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Research

High nitrogen contribution by *Gunnera magellanica* and nitrogen transfer by mycorrhizas drive an extraordinarily fast primary succession in sub-Antarctic Chile

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Summary

- Chronosequences at the forefront of retreating glaciers provide information about colonization rates of bare surfaces. In the northern hemisphere, forest development can take centuries, with rates often limited by low nutrient availability. By contrast, in front of the retreating Pia Glacier (Tierra del Fuego, Chile), a *Nothofagus* forest is in place after only 34 yr of development, while total soil nitrogen (N) increased from near zero to 1.5%, suggesting a strong input of this nutrient.
- We measured N-fixation rates, carbon fluxes, leaf N and phosphorus contents and leaf $\delta^{15}N$ in the dominant plants, including the herb *Gunnera magellanica*, which is endosymbiotically associated with a cyanobacterium, in order to investigate the role of N-fixing and mycorrhizal symbionts in N-budgets during successional transition.
- *G. magellanica* presented some of the highest nitrogenase activities yet reported (potential maximal contribution of 300 kg N ha^{-1} yr^{-1}). Foliar $\delta^{15}N$ results support the framework of a highly efficient N-uptake and transfer system based on mycorrhizas, with *c.* 80% of N taken up by the mycorrhizas potentially transferred to the host plant.
- Our results suggest the symbiosis of *G. magellanica* with cyanobacteria, and trees and shrubs with mycorrhizas, to be the key processes driving this rapid succession.