

Modern food emissions

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The modern food industry is reshaping society and contributing to global warming. Mitigation efforts at different levels are needed to promote environmental and human health.

The food sector is known as a major source of anthropogenic greenhouse gas emissions, contributing about 30% of the total global emissions, through livestock, fisheries, crop production, land-use changes and processing¹. Writing in this issue of *Nature Climate Change*, Ivanovich et al. further confirm in their [Analysis article](#) that global food consumption can add nearly 1°C to warming by the end of this century, driven by foods that are high sources of methane, such as beef, dairy and rice.

At the same time, new technologies and business models are reshaping the way we produce, distribute and consume food products. People have seen more food produced today per person than ever recorded, and fewer people are cooking at home. This large-scale intensification and specialization have been criticized because of the large associated environmental costs². A large body of research has explored the challenges and opportunities to mitigate the climate impact from agricultural practices.

From the consumer perspective, food has never been easier and cheaper to obtain. There is no doubt that the increased affordability has led to a continued growth in food demand. It is expected that total global food demand will increase by up to 56% between 2010 and 2050 (ref. ³). This diet-driven trend, combined with the overall increase in the population and expansion of the middle class, will put a number of pressures on future food security, and



will raise issues of inequality as some of the world's population still has limited access to adequate nutrition⁴.

Fast food chains, which have swept the restaurant landscape over the past 50 years around the world as a convenient and affordable option, are one example causing serious concern because of their climate impacts. They use a high number of carbon-intensive ingredients, such as beef, and have high levels of energy use and packaging as well as food waste. Even though fast food chains are trying to reduce their carbon footprint by adding climate impact labels or climate-healthy choices, concerns remain that these initiatives are mainly greenwashing.

With the development of online-to-offline mobile technology, online food delivery services have gained popularity over the past few years, and lockdowns related to the COVID-19 pandemic accelerated this trend. Similarly to fast food chains, these services could cause larger food-related emissions, because of their intensive use of packaging and transportation. Their decentralized operation makes it even harder for these companies to reduce their carbon impact through effective supply-chain management.

Another signature of the modern food industry is ultra-processed foods. Refined additives used to enhance sensory qualities

have become the foundation of the daily diet and made up 58% of the energy intake in the United States⁵. One study found that ultra-processed foods can contribute up to one-third of the total diet-related greenhouse gas emissions, in particular for adults in developed countries⁶.

Beyond environmental health concerns, such dietary shifts could have serious negative impacts on human health. The overuse of ultra-processed foods is found to be linked to an increase in non-communicable diseases, as well as to overweight and obesity. Thus, dietary choices that offer both climate and health benefits are needed. In fact, a previous study has proven the feasibility of such options and wide adoption is urgently needed⁷.

Although the development of the modern food industry has improved the welfare of people from many regions, it is now time to move onto the next stage to address the future challenges. Green transitions within the food industry are necessary, as well as changes in consumer behaviour and habit. Progress is already happening, but individuals, society, corporations and governments need to continue to work together to promote further change.

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References

1. Poore, J. & Nemecek, T. *Science* **360**, 987–992 (2018).
2. Ritchie, H. You want to reduce the carbon footprint of your food? Focus on what you eat, not whether your food is local. *Our World in Data* <https://go.nature.com/3kmXEP5> (24 January 2020).
3. van Dijk, M., Morley, T., Rau, M. L. & Saghai, Y. *Nat. Food* **2**, 494–501 (2021).
4. *Global Agriculture Towards 2050: How to Feed the World 2050* (FAO, 2009).
5. Steele, E. M. et al. *BMJ Open* **6**, e009892 (2016).
6. Anastasiou, K., Baker, P., Hadjikakou, M., Hendrie, G. A. & Lawrence, M. J. *Clean. Prod.* **368**, 133155 (2022).
7. Tilman, D. & Clark, M. *Nature* **515**, 518–522 (2014).