EGU21-10540
https://doi.org/10.5194/egusphere-egu21-10540
EGU General Assembly 2021

Rising CO_2 and warming lead to declining global canopy demand for nitrogen

Ning Dong[1,2], Iain Colin Prentice[1,2,3], Ian Wright[2], Xiangzhong Luo[4], and Nick Smith[5]

[1]Imperial College London, Department of Life Sciences, Silwood Park Campus, Ascot , UK
[2]Department of Biological Sciences, Macquarie University, Ryde, Australia
[3]Ministry of Education Key Laboratory for Earth System Modelling, Department of Earth System Science, Tsinghua University, Beijing, China.
[4]Department of Geography, National University of Singapore, Singapore, Singapore
[5]Department of Biological Sciences, Texas Tech University, Lubbock, USA

Nitrogen (N) limitation constrains the magnitude of terrestrial carbon uptake in response to CO_2 fertilization and climate change. However, the trajectory of N demand, and how it is influenced by continuing changes in CO_2 and climate, is incompletely understood. We estimate recent changes in global canopy N demand based on a well-tested optimality hypothesis for the control of photosynthetic capacity (V_{cmax}). The predicted global pattern of optimal leaf-level V_{cmax} is similar to the pattern derived from remotely sensed chlorophyll retrievals. Over the period from 1982 to 2015, rising CO_2 and warming both contributed to decreasing leaf-level N demand. Widespread increases in green vegetation cover over the same period (especially in high latitudes) imply increasing total canopy N demand. The net global trend is, nonetheless, a decrease in total canopy N demand. This work provides a new perspective on the past, present and future of the global terrestrial N cycle.