Sustainable Earth Reviews

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Zero hunger: future challenges and the way forward towards the achievement of sustainable development goal 2

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Abstract

Since 2020, the progress towards the achievement of Sustainable Development Goal (SDG) 2– Zero Hunger has faced a sudden stall due to an ongoing "polycrisis". While some countries are on track, a great effort is still globally necessary to achieve the SDG2 targets. Here we provide a brief background about SDG2, including its synergies and trade-offs with other SDGs. We then identify and discuss the main challenges that the pathway towards zero hunger will have to tackle. The lack of a systemic approach, together with the complex, global, and nested dimensions of food systems are identified as key elements to be carefully considered when designing sustainability strategies. This means that a variety of stakeholders are called to simultaneously and cooperatively act on multiple fronts to ensure a safe, equal, and just progress of all countries and populations towards the achievement of SDG2.

Background

Sustainable Development Goal (SDG) 2– Zero Hunger– consists of eight targets aiming to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture" [1]. The first five targets (2.1–2.5) focus on food security, nutrition, and agricultural practices, while the last three focus on financial and market aspects to support the achievement of those targets (2.A-2.C).

As a result of major global events (e.g., the COVID-19 outbreak and the Russian-Ukrainian conflict), most of the global progress in achieving SDG2 has receded back to levels dating around 2015. Although improvements have been made in a few cases, most countries are off-track to meet the targets by 2030 [2]. For instance, the global trend in the prevalence of undernourishment (target 2.1.1) reverted to levels of 2009–2010 during 2020 [3], as a result of the various food systems shocks triggered by the COVID-19 pandemic. The levels of childhood stunting (target 2.2.1) stagnated after 2020, interrupting the previous positive trend. Similarly, the decreasing trend in wasting prevalence

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turned into stagnation, and the prevalence in overweight even slightly increased (target 2.2.2) [4]. Moreover, despite progress in public spending on agriculture, the recent polycrisis has resulted in high food and fertilizer prices, limiting the expected income gains for populations living off agriculture [2]. From a market perspective, substantial progress on meeting target 2.B.1, which aims to eradicate agricultural export subsidies, has been achieved [3]. Nevertheless, food price anomalies (indicator 2.C.1) are still quite diffused across countries.

The 17 SDGs and their relative targets are designed to be strongly interconnected which means that there may be trade-offs or synergies between them [5, 6]. The presence of these interlinkages, together with the global dimension of food systems, explains the repercussions that global events had, have, and will continue to have on the achievement of SDG2 targets. For instance, although agricultural activities were exempted from the restrictions imposed during the COVID-19 pandemic, disruptions in the functioning and effectiveness of global food supply chains inevitably occurred during those years, with consequences on food security and nutrition [7]. The Russian-Ukrainian conflict has exposed the sensitivity of global food systems, and food and nutrition security objectives, to geopolitical events, which impact countries regardless of their physical proximity to them [8]. Finally, climate change is also projected to hamper the achievement of SDG2 [9], and might have already done so. Some attribute to climate dynamics the increase in the percentage of undernourished people that occurred (after a period of positive trends between 2018 and 2019), when the absolute number of undernourished people in the world (since 2014) also increased [10–12]. Looking ahead, this situation will possibly continue to worsen, since the three recent drivers of disruption (major global health threats, geopolitical conflicts, and climate-induced environmental degradation) are themselves interconnected [13]. The cumulative effects of conflict, climate unpredictability and extreme weather events, have already produced resource degradation, economic hardship, and social and political instability, which have in turned exacerbated situations of chronic hunger, acute food insecurity, and malnutrition [14].

In sum, the challenges currently faced by the global food system are characterized by synergies, trade-offs, and feedback mechanisms [15]. Future challenges that will affect the achievement of SDG2 in the 7 years left to 2030 are likely to be complex. To engage with this complexity, in this debate paper we have adopted a systemic lens to the analysis of data collected through a review of recent literature and informal interviews with professionals with diverse food-related areas of expertise. Our analysis has identified four main challenges that– in our opinion– the pathway towards Zero Hunger will have to tackle.

Global causes, effects, and governance

Food systems will be severely affected by the consequences of the multiple global environmental impacts they continue to produce [16–18]. Climate crisis and shocks, in particular, will have direct negative consequences on food prices, food insecurity, and malnutrition through various direct and indirect pathways and feedback mechanisms. Indeed, the increasing climate unpredictability is altering planting patterns, amplifying the prevalence of pest and disease outbreaks, exacerbating the pressure on already scarce natural resources, and fostering local conflicts and migration patterns that detrimentally affect food security and nutrition [12]. The existence of Most Affected People and Areas (MAPAs) raises the need for a global recognition of the underlying past and present responsibilities and for a shared and active engagement with the drivers of both current and expected negative impacts. A global, target-oriented and evidence-based governance framework is urgently needed to avoid the persistence and worsening of the environmental, social, and economic injustice that continue to affect food security of populations across the globe [19–21]. In this sense, it is remarkable that inter-governmental action is lagging behind the sub-national actions undertaken by local governments, stressing the unacceptable lack of willingness of national bodies to acknowledge the urgency of global action [22, 23]. To address this gap, it is vital to reinforce the science-policy-society interface, ensuring that policies are backed by sustainability assessments that are multidisciplinary (encompassing environmental, social and economic domains), comprehensive (covering cradle-to-grave systems), integrated (focused on the whole diet instead of single foods) and with a special attention for nutritional and health aspects [23]. While there is a clear attention for the evaluation of policy readiness towards SDG2, existing assessments are fragmented across specific areas [24, 25] and are oriented towards domestic policies. The lack of a global integrated assessment of the policy readiness towards SDG2 is a key gap, that will have to be filled out in the next few years. The urgency to acknowledge the relevance of food systems at the intergovernmental level, and the need to elevate its governance at the global scale were clearly stated in a letter addressed to the COP 28 (Conference of the Parties) and signed by 80 organizations and individuals[1], which luckily resulted in the inclusion– for the first-time– of food-related actions in the final stocktaking decision text[2]. Only by thoroughly engaging with the global dimension of food systems it will be possible to design effective policies to sustainably accelerate the progress towards the achievement of SDG2.

[1] https://docs.google.com/document/d/1YQdbg4FSUYJUQC7HZxOpAht5gE4uqTOlYxiIlml0Eo0/edit.

[2] https://unfccc.int/sites/default/files/resource/cma2023_L17_adv.pdf.

Supply chains: inequality, power imbalances, and conflict

The global dimensions of food systems' challenges raises the need for the adoption of a broad systemic approach that accounts for all components that connect food production with food security, nutrition, and human health. Developing frameworks that can reliably model and predict the place-based connections between food production and nutrition– and that account for such deep diversity and complexity– can be a monumental step towards achieving SDG2 [17].

Food consumption is generally linked to food production via supply chains, which can be short (e.g., subsistence-oriented), or, more often, long (e.g., global food trade) [26]. This imposes the urgent need to consider the whole supply chain when evaluating the sustainability of food systems [27], which should be transparent and explicitly highlight the role of international trade as a driver of negative environmental, social, or economic impact [28]. Through international trade, globalization ensures the availability of food items that would otherwise be only seasonally available. While this might meet consumer desires, the supply of off-season foods often comes with higher environmental and economic costs, which are mostly beared on regions that produce food for export [29]. The bridge between production and consumption (the missing middle) has already been identified as a critical entry point for policies oriented towards SDG2 [30].

However, the structure of global supply chains is often shaped by large (multinational) companies, which impose a monopoly dictated by the objective of maximizing their profit by taking advantage of the critical socio-economic situation of countries that have availability of natural resources, cheap labor, and relaxed regulation. This power imbalance, fueled by capitalism and globalization, risks to perpetuate existing inequalities, especially within supply chains of cash crops extensively demanded (though not supplied) by the Global North [29]. Pursuing profit means pursuing cheap primary inputs, such as labor and natural resources, which are often in the hands of a few powerful food system actors. The concentration of resources across the globe is often the cause of conflicts, which disrupt the environmental and socio-economic context of the regions involved, displacing small-scale family farms that, in many areas of the world, play a key role in terms of food security [31, 32]. A key feature of the global capitalist food economy is the widespread tendency to disregard the real costs of food (i.e., the negative externalities associated with its production) in the market price. Such tendency has supported the diffusion of cheap, unhealthy, and ultra-processed foods, with negative socio-economic consequences even in wealthy countries [33]. Climatic and environmental policies are striving to incentivize the production of nutrient-dense crops that support a healthy diet. However, trade-offs are common and have the potential to seriously undermine the cost of healthy eating. The relative costs of nutrient-dense foods and foods with high energy density and low nutritional value could be significantly changed by internalizing those costs through pricing (such as carbon taxes or cap and trade systems); practically, however, financial measures are difficult to implement and may require global agreements [34].

Food production: farming practices, assessment methods, and data

Current farming practices and orientation are not sustainable. The use of more sustainable practices (such as organic farming) should be prioritized, and intensive farming (along with feed-food competition) should be restricted [35]. In terms of scope, SDG2 is mostly focused on cultivation, while livestock farming, pastoralism, fisheries and aquaculture are given marginal attention– also by other SDGs [36]. These food production activities urgently need attention given their multi-dimensional role as generators of resources (e.g., feed-food competition) but also as sources of income and nutrition (i.e., of food security). This implies, amongst other things, the implementation of a much larger effort in terms of data collection as well as the use of more robust methodologies. The latter should adopt a multi-scalar approach to complement on field-level surveys (the most common practice) with higher-level assessments that move beyond the mere consideration of the environmental burden [37, 38].

Farming (including fishing and aquaculture) is the first step in the food supply chain. It is the activity most exposed to environmental disruptions, and the one that generates the greatest environmental impact– especially on climate dynamics. Farming practices matter not just in terms of how crops and livestock are produced and where. Detailed, item-specific and spatially disaggregated data on food production are often insufficient, outdated, and fragmented [39]. This severely constrains the ability of countries to quantify the current state of food production and prevents the implementation of evidence-based and targeted agricultural interventions that could improve food systems sustainability across multiple dimensions [40, 41].

Place-based datasets would be a much-needed complement for the large variety of data collected on global food systems; their integration would indeed support the prioritization of actions on impactful leverage points associated with the use of agricultural inputs (e.g., nitrogen and phosphorous), as well as outputs (e.g., pollutant emissions). Finally, actions to measure, monitor and prevent food loss and waste are extremely valuable and need to deal with each stage of the supply chain: from product design (e.g., size and shelf life), processing (e.g., favoring less processed foods), and packaging (e.g., preferring materials that are easily up-cyclable), up to the provision to consumers of crystal clear instructions on the best food preservation practices.

Consumption: dietary patterns, shifts, and novel food

As the global population continues to increase, the need for sustainable production practices will become even more imperative. In quantitative terms, population growth translates into increased demand, which will not be met without changes in lifestyles and related dietary habits. These two key drivers are bound to clash with the shrinking resources of an overexploited, warming planet, where land and water availability continue to shrink– primarily due to unsustainable farming practices and climate change– and where rural out-migration is drastically decreasing the labor-force available in the fields [42]. A systemic approach to sustainable food systems must encompass strategies that address both demographic shifts and the multiple challenges posed by a changing climate and embracing the interconnected nature of the two phenomena. Dietary patterns are placing a substantial strain on natural resources and causing environmental burden that goes beyond the local boundaries [26]. More sustainable (and widely available) food alternatives (e.g., novel food such as edible insects, cultured meat, and algae, which have not yet been subjected to an adequate number of sustainability assessments) [43, 44] are under-utilised, given the widespread tendency in the Global North to refrain from designing consumption-side solutions in favor of actions that rarely go beyond simple guidelines or recommendations. An interesting exemplary exception is the case of Denmark, which introduced the shift to a plant-based diet as an action not only to achieve climate goals, but also to generate socio-economic benefits [45]. This kind of effort confirms Kearney [46]'s hypothesis that in high-income countries– which have in the past transitioned towards heavy meat consumption– wealthier and highly educated residents (primarily located in urban areas) are shifting to diets reduced in fat and rich in fruits and vegetables. Conversely, low- and middle-income countries are abandoning a starchy low-fat diet with limited variety moving towards energy dense diets that are rich in sugar and fat and are based on the consumption of a higher variety of food items [46, 47]– including animal-based (e.g., meat, fish and seafood) and sugar-rich products which place additional strain on land and water use and cause increased GHG emissions [46–48]. Policy makers should begin to engage with current food consumption issues, for instance by pushing towards the adoption of dietary patterns proven to be more sustainable, as proposed by the One Health approach [49]. At a bare minimum, action in this sense should be directed towards the promotion of local, seasonal, and more nutrient-rich foods (quality vs. quantity). This kind of actions are unlikely to have long-term effects unless they are coupled with a radical reform of the amount and quality of information provided to consumers (e.g., food marketing). A reorientation of consumption patterns towards sustainability entails the designing of a standardized and comprehensive labeling system, providing nutritional information (i.e., about the quality of nutrients) alongside information on the environmental [50] and socio-economic costs of the whole supply chain. School meals could play a vital role in the dissemination of information about sustainable diets to young generations, while at the same time representing an important market for more sustainable food products (e.g., plant-based options).

Conclusions

Returning to the challenges identified above, we draw the following recommendations for the achievement of SDG2:

Global causes, effects and governance

Drawing on the conclusions reached at COP28, creating a global multi-scale governance framework is required to ensure collective surveillance, coordination and cooperation, with particular attention for the actors and areas that are, and will be, most vulnerable to climate shocks and related price shocks. This could be achieved– for instance– by strengthening the resources and scaling-up the remit and ambitions of the Committee on World Food Security (CFS).

Supply chains: inequality, power imbalances, and conflict

Confining of strategic intervention at either the supply or the demand side of food chains is clearly not working. A comprehensive mapping of food supply chains is necessary and can be achieved through multidimensional life-cycle sustainability evaluations covering all dimensions of the food system, from production to consumption. The standardized mapping of environmental, social, and economic information, especially with regard to international supply chains, is also necessary to progress towards a more systemic approach to food issues.

Food production: farming practices, assessment methods, and data

National governments should push towards more sustainable farming practices (such as organic farming) while strengthening assessment and data collection methods that would support place-based interventions. This can prevent the proliferation of profit-driven (especially when export-oriented) practices that disregard food security and the conservation of natural resources in local communities. Waste and loss prevention should be prioritized, especially for long supply chains and packaged foods.

Consumption: dietary patterns, shifts, and novel food

National governments must intervene on food consumption and move beyond the sole (ineffective) redaction of guidelines. An immediate strategy to contribute to shaping new and healthier dietary patterns could involve public procurement (e.g., targeted intervention on school meals). Even though it is difficult to set limits on the consumption of

high impact (social and environmental) food items, a standardized, clear, and transparent labeling scheme should be implemented to stimulate more sustainable consumption patterns.

Overall, transversal remarks

The imposition of radical changes within food systems must ensure that the effort and consequent burdening is fairly shared among all actors involved. The required measures must be implemented gradually and all stakeholders within the most affected sectors (e.g., farmers, and especially livestock farmers) must be safeguarded by targeted social safety nets, such as temporary subsidies, while ensuring (or maintaining) fair wages and decent working conditions[3]. These important but still neglected issues should be placed on the agenda of global processes and organizations such as the CFS as well as incorporated in national roundtable discussions. More generally, it is time to turn emerging systemic initiatives, visions, and strategies into concrete and tangible policies. For instance, this is the case for the EU Farm-To-Fork Strategy[4] which still lacks a legislative framework (originally due by 2023). Similarly, there is an urgent need to put into practice the EU Biodiversity Strategy for 2030[5] through the designing of dedicated policies, which should be supported by an enabling legislative context– e.g., the not yet approved Nature Restoration Law[6].

Effectively implementing the Zero Hunger ambition of SDG2 by 2030 urgently requires a combination of long-term, concerted efforts by multiple actors (e.g., producers, consumers and policy makers), which can trigger systemic behavioral changes at both individual and societal, collective level. The 2030 time horizon is not just a politically set deadline, but also the time-frame beyond which the destabilization of multiple Earth System processes might become irreversible [51].

Abbreviations

SDG	Sustainable Development Goal
MAPAs	Most Affected People and Areas
COP	Conference of the Parties
CFS	Committee on World Food Security

Acknowledgements

The authors are very grateful to Adrian Mueller (Research Institute of Organic Agriculture FiBL), Sara Moreno Pires (University of Aveiro), and Shauna Downs (The State University of New Jersey) for their remarkable suggestions that greatly improved the quality of this work. This paper and related research have been conducted during and with the support of the Italian national inter-university PhD course in Sustainable Development and Climate change.

[3] See for instance the European Globalisation Adjustment Fund for Displaced Workers (https://ec.europa.eu/social/main.jsp?catId=326&langId=en).

[4] https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en.

[5] https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en.

[6] https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-law_en.

Author contributions

F.S., A.G., and M.A. contributed to the design of the work, F.S., A.G., M.A., K.D., A.B.F., A.A.M., and D.C., prepared the original draft, F.S., A.G., M.A., R.S., A.B.F., A.A.M., and D.C. revised and edited the manuscript.

Funding

Not applicable.

Data availability

Not applicable.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 15 December 2023 / Accepted: 5 February 2024
Published online: 01 April 2024

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