

LeafWeb global synthesis paper demonstrates the importance of mesophyll conductance for photosynthesis models

Correspondence author: Lianhong Gu, lianhong-gu@ornl.gov, 865-241-5925, DOE/Office of Science/Biological & Environmental Research

Objective

- Use worldwide datasets gathered through an online virtual laboratory for photosynthesis research (leafweb.ornl.gov) to determine the effects of CO₂ diffusion inside leaves (i.e., mesophyll conductance), on photosynthesis across all major plant functional types and climates.

New Science

- Mesophyll conductance has been generally assumed to be infinitely large
- Synthesis of LeafWeb data from over 130 species in different countries showed that mesophyll conductance of most species is as important as stomatal conductance in affecting photosynthesis
- We found that standard assumptions of an infinite mesophyll conductance resulted in a major underestimation of CO₂ assimilation capacities of the photosynthetic machinery and a distortion of relationships between key biochemical processes.
- A functional model is proposed to facilitate the representation of mesophyll conductance in global carbon cycle models

Significance

- The findings of this study will lead to better understanding of photosynthetic processes under natural conditions and development of better global carbon cycle models
- A virtual laboratory like LeafWeb is a cost effective, efficient tool for promoting international collaboration, collecting spatially distributed datasets of global importance, and conducting synthesis research that would otherwise be difficult to carry out

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