BG1.4 – Amazon forest – a natural laboratory of global significance

# Short-term responses of *Inga edulis* Mart. seedlings growing under elevated $CO_2$ and phosphorus addition: understanding potential phosphorus constratins on plant responses to elevated $CO_2$ in the understory of a central Amazon forest


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# Background

- Studies in temperate regions have shown that elevated $CO_2$ concentration ($eCO_2$) positively affects carbon assimilation and stock in plants;
- Temperate forests are N-limited, but tropical ones are mostly P-limited;

**Could natural low P availability constrain plant responses to $eCO_2$ in the Amazon forest?**

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How **carbon primary metabolism** and **aboveground development** will respond to $eCO_2$?

# Experimental design

8 Open Top Chambers (OTCs)
4 ambient $CO_2$ ($aCO_2$)
4 elevated $CO_2$ ($eCO_2$ + 200ppm; $eCO_2$)

Photo: Personal archive

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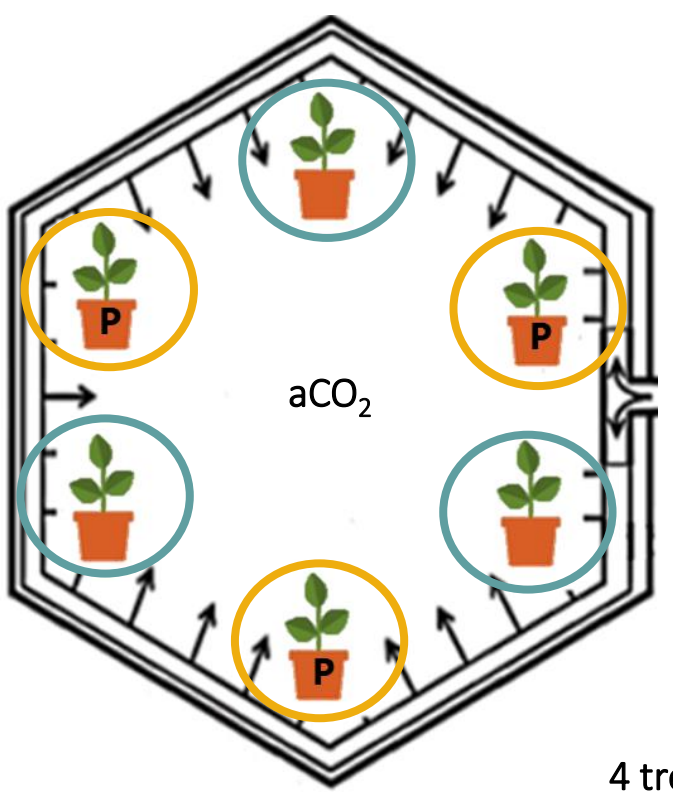
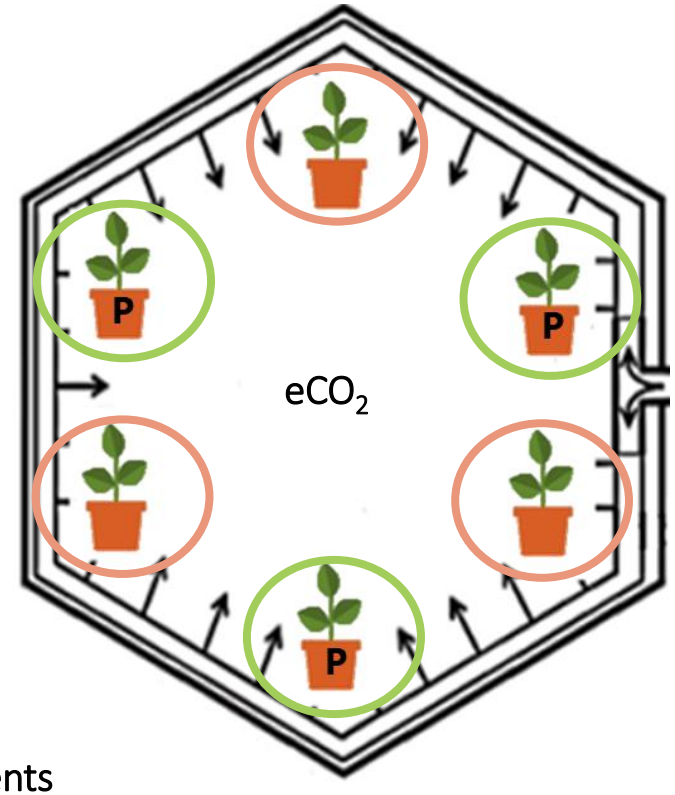
*Inga edulis* Mart. seedlings
N-fixing species
Model species




4 treatments
Control
+P
$eCO_2$
$eCO_2$+P

3 pots per treatment per OTC X 4 ⟶ 12 pots per treatment ⟶ **48 pots**

# Variables measured

*After 10 months...*

## Primary carbon metabolism
(physiological variables)

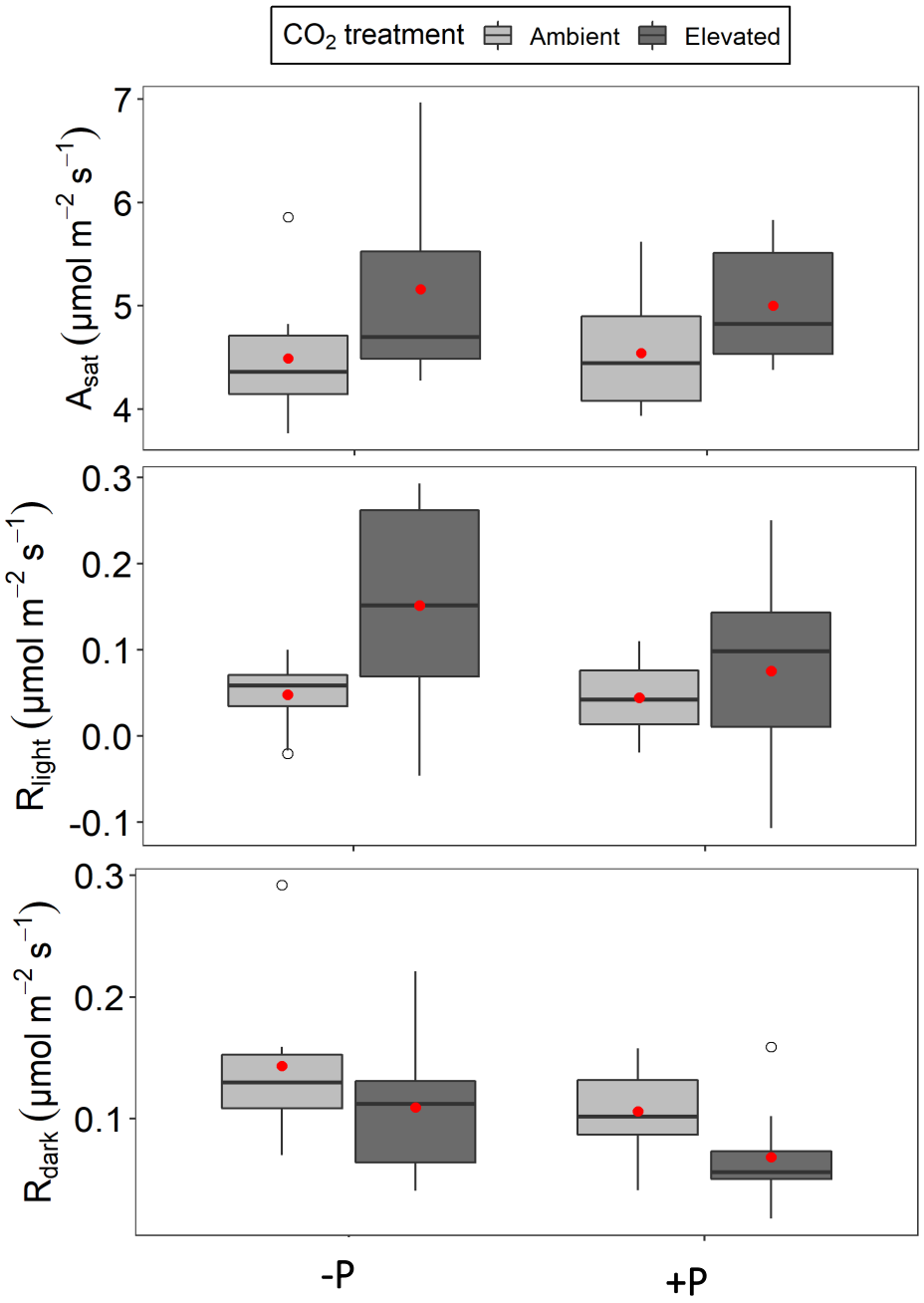
- Light-saturated net $CO_2$ assimilation ($A_{sat}$),
- Leaf respiration in the light ($R_{light}$);
- Leaf respiration in the darkness ($R_{dark}$);
- Photorespiration ($P_R$)

## Aboveground development
(allometric variables)

- Whole-plant height (H);
- Whole plant diameter (D);
- Crown height (CH);
- Crown diameter (CD);
- Number of leaves;
- Total leaf area (TLA)


Photos: Personal archive

# Main results




Higher $A_{sat}$ and $R_{light}$ under $eCO_2$

Lower $R_{dark}$ under $eCO_2$

- $eCO_2$ affected physiological variables;
- No changes on $P_R$;
- **+P** did not affect physiological variaibles, indicating its low availability does not limit the photosynthetic apparatus

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No interaction between $eCO_2$ and +P treatments

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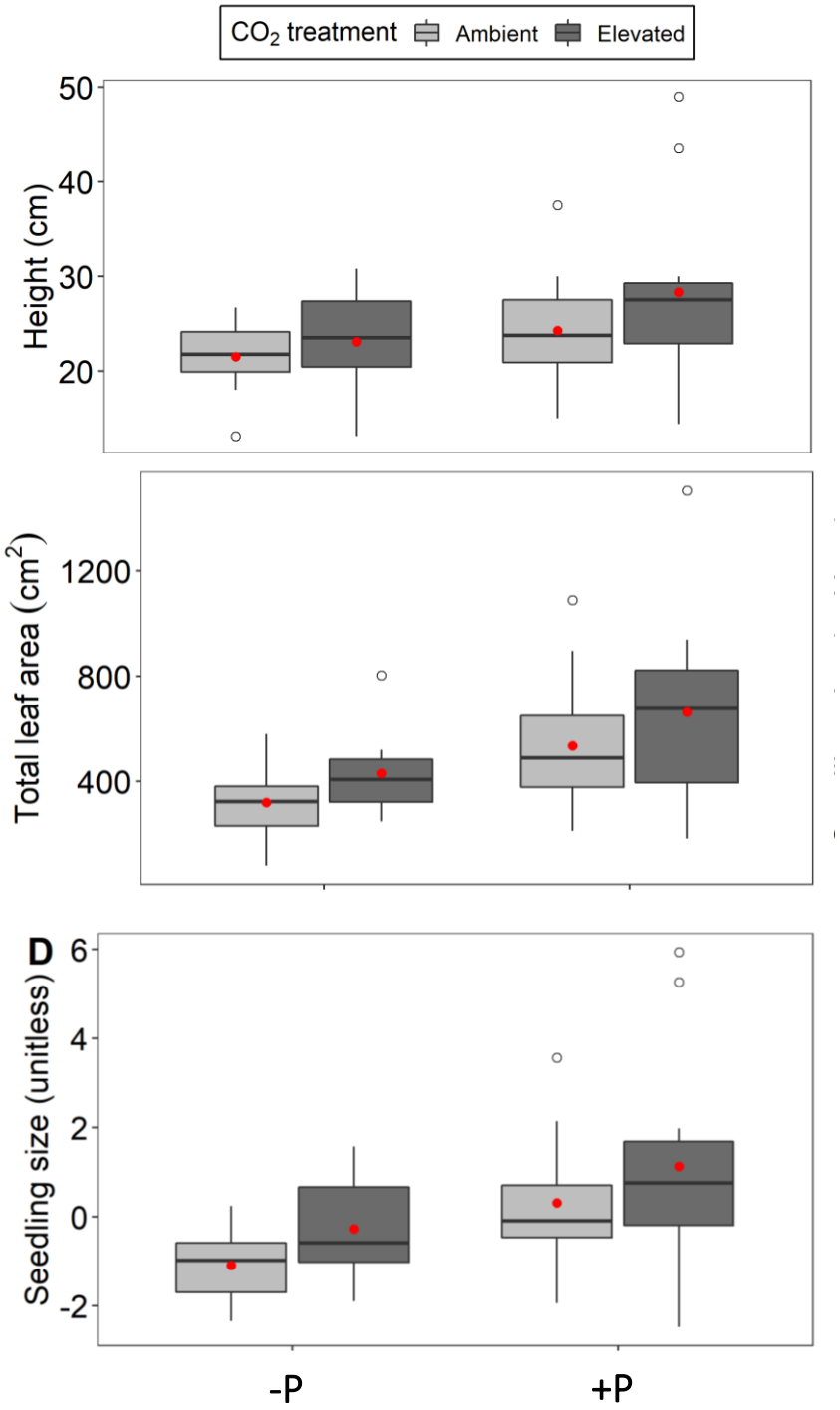
Plants assimilated more carbon under $eCO_2$

# Main results




Higher H, TLA and size under +P

- $eCO_2$ did not change aboveground development;
- +P affected increased aboveground responses

No interaction between $eCO_2$ and +P treatments

No difference between seedlings under +P (+P and $eCO_2$ +P), indicaiting a P-only effect on aboveground development

# Conclusions

Distinguised pattern of responses:

- $eCO_2$ mainly affected carbon metabolism
- +P mainly affected aboveground development

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Lack of response of abovegrond components under $eCO_2$ suggests that the extra carbon assimilated was not necessarily used for increasing aboveground development as expected

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In the short-term, eCO2 was highly important in determining changes in plant metabolism, but has little impact on plant growth, even when nutrient limitation is alleviated

- Long-term responses?
- Similar responses for different species?

Thank you for your attention!