Abstract

EVALUATING BIOMASS WATER STORAGE AND SAP FLUX IN THREE SEMI-ARID TREE SPECIES

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This study explores how semi-arid forests respond to drought and the potential impact of climate change on these ecosystems. It provides novel information to guide political decision-making concerning climate change, water use, and land use with respect to juniper tree clearing. We used sap flux observations as a proxy for transpiration and capacitance-style FDR sensors installed directly into trees as a means to assess wood water storage. We also recorded meteorological conditions at the field site including atmospheric vapor pressure deficit (VPD), temperature, precipitation, and soil moisture. Our results indicate sap flux can either use internal wood water storage to preform daily transpiration (an inverse relationship) or be used to recharge the wood water storage (an analogous relationship) depending on environmental conditions. During stressful environmental conditions, sap flux is typically well below 10 $\frac{gH_2O}{m^2}/sapwood/s$ and used to refill wood water storage rather than for transpiration. During non-stressful times with moderate temperatures, VPD, and ample soil moisture, sap flux is typically above 10 $\frac{gH_2O}{m^2}/sapwood/s$ and is used for transpiration. On an individual tree scale, we found junipers are neither transpiring at higher rates nor storing more wood water than either oak or pine. Current policies suggest removal of woody brush such as juniper, will lead to an increase in water yield. Our results show that this may only be the case in certain circumstances. Our study showed

daily wood water storage and withdrawal is highly dependent on VPD (water demand) and soil water potential (water supply). As the effects of climate change intensify, VPD will likely increase while soil water potential will further decline. This is expected to have a large effect on internal wood water storage and ultimately lead to an increase in cavitation and tree mortality.