Abstract

Evaluating Abnormalities in Daily Transpiration Patterns Across Tree Species in a Semi-Arid Climate

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Climate change causes shifts in precipitation, temperature, climate zones and more, thus affecting the ecology and hydrologic cycles of many environments, specifically those existing in already vulnerable climate zones. Vegetation affects the local hydrologic cycle, as it promotes multiple feedback mechanisms, such as the extraction of soil water via roots, the re-wetting of the atmospheric boundary layer and lowering temperatures through transpiration, and more. This study focuses on transpiration patters in a hot semi-arid environment, with an annual precipitation is between one-fifth and one-half of potential evapotranspiration and an annual mean temperature above 18°. Meteorological conditions, sap flow, leaf water potential, carbon assimilation and stomatal conductance were all recorded during 2021 in order to observe the drivers of transpiration among ashe juniper, lacey oak and pinyon pines, as well as abnormalities in their diurnal sap flow patterns. Sap flow was shown to increase in magnitude (up to 350% in P6's case) when environmental conditions such as vapor pressure deficit (VPD), temperature and soil water potential (SWP) are favorable. Ashe juniper was found to have a weak relationship between leaf

water potential (LWP) and VPD, along with a stronger relationship between LWP and SWP. Oaks were found to have a very strong relationship between LWP and VPD, while pines were found to have a weak relationship between LWP and VPD. Of the three species, only the oaks were found to have a relationship between assimilation rates and VPD, assimilation rates and SWP, and stomatal conductance and SWP. This makes oaks the most vulnerable of the three species to future climate change and shifting climate zones. Better understanding of plant responses to stressful climatic conditions and in arid environments will provide insight in plant durability and adaptations to a warming climate, all of which is important as our global and local climates continue to change.