BG3.1| EGU22-426
Plant traits, adaptation, and biogeochemical cycles – from measurements to models

Initial responses of fine root dynamics of understory plants to elevated CO_2 in a Central Amazon rainforest

Ph.D. research Nathielly P. Martins

Laynara F. Lugli, Oscar J. Valverde-Barrantes, Bruno Takeshi, Maria Pires, Juliane G. Menezes, Iokanam Sales Pereira, Alacimar Guedes, Vanessa R. Ferrer, Yago R. Santos, Gabriela U. Neves, Anna C. M. Moraes, Ana Caroline Miron, Iain P. Hartley, Richard J. Norby, Carlos A. Quesada, Lucia Fuchslueger and the AmazonFACE team

Image: amazonFACE

Background - Motivation

Approximately 60% of the soils in the Amazon basin are phosphorus (P) limited;

Low P availability may limit the forest growth in response to elevated CO_2 (eCO_2);

FACE experiments in temperate forests (N limited), showed that the extra C assimilated can be allocated to below ground, increasing the nutrient acquisition efficiency;

Hypothesis for the Amazon rainforest

Elevated CO_2 causes and upregulations of fine root dynamics:

↑ Fine root productivity → Increased P mobilization

Adaptions of morphological parameters:

↑ Specific root length (SRL) ↑ Specific root area (SRA)

Exploit a larger soil and litter volume

↑ Root phosphatase activity → Increased directly P availability

Experimental designer

AmazonFACE – Open Top Chambers (OTC's) experiment – understory plants

- 4 OTC with **CO_2 ambient;**
- 4 with with elevated CO2: **+ 200 ppm**

Variables measured:

- Soil: ingrowth cores (0-15 cm)

Fine root productivity;
Fine root morphological parameters (SRL; SRA; RTD);
Fine root phosphatase activity

- Litter: superficial ingrowth cores

Fine root stock;
Fine root morphological parameters (SRL; SRA; RTD);
Fine root phosphatase activity

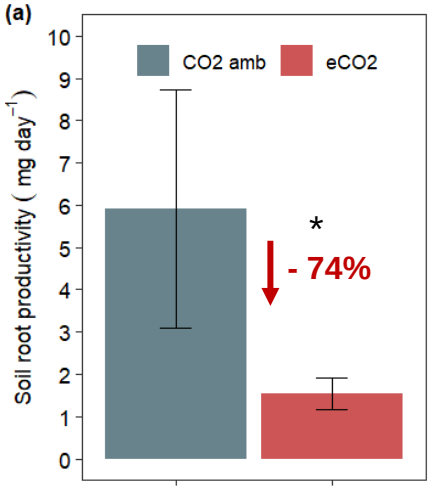
*data used: for soil after 12 months and litter after 8 months

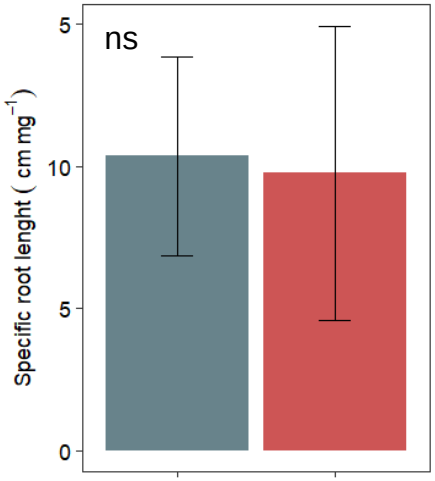
Images: personal file

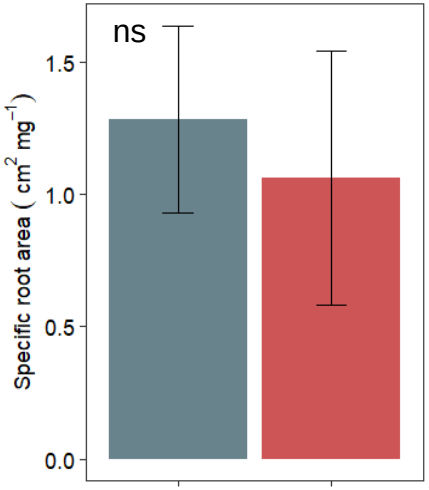
Results

After 12 months – soil fine root dynamics

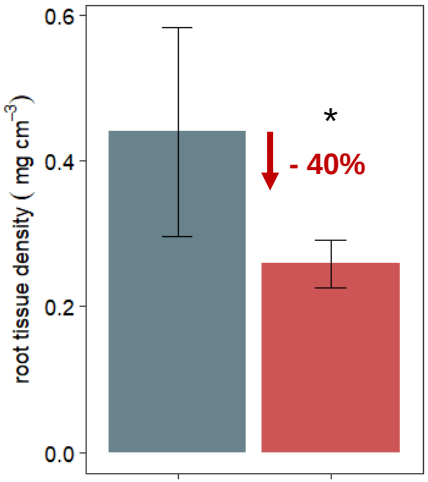
Morphological parameters

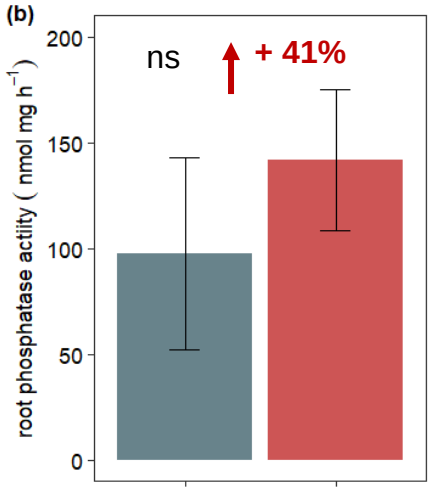






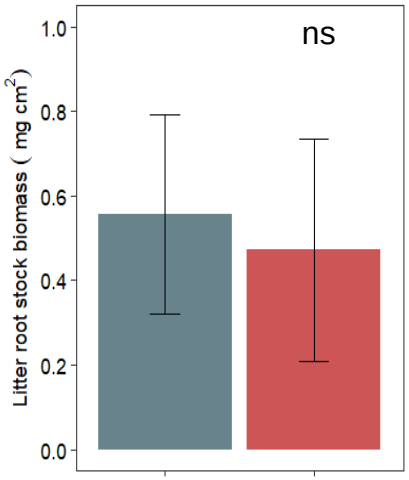
No differences were observed for SRL and SRA.

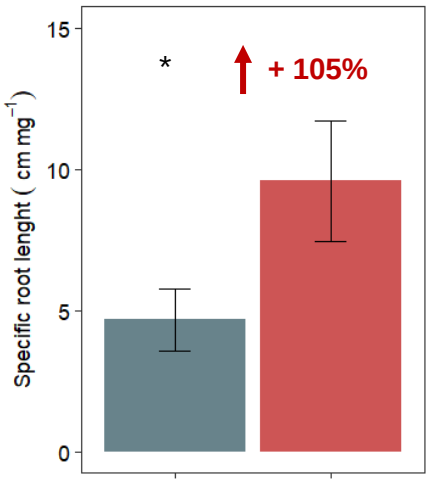


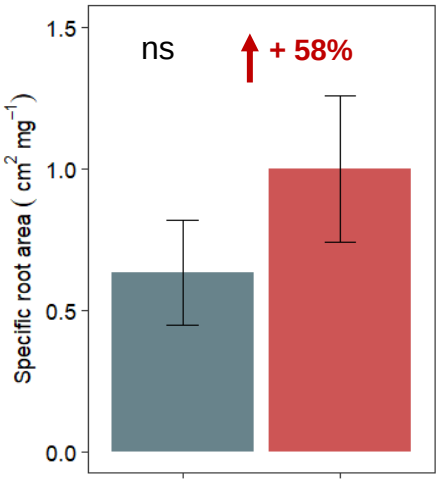


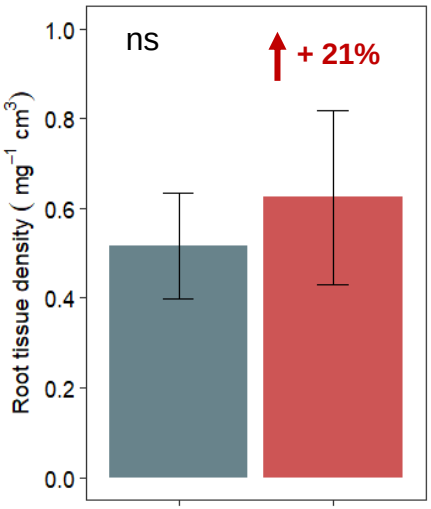
Results

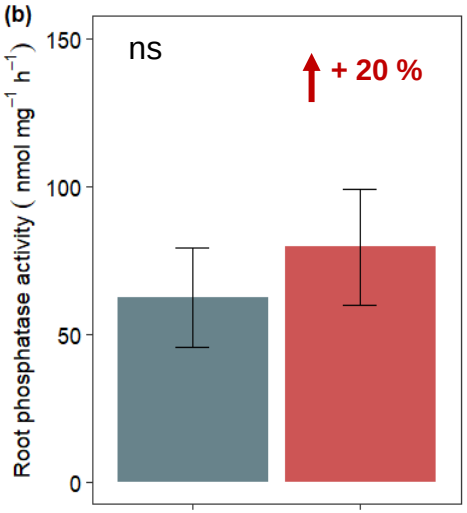
After 8 months – litter fine root dynamics



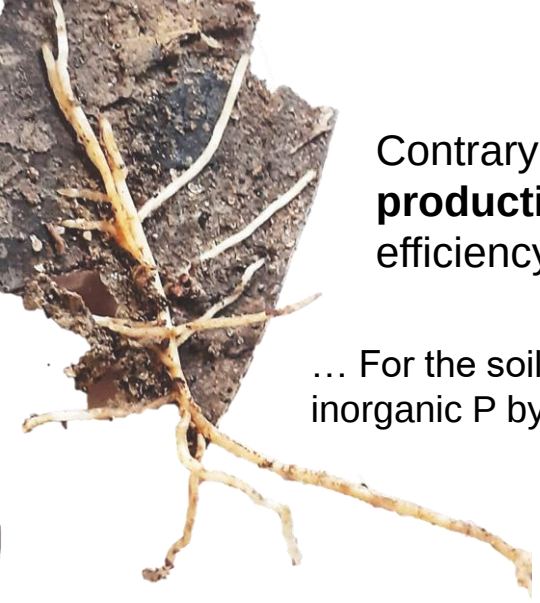








Conclusions and implications



Contrary to our hypothesis, our results suggest that **the increase in root productivity will not be the main strategy** for greater nutrient acquisition efficiency with eCO_2 .

… For the soil and litter, we observed a potential increase in the capacity to mobilize directly inorganic P by increasing root phosphatase activity.

… Furthermore, in the litter layer, we observed an increase in the efficiency of nutrient interception (already available by litter decomposition) by an increase in SRL.

Litter cycling is the main source of nutrients for plants in the Amazon, our results suggest that an **increase in the efficiency of direct nutrient cycling** can be an efficient strategy for greater nutrient acquisition under elevated CO_2.

However, we must consider that the results obtained are preliminary and only consider understory plants…
...Monitoring at the ecosystem level for longer time periods is essential to better understand the nutrient mechanisms acquisition in the Amazon rainforest with eCO_2.

Thanks for your attention!

nathiellymartins9@gmail.com
@NathiellyP_M

If you have any questions or are interested in more information, please contact me!