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Mesophyll conductance measured at the whole-tree canopy level does not respond to elevated temperature

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Mesophyll conductance (g_{mes}) plays a central role in the regulation of plant-atmospheric exchange of carbon and water from the leaf up to the whole canopy. Nonetheless, most commonly available techniques for measuring g_{mes} are still costly and/or time-consuming and thus are usually limited to the leaf level. Hence, we lack a holistic understanding of how g_{mes} scales to the canopy level. Here, for the first time, we present measurements of whole-tree canopy g_{mes}, calculated from concurrent measurements of whole-tree discrimination against ^{13}C (Δ^{13}C) and whole-tree gas-exchange measured over the course of one day. We measured g_{mes}, photosynthesis (A), transpiration (E) and phloem carbon isotopic composition ($\delta^{13}C_{phloem}$) once a month over one growing season (October-April) in large, field-grown *Eucalyptus tereticornis* trees. Six trees were exposed to ambient and six to warmed air-temperature (3 ˚C above ambient). Our results showed that at the canopy level, g_{mes} strongly limits A and that this limitation is greater in spring and autumn than in the peak of the growing season. Warming did not increase g_{mes} at the canopy level, in agreement with leaf-level measurements on the same trees. Lack of a significant effect of warming on both leaf- and canopy-level g_{mes} contrasts with most leaf-level observations from previous studies. Finally, we suggest that $\delta^{13}C_{phloem}$ serves as a good proxy of canopy-integrated g_{mes} and, once calibrated, for whole-tree water-use efficiency.