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Is microbial carbon use efficiency and soil N and P cycling controlled by P availability in tropical forest soils across the Amazon Basin?

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The Amazon Basin represents the largest intact tropical rainforest ecosystem. On a large scale the Basin is characterized by an east-west gradient in geology and soil fertility, with rather nutrient (particularly P) poor soils in the Eastern Amazon and more fertile soils in the West. On a smaller scale, local topography influences soil mineralogy, texture, and nutrient stocks and availability. Such gradients have been shown to affect plant productivity, but how the decomposition of organic matter by soil microbial communities, which is crucial for making nutrients available for plants, is controlled by such gradients has rarely been evaluated. We therefore collected forest soils from representative regions in the Eastern, Central and Western Amazon Basin at different topographic locations and two different soil depths (0-5 cm and 5-15 cm) to cover a wide range of soil types, texture and nutrient availability. In these soils we determined nutrient pools, microbial biomass and growth, as well as microbially mediated nutrient cycling rates to determine how these pools and processes affect microbial carbon use efficiency (CUE), an important indicator for microbial C sequestration.

Our preliminary results confirmed a pronounced gradient of total soil P from east to west that was also related to soil texture, with highest total P and available P (both Olsen and Bray-P) concentrations in younger, silty soils in the Western Amazon. Microbial biomass was positively related to both total and available P concentrations, and even more strongly positively correlated to soil organic N pools. Extracellular enzyme activity rates increased with microbial biomass and were highest in nutrient-rich soils. We hypothesize that soils with higher nutrient availability will not only foster high soil microbial activities, but similarly increase microbial CUE, thus emphasizing the importance of soil microbes for C sequestration.