ECOPHYSIOLOGY

Understory oases

Front. Plant Sci. **10**, 558 (2019).

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Gas exchange is an essential physiological process for plants, by which they take up CO_2 required for photosynthesis at the expense of water vapour. How differently gas exchange takes place in plants from different habitats and bioclimatic regimes has been a recurrent question, mainly addressed by meta-analyses so far. Putting together results of different studies performed at different locations and times, with different climates, and gathered using different methods, yields data with limited comparability and robustness. Michelle Murray, from Trinity College Dublin, and colleagues have instead developed a rigorous, standardized experimental design to measure the maximum stomatal conductance (g_{max}; the mean highest rate of passage of CO_2 or water vapour through the stomata of a leaf) of understory and open-canopy C_3 woody angiosperms from six different bioclimatic zones around the world.

The researchers found that leaf g_{max} in the understory was significantly lower than that in the open canopy in all six regions. Measured values in the understory were also very similar between different bioclimatic zones suggesting that, at the leaf level, understory plants are buffered against the effects of climate. Open canopy leaf g_{max} values, however, were not comparable between the studied bioclimatic zones. This study further indicates that C_3 woody angiosperms tend to optimize g_{max} towards a central value of approximately 250 mmol m^{-2} s^{-1} in response to changing climate conditions.

These findings provide evidence for the differential impacts of climate change on different vegetation habitats within the same ecosystem, and the role of canopies in building gas exchange ecophysiology 'oases' for understory and sub-canopy plants. In addition, the reported differences in g_{max} between canopy levels, its convergence in understory habitats and the tendency of woody angiosperms to optimize it, have important implications for enhancing the inference of ecosystem-scale photosynthesis dynamics from remote sensing data.

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Published online: 31 May 2019
https://doi.org/10.1038/s41477-019-0457-1