Effects of vegetation on soil microbial dynamics in a tropical forest and savanna of eastern Cameroon

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The forest-savanna transition zone is widely distributed on nutrient-poor Oxisols in central Africa. Our previous studies of soil nutrient stock in this area showed that forest is likely N rich and P limited ecosystems, due to the N-fixation tree, though savanna is likely N limited ecosystems. To reveal and compare the nutrient flow in relation to soil microbes for forest and savanna vegetation in this area, we evaluated seasonal fluctuations in microbial biomass carbon (MBC), nitrogen (MBN), and phosphorus (MBP) for 1 year as well as soil moisture, temperature, soil pH, and extractable soil nutrients for both vegetation types in eastern Cameroon. Soil pH was significantly lower in forest (4.3) than in savanna (5.6), and soil extractable N was larger in forest (87.1 mg N kg^{-1} soil) than in savanna (32.9 mg N kg^{-1} soil). We found a significant positive correlation between soil moisture and MBP in forest, indicating the importance of organic P mineralization for MBP, whereas in savanna, we found a significant positive correlation between soil N availability and MBP, indicating N limitation for MBP. These results indicate that forest is an N-saturated and P-limited ecosystem, whereas savanna is an N-limited ecosystem for soil microbes. Interestingly, we observed a significantly lower MBN and larger MB C:N ratio in forest (50.7 mg N kg^{-1} soil and 8.6, respectively) than in savanna (60.0 mg N kg^{-1} soil and 6.5, respectively) during the experimental period, despite the rich soil N condition in forest. This may be due to the significantly lower soil pH in forest, which influences the different soil microbial communities (fungi-to-bacteria ratio) in forest versus savanna, and therefore, our results indicate that, in terms of microbial N dynamics, soil pH rather than soil substrate conditions controls the soil microbial communities in this area.

Keywords: Soil N and P dynamics, Soil microbial dynamics, Forest-savanna transition zone, Tropical africa

