A Comparison of Transpiration Rates from Three Semi-Arid Tree Species in Response to Partial Stand Clearing

Austin Francis Rechner

ABSTRACT

As precipitation and temperature patterns continue to shift in response to climate change, total water availability, including soil and surface waters, are likewise altered. In central and west Texas, a common land management practice thought to increase surface water quantities and spring flow is the removal of *Juniperus ashei*, commonly referred to as ashe juniper or cedar. Through transpiration, plants exchange water for carbon from the atmosphere. This water flux is the largest component of the terrestrial water cycle for many vegetated ecosystems. We use micrometeorological and sap flux data to quantify transpiration rates in three tree species, pinyon pine (*Pinus remota*), lacy oak (*Quercus laceyi*), and ashe juniper (*J. ashei*), in a semi-arid forest located near Rocksprings, Texas. We compare transpiration rates between species under a variety of environmental conditions and in response to partial clearing of the ashe juniper. We hypothesized that (1) ashe juniper will transpire more than oaks or pines, (2) trees located at higher elevations will have reduced connectivity to groundwater evidenced by lower predawn leaf water content, (3) ashe juniper trees will use a risk prone hydraulic strategy to enable enhanced transpiration, and (4) transpiration from all species will increase after a partial ashe juniper clearing due to reduced competition. Sap flow data revealed that ashe juniper used less water than the oaks but more than the pines. Within a given species, individuals located at lower elevations transpired more than individuals at higher elevations. However, this comparison did not provide a substantial pattern to suggest different rooting strategies or ability to reach the water table. As precipitation patterns become increasingly variable, an enhanced understanding of vegetation-climate interactions will provide key information for land management best practices to ensure resource resilience in the face of changing climate.

Acknowledgments: I would like to thank Ana Maria Restrepo Acevedo, A. Rio Mursinna, Christian Roumelis, Suvan Cabraal, Chance Bolduc, Ashley M. Matheny, and the 2018-2020 Ecohydrology classes for their assistance with field work. I would also like to thank Renee Bevirt for permitting us to conduct this experiment on her property.

Ashley Michelle Matheny

Digitally signed by Ashley Michelle Matheny
DN: cn=Ashley Michelle Matheny, o=University of Texas at Austin, ou=Department of Geological Sciences, email=ashley.matheny@jsg.utexas.edu, c=US
Date: 2020.04.20 09:36:01 -05'00'

(advisor sign here; electronic signatures with pdf authentication are OK
(Ashley Matheny)