Conifer Encroachment & Removal in Oak Woodlands: Influences on Ecosystem Physiology & Biodiversity

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Cal Poly Humboldt | Forestry, Fire, & Rangeland Management
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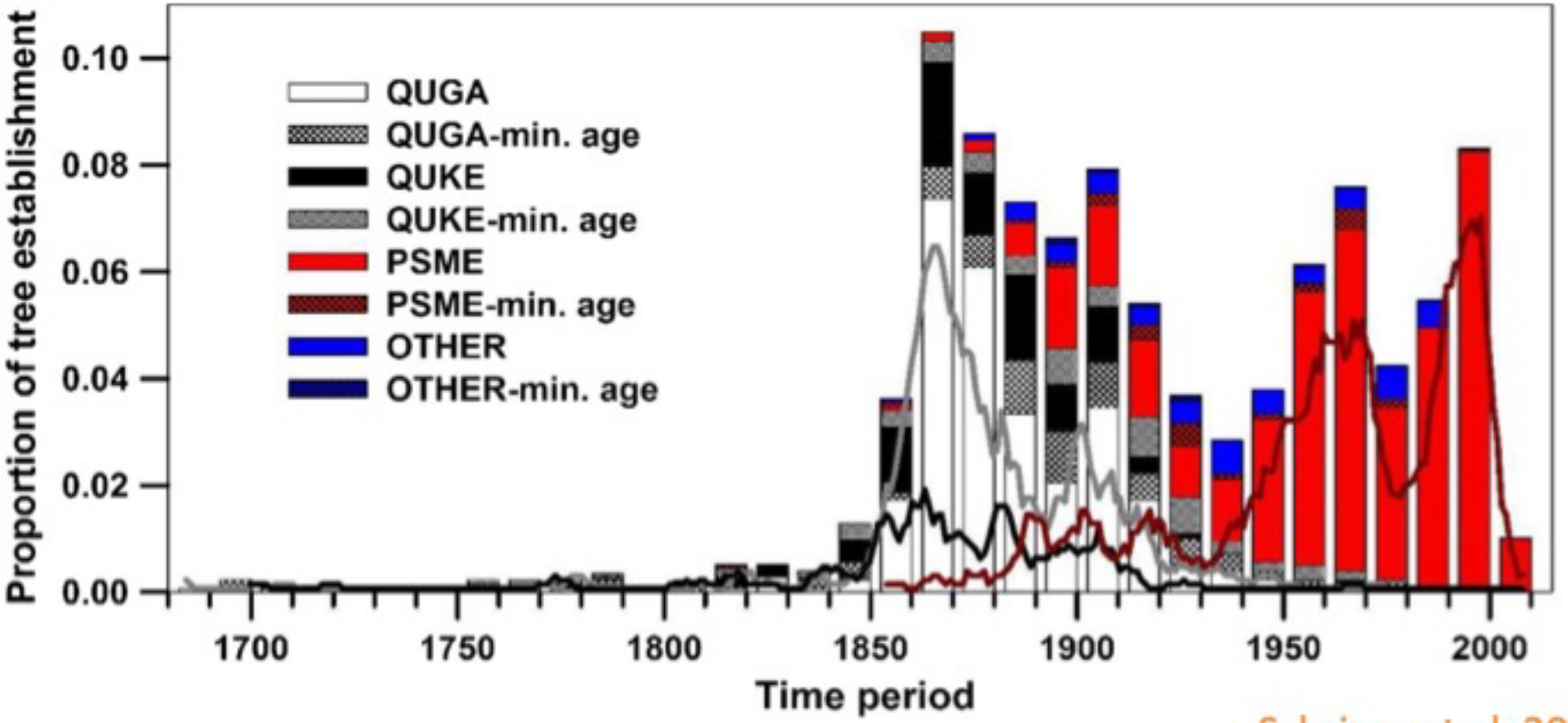
N E S W

Conifer Encroachment

In past 50-100 years, lost ~30% of oak woodlands in northern CA



Schriver et al. 2018

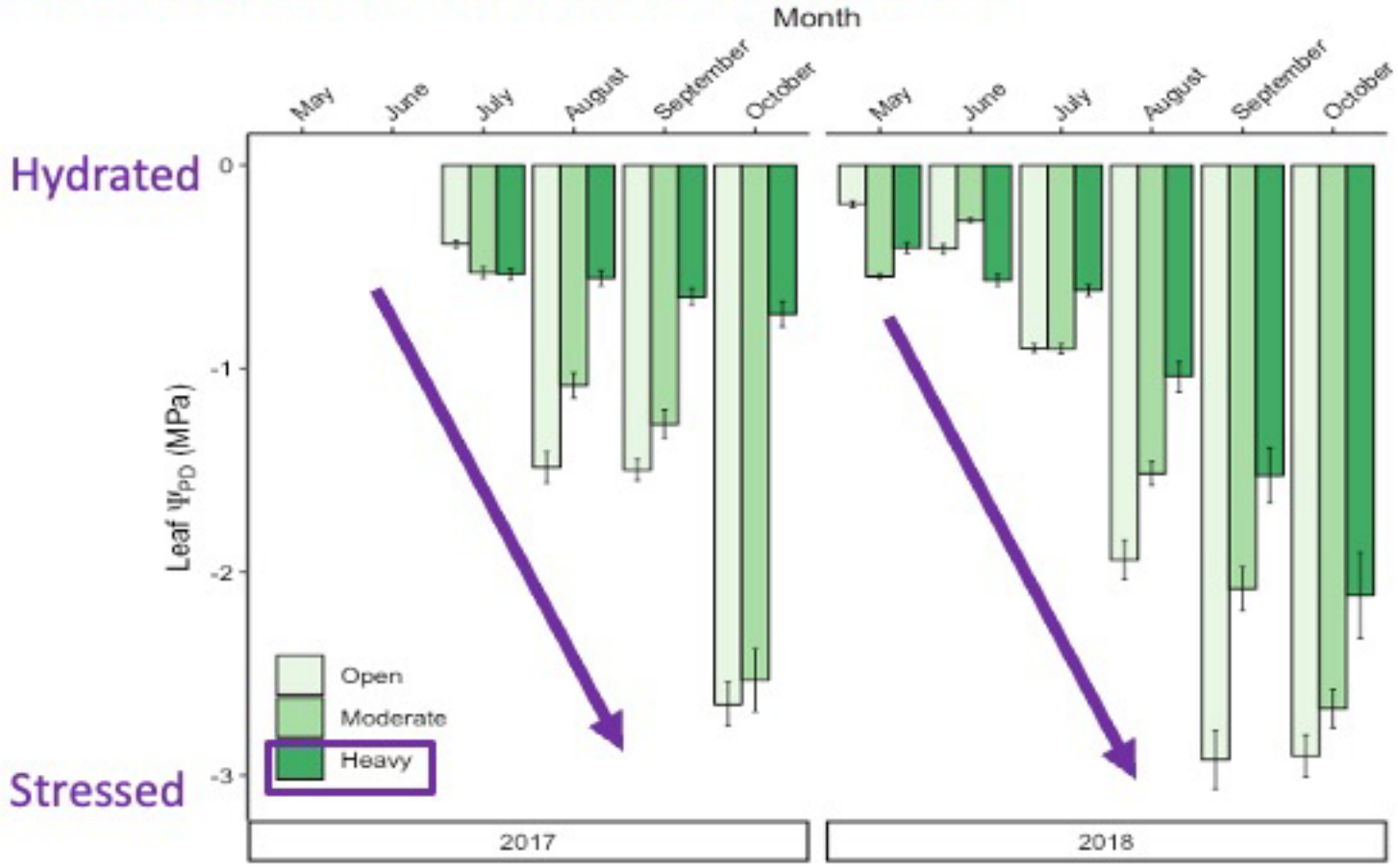
Questions

1. How does oak physiology vary with season, encroachment, treatment, & climate?
2. How does woodland biodiversity vary with encroachment & treatment?

Open

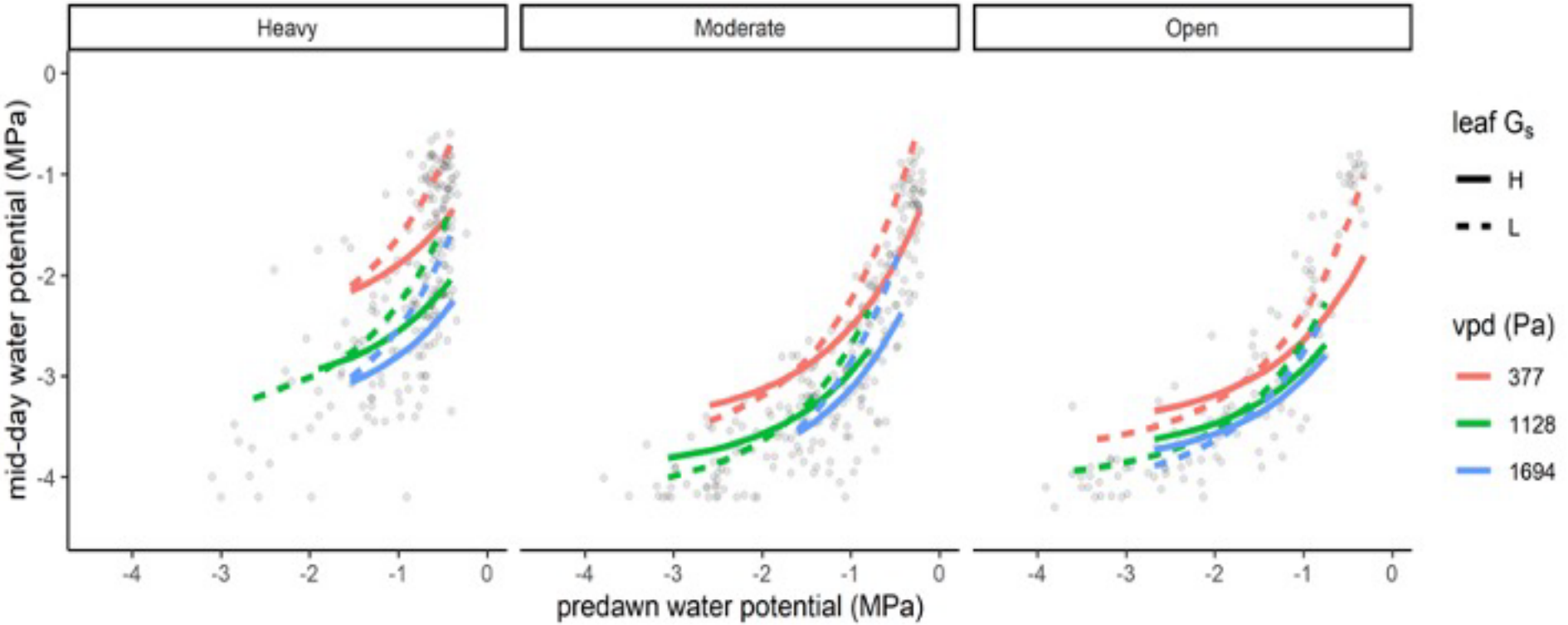
Heavily Encroached

Ψ: Season & Encroachment Levels



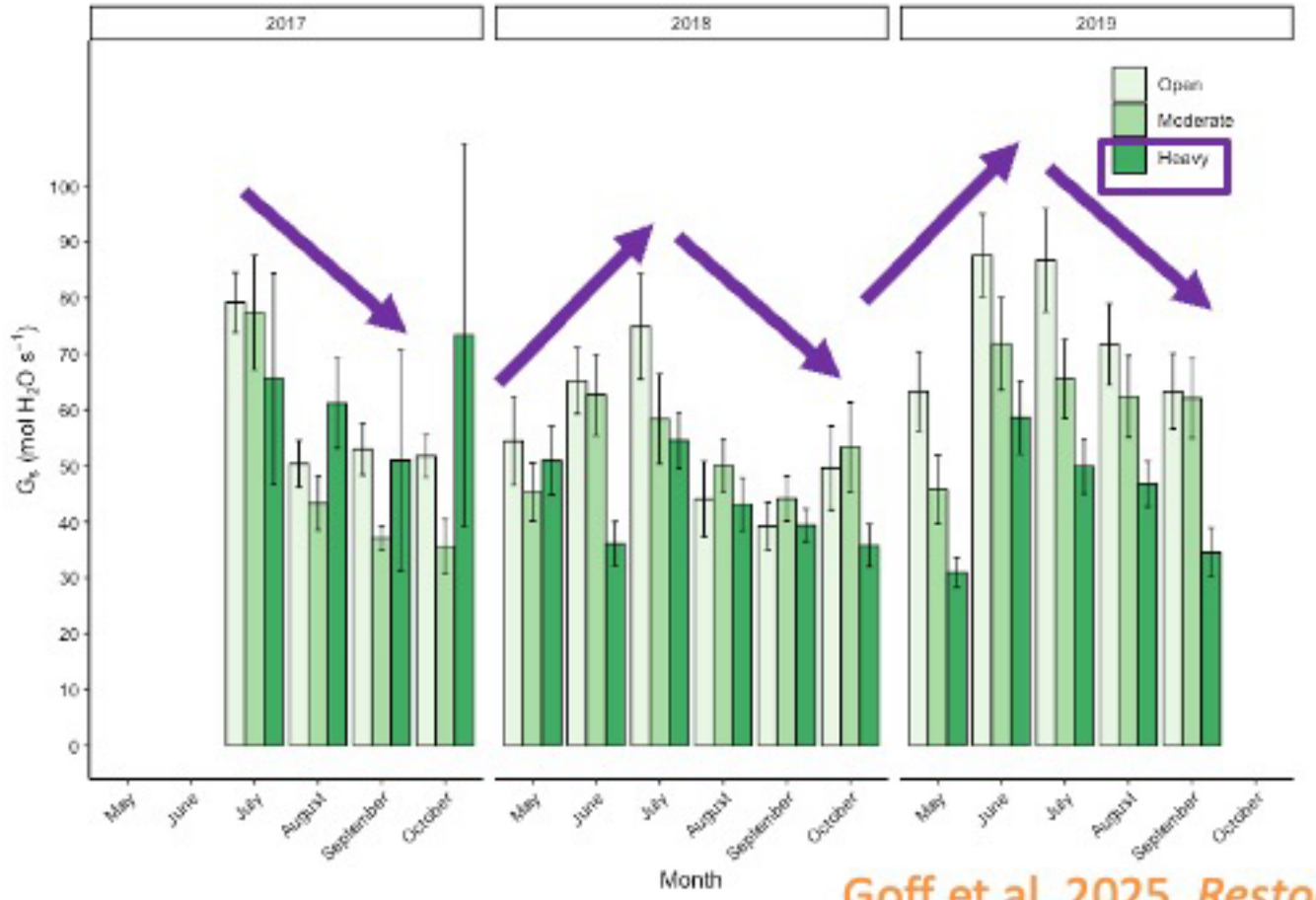
Goff et al. 2025, *Restoration Ecology*

Encroachment Increases Oak Sensitivity to VPD



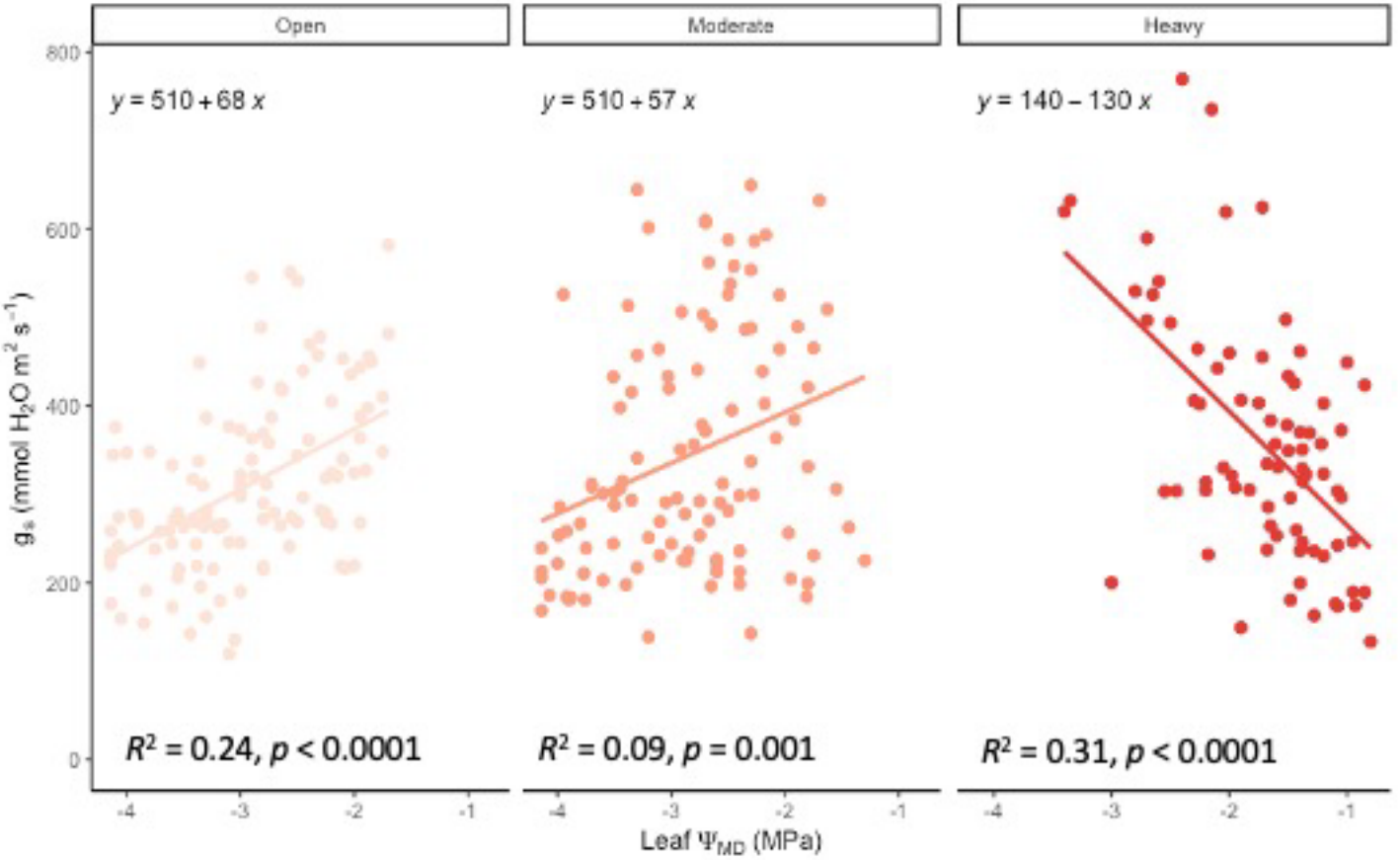
Goff et al. 2025, *Restoration Ecology*

G_s: Season & Encroachment Levels



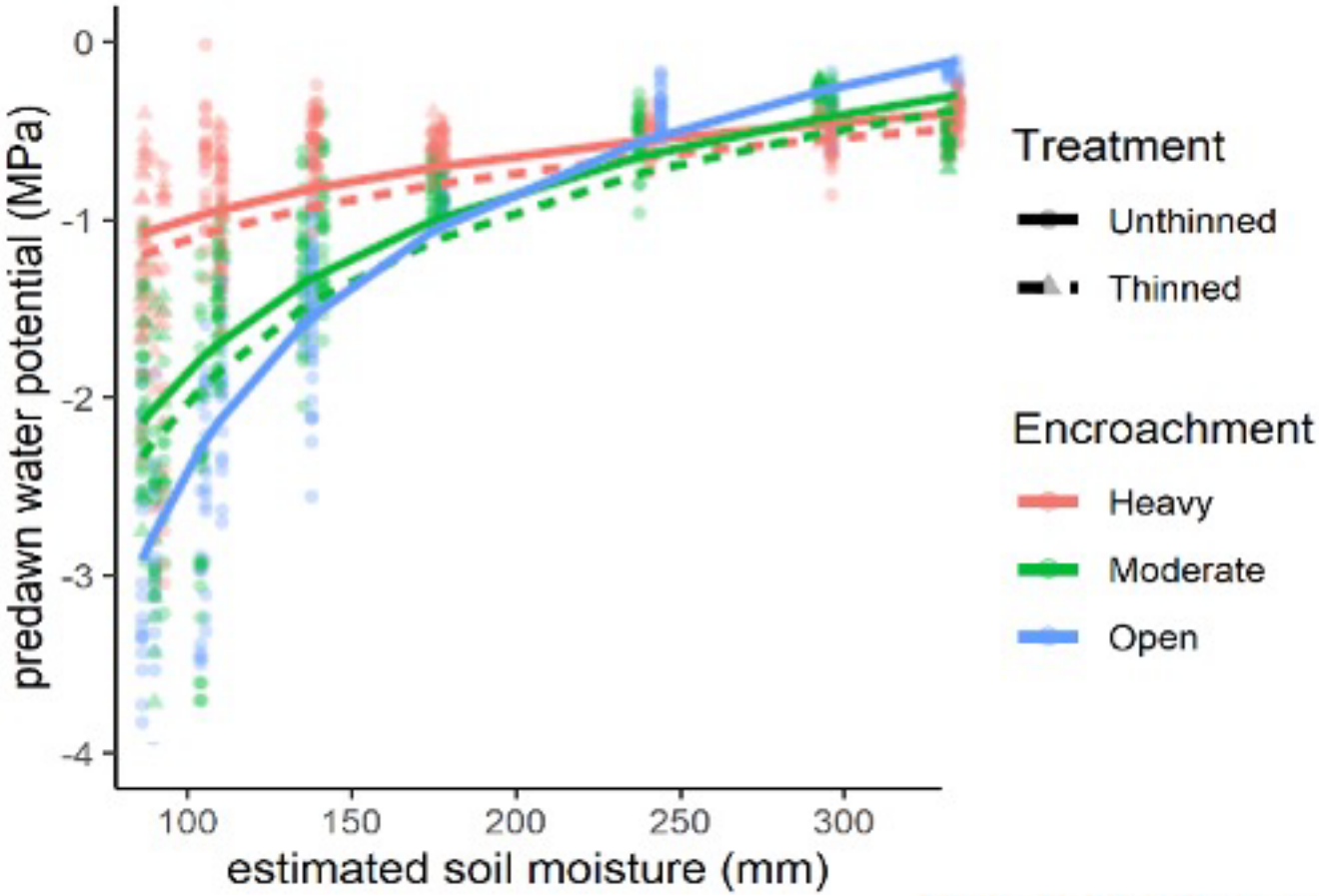
Goff et al. 2025, *Restoration Ecology*

Physiological Acclimation?



Goff et al. 2025, *Restoration Ecology*

Thinning Decreases Water Status



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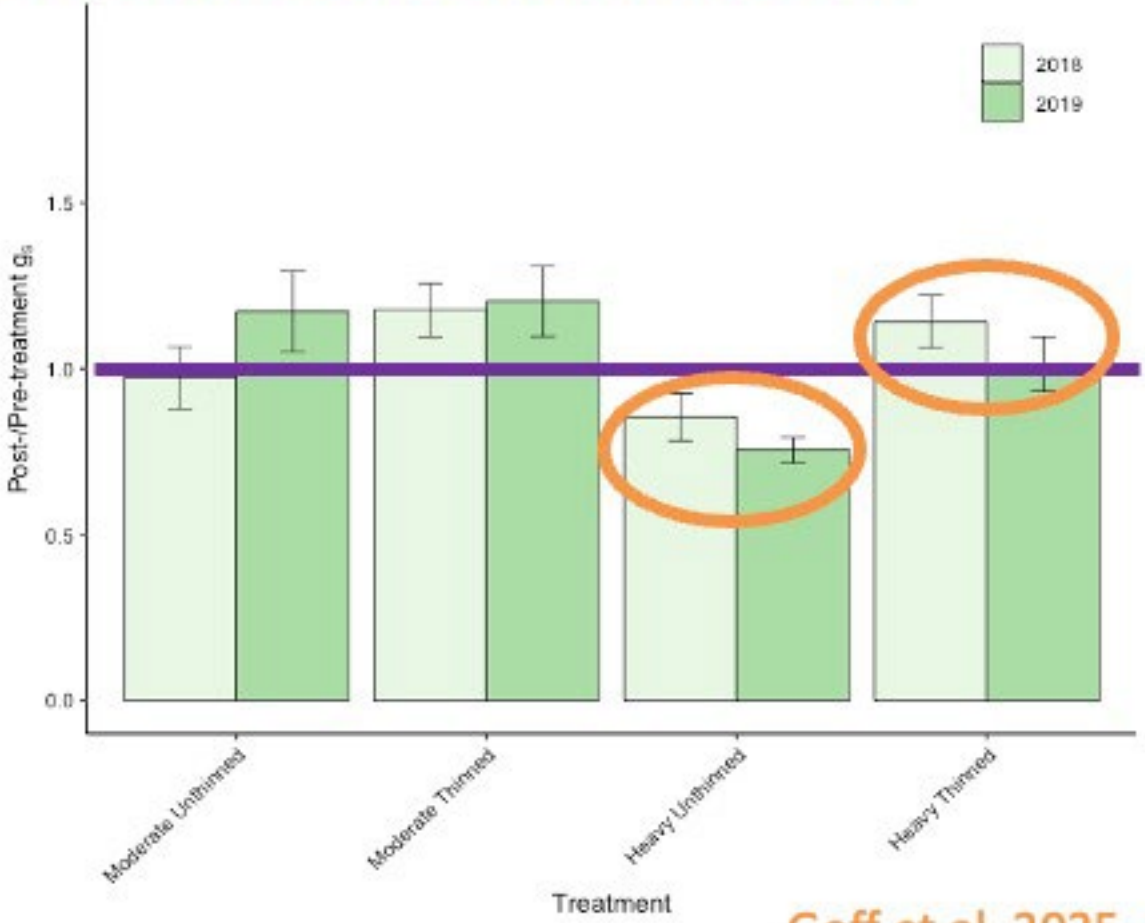
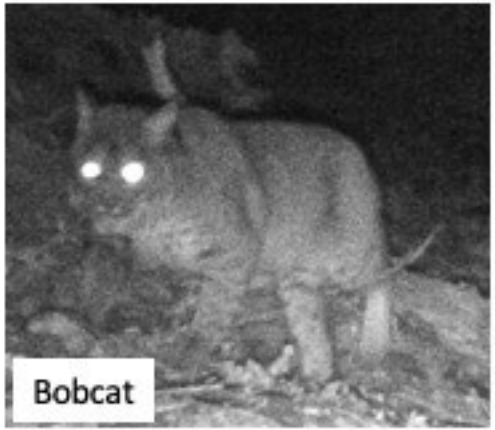
G_s Response to Conifer Removal?



Goff et al. 2025, *Restoration Ecology*

Biodiversity

- Lowest plant diversity in heavily encroached stands
- Lowest mammal diversity in open stands
- Bird diversity relatively invariable with encroachment & treatment



Goff et al. 2025, *Restoration Ecology*

Take-Home Points

1. Conifer encroachment reduces oak water stress & gas exchange
2. Conifer removal does not meaningfully increase oak water stress & increases gas exchange, even in heavily encroached stands
3. *Conifer removal should be aggressive*


Thank you! Questions?
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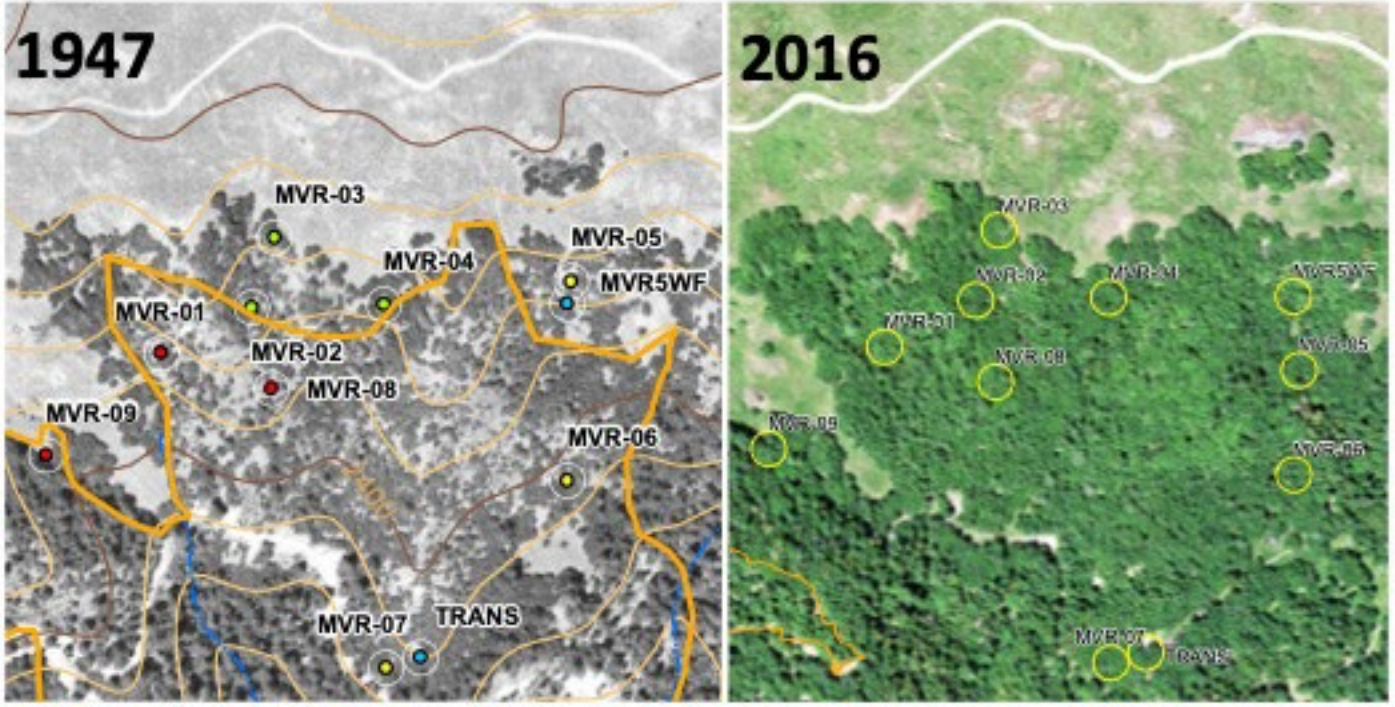
Extra Slides

Study Sites

- 2 Open
- 2 Moderately encroached
- 2 Moderately encroached, thinned
- 2 Heavily encroached
- 2 Heavily encroached, thinned



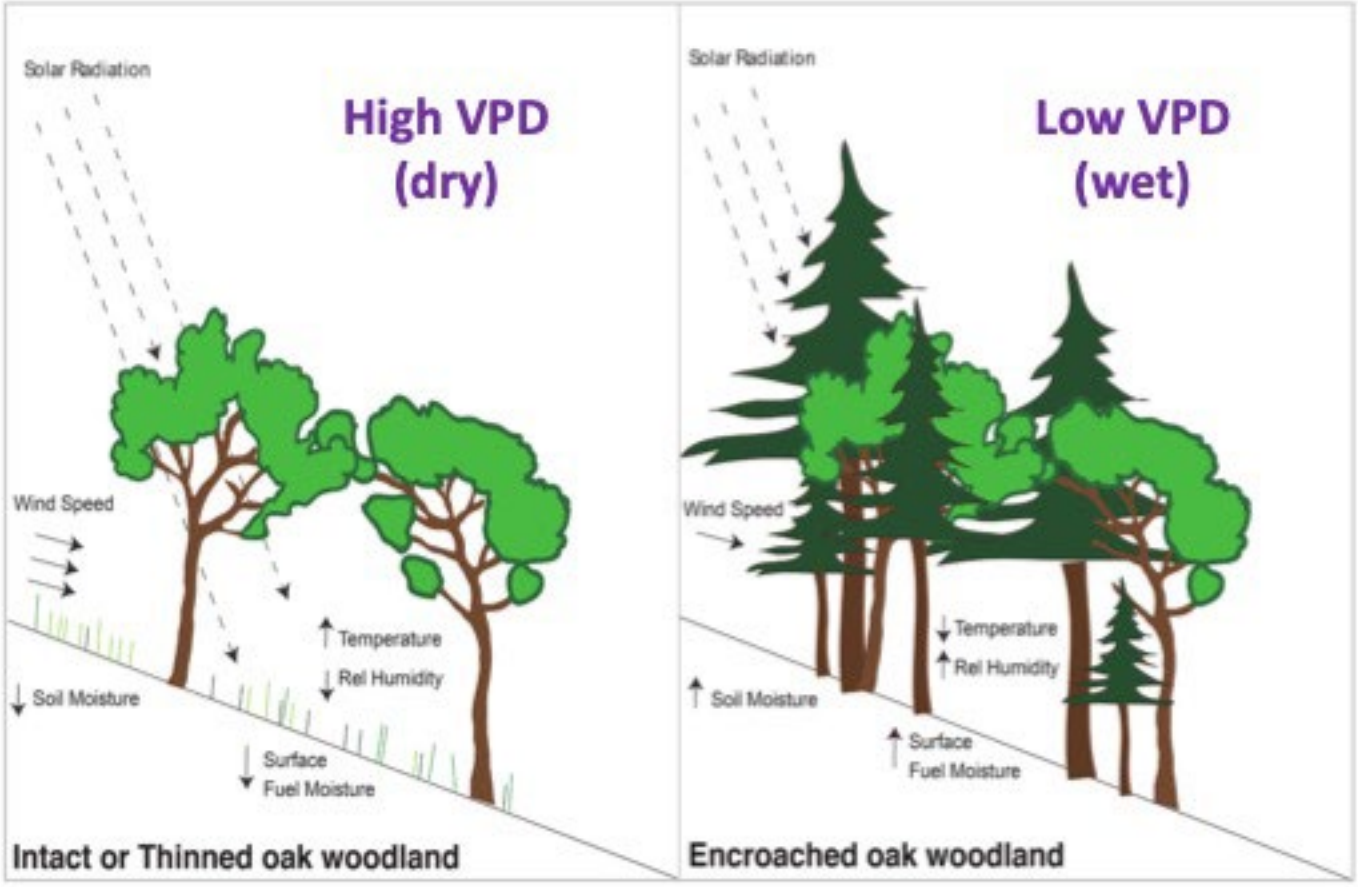
Methods

- 2017 (pre-thin), 2018, 2019
- Measurements
  - Water potential (predawn & midday)
  - Stomatal conductance
  - Physiology/Climate modeling
  - Biodiversity (post-thin only)
    - Plants
    - Mammals
    - Birds

Photo: ECOP

New Olympic Sport: Pole Pruning!

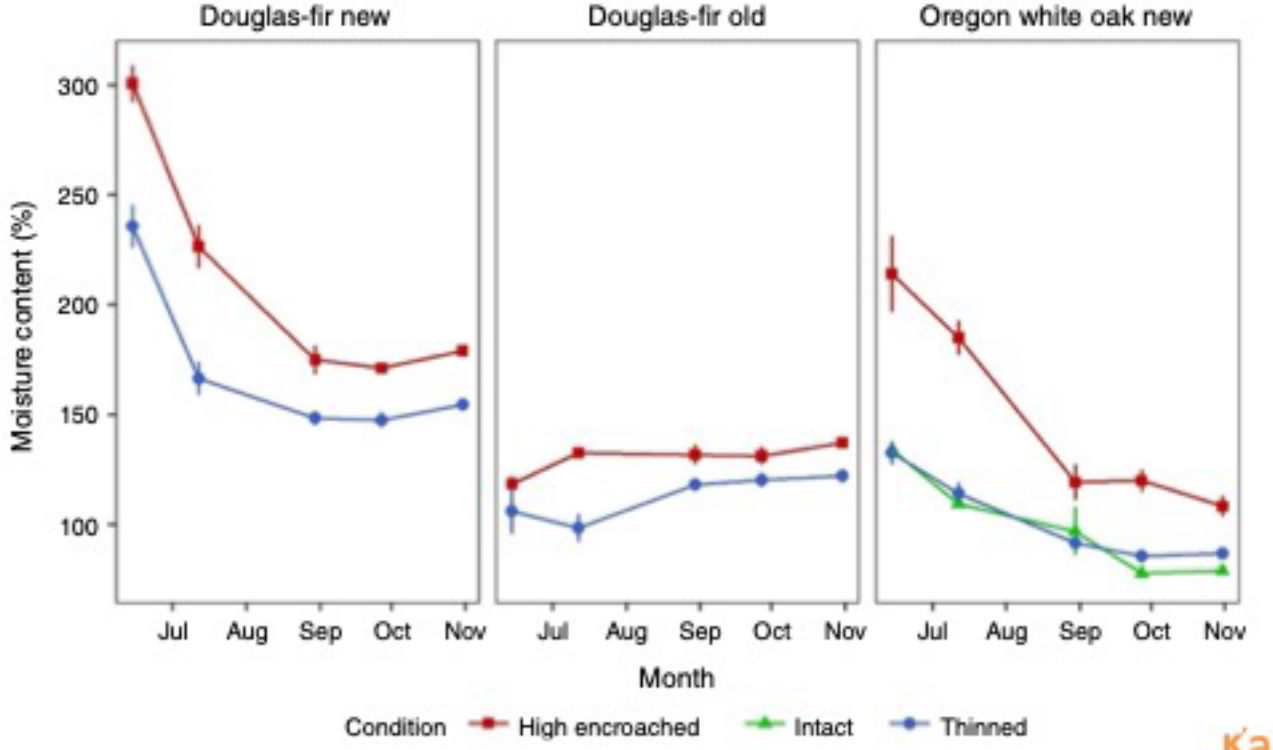
Altered Microclimate



Kane 2021

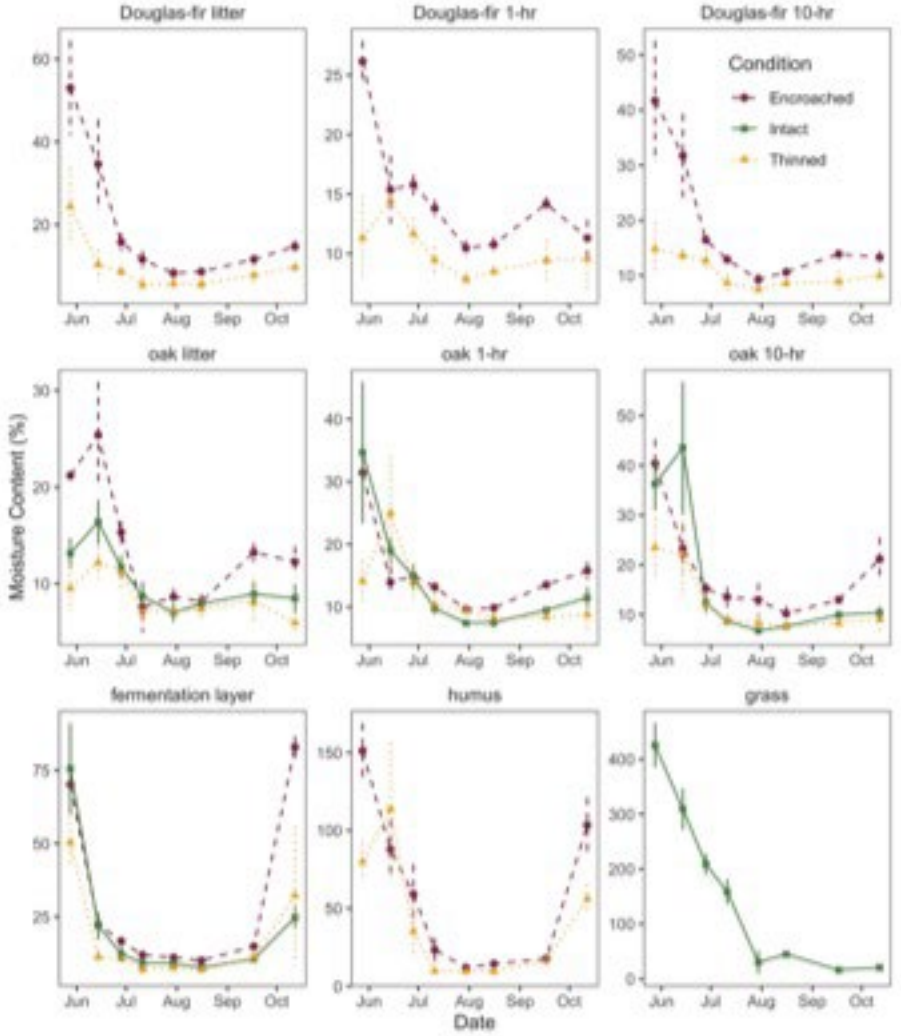
Fuel Moisture

- Encroachment adds fuel & increases foliar moisture (harder for Rx fire)
- Treatment reduces & dries fuel → longer Rx fire window



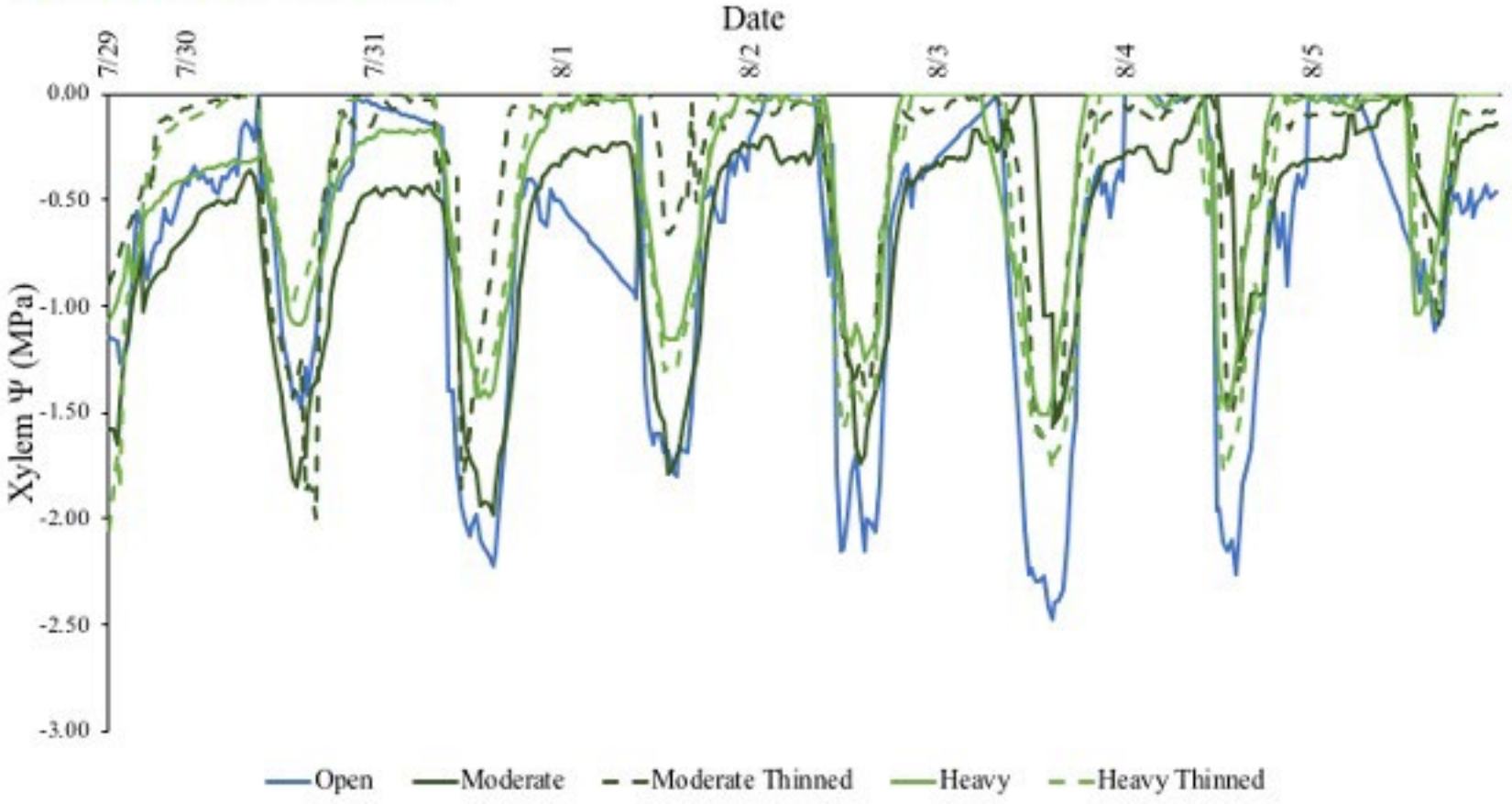
Kane et al. 2023

Fuel Moisture



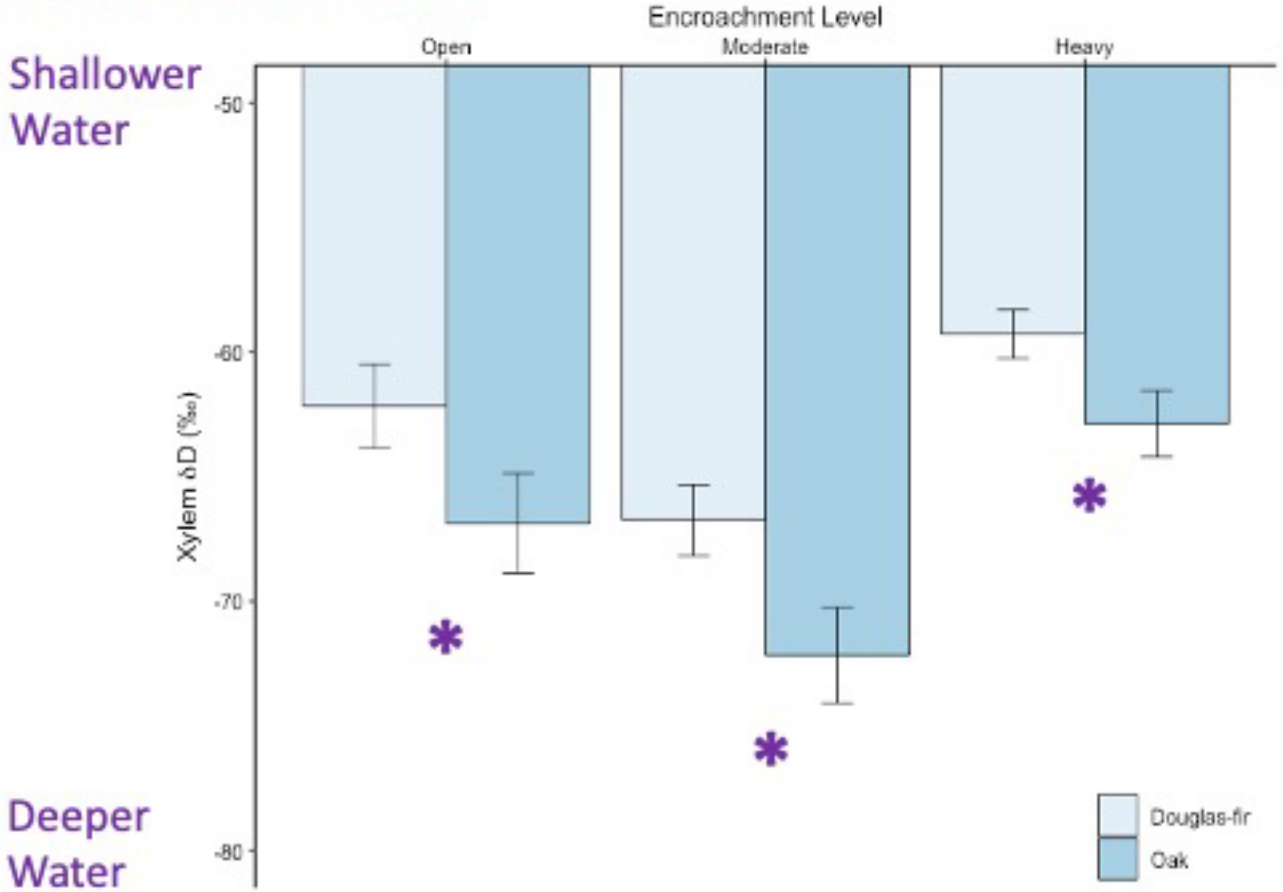
Kane 2021

Ψ Diurnal Trends



Goff et al. 2025, *Restoration Ecology*

Tree Water Sources?



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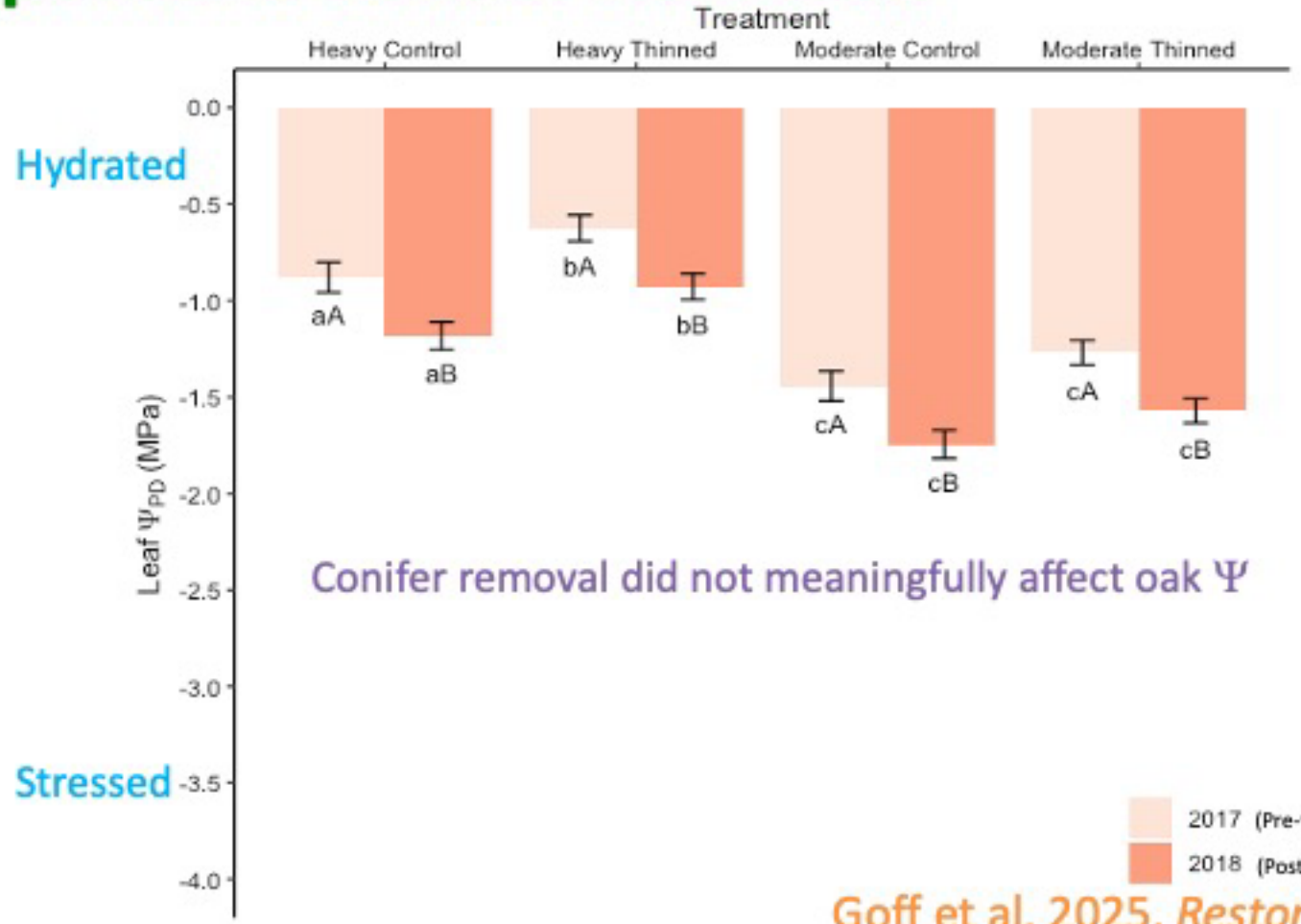
Ψ Response to Conifer Removal?



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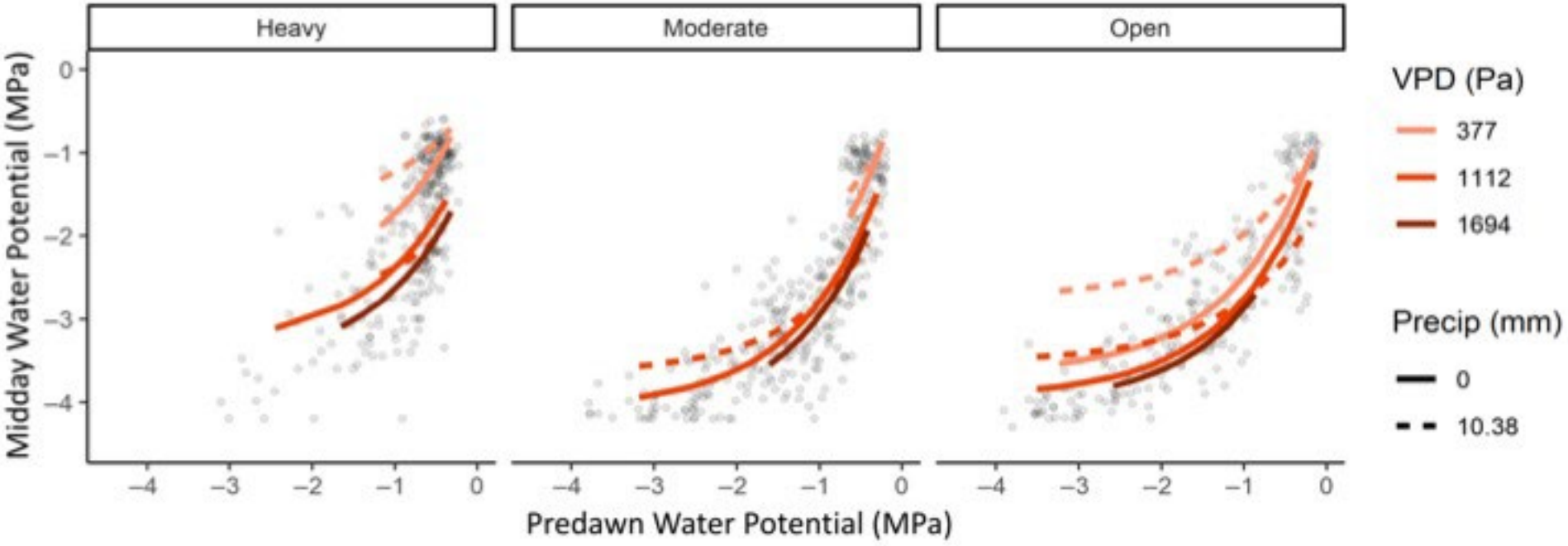
Encroachment Increases Oak Sensitivity to VPD



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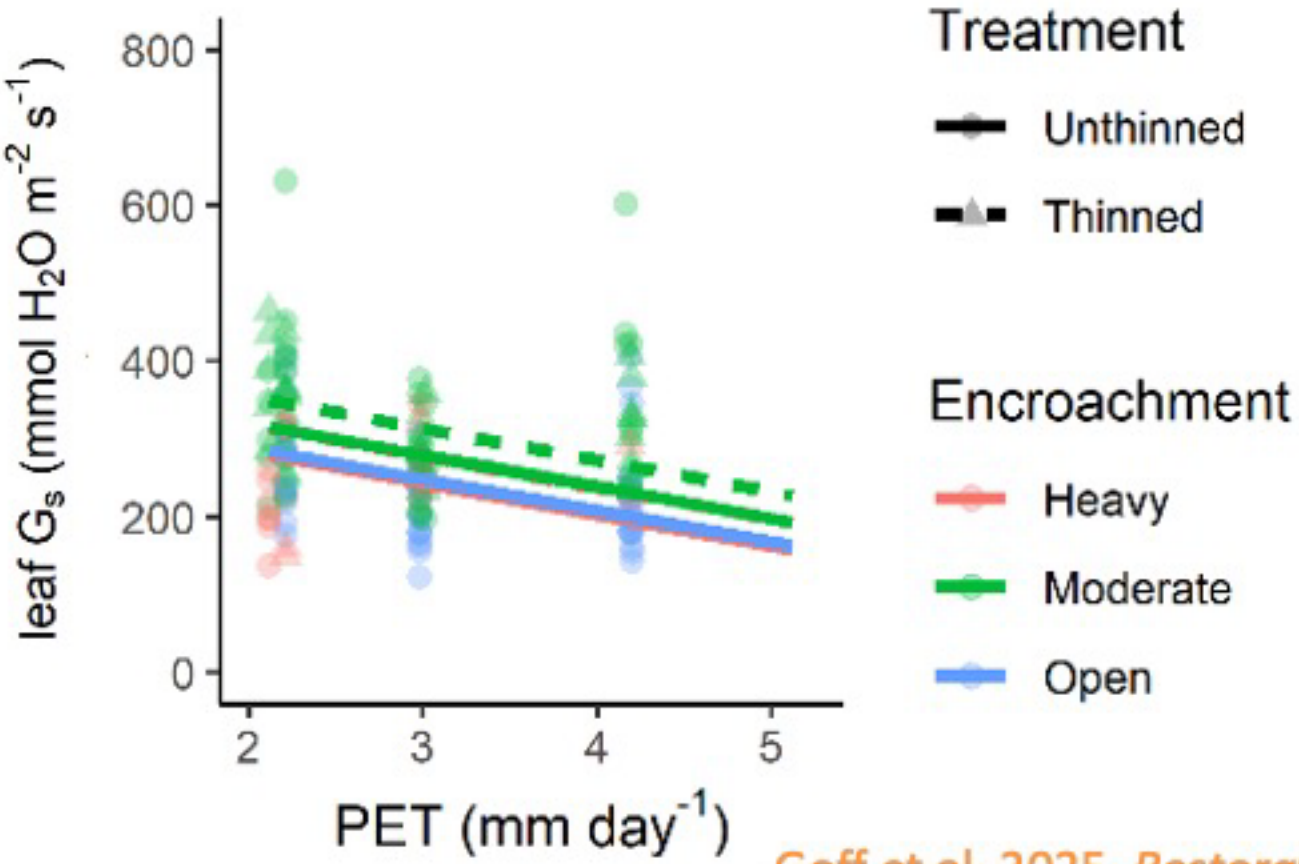
Thinning Increases Gas Exchange



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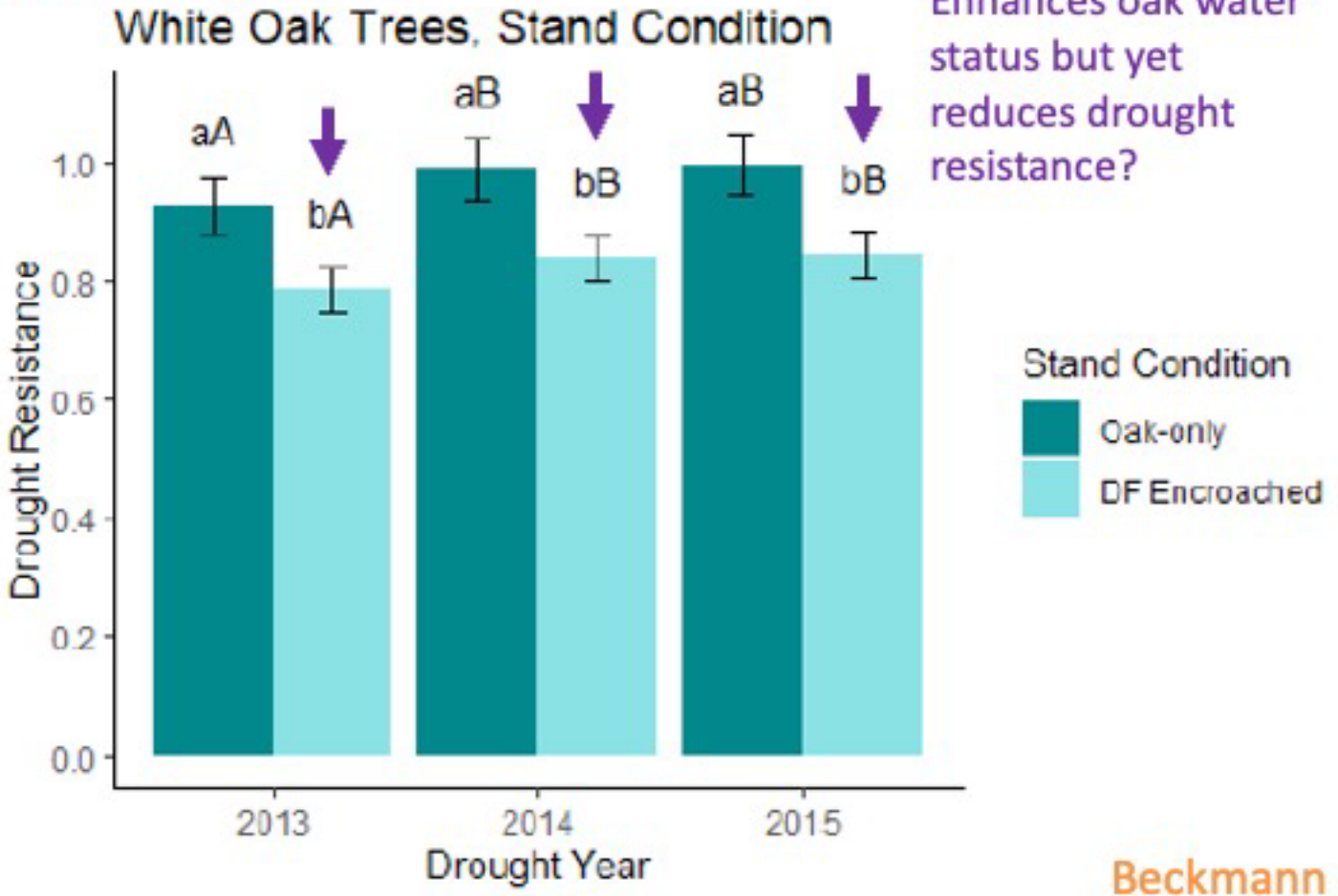
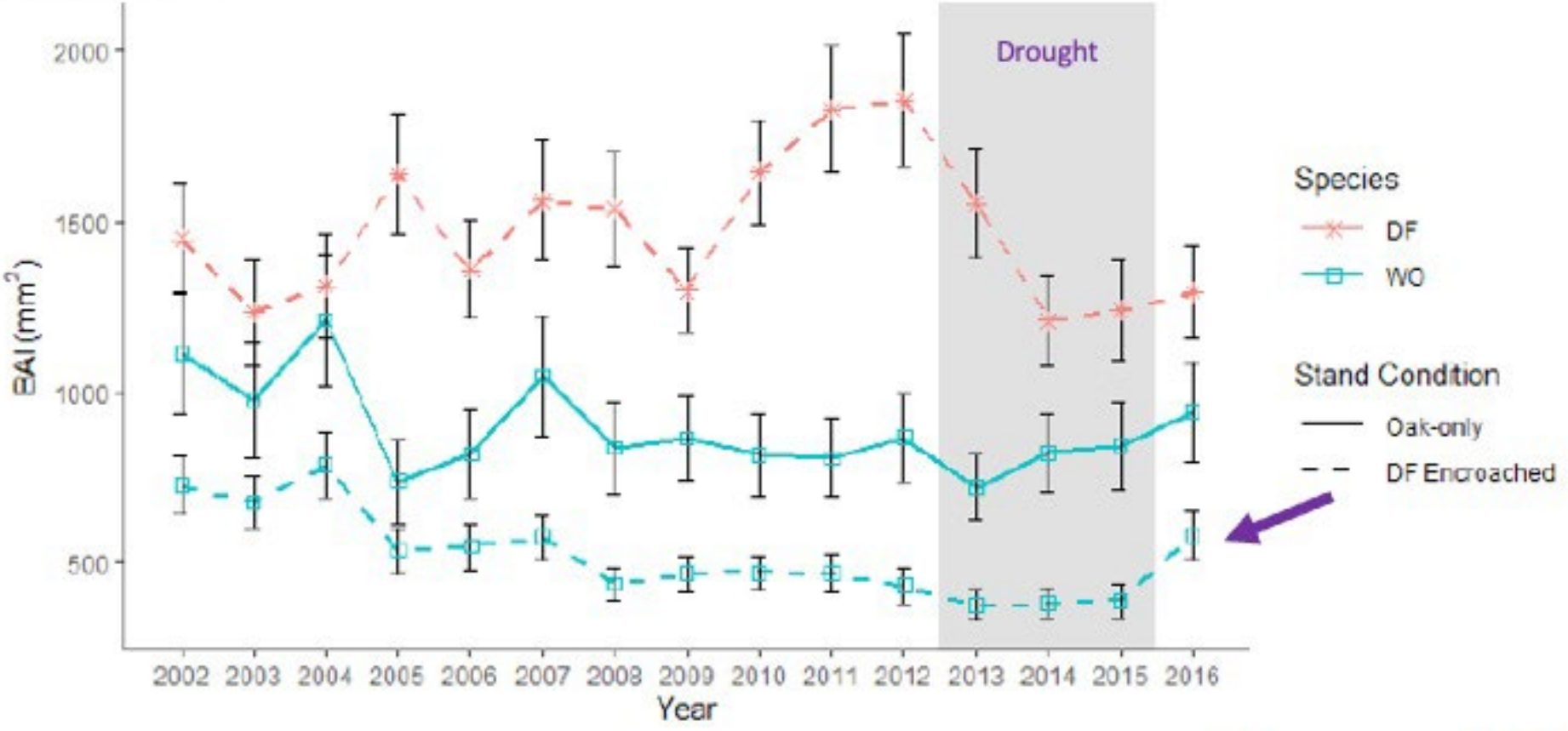
Drought Resistance



Thoughts? PSME Enhances oak water status but yet reduces drought resistance?

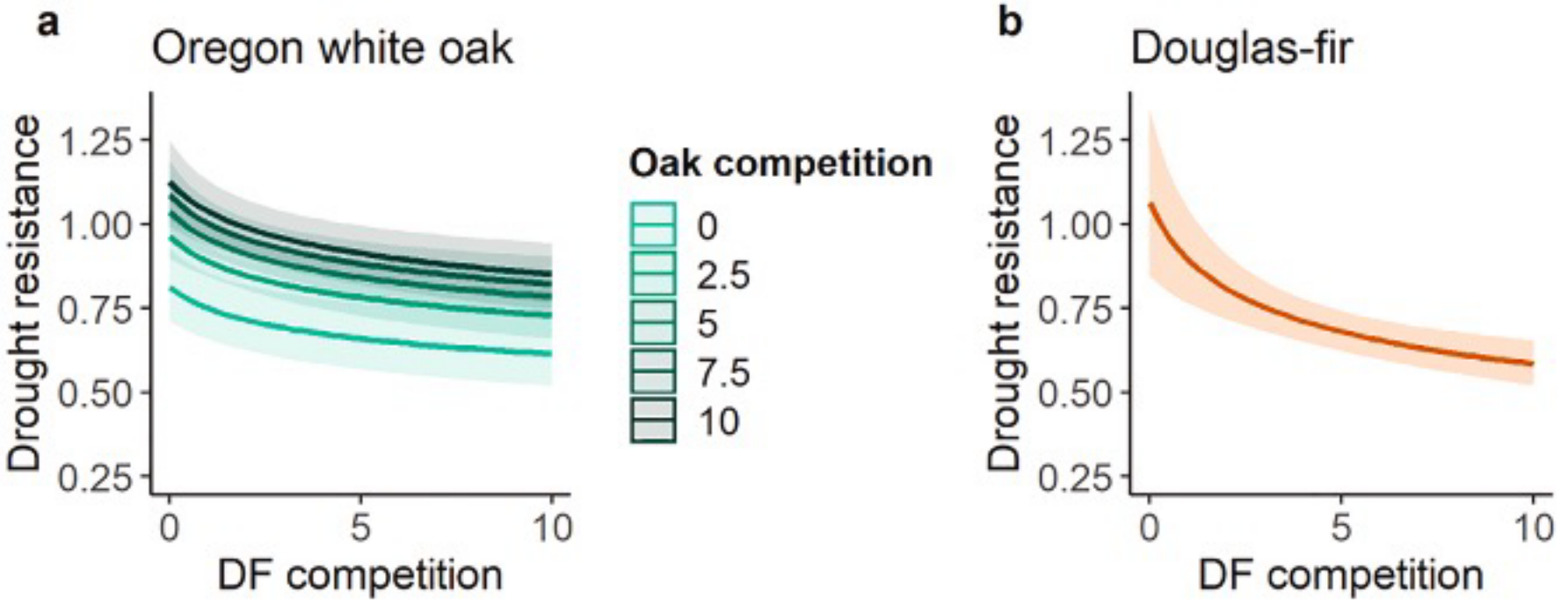
Beckmann et al. 2021

Growth



Beckmann et al. 2021

Competition



Beckmann et al. 2021

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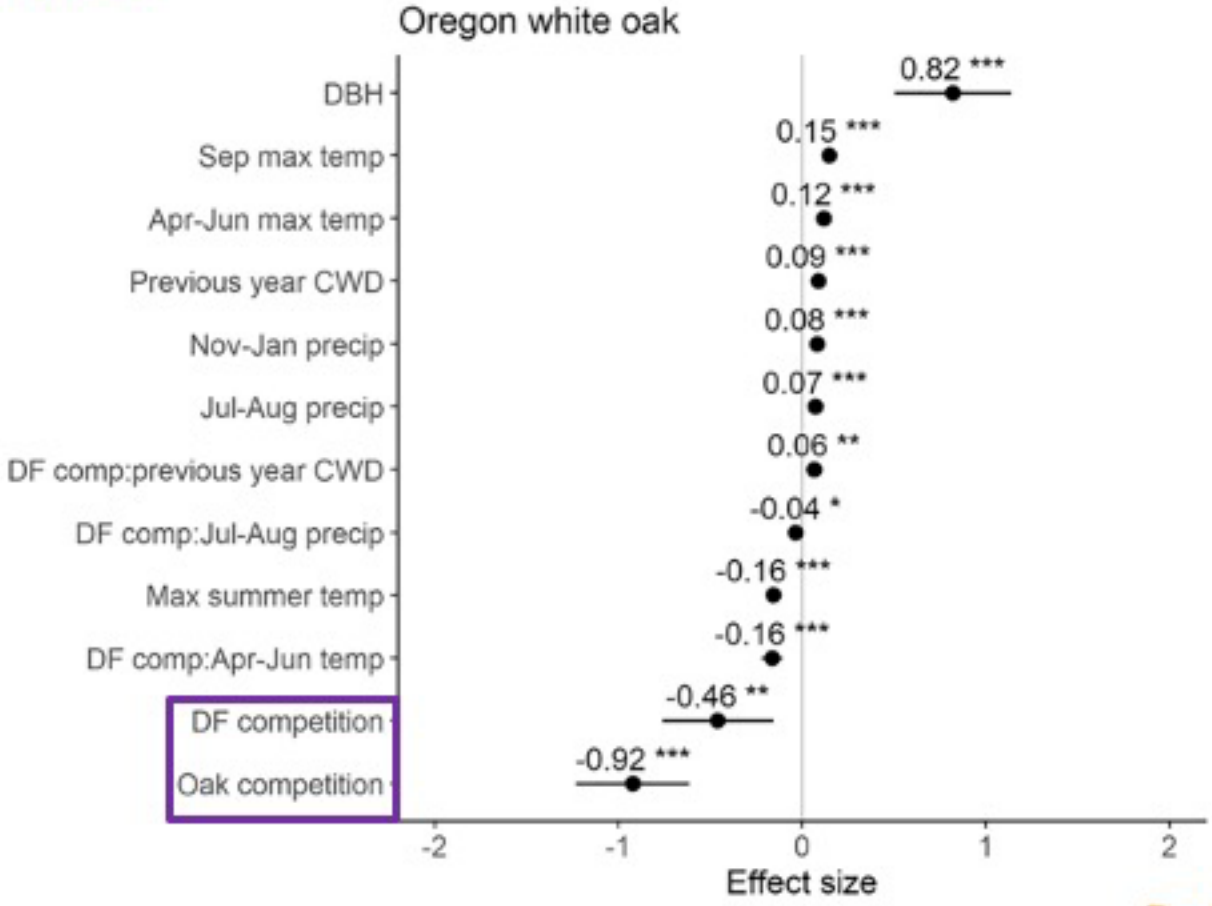
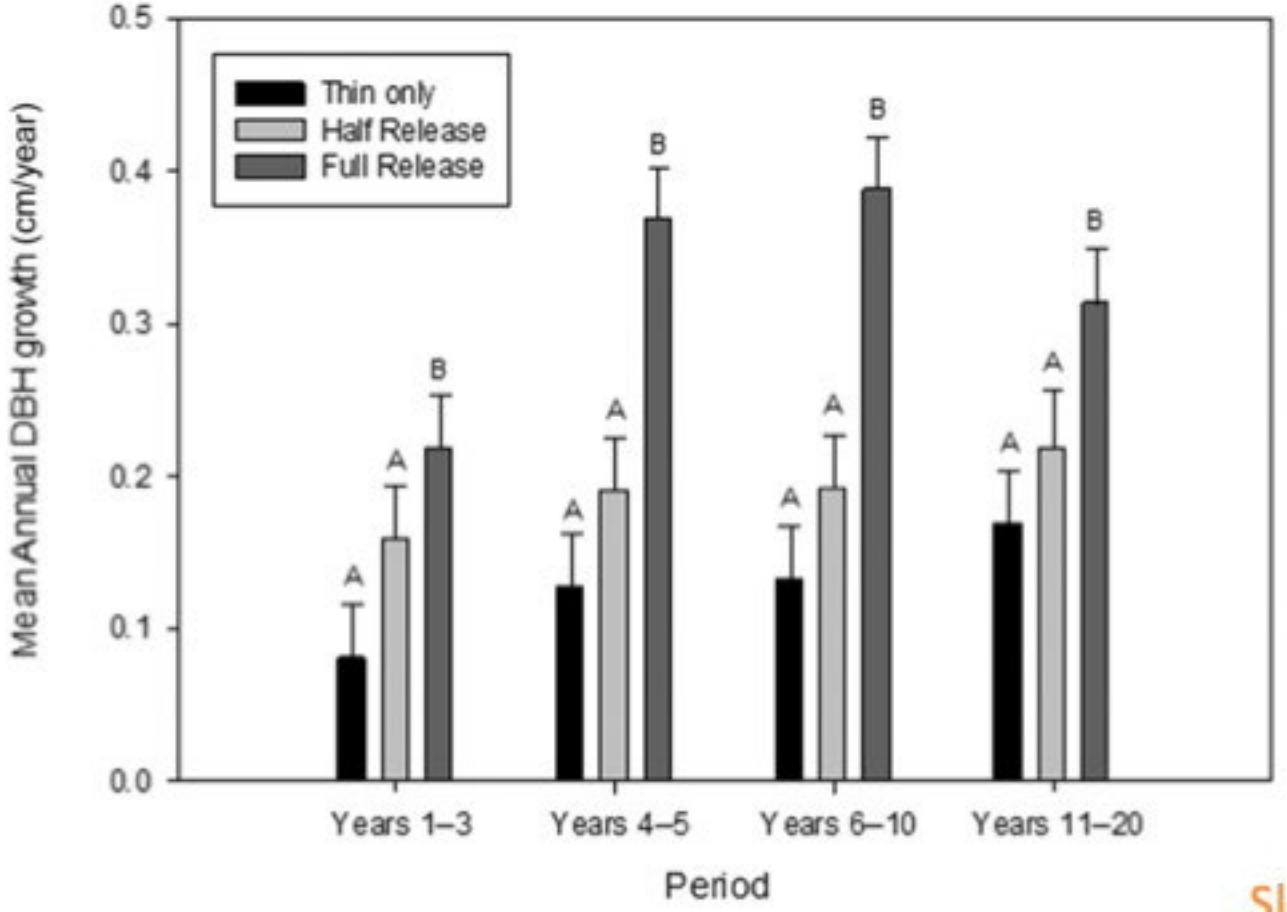


Beckmann et al. 2021

Oak Growth Release



Slesak et al. 2024

California Black Oak Research

- Legacy black oak mortality after conifer removal on Karuk Ancestral Lands
- Can coppicing improve oak survivorship after conifer removal treatments?

WESTERN KLAMATH
RESTORATION
PARTNERSHIP

East Cascades Oak Partnership

- Collaborators: Columbia Land Trust, OSU, NRCS, Confederated Tribes of Warm Springs, American Forests, Conservation Fund
- Companion study on eastern edge of Oregon white oak range near Mt. Hood

Photo: ECOP

Pictures