

Are Tropical Mountaintop Trees Constrained in Their Distributions by Physiological Limitations? Thermal Adaptation and Acclimation to Climate Change

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Abstract

Habitat suitability for most tree species restricted to the wet tropical mountaintops of Australia is predicted to decline with climate change. This is especially concerning because no available alternative habitat exists for species to migrate, and their growth responses to warming are understudied. We present a study investigating the effects of warming on an ecologically important taxon, *Flindersia* spp., distributed across an elevation gradient in the Australian Wet Tropics. We test: (a) whether tropical mountaintop tree species are constrained in their distributions by physiological limitations to their thermal environment; and (b) whether species display an ability to adapt and/or acclimate to future warming. We first explored trends in species' *in situ* adaptation by studying leaf traits among congeners paired with environmental variables, and then evaluated plant physiological and growth responses under experimental soil nutrients and growth temperatures. We found that field trends in fundamental leaf traits with elevation were strongly driven by climate – decreasing temperatures, increasing soil moisture content and decreasing soil nutrient availability – and under experimental growth conditions showed increasing growth under warmer conditions, but then either declined or did not significantly change for upland and mountaintop species under resource-rich conditions. These modifications were associated with limitations in their photosynthetic biochemistry and selection of pathways favouring either growth or defence under resource-poor conditions. Our research findings have implications for conservation of these species in these fragile ecosystems under future warming.

Keywords: habitat suitability, wet tropics, *Flindersia*, leaf traits, fragile ecosystems

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Singh Ramesh, A., Cheesman, A. W., Crayn, D. M., & Cernusak, L. A. (2022) Are tropical mountaintop trees constrained in their distributions by physiological limitations? Thermal adaptation and acclimation to climate change. *Proceedings of The Royal Society of Queensland*, 131, 159. <https://doi.org/10.53060/prsq.2022-08>

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