Immediate Impact of Elevated Nitrogen Input on Trace Gases Emissions in an Old-Growth Lowland Forest in Panama

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Abstract

In tropical areas, nitrogen (N) emission, transport and deposition are projected to increase rapidly in the next decades. In this study, the consequences of elevated N input on trace gases emissions from a tropical lowland forest soil were evaluated. The study site is located in Gigante Peninsula, Panama, which included control and N addition treatments each with four replicate plots. Urea-N was applied twice in 2006 (April 28 and June 6) at a rate of 31.25 kg N ha⁻¹ each application. Nitrous oxide (N₂O), nitric oxide (NO), carbon dioxide (CO₂) and methane (CH₄) fluxes were intensively measured prior to and until one month after the second N application; this measurement period was within the beginning of the rainy season. We observed significantly higher NO emissions from the N-fertilised than the control plots, but N₂O, CO₂ and CH₄ fluxes did not differ. The increased NO fluxes were largely observed during the first week after the second fertilisation, when water-filled pore space (WFPS) has increased as the rainy season progressed. N₂O emissions could possibly increase with N addition when soil moisture further increase into the rainy season. The significant correlation between N₂O + NO fluxes and NH₄⁺ levels and the range of WFPS (40–60 %) indicated that N trace gases were possibly predominantly produced by nitrification. The fertiliser-induced N oxide emission was 3 % of the applied N. The CO₂ and CH₄ fluxes indicated that initial N addition did not bring detectable change in microbial decomposition and root respiration for CO₂ emissions and in CH₄ consumption and production for CH₄ fluxes, at least during the early rainy season covered in our measurement.

Keywords: Climate change, denitrification, N cycling, nitrification, tropical lowland forest

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