The role of Carbon depletion in conifer physiological resistance to drought and pests

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California “Hot Drought”

Griffin and Anchukaitis 2014

Young et al. 2017
Hydraulic safety = \( \frac{0.5 \times \text{Thickness}}{\text{Diameter}} \)

Rosner et al. 2015
Methods

Pinus jeffreyi

Pinus ponderosa

Central Valley

Sierra Crest

P. jeffreyi

P. ponderosa

= plot

West                      East
Dendrochronology

\[
G = \frac{\sum_{j}^{n} \sum_{j=1}^{n} |X_i - x_j|}{2n^2 \mu}
\]

Biondi and Qaedan 2008
Cellular Controls on Growth and Resilience

Automated measurement of ~700-1k tracheids per ring

Lumen diameter
Wall thickness
Lumen Area

HSF: \( \frac{0.5 \times \sum \text{Wall}}{\text{Lumen}} \)
Tracheid Anatomy

Alive: no dramatic change

Dead: rapid increase in wall thickness, highly variable
Hydraulic Safety

Living tree HSF < drought-killed tree HSF

Lauder et al., *in prep*
Growth and Tracheid Anatomy

Dead trees

- Sensitive to climate
- Higher GINI
- Rapid growth in average and wet years
- Higher HSF (but also more variance)

Survivors

- “Slow and steady” growth

Lauder et al., in prep
A Question of Carbon

McDowell et al. 2008

Adams et al. 2017
Lignin = 1.3x C cost of cellulose

Lauder et al. 2019
Lignin

ANOVA $p = 0.056$ living vs dead

$p = 0.045$ living vs dead by species (driven by PIJE)

Lauder et al. submitted
Can we target management to maximize defenses to both stressors?

Can we select for/plant from stock with identified resilience traits?
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