

Plants emit greenhouse gas nitrous oxide at substantial amounts

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Sterile tobacco plants in the climate chamber. Credit: Steffen Greiner, Heidelberg University, COS

Nitrous oxide, or N_2O , is a greenhouse gas that affects the ozone layer and the earth's climate. Until now, experts believed that microbes in the soil were largely responsible for its formation. Now an interdisciplinary research team from the University of Applied Sciences Bingen and Heidelberg University have looked more closely at plants as the source. The result of the study: The earth's flora emits considerable amounts of nitrous oxide that contributes to the greenhouse gas effect. Unlike human-induced global warming, however, this process is part of a natural effect.

Until now, climate reports like those from the UN's IPCC did not include plants as a significant source of nitrous oxide in the global climate budget. Yet to accurately calculate the human contribution to the greenhouse gas effect, it is essential to identify and quantify all sources of greenhouse gases – including the natural ones. The current study shows that all the plants studied emit nitrous oxide and contribute significantly to total N_2O emissions. The researchers report that based on these studies, emissions from plants could make up roughly five to ten percent of nitrous oxide in the earth's atmosphere. "To truly understand the role of plants in the nitrous oxide cycle and to quantify it more precisely, further studies on representative types of plants, especially trees, are needed," stresses Prof. Dr. Katharina Lenhart. "This study was just a first step toward quantifying plant emissions of nitrous oxide and understanding the related biochemical processes," states the researcher, a professor of botany, limnology and ecotoxicology at the University of Applied Sciences Bingen and guest scientist at Heidelberg University.

To determine the amount of N_2O emissions, the researchers studied 34

different plants under controlled conditions in a closed laboratory. Among the plants were tobacco, corn, and lavender. To avoid contamination with bacteria-generated nitrous oxide, some of the experiments were conducted under sterile conditions. All the experiments took place in the dark so that the nitrous oxide emitted could be related to plant respiration. Like humans, plants release carbon dioxide (CO₂) when they breathe. The opposite and generally better known process of CO₂ absorption, however, occurs only in the presence of light during photosynthesis. "The N₂O and CO₂ ratio is correlated, so we were able to use the ample existing research on plant carbon dioxide emissions to calculate the amount of nitrous oxide released," explains Prof. Lenhart.

Isotope analyses were also carried out, because all nitrous-oxide-producing processes release a nitrous oxide molecule with a typical isotope fingerprint, including plants. "By measuring the composition of the isotopes, we were able to clearly demonstrate that most of the nitrous oxide is not released by bacteria in the soil, and that it differs from all the previously known sources," adds Prof. Dr. Frank Keppler, who directs the Biogeochemistry Research Group at Heidelberg University's Institute of Earth Sciences. In the next phase, the researchers will verify their laboratory results in field studies and include other plant species in their investigations. They also want to explore which biochemical process contributes to the formation of nitrous oxide in plants and the role of the biosphere in nitrous [oxide](#) formation in geological history. One particularly interesting question is how increasing global temperatures affect the rate at which plants release [nitrous oxide](#).

The research results were published in the journal *New Phytologist*.

More information: Katharina Lenhart et al. Nitrous oxide effluxes from plants as a potentially important source to the atmosphere, *New Phytologist* (2018). [DOI: 10.1111/nph.15455](https://doi.org/10.1111/nph.15455)

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