Fire severity drives post-fire evapotranspiration in a southwestern pine-oak forest, Arizona, USA

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Differences in evapotranspiration across the fire severity gradient can be explained by post-fire species composition

TRIO
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Introduction:

- The Sky Island forests of the Sierra Madre Occidental are vital biodiversity hotspots. Shifting fire regimes have triggered transitions from mixed pine-oak forests with high species diversity to post-fire shrublands without pines.
- Post-fire stand, water balance, and hydrology are critical factors influencing vegetation recovery after a wildfire. In many high-severity fire sites, post-fire plant evapotranspiration (ET) can be high within post-fire shrub-land sites that burned at high fire severity.
- Quantified the influences of fire severity on diurnal post-fire plant sap flow rates within a post-fire Sky Island in southeastern Arizona.
- Examined variation in post-fire sap flow across the fire severity gradient of the 2011 Horseshoe Two Fire in the Chiricahua National Monument to understand how contemporary fire severity influences post-fire tree water balance and cycling.

Methods:

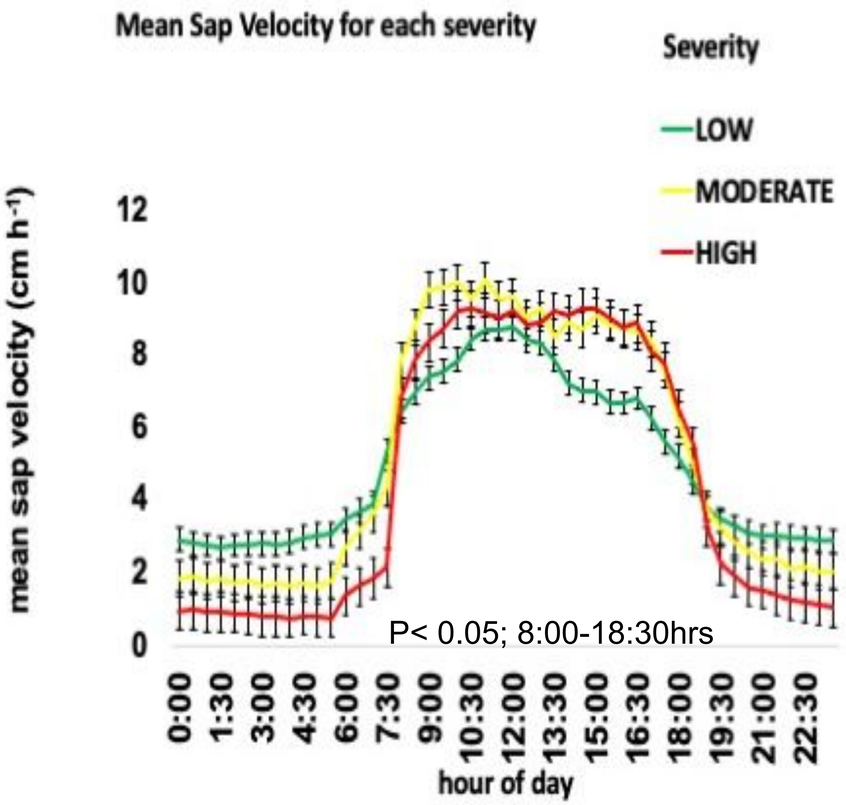
- Installed a network of 42 sap flow sensors spanning the fire severity gradient to measure diurnal variation in sap flow velocity and daily transpiration rates among species and fire severities
- Calculated 30 minute-interval sap flow velocities using the heat ratio method for each instrumented tree and evaluated differences in mean sap flow rate among species and fire severities using linear mixed effects models
- Used ICT International's SFT1 Sap Flow Tool to visualize and manipulate data

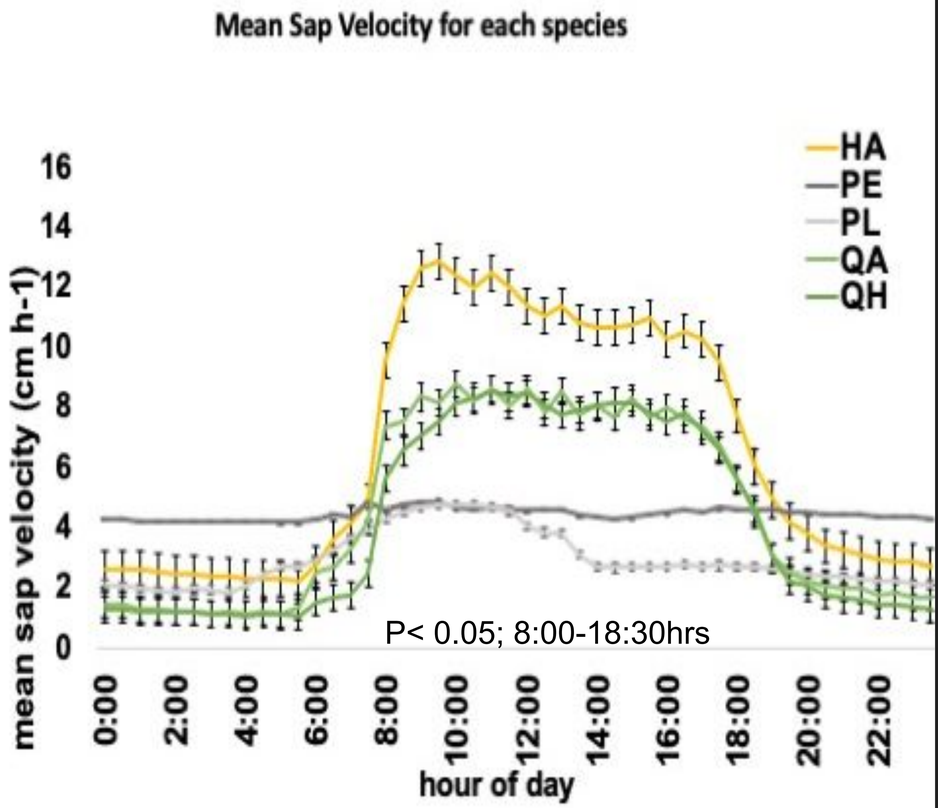
Discussion:

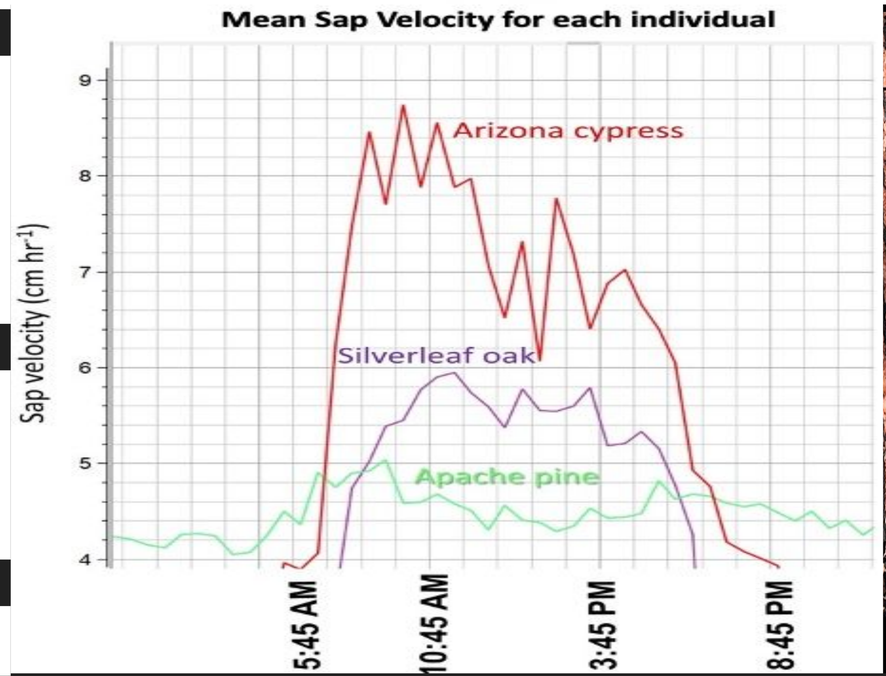
- Our results suggest that plant functional traits and stomatal regulation of gas and water exchange play critical roles in explaining post-fire forest recovery trajectories
- Cypress and oaks maintain high sap velocity through sundown, demonstrating multiple peaks throughout the day.
  Cypress and oaks to keep their stomata open throughout the day and their high transpiration rates may be a key mechanism explaining their success on high-severity sites relative to pines.

Next Steps:

- Calculate daily transpiration for each tree and then scale to the stand-scale using individual transpiration rates and forest stand data
- Compare stand transpiration rates to satellite-derived ET estimates from NASA ECOSTRESS imagery.







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