Food Systems – Synthesis Report*. Concern Worldwide. <https://www.concern.net/knowledge-hub>
- Pingali, P. and Sunder, N. (2017). Transitioning Toward Nutrition-Sensitive Food Systems in Developing Countries. *Annual Review of Resource Economics*, 9, 439–459. <https://doi.org/10.1146/annurev-resource-100516-053552>
- Pope, D. H. , Karlsson, J. O. , Baker, P. , & McCoy, D. (2021). Examining the Environmental Impacts of the Dairy and Baby Food Industries: Are First-Food Systems a Crucial Missing Part of the Healthy and Sustainable Food Systems Agenda Now Underway? *International Journal of Environmental Research and Public Health*, 18(23), 12678
- Pretorius, B., Ambuko, J., Papargyropoulou, E. and Schönfeldt, H.C. (2021). Guiding Nutritious Food Choices and Diets along Food Systems. *Sustainability*, 13(17), 9501.
- Quark, E.J. (2018). *Food Systems in Protracted Crises: Strengthening Resilience against Shocks and Conflicts* <https://www.ids.ac.uk/publications/food-systems-in-protracted-crises-strengthening-resilience-against-shocks-and-conflicts/>
- Queiroz, C., Norström, A.V., Downing, A. et al. (2021) Investment in resilient food systems in the most vulnerable and fragile regions is critical. *Nat Food*, 2, 546–551. <https://doi.org/10.1038/s43016-021-00345-2>
- Ringler, C., Agbonlahor, M., Baye, K., Barron, J., Hafeez, M., Lundqvist, J. et al. (2023). Water for Food Systems and Nutrition. In: von Braun, J., Afsana, K., Fresco, L.O., Hassan, M.H.A. (eds) *Science and Innovations for Food Systems Transformation*. Springer, Cham. https://doi.org/10.1007/978-3-031-15703-5_26
- Ritchie, H. (2021) *Three billion people cannot afford a healthy diet*. OurWorldInData.org. <https://ourworldindata.org/diet-affordability>
- Roche, M. L., Sako, B., Osendarp, S. J. M., Adish, A. A., & Tolossa, A. L. (2017). Community-based grain banks using local foods for improved infant and young child feeding in Ethiopia. *Maternal and Child Nutrition*, 13(2), 1–15. <https://doi.org/10.1111/mcn.12219>
- Romanello, M., Napoli, C.D., Green, C., Kennard, H., Lampard, P., Scamman, D. et al. (2023). The 2023 report of the Lancet Countdown on health and climate change: the imperative for a health-centred response in a world facing irreversible harms. *Lancet*, 402(10419), 2346-2394. doi: 10.1016/S0140-6736(23)01859-7.
- Ruel, M.T., Quisumbing, A.R., Balagamwala, M. (2018) Nutrition-sensitive agriculture: what have we learned so far? *Glob Food Sec*, 17, 128–53.
- Saavedra, J.M. (2022). The changing landscape of children’s diet and nutrition: new threats, new opportunities. *Annals of Nutrition and Metabolism*, 78(Suppl. 2), 40–50.
- Santoso, M.V., Bezner Kerr, R.N., Kassim, N., Martin, H., Mtinda, E., Njau, P. et al. (2021). A Nutrition-Sensitive Agroecology Intervention in Rural Tanzania Increases Children’s Dietary Diversity and Household Food Security But Does Not Change Child Anthropometry: Results from a Cluster-Randomized Trial. *The Journal of Nutrition*, 151(7), 2010–2021. <https://doi.org/10.1093/jn/nxab052>
- Sena, A. and Ebi, K. (2021). When land is under pressure health is under stress. *International Journal of Environmental Research and Public Health*, 18(1), 136.
- Sharma, I., Di Prima, S., Essink, D., Broerse, J. (2021) Nutrition-Sensitive Agriculture: A Systematic Review of Impact Pathways to Nutrition Outcomes, *Advances in Nutrition*, 12(1), 251-275. <https://doi.org/10.1093/advances/nmaa103>
- Smith, J.P., Borg, B., Iellamo, A., Nguyen, T.T. and Mathisen, R. (2023) Innovative financing for a gender-equitable first-food system to mitigate greenhouse gas impacts of commercial milk formula: investing in breastfeeding as a carbon offset. *Front. Sustain. Food Syst.*, 7, 1155279. doi: 10.3389/fsufs.2023.1155279
- Standing Together For Nutrition (2023). *Nutrition resilience during crises: Strengthening systems to safeguard the nutrition of vulnerable children and women: Summary brief of the forthcoming Global Resilience Report*. Micronutrient Forum. https://micronutrientforum.org/wp-content/uploads/2023/10/ST4N-GRR-Summary-Brief_FINAL_13Oct2023.pdf

- Swinburn, B. A., Kraak, V. I., Allender, S., Atkins, V. J., Baker, P. I., Bogard, J. R. et al. (2019). The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report. *Lancet*, 393(10173), 791–846. [https://doi.org/10.1016/S0140-6736\(18\)32822-8](https://doi.org/10.1016/S0140-6736(18)32822-8)
- Talabi, A.O., Vikram, P., Thushar, S., Rahman, H., Ahmadzai, H., Nhamo, N. et al. (2022) Orphan Crops: A Best Fit for Dietary Enrichment and Diversification in Highly Deteriorated Marginal Environments. *Front Plant Sci*, 13, 839704. doi: 10.3389/fpls.2022.839704. PMID: 35283935; PMCID: PMC8908242.
- Tirado, M.C., Vivero-Pol, J.L., Bezner Kerr, R. & Krishnamurthy, K. (2022). Feasibility and effectiveness assessment of multi-sectoral climate change adaptation for food security and nutrition. *Current Climate Change Reports*, 8(2), 35–52.
- Tranchant, J.P., Gelli, A., Bliznashka, L., Sekou Diallo, A., Sacko, M., Assima, A. et al. (2019). The impact of food assistance on food insecure populations during conflict: Evidence from a quasi-experiment in Mali. *World Development*, 119, 185–202. <https://doi.org/10.1016/j.worlddev.2018.01.027>
- UN-Nutrition (2023). *Nutrition and the environment – Nurturing people, protecting the planet*. FAO on behalf of UN-Nutrition
- UNICEF/WHO/World Bank Group (2023). *Joint Child Malnutrition Estimates 2023 edition*.
- UNICEF, FAO, United Nations High Commissioner for Refugees, WFP and WHO. (2021). *Global Action Plan on Child Wasting: A Framework for Action to Accelerate Progress in Preventing and Managing Child Wasting and the Achievement of the Sustainable Development Goals*. WHO. <https://www.who.int/publications/m/item/global-action-plan-on-child-wasting-a-framework-for-action>
- USAID Advancing Nutrition (2023). *Technical Brief. Desk Review of food systems approach to support wasting reduction*. <https://www.advancingnutrition.org/resources/desk-review-food-systems-approaches-support-wasting-reduction>
- Villaverde, P., Tolentino-Mayo, L., Cruz-Casarrubias, C. et al. (2023). Hypothetical impact of the Mexican front-of-pack labeling on intake of critical nutrients and energy. *J Health Popul Nutr*, 42, 124. <https://doi.org/10.1186/s41043-023-00462-7>
- Vos, R. & Wilson, J. (2020). *IFPRI Blog: Integrating displaced communities into food systems*, 1 May 2020. <https://www.ifpri.org/blog/integrating-displaced-communities-food-systems>
- Warren, A. M., & Frongillo, E. A. (2017). Mid-level actors and their operating environments for implementing nutrition-sensitive programming in Ethiopia. *Global Food Security*, 13, 66–73.
- Webb, P., Flynn, D.J., Kelly, N.M. & Thomas, S.M. (2023). The Transition Steps Needed to Transform Our Food Systems. In J. von Braun, K. Afsana, L.O. Fresco, M.H.A. Hassan (Eds.) *Science and innovations for food systems transformation*. Springer.
- Westbury, S., Ghosh, I., Jones, H.M. et al. (2021). The influence of the urban food environment on diet, nutrition and health outcomes in LMICs: a systematic review. *BMJ Global Health*, 6, e006358
- WFP (2020). *Food assistance: cash and in-kind*. <https://www.wfp.org/foodassistance>
- WHO (2022) *Marketing of breast-milk substitutes: national implementation of the international code, status report 2022*. Licence: CC BY-NC-SA 3.0 IGO.
- WHO (2019). *Technical series on Adapting to Climate Sensitive Health Impacts Undernutrition*.
- WHO (2023) *Fact Sheet on Malnutrition*. <https://www.who.int/news-room/fact-sheets/detail/malnutrition>
- WHO & FAO (2022). *Food safety is everyone's business in street food vending*. Technical document. WHO. <http://www.who.int/publications/i/item/WHO-HEP-NFS-AFS-2022.4>
- World Bank (2007). *Gender Equality, Poverty and Economic Growth Policy Research Working Paper No. 4349*. <http://documents1.worldbank.org/curated/pt/758041468340239015/pdf/wps4349.pdf>
- World Bank (2021). *Future of Food: Building Stronger Food Systems in Fragility, Conflict, and Violence Settings*. <https://openknowledge.worldbank.org/entities/publication/bcf1e3f8-4d15-5442-9d42-02af844978f4>
- World Bank (2023). *Classification of Fragility and Conflict Situations (FCS) for World Bank Group Engagement*. <https://thedocs.worldbank.org/en/doc/fb0f93e8e3375803bce211ab1218ef2a-0090082023/original/Classification-of-Fragility-and-Conflict-Situations-FY24.pdf>

Annex: methods

The literature review included peer-reviewed publications and grey literature, limited to reports (case studies, blogs, websites, and other formats were not included in our search). For **Part 1**, the time frame was set between January 2021 and October 2023, to capture the literature produced between the United Nations Food Systems Summit and the time of the review. For **Part 2**, the time frame was set as between January 2015 and October 2023, which was seen to be the most relevant period (see **Table 1**). The literature search used the Google Scholar, PubMed and Google databases to identify potentially relevant studies and reports. This was complemented with a light snowballing approach to further consider relevant literature and reports, including a multitude of very relevant documents released in October–November 2023, in advance of the COP 28. Publications were limited to English. All identified articles were first screened to further ensure their relevance to the subject topic, then documents were read in their entirety, with notes taken on key findings and interesting quotes.

Thematic analysis was applied. Key findings and emerging themes were captured and formed the basis of ongoing discussions within the team to identify broad themes and emerging areas of interest. For **Part 1**, the most commonly repeated themes were then identified and reviewed to establish whether discussions on them presented them as conclusively established topics, or newly emerging topics that were the subject of recent discussion. For the areas of conflict settings and preventing malnutrition in **Part 2**, the findings were analysed and grouped according to the different components within the food system, namely the drivers, food supply chain, food environments, individual factors, outcomes and impacts (**Figure 1**), in order to map the findings across the entirety of the food system.

Preliminary results were presented and discussed with reviewers from the UN-Nutrition Secretariat and APHRC who provided valuable feedback and suggestions for incorporation into the written product, which they later reviewed. A subsequent internal review was also conducted by ENN colleagues in order to support the quality of the write-up.

Table 1. Summary of literature review methodology

Focus of literature review	Time frame	Search terms	Number of items analysed	Note
New and emerging trends	January 2021 to October 2023	The search terms used were 'climate change', 'climate action' 'food systems', 'sustainable food systems', 'nutrition', 'malnutrition', 'wasting', 'stunting'	36	To capture the literature produced between the United Nations Food Systems Summit in 2021 and COP28 in 2023
Prevention	January 2015 to October 2023	The search terms used included 'climate change', 'climate action' 'food systems', 'sustainable food systems', 'nutrition', 'malnutrition', 'wasting', 'stunting', 'prevention', 'dietary diversity', 'breastfeeding', 'complementary feeding', and 'infant and young child feeding practices'	54	The Sustainable Development Goals, established in 2015, mark the beginning of a focus on interconnected goals linking the well-being of people and planet. It was at this time that the concept of sustainable food systems started gaining traction and therefore 2015 was chosen as a logical cut-off point for our deep dives
Conflict settings	January 2015 to October 2023	The search terms used included 'climate change', 'climate action' 'food systems', 'sustainable food systems', 'nutrition', 'malnutrition', 'wasting', 'stunting', 'fragile states', 'fragile settings', 'conflict', 'insecurity' and 'recurrent crises'	45	



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