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Within-catchment variation in regulation of water use by eucalypts, and the roles of stomatal anatomy and physiology

Mana Gharun, Tarryn Turnbull, and Mark Adams
University of Sydney, Australia (mana.gharun@sydney.edu.au)

Understanding how environmental cues impact water use of forested catchments is crucial for accurate calculation of water balance and effective catchment management in terrestrial ecosystems. We characterised structural and physiological properties of leaves and canopies of Eucalyptus delegatensis, E. pauciflora and E. radiata, the most common species in high-country catchments in temperate Australia. These properties were related to whole-tree water transport to assess differences in water use strategies among the three species.
Stomatal conductance, instantaneous transpiration efficiency, stomatal occlusion (through cuticular ledges) and leaf area index differed significantly among species. Whole-tree water use of all species was strongly coupled to changes in vapour pressure deficit (VPD) and photosynthetically active radiation (Q), yet stomatal closure reduced water transport at VPD > 1 kPa in all species, even when soil water was not limiting.
The observed differences in leaf traits and related water use strategies reflect species-specific adaptations to dominant environmental conditions within the landscape matrix of catchments. The generalist E. radiata seems to follow an opportunistic, while the two more spatially restricted species have adopted a pessimistic water use strategy. Catchment-scale models of carbon and water fluxes will need to reflect such variation in structure and function, if they are to fully capture species effects on water balance and yield.