



Editorial: Food Security, Agricultural Productivity, and the Environment: Economic, Sustainability, and Policy Perspectives

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Keywords: Sustainable Development goals, food systems, climate change, institutions, ecosystem services

Editorial on the Research Topic

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As we move forward to meet the challenge of feeding 9.6 billion people by 2050, trade-offs between agricultural productivity and environmental conservation are going to intensify. Nearly 9% of the world's population is undernourished (Roser and Ritchie 2019), largely in the developing parts of the world where agricultural systems are characterized by smallholders and weak institutional structures. Increasing food demands are thereby met with either intensive efforts to increase yields or to expand agricultural crop land. On the other hand, agricultural yields are projected to decrease in the next decades in most world regions due to climate change impacts such as droughts, soil desertification, floods, sea level rise and soil salinization that might also interact with an increased frequency of diseases and pathogens in crop, and livestock production (Ringsmuth et al., 2022). We can also expect that the competition for land use will intensify due to the low-carbon transition that must be achieved by mid-century. Getting away from fossil-fuels and expanding renewables will require massive amounts of the Earth's surface (Otto et al., 2020). Some compromises with land use for food production and consumption, as well as land use of human settlements and infrastructure will have to be found.

Efforts towards increasing agricultural productivity to solve some of these problems can have a direct impact on the natural resource base such as soil and water. At the same time, geopolitical crises intensify disruptions of global supply chains and food shortages. It is increasingly clear that the war in Ukraine that started 1 month ago will negatively impact the global supply of grains. Many countries that relied in the past on grain imports from Ukraine are located in Northern Africa, have a high share of population exposed to poverty and hunger, and many of them are politically unstable (Knaepen and Dekeyser 2022). In addition, induced by the war in Ukraine, high fossil fuel energy prices may soon lead to higher prices for agricultural inputs, which in consequence could lead to higher food prices.

In this Research Topic, we present ten articles that address a deeper understanding of the inter-linkages and potential solutions for achieving pathways to meet increasing food demand through improved agricultural processes that can co-exist with environmental conservation objectives, especially as envisaged under the Sustainable Development Goals (SDGs). Contributions come from various fields and include analyses of trade-offs between food security, agricultural productivity and environmental goals, spanning various geographical

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Edited and reviewed by:

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Specialty section:

This article was submitted to
Environmental Economics and
Management,
a section of the journal
Frontiers in Environmental Science

Received: 09 April 2022

Accepted: 05 May 2022

Published: 23 May 2022

Citation:

Ghosh RK, Otto IM and Rommel J
(2022) Editorial: Food Security,
Agricultural Productivity, and the
Environment: Economic, Sustainability,
and Policy Perspectives.
Front. Environ. Sci. 10:916272.
doi: 10.3389/fenvs.2022.916272

scales, and analytical foci. While grouping the diverse contributions is not an easy task, it is analytically useful to provide a broader perspective on these contributions.

Three articles provide new frameworks and meta-perspectives on rethinking food systems, acknowledging the increasing importance of low probability, but high-impact events such as the SARS-CoV-2 pandemic, the Ukraine war, or climate change. While it is difficult to fully capture the complexity of food systems and the many unpredictable cascading effects major crises trigger in these systems, Hogeboom et al., Manevska-Tasevska et al., as well as Srigiri and Dombrovsky adopt novel perspectives which assess food systems in their response to shocks. Focusing on attributes such as the modularity, diversity, or redundancy of a specific food system can provide novel insights that augment more narrowly focused disciplinary analysis. A second set of articles is concerned with the embeddedness of actors within organizations and institutions (understood as sets of rules). Providing an in-depth understanding of local cases, Ires; Yu and Nilsson; Censkowsky and Otto, as well as Xiao and You, critically discuss the complex interplay between heterogeneous actors and legal or organizational frameworks. Finally, three articles—Enriquez et al., Markandya et al., and Vittis et al.—synthesize current global evidence or provide long-term historic perspectives on food systems at national scales. For instance, Markandya et al. point out that building a better post-Covid future would require moving beyond immediate economic risk management and making substantial

investments to promote food security, healthy diets, environmental sustainability, rural livelihoods, and social justice.

We believe that these contributions are essential for understanding challenges which global food production will face over the next months and years. The type of human-nature interactions in food production that have been developed in the second part of the 20th Century will have to undergo profound changes. An answer could be to adequately incentivize locally closed nutrient cycles which will also imply that consumers need to rely more on local ecosystem services, as discussed by Censkowsky and Otto. This would also be in line with a greater political emphasis placed on self-sufficiency in times of crises. Many studies also point towards novel regenerative types of agricultural systems or sustainable intensification practices that promise food production modes that may have lower or even net positive environmental and social impacts (Garnett et al., 2013; Newton et al., 2020). The contributions gathered under this Research Topic, help to understand which policies and constellations of stakeholders will be essential to guide the transformation that we are currently facing.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Roser, M., and Ritchie, H. (2019). Hunger and Undernourishment. Available at: <https://ourworldindata.org/hunger-and-overnourishment>.

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