CHAPTER 2

Achieving Food Security Through a Food Systems Lens

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Introduction

The twentieth and early twenty-first centuries have been marked with many international commitments, starting with the first United Nations declaration of a goal of zero hunger in 1943 (Byerlee & Fanzo, 2019). This commitment has been periodically renewed in international fora, most recently, with the Sustainable Development Goals (SDGs) and the specific goal of SDG2 to end hunger by 2030 and the Food Systems Summit in 2021 (Covic et al., 2021). Despite noble intentions, the world can claim only mixed success in eliminating food insecurity (and with it, hunger and other forms of malnutrition) (Fanzo, 2019).

Undernourishment has increased for the fourth straight year in a row since 2016, with approximately 828 million people considered undernourished in 2020 (FAO et al., 2022). Roughly 20% of the world's

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young children are chronically undernourished or stunted, and overweight is increasing in that same demographic with 39 million children under the age of five considered overweight (Micha et al., 2020). The growing pandemic of obesity now tops 2 billion adults struggling with overweight and obesity, with significant risk of diet-related non-communicable diseases (Micha et al., 2020). Food systems have a role to play in ending or perpetuating food insecurity and malnutrition in all its forms.

This chapter has three objectives. First, it describes the evolution of the concept of food security and its historical framing. Second, it presents three mainstream approaches to address food security that have failed to deliver promised outcomes and improve overall food security. Third, it articulates why a food systems perspective is now necessary, but not always sufficient, to guide effective food security improvements.

The Evolution of Food Security and Its Framing

Food security and its framing in international development has historically evolved to adapt to the times. This adaptation process has become more nuanced because of our further understanding of the social, political, environmental, and biological causes and consequences of food insecurity.

The evolution began in 1943 when the Hot Springs conference—the first of a series of conferences on the post-war architecture of the proposed United Nations—set the goal of "freedom from want of food, suitable and adequate for the health and strength of all peoples" and agreed that "the most fundamental of necessities is adequate food which should be placed within the reach of all men in all lands within the shortest possible time" (Department of State, 1943). This goal was equivalent in many respects to SDG2 to end hunger but without a firm end date and nebulous targets (Barona, 2008).The conference also urged countries to "maintain optimum levels of productivity consistent with ensuring the preservation of basic resources"—in other words, a call for integrating more sustainable practices with agriculture. There were also explicit calls for the state to take a more proactive role in promoting better nutrition and coordinating efforts to improve food security through various ministries (Barona, 2008).

Starting in the 1960s, the UN held several high-profile world food summits that reaffirmed global commitments to ending hunger. Notably, these conferences emphasized the supply of calories through increased production of food staples but largely ignored the broader dimensions of malnutrition. At the World Food Congress in 1963, the President of the United States, John F. Kennedy, declared "we have the capacity to eliminate hunger in our lifetime, we only need the will" (Shaw, 2007b). Another food summit was held in 1974 during the 1973–1975 world food crisis that declared that "every man, woman, and child have the inalienable right to be free from hunger and malnutrition" (Shaw, 2007a). The conference called on "all governments to accept the goal that within a decade no child will go to bed hungry, that no family will fear for its next day's bread, and no human being's future capacity will be stunted by malnutrition" (Shaw, 2007c).

At the next World Food Summit in 1996, food security was further articulated. The definition is still widely used and says: "Food security means that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life" (FAO, 1996). This definition thus evolved from when the term was first used at the World Food Conference in 1974, where food security was defined as: "Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" (FAO, 1974).

The major focus for many of these summits was on agriculture—to produce enough calories to feed a growing population and stave off famines. What was considered successes, such as the Green Revolution, became the paradigm of how agriculture was designed, managed, and governed since then, resulting in a significant increase in yields and starchy calories coming largely from cereal grains with minimal extensification into land (Fig. 2.1). However, cracks became apparent with large-scale trade-offs for environmental sustainability, nutrition, and some livelihoods (Pingali, 2012, 2015).

To further articulate food security, four distinct but connected pillars have been defined to bring clarity and to enable measurement across discrete areas of food security (FAO, 2008). It has also created silos of thought and political action in some regards. The first pillar is *food availability*, which refers to ensuring sufficient quantity and diversity of food is available for consumption from the farm, the marketplace, or elsewhere. Such food can be supplied through household production, other domestic output, commercial imports, or food assistance. Second, *food access* refers

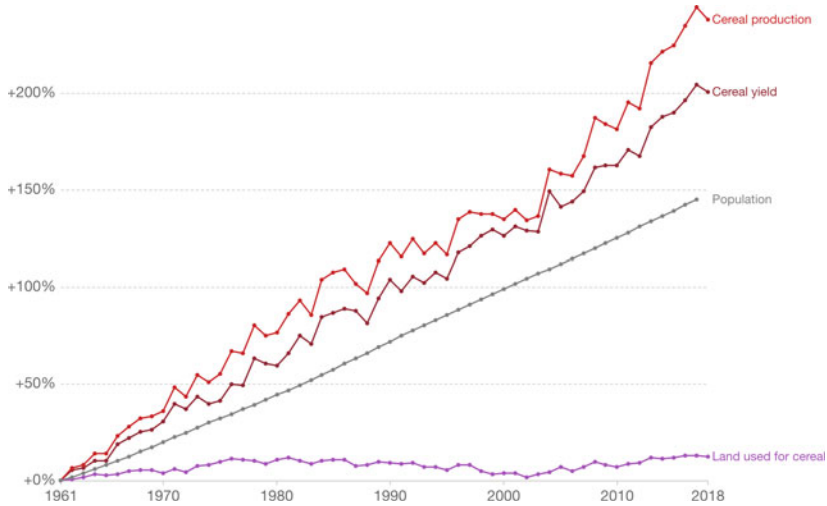

Fig. 2.1 Global changes in cereal production, yield, and land use, 1961–2018 (*Source* Our World in Data [2021])

to households having the physical and financial resources required to obtain appropriate foods for a nutritious diet. Access depends on income available to the household, on the distribution of income within the household, distance to markets, and on the price of food. Third, *food utilization* implies the capacity and resources necessary to use food appropriately to support healthy diets including sufficient energy and essential nutrients, potable water, and adequate sanitation. Utilization often refers to an individual's ability to absorb nutrients, based on their health status. Effective food utilization depends, in large measure, on knowledge within the household of food storage and processing techniques, basic principles of nutrition and proper childcare, and illness management. *Stability* is considered a fourth pillar, which mainly refers to the stability of the food supply/access but can also refer to stability in availability and quality. Stability is reliant on food imports and domestic production and can be negatively impacted by disruptions in the food supply such as price volatility, seasonality, and conflicts (FAO, 2006). Instability can significantly impact low-income households, especially those in low-income countries, such as in South and Southeast Asia, Africa and Latin America who spend a large share of their income on food (Ivanic & Martin,

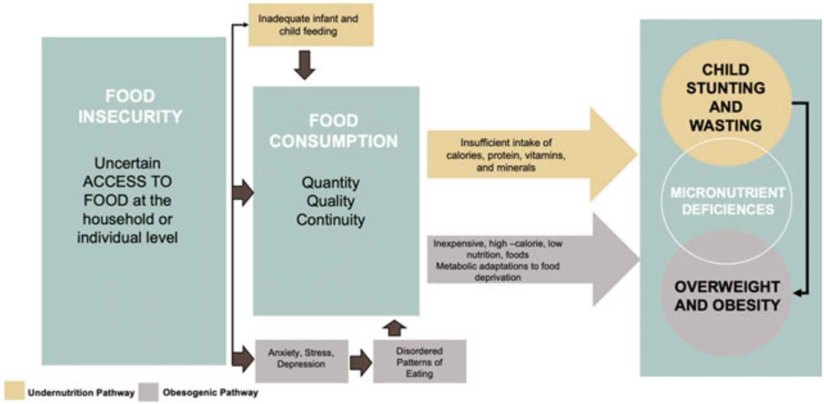

Fig. 2.2 Food insecurity pathways to multiple forms of malnutrition (*Source* FAO et al. [2018])

2008; Martin & Ivanic, 2016; Raghunathan et al., 2021; Vellakkal et al., 2015). Often, what is purchased can be of poor nutritional quality, made up mainly of grain staple crops (Bouis & Saltzman, 2017). Since 1996, the definition of food security has even further evolved to not only consider the four pillars of food security but to account for agency and sustainability as well (Clapp et al., 2021; HLPE, 2020).

Fast forward to 2021, after two global goal setting agendas—the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs)—which were met with limited success in zeroing hunger, the UN Food Systems Summit (UNFSS) in September of 2021 adopted a food systems approach to address food security (Covic et al., 2021). As a consequence, food security is now recognized as a highly complex outcome that is influenced by hunger, as well as poverty, conflict, and climate change, among other causal factors (Fanzo, 2018; FAO et al., 2018). Resulting food insecurity can contribute to multiple forms of malnutrition, as shown in Fig. 2.2.

Achieving Food Security Has Become More Complex in the Modern World

While our understanding of food security as a concept has progressed in how it fits within a food systems lens, we still grapple with how to solve massive food insecurity and address its root causes. At the same time, much related to food systems and security, malnutrition in all its forms is increasing; the risk in zoonotic and other infectious diseases related to food production is rising (Rohr et al., 2019); climate change and environmental and biodiversity degradation associated with food systems are volatile (Fanzo, Haddad et al., 2021; Willett et al., 2019); and rural poverty and urban poverty are increasing along with social unrest and conflict (Breisinger et al., 2014; Makita et al., 2019; Micha et al., 2020; Mozaffarian et al., 2018; Rivera-Ferre et al., 2021; Webb et al., 2020). Layered upon these trends are larger, complex political and social forces that are making it challenging to transform food systems (Béné, Fanzo, Haddad et al., 2020). Vexing issues beyond food system components and outcomes such as nationalism, geopolitics, and conflicts plague progress to address food security and transform food systems in positive directions that benefit human health, well-being, and planetary resilience (Brands & Gavin, 2020).

Adding to this complexity has been the approach taken by global food system actors and policies to address food security. Three mainstream approaches have dominated the global food policy agenda and architecture. The first has been the *vertically sectoral approach*. There have been many attempts to improve food security historically, but often these have been siloed, with a singular focus through one sector's lens, a vertically driven approach (Jeppsson & Okuonzi, 2000). One such example is the Green Revolution. This revolution averted social and economic upheaval and large-scale famines in the 1960s in Asia due to the development and widespread adoption of genetically improved high-yielding varieties of cereal crops (maize, rice, and wheat) that were responsive to the application of advanced agronomic practices, including most importantly, fertilizers and improved irrigation (Swaminathan, 2006). Between 1966 and 2005, food production in South Asia increased by almost 250% (FAOStat, n.d.).

While the Green Revolution had a tremendous impact on food production and socio-economic conditions in Asia, it had its fair share of trade-offs including insufficient improvements in nutrition outcomes, increases in environmental stress such as overuse of water, and minimal focus on women's empowerment issues (Negin et al., 2009; Pingali, 2012). To ensure improvements in food security for individuals, households, or communities, the literature suggests that instead, multi-sectoral approaches are essential (Fanzo, 2014; Garrett & Natalicchio, 2010).

At minimum, there are three key sectors that need to engage, collaborate, and contribute to nutrition improvements: agriculture, health, and water sectors (Garrett & Natalicchio, 2010; Lamstein et al., 2016; Pelletier et al., 2016, 2018). These sectors have the capability of injecting nutrition across functioning and effective food, health, and water and sanitation systems (Fanzo, 2014). While the multi-sectoral approach is usually adopted with good intentions, effectively engaging across diverse sectors and distinct systems has proven to be complex (Pelletier et al., 2016).

The second is the *technological treatment approach*. This approach promotes interventions and policy responses through a technocratic lens—focusing on addressing the symptoms more than the root causes. As such, the technocratic solution often attempts to find the "low hanging fruit" or "quick wins" to address what are usually more complex challenges that are entrenched in systemic issues of poverty, marginalization, and food system constraints. Instead, this approach aims to treat the consequences through a technology-driven solution. Some aspects of the Green Revolution fall under this type of approach, but addressing vitamin A deficiency and genetically modified organisms could be seen as other examples.

Vitamin A deficiency is the cause of what is known as preventable blindness in children and severe visual impairment as well as increased susceptibility to succumbing from measles, extreme diarrhea, or respiratory infection (Black et al., 2013). There is much debate and politics around vitamin A deficiency and how to treat it. In the 1970s and 1980s, nutrition planners had three options for dealing with widespread vitamin A deficiency: (1) provide all young children with megadose capsules of vitamin A semi-annually; (2) fortify commonly eaten foods with vitamin A; or (3) improve dietary diversity of foods and ensure people get access to vitamin A-rich sources of foods. The dominating intervention has been through supplementation, and now, most countries are now distributing vitamin A capsules twice a year to children under five years of age quite successfully. Some have argued that a singular, short-term focus on supplements has diverted necessary funds away from improving the diversity of the food supply to ensure that foods rich in micronutrients (such as vitamin A) are available, accessible, and utilized (Chambers et al., 2017; Mason et al., 2015).

Another example of such a technology-driven approach that has polarized the food security world is genetically modified organisms (GMOs).

Some have questioned whether GMOs are necessary when the existing pool of genetic diversity of crops could potentially address concerns of drought, flood, pest, wind, and saline tolerance and resistance, nutrient content, or high-yielding traits (Klümper & Qaim, 2014; Zilberman et al., 2018). GMOs have garnered a lack of consensus on their benefits, risks, and potential impacts on the environment and on human health (Glass & Fanzo, 2017; Sarkar et al., 2021). At the center of the debate is the idea that GMOs can increase crop yields and are thus necessary or at least part of the solution to feeding the world's population and staving off hunger (Klümper & Qaim, 2014; Kovak et al., 2021). Others argue that investing in conservation and use of agricultural biodiversity is a better approach (Jacobsen et al., 2013). There are also scholars that contend GMOs prohibit rights of smallholders and indigenous peoples and their traditional knowledge and values (Calabrò & Vieri, 2014; Koutouki & Marin, 2013). Some argue that GMOs perpetuate "agrarian dispossession," farmers losing the control over seeds and other inputs necessary for food production that are owned by agricultural input and chemical manufacturers and companies (Kloppenburg, 2014). The challenge is to make the best possible use of innovation and technologies to meet the needs of a growing population while also preserving natural resources, biodiversity, ecosystem health, and livelihoods of the most vulnerable. While fair and sustainable use of innovations and technologies has great potential, there are also significant risks and inequities that need to be considered at the same time (Glass & Fanzo, 2017).

The third is the *short-view approach*, which has been disproportionately prioritized by donors in recent decades. This approach often does not elicit lasting change and can have unintended consequences. One such example is food aid. Though food aid is crucial in times of crisis, it is by no means a sustainable, long-term solution to addressing the root causes of hunger (Garrett, 2008). While the cost of emergency food assistance is small compared to the cost of hunger, it is a comparatively expensive measure. One study estimated that food aid costs $812 to deliver one ton of maize as United States food assistance to a distribution point in Africa, whereas it costs only $135 to give local farmers the seed, fertilizer, and technical support to grow an extra ton of maize themselves (Sanchez, 2009). Furthermore, purchasing a ton of maize locally to use as food assistance, rather than maize donated from the United States, was only $320—a much cheaper alternative to international food aid. One potential way to improve the cost effectiveness of food aid would be either by improving the nutritional quality of the staple commodities (flour, sugar, and oil) provided or by diversifying the basket. By improving its nutritional content, billions of dollars can be saved that would have to be later spent on saving lives from nutrition-related illnesses (Rosenberg et al., 2012; Webb et al., 2017).

Food Systems Lens to Tackling Food Security

Food systems have become the predominant theme among food actors and scholars to frame, understand, and adequately address food security. A "food systems approach" is a departure from traditional, historical approaches, which (as we saw above) tend to be sectoral, technical, and short term with a narrowly defined focus and scope of food security. Instead, a food systems approach uses a holistic, comprehensive view of the entire system. This approach includes the actors within the food supply chain and the governance mechanisms that shape their roles. A food systems approach requires "food systems thinking," which identifies and describes the influences, or "drivers," and relationships in the systems. Food systems thinking also considers how these influences intersect with each other in both positive and negative ways (Hawkes & Fanzo, 2019).

Figure 2.3 shows the components of the entire food system, including food supply chains, food environments, individual factors, consumer behaviors, and diets; the outcomes, including nutrition and health, environment, economic (livelihoods and wages), and social equity; and the drivers, many of which are exogenous to food systems but "push" or "pull" systems in various directions (Béné, Oosterveer et al., 2019; Béné, Prager et al., 2019; Fanzo, Rudie et al., 2021; HLPE, 2017).

Food supply chains are the components that link food production, food storage, loss and distribution, processing and packing, and retail. These links in the chain are influenced by the decisions of many food-specific and indirect actors from small to multi-national scales. The types of foods generated by supply chains avail foods to food environments, which are the places where people buy and order food (Constantinides et al., 2021; Swinburn et al., 2015; Turner et al., 2018, 2019). These environments vary from informal, wild environments (e.g., forests) to highly formalized environments (e.g., supermarkets) (Downs et al., 2020). The architecture of these environments is influenced by the types of food on offer, their affordability, their properties, and their promotion and advertising. Consumer decision-making and behavior are shaped

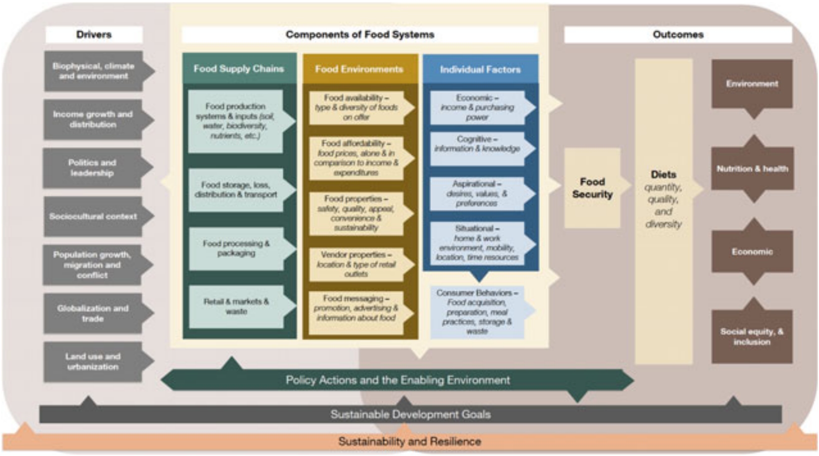

Fig. 2.3 A food systems framework (*Source* Fanzo, Rudie et al. [2021])

by individual's purchasing power, knowledge, aspirations, resources, and culture. These factors subsequently influence diets (Bell et al., 2021; Mancino et al., 2018).

All of these components affect many outcomes that include health, nutrition, wages, income, the environment, climate, cultures, and systemic societal equity (Ericksen, 2008; Fanzo, Rudie et al., 2021; Webb et al., 2020). Drivers such as climate change, urbanization, population pressure, policies and politics, and migration, to name just a few, can influence the directionality and dynamism of food systems in both positive and negative ways (Béné, Fanzo, Prager et al., 2020). Political, programmatic, and institutional actions can both influence and be influenced by food system components, outcomes, and drivers, all of which affect progress on the SDGs. The pillars of food security intersect with food systems (HLPE, 2020), and risks, shocks, and vulnerabilities consistently threaten resilience and various outcomes of food systems (Barrett, 2020; Gaupp et al., 2019).

With the examples above on the Green Revolution, vitamin A supplementation, GMOs, and food aid, a food systems approach is a way of considering food systems in their totality, which includes all the elements, their relationships, and related impacts. It goes beyond one element (e.g., a value chain, a food environment) and considers the intricate web and networks of activities, actors, and feedback loops of the different directions food systems can take. It also does not focus on one single sector. It considers many sectors that interact with food and considers the many impacts that food system can bring, including health, nutrition, environment, livelihoods, and equity.

Beyond just definitions, food system solutions to ensure food security require integrated actions across multiple scales (from global to local systems; from long to short supply chains), actors, and sectors (e.g., agriculture, trade, policy, health, environment, education, transport, and infrastructure). Food systems are highly interconnected—any intervention or policy that addresses one part of the system will affect other parts. Health, politics, society, the economy, and environmental systems all intersect with food systems. As a result of this interconnectedness, any action can lead to unintended consequences. The global COVID-19 pandemic further highlights the need to take a systems approach—a shock to the health system had ramifications on every other system with the pandemic (Brands & Gavin, 2020; Fanzo, 2021).

Food systems result in many trade-offs due to decisions made within food systems and the many drivers that result in a diverse set of interactions (Béné, Oosterveer et al., 2019), and positive and negative feedback loops which can mitigate harmful outcomes or highlight trade-offs (Béné, Fanzo, Prager et al., 2020). One such example is trade. Trade is of critical importance in moving a diversity of food and the nutrients that food contains around the world. Figure 2.4 shows the number of extra people, in billions, who could be nourished if nutrients in excess of current global needs were evenly distributed. Without trade, there would be increased deficiencies in protein, zinc, and iron for example (Wood et al., 2018) (Fig. 2.4). At the same time, trade moves nutrient-poor, highly processed, packaged foods to the far reaches of the world and that trend is increasing (Garton et al., 2020). These foods have been associated with obesity and non-communicable diseases (Baker et al., 2020; Elizabeth et al., 2020). Both have implications for food security, when taken in its broader view (c.f. Figure 2.2).

Functional Food Systems Do Not Always Equate to Food Security

If food systems don't function well (see, however, Caron et al., Chapter 3 in this volume), it will be difficult to achieve food security; yet even if

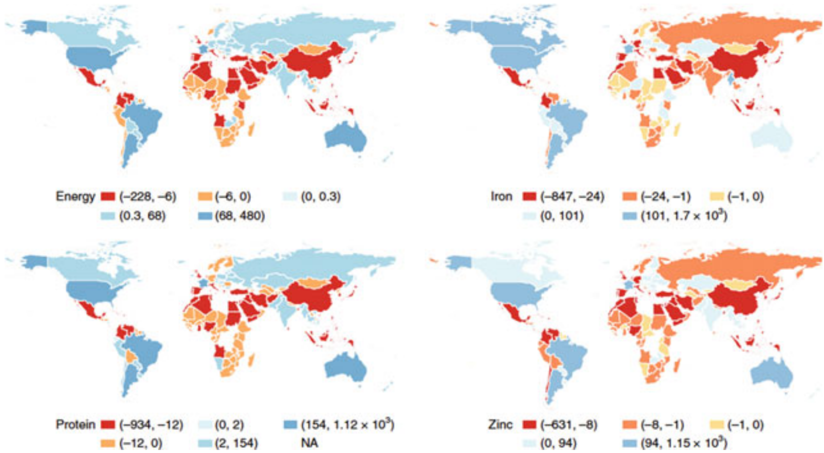

Fig. 2.4 Change in number of people who could be nourished without trade. For each country, the number of people (in millions) who could be nourished under current (average of 2007–2011) scenarios was subtracted from the number of people who could be potentially nourished under a no-trade scenario. Map breaks correspond to minimum, first quantile, medium, third quantile, and maximum for each nutrient (*Source* Wood et al. [2018])

food systems are well functioning, food insecurity can still occur. Food systems are involved in an intimate societal interdependence with many other systems. These systems influence food security as well. Food security also requires functioning health systems, education systems, water and sanitation, transports, energy, etc. The 1996 World Food Summit definition of food security stated earlier alludes to the necessity of a whole systems approach in that the physical and economic access alone indicates that built environments, urban and rural development and infrastructure, economics, livelihoods, and fair wages and equality of access to resources—all outside the technicalities of food system components—influence food security outcomes.

One illustration is the COVID-19 pandemic. There is growing evidence to suggest that while food supplies have been largely protected during the pandemic, food insecurity still increased for various reasons including loss of income and the global economic slowdown (Béné, Bakker, Chavarro et al., 2021; Béné, Bakker, Rodriguez et al., 2021). The longer-term implications of this loss of income and employment are profound. Food prices have been rising and are 3–25% higher in some parts of the world one year later than they were in July 2020 (FAOStat, n.d.). In addition, models suggest that by 2022, COVID-19 related disruptions may increase the number of children who are undernourished with an additional 9.3 million children wasted and 2.6 million children stunted—essentially unraveling the progress made over the last two decades to reduce these devastating growth outcomes (Osendarp et al., 2021). Thus, it is not just food systems alone that can tackle food security—other systems and their functioning effectively also impact food security and nutrition outcomes.

Another example is the United States (U.S.) and its prevalence of food insecurity—which sits at 10.5% (USDA, n.d.). At the crude level, one can argue that the U.S. food system works effectively well at ensuring food is available and accessible and is abundant in calories and diversity. However, food insecurity still exists. The question is why? Is it a food system problem per se, or a systemic societal problem of injustices and disadvantage that plague populations and their ability to access and afford a healthy diet? Evidence suggests the latter (Cooksey Stowers et al., 2020; Myers & Painter, 2017). The U.S. is plagued with issues of systemic racism that have impacted communities' ability to physically, economically, and socially access healthy foods (Bowen et al., 2021; Odoms-Young & Bruce, 2018). Much of this inaccessibility has to do with redlining—a historic, systematic denial of various services to residents of specific, often racially associated, neighborhoods or communities, either explicitly or through the selective raising of prices (Zhang & Ghosh, 2016). Of the foods that are often available to poor, marginalized populations, are processed, packaged foods that are cheap, convenient, and unhealthy make up a large proportion of the American diet, and are highly traded across the world (Baker et al., 2016; Development Initiatives, 2018; Thow, 2009). Thus, while the U.S. food system is one that has brought about incredible technological advances and abundance, not everyone benefits from the system.

Conclusion

With only 8 years remaining to achieve the SDGs, the UNFSS and the Convention of Parties (COP26) climate change meetings of 2021 were important moments for States to commit once again to ending food insecurity through a food systems approach or mitigating climate change, respectively. However, history has taught the world what has worked, and what has not, and simplification of definitions and singular or overly technocratic fixes have not been completely effective in driving down, in aggregate, food insecurity. Taking a food systems approach to the problem is a step forward in that it would allow for a more holistic approach to address multiple problems and their root causes at the same time. It also allows for solutions that may serve to benefit multiple outcomes. Moreover, ignoring the importance of other systems—such as health, water, and economic systems—and how they influence food systems is also a dangerous path to take. To effectively address food security, especially for the most marginalized and vulnerable, actions must be seen through a wider, multi-system lens.

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