Small understorey trees have greater capacity than canopy trees to adjust hydraulic traits following prolonged drought in a tropical forest

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Abstract

The future of tropical forests is dependent on the capacity of young trees to adjust to drought. We evaluated multiple hydraulic traits indicative of the drought tolerance of small trees across nine common genera at the world's longest-running tropical throughfall exclusion experiment and compared their responses with surviving large canopy trees. Small understorey trees increased specific hydraulic conductivity by 56.3% and leaf:sapwood area ratio by 45.6% in response to the drought treatment. However, understorey trees in both a control and the throughfall exclusion treatment had significantly lower minimum stomatal conductance and maximum hydraulic leaf-specific conductivity relative to the large trees, as well as significantly greater hydraulic safety margin (HSM) and PLC and embolism resitance, occupying a distinctly different hydrualic niche. The greater HSM of small understorey trees relative to large canopy trees likely enables them to adjust other aspects of their hydraulic systems to take advantage of increases in light availability in the understorey, driven by drought-induced mortality of canopy trees. Our results suggest that small understorey trees can adjust their hydraulic systems in response to changes in water and light availability and this has major implications for the regeneration potential of tropical forests following droughts.

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