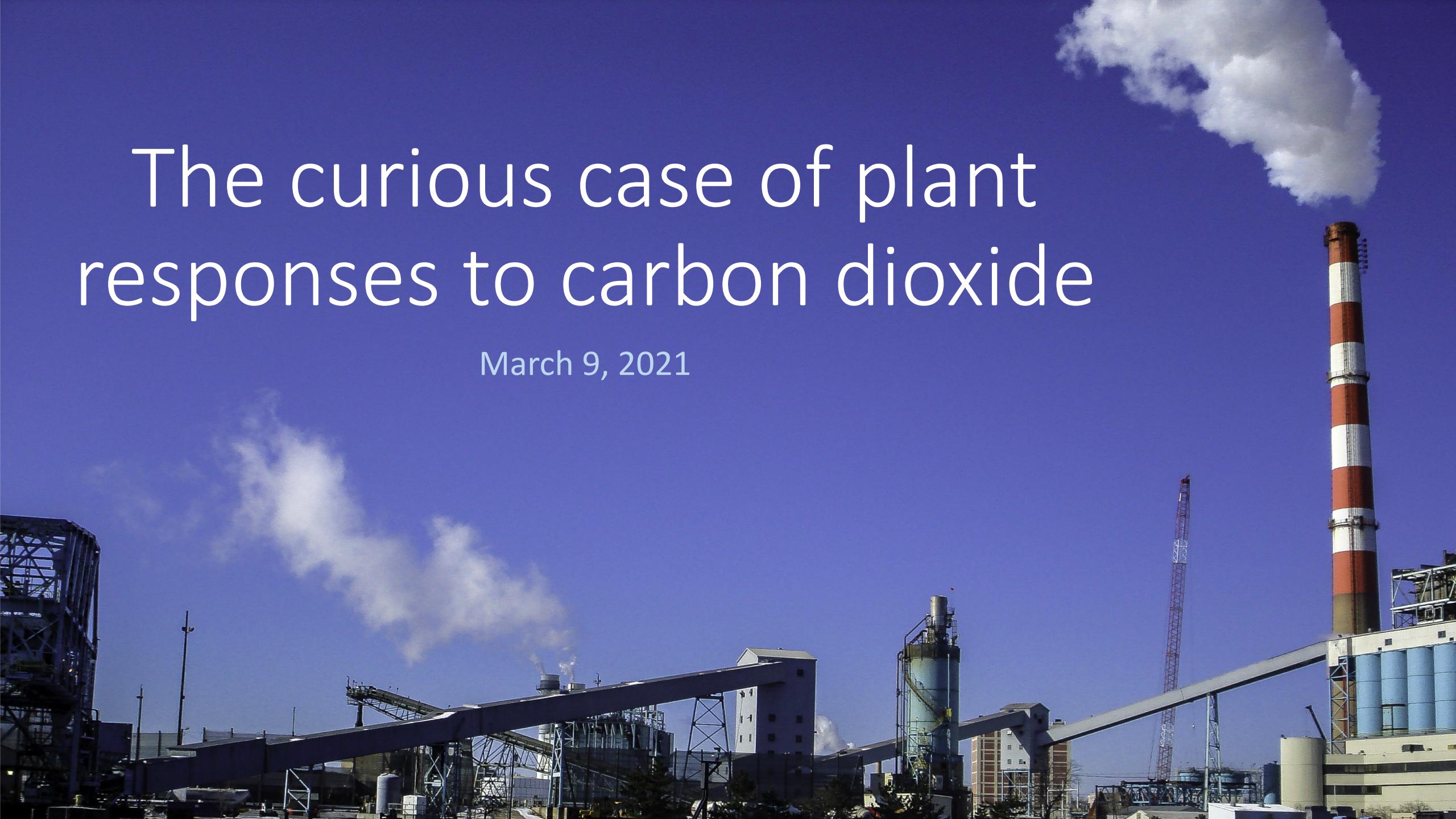


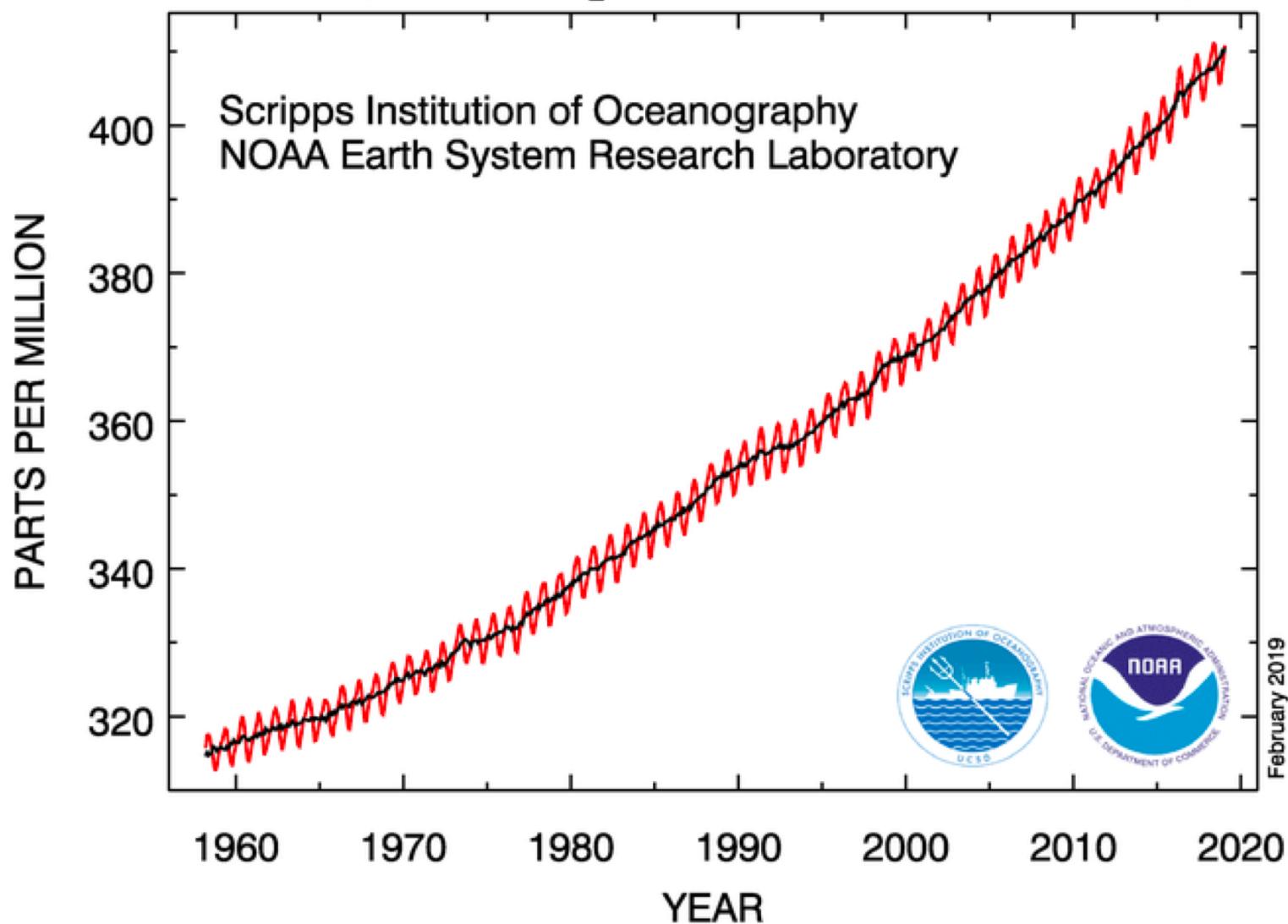
The curious case of plant responses to carbon dioxide

March 9, 2021

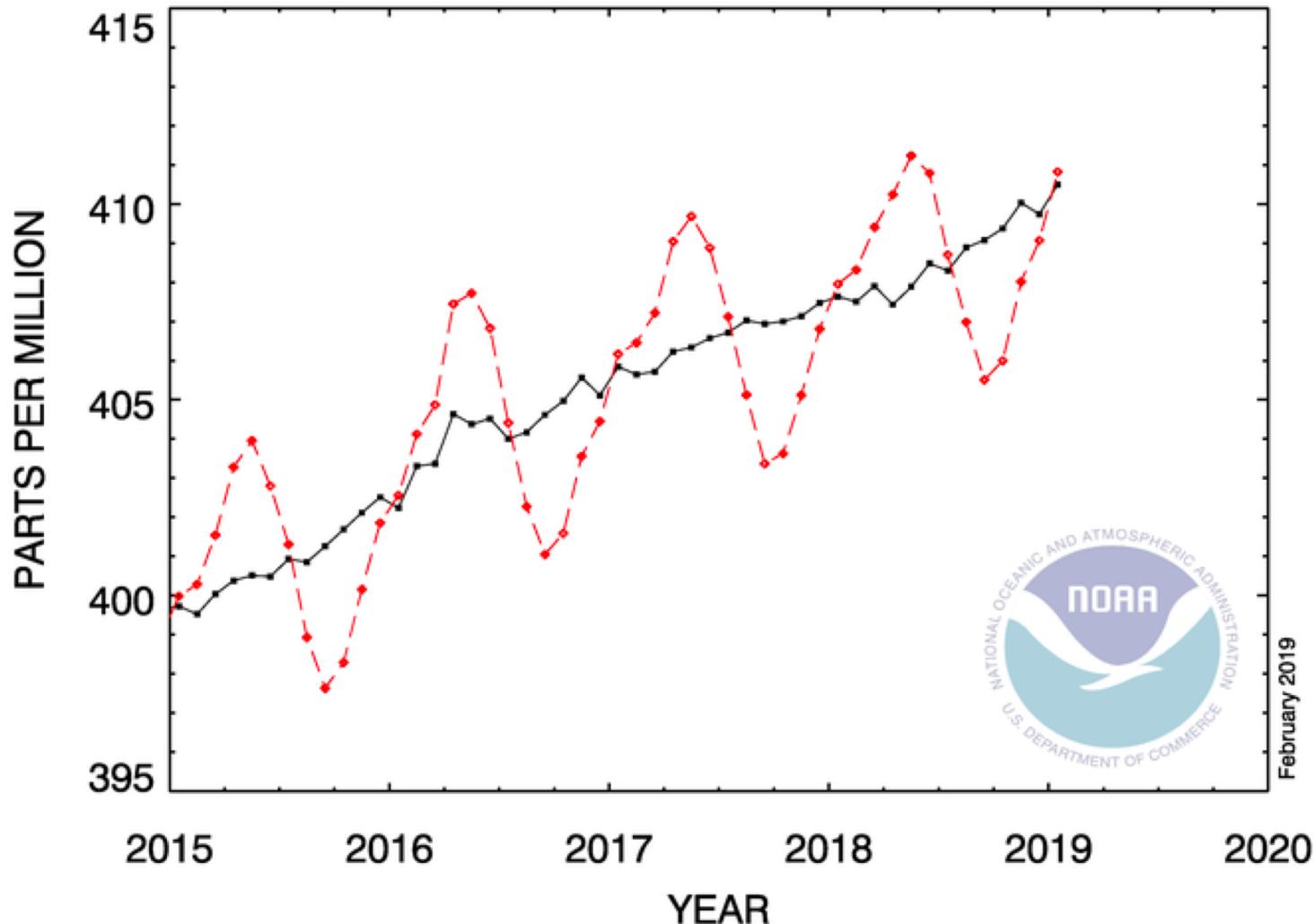


Why should we care about plant responses to CO₂?

Atmospheric CO₂ at Mauna Loa Observatory

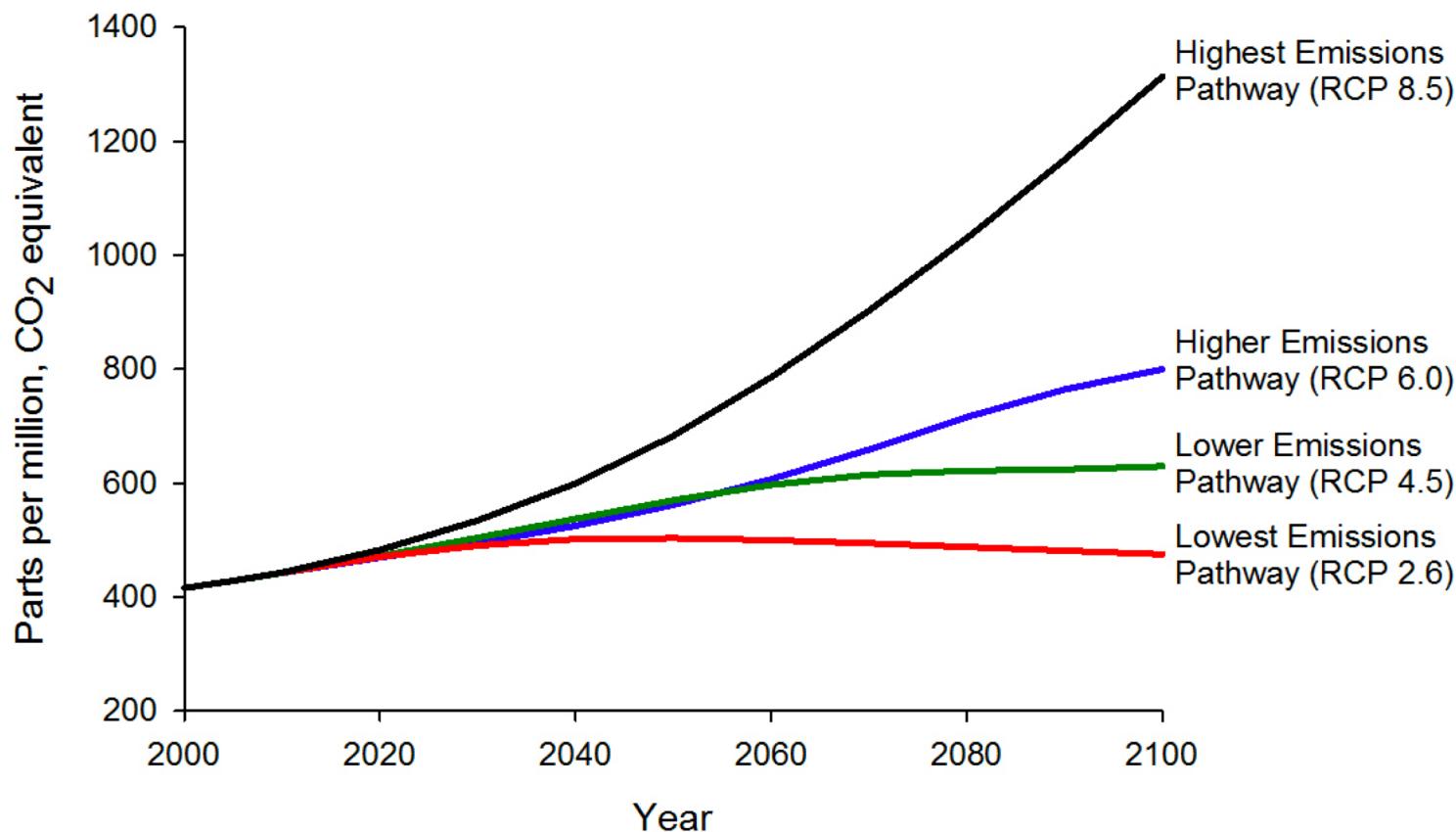


RECENT MONTHLY MEAN CO₂ AT MAUNA LOA

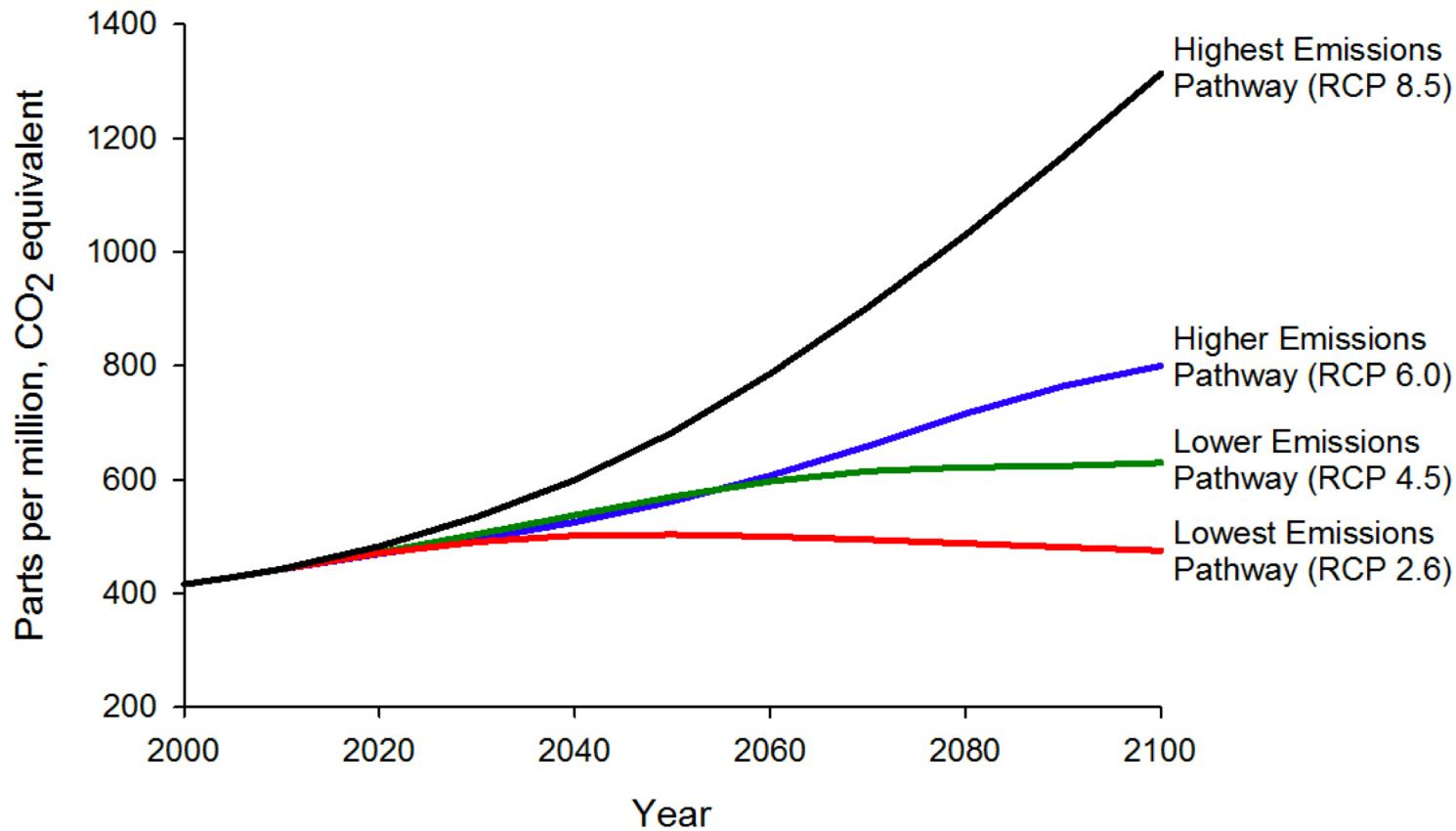


What causes the variations in the red line?

Projected Atmospheric Greenhouse Gas Concentrations



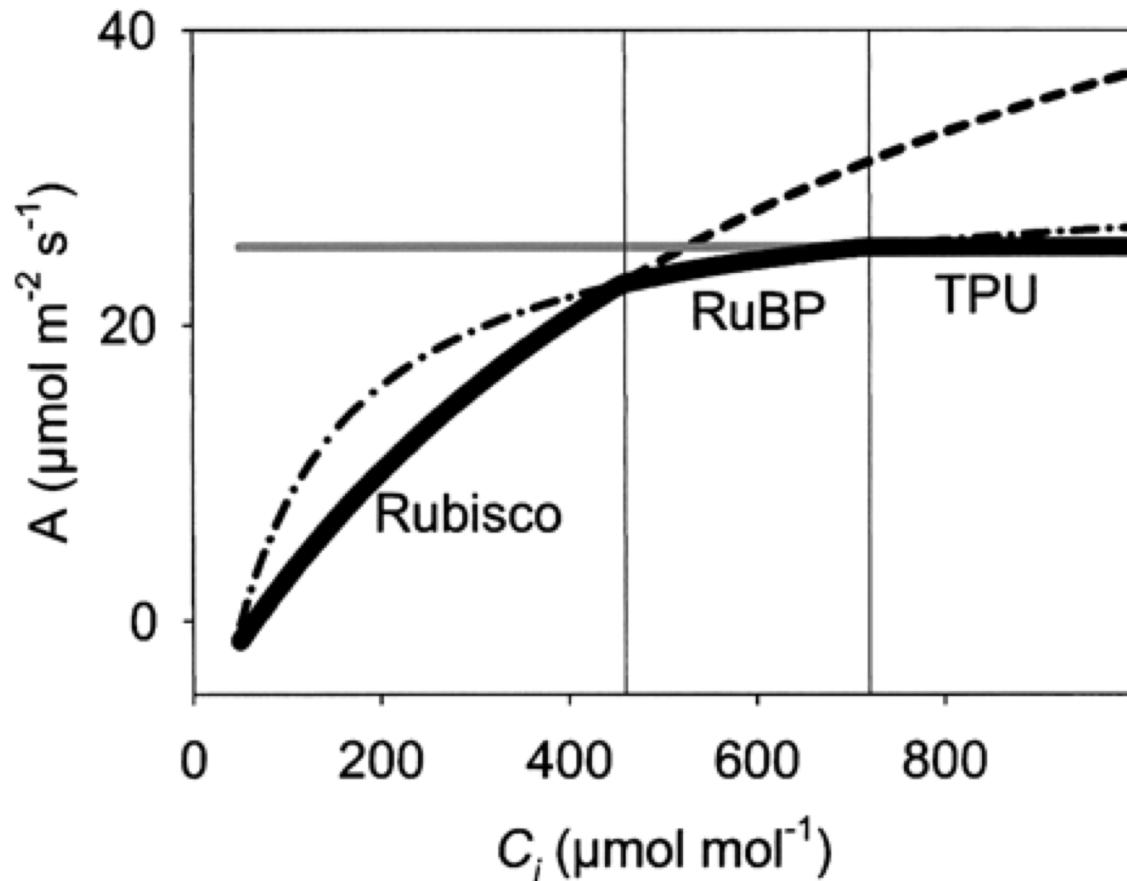
Projected Atmospheric Greenhouse Gas Concentrations



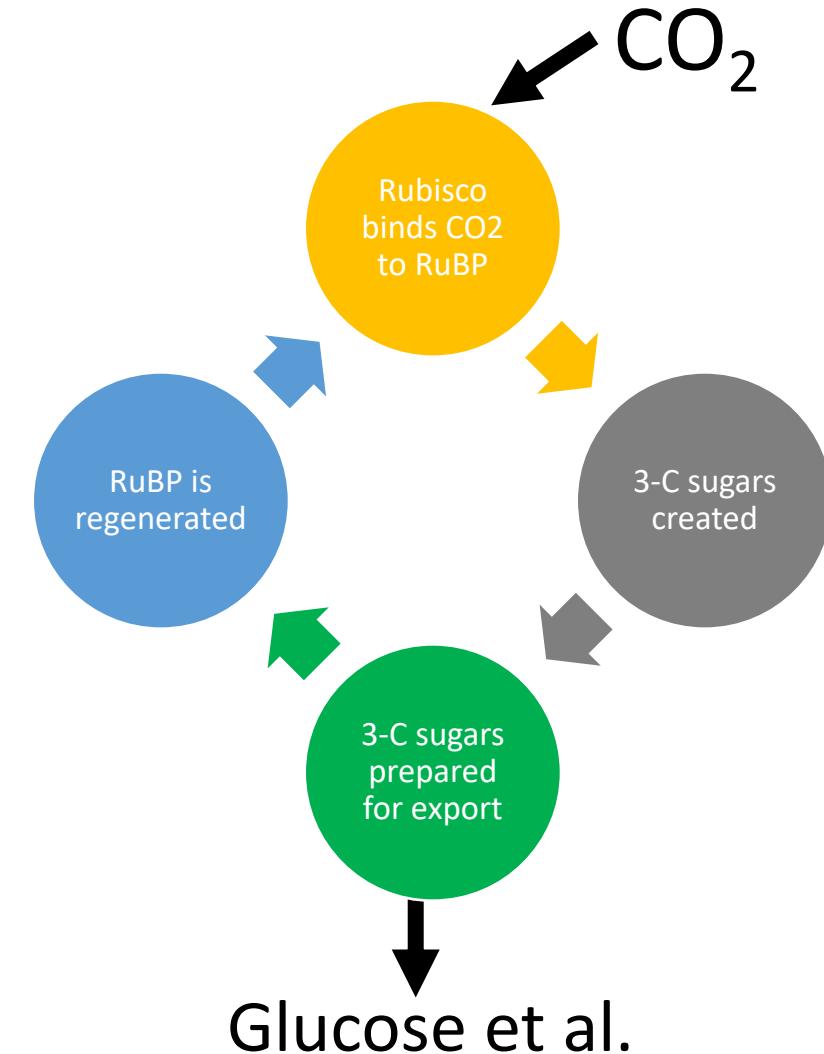
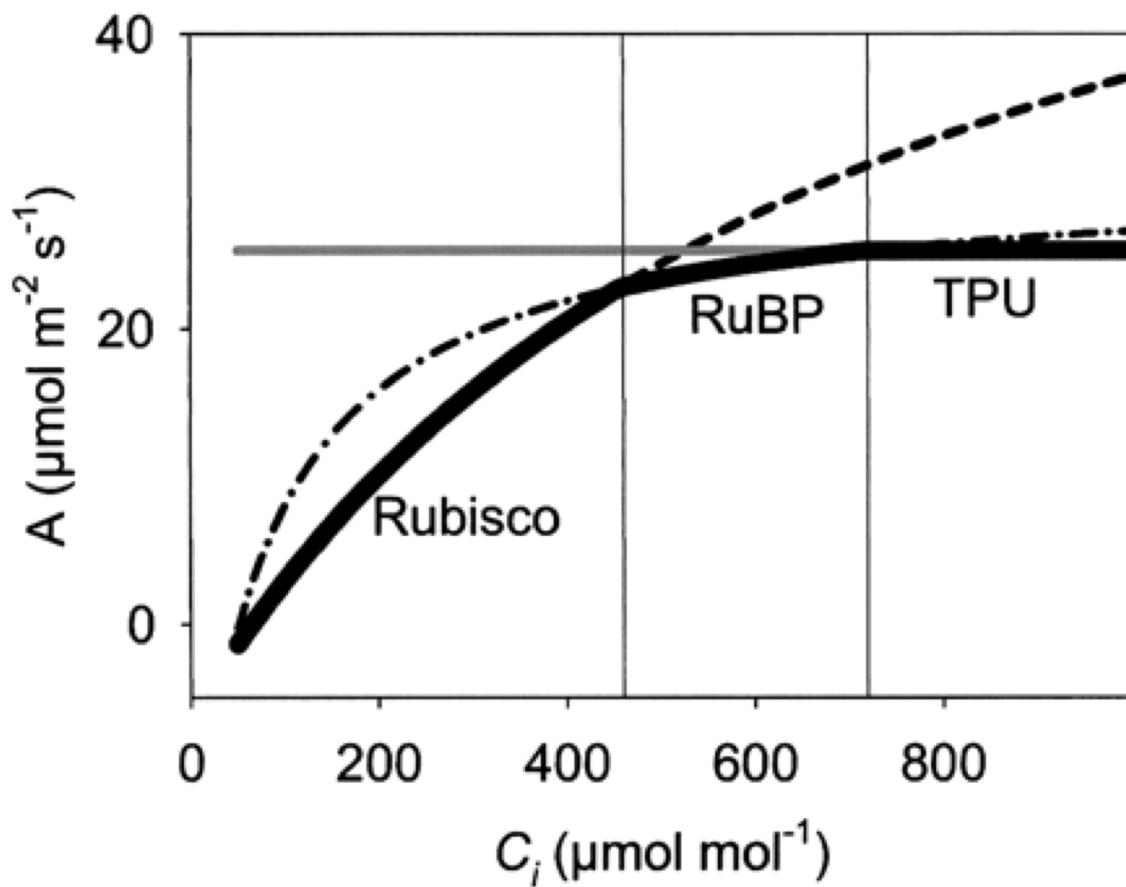
What do you
expect the plant
response to be?

Short-term plant response to elevated CO₂: the A-Ci curve

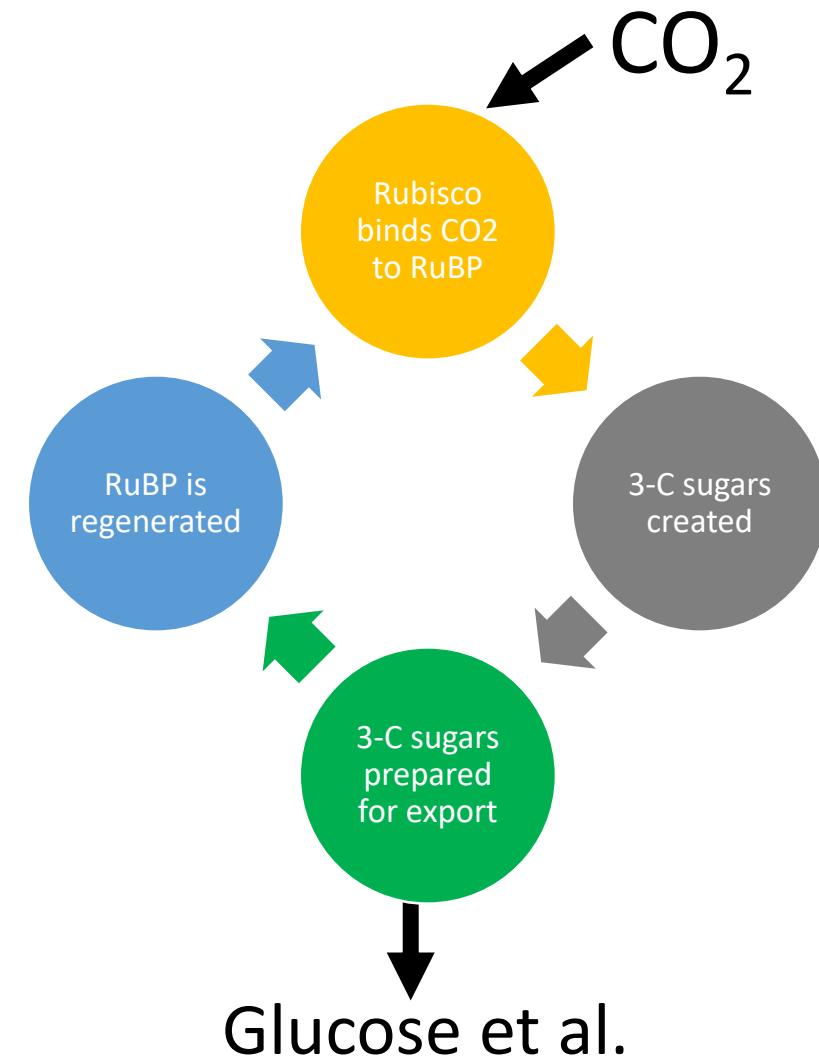
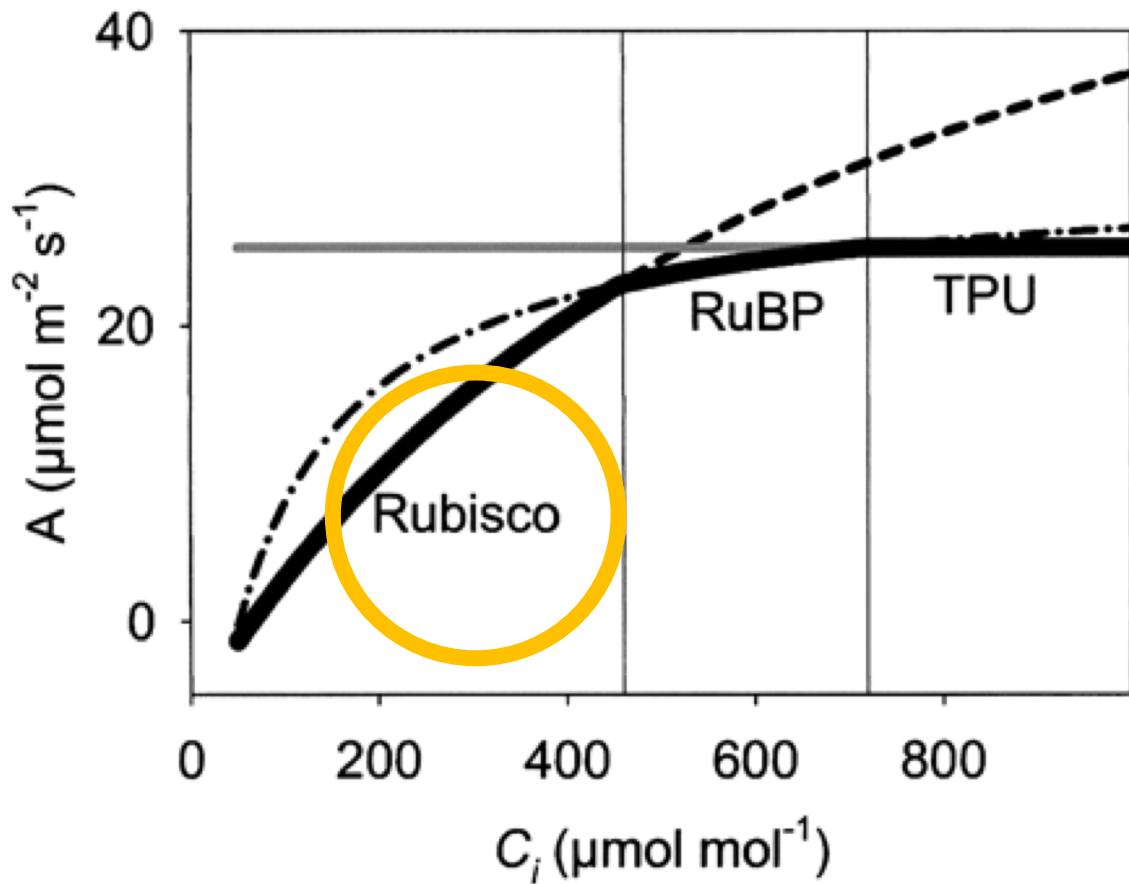
Short-term plant responses to CO₂: the A-C_i curve



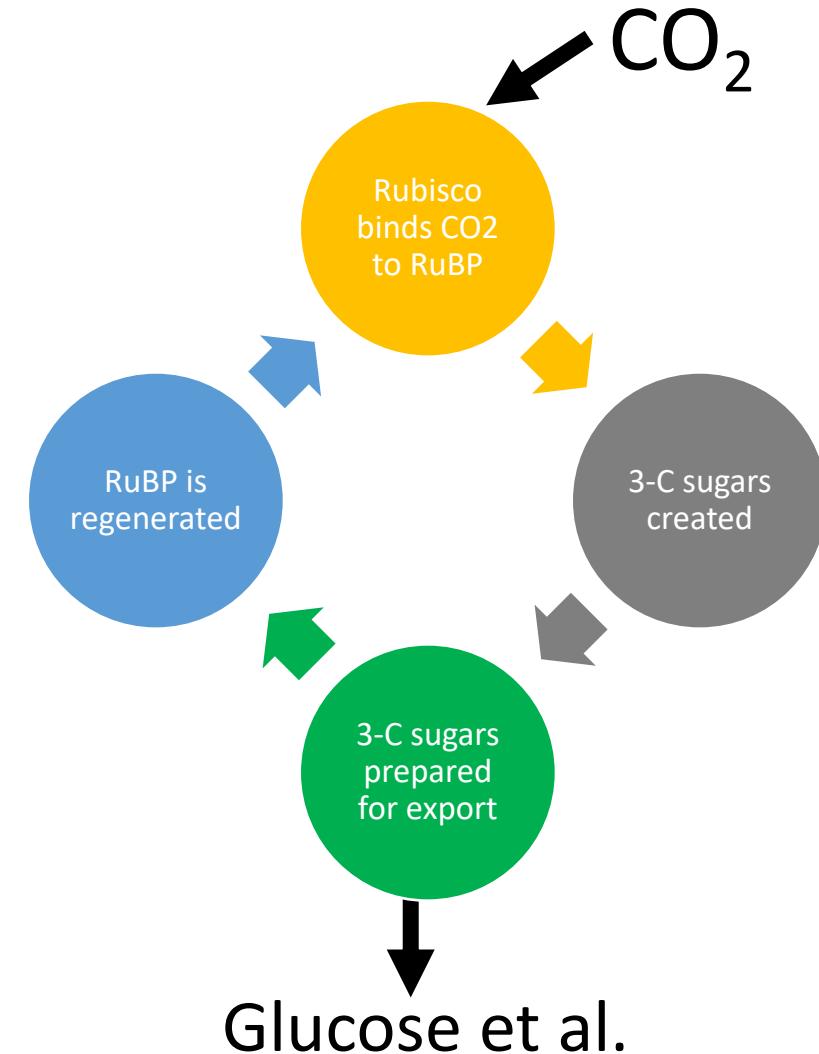
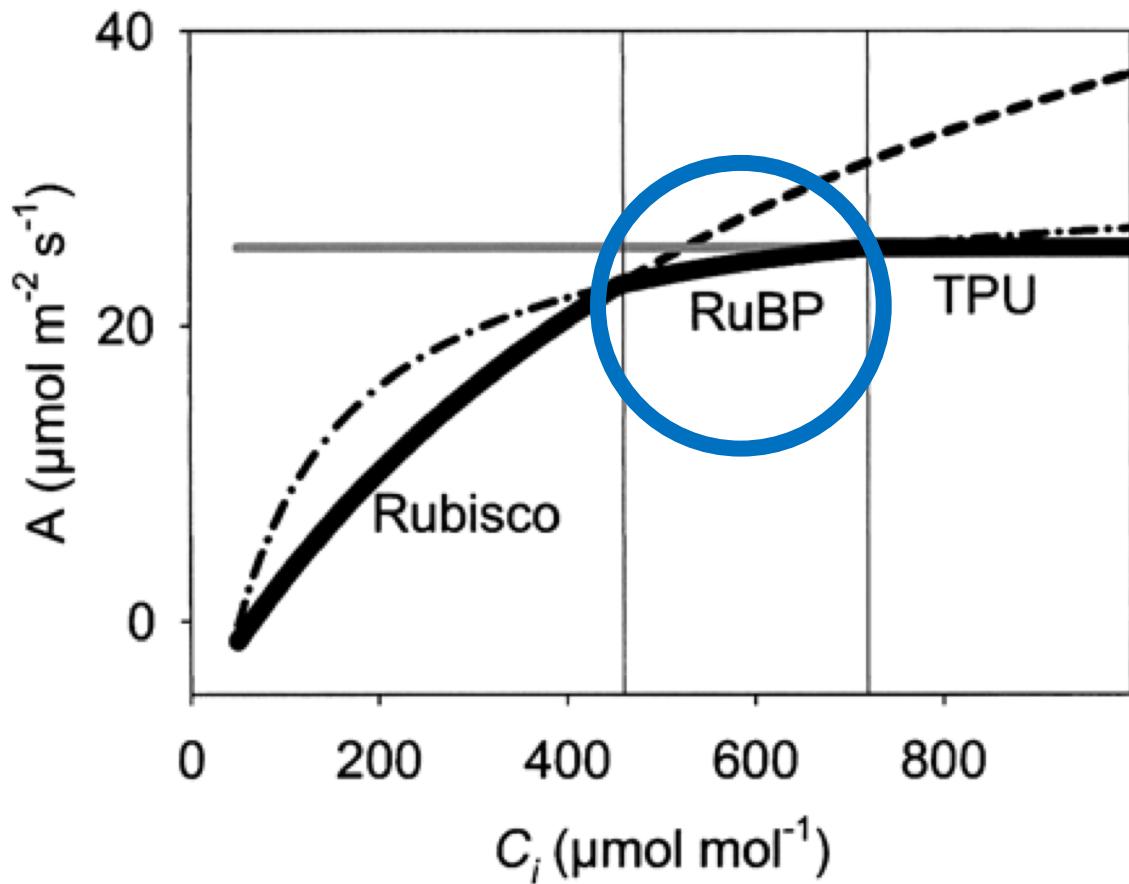
Short-term plant responses to CO₂: the A-C_i curve



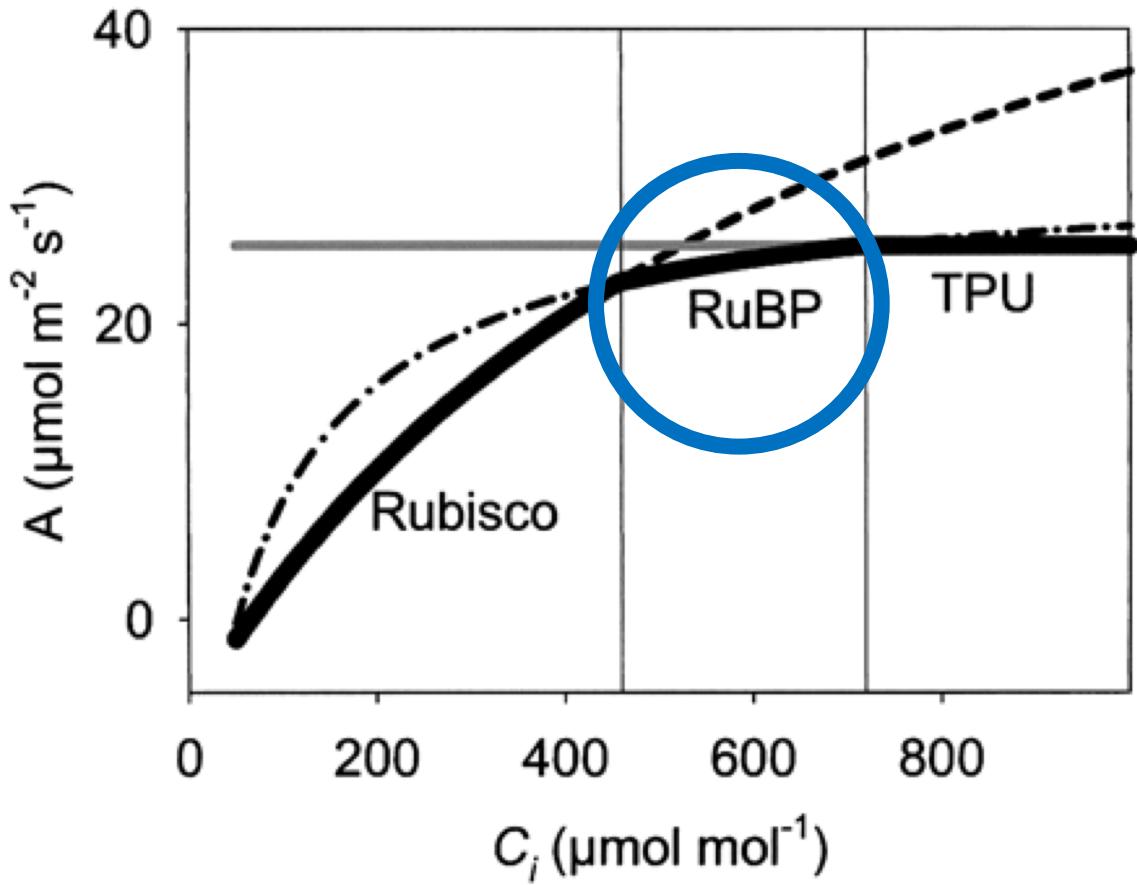
Short-term plant responses to CO₂: the A-C_i curve



Short-term plant responses to CO₂: the A-C_i curve

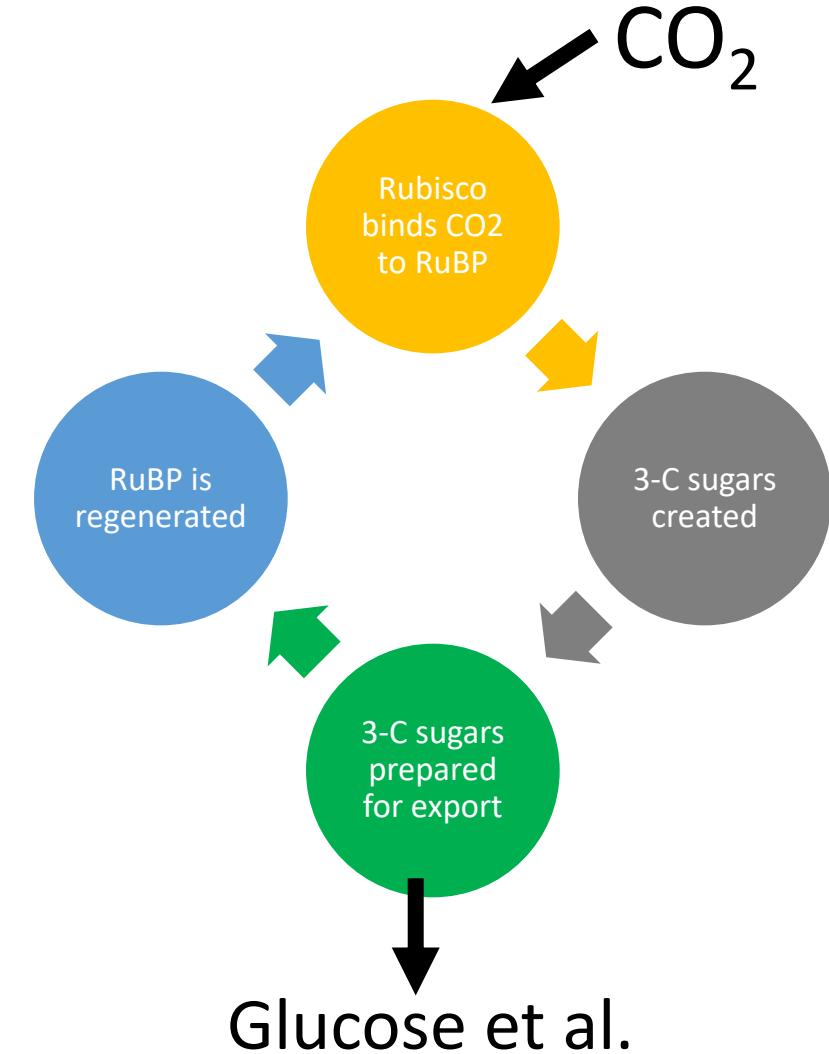
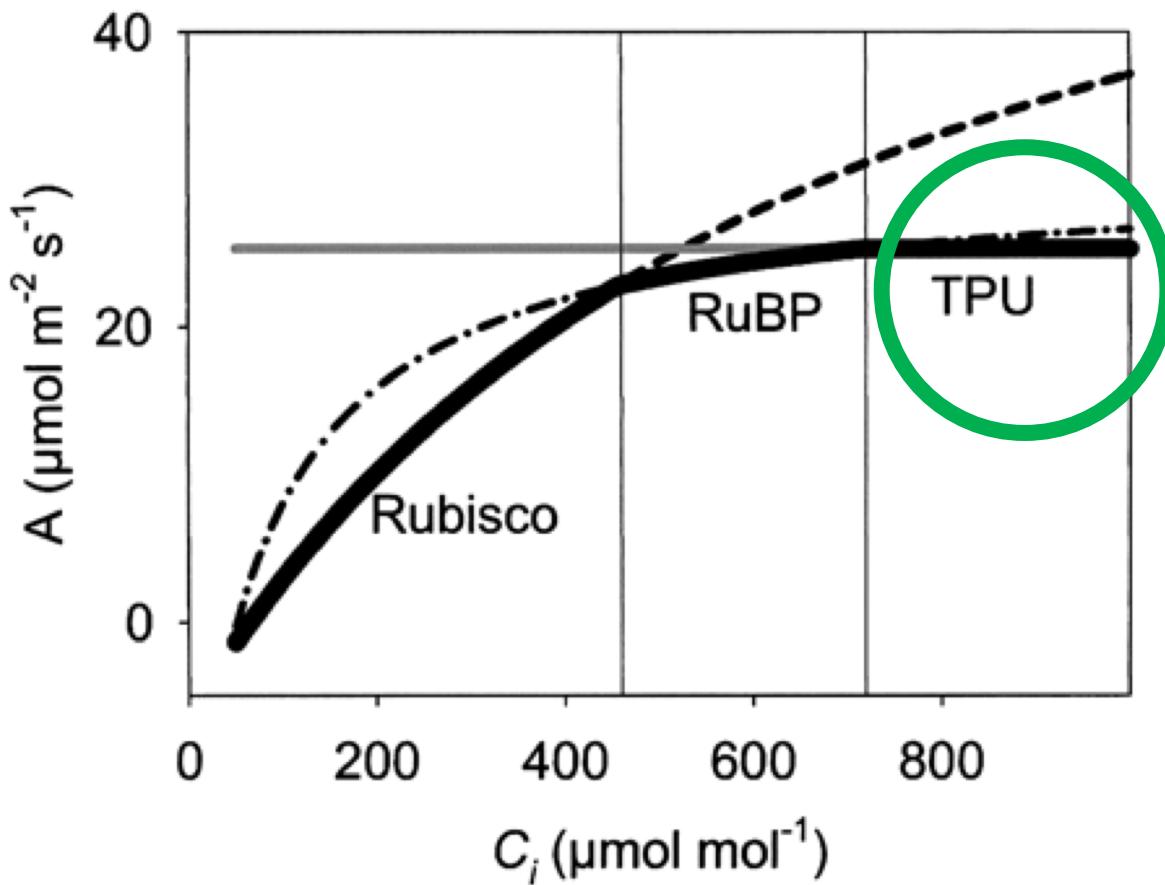


Short-term plant responses to CO₂: the A-C_i curve



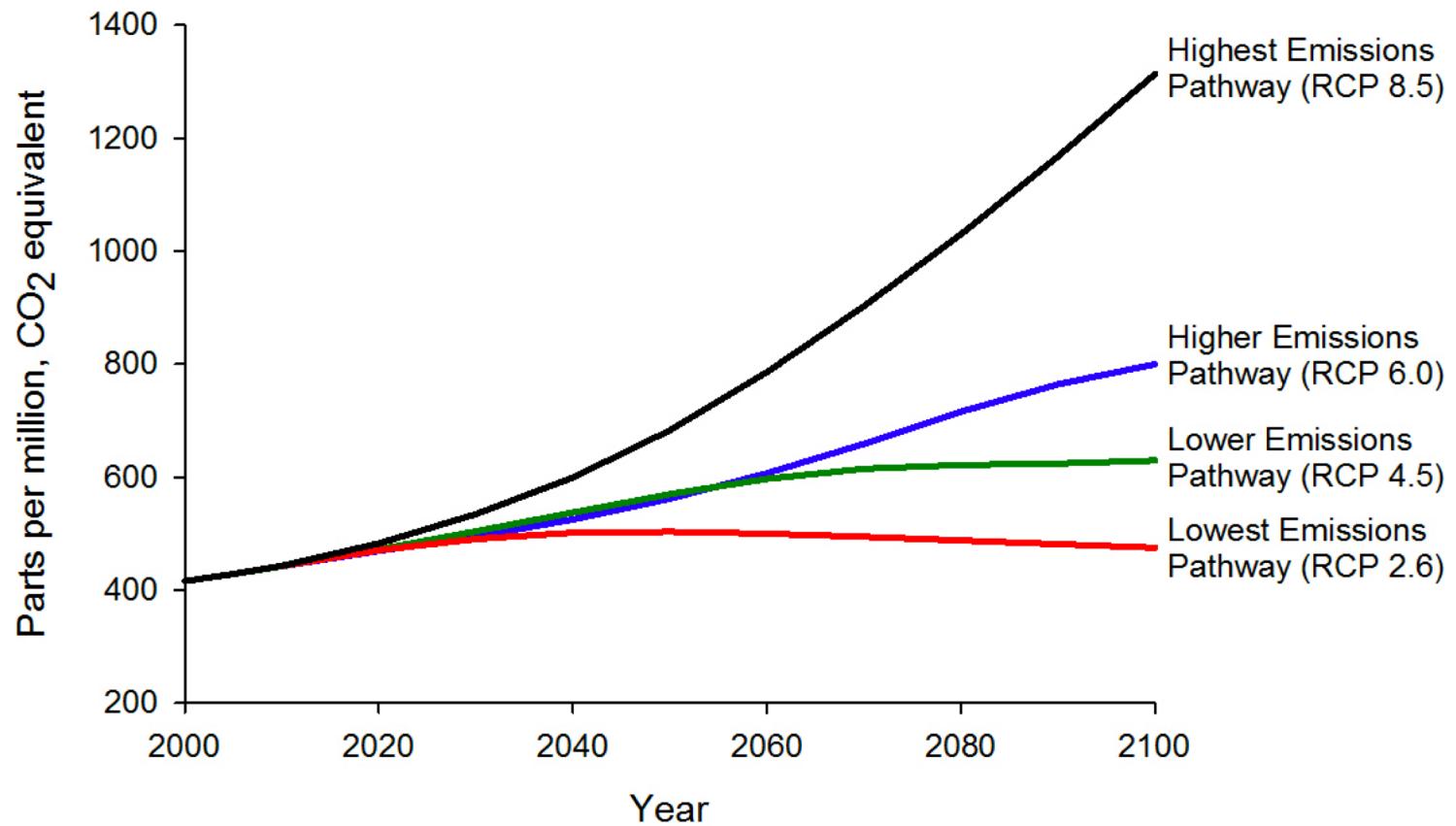
Hold on: What
is strange about
the RuBP
regeneration
response to
CO₂?

Short-term plant responses to CO₂: the A-C_i curve

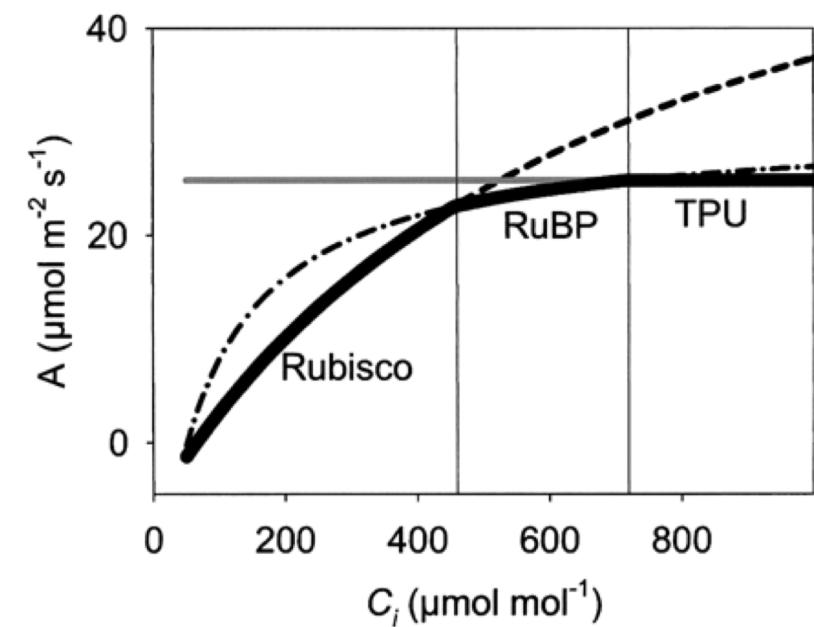


This response is relatively
consistent across species and
fairly easy to measure!

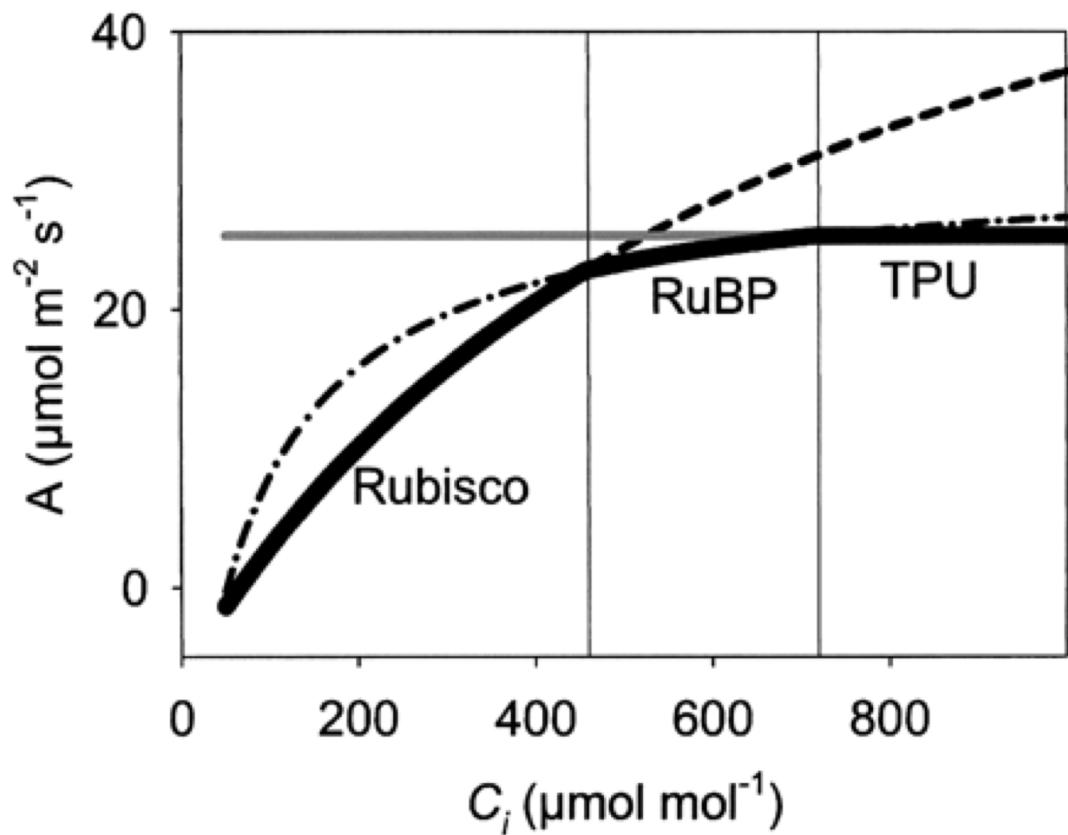
Projected Atmospheric Greenhouse Gas Concentrations



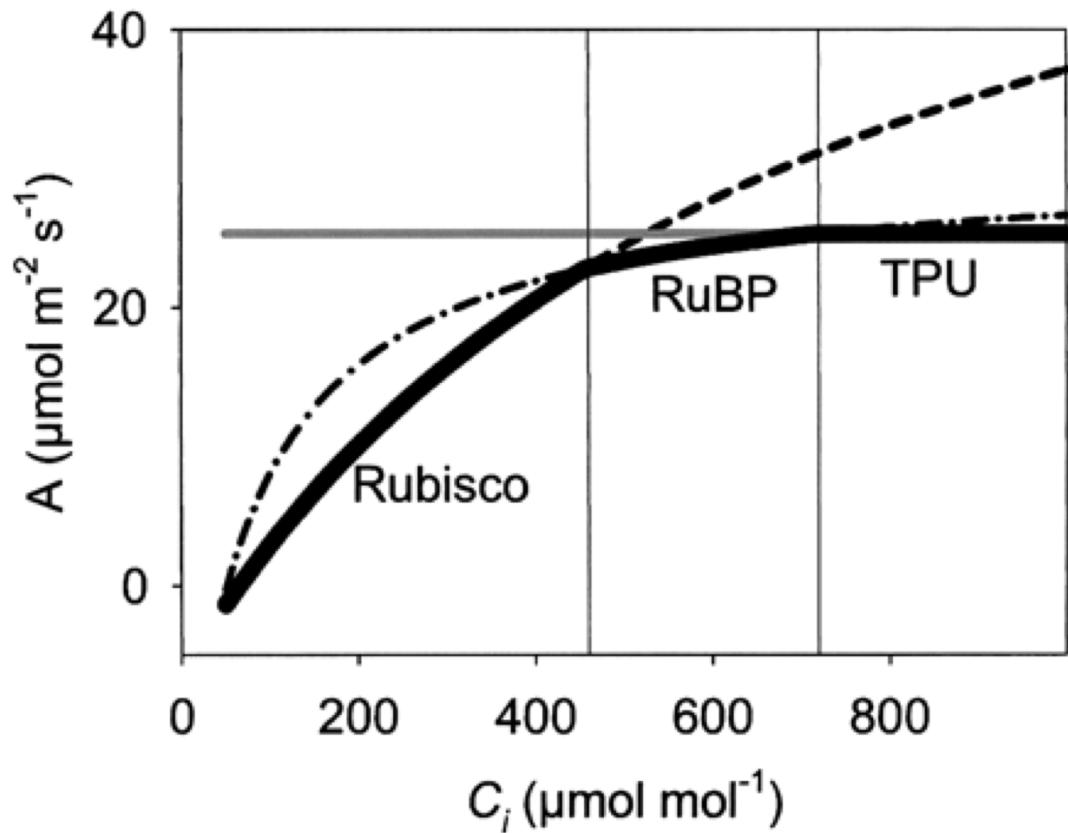
What do you
expect the plant
response to be?



How might the long-term response to elevated CO₂ differ?



How might the long-term response to elevated CO₂ differ?

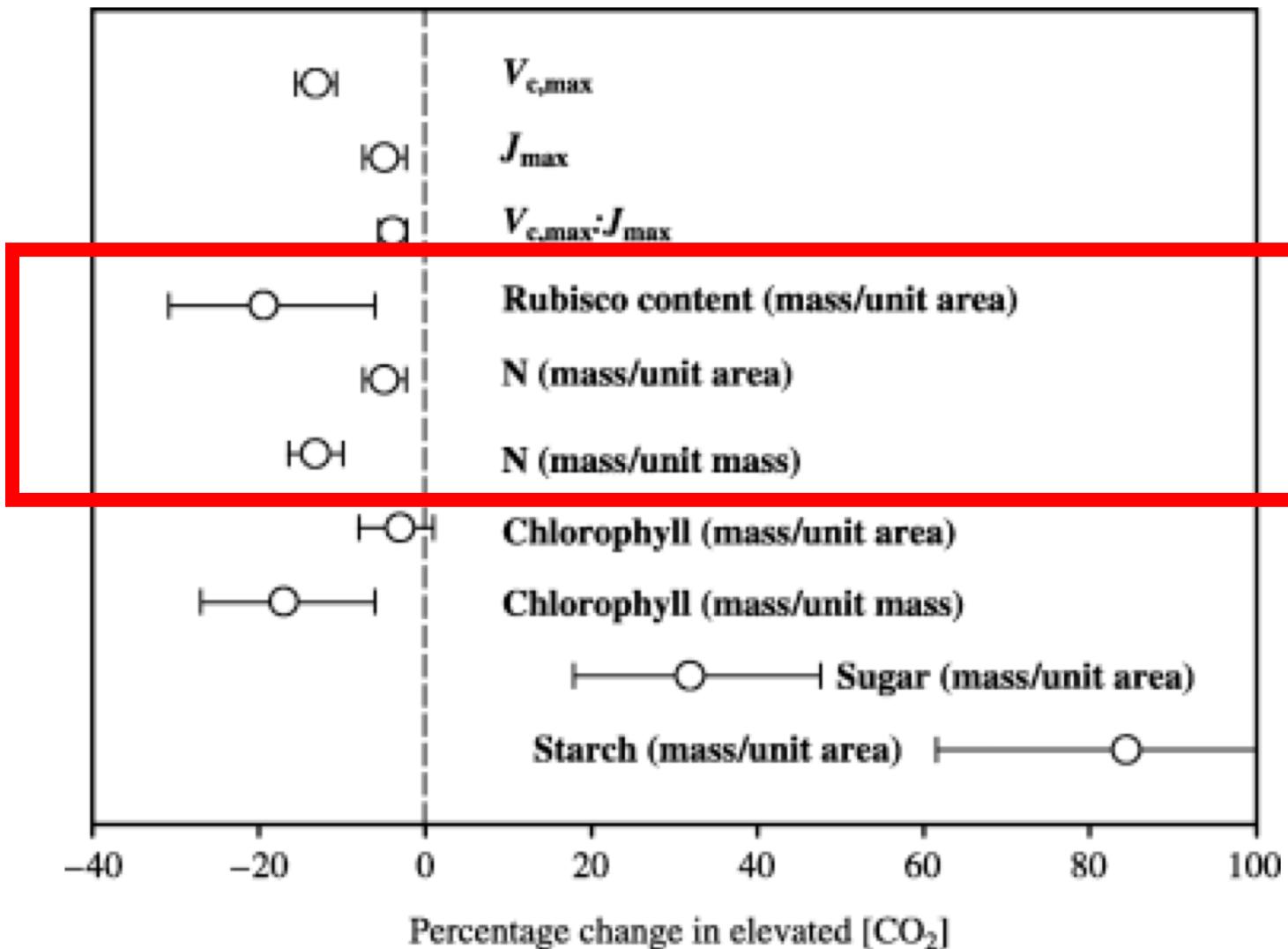


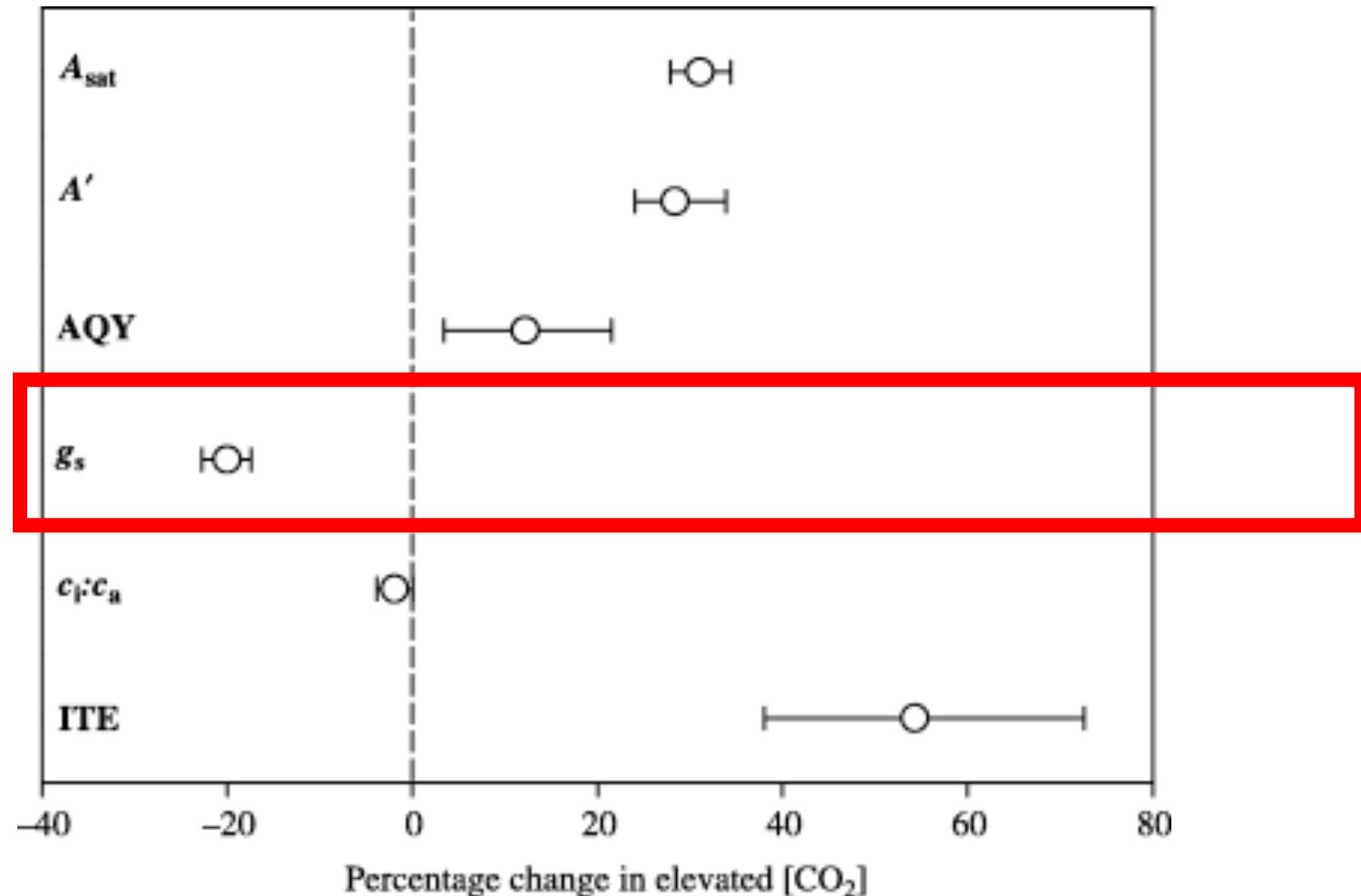
Things to consider:

- Each component represents a within leaf investment
- Plants generally aim for efficiency
- RuBP regeneration is principally determined by light availability
- Rubisco is an expensive enzyme (lots of N)
- It's costly to use water

Free Air CO₂ enrichment (FACE) experiments

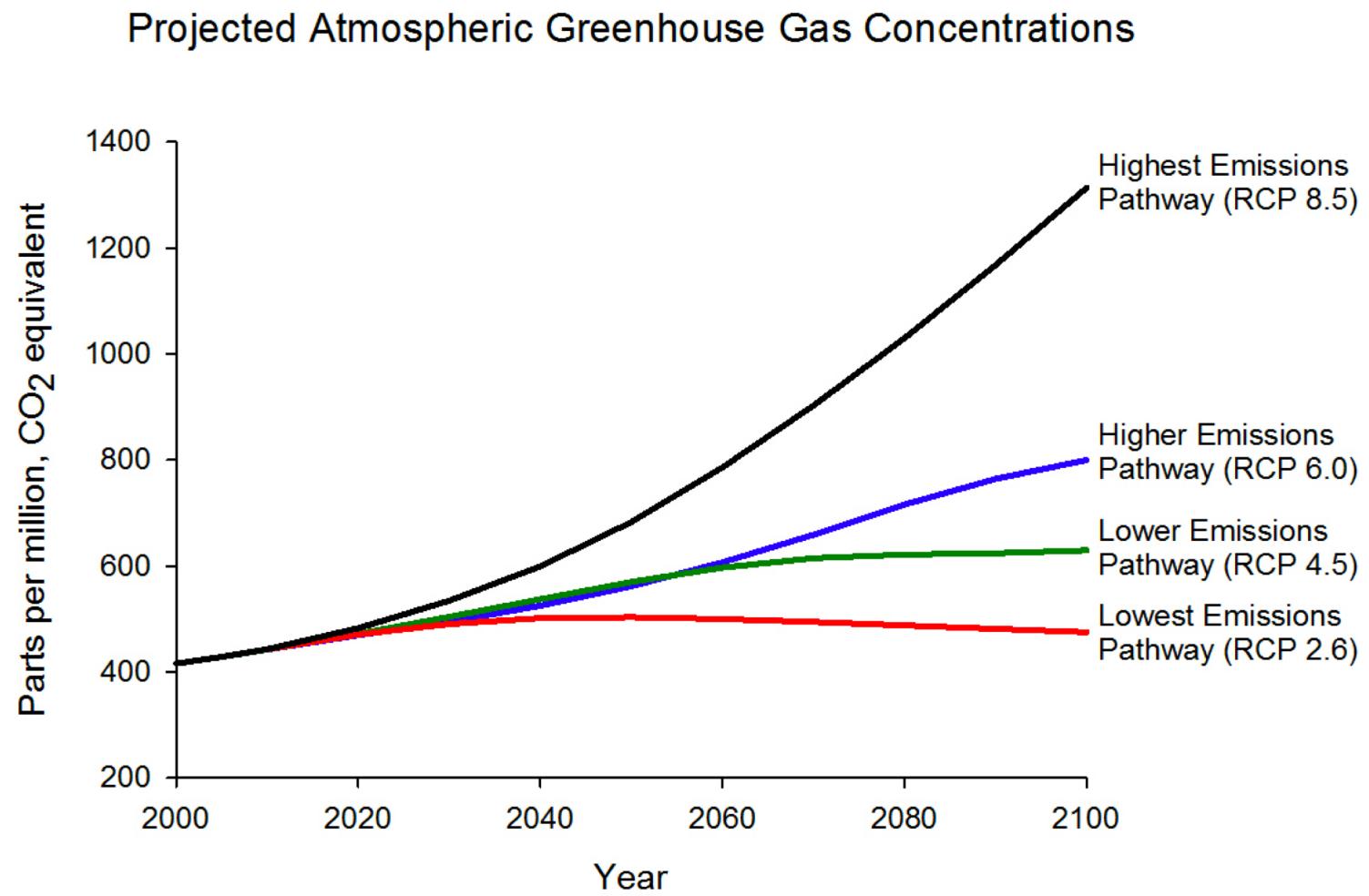






What does this mean for the
whole plant?

What does this mean for the
whole ecosystem?



What do you
expect the plant
response to be?

Draw a systems
diagram

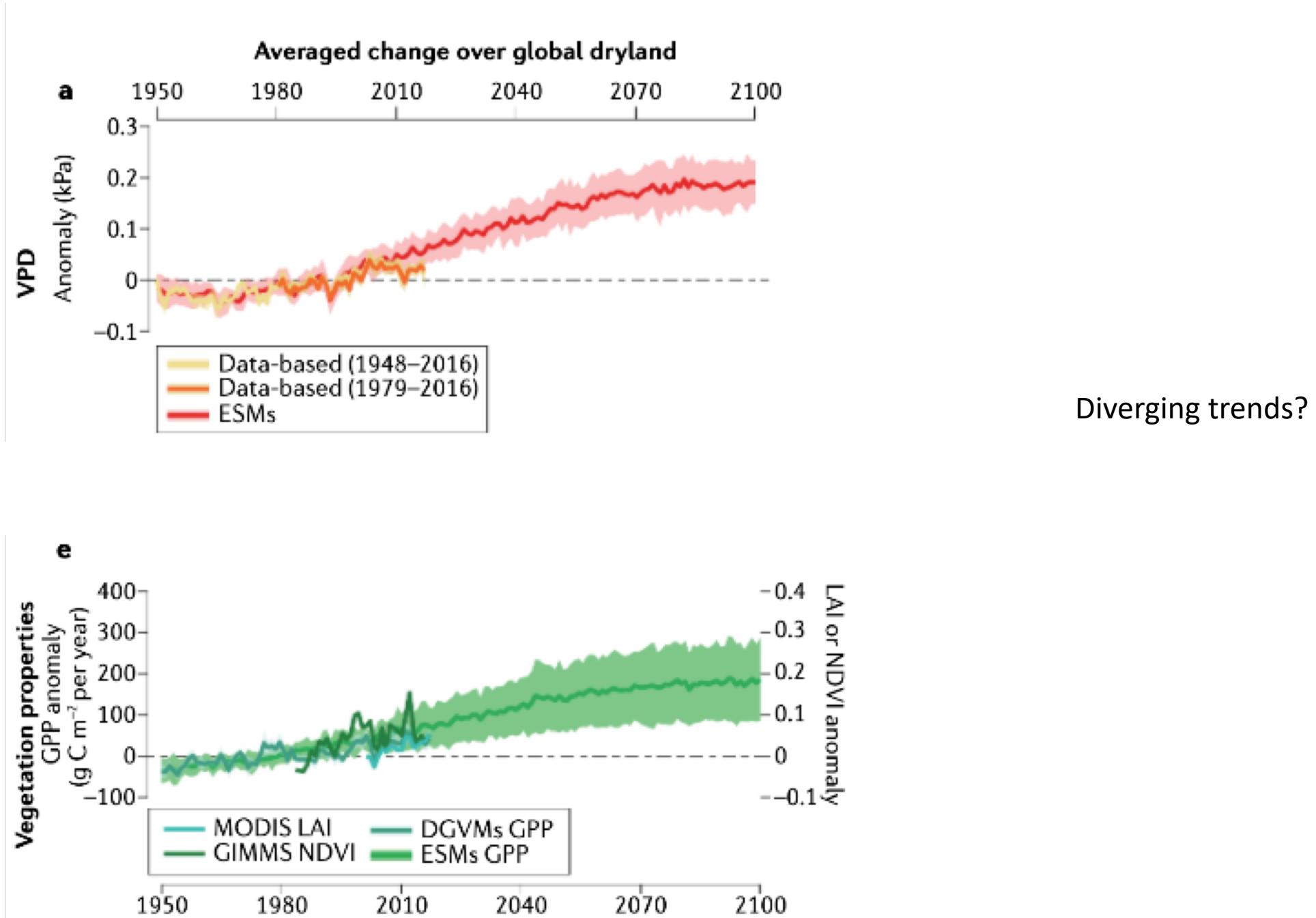
Hot off the press!!

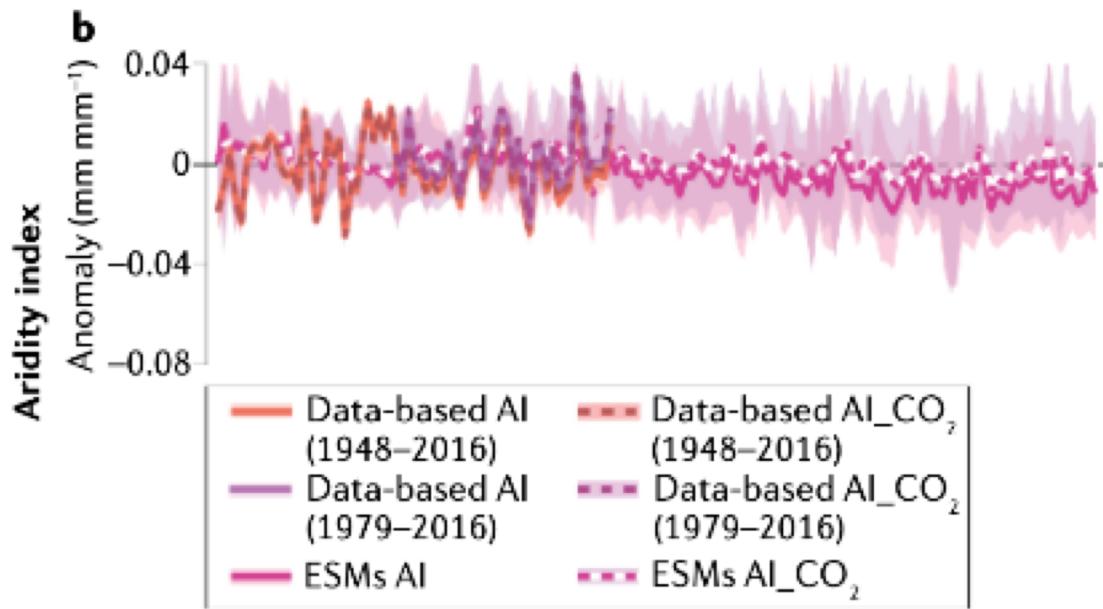
Review Article | Published: 09 March 2021

Multifaceted characteristics of dryland aridity changes in a warming world

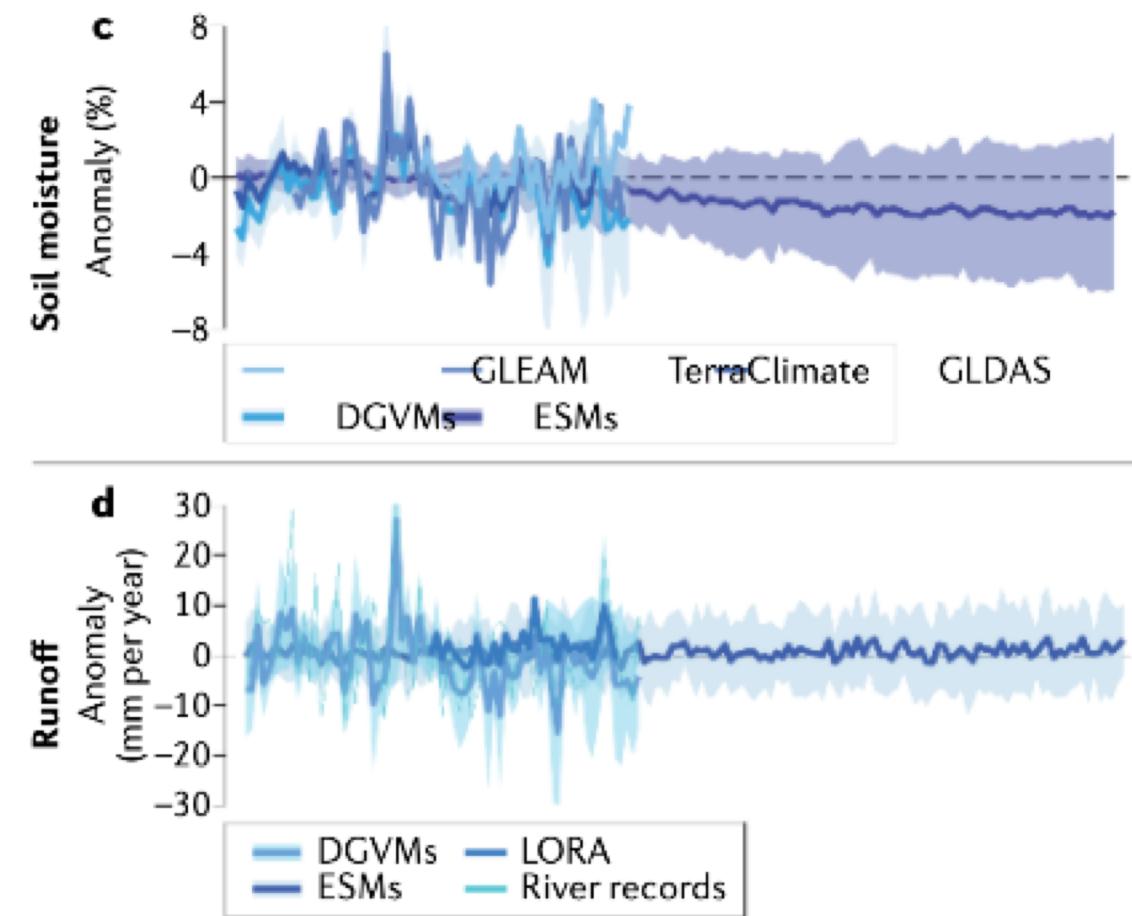
Xu Lian, Shilong Piao , Anping Chen, Chris Huntingford, Bojie Fu, Laurent Z. X. Li, Jianping Huang, Justin Sheffield, Alexis M. Berg, Trevor F. Keenan, Tim R. McVicar, Yoshihide Wada, Xuhui Wang, Tao Wang, Yuting Yang & Michael L. Roderick

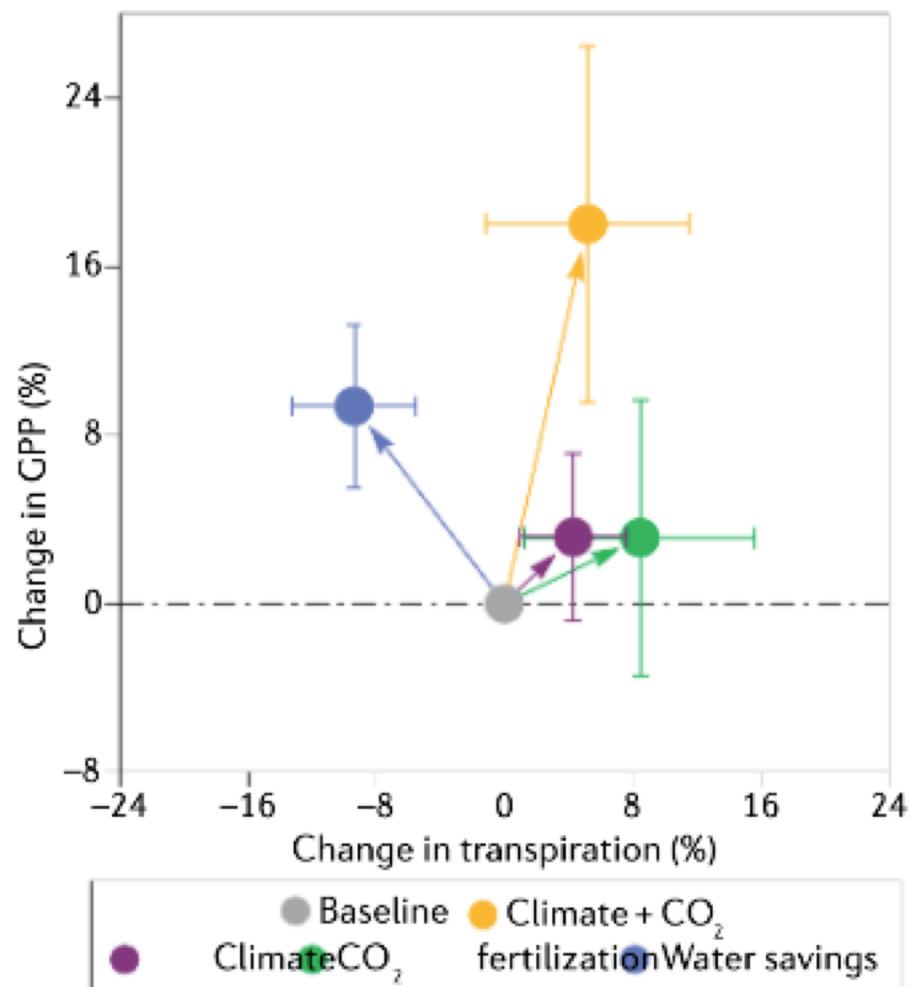
Nature Reviews Earth & Environment (2021) | [Cite this article](#)





Need to look belowground!





TRENDY model results showing separated and combined (yellow) effects

Bazzaz figure for discussion

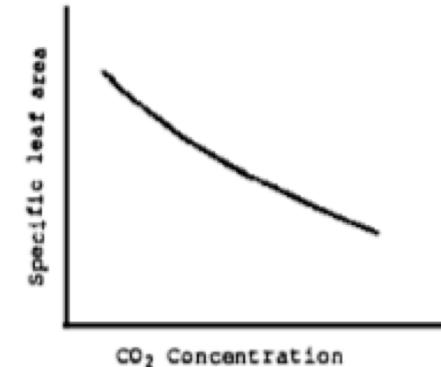
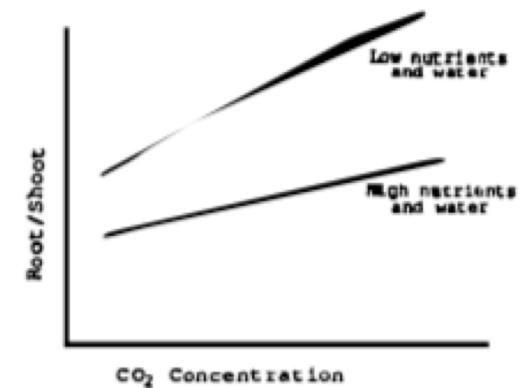
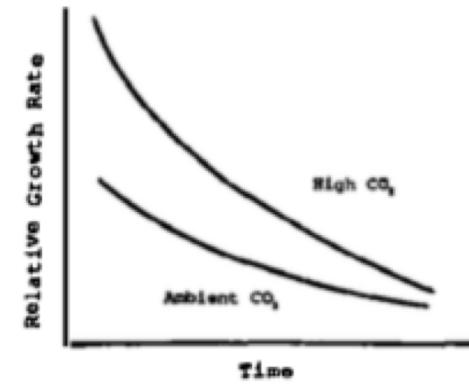
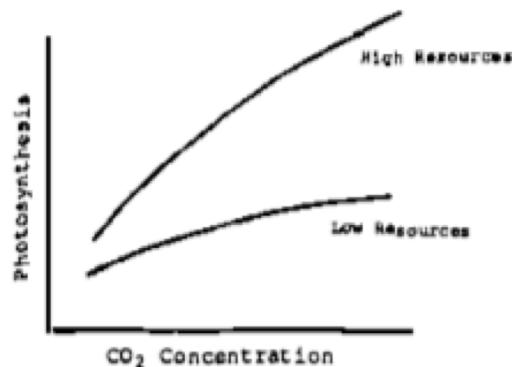
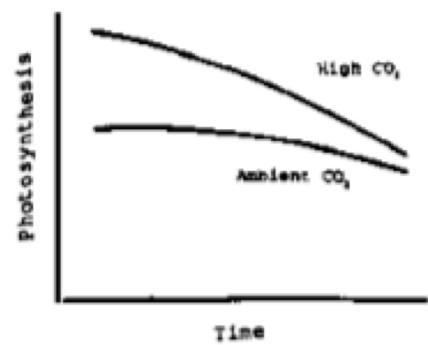
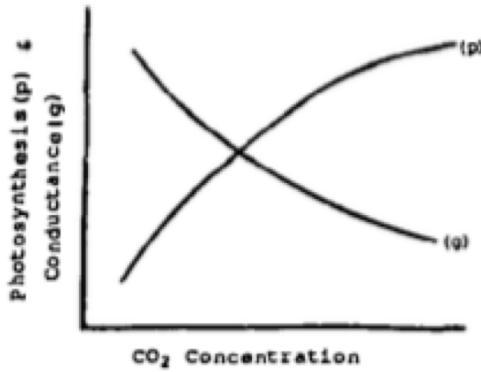


Figure 1 General trends of response of plants to CO₂ concentrations.