10th International Symposium on Soil Organic Matter 2026 SÃO PAULO BRAZIL

AMAZONFACE

Going deeper underground – unravelling microbial activity and carbon cycling in deep soils in the Central Amazon

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Introduction

Microbial communities play a crucial role in tropical forest soil carbon, nitrogen and phosphorus cycling[1]. Yet, little is known about the role of microbial activity affecting carbon cycling beyond the more frequently studied top layers. Our objective was to analyze soil carbon stocks, as well as microbial activity in deep soil layers in the Central Amazon, to better understand their role and susceptibility to future climate change.

Methods

We collected soil samples down to 2 meters at the experimental site of the AmazonFACE program located in Central Amazonia, near Manaus, Brazil. We analyzed carbon and nitrogen content and to estimate stocks. We analyzed microbial community composition using phospholipid fatty acids (PLFA)[2], as well as microbial respiration and potential extracellular enzyme activity rates[3].

Results and discussion

Soil C content and isotope composition

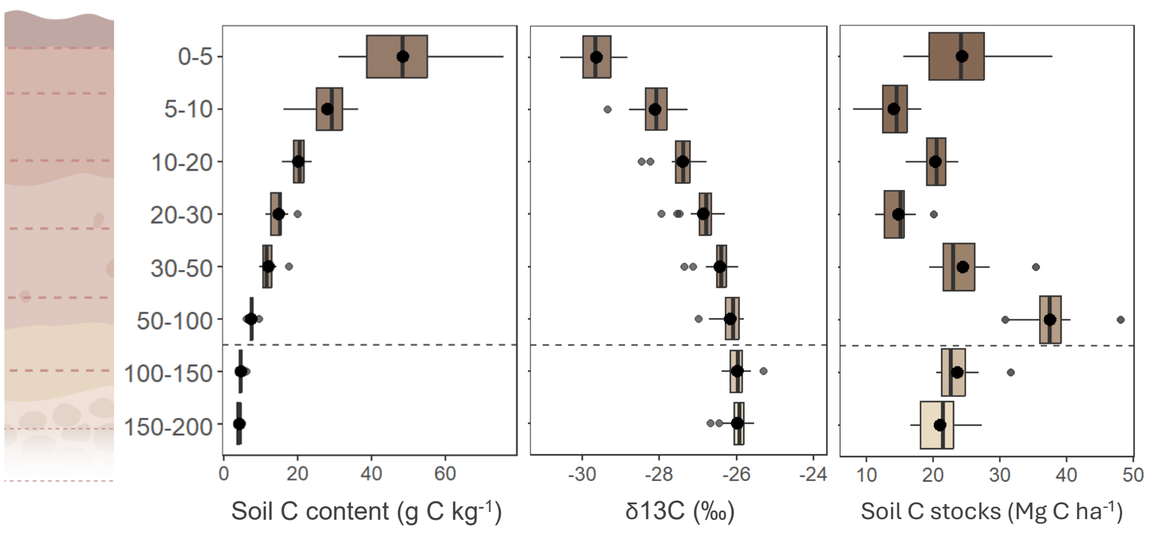

Figure 1. Carbon content decreases from top to bottom layers. The $\delta^{13}C$ signal becomes more enriched, indicating a change in SOM quality, from primary plant to more turned over C.
Estimated SOC stocks to 2 m are 180 Mg C ha^{-1}.

Microbial biomass and activity

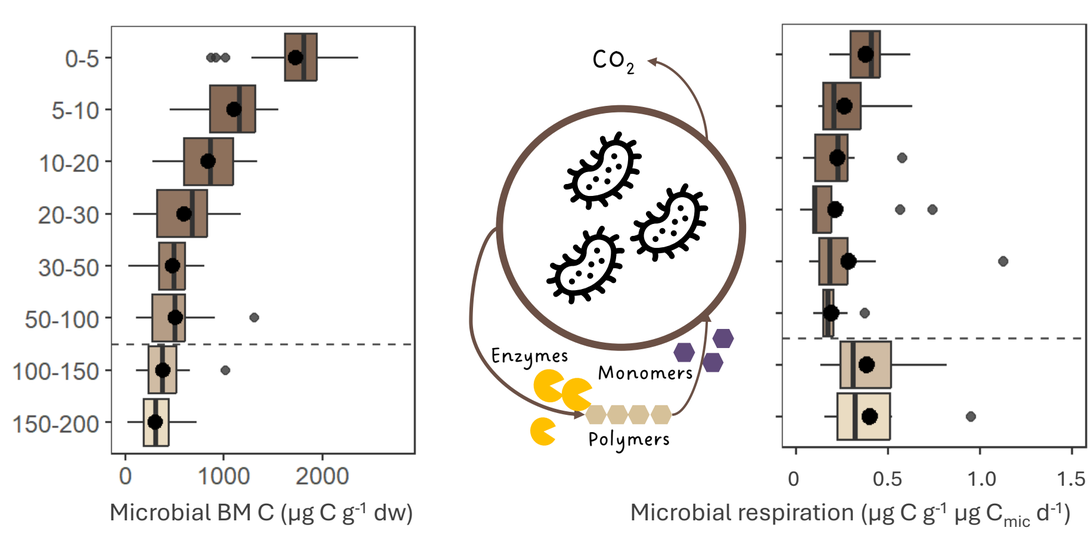

Figure 2. Microbial biomass decreases with depth, the proportion to SOC incrases from 2 to 6 % on average. Microbial respiration normalized by biomass is as high at deep as in top layers.

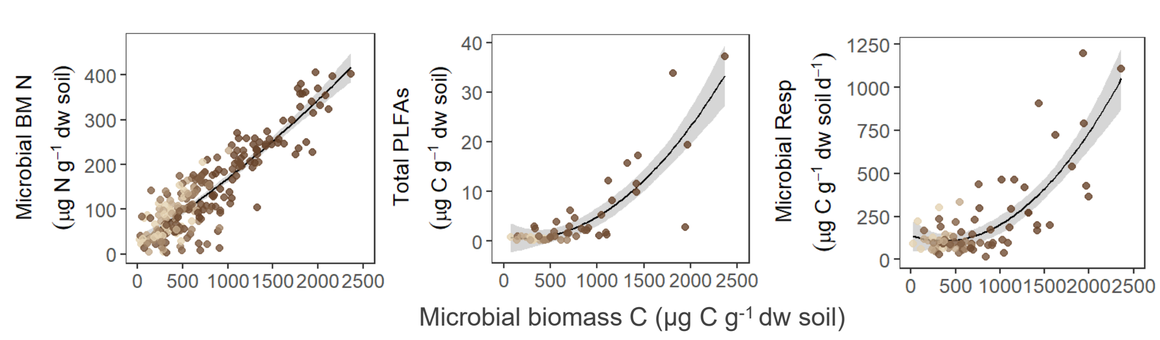

Figure 3. Positive relations between microbial biomass carbon and nitrogen, total PLFAs and respiration rates.

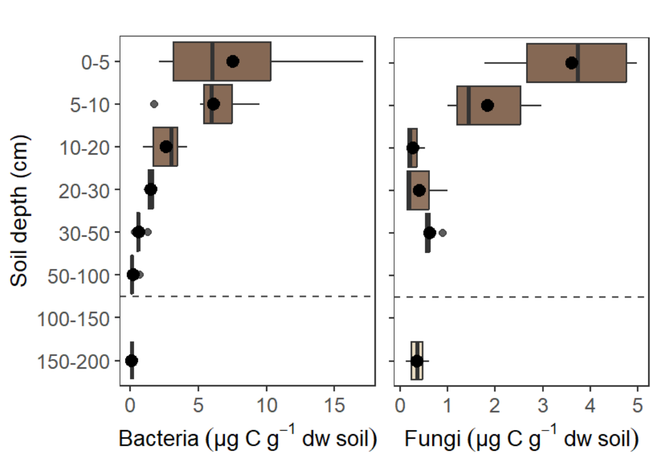

Figure 4. Fungal markers decrease stronger than bacteria with depth, indicating a change in microbial community composition

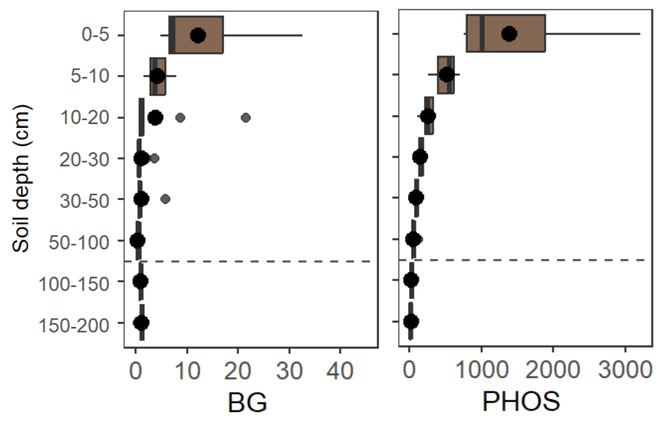

Figure 5. Extracellular enzyme activity rates decrease with depth; ß-glucosidases hydrolyze carbon compounds, acid phosphatases tackle PO_4 containing compounds.

Conclusions

Deep soils are crucial carbon stocks in tropical forests. Microbial activity appears not only to be important in top layers, but also in deep layers carbon can become mineralized by an active microbial community. This suggests that soil carbon stored in deep soil layers could also be senstitive to environmental and climate change.

ACKNOWLEDGEMENTS

This work was supported by the AmazonFACE project. More precisely, we want to acknowledge the **Brazilian MCTI, the FAPESP and the UK Government** for supporting the research on site, and the INPA Manaus, TUM and University of Vienna for laboratory support.

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