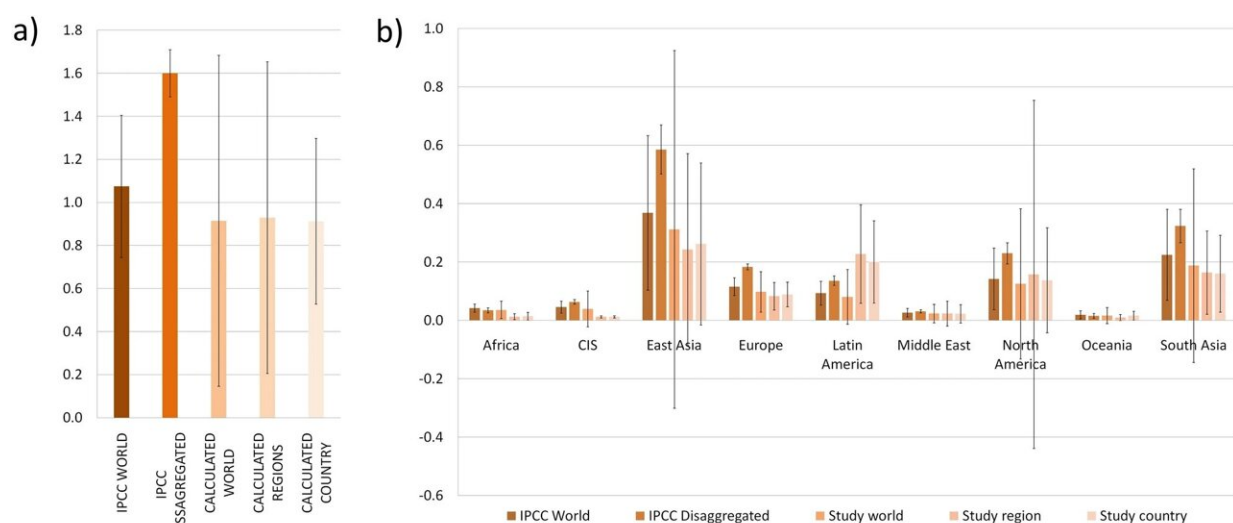


Fertilizers cause more than 2% of global emissions

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(a) global direct soil emissions (TgN₂O) calculated using different emission factors; (b) regional direct soil emissions (TgN₂O) calculated using different emission factors. Gray bars indicate standard deviation. Credit: *Scientific Reports* (2022). DOI: 10.1038/s41598-022-18773-w

Synthetic nitrogen fertilizers account for 2.1% of global greenhouse gas emissions, new research shows.

Unlike organic fertilizers, which come from plant or animal material, synthetic fertilizers are made by humans using chemical processes. Production and transportation cause [carbon emissions](#), while agricultural

use of these fertilizers leads to the release of nitrous oxide (N_2O)—a greenhouse gas 265 times more potent than carbon dioxide (CO_2) over a century.

The research team—from the Greenpeace Research Laboratories at the University of Exeter, and the University of Turin—found that the synthetic nitrogen fertilizer supply chain was responsible for emitting the equivalent of 1.13 gigatonnes of CO_2 in 2018.

This is more than 10% of [global emissions](#) from agriculture, and more than the emissions from commercial aviation in that year. The top four emitters—China, India, U.S. and the EU28 (European Union countries plus the UK)—accounted for 62% of the total.

"There is no doubt that emissions from synthetic nitrogen fertilizers need to be reduced—instead of increasing, as is currently predicted," Dr. Reyes Tirado, from the Greenpeace Research Laboratories.

"The global agri-food system relies on synthetic nitrogen to increase [crop yields](#), but use of these fertilizers is unsustainable."

"Emissions could be reduced without compromising [food security](#)."

"At a moment when synthetic fertilizer prices are skyrocketing, mirroring the energy crisis, reducing their use could both benefit farmers and help us tackle the climate crisis."

When nitrogen fertilizer is applied to soil, some is taken up by plants and some is used by soil micro-organisms, which produce N_2O as a by-product of their metabolism. Nitrogen can also end up leaching from the site.

The researchers say the most effective strategy for cutting emissions is

to reduce over-fertilization—which currently happens in most cases.

"We need a comprehensive scheme to reduce overall use of fertilizers and to increase efficiency of nitrogen recycling in agricultural and food systems," said Dr. Stefano Menegat, from the University of Turin.

"We can produce enough food for a [growing population](#) with a much smaller contribution to [global greenhouse gas emissions](#), without compromising yields."

"Shifting dietary patterns towards less meat and dairy products could play a central role."

"Three quarters of nitrogen in [crop production](#) (expressed in terms of protein and including bioenergy by-products) is currently devoted to livestock feed production globally."

The study's data, from 2018, showed North America had the highest annual per person nitrogen fertilizer use (40 kg) followed by Europe (25-30 kg). Africa had the lowest use (2-3 kg).

The research team developed the largest field-level dataset available on N₂O soil emissions. Using this, they estimated national, regional and global N₂O direct emission factors, while they used existing literature to find emission factors for indirect N₂O soil emissions, and for nitrogen fertilizer manufacturing and transportation.

The paper is published in the journal *Scientific Reports*.

More information: Stefano Menegat et al, Greenhouse gas emissions from global production and use of nitrogen synthetic fertilisers in agriculture, *Scientific Reports* (2022). [DOI: 10.1038/s41598-022-18773-w](#)

Provided by University of Exeter

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