Improving the assessment of food system sustainability

The global food system is causing unsustainable pressures on the environment, leading to widespread land use change, increased greenhouse gas emissions, disruption of the nitrogen and phosphorus cycles, biodiversity loss, and freshwater depletion and pollution.[1,2] Environmental pressures are mounting as populations grow and diets change, escalating the need to make food production and consumption more sustainable. Yet, there are limitations in the current analysis of global food system sustainability. We believe there are four main areas that could be improved to make such analysis more comprehensive and insightful. These improvements could have important repercussions on the development of effective evidence-based policy that ultimately promotes production efficiencies and sustainable diets.

One set of opportunities for improvement in the analysis of food system sustainability relates to the robustness of the dietary scenarios that are modelled. First, these scenarios need to be made more plausible. Although assessment of radical shifts in human diets might be useful in highlighting the effects of animal-based versus plant-based foods, we question the benefit of emphasising the most extreme of scenarios (ie, a complete switch from omnivore to vegetarian or vegan diets), when the foreseeable global trend is heading strongly in the opposite direction.[2] In addition, analyses of these extreme diet substitution scenarios tend to focus on greenhouse gas emissions, but in such scenarios, trade-offs between sustainability indicators are highly likely—aptly highlighted by the increased use of water in scenarios that model shifts from grass-fed livestock towards water-intensive crops.[3] We argue that it is more insightful to model ambitious yet achievable, context-specific reductions in animal products, overconsumption (particularly of discretionary foods), and food waste, in line with those recently recommended by the EAT-Lancet Commission on sustainable food systems for overall planetary health.[4]

Secondly, more granular and dynamic analyses are needed. Estimates of environmental effects under-pinning global food system analyses are typically based on life cycle assessment, an environmental accounting framework that captures effects from farm-to-fork. While the rigour and comprehensiveness of available life cycle assessment data and associated meta-analyses are improving and encompassing important trade-offs between sustainability objectives,[5] significant shortcomings remain, notably in terms of low commodity-level detail and the use of global averages to infer region-specific or nation-specific environmental intensities (defined in life cycle assessments as the impact per functional unit of production). In addition, most life cycle assessments are static, and therefore do not represent system feedbacks that incorporate changes in demand because of production efficiency enhancements, or marginal changes in environmental effects involved in large-scale dietary shifts—such as when animal-based products are completely eliminated. The quantification of these dynamics and their system-wide environmental impacts is an opportunity to greatly improve sustainability assessments of different food products and proposed substitutions.

Thirdly, protein sources beyond conventional livestock need greater consideration. In many parts of the world, alternative animal protein sources such as abundant native species that are better adapted to local conditions (eg, kangaroo in Australia and deer in the northern hemisphere) can contribute to human nutrition, with such sourcing having considerably lower environmental effects than farming of conventional livestock.[6] Many countries are also host to introduced feral animal populations that could serve as alternative protein sources—for example, Australia has substantial feral deer, goat, rabbit, pig, horse, and camel populations. Partly replacing existing mainstream protein sources with wild harvests of these alternative sources could achieve co-benefits for the environment (eg, through reducing emissions, land degradation, and the effects on native biodiversity), and improve human health, since game meat is typically leaner than lamb and beef.[7] Conventional analyses also fail to account for other transformative shifts in animal-sourced protein, such as those towards laboratory-grown meat, insect-derived protein, and feeding animals on ecological leftovers such as food waste or grass from pastures.[8] Including potential shifts to novel low-impact protein sources would ensure more comprehensive modelling of the associated environmental effects.

Finally, analyses should better quantify the diverse effects of food production on biodiversity and ecosystems. Food production contributes considerably to species extinction, which has detrimental effects on many ecosystems and plant and animal communities that are essential for supporting human life.[2] Yet, there is an overreliance on proxy indicators such as land use when assessing terrestrial food systems.[5] Previous research has highlighted how the extent of agricultural land area is not a good proxy for biodiversity impact, because of differences in production intensity and heterogeneity in biodiversity values.[9] This limited analysis also extends to marine and freshwater food production. Stock depletion, bycatch, and habitat modification or loss, resulting from intensive aquaculture and fishing practices such as trawling, have substantial effects on the biodiversity of coastal and oceanic ecosystems. However, although some studies have considered the environmental intensities of aggregate categories such as farmed fish and crustaceans,[6] the effect of fishing on wild stocks is typically not encompassed in life cycle assessments, despite appropriate data being available.[10] Integration of a more diverse range of biodiversity indicators into the assessment of food system sustainability would allow for more meaningful analyses.

Taking advantage of the opportunities outlined here could facilitate a more complete understanding of the environmental effects of food production and consumption. Embracing these advances is a key prerequisite for developing effective policy recommendations. Our recommendations aim to foster a more comprehensive and nuanced debate on sustainable diets and the food system within the context of global environmental limits.

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