

How much greenhouse gas do tropical soils emit?

January 30 2023, by Sarah Derouin



Examples of intact soil cores a) collected/stored (soils in image are not from Puerto Rico) and b) sealed into incubation jars (soils in image are from Puerto Rico but may not have been used for gas measurements) for N₂ and N₂O measurement using the Nitrogen Free Air Recirculation Method (N-FARM). Credit: *Journal of Geophysical Research: Biogeosciences* (2023). DOI: 10.1029/2022JG007210

Nitrogen changes form as it cycles between air, soil, and life. Soils, for example, emit nitrogen either as inert dinitrogen (N_2), which dominates our atmosphere, or as nitric oxide (NO) or nitrous oxide (N_2O), the greenhouse gases that warm it.

Understanding what types of nitrogen gas emissions are coming from soils is important in managing [greenhouse gas emissions](#) and characterizing nitrogen budgets globally. But because Earth's atmosphere is teeming with dinitrogen gas, it can be difficult to measure the small N_2 emissions from soils amid the high background concentrations.

Almaraz et al. headed to Puerto Rico to better understand how tropical soils emit nitrogen as N_2 or N_2O . They discovered that dinitrogen dominated soil emissions, but the exact ratio depended on the topography and soil moisture.

The researchers took soil cores from Luquillo Experimental Forest in Puerto Rico at various topographic gradients, including valleys and ridges and the slopes that lie in between. In the laboratory, they incubated the samples in an artificial atmosphere, which replaced the soil's nitrogen with mixtures of oxygen and helium. This method allowed the team to measure the forms of nitrogen as it left the [soil](#).



Researchers measured soil nitrogen emissions from Luquillo Experimental Forest in Puerto Rico. Within the 11,540 hectares of land are mountain ridges, deep valleys, and pristine rivers. Credit: U.S. Department of Agriculture, Public Domain

They found that dinitrogen dominated the samples. Furthermore, wet valleys emitted more N_2 , NO , and N_2O than aerated ridges and slopes. The team estimates that in total, tropical forest soils emit about 37 kilograms of nitrogen per hectare per year, with 99% of the gas being N_2 .

The researchers suggest that dinitrogen fluxes might have been underestimated in lowland tropical forest landscapes in the past, and they call for a reevaluation of nitrogen budgets in light of these new findings.

The research is published in the *Journal of Geophysical Research*:

Biogeosciences.

More information: Maya Almaraz et al, Dinitrogen Emissions Dominate Nitrogen Gas Emissions From Soils With Low Oxygen Availability in a Moist Tropical Forest, *Journal of Geophysical Research: Biogeosciences* (2023). [DOI: 10.1029/2022JG007210](https://doi.org/10.1029/2022JG007210)

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