

# Feeding 10 billion people by 2050 within planetary limits may be achievable

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A global shift toward healthy and more plant-based diets, halving food loss and waste, and improving farming practices and technologies are required to feed 10 billion people sustainably by 2050, a new study finds. Adopting these options reduces the risk of crossing global environmental limits related to climate change, the use of agricultural land, the extraction of freshwater resources, and the pollution of

ecosystems through overapplication of fertilizers, according to the researchers.

The study, published in the journal *Nature*, is the first to quantify how [food](#) production and consumption affects the planetary boundaries that describe a safe operating space for humanity beyond which Earth's vital systems could become unstable.

"No single solution is enough to avoid crossing planetary boundaries. But when the solutions are implemented together, our research indicates that it may be possible to feed the growing population sustainably," says Dr. Marco Springmann of the Oxford Martin Programme on the Future of Food and the Nuffield Department of Population Health at the University of Oxford, who led the study.

"Without concerted action, we found that the environmental impacts of the food system could increase by 50-90 percent by 2050 as a result of population growth and the rise of diets high in fats, sugars and meat. In that case, all [planetary boundaries](#) related to food production would be surpassed, some of them by more than twofold."

The study, funded by EAT as part of the EAT-Lancet Commission for Food, Planet and Health and by Wellcome's "Our Planet, Our Health" partnership on Livestock Environment and People, combined detailed environmental accounts with a model of the global food system that tracks the production and consumption of food across the world. With this model, the researchers analysed several options that could keep the food system within environmental limits. They found:

- Climate change cannot be sufficiently mitigated without dietary changes toward more plant-based diets. Adopting more plant-based "flexitarian" diets globally could reduce greenhouse gas emissions by more than half, and also reduce other

environmental impacts, such as fertilizer application and the use of cropland and freshwater, by a tenth to a quarter.

- In addition to dietary changes, improving management practices and technologies in agriculture is required to limit pressures on [agricultural land](#), freshwater extraction, and fertilizer use. Increasing agricultural yields from existing cropland, balancing application and recycling of fertilizers, and improving water management, could, along with other measures, reduce those impacts by around half.
- Finally, halving food loss and waste is needed for keeping the food system within environmental limits. Halving food loss and waste could, if globally achieved, reduce environmental impacts by up to a sixth (16 percent).

"Many of the solutions we analysed are being implemented in some parts of the world, but it will need strong global co-ordination and rapid upscale to make their effects felt," says Springmann.

"Improving farming technologies and management practices will require increasing investment in research and public infrastructure, the right incentive schemes for farmers, including support mechanisms to adopt best available practices, and better regulation, for example of fertilizer use and water quality," says Line Gordon, executive director of the Stockholm Resilience Centre and an author on the report.

Fabrice de Clerck, director of science at EAT says, "Tackling food loss and waste will require measures across the entire food chain, from storage, and transport, over food packaging and labelling to changes in legislation and business behaviour that promote zero-waste supply chains."

"When it comes to diets, comprehensive policy and business approaches are essential to make [dietary changes](#) toward healthy and more plant-

based diets possible and attractive for a large number of people. Important aspects include school and workplace programmes, economic incentives and labelling, and aligning national dietary guidelines with the current scientific evidence on healthy eating and the environmental impacts of our diet," adds Springmann.

The paper, "Options for keeping the food system within environmental limits," will be published by *Nature* on 10th October 2018.

**More information:** Marco Springmann et al, Options for keeping the food system within environmental limits, *Nature* (2018). [DOI: 10.1038/s41586-018-0594-0](https://doi.org/10.1038/s41586-018-0594-0)

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