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Nitrogen availability links soil nitrous oxide and nitric oxide fluxes with forest productivity of a tropical montane forest in southern Ecuador

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Tropical forests are important sources of the greenhouse gas nitrous oxide (N2O) and of nitric oxide (NO), a precursor of ozone. In tropical montane forests nitrogen limitation is common which affects both soil N2O and NO fluxes and forest productivity. Here we present evidence that forest productivity and N-oxide (N2O+NO) fluxes are linked through N availability across elevation and topographic gradients in tropical montane forests. We measured N-oxide fluxes, several indices of N availability, and forest productivity along an elevation gradient from 1000 m to 3000 m and across topographic gradients. Organic layer thickness of the soils increased and N availability decreased with increasing elevation and along the topographic gradient from the lower slope position to the ridges. Annual N2O fluxes ranged from -0.53 μg(N)m-2h-1 to 14.54 μg(N)m-2h-1 while NO fluxes ranged from -0.02 μg(N)m-2h-1 to 1.13 μg(N)m-2h-1. Both N-oxide fluxes and forest productivity increased with increasing N availability and showed close positive correlations with indices of N availability (C/N ratio and 15N signature of litterfall). We interpret the close correlations of N-oxide fluxes with total litterfall and tree basal area increment as evidence that N availability links N-oxide fluxes and forest productivity. This opens the possibility to include forest productivity as co-variable in predictions of N-oxide fluxes in nitrogen limited tropical montane forests. Especially increment of tree basal area was a promising proxy to predict soil N-oxide fluxes in these N limited ecosystems, possibly because it better reflects long-term forest productivity than total litterfall.