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Assessing the vulnerability and resilience of riparian vegetation to water stress

Bryn Morgan^{1,2} and Kelly Caylor^{1,2,3}

¹Department of Geography, University of California, Santa Barbara, Santa Barbara, USA

²Earth Research Institute, University of California, Santa Barbara, Santa Barbara, USA

³Bren School of Environmental Science and Management, University of California, Santa Barbara, Santa Barbara, USA

Riparian corridors act as thermal and moisture refugia for a range of plant and animal species, particularly in water-limited environments. Declining water tables, increasing temperatures, and an increase in extreme hydrologic events due to climate change threaten the diversity of life these landscapes support. Successful adaptive conservation management strategies require an understanding of how species are responding to climate change and an ability to anticipate how changing patterns of water resource availability and demand will alter vegetation patterns and processes.

Here, we investigate dryland riparian plant responses to fluctuating water availability and atmospheric demand using a novel drone-based approach for estimating transpiration. Integrating thermal imagery, structural data, and a suite of environmental sensors mounted on an unmanned aerial vehicle (UAV) platform, this approach was specifically designed to capture fine-scale functional data and variation in individual-level plant functional traits within riparian ecosystems and allows for efficient calculation of evapotranspiration for a site solely using data collected from the UAV. Using UAV-based measurements of transpiration across seasonal, diurnal, and spatial gradients of water stress, we quantify individual-scale hydraulic sensitivity to fluctuating water availability and atmospheric moisture demand. Finally, we highlight how these fine-scale estimates of plant water use facilitate understanding of how ecologically important plants respond to the increasingly variable hydrologic regimes that sustain them, yielding valuable insights into how such ecosystems will evolve in the face of global environmental change.