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Will a changed element composition of rainfall - due to climate change - affect the biogeochemical cycle of montane forest soils in Southern Ecuador?

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Increasing biomass burning, fertilization and industrialization in tropical areas will generally lead to a greater N deposition in the Tropics including the northern Andean forests in the coming decades. In previous work, we detected extra Ca deposition from the atmosphere in the northern Andes originating from Sahara dust during a pronounced la Niña event. Therefore, the possible shortening of the El Niño Southern Oscillation might result in more frequent Ca input into the northern Andean forests.
We quantify biogeochemical processes in a tropical montane forest in southern Ecuador at 2000 m a.s.l. in response to N and Ca additions to simulate elevated N and Ca deposition from the atmosphere. Four replicate experimental plots under native forest were fertilized with either 50 kg N or 10 kg Ca ha-1 y-1 with urea (46%) and CaCl2.2H2O, respectively, distributed between two dates per year and the effects were compared with non-fertilized control plots. We collected litter percolate with zero-tension lysimeters, soil solution with suction cups at 0.15 and 0.30 m, rainfall and throughfall. Samples were analyzed for concentrations of total N, nitrate, ammonium, dissolved organic nitrogen (DON) and Ca.
Two months after the first fertilization, nitrogen addition mainly stimulates microbial activity where in a priming effect ammonium is transferred to nitrate and soil organic matter is mineralised, resulting in increased DON concentrations. This stimulation would also release other nutrients than N which in turn enhance tree growth. Total nitrogen concentration in litter leachate increased slightly after N fertilization from 1.75 mg/l to 1.8 mg/l, which represents about 1.5% of the total applied N. In contrast, the low Ca concentrations in litter leachate doubled from 0.10 mg/l to 0.20 mg/l after Ca addition, which on yearly basis would represent about 15% of the total applied Ca.
From these preliminary results we conclude that (i) both added N and Ca are net retained in the forest suggesting that these elements are needed by the organisms of the ecosystem and (ii) particularly the N addition seems to stimulate nitrification and mineralization of soil organic matter. Thus, N and Ca input likely will contribute to eutrophication of the tropical montane forest with possible implications for the biodiversity of the study forest.