

Nitrous oxide emissions 300 times more powerful than carbon dioxide are jeopardising Earth's future

October 8 2020, by Pep Canadell



Credit: AI-generated image ([disclaimer](#))

Nitrous oxide from agriculture and other sources is accumulating in the atmosphere so quickly it puts Earth on track for a dangerous 3°C warming this century, [our new research](#) has found.

Each year, [more than 100 million tons of nitrogen](#) are spread on crops in the form of synthetic fertilizer. The same amount again is put onto pastures and crops in manure from livestock.

This colossal amount of nitrogen makes crops and pastures grow more abundantly. But it also releases [nitrous oxide](#) (N_2O), a greenhouse gas.

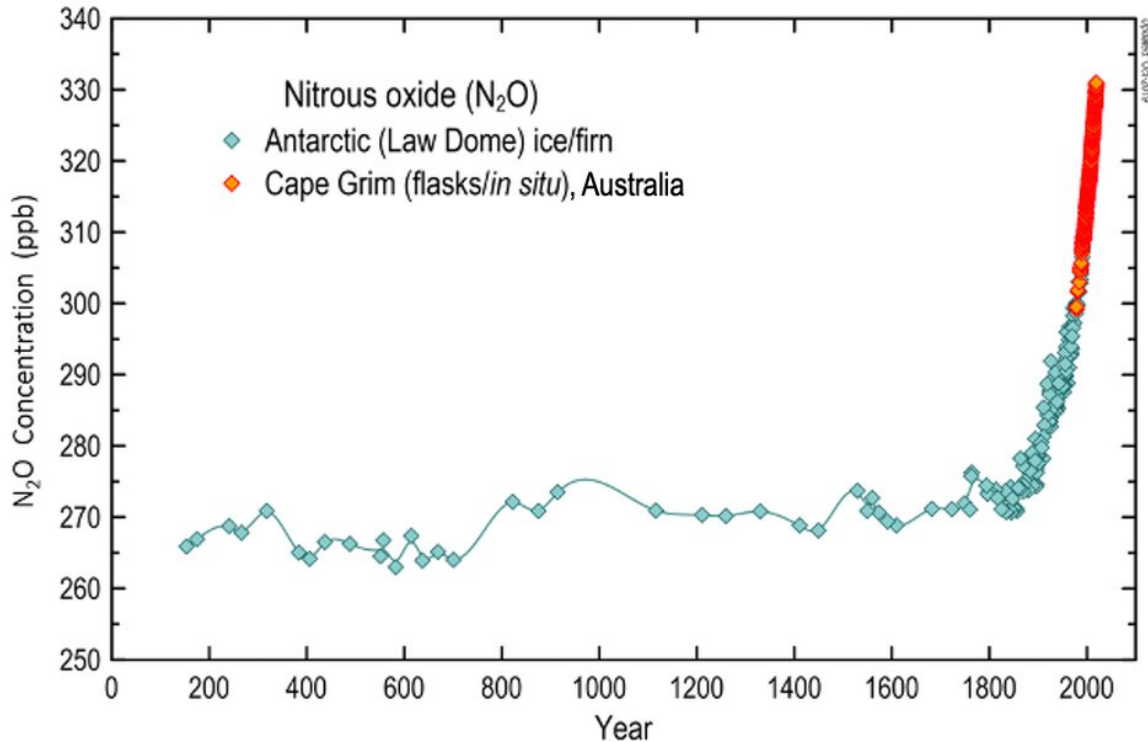
Agriculture is the main cause of the increasing concentrations, and is likely to remain so this century. N_2O emissions from agriculture and industry can be reduced, and we must take urgent action if we hope to stabilize Earth's climate.

Where does nitrous oxide come from?

We found that N_2O emissions from natural sources, such as soils and oceans, have not changed much in recent decades. But emissions from human sources have increased rapidly.

Atmospheric concentrations of N_2O reached 331 parts per billion [in 2018](#), 22% above levels around the year 1750, before the industrial era began.

Agriculture caused [almost 70%](#) of global N_2O emissions in the decade to 2016. The emissions are created through [microbial processes](#) in soils. The use of nitrogen in synthetic fertilizers and manure is a key driver of this process.



2000 years of atmospheric nitrous oxide concentrations. Observations taken from ice cores and atmosphere. Credit: BoM/CSIRO/AAD

Other human sources of N₂O include the chemical industry, waste water and the burning of fossil fuels.

N₂O is destroyed in the upper atmosphere, primarily by [solar radiation](#). But humans are emitting N₂O faster than it's being destroyed, so it's accumulating in the atmosphere.

N₂O both depletes the [ozone layer](#) and contributes to [global warming](#).

As a greenhouse gas, N₂O has 300 times the warming potential of carbon dioxide (CO₂) and stays in the atmosphere for an average 116 years. It's the third most important greenhouse gas after CO₂ (which lasts up to

thousands of years in the atmosphere) and methane.

N_2O depletes the ozone layer when it interacts with ozone gas in the stratosphere. Other ozone-depleting substances, such as chemicals containing chlorine and bromine, have been banned under the United Nations [Montreal Protocol](#). N_2O is not banned under the protocol, although the Paris Agreement seeks to reduce its concentrations.



Credit: AI-generated image ([disclaimer](#))

What we found

The Intergovernmental Panel on Climate Change has developed [scenarios](#) for the future, outlining the different pathways the world could take on emission reduction by 2100. [Our research](#) found N_2O

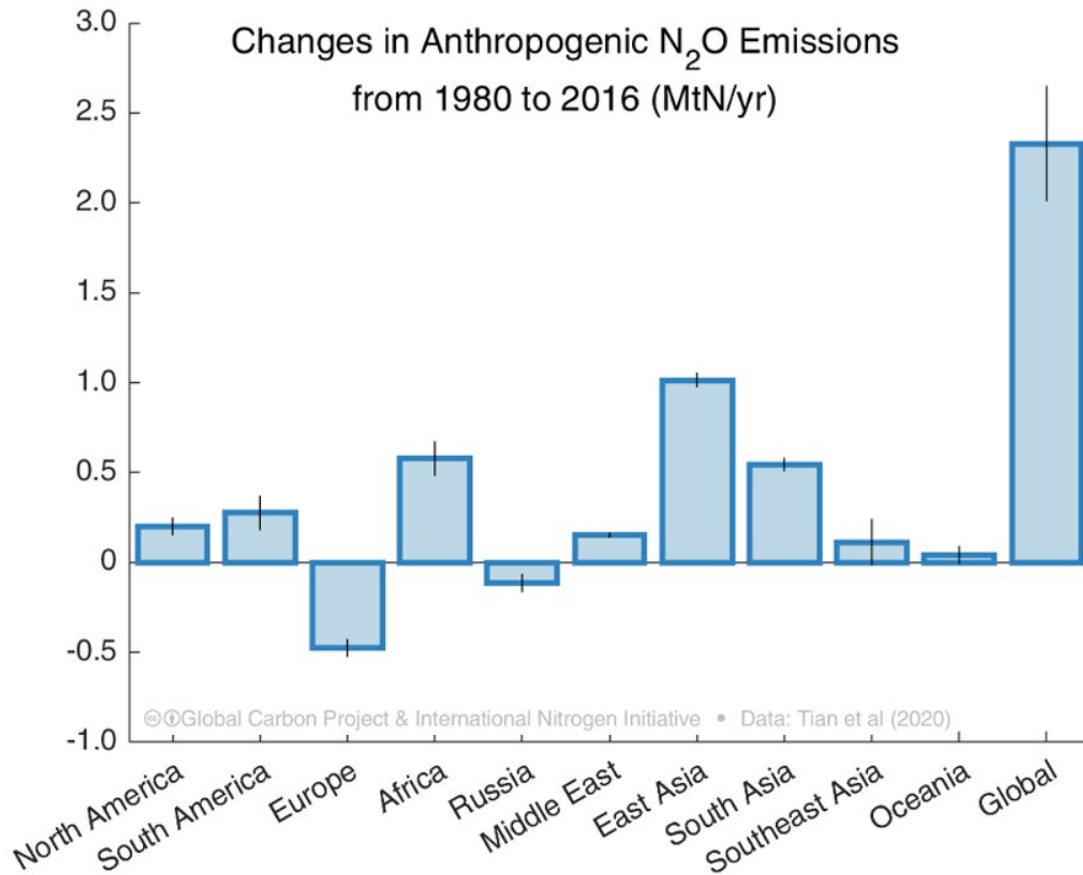
concentrations have begun to exceed the levels predicted across all scenarios.

The current concentrations are in line with a global average temperature increase of well above 3°C this century.

We found that global human-caused N₂O emissions have grown by 30% over the past three decades. Emissions from agriculture mostly came from synthetic nitrogen fertilizer used in East Asia, Europe, South Asia and North America. Emissions from Africa and South America are dominated by emissions from livestock manure.

In terms of emissions growth, the highest contributions come from emerging economies—particularly Brazil, China, and India—where crop production and livestock numbers have increased rapidly in recent decades.

N₂O emissions [from Australia](#) have been stable over the past decade. Increase in emissions from agriculture and waste have been offset by a decline in emissions from industry and fossil fuels.



Regional changes in N₂O emissions from human activities, from 1980 to 2016, in million tons of nitrogen per year. Data from: Tian et al. 2020, Nature. Credit: Global Carbon Project & International Nitrogen Initiative

What to do?

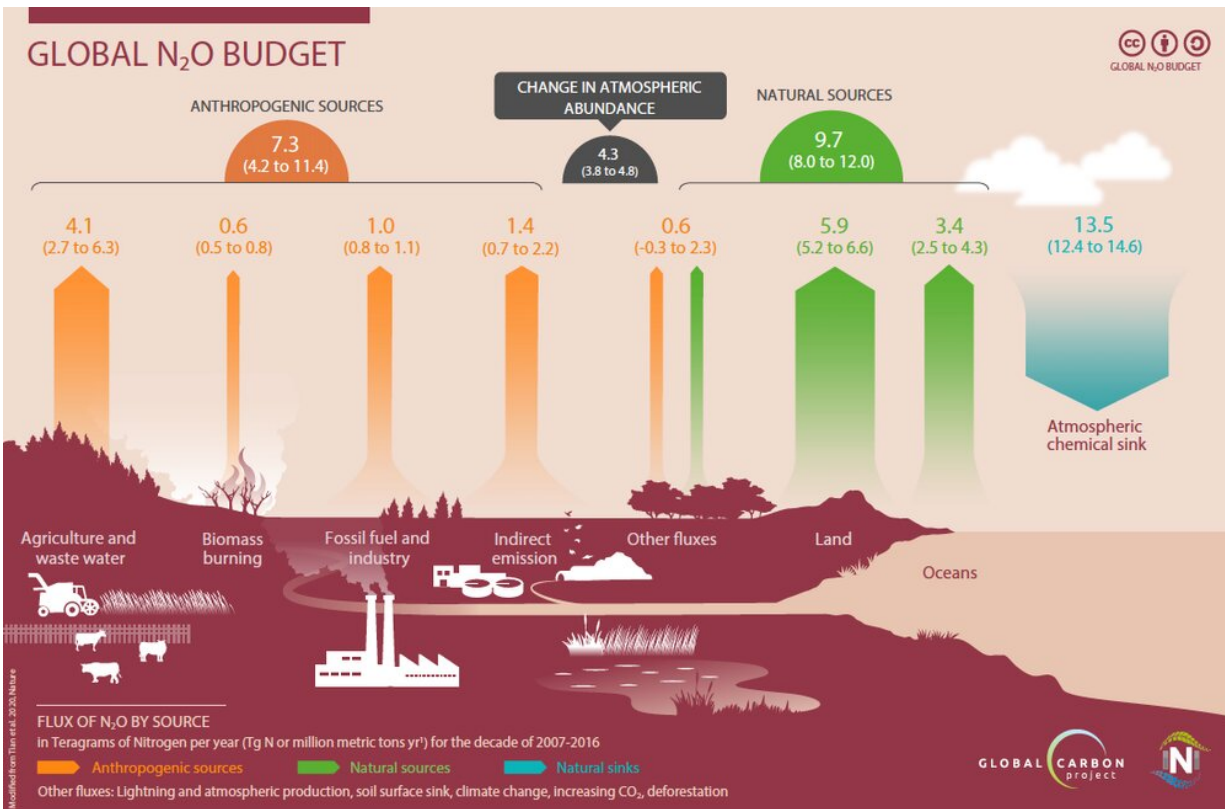
N₂O must be part of efforts to reduce greenhouse gas emissions, and there is already work being done. Since the late 1990s, for example, efforts to reduce emissions from the chemicals industry have been successful, particularly in the production of [nylon](#), in the [United States](#), Europe and Japan.

Reducing emissions from agriculture is more difficult—food production must be maintained and there is no simple alternative to nitrogen fertilizers. But some options do exist.

In Europe over the past two decades, N_2O emissions have fallen as agricultural productivity increased. This was largely achieved through [government policies](#) to reduce pollution in waterways and drinking water, which encouraged [more efficient fertilizer use](#).

Other ways to reduce N_2O emissions from agriculture include:

- better management of animal manure
- applying fertilizer in a way that better matches the needs of growing plants
- alternating crops to include those that produce their own nitrogen, such as legumes, to reduce the need for fertilizer
- enhanced efficiency fertilizers that lower N_2O production.



Global nitrous oxide budget 2007-16. Credit: Adopted from Tian et al. 2020. Nature. Source: Global Carbon Project & International Nitrogen Initiative.

Getting to net-zero emissions

Stopping the overuse of nitrogen fertilizers is not just good for the climate. It can also reduce water pollution and increase [farm profitability](#)

Even with the right agricultural policies and actions, synthetic and manure fertilizers will be needed. To bring the sector to net-zero [greenhouse gas emissions](#), as needed to stabilize the climate, new technologies will be required.

This article is republished from [The Conversation](#) under a Creative Commons license. Read the [original article](#).

Provided by The Conversation

Citation: Nitrous oxide emissions 300 times more powerful than carbon dioxide are jeopardising Earth's future (2020, October 8) retrieved 25 June 2024 from <https://phys.org/news/2020-10-nitrous-oxide-emissions-powerful-carbon.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.