ABSTRACT BOOK

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TD correction factors applied to larger trees, since calibration in large trees is not feasible, and many study sites prohibit destructive sampling. Study sites in Texas, USA included TD sap flow systems installed in large oak and other hardwood species along with eddy covariance for determination of transpiration (T) and total evapotranspiration (ET), respectively. One site was a mixed-oak savanna, and the other site was an oak-dominated wetland forest. Both sites were on federal land that prohibited stem removal. Traditional Granier estimation of scaled T was tested against corrected T using a set of recently published calibration factors for TD probes, as well as total site ET. We assumed that T approached ET in these closed-canopy stands during periods between rain events under conditions when soil and plant surfaces were dry.

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Radial variations in xylem sap flow in a temperate red pine plantation in Great Lakes region, Canada

Transpiration is among the largest components of the terrestrial hydrologic cycle, of which forests play a dominant role. Future climate change scenarios suggest southern Ontario, like many regions, will see increased temperatures and extreme weather events, calling for mitigation efforts such afforestation and reforestation. In the past 15 years, Ontario has planted more than 10,500 hectares of new forests across the province, many of which are composed of eastern white pine (Pinus strobus) and red pine (Pinus resinosa). Forest managers are faced with the challenge of maintaining these plantations and ensuring the resiliency of these ecosystems amidst changing climatic conditions. Therefore, a thorough physiological understanding of water use is crucial for the survival of these ecosystems. Water use is commonly estimated by measuring xylem sap flow through techniques such as the heat-pulse, the thermal-dissipation and the heat balance methods as an assessment of transpiration, and commonly scaled up to the tree/stand level. Large errors have been reported when scaling point-measurements to the tree and stand level, due to uncertainties in sapwood depth and an assumption of even sap-flux density throughout the sapwood. Therefore, it is important to measure sap-flux density at various depths within the sapwood. In this study we examined sap-flux density in variable retention harvesting (VRH) plots in a 79-year-old managed red pine plantation in southern Ontario, Canada. This experimental setup is part of Global Water Futures (GWF) Southern Forests Water Futures project and the Turkey Point Observatory. It is comprised of 20 VRH plots (1 ha each), including four different sets of harvesting densities and arrangements (plus one, non-treated control). Additionally, radial sensors were installed in 4 trees in the control (non-treated) plot at depths of 20mm from the cambium, 20-40mm and 40-60mm. The purpose of these radial sensors is to understand patterns in hydraulic conductivity within the sapwood and appropriately correcting for this variation when reporting transpiration contributions from the whole stand. This study determined that failure to consider radial variations in sap-flux density can lead to an overestimation of transpiration by up to 200%. This work will help to gain a more thorough understanding of water exchanges, and extreme weather impacts on these plantations. Such knowledge is crucial for sustainable management of forest ecosystems and development of water resources in the region.

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Contribution of leaf water uptake to transpiration and water status in arid ecosystems

Foliar water uptake (FWU) could be relevant for the plants, allowing them to use alternative water sources and thus prevent dehydration especially during the dry season in arid/semiarid ecosystem characterized by small and erratic water pulses. The main objective of this study was to evaluate the effects of FWU on leaf water status and its contribution to daily transpiration in an arid ecosystem in southern Argentina. Eight dominant species, including shrubs and grasses, with different rooting depth (< 0.5 m, < 1 m, < 2 m and > 2 m) and thus different soil water access, were selected. We hypothesized that FWU is higher in species with shallow roots than in species with permanent water access and that FWU enhances the water status. We determined FWU capacity by changes in leaf mass after spraying with deionized water. The water potential (Y_{Leaf}) was determined in the field before and after small water experimental application. Leaf transpiration (E) was measured using a portable photosynthesis system. All study species exhibited leaf water uptake capacity, but it was lower in species with deep roots than in the species with shallow roots during the growing season, however the effects on Y_{Leaf} were different. During the dry season, only grasses had a substantial enhancement of water status after a water leaf application. A linear negative relationship between FWU and the changes in Y_{Leaf} after an experimental water pulse was found during the spring season ($R^2 = 0.80$) and an inverse relationship during summer ($R^2 = 0.59$). Species with higher FWU were those with higher transpiration rate ($R^2 = 0.66$) suggesting that FWU contribute to plant water balance allowing stomata to remain open, thus enhancing to carbon assimilation during the growing season.

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Effects of soil berms on sap flow and fruit production in young hass avocado trees

Persea americana species are water demanding crops that require the correct amount of water for optimal growth and fruit production. Properly wetted soils during periods of high evaporative demands contribute to maintaining daily plant water balance, root growth, and preventing root rot. The latter can be prevented by planting trees on soil berms. Planting on berms can also cause avocado roots to stay largely within the berms rather than grow into unirrigated areas between the rows and thereby allow for more efficient irrigation. The purpose of this study was to compare sap flow rates for young Hass avocado trees grown on regular soil surfaces and on 2-foot-tall soil berms in Ventura County, Southern California, USA, to determine actual water needs that can guide irrigation. It was hypothesized that avocado trees grown on soil berms are rooted more deeply, with roots restricted to the width of the berm, resulting in higher sap flow rates and fruit production. Eight avocado trees were instrumented with 1-inch diameter EXO-Skin heat-balance sensors (Dynamax Inc., USA) from January to November 2017. Branch sap flow was measured at 15 minute intervals, extrapolated to entire trees, and then averaged for all replicates per treatment to estimate actual tree water use (Ta) as a fraction of evapotranspiration (ETo). Meteorological data were available from a nearby CIMIS weather station. To assess growth and fruit production, tree size, total number of fruit and mean fruit weights were compared between treatments. Overall, no significant differences were found between treatments for sap flow rates and tree size. However, berm treatments produced more fruit compared to the regular soil treatments. Despite not finding any differences in actual water use between treatments, this study demonstrated that direct measurements of sap flow can be used in avocado to determine irrigation needs to conserve water.

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Testing of low-cost microprobe sap flow sensors on woody plants

Conventional sap flow sensors are invasive and generate significant amounts of heat, creating associated risks of flow disruption and thermal damage to the vasculature in the sensing area of woody plants. Also their substantial per unit cost currently precludes their use in large numbers in replicated experiments or for monitoring of crop water use. Recently, microprobe sap flow sensors have been developed by Seoul National University and a start-up company, Telofarm. These miniaturised microprobes are smaller, lower cost and less invasive than conventional sap flow probes so they can feasibly be applied to obtain well-replicated measurements across numerous plants in an orchard, and at various locations within plants, ranging from thin