

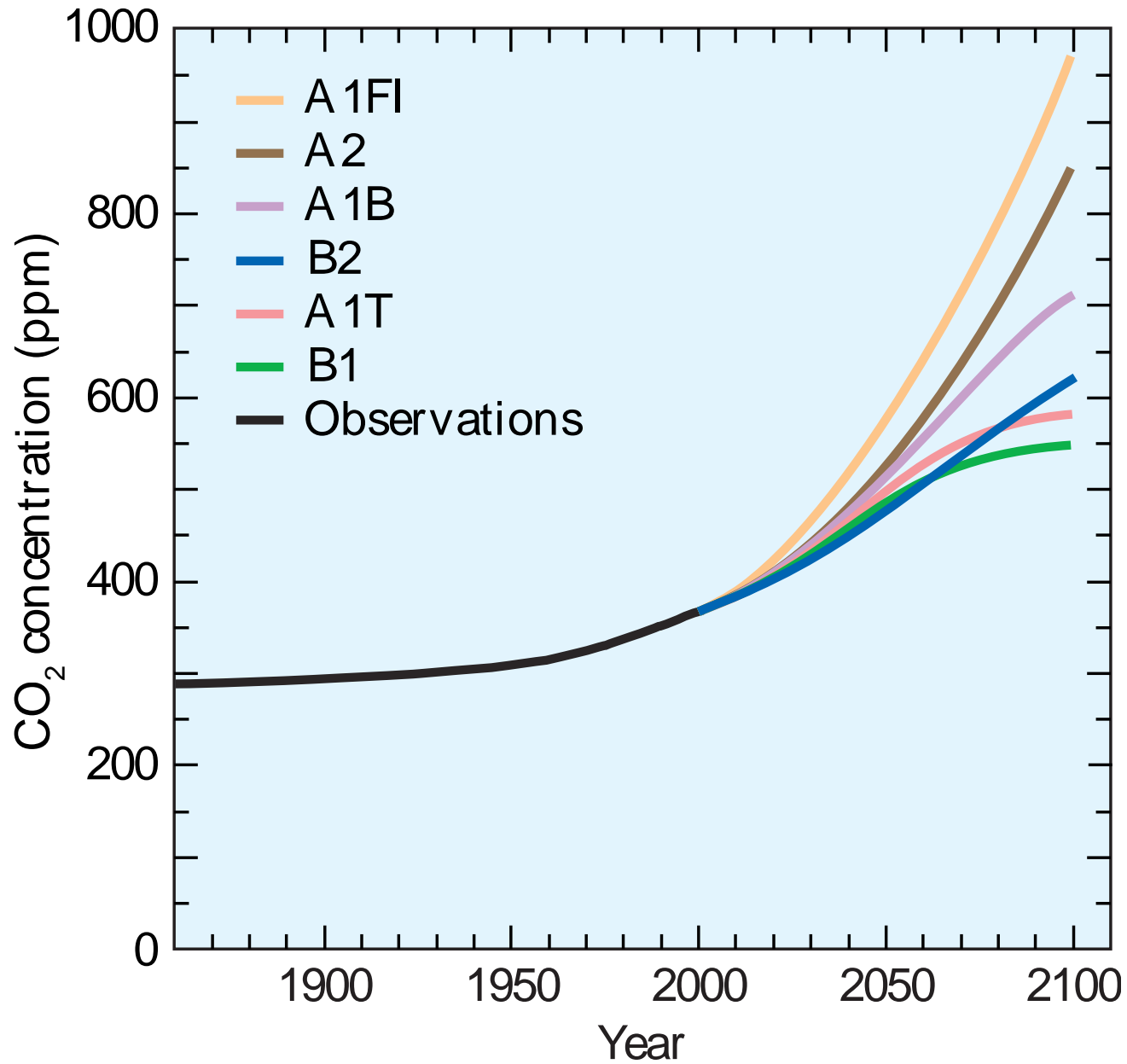
Plant Responses to Rising Atmospheric CO₂ Concentrations



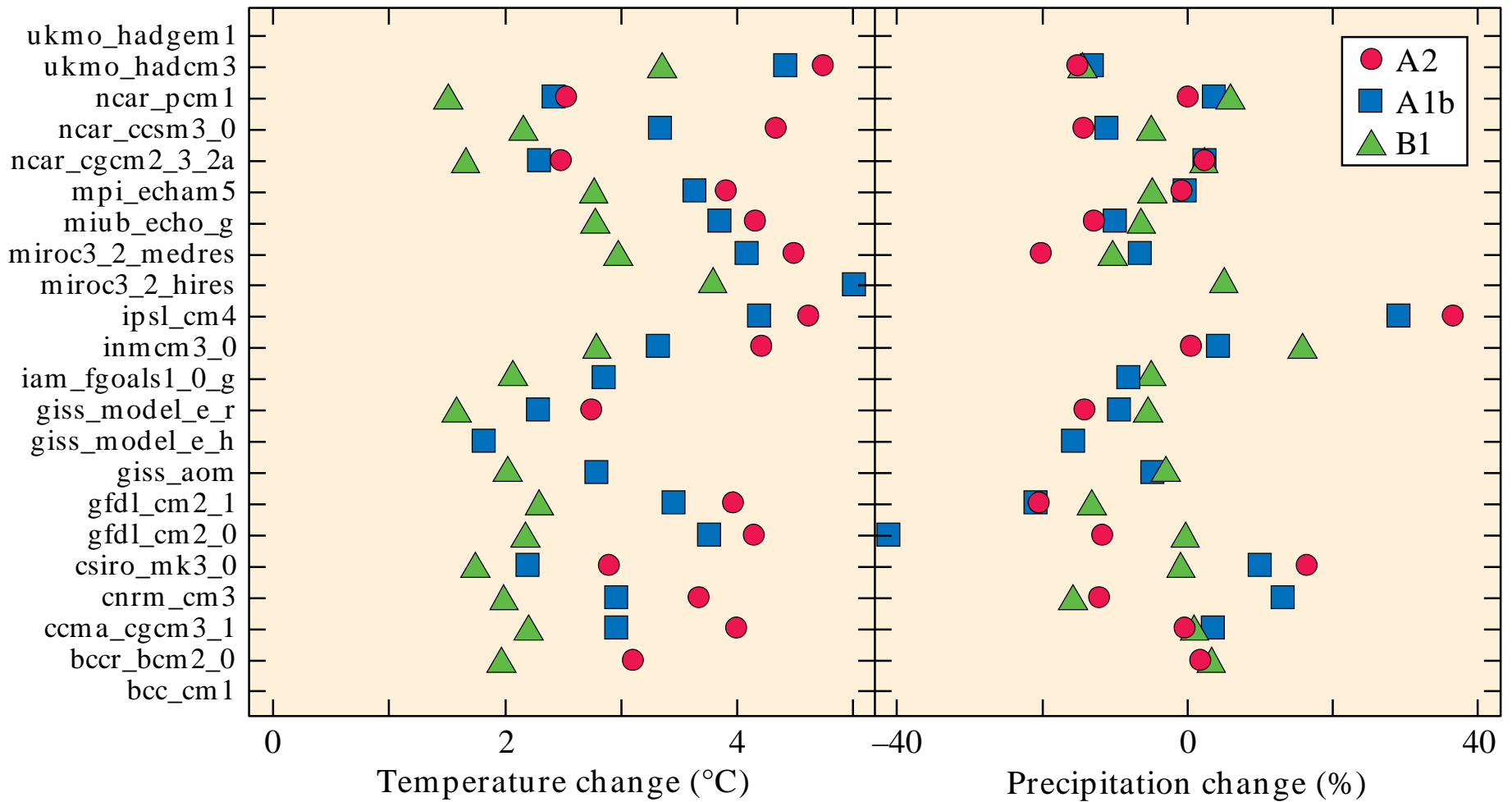
Arnold J. Bloom



- ❖ **Jose Salvador Rubio Asenio, Plant Sciences, UC Davis**
- ❖ **Martin Burger, Plant Sciences, UC Davis**
- ❖ **Asaph Cousins, Washington State U.**
- ❖ **Shimon Rachmilevitch, Ben Gurion U., Israel**
- ❖ **Leslie Randall, Plant Sciences, UC Davis**
- ❖ **Peter Searles, CRILAR, La Rioja, Argentina**
- ❖ **David Smart, V & E, UC Davis**



IPCC (2007) Cambridge U. Press, NY.



Lobell *et al.* (2006) *Ag. For. Met.* 141:208-218.

Plant Responses to Rising Atmospheric CO₂ Concentrations

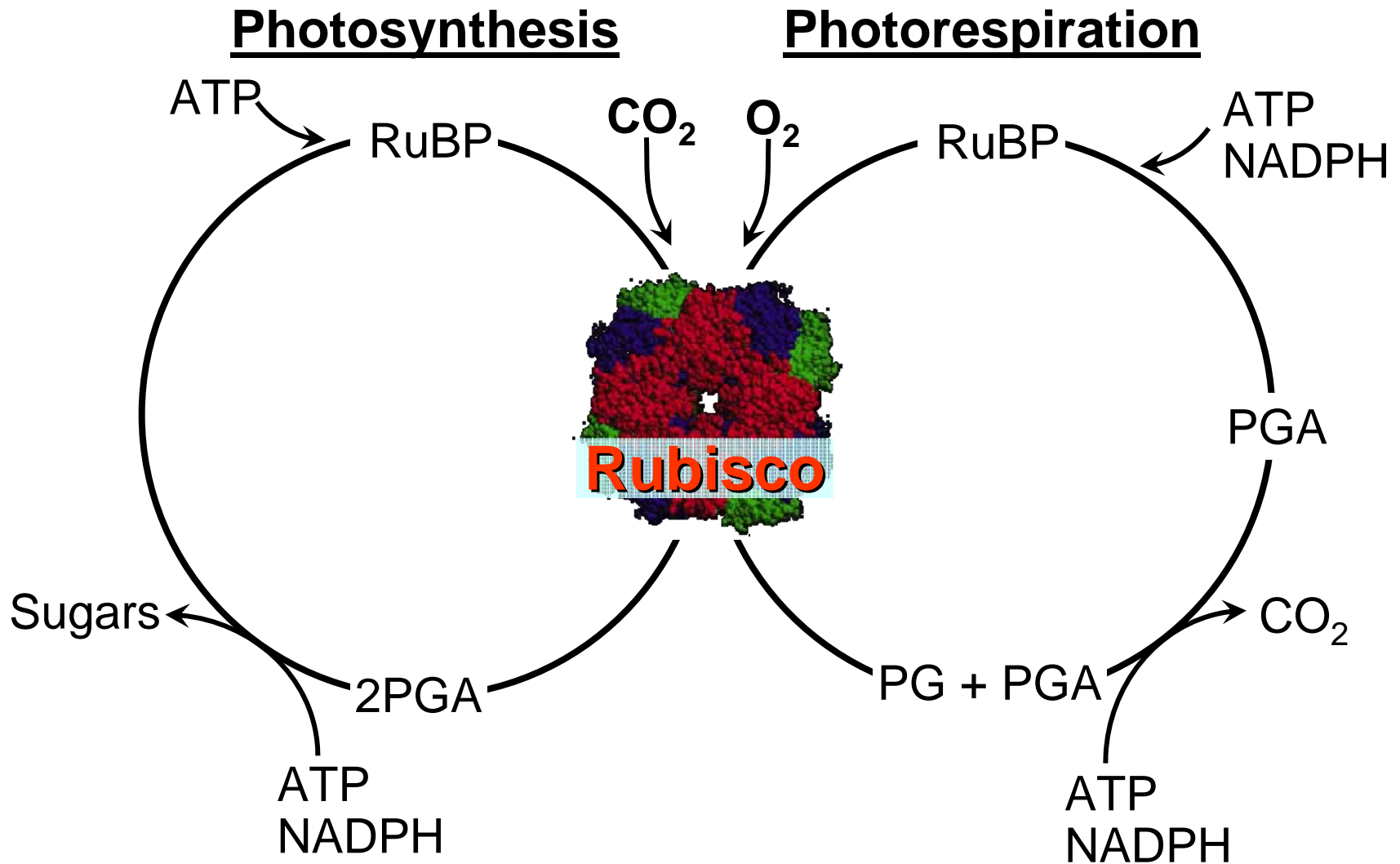
1. Direct Effects of Rising CO₂ on Crops

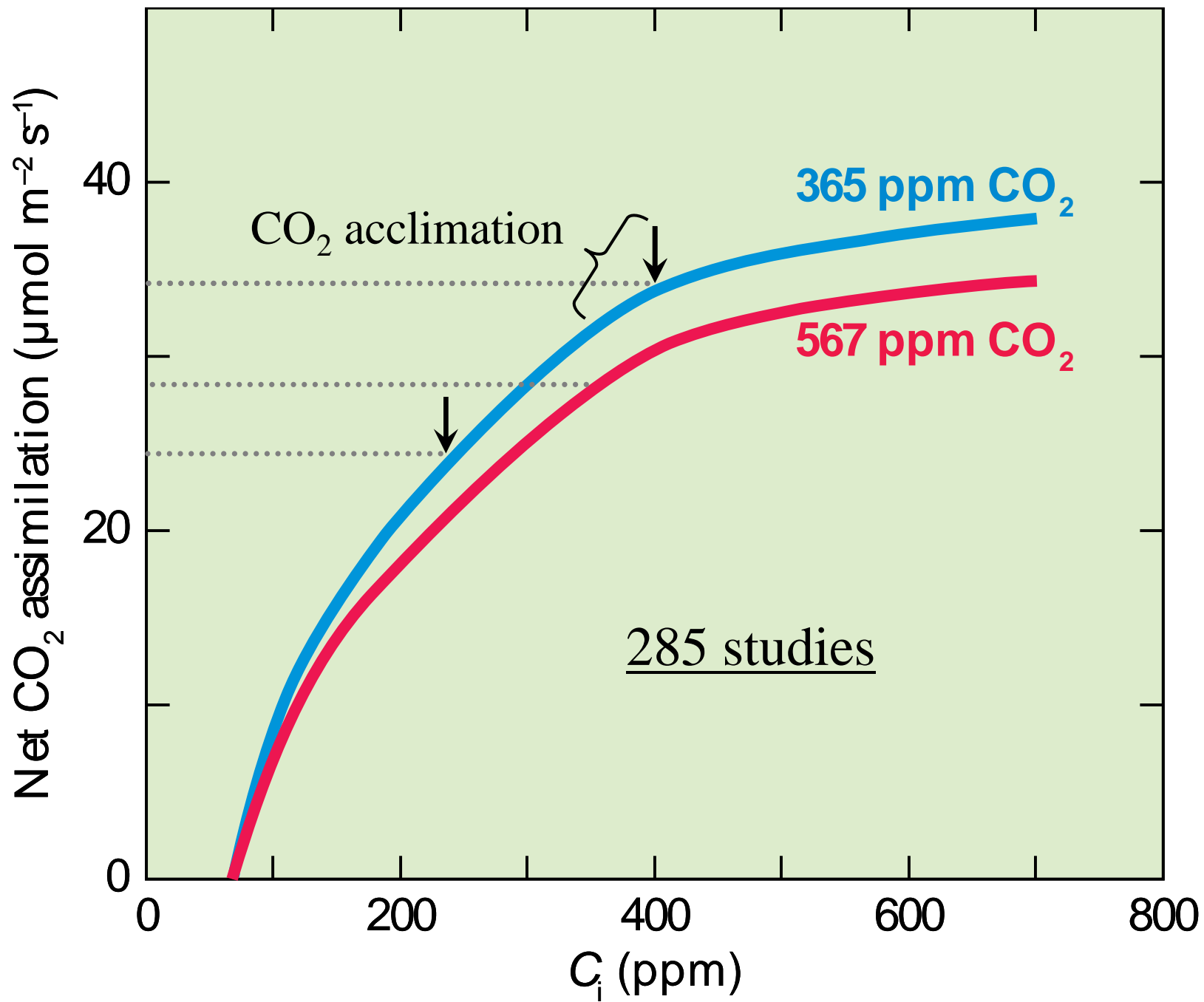
- CO₂ acclimation.
- Inhibition of nitrate assimilation.

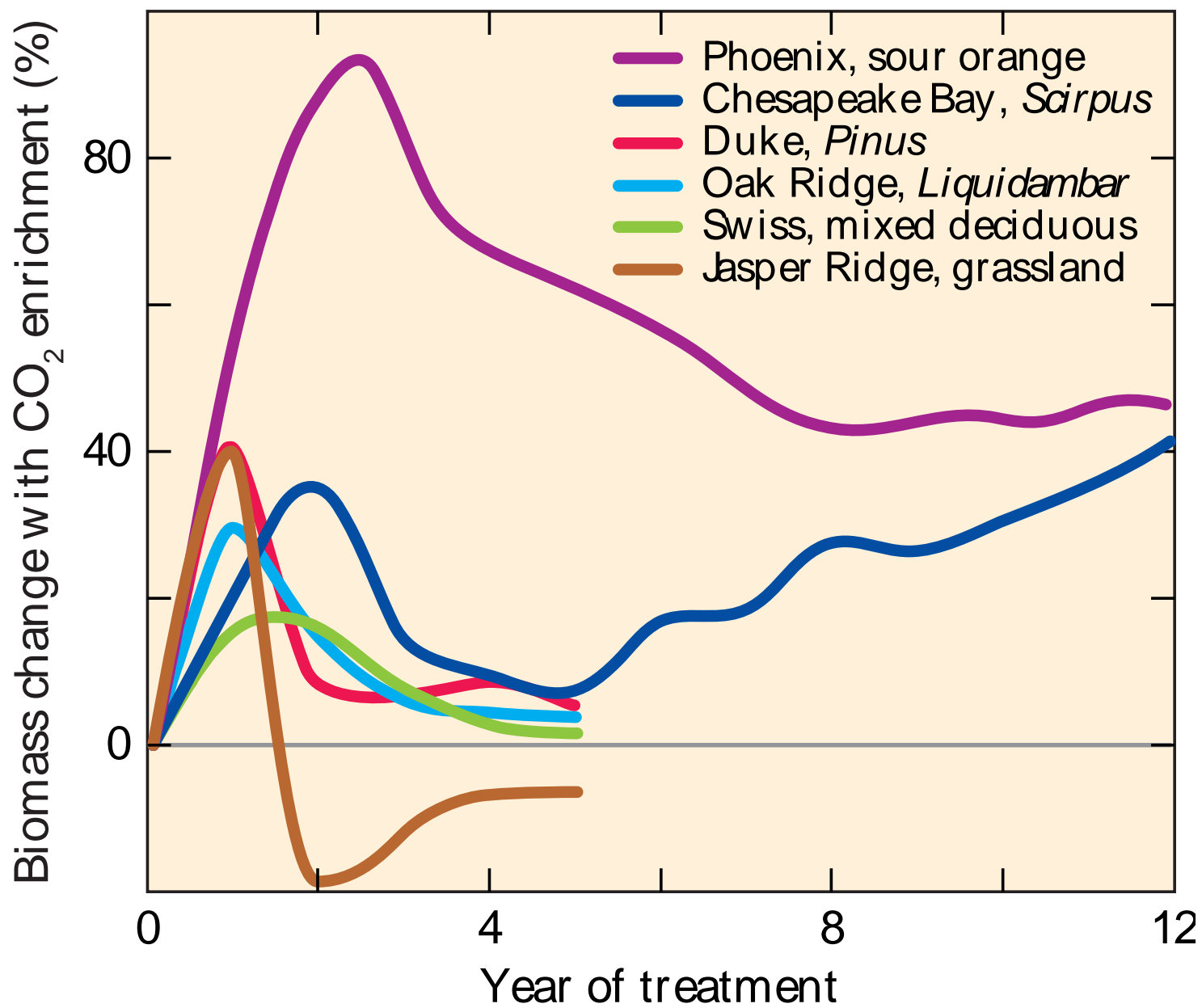
2. Variable Precipitation

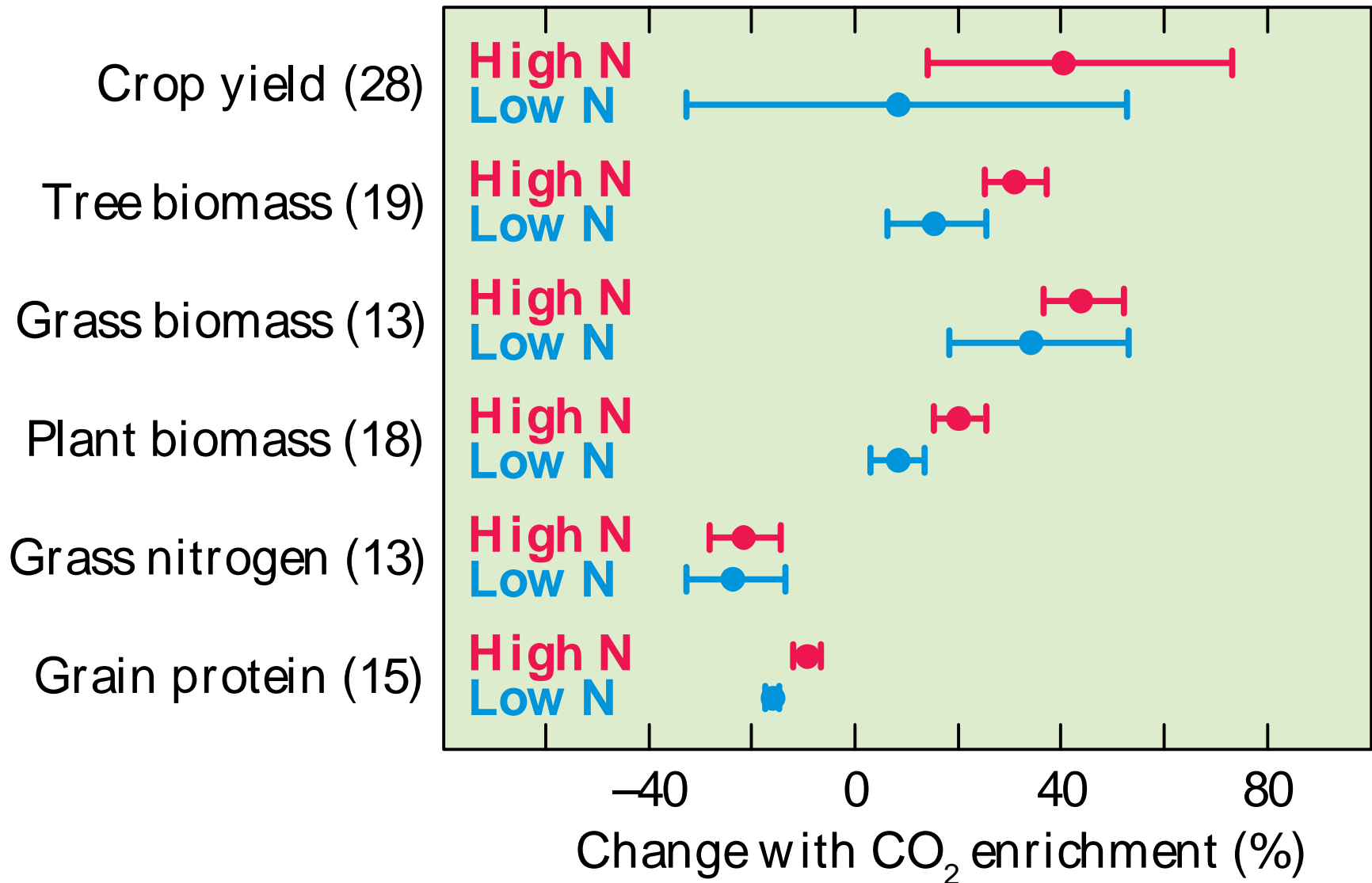
- Higher CO₂ will encourage greater WUE.

Plant Photobiology



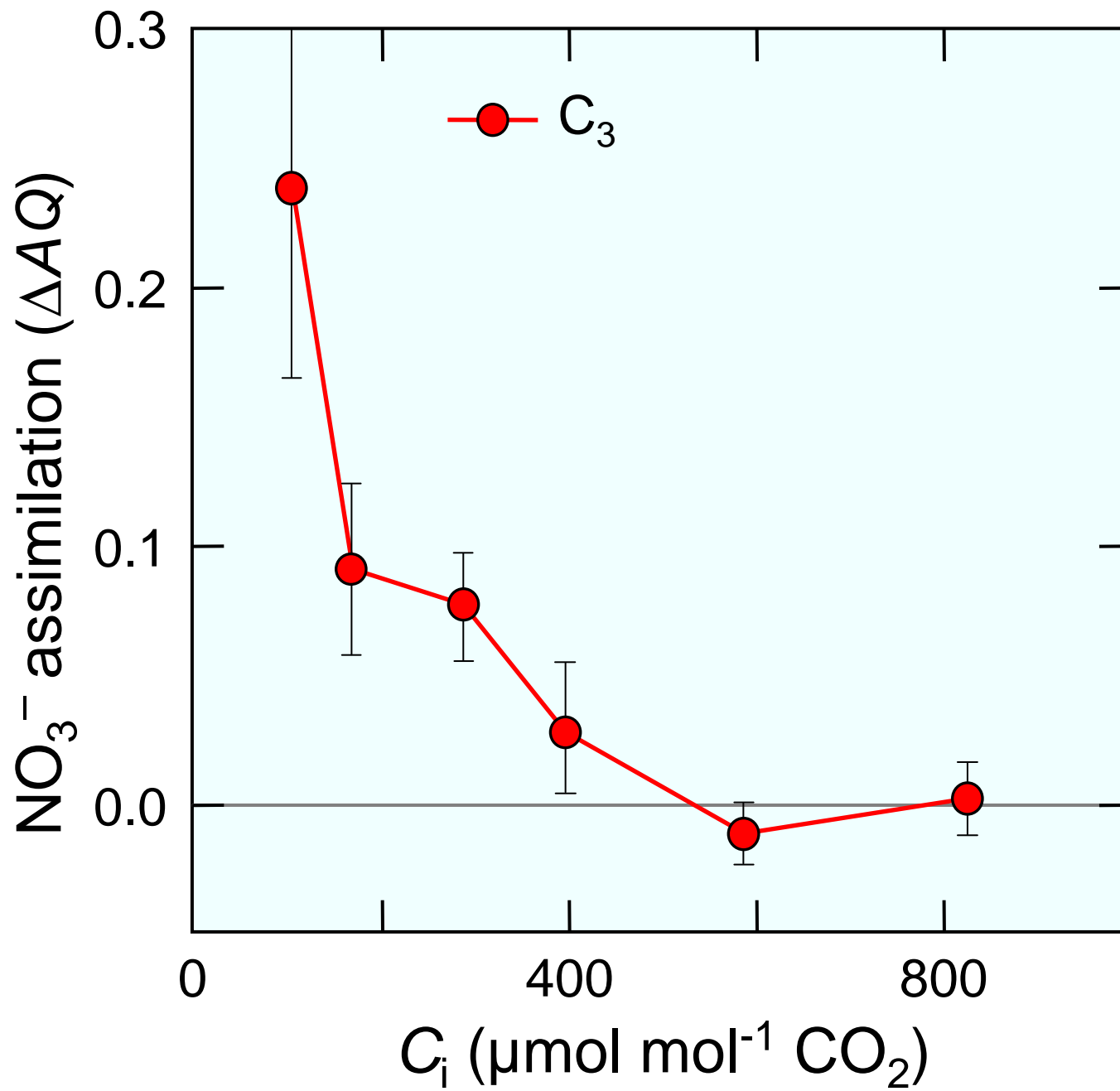




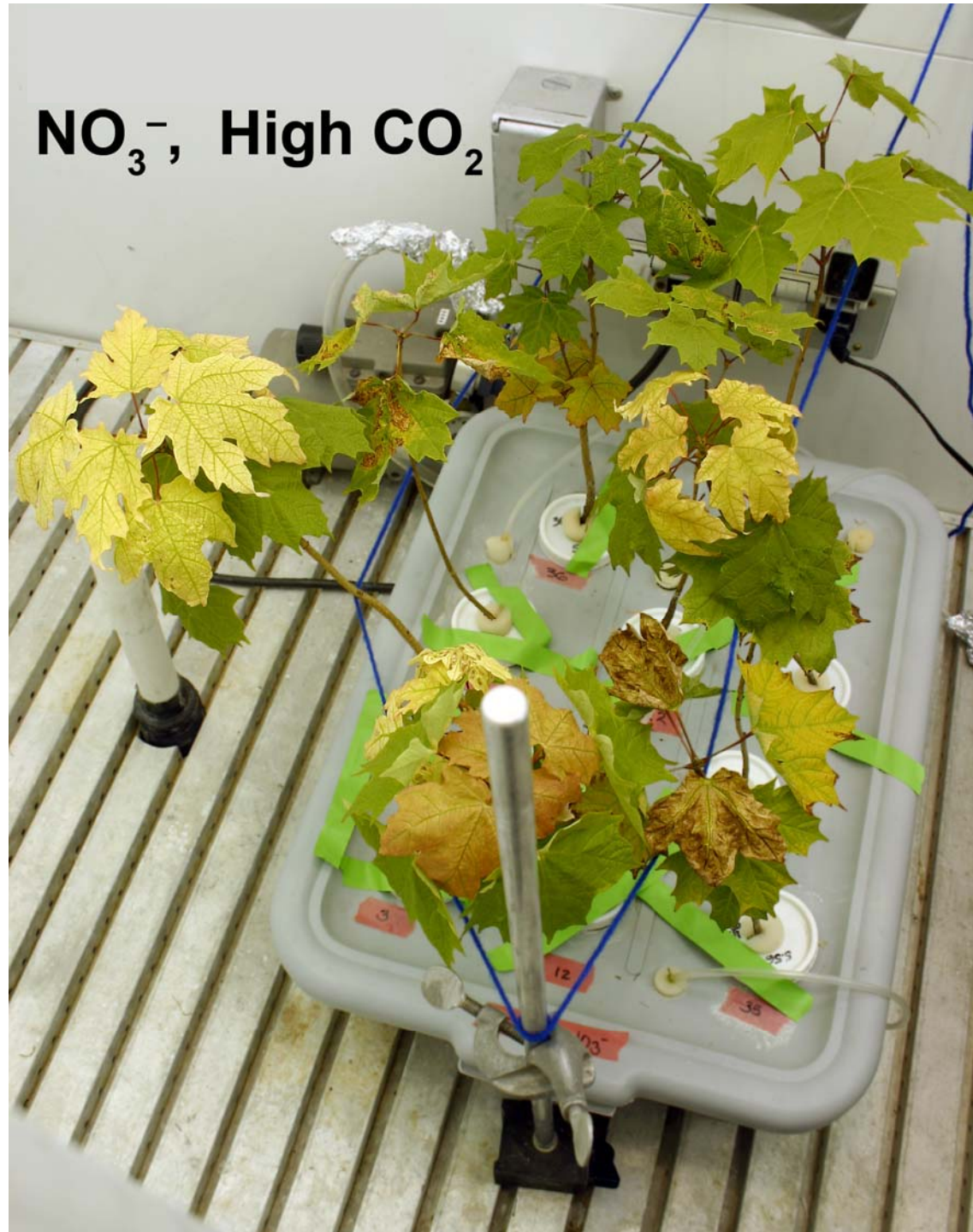


Plant Responses to Rising CO₂

- **Photorespiration decreases**
 - Doubling CO₂ increases growth & PS 30% short-term.
- **CO₂ Acclimation**
 - Stimulation of elevated CO₂ declines to 8% growth & 12% PS.
 - Highly variable.
- **Plant N decreases**
 - Doubling CO₂ produces a 17% decline in N concentration.
 - Decrease in N, 2x that expected through dilution by growth.
- **Hypothesis**
 - Elevated CO₂ inhibits shoot NO₃⁻ assimilation.



Sugar Maple
Acer saccharum

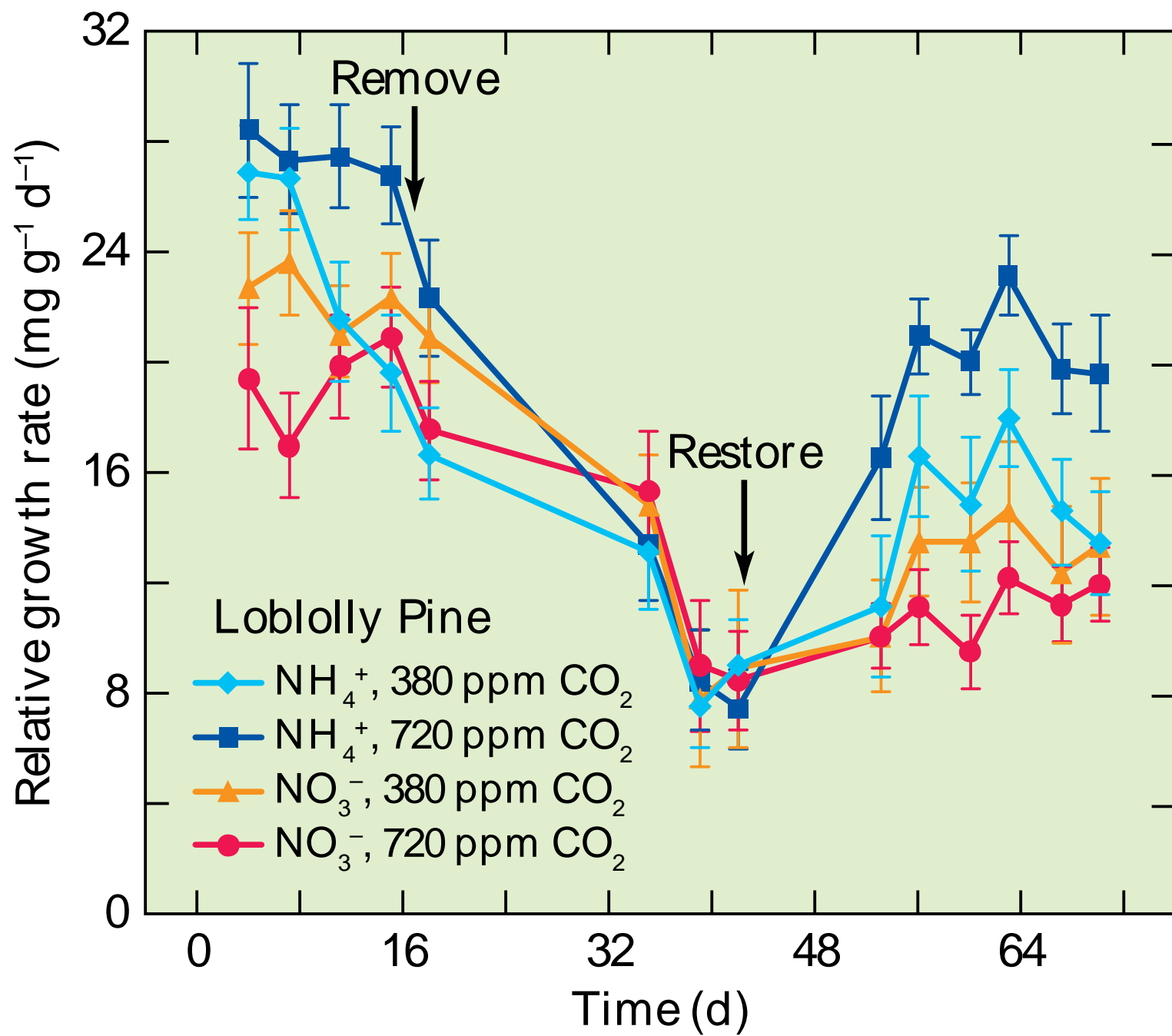


Sweet Gum

Liquidambar styraciflua

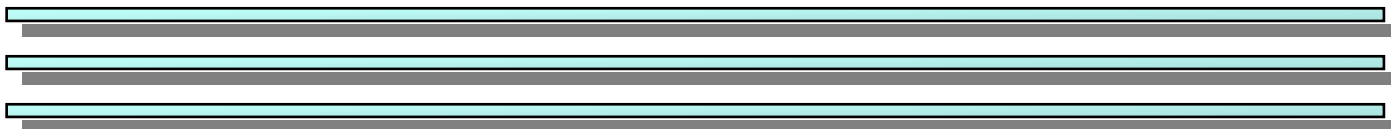
NO₃⁻, High CO₂

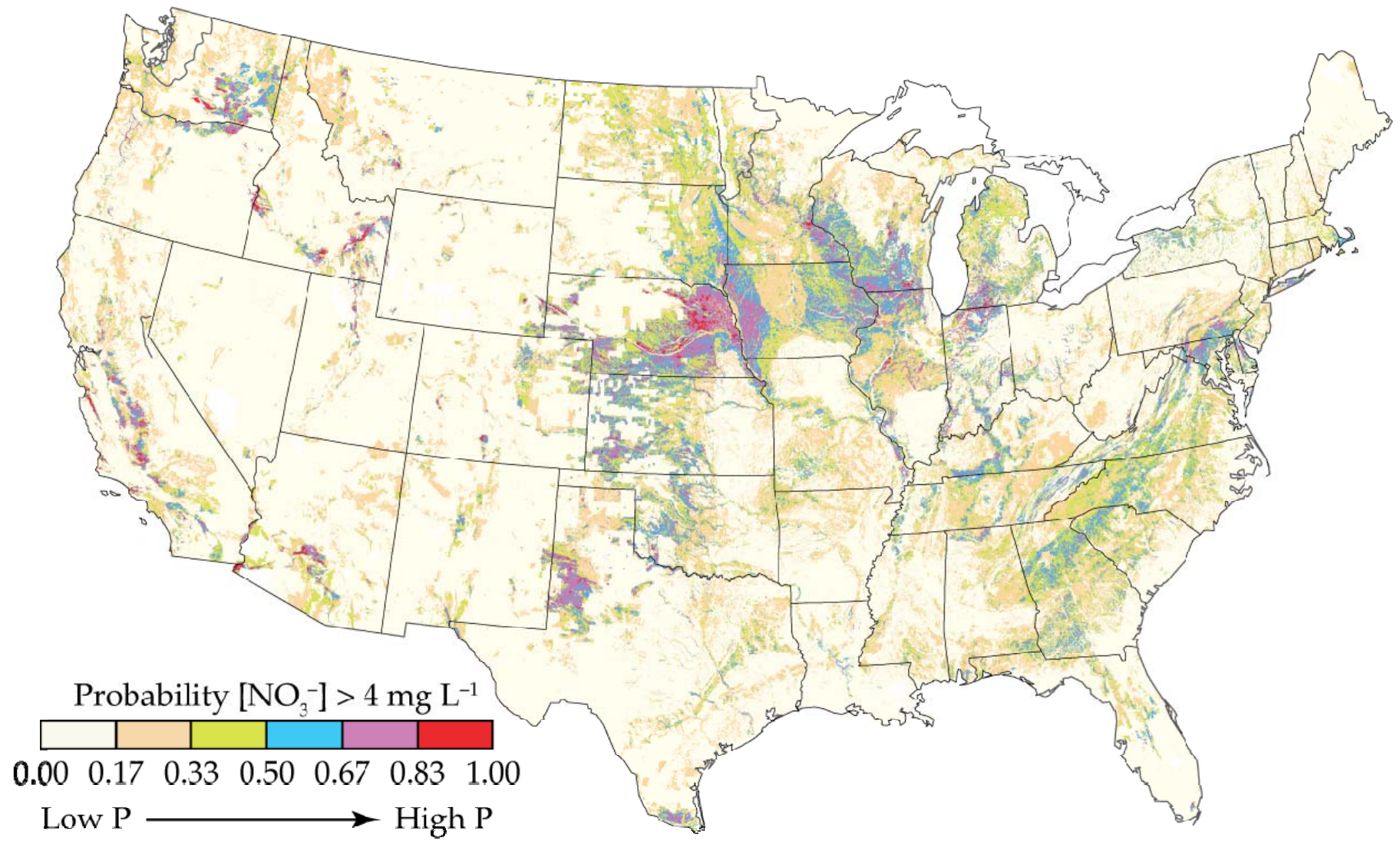




NO₃⁻ Assimilation & Photorespiration

- **NO₃⁻ assimilation depends on photorespiration**
 - Conditions that inhibit photorespiration (high CO₂, low O₂) inhibit NO₃⁻ assimilation.
 - Monocot, dicot, & gymnosperm C₃ species.
- **Compensation through higher N fertilization**
 - Higher costs.
 - Environmental degradation.





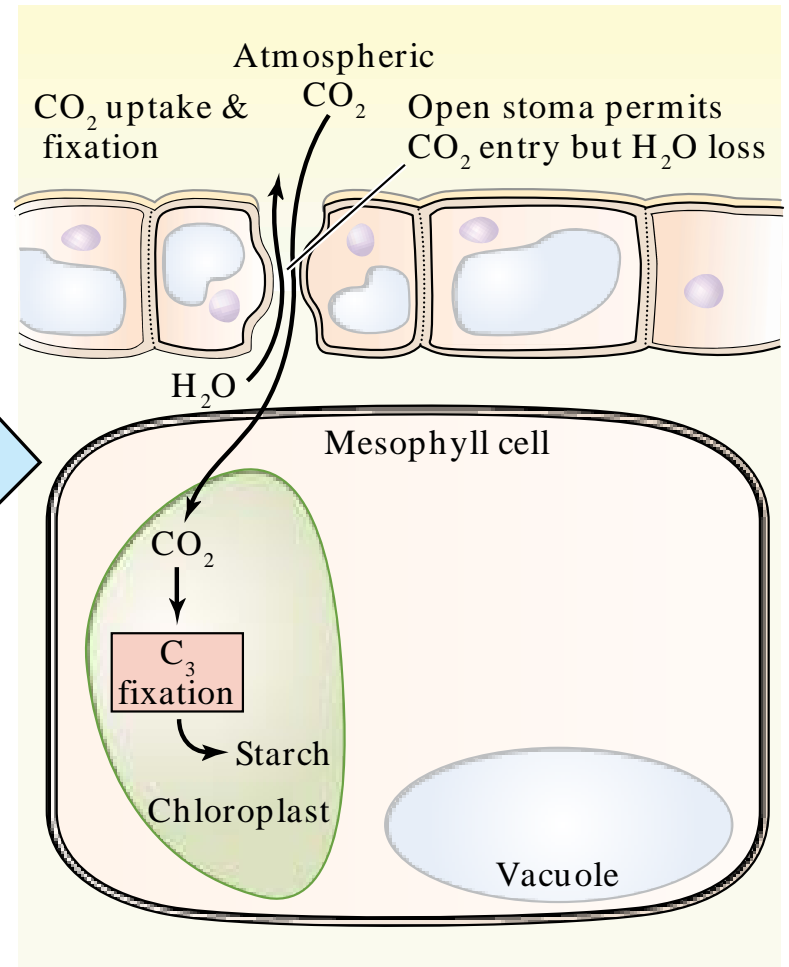
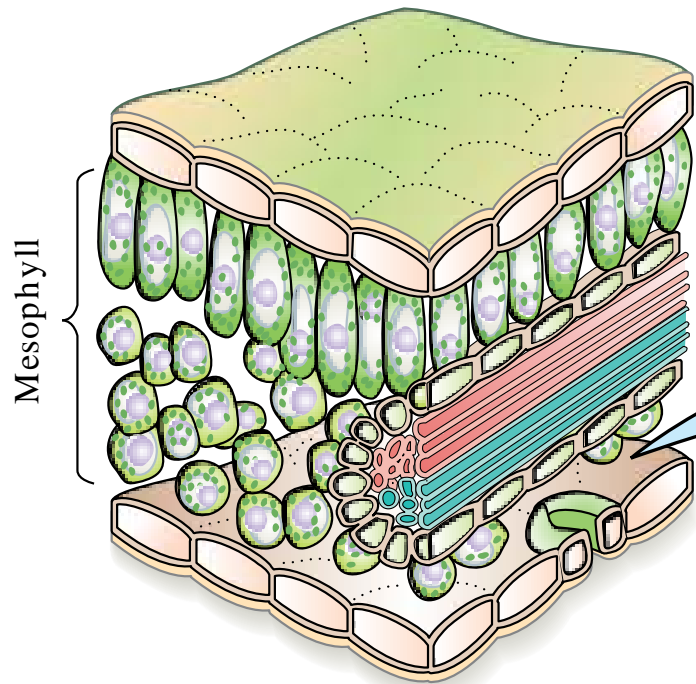
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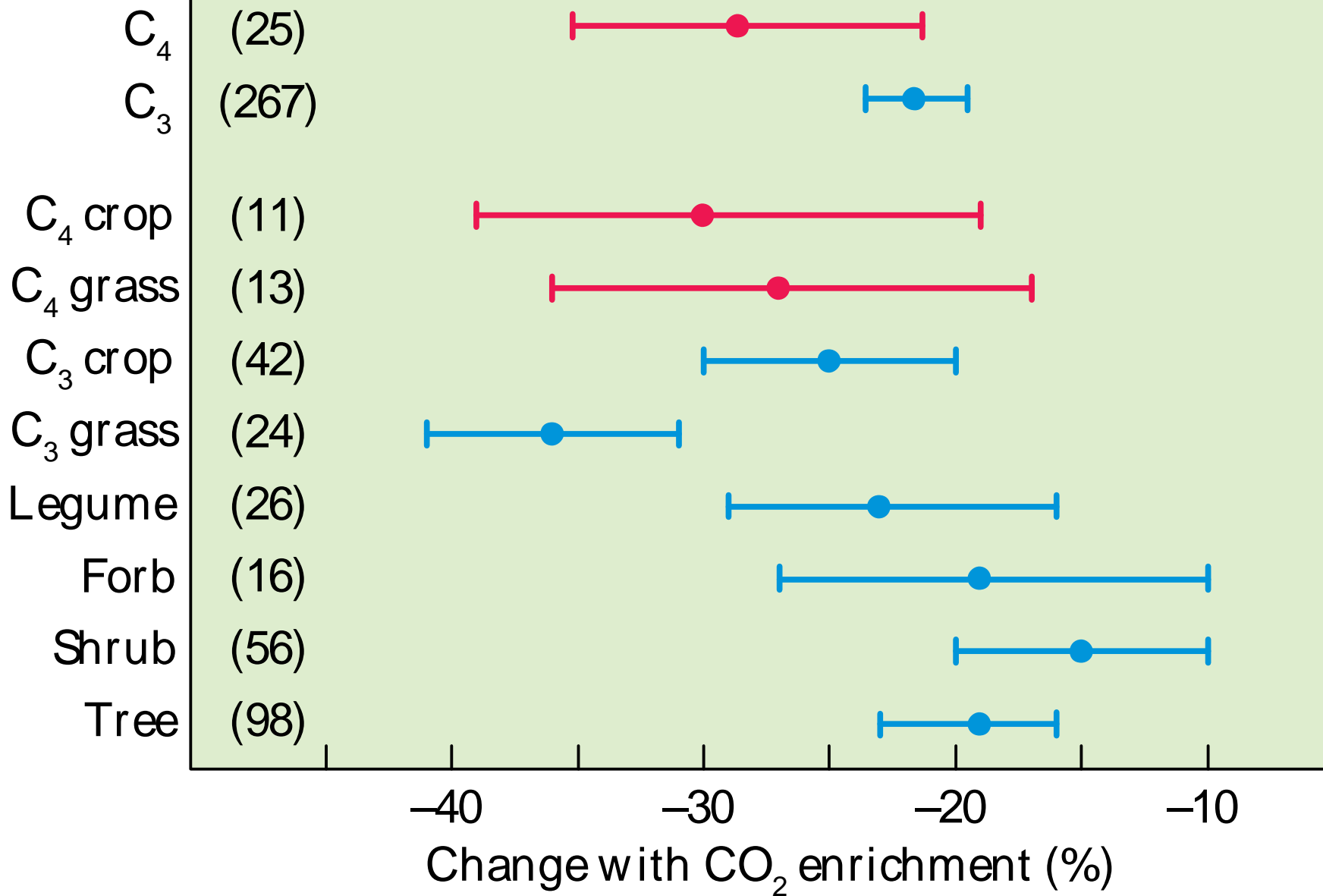
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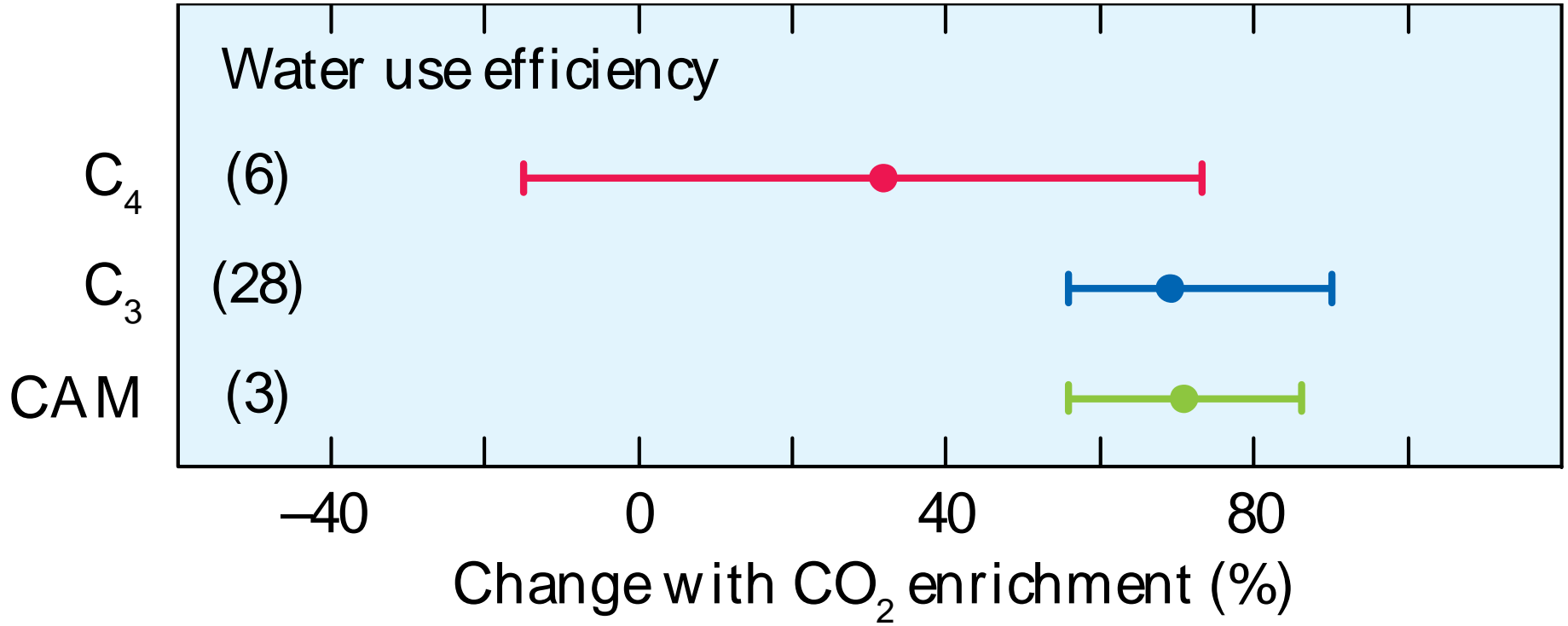
2. Variable Precipitation

- Higher CO₂ will encourage greater WUE.



A. Stomatal response





Plant Responses to Rising Atmospheric CO₂ Concentrations

1. Direct Effects of Rising CO₂ on Crops

- CO₂ acclimation.
- Inhibition of nitrate assimilation.

2. Variable Precipitation

- Higher CO₂ will encourage greater WUE.