Advancing the Science and Management of Inland Northwest Forests

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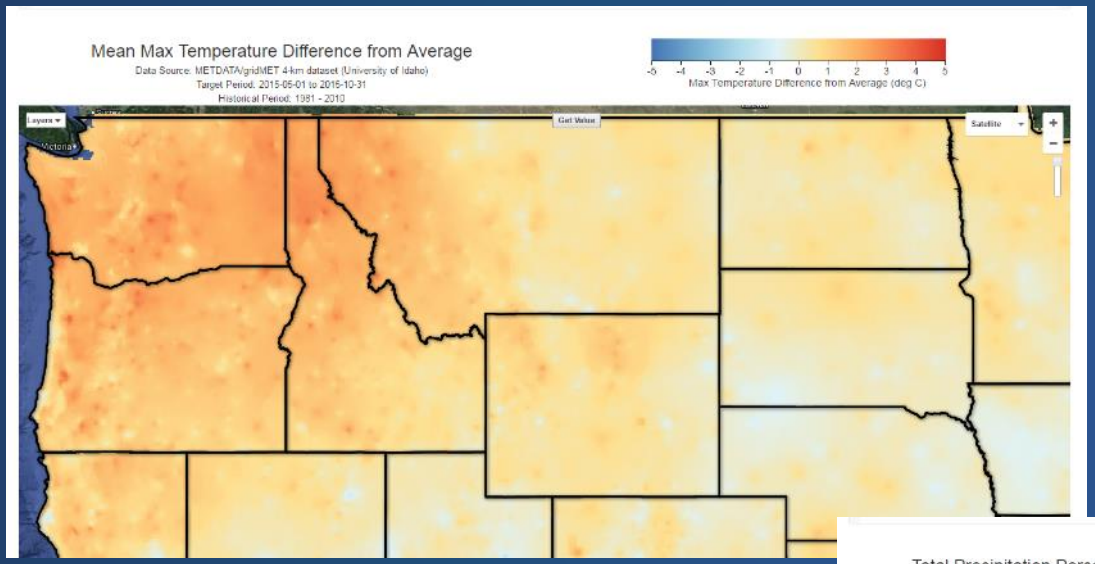
Issues facing INW silviculturists

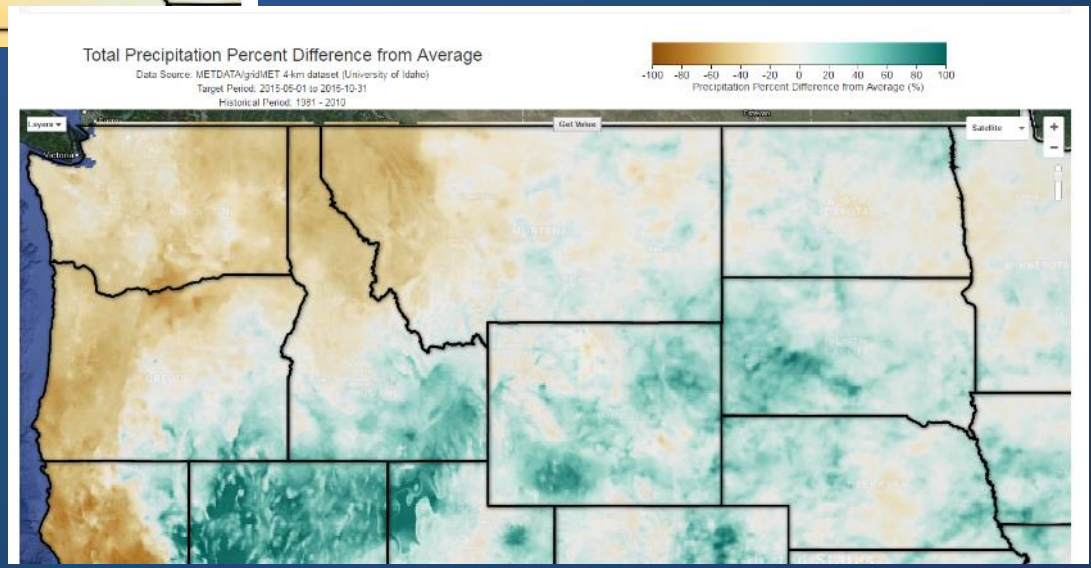
- Reforestation
- Productivity
- Forest health
- Ecosystem goods and services
  - Clean air
  - Watershed services
  - Fiber/Timber
  - Genetic resources
  - Wildlife habitat and diversity
  - Carbon storage
  - Recreation

- Within the context of:
  - Drought
  - Wildfire
  - Insects and pathogens
  - Climate change
  - Public perceptions

Drought across the Northwest

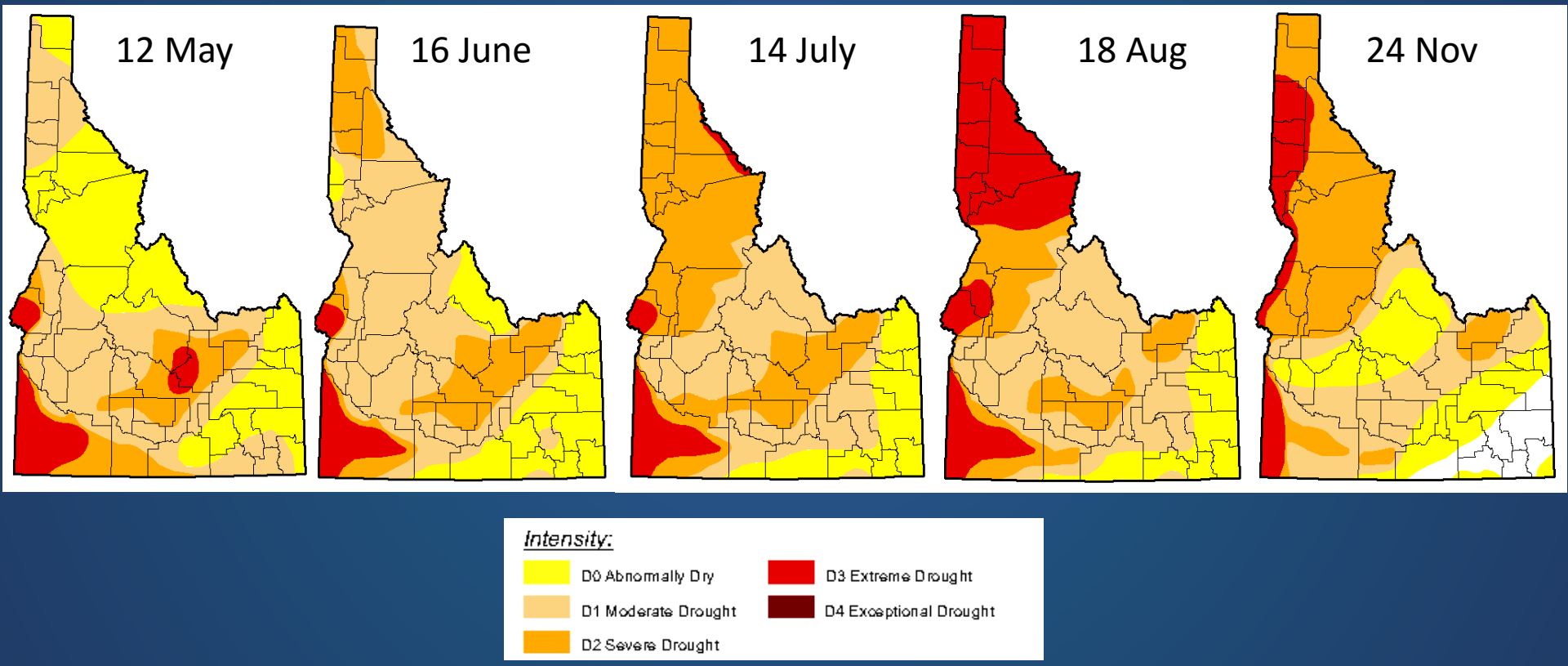


Above-average temperatures and below-average precipitation in 2015



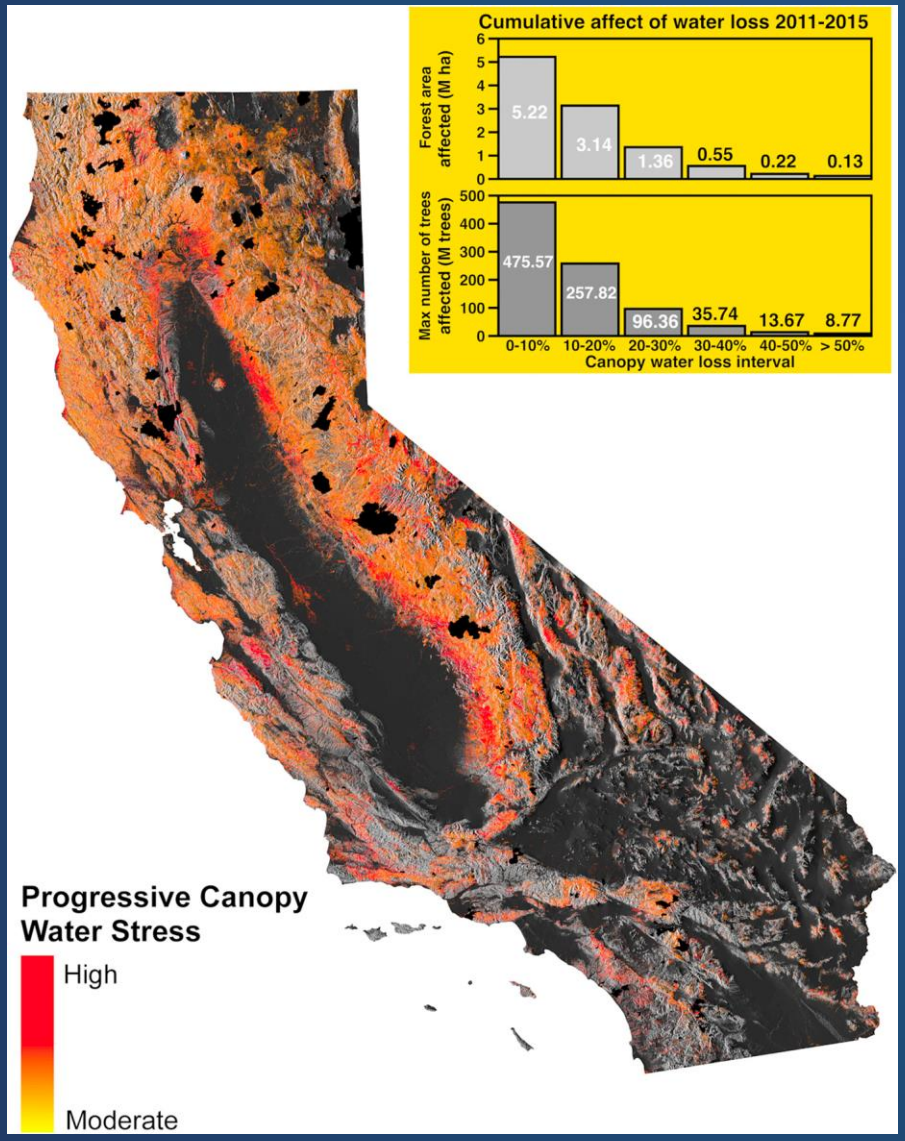
Source: climateengine.org

2015 Drought in Idaho



Source: http://droughtmonitor.unl.edu

Drought effects on forests



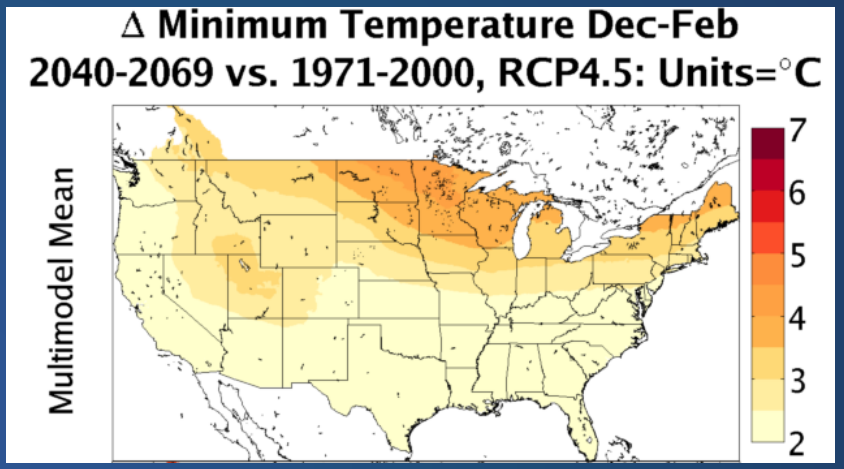
Increases in forest water stress affect forest productivity, forest health, and reforestation efforts

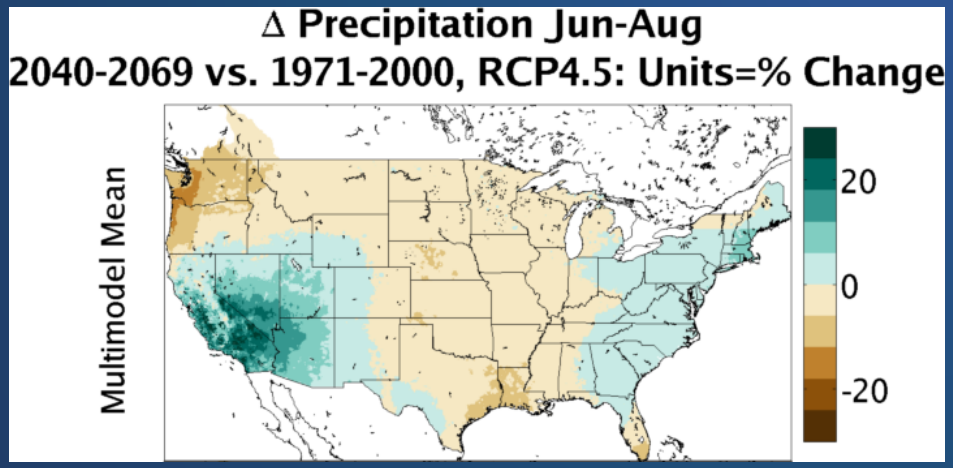
Asner et al. 2015. PNAS E249-E255

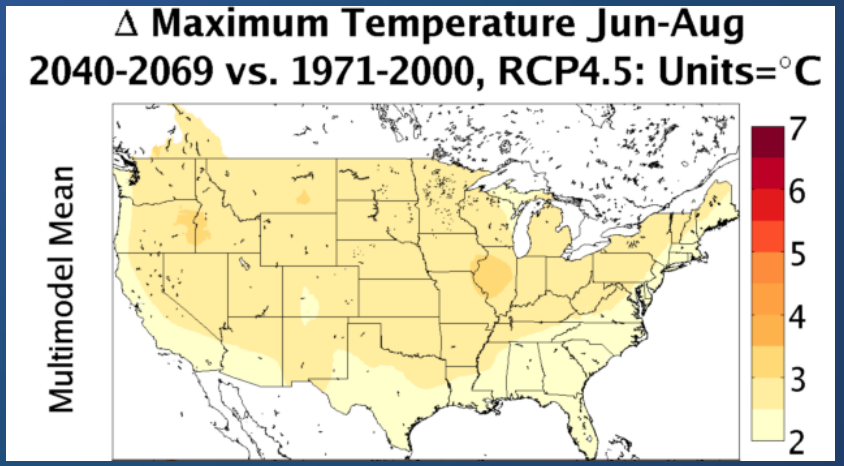
What will the future bring?

Future predictions

Expected increases in winter minimum temperatures and summer maximum temperatures with decreases in summer precipitation may cause more frequent, longer droughts







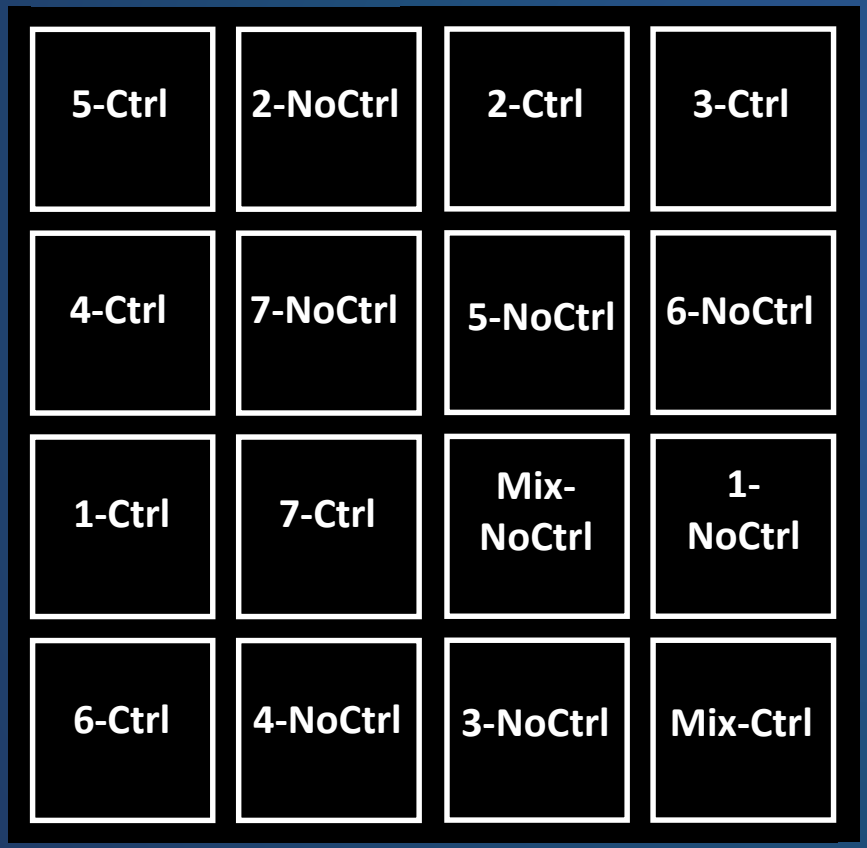
MACA downscaled multi-model GCMs, RCP 4.5: http://climate.nkn.uidaho.edu/MACA

Forest management adaptation measures

Management objective	Adaptation measure
Reforest managed forestland	Emphasize species/populations with genetic ability to tolerate wide range of conditions
Maintain species productivity	Thin stands to reduce water use
	Control undesirable plant species likely to become more competitive
Conserve genetic diversity	Silvicultural systems maintain genetic/species diversity
Enhance adaptive capacity	Incorporate knowledge of species vulnerability in silvicultural decisions
	Develop reliable process models for predicting future stand development

Leech et al. 2012. BC Journal Ecosys & Mgt. 12: 18-34

Emphasize genetics to tolerate wide range of conditions: western larch improved family field trial



Field performance of top improved western larch families from IETIC orchard

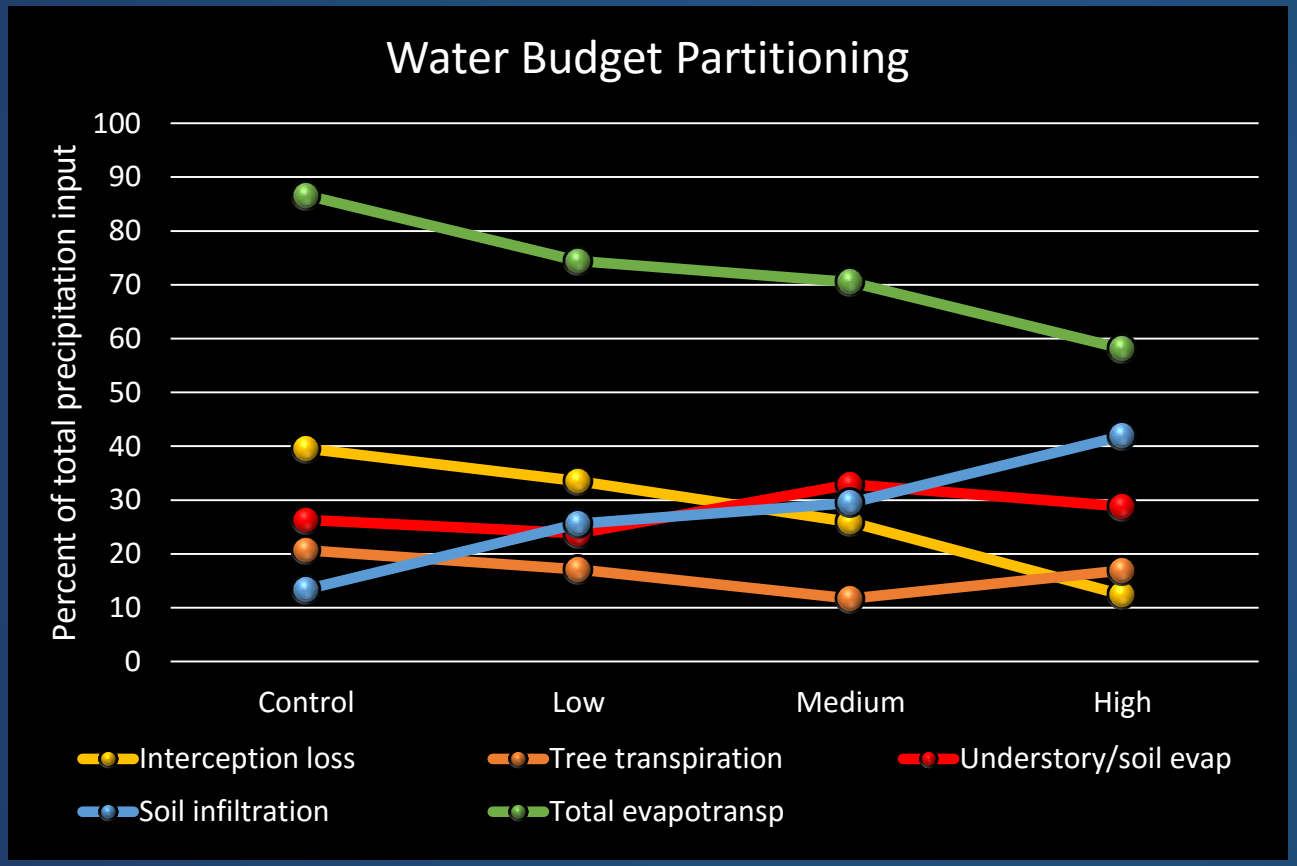
Test family differences in drought tolerance and growth (greenhouse)

Examine family responses to site quality and presence of non-tree competition

Density management to maintain/improve vigor

Chris Schnepf, University of Idaho bugwood.org

Hydrology-oriented silviculture



Mid-aged (~60 years) Mediterranean pine thinned to different densities:

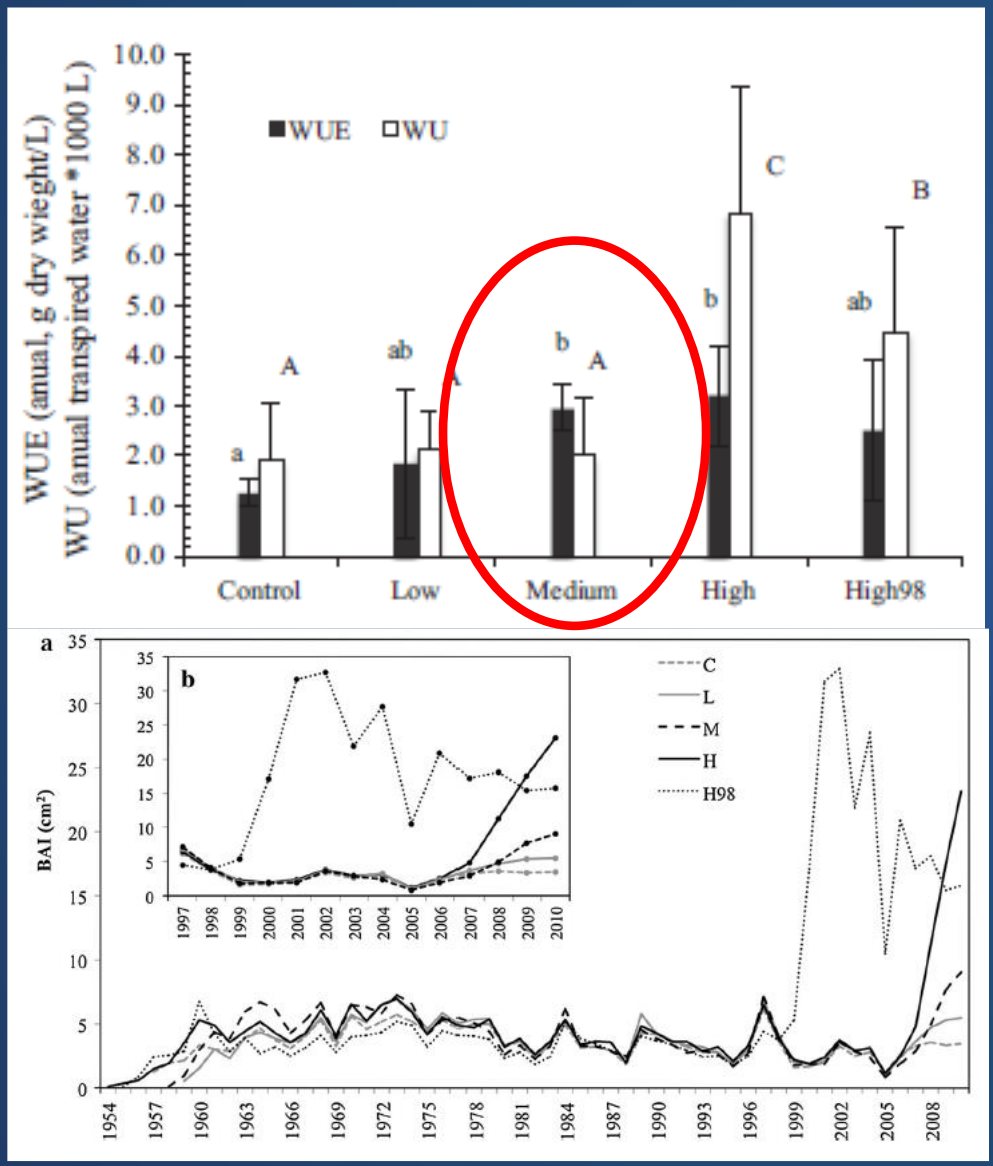
Control: 600 tpa
Low: 300 tpa
Med: 190 tpa
High: 70 tpa

Reducing density:

- Lowered tree water use, loss from surface evaporation, and total water loss
- Increased loss from understory & upper soil
- Increased soil storage

Adapted from: del Campo et al. 2014. EJFR 133: 879-894

Hydrology-oriented silviculture



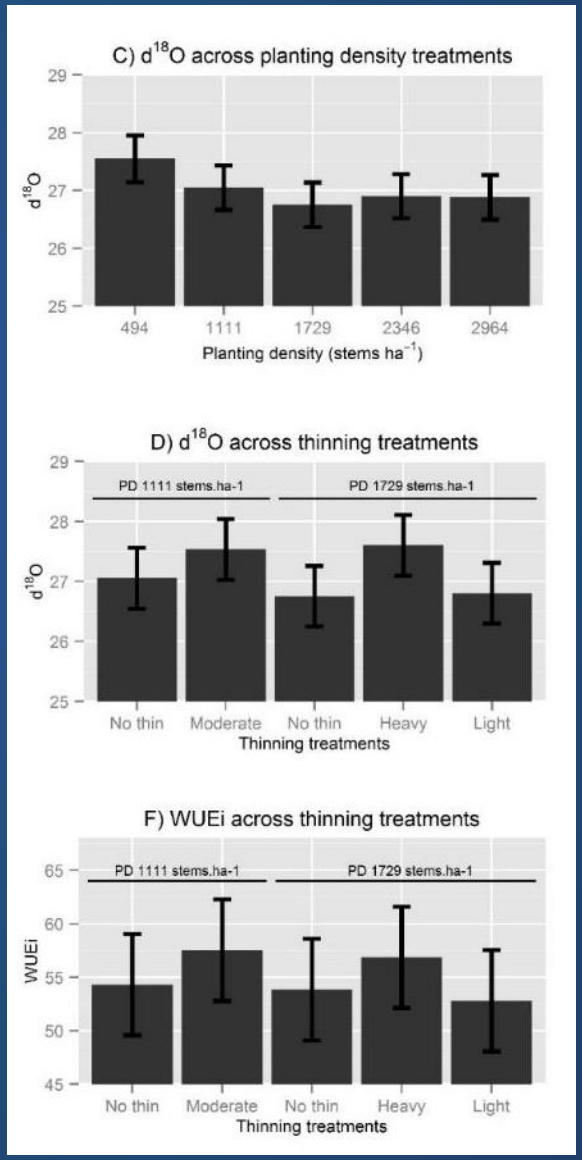
Reducing density:

- Increased average tree growth per unit of water used (WUE)
- Only heavy thinning increased water used per tree
- "Sweet-spot" is medium thinning: increased WUE but not total water use over the control

Fernandes et al. 2016. FEM 361: 298-308

Density, water loss, and water stress (loblolly pine in Arkansas)

Thinning to low densities increased soil evaporation and tree water stress on these drought-prone sites



Bose, Nelson, and Kane. *In Review*.

Effects of understory vegetation on water and stress

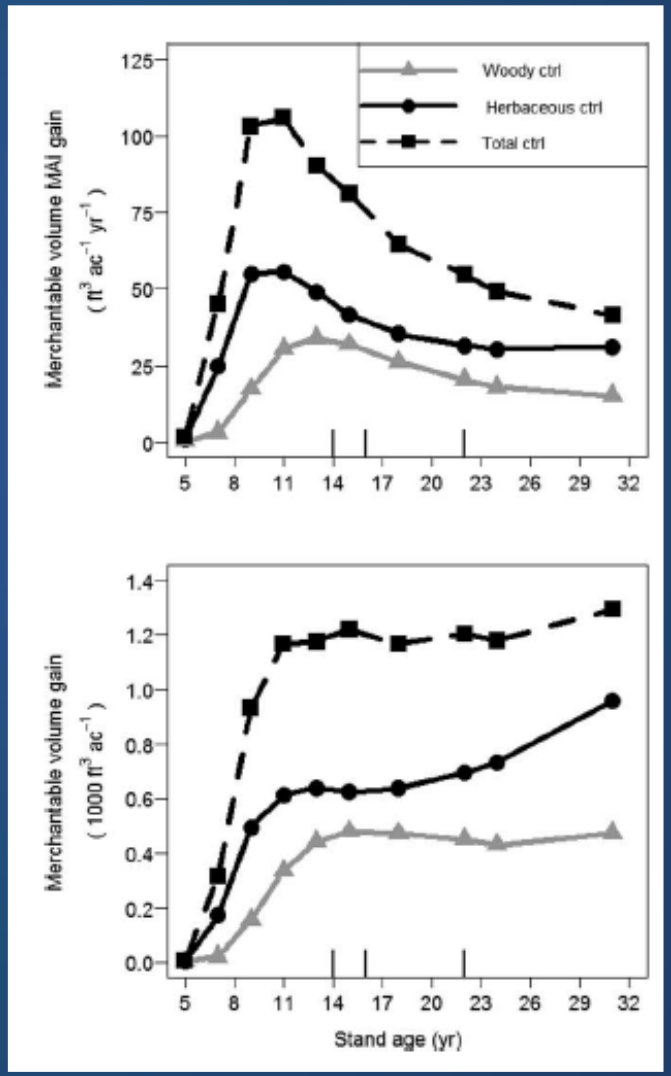
What if resources (water, nutrients) are captured by non-tree understory vegetation following thinning?

Lower tree density increased understory transpiration and soil evaporation in European oak stands

Gobin et al. 2014. Intl. Forest Veg Mgt Conference Proceedings, pp. 25-27

Early competition management improves long-term productivity

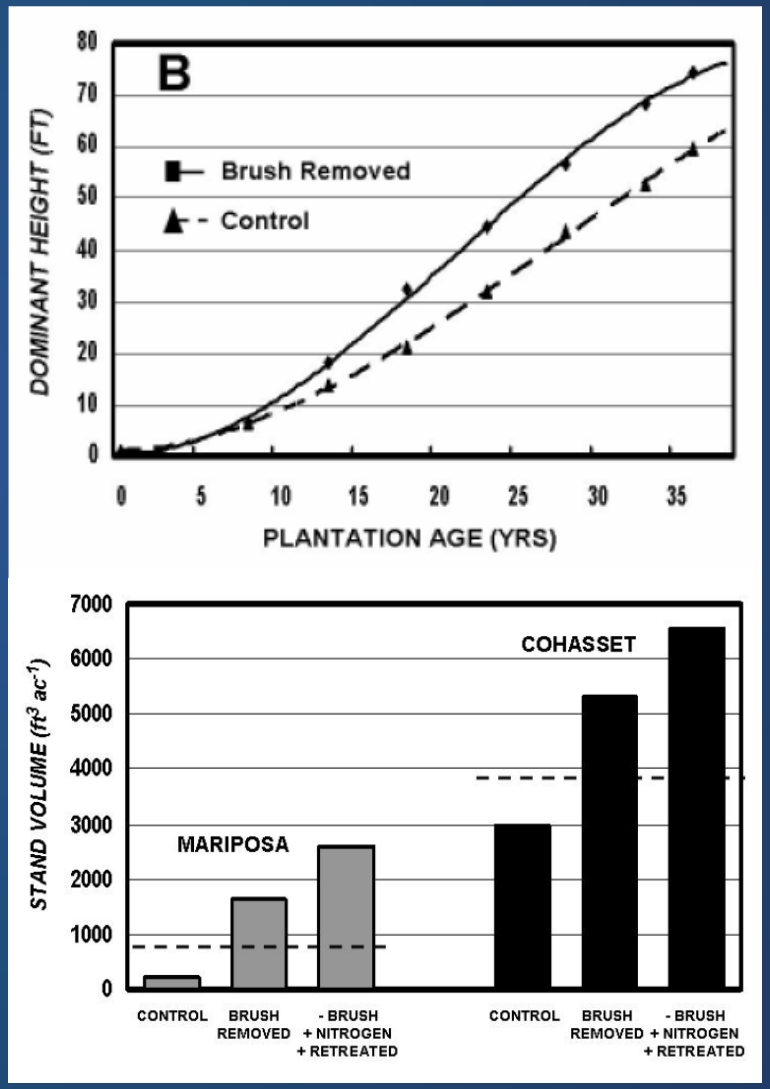
Effects of early competition on stand growth and yield were still evident after 32 years



Nelson and Bragg. 2016. Forest Science 62:115-124

Early competition management improves long-term productivity

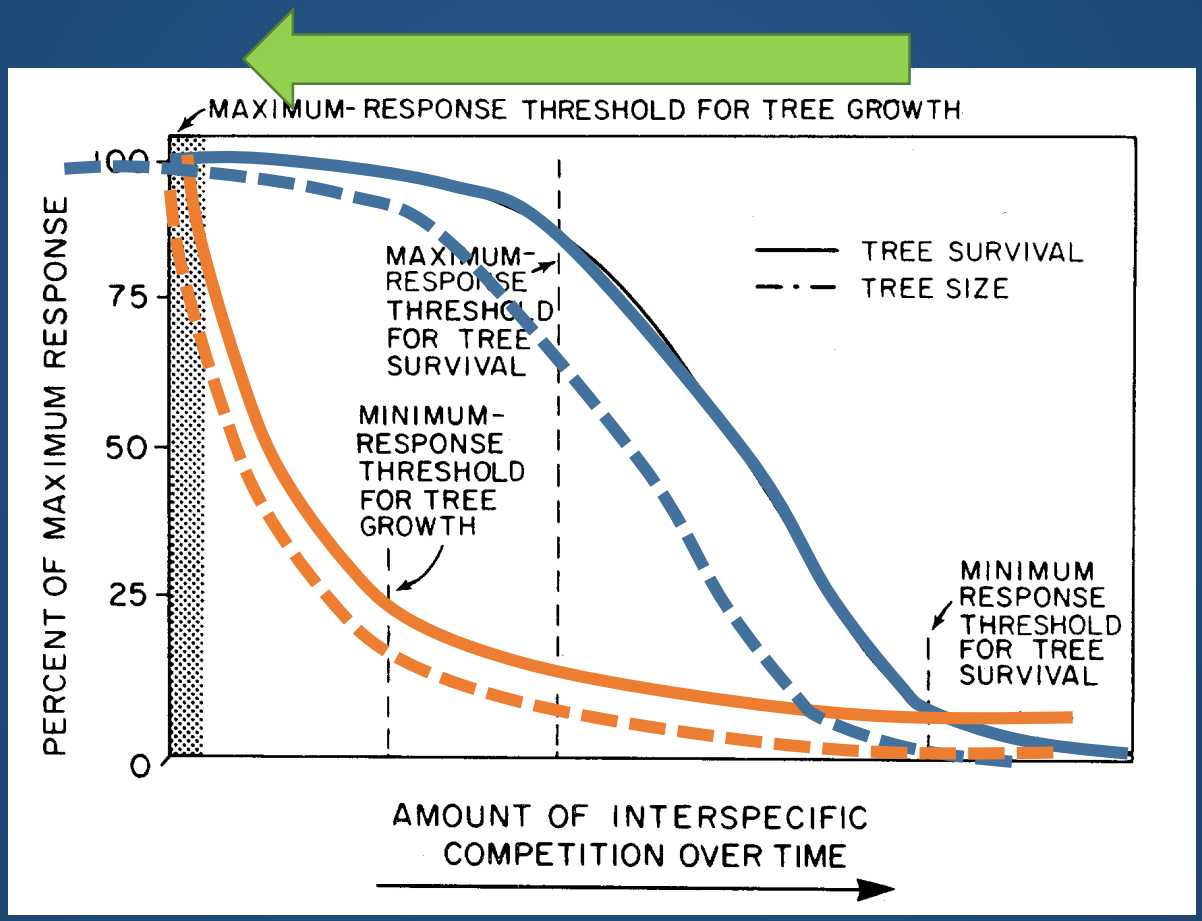
Early competition removal to enhance vigor and growth through age 37 in Ponderosa pine



Power et al. 2005. Proceedings 25th Forest Vegetation Management Conference

Altered competitive dynamics

Will increased tree stress and increased vigor of competing vegetation cause shifts in competition thresholds?



Wagner et al. 1989. New Forests 3: 151-170.

Future Research Directions

- Strategies for managing water use and water-use efficiency
  - Response to thinning and understory control
  - Silvicultural prescriptions based on minimizing water loss, enhancing water-use efficiency, and improving productivity
- Strategies for promoting early tree establishment and growth
  - Changing competitive dynamics
  - Deploying genetics adapted to current & future site conditions (drought-resistance & growth)


Questions?