Dynamics of N_2O Emissions from Amazonian Tropical Peat Forest and Partitioning N-Processes Using ^{15}N Isotopes

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Tropical peatlands are crucial for global nitrogen (N) cycling because they store large amounts of carbon and N. This study, conducted in November 2023, investigated the dynamics of N_2O emissions from Amazonian peatland forests in Peru. It focused specifically on two peatland forest sites in Iquitos: the *Quistococha* and *Zungarococha* forests. We conducted static chamber gas measurements to assess soil greenhouse gas (GHG) fluxes. Additionally, we took soil samples for physical and chemical properties and soil microbiome (DNA & RNA). In order to investigate the source processes for N_2O production and consumption, we applied ^{15}N isotopes as tracers in soil. Our results indicate that both forests exhibited different trends in soil GHG fluxes and N substrates. Quistococha had higher levels of soil nitrate and ammonium compared to Zungarococha, which correlated with increased N_2O emissions from Quistococha. A similar pattern was observed for CO_2 emissions, with Quistococha producing higher levels than Zungarococha. Contrastingly, Zungarococha had higher soil moisture levels, which aligned with its lower N_2O emissions. This forest also showed greater soil N_2 emissions, suggesting the potential for complete denitrification. However, this site was also a significant source of CH_4 emissions due to its higher soil moisture, which supports methanogenic activity. Overall, the two sites demonstrated distinct behaviors: Quistococha was a source of N_2O and CO_2, influenced by intermediate soil moisture. Zungarococha emitted higher levels of CH_4 and N_2 due to its high soil moisture conditions. The application of ^{15}N tracers increased soil N_2O emissions only in Quistococha, while we did not observe a significant increase in Zungarococha, suggesting that complete denitrification may be the dominant process there. This is further supported by ^{15}N isotopic mapping, correlating N_2O emissions with their source processes. The site preference values fall within the denitrification zone at Zungarococha and the nitrification zone, with some hybrid processes in Quistococha. The microbiome analyses show similar results, with denitrifying microbes dominating the Zungarococha soil and nitrifying microbes dominating the Quistococha soil.