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Sap flux and stable isotopes of water show contrasting tree water uptake strategies in two co-occurring tropical rainforest tree species

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Abstract

Little is known about the short-term dynamics of tree water use strategies particularly for neighbouring co-occurring species. Here, we quantify the high frequency changes in water sources and sap flux patterns of two commonly co-occurring tropical rainforest tree species: *Dendrocnide photinophylla* (Kunth; Chew) and *Argyrodendron peralatum* (F.M. Bailey; Edlin ex J.H. Boas). A combination of continuous sap flux measurements and hourly sampling of xylem water stable isotope composition (δDand δ ^{18}O) were used to observe water use strategies through a 24 h transpiration cycle. Sap flux ranged from 2.82-28.50 L d $^{-1}$ and was 66.67% higher in *A. peralatum* compare to *D. photinophylla.* For both tree species, sap flux increased with tree size and diurnal sap flux increase resulted in more isotopically enriched xylem water. A Bayesian Mixing Model analysis using sampled soil water isotopic composition from five soil depths from of 0 to 1 m showed that *D. photinophylla*used very shallow or surface layer (0-20 cm) water, while *A. peralatum* sourced its water mostly from deeper in the soil profile (>20 cm). We hypothesize that these differences in species' water consumption patterns are reated to plant water storage capacity and, wood anatomical features. Our study shows that combning xylem isotope composition and sap flux measurements can help reveal species level water use strategies—useful for improved process understanding for ecohydrological modeling.

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