The effects of elevated CO_2 and phosphorus limitation shaping fine root functioning in Central Amazon forests

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How the Amazon rainforest, the largest tropical forest in the world, will respond to elevated atmospheric CO_2 (eCO_2)?

- Large parts of the Amazon grow in soils with very low phosphorus (P);
- Plants would require increased access to P to sustain growth;
- Importance of eCO_2 affecting root P-uptake strategies.

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Would eCO_2 change the amount of carbon (C) being allocated belowground among different root traits?

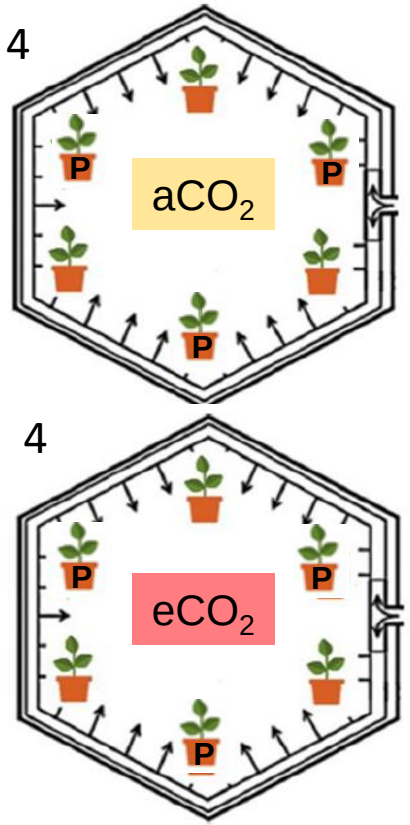
What is the role of P availability controlling the potential investment of such extra C belowground?

Photo: R. Di Ponzio

8 Open-Top Chambers (OTCs)

Photo: L.F. Lugli

Manaus, Brazil
INPA, AmazonFACE



200 ppm **eCO2** in relation to **aCO2**

Inga edulis (N-fixing) seedlings in 6 pots by OTC = 48 pots

Half of pots with 600 mg/kg P = **3 +P** and **3 -P** per OTC

12 pots per treatment = **aCO2-P, aCO2+P, eCO2-P, eCO2+P**

Harvest after 2 years

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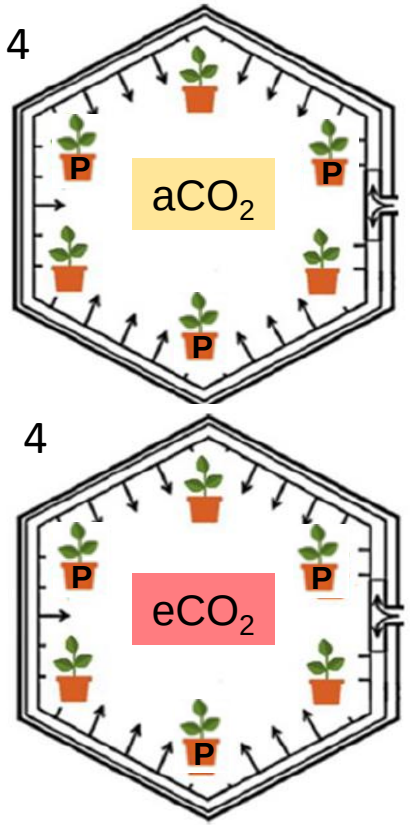

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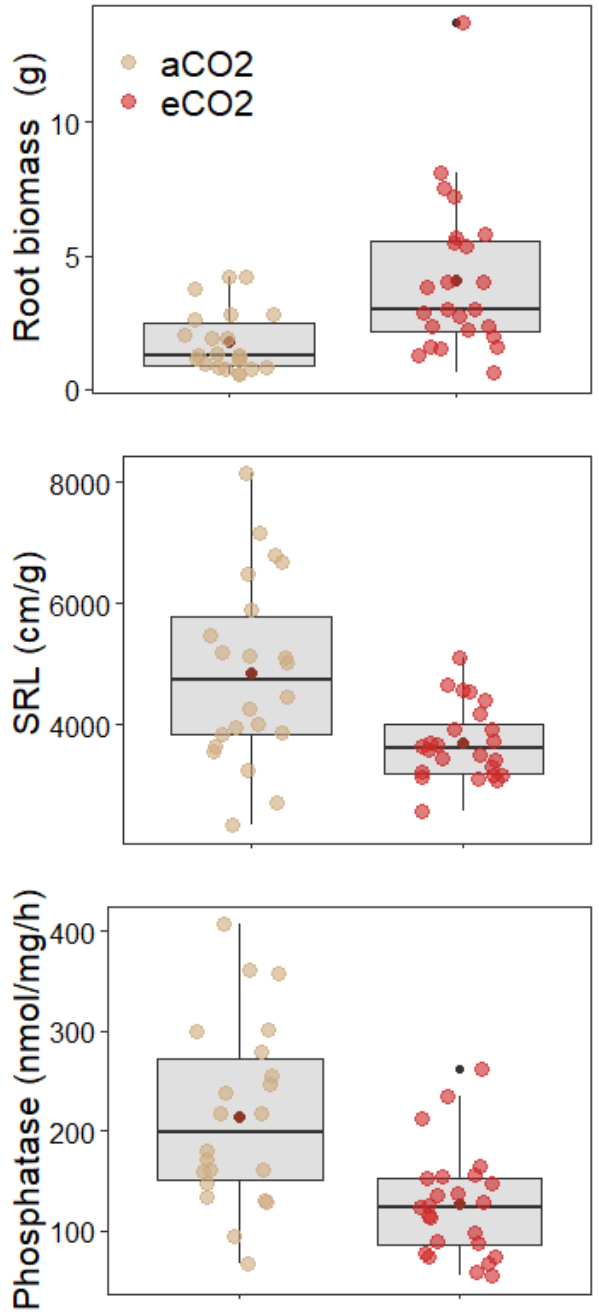
Traits measured

1. Total root dry biomass and nodules;
2. Mean root diameter; specific root length (SRL); specific root area (SRA); root tissue density (RTD);
3. Potential root phosphatase activity;
4. Root arbuscular mycorrhizal colonisation



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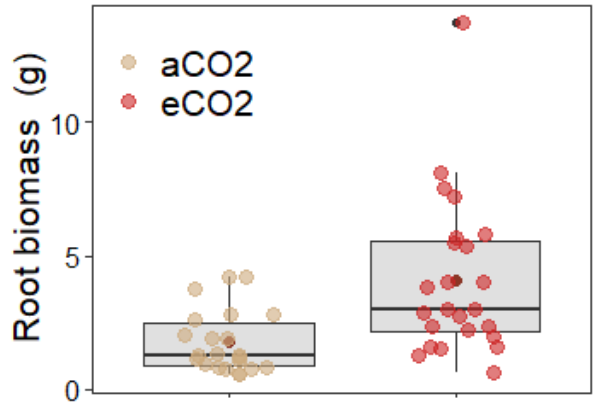
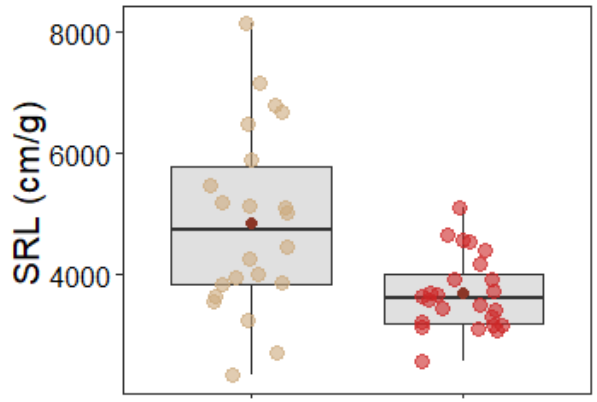
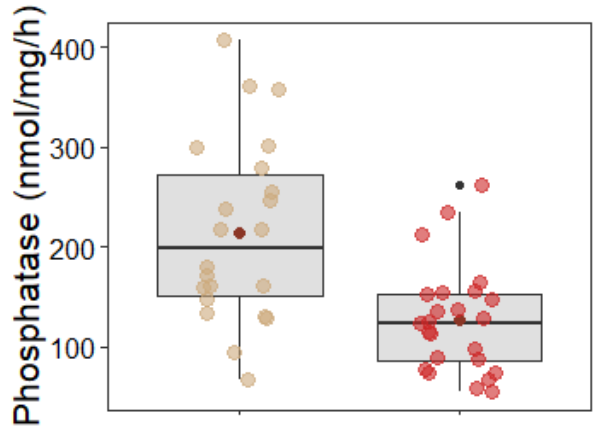
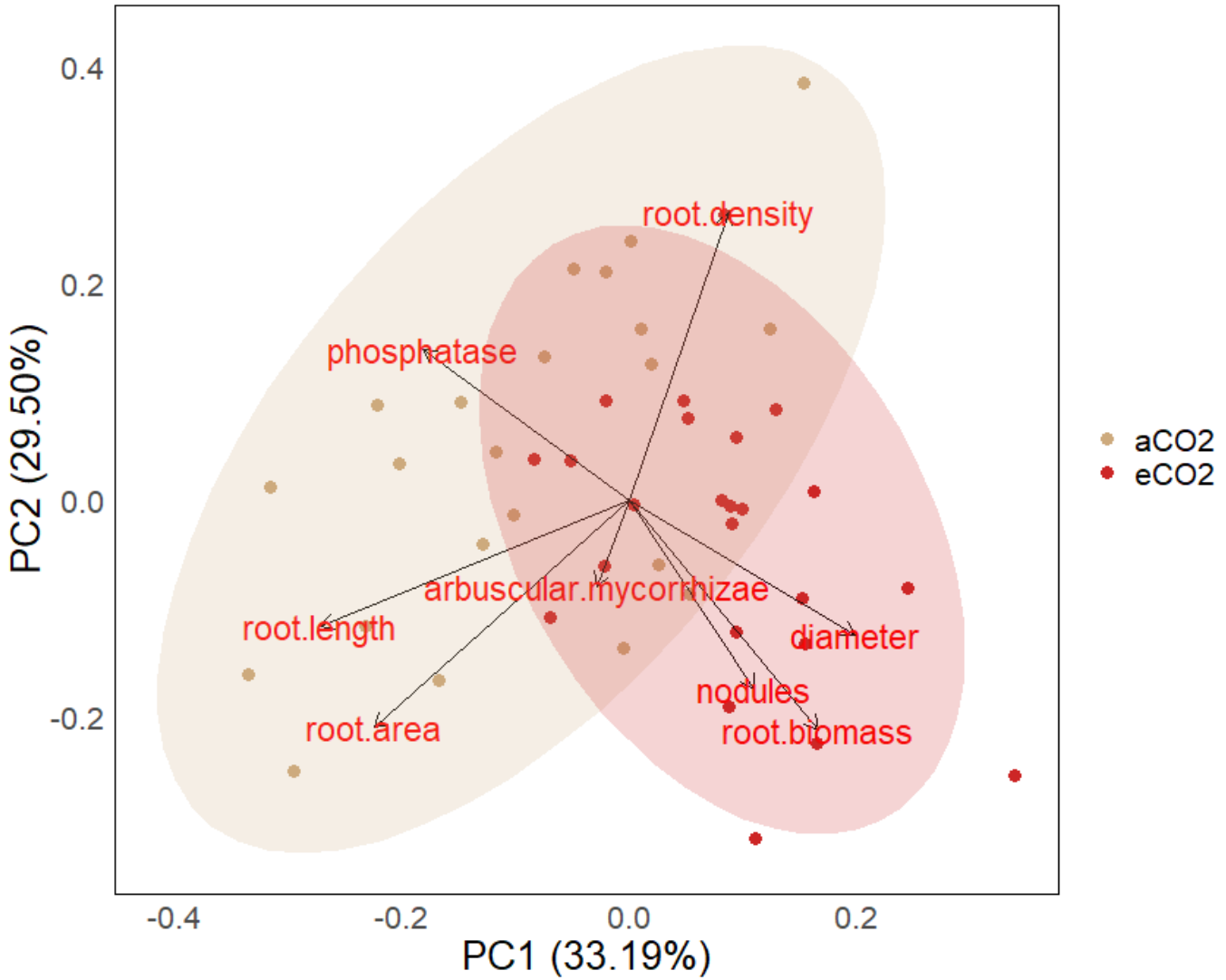
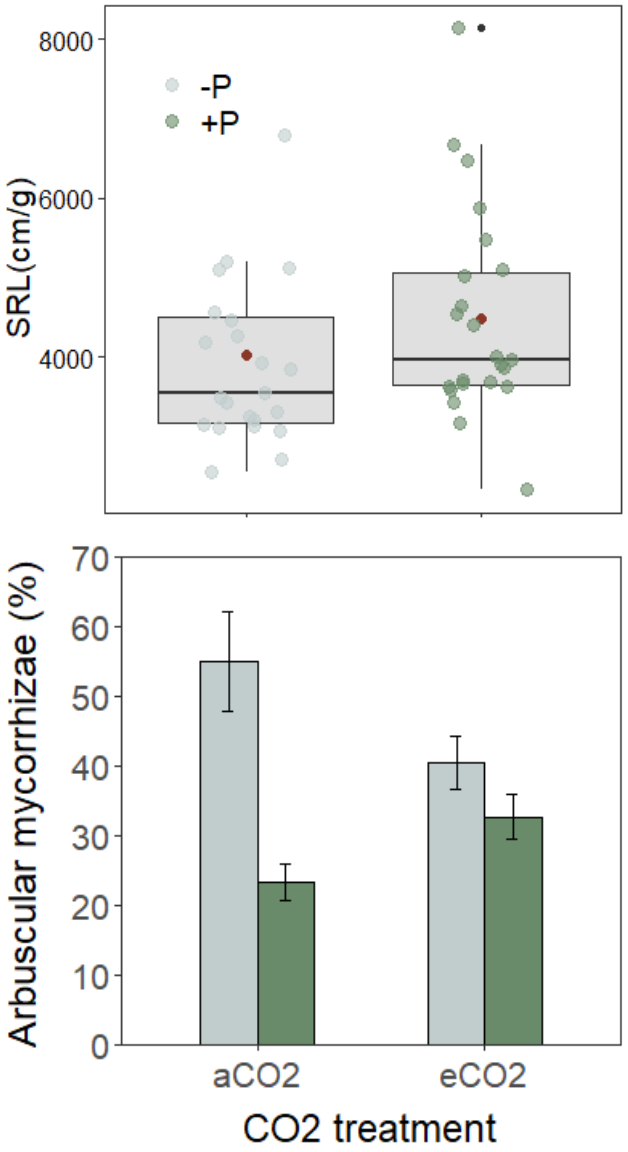








+P did **not** change root biomass or phosphatase activity but roots became thinner, with higher specific length and less colonised by mycorrhizae in aCO_2



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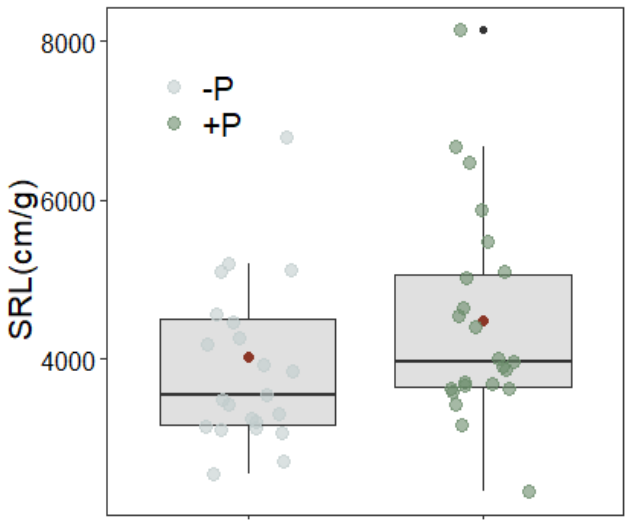

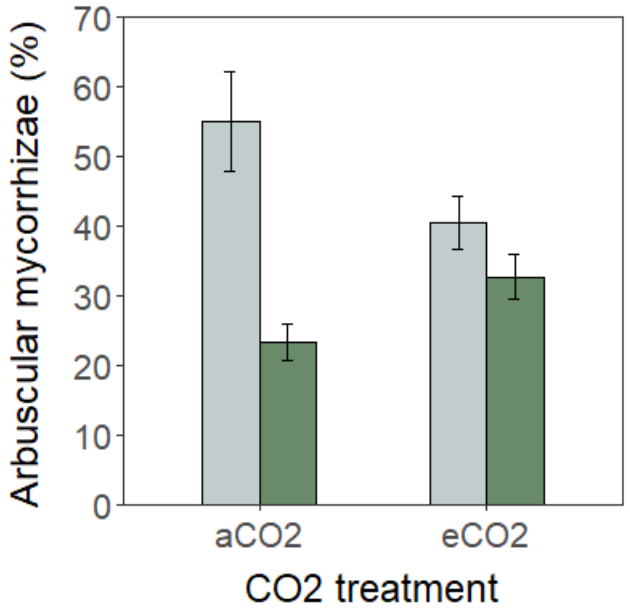

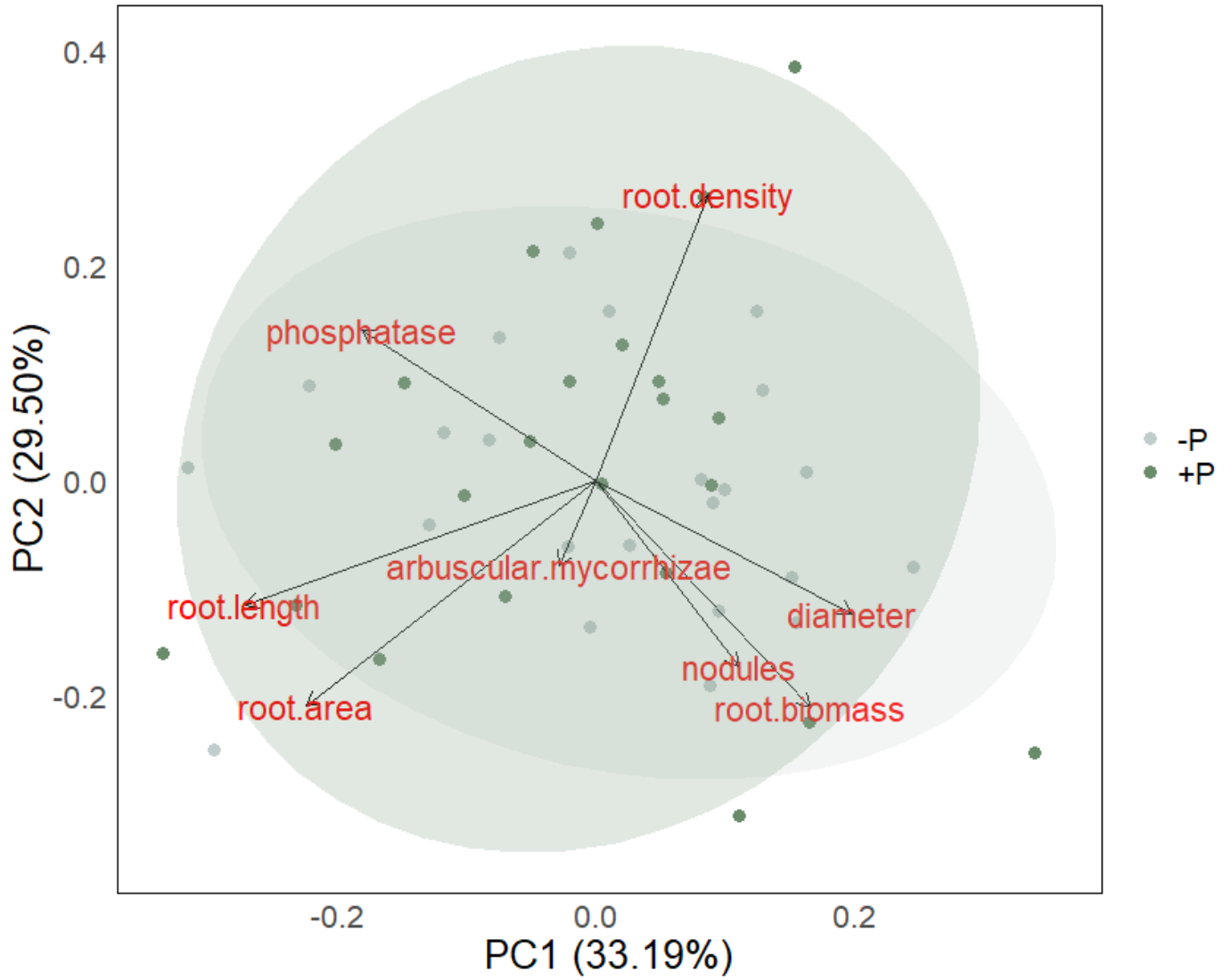

Shift in plant belowground strategies, **strongly controlled by eCO_2 rather than phosphorus in the short-term**

- With eCO_2 plants might acquire P directly by the **"do-it-yourself" strategy exploring higher soil volumes** by investing in more root biomass, decreasing investments in phosphatase and arbuscular mycorrhizas.

- In the long-term eCO_2 and nutrient availability could result in important **trade-offs controlling ecosystem-scale responses in future climate scenarios**.