

Food systems, nutrition, health and the environment



Nutritionists are classically concerned with the associations between nutrients and diets and nutrition and health outcomes. Understanding these associations is important. Insufficient and poor quality food, especially during pregnancy and in early childhood is a major contributor to the high burden of undernutrition: globally, 159 million children younger than 5 years are stunted (too short for their age), 50 million children globally are wasted (dangerously thin), and more than 3 million children die every year from causes associated with undernutrition.^{1,2} Simultaneously, nutrition-related chronic diseases such as obesity, diabetes, cardiovascular disease, and some forms of cancer are major contributors to the global burden of disease.³ Ambitious goals have been set by the international community to eliminate malnutrition in all its forms, and 2016 saw the start of a UN Decade of Action on Nutrition designed to reinvigorate national and international efforts for nutrition.^{4,5}

In this context, the food system—encompassing the production, processing, marketing, and purchase of food and the related consumer behaviours, resources and institutions—appears to be struggling to deliver nutritious and healthy diets in an equitable manner. And the world is changing: the global population is increasing, migration to cities is accelerating, and transitions in dietary habits towards more processed and animal-source based foods are becoming commonplace, putting the food system under ever-increasing pressure.

Worryingly, the situation seems likely to deteriorate further, largely as a result of increasing pressures on land-use and environmental change. For example, global and national modelling studies suggest that yields of major cereals will decline under scenarios of increased temperature, especially in tropical countries.⁶ Water scarcity threatens the ability of large parts of the world to continue its present agricultural growth,⁷ and agricultural land is increasingly in conflict with infrastructure development and with protected areas. Biodiversity loss, including of critical crop pollinators, and loss of soil quality will both have substantial impacts on global fruit and vegetable supply and thereby on population health.⁸ The costs for people and governments are also becoming clearer: recent spikes in the price of food, resulting from poor harvests and speculation on world cereal markets led to major

riots in more than 20 countries.⁹ Although agriculture is a major contributor to environmental impacts (food production generates up to 30% of global greenhouse gas emissions, and accounts for substantial proportions of land-use change and global water consumption), there are many opportunities to mitigate or reduce these impacts that will become increasingly important as the demand for food continues to rise.

Historically, studies by nutritionists and others working in public health have not been designed to address these new problems that span environmental change, food system activities, and health outcomes within specific socioeconomic, societal, and political contexts (figure). In this new, more complex arena, traditional research and policy that engages across narrowly aligned sectors is limited and typically fails to take on board potentially key underlying changes in the broader food system. The distinct literatures and research communities that have evolved around the food system and health and food system and environment agendas over the past decades now need to converge and coalesce, clarifying trade-offs, and seeking co-benefits and synergistic solutions. In this context, it is not clear whether the results of traditional research, while important for many of the major issues of today, will provide solutions that are fit for the future.

Agricultural and food technology research efforts are essential to identify ways to reduce the environmental impacts of the production, processing and distribution of foods, and to enhance the ability of the food system

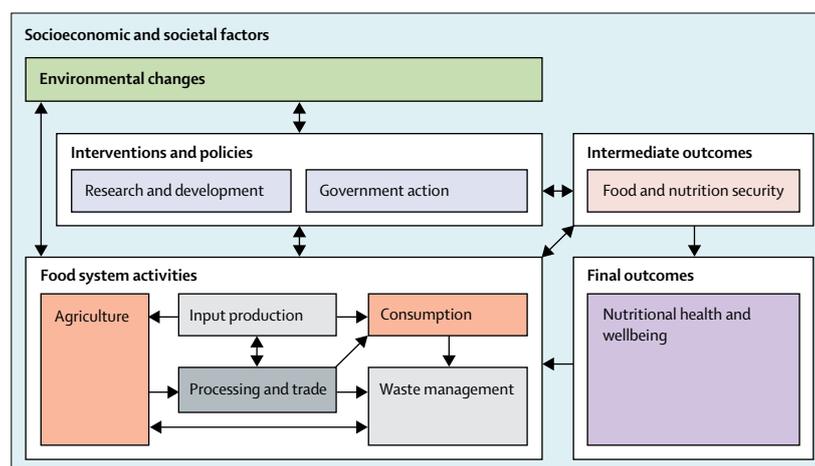


Figure: Framework of environmental change, food system, nutrition, and health interactions

to deliver healthy and nutritious diets to all in a rapidly changing environment. But engagement with people on planetary health, and designing mechanisms to encourage consideration of the public good aspects of food in addition to its private benefits is also critical for a sustained and collective impact. A recent online survey of more than 2000 British adults identified a relatively good public knowledge of climate change and the impact of the food system on the environment.¹⁰ However, although four in five of those asked stated that they would change their diets to improve their health, only a little more than half said that they would do so to reduce their impact on the environment.

Our ability to plan sustainable, equitable, and healthy food systems for the future requires integration of methods from distinct disciplines, innovation in analytical approaches and intersectoral policy analysis and engagement. The Rockefeller Foundation–Lancet Commission on Planetary Health¹¹ identified three first-order challenges to secure human health in the future: challenges of imagination, research, and governance. The complexities of this new planetary health research agenda and the enormous political and governance obstacles to transformational change may slow our collective progress. But let us not allow a lack of empathy and imagination thwart our ambition to deliver environmentally sustainable and healthy diets for all.

*Alan D Dangour, Georgina Mace, Bhavani Shankar
London School of Hygiene & Tropical Medicine, London, UK
(ADD); Leverhulme Centre for Integrative Research on Agriculture

and Health, London, UK (ADD, BS); University College London, London, UK (GM); and School of Oriental and African Studies, London, UK (BS)
alan.dangour@lshtm.ac.uk

We declare no competing interests.

Copyright © The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY license.

- 1 International Food Policy Research Institute. Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030. 2016. <http://www.ifpri.org/publication/global-nutrition-report-2016-promise-impact-ending-malnutrition-2030> (accessed March 1, 2017).
- 2 Black RE, Victora CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet* 2013; **382**: 427–51.
- 3 Forouzanfar MH, Alexander L, Anderson HR, et al. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2015; **386**: 2287–323.
- 4 United Nations. Zero hunger: why it matters? Sustainable development goal. 2015. http://www.un.org/sustainabledevelopment/wp-content/uploads/2016/08/2_Why-it-Matters_ZeroHunger_2p.pdf (accessed March 1, 2017).
- 5 UN Food and Agriculture Organization. UN General Assembly proclaims Decade of Action on Nutrition. 2016. <http://www.fao.org/news/story/en/item/408970/icode> (accessed March 1, 2017).
- 6 Challinor AJ, Watson J, Lobell D, Howden S, Smith D, Chhetri N. A meta-analysis of crop yield under climate change and adaptation. *Nat Clim Chan* 2014; **4**: 287–91.
- 7 UN Food and Agriculture Organisation. The state of the world's land and water resources for food and agriculture—managing systems at risk. 2011. <http://www.fao.org/docrep/017/i1688e/i1688e.pdf> (accessed March 1, 2017).
- 8 Smith MR, Singh GM, Mozaffarian D, Myers SS. Effects of decreases of animal pollinators on human nutrition and global health: a modelling analysis. *Lancet* 2015; **386**: 1964–72.
- 9 Lagi M, Bertrand KZ, Bar-Yam Y. The food crises and political instability in North Africa and the Middle East. 2011. http://necsi.edu/research/social/food_crises.pdf (accessed March 1, 2017).
- 10 Global Food Security. Public Attitudes to Climatic Shocks and their interaction with the Food System. 2017. <http://www.foodsecurity.ac.uk/assets/pdfs/public-attitudes-climatic-shocks-interaction-food-system.pdf> (accessed March 1, 2017).
- 11 Whitmee S, Haines A, Beyrer C, et al. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation–Lancet commission on planetary health. *Lancet* 2015; **386**: 1973–2028.