

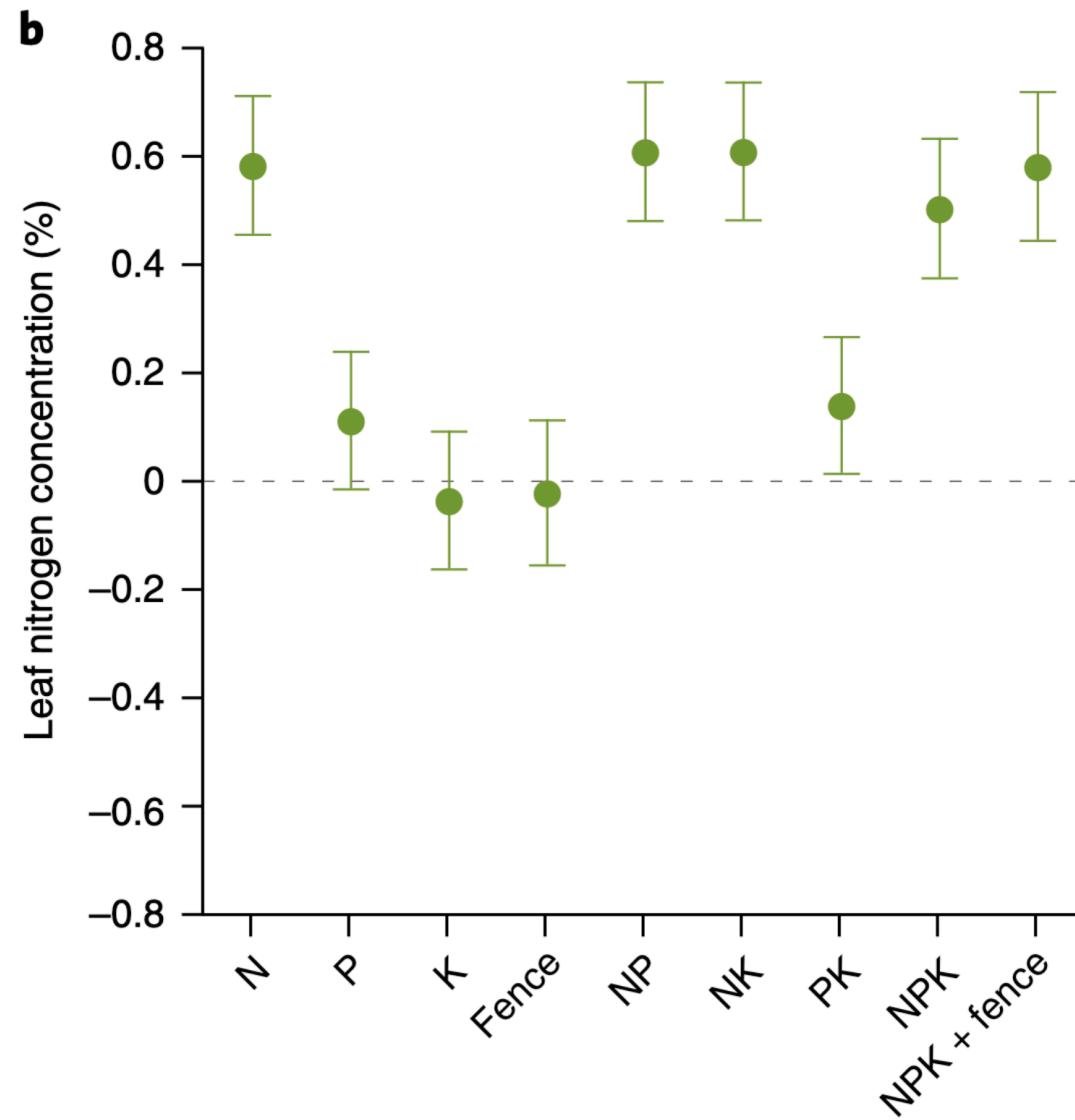


# **Leaf nitrogen is driven by net costs of resource use in Texan grasslands**

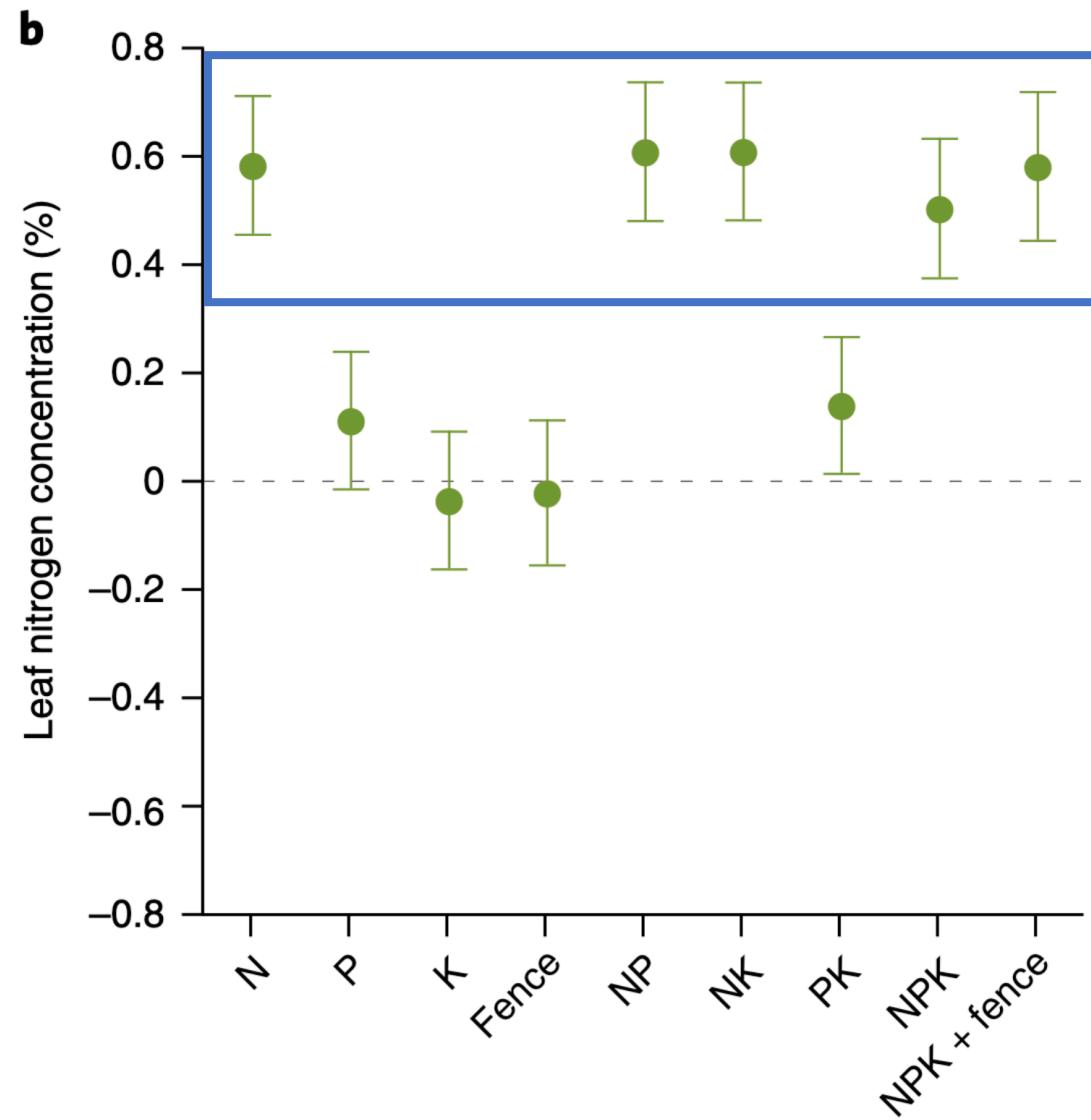
Evan A. Perkowski; Nicholas G. Smith



# Soil nitrogen generally increases leaf nitrogen

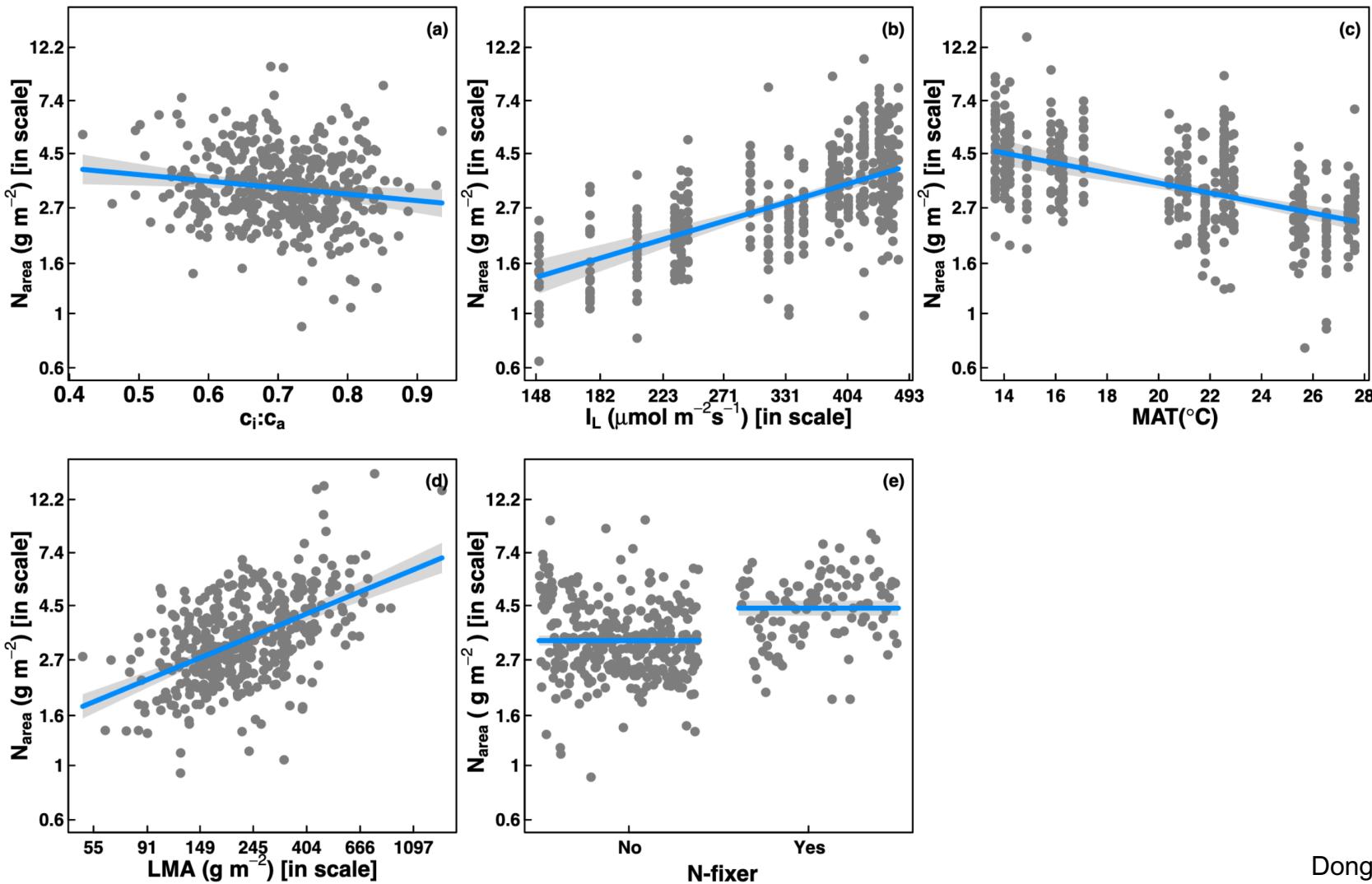


# Soil nitrogen generally increases leaf nitrogen



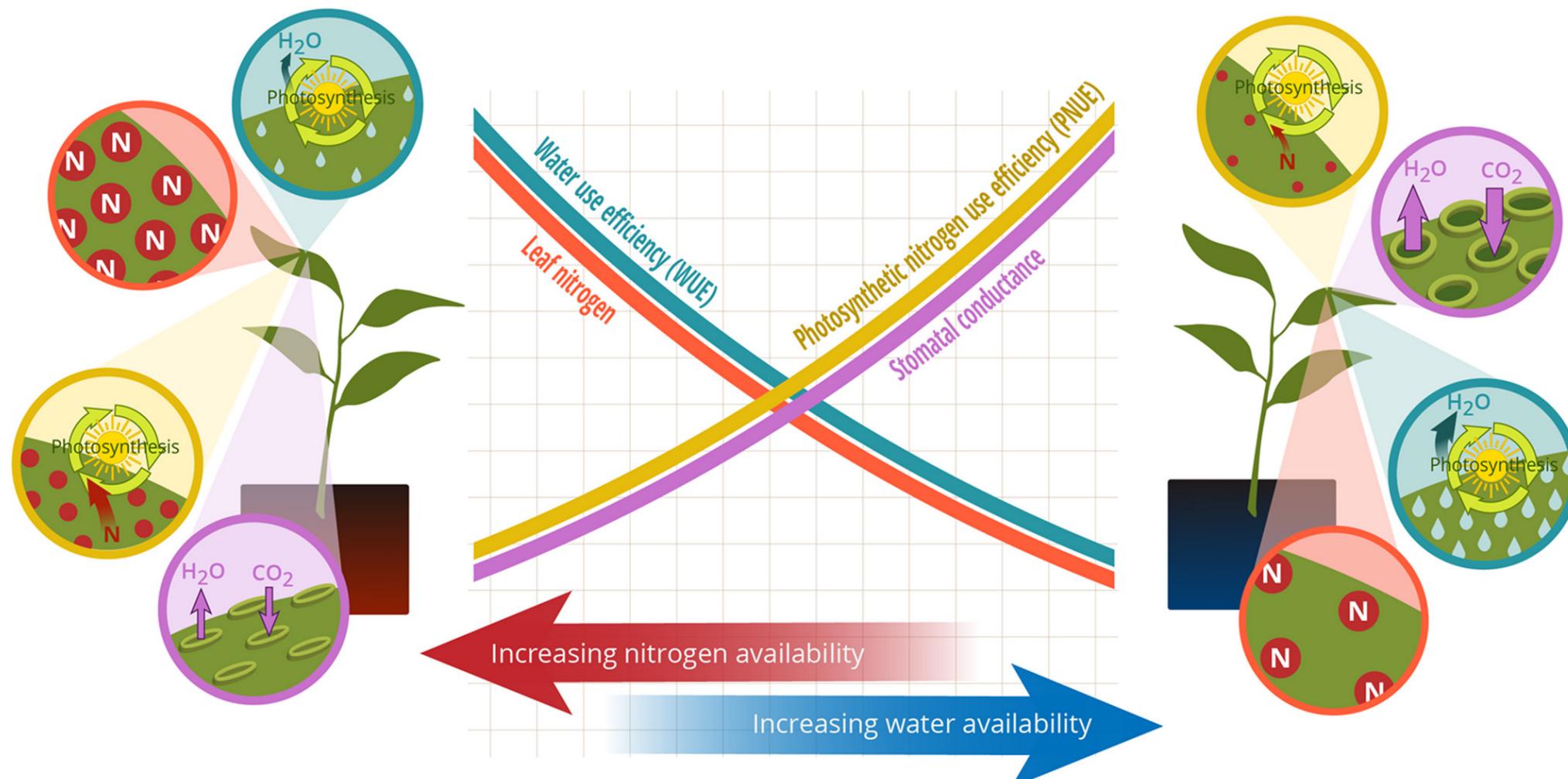
Plots that receive  
nitrogen have higher  
leaf nitrogen content

... but leaf nitrogen can be predicted independent of soil nitrogen

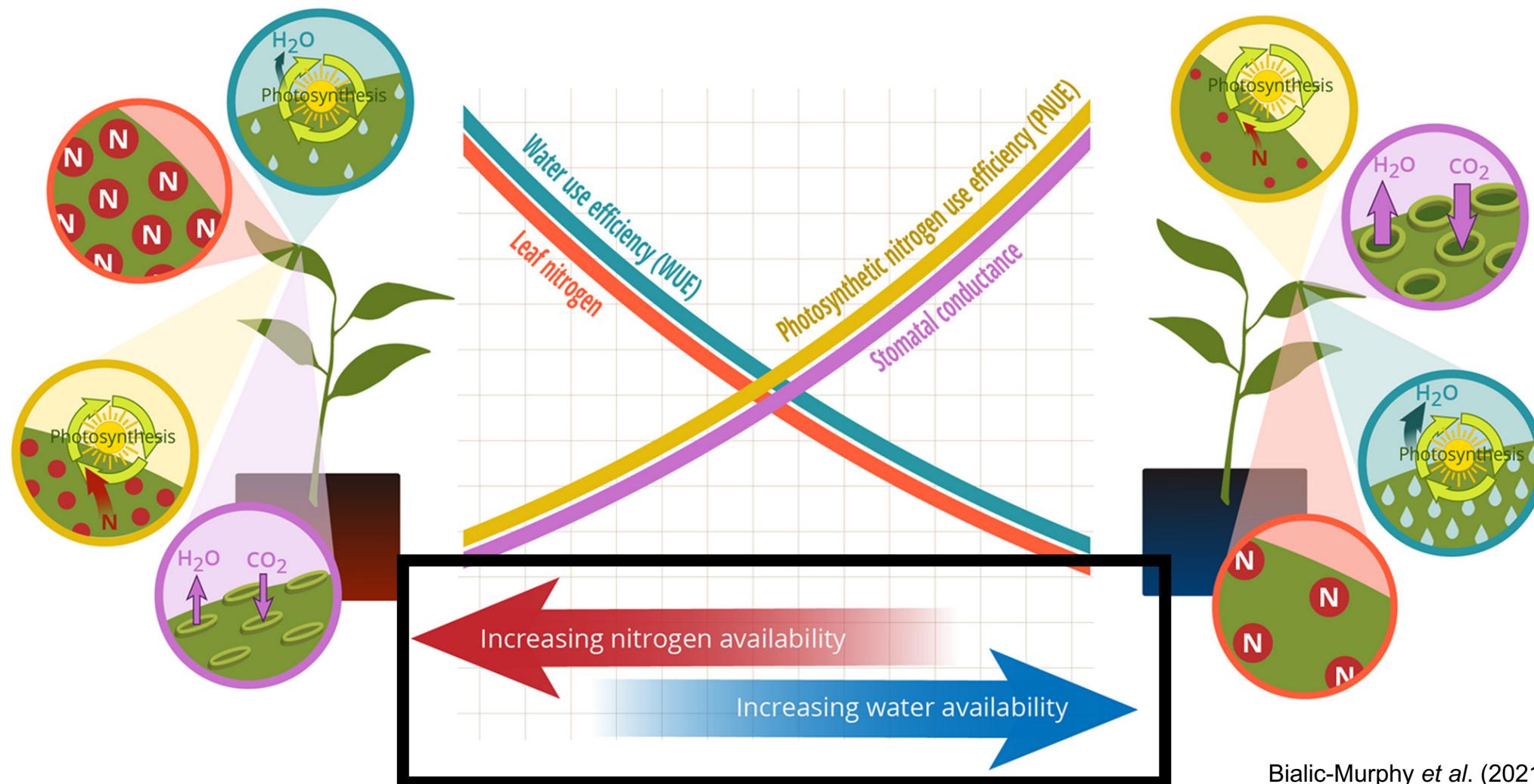


Leaf N is likely a product of interactions between climatic and edaphic factors

# Photosynthetic ‘least-cost’ theory: leaves acclimate to changing climatic and edaphic environments via summed cost of resource use



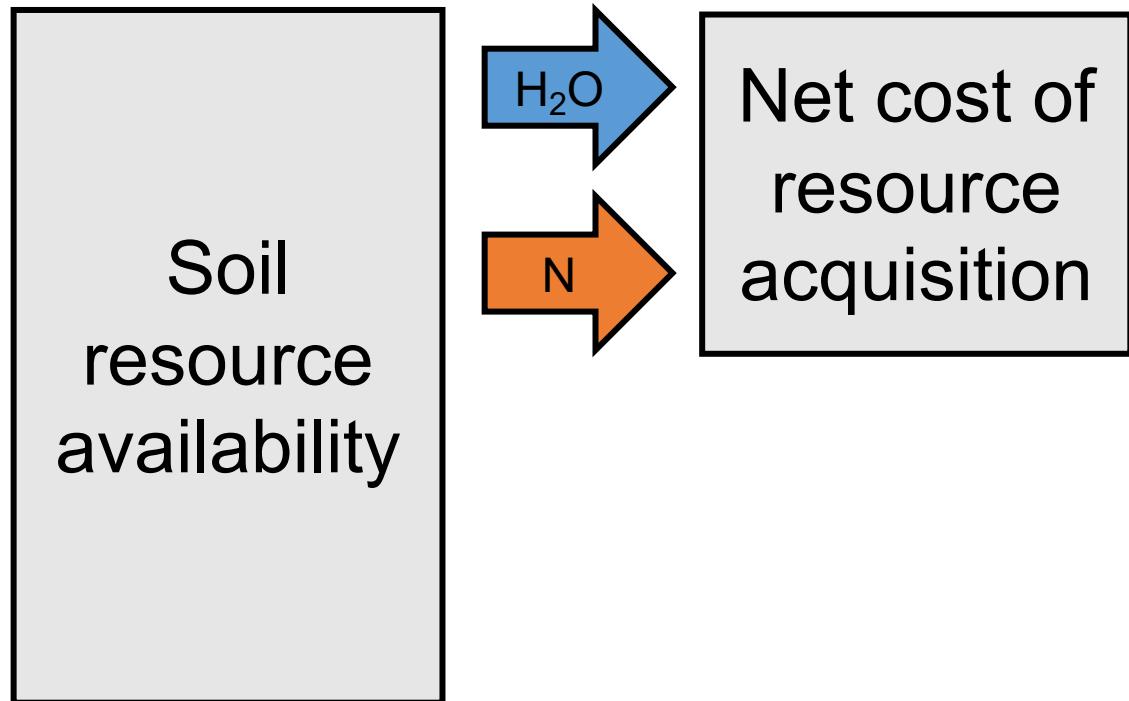
# Photosynthetic ‘least-cost’ theory: leaves acclimate to changing climatic and edaphic environments via summed cost of resource use



Positive effect

Negative effect

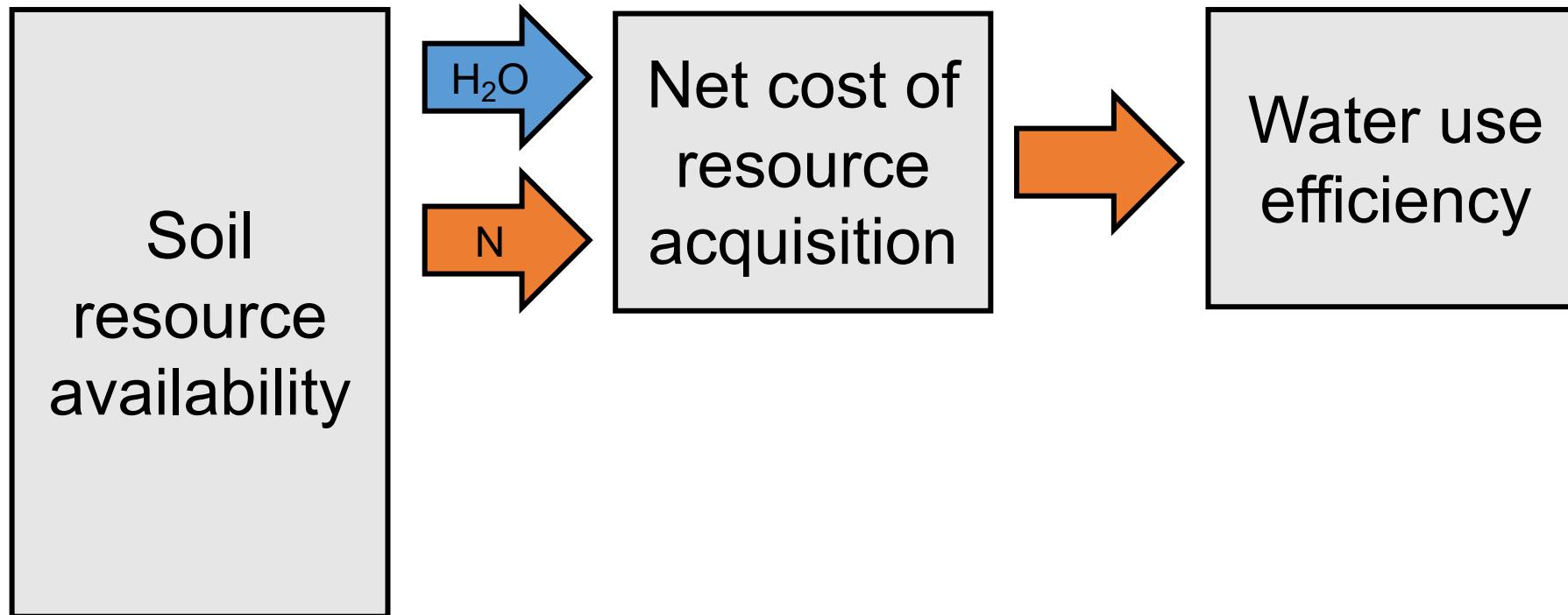
# Hypotheses



Positive effect

Negative effect

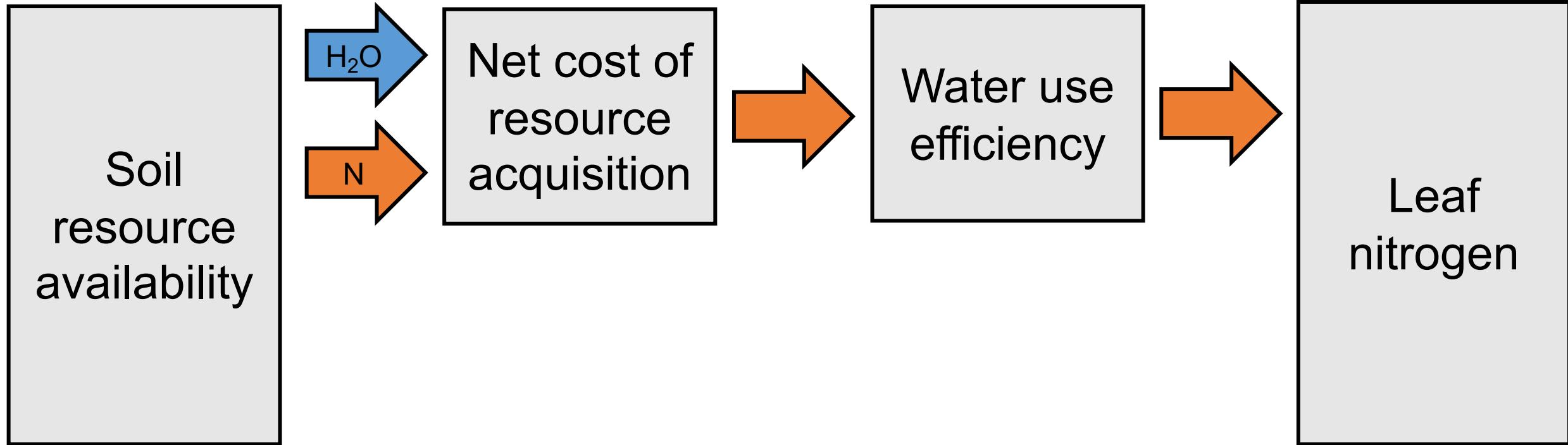
# Hypotheses



# Hypotheses

Positive effect

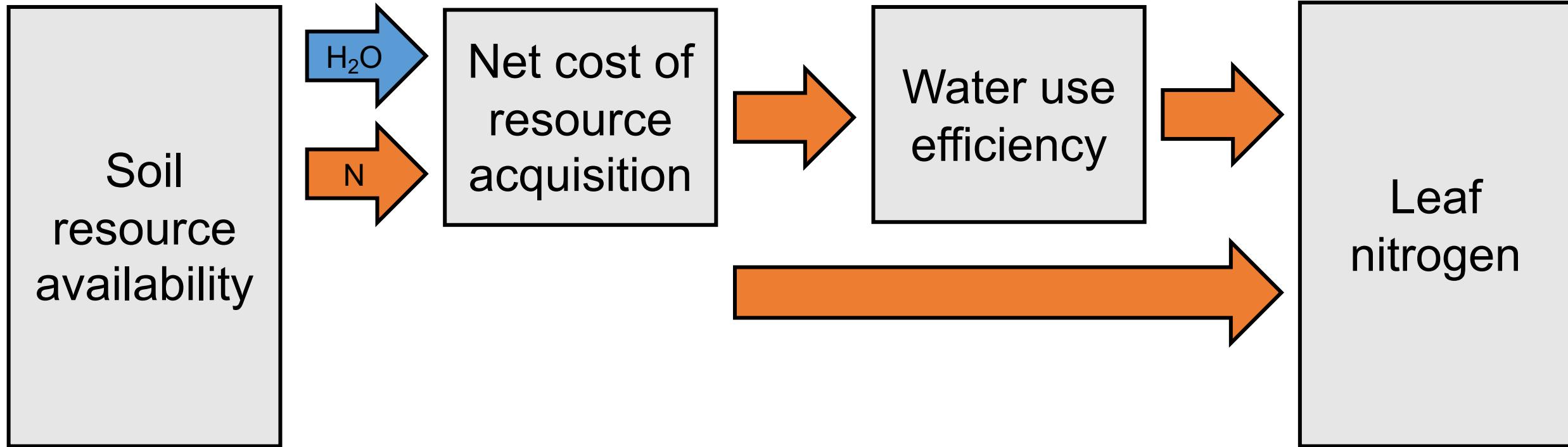
Negative effect



# Hypotheses

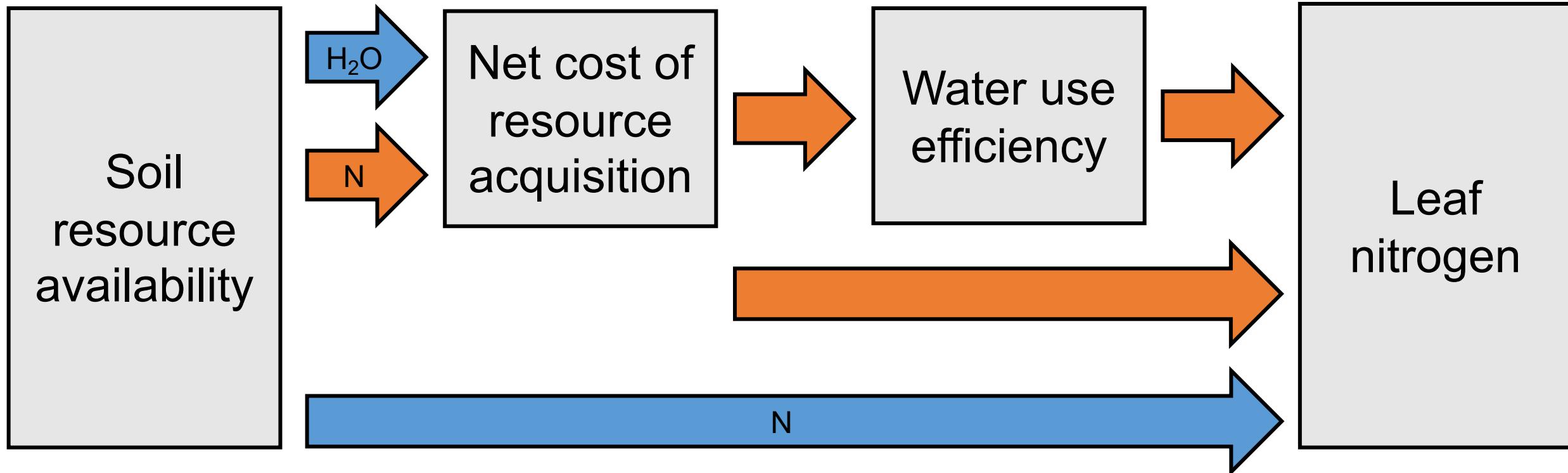
Positive effect

Negative effect



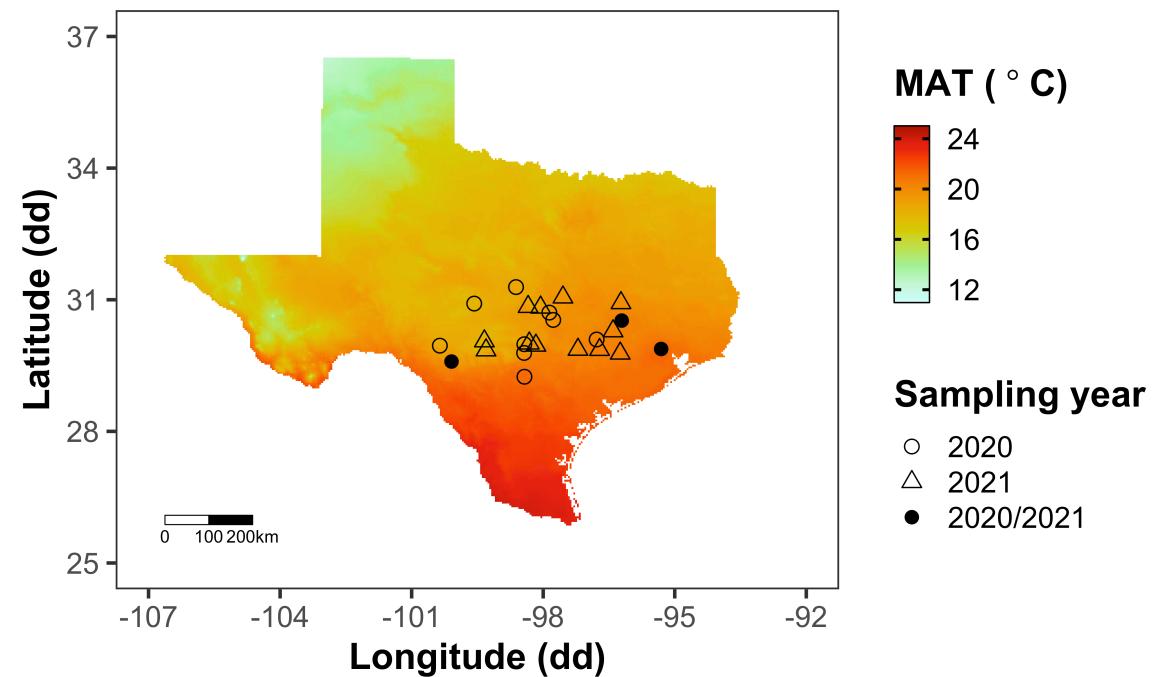
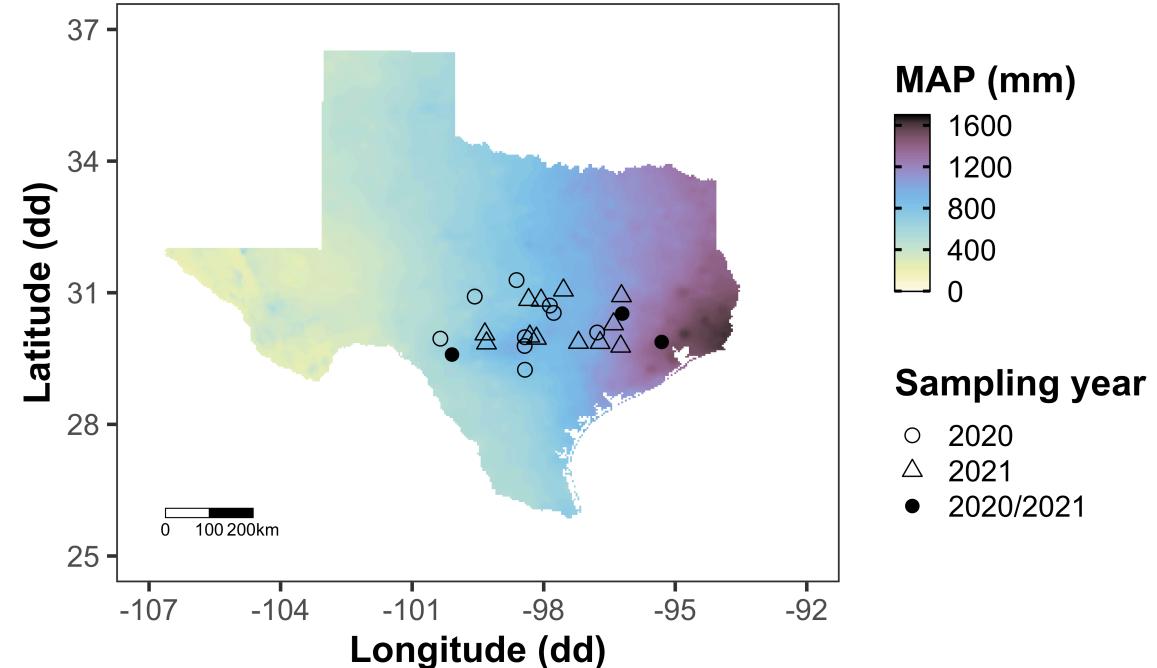
# Hypotheses

Positive effect  
Negative effect



# Study sites, collection methods, traits

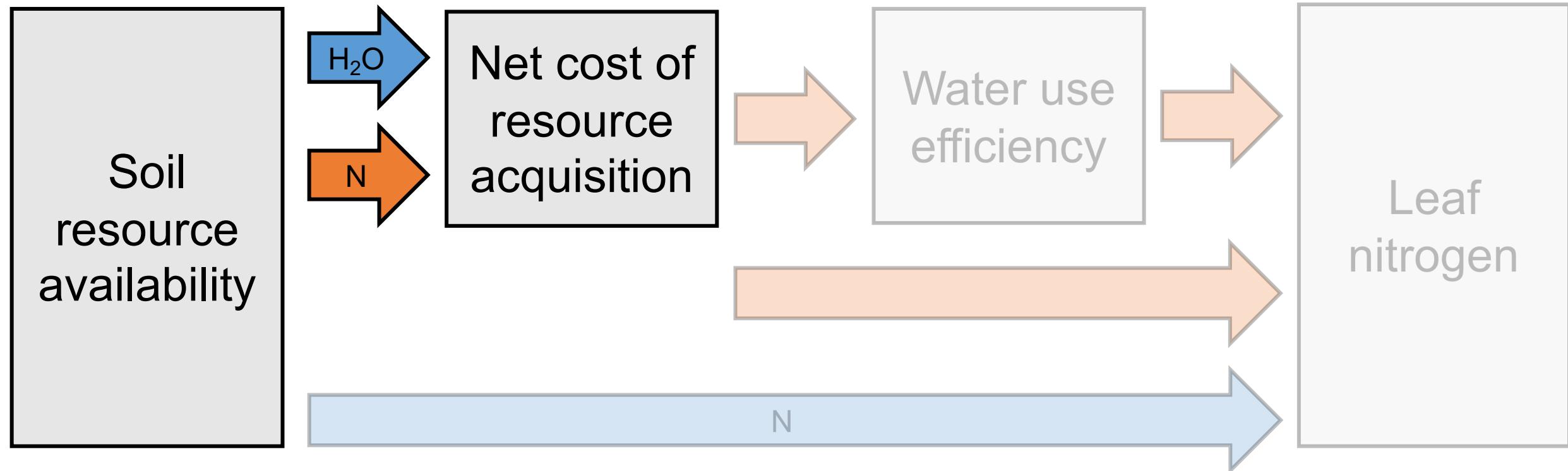
- 24 sites
  - 12 in 2020
  - 15 in 2021 (3 same from 2020)
- 3 leaves of 5 most dominant species at each site
  - Leaf N
  - Leaf water use efficiency
- Composite soil sample
  - $[NO_3\text{-}N]$



# Results

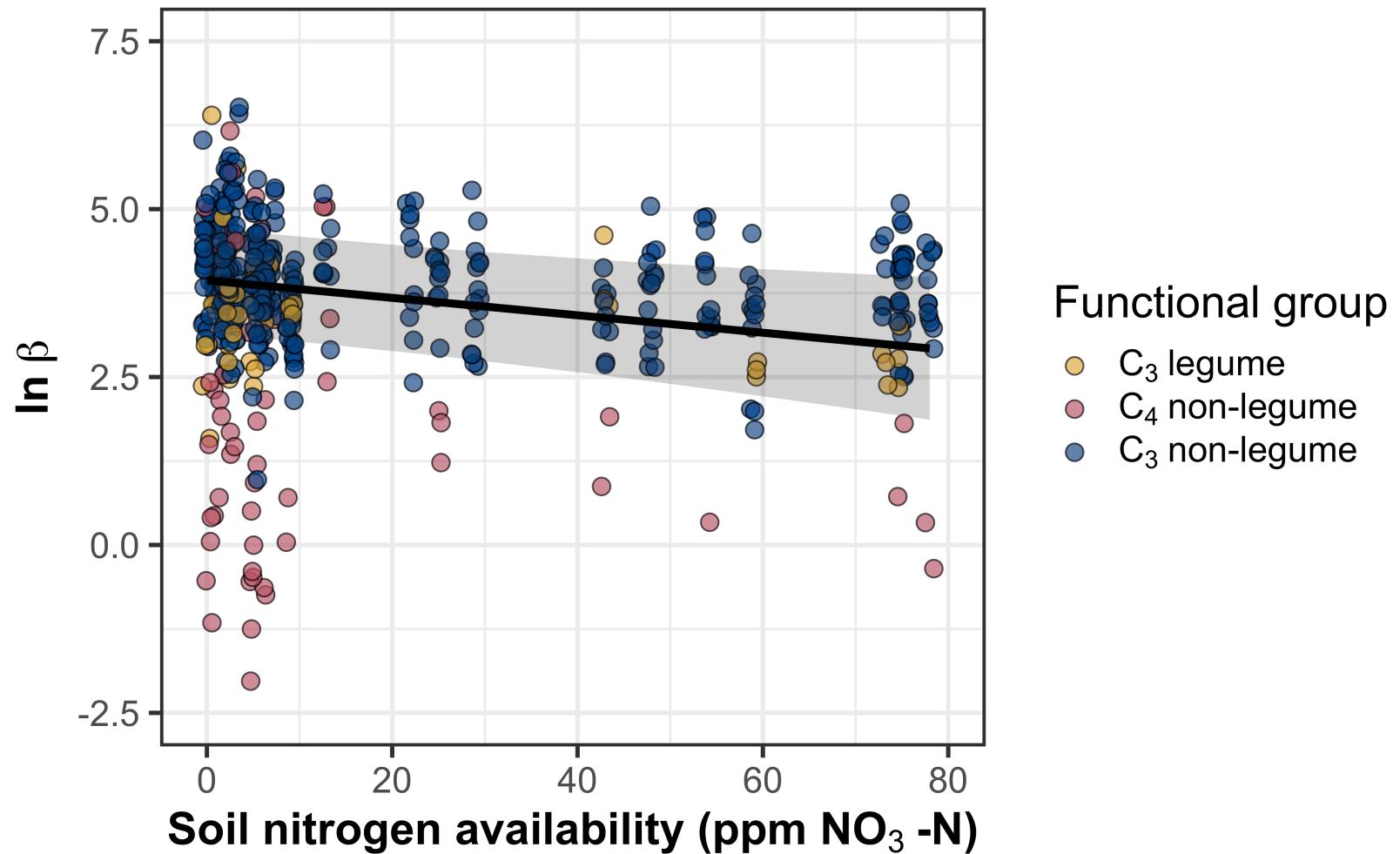
Positive effect

Negative effect

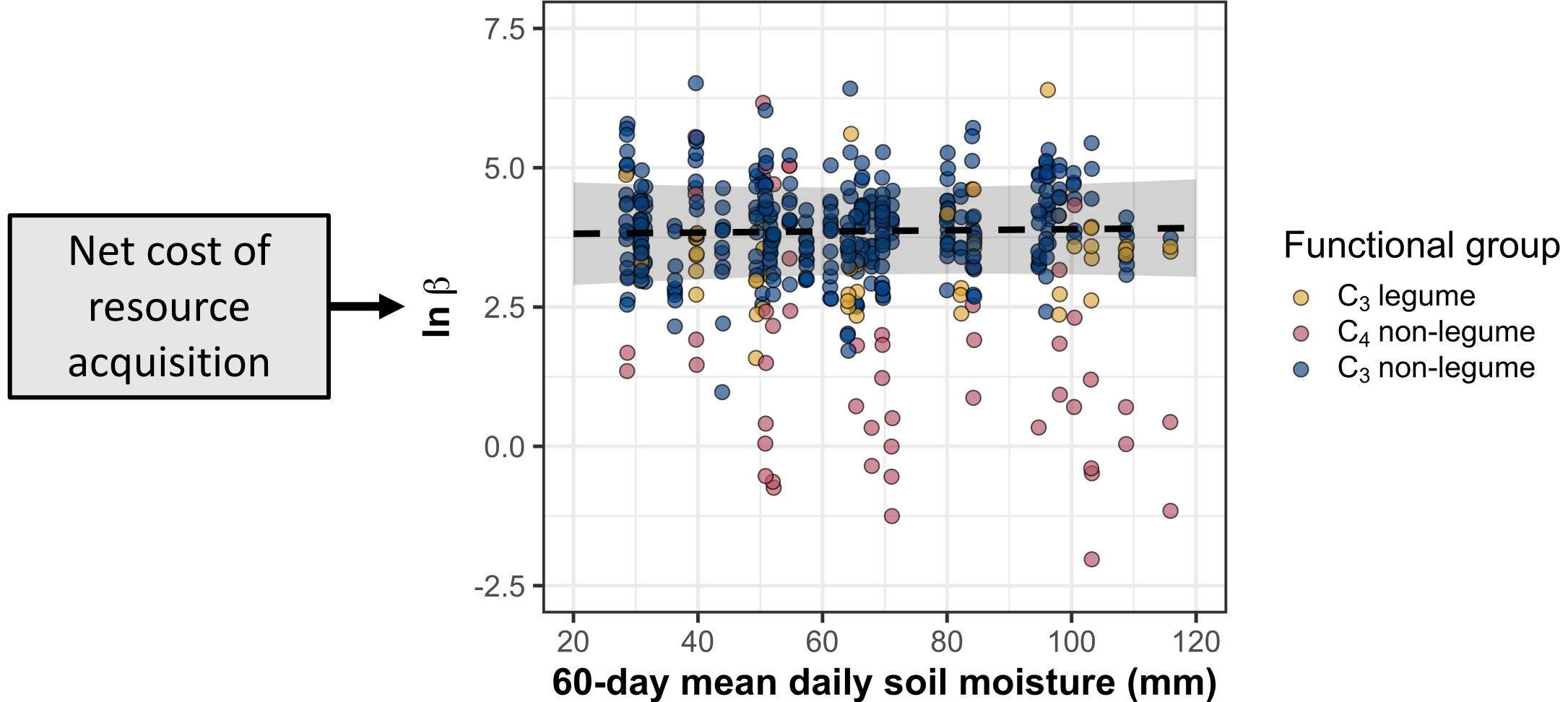


# Soil nitrogen availability **decreases** the net cost of resource acquisition

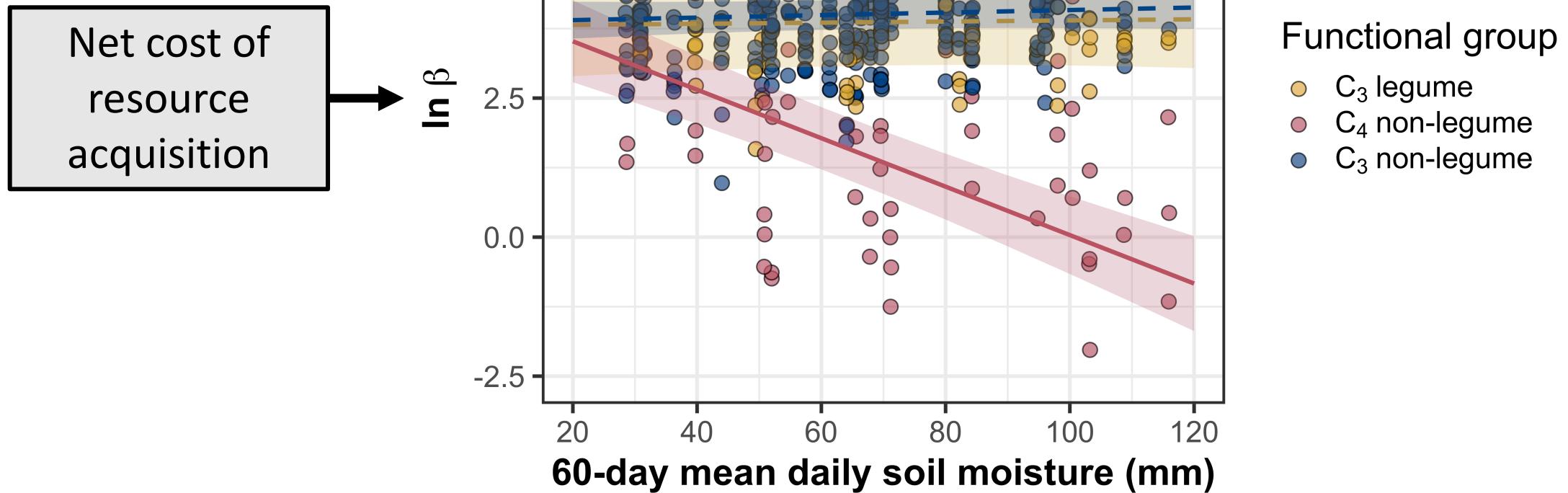
Net cost of  
resource  
acquisition



# Soil moisture does not change the net cost of resource acquisition across species

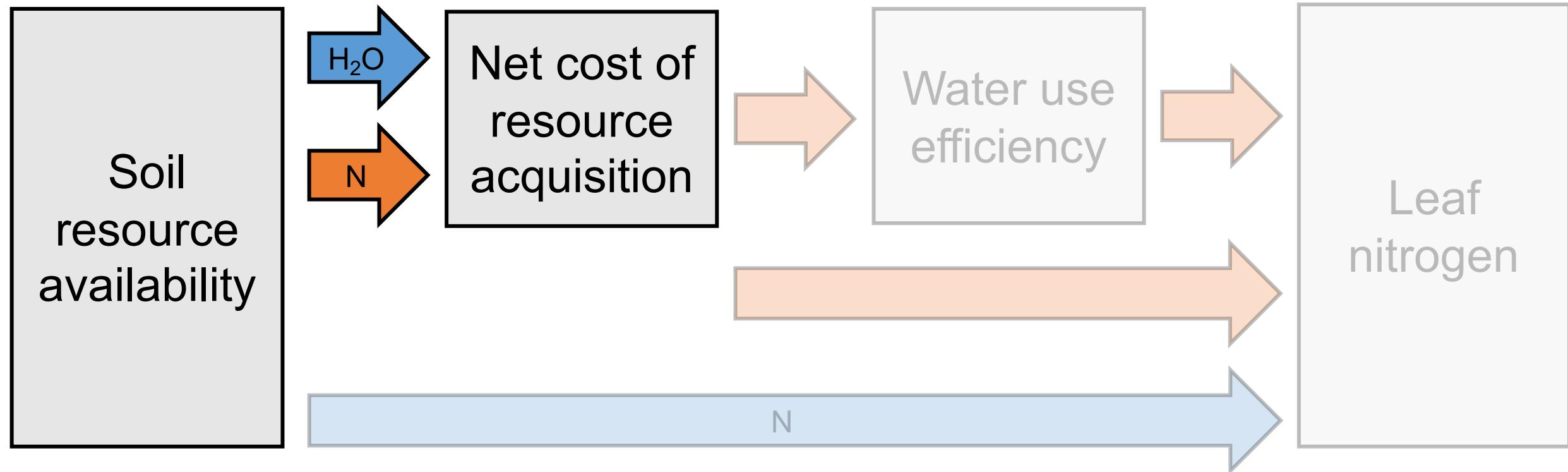


# Soil moisture does not change the net cost of resource acquisition across species



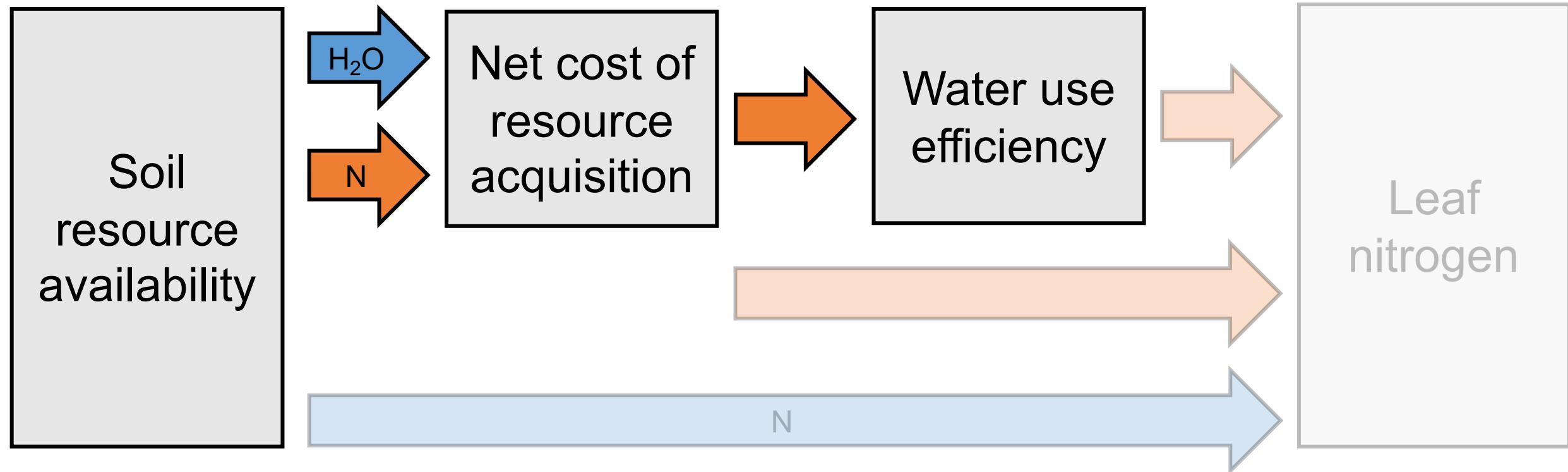
Positive effect

Negative effect

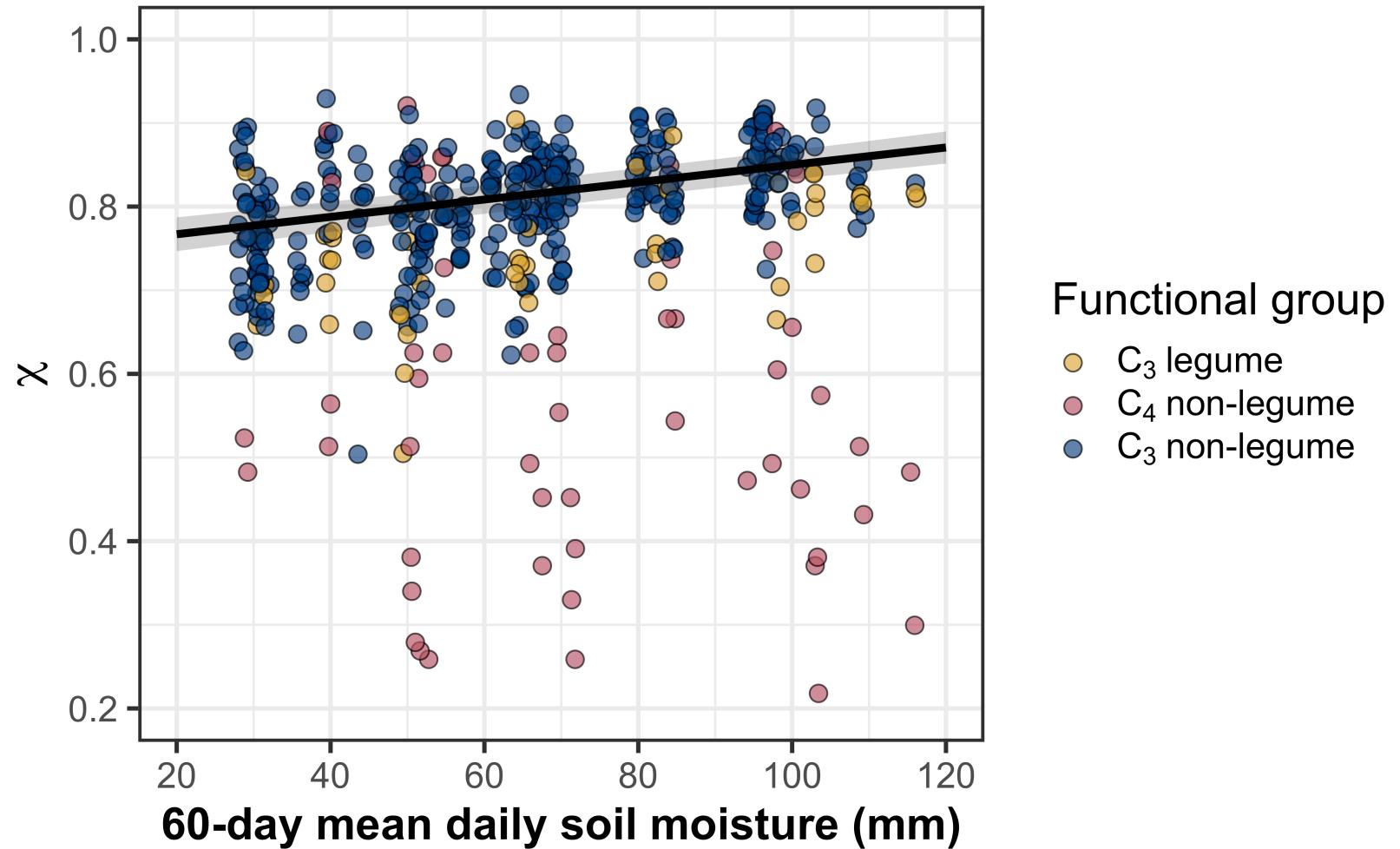


Positive effect

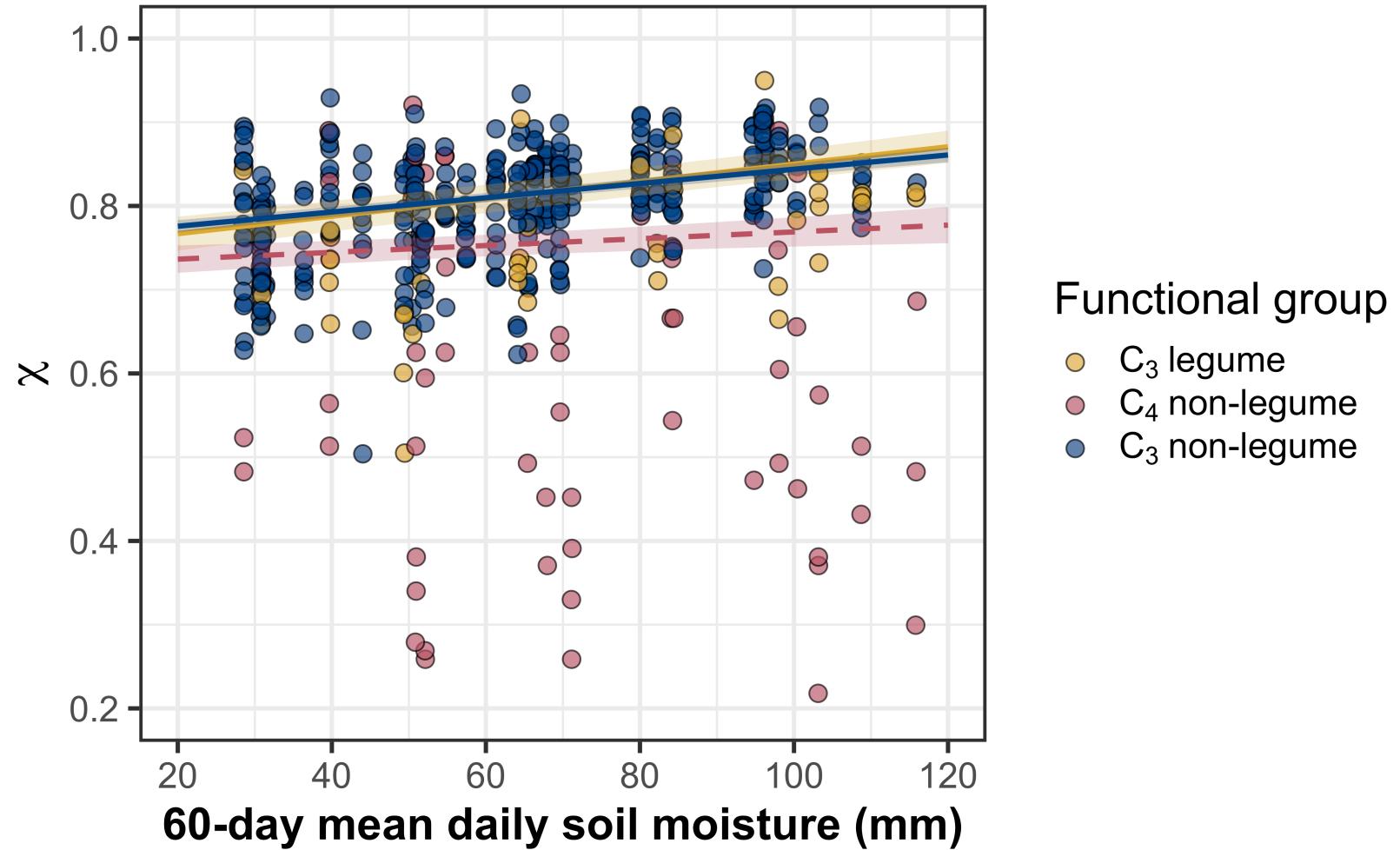
Negative effect



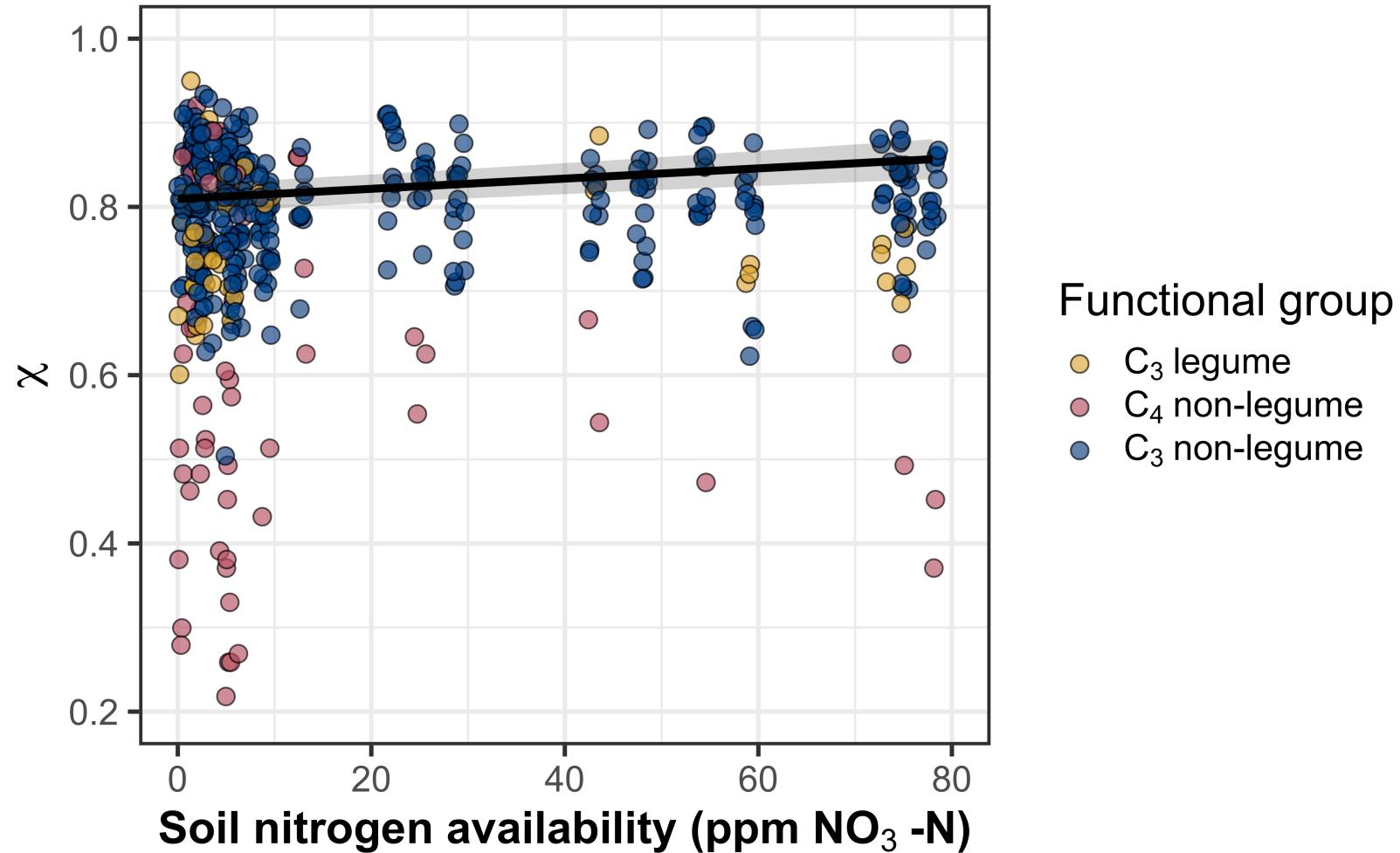
# Soil moisture **decreases** water use efficiency



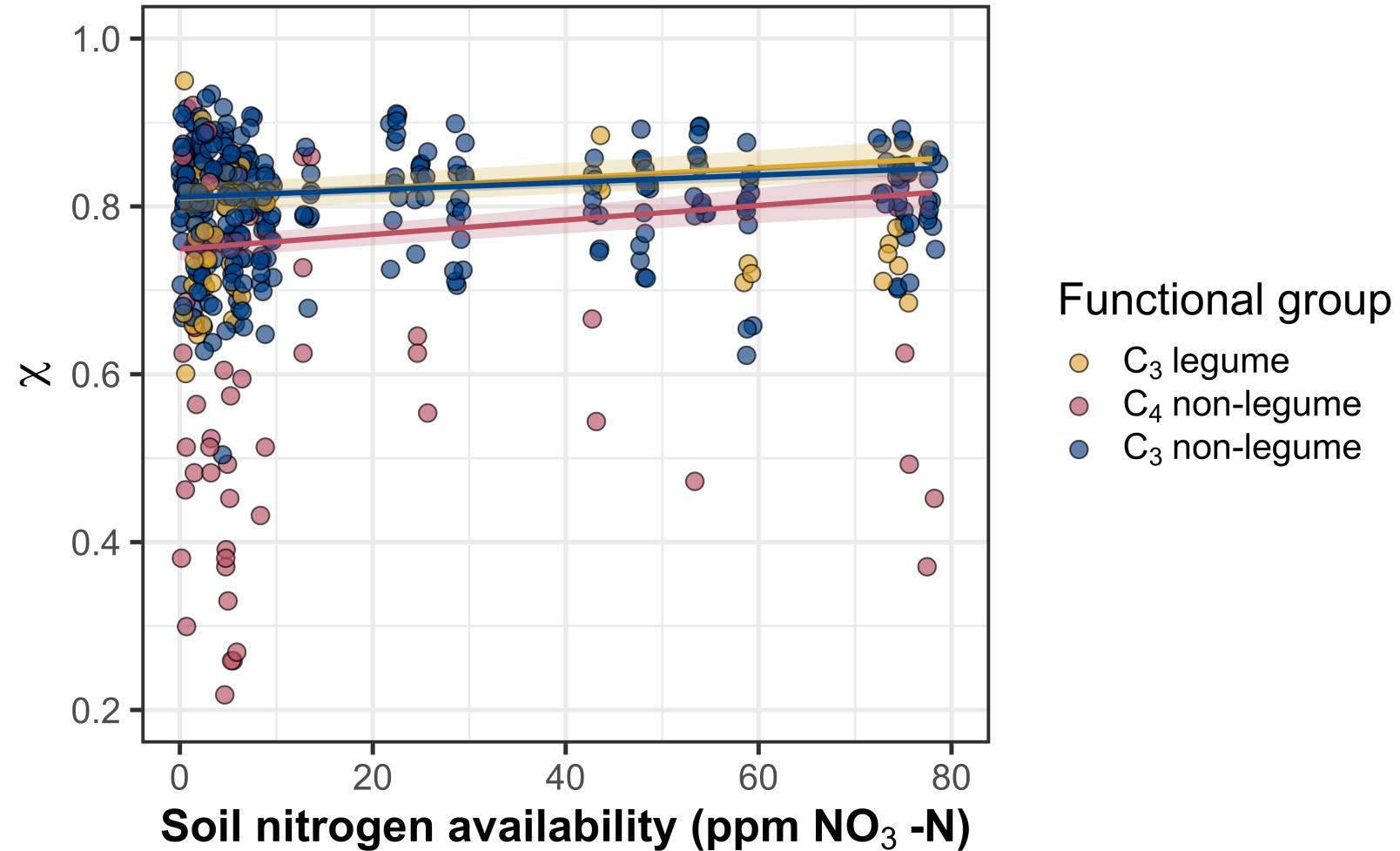
Soil moisture **decreases** water use efficiency,  
a pattern observed only in C<sub>3</sub> species



# Soil nitrogen availability **decreases** water use efficiency

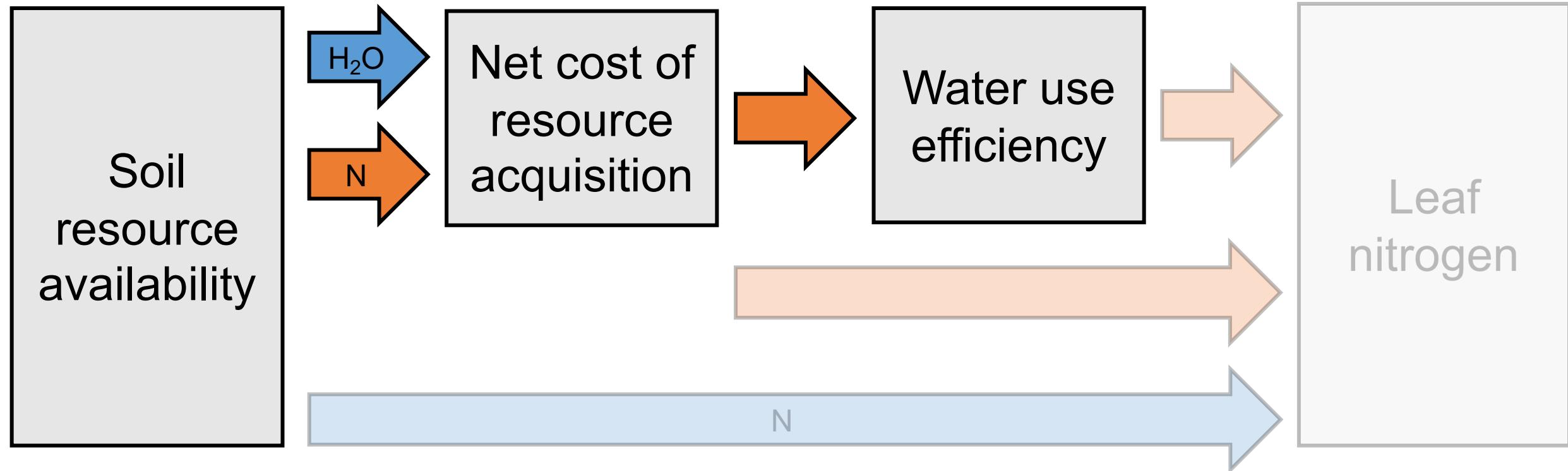


Soil nitrogen availability **decreases** water use efficiency, a pattern observed across all PFTs



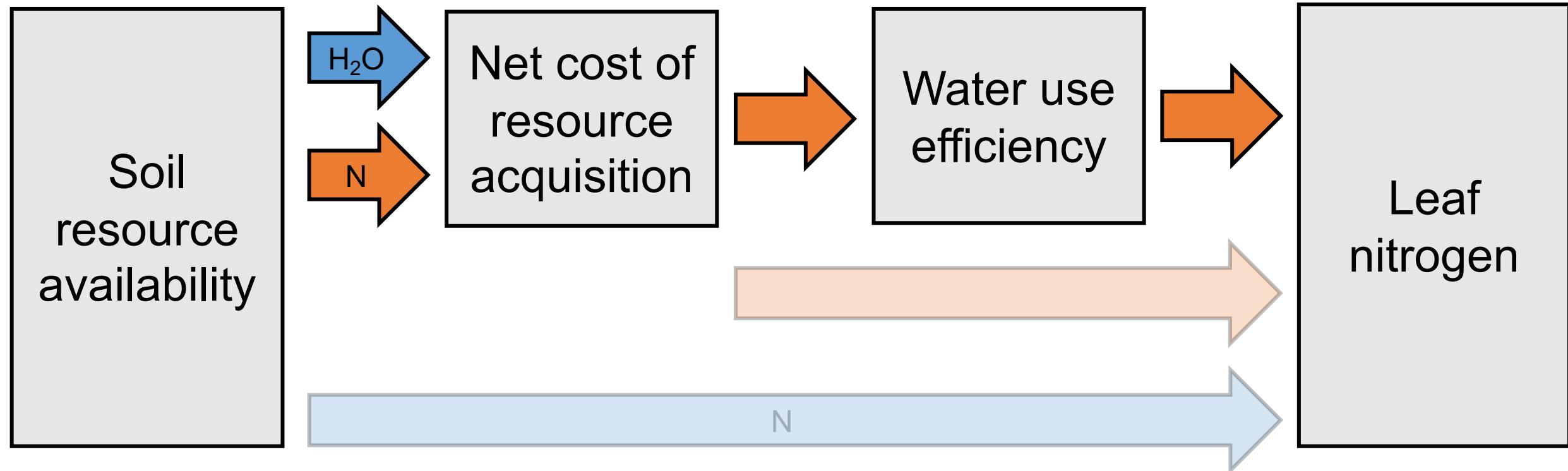
Positive effect

Negative effect

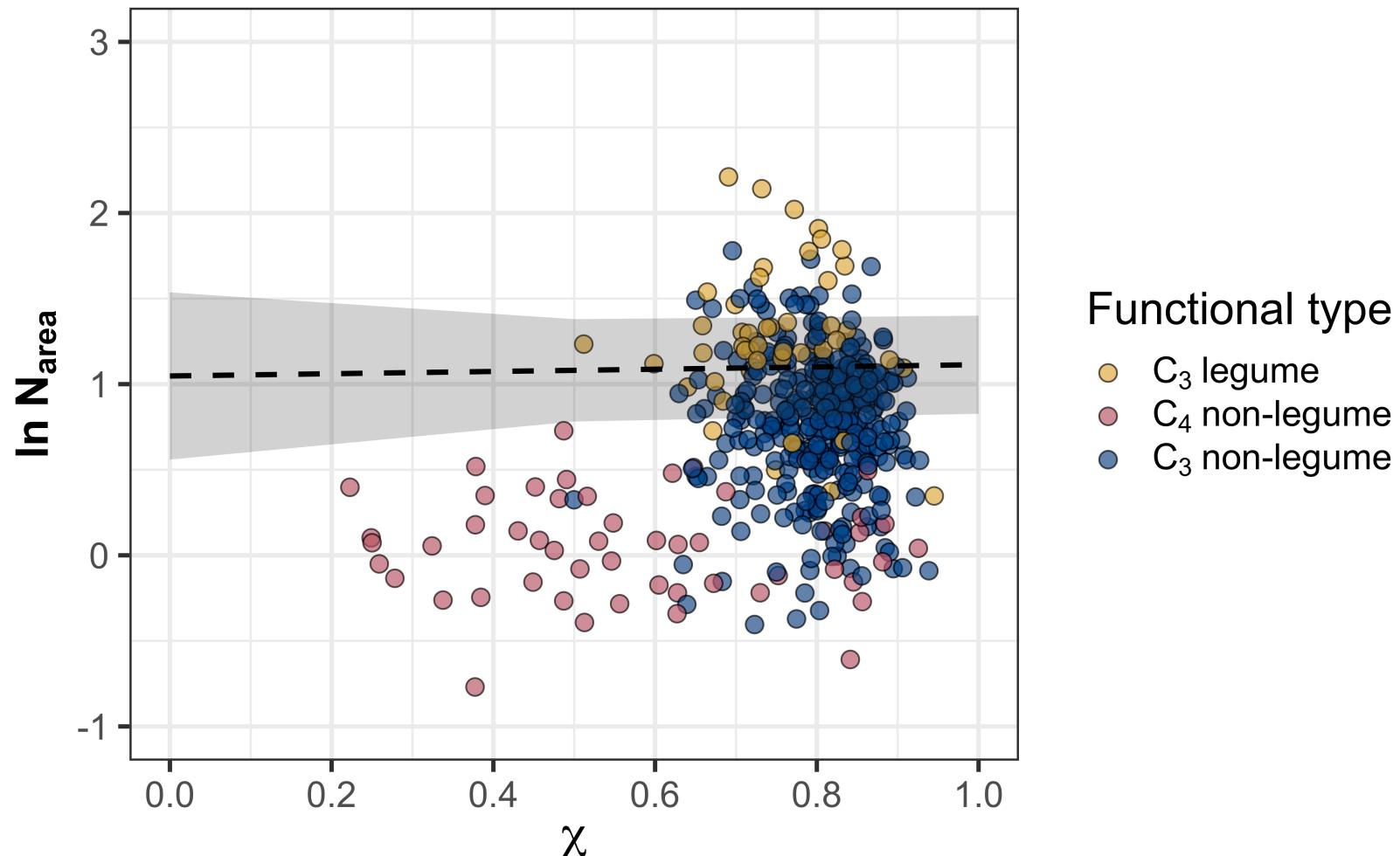


Positive effect

Negative effect

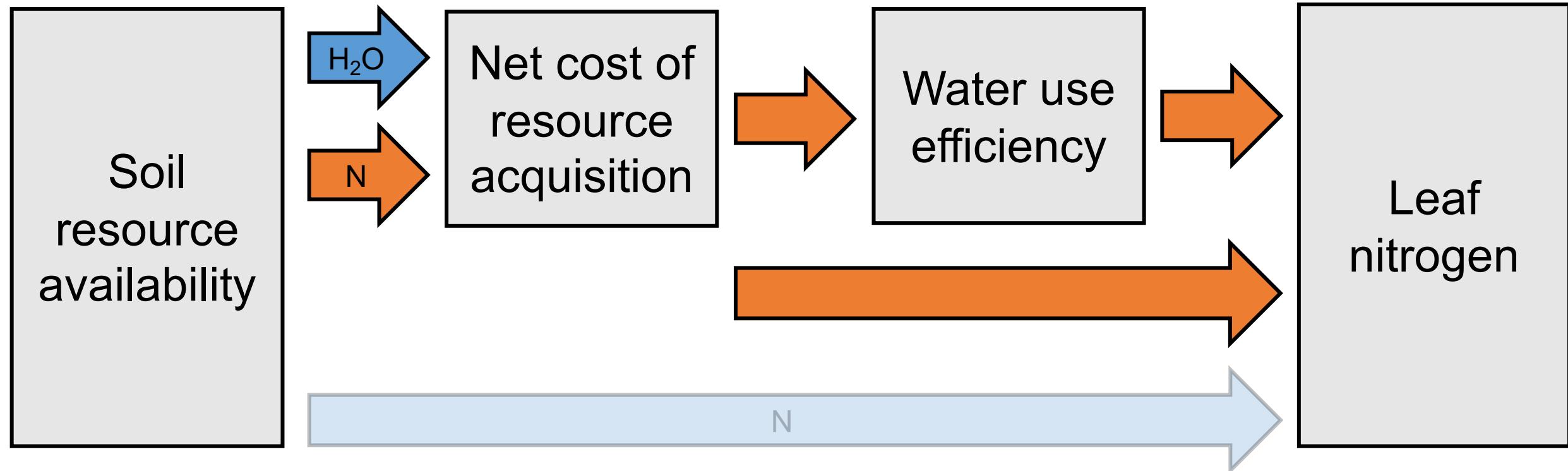


# Water use efficiency does not change leaf nitrogen

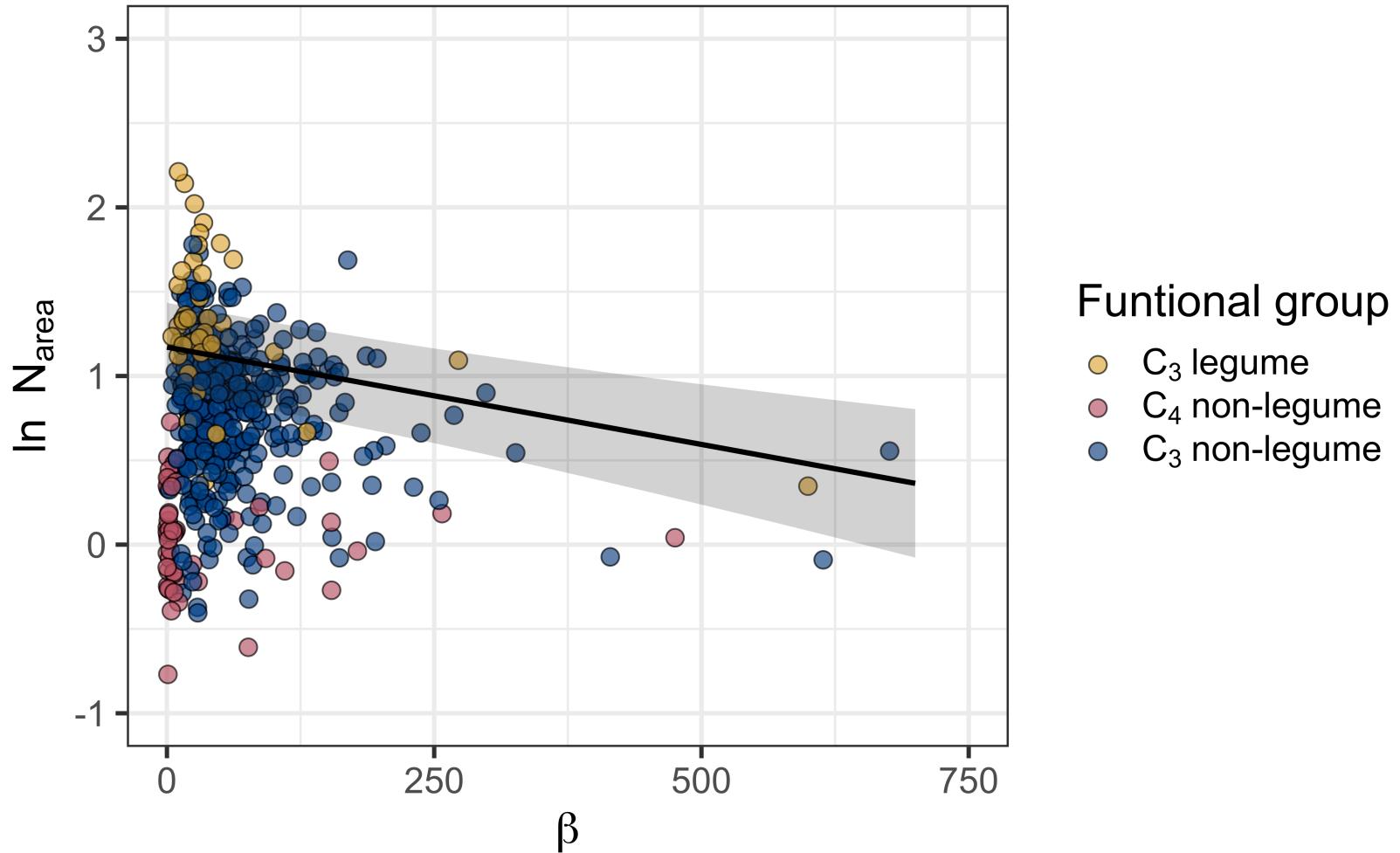


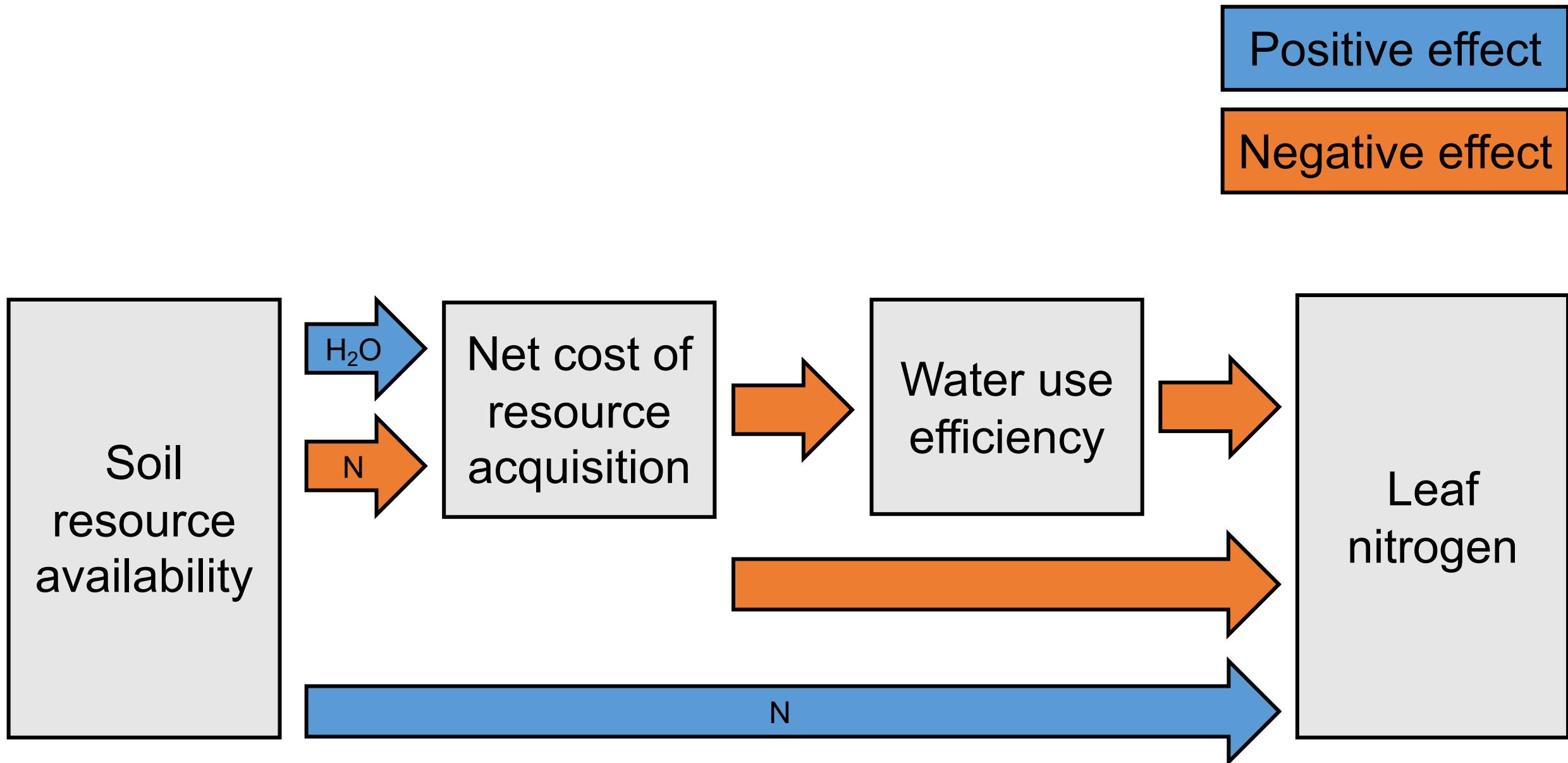
Positive effect

Negative effect

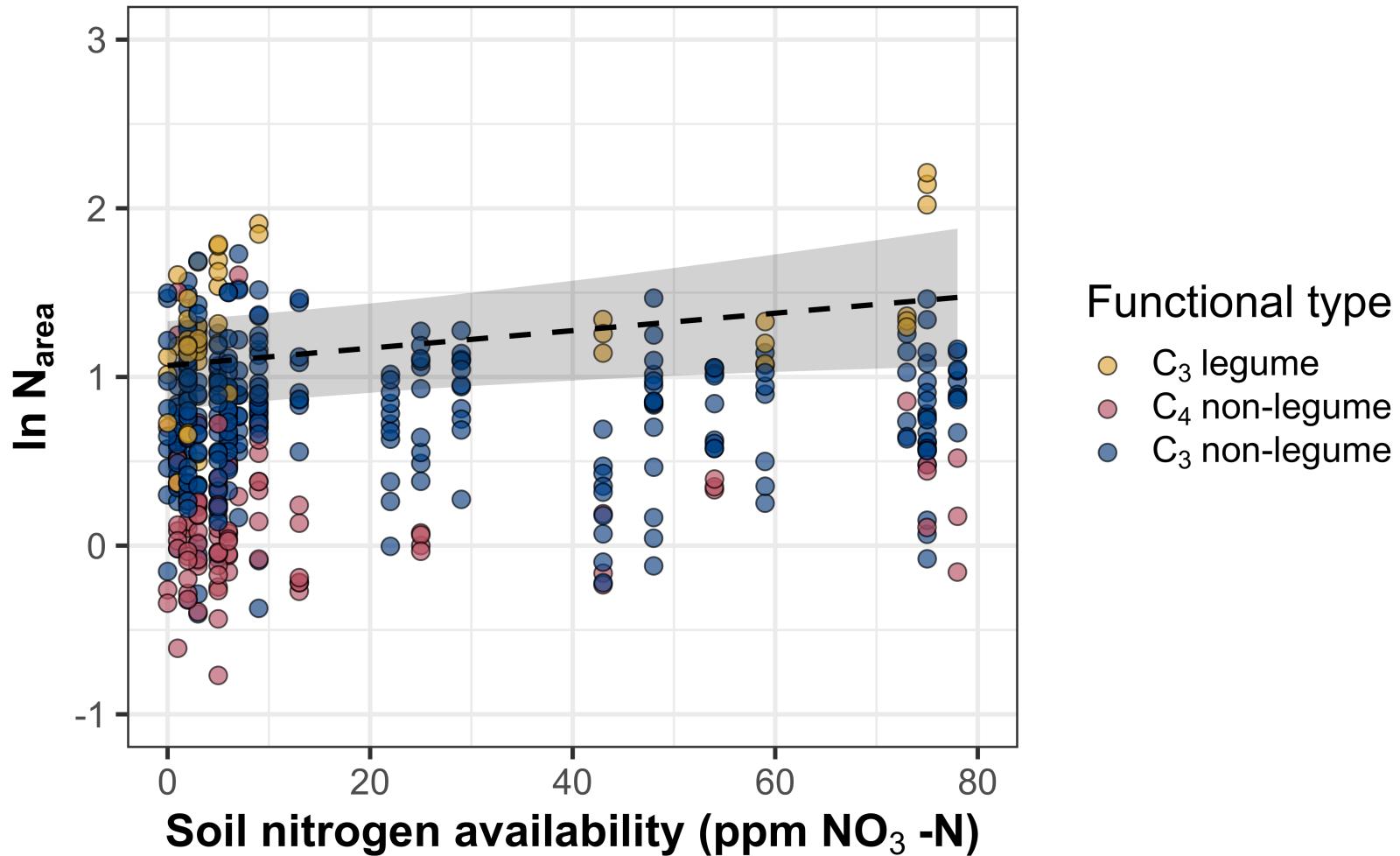


# Increasing net costs of resource use generally **decrease** leaf nitrogen





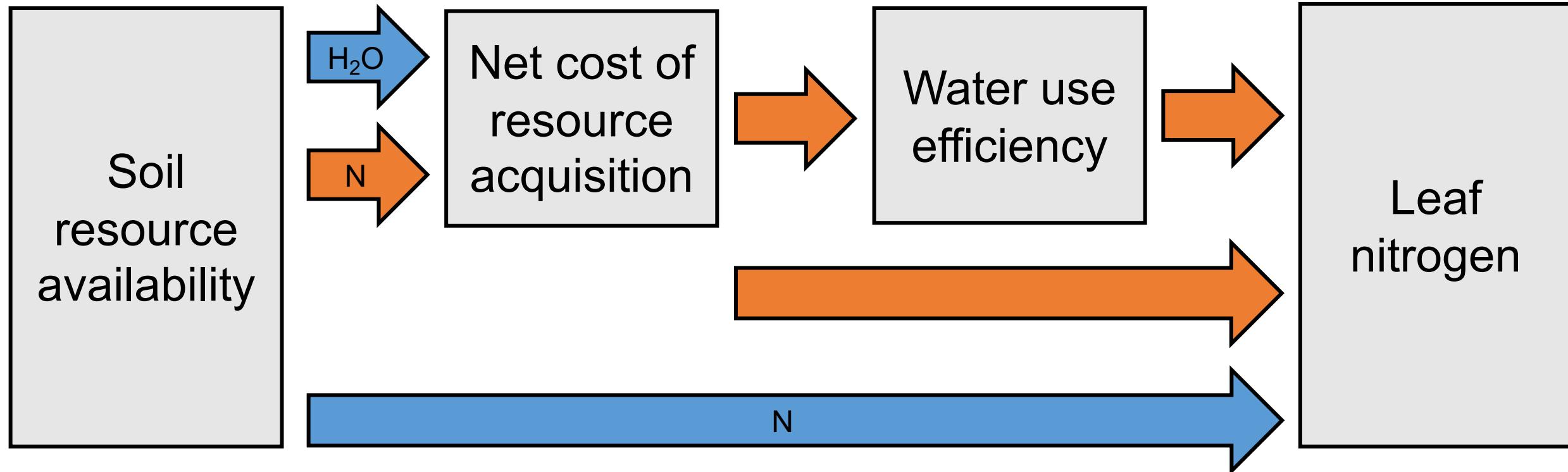
# Soil nitrogen availability does not change leaf nitrogen



# Revisiting hypotheses

Positive effect

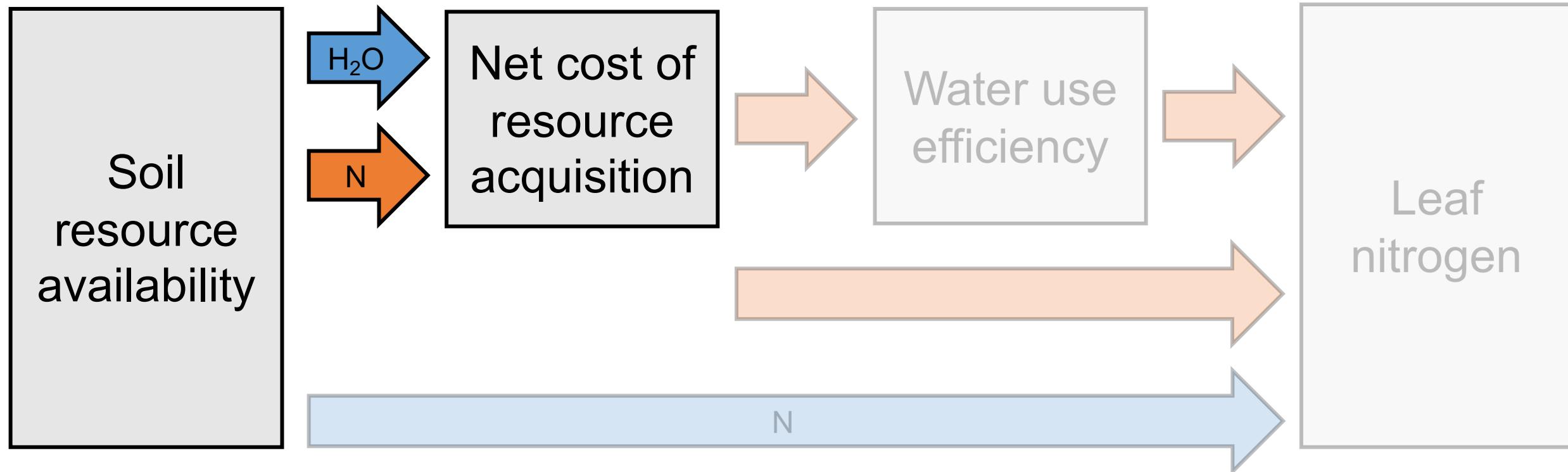
Negative effect



# Revisiting hypotheses

Positive effect

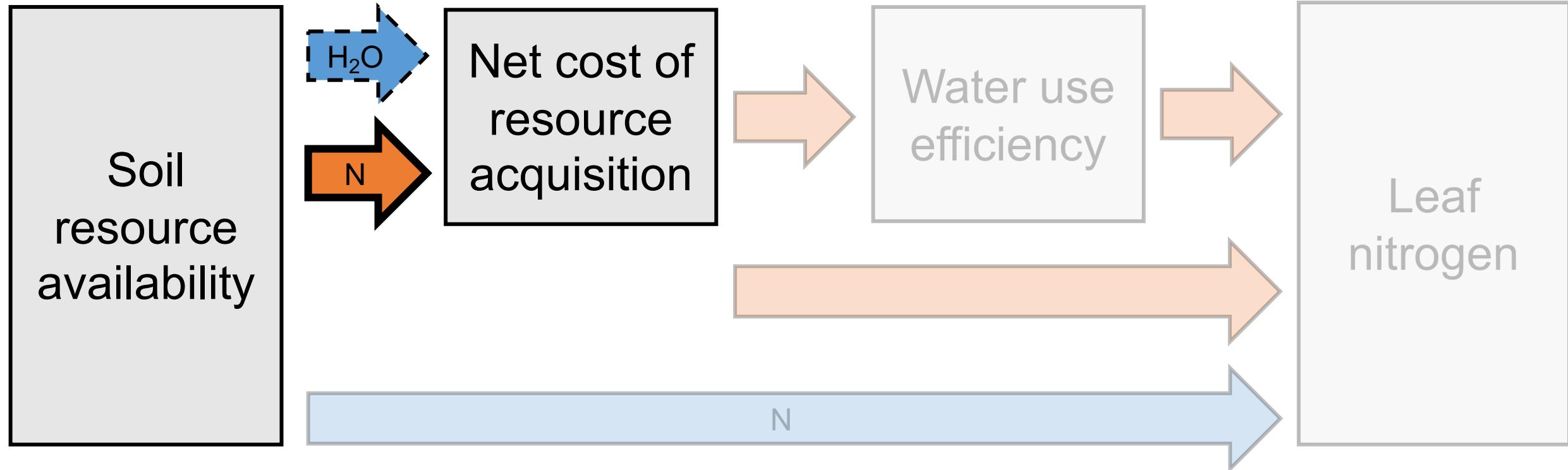
Negative effect



# Revisiting hypotheses

Positive effect

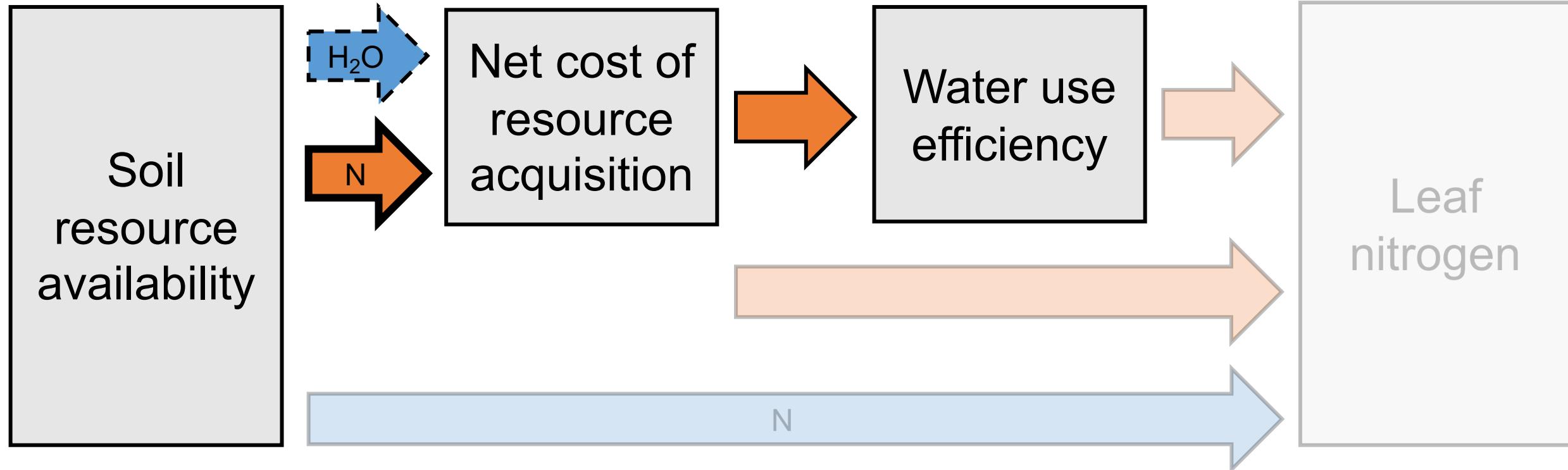
Negative effect



# Revisiting hypotheses

Positive effect

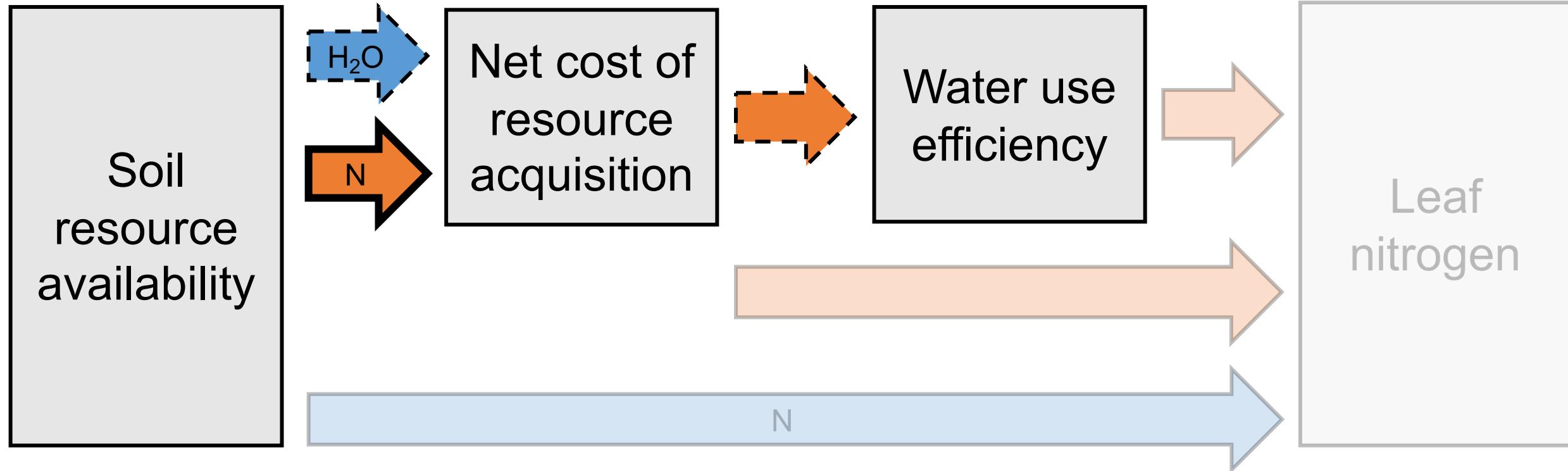
Negative effect



# Revisiting hypotheses

Positive effect

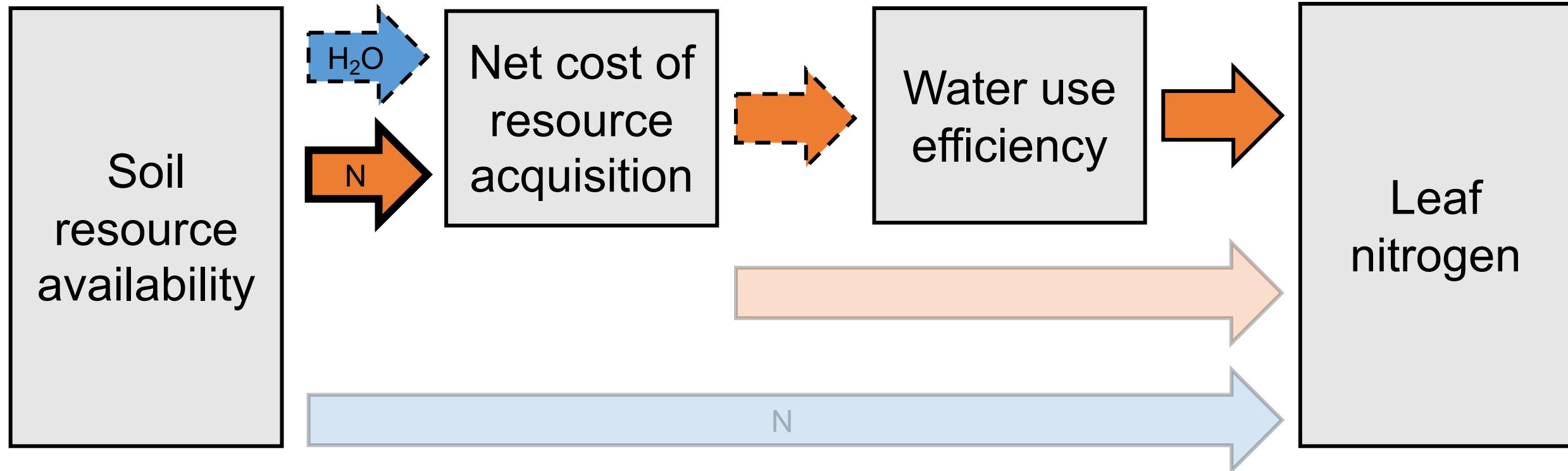
Negative effect



# Revisiting hypotheses

Positive effect

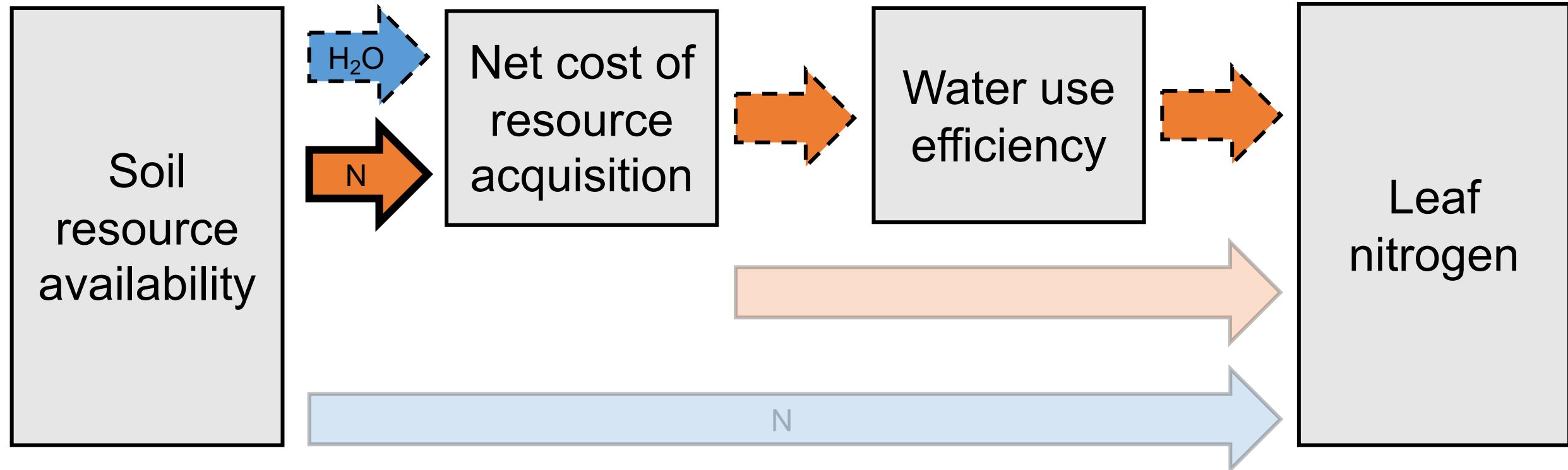
Negative effect



# Revisiting hypotheses

Positive effect

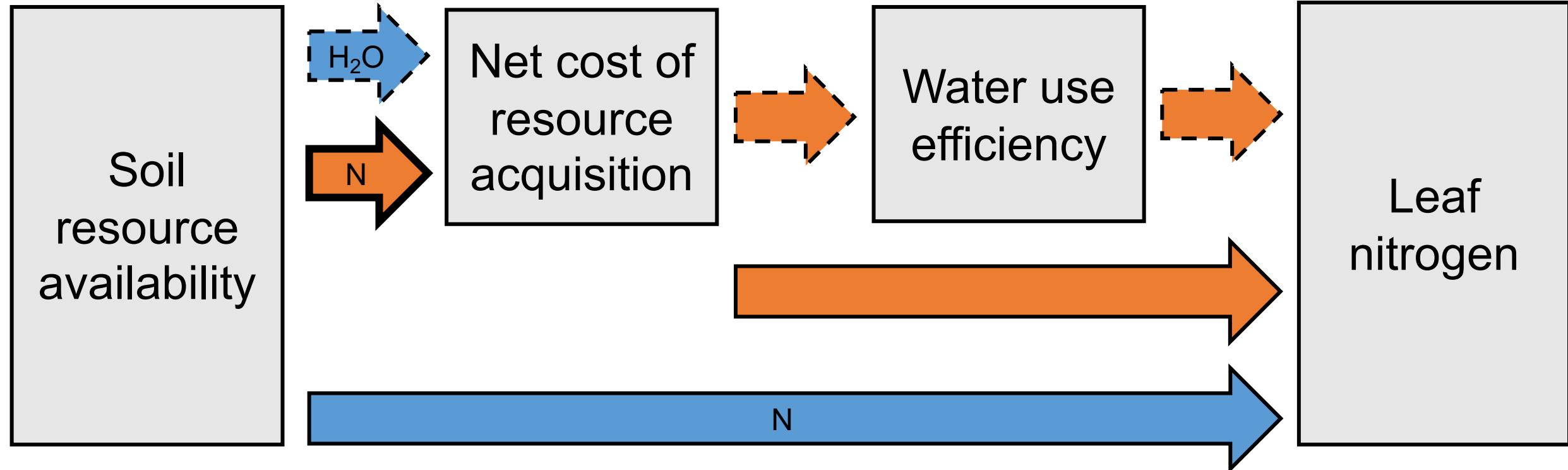
Negative effect



# Revisiting hypotheses

Positive effect

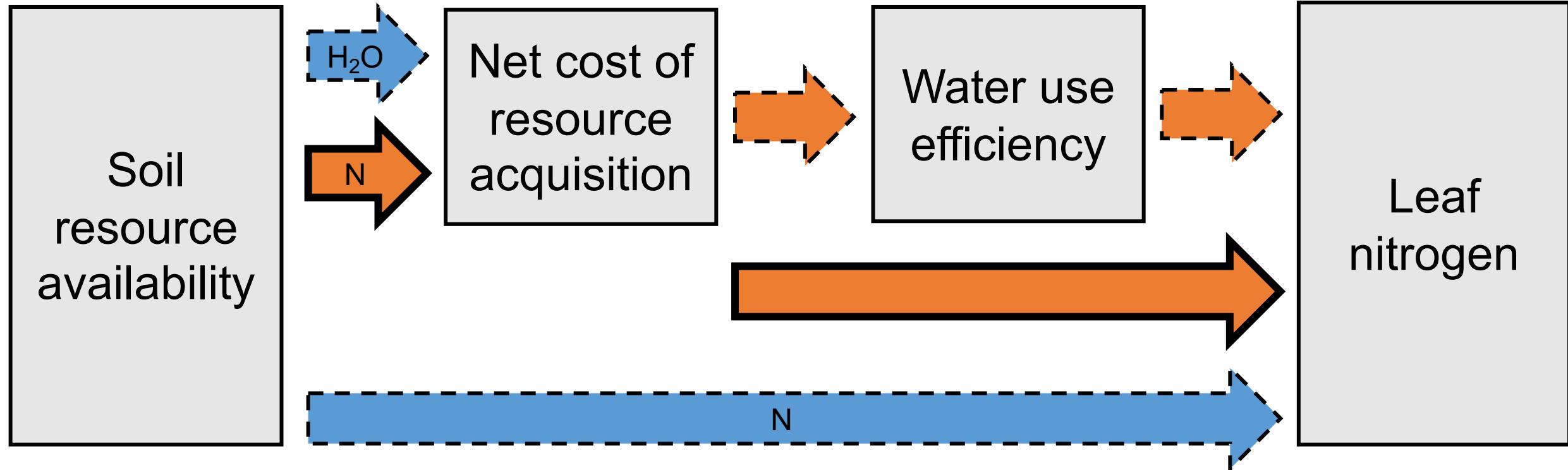
Negative effect



# Revisiting hypotheses

Positive effect

Negative effect





Texas Ecological Laboratory

# Acknowledgements

- Risa McNellis
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- Jose Villeda
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- Avery Schoenherr



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**Thank you!**

**Slides available at [insert URL here]**

# Extra slides

# Resource unit cost ratio ( $\beta$ )

cost of acquiring and using N

$$\beta = \frac{b}{a}$$

cost of acquiring and using H<sub>2</sub>O

# Resource unit cost ratio ( $\beta$ )

$$\beta = \frac{b}{a} = 1.6\eta^* D \frac{\left( \chi_{leaf} - \frac{\Gamma^*}{C_a} \right)}{\left( 1 - \chi_{leaf} \right)^2 * (K + \Gamma^*)}$$