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Seasonality of microbial organic matter decomposition affecting phosphorus availability in a Central Amazonian tropical lowland rainforest soil

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Large areas in the Amazon Basin consist of old and highly weathered soils. In these soils, P is either chemically or physically occluded with very low stocks of inorganic P immediately available for plant or microbial uptake. Thus, Amazonian ecosystem productivity is more constrained by phosphorus (P) than by nitrogen (N) availability. In these poor P soils, microbial dynamics associated to P cycling play a crucial role in controlling the plant available P pool: in P-poor tropical soils microbial biomass can be a large P stock, and moreover, microbes allocate C and N to increase the production of phosphatases enzymes to mineralize organic forms of P.
To get more insights in the role and dynamics of microbe-mediated soil nutrient cycling we collected soil samples monthly from a primary tropical lowland rainforest in Central Amazonia near Manaus, Brazil. We determined microbial biomass and used extracellular enzyme rates (β-glucosidase, N-acetylglucosaminidase, acid phosphatase) and heterotrophic soil respiration rates as activity indicators. Our first results show that microbial investment in P acquisition, indicated by potential acid phosphatase activities, is high in these low P soils. Moreover, during the year, we found significant fluctuations in soil organic P pools, as well as strong fluctuation of microbial activity. Soil extracellular enzyme activities and heterotrophic respiration rates increased with litterfall inputs, and responded to increased rainfall frequency. Importantly, phosphatase activity rates were positively correlated with soil inorganic N concentrations suggesting that greater N availability may allow microbes to invest more in P acquisition. By including microbial biomass C, N and P stocks, we will be able to evaluate the interactions between microclimate and nutrient availability on microbial metabolic quotients. This study will give further insights into nutrient acquisition strategies in tropical soil P cycling, increasing our understanding of the role of soil microbial activity on the net primary productivity of Amazonian forests.