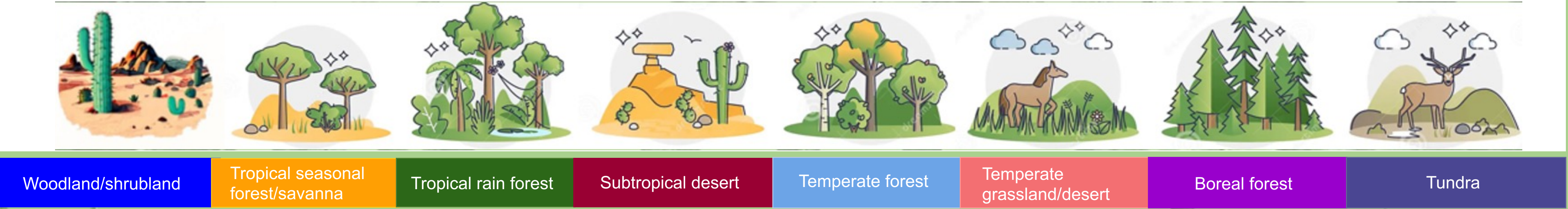


# Is the Relationship Between Photosynthetic Rate and Leaf Nitrogen Consistent Across Biomes?

BIO300A



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## Background

Terrestrial plant photosynthesis, the largest carbon flux in the global carbon cycle, plays a crucial role in the context of contemporary environmental changes <sup>1</sup>.

Understanding the variability of the photosynthetic rate,  $V_{c,max25}$ , which quantifies the maximum carboxylation rate standardized to a reference temperature of 25°C, is important for refining terrestrial biosphere models <sup>1</sup>. Photosynthetic capacity is also known to correlate with different leaf traits, such as leaf nitrogen, and external factors such as temperature.

**We hypothesize that the relationship between leaf nitrogen and the photosynthetic rate is positive and consistent across different biomes.**

## Methods

**From an already compiled data set we extracted:**

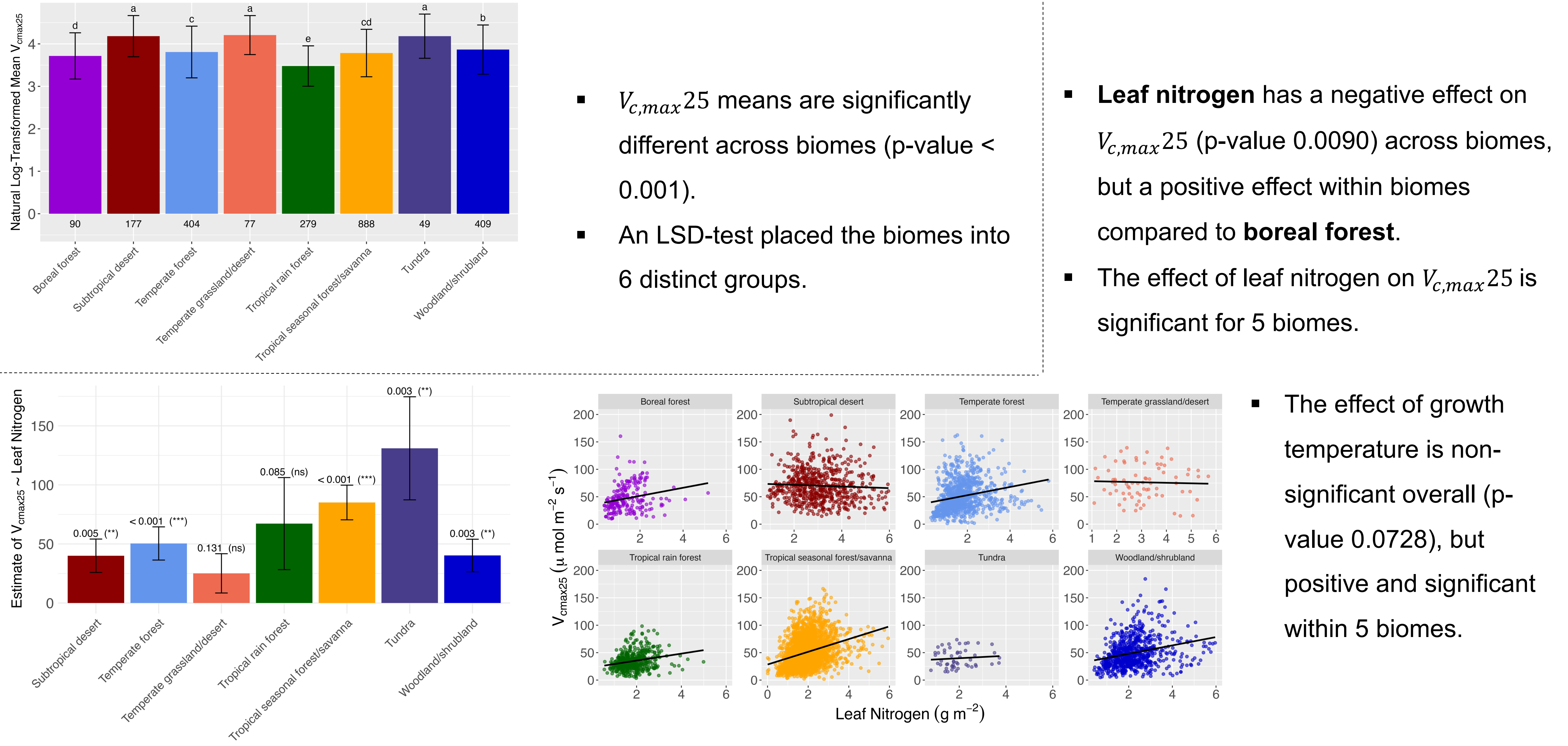
- Leaf nitrogen ( $gm^{-2}$ )
- Growth temperature (°C)
- $V_{c,max}25$  ( $\mu mol m^{-2}s^{-1}$ ) with formula derived from:

$$V_{c,max25} = V_{c,maxT_{obs}} \times f(T_{obs}, 25),$$
$$f(T_{obs}, 25) = e^{\frac{H_a(25 - T_{obs})}{298.15R(T_{obs} + 273.15)}} \times \frac{1 + e^{\frac{(T_{obs} + 273.15)\Delta S - H_d}{R(T_{obs} + 273.15)}}}{1 + e^{\frac{298.15\Delta S - H_d}{298.15R}}}$$

**For:**

- 8 biomes
- 2157 species in total

## Results



## Conclusion

We found that while there is a general trend of a positive relationship between leaf nitrogen and photosynthetic rate across biomes, the strength and significance of this relationship can vary depending on the specific biome. However, the differences are of small significance. Furthermore, despite high AIC and null deviance, the clear overall trend among the biomes ensures that the results are of interest.

**Based on the results from this study, the relationship between photosynthetic rate and leaf nitrogen is consistent across biomes, which is consistent with previous studies <sup>2</sup>.**

**References:**  
1: Yan, Z., Sardans, J., Peñuelas, J., Detto, M., Smith, N. G., Wang, H., Guo, L., Hughes, A. C., Guo, Z., Lee, C. K. F., Liu, L., & Wu, J. (2023). Global patterns and drivers of leaf photosynthetic capacity: The relative importance of environmental factors and evolutionary history. *Global Ecology and Biogeography*, 32(5), 668–682. <https://doi.org/10.1111/geb.13660>  
2: Wright, I. J., Reich, P. B., Westoby, M., Ackerly, D. D., Baruch, Z., Bongers, F., Cavender-Bares, J., Chapin, T., Cornelissen, J. H. C., Diemer, M., Flexas, J., Garnier, E., Groom, P. K., Gulias, J., Hikosaka, K., Lamont, B. B., Lee, T., Lee, W., Lusk, C., ... Villar, R. (2004). The worldwide leaf economics spectrum. *Nature*, 428(6985). <https://doi.org/10.1038/nature02403>

