The Impact of Competition on Plant Water Use Efficiency

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Goals

- Determine and compare **water use efficiency (WUE)** of Utah native trees in differing types of competition:
  - **Interspecific Competition** (between different species)
  - **Intraspecific Competition** (within one species)
- Will plants decrease their WUE when competing for the same water source?

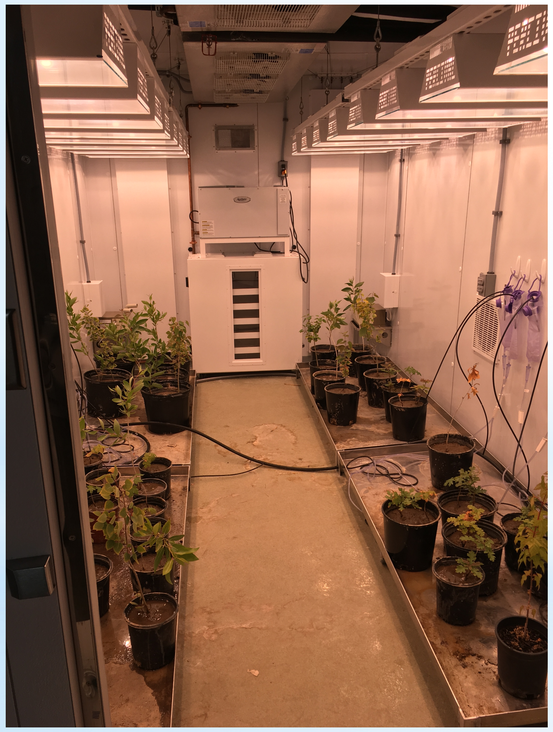
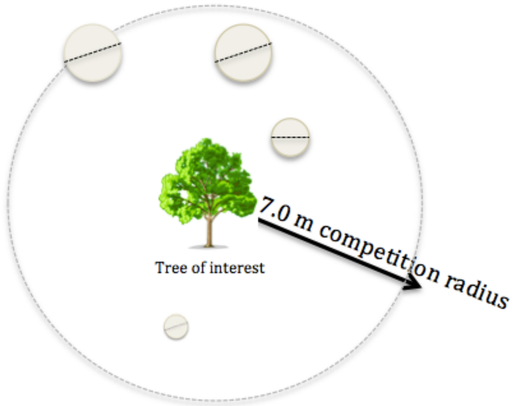


Figure 1. Seedlings growing in the growth chamber—a completely controlled environment

Research Methods

- Measure stomatal conductance (gs), photosynthesis (A) and transpiration (E) to calculate water use efficiency **(WUE=A/gs)** using a LiCor 6800 for 2 experiments:
  - Growth chamber study of **intraspecific competition** in Fall 2016 (*Populus tremuloides*)
  - Red Butte Garden Study of **interspecific competition** with respect to calculated competition index (*Quercus gambelii, Acer grandidentatum* and *Acer negundo)*
- Calculate competition using **Hegyi's Competition Index** Equation:



$$\sum_{i=1}^{n} d_i/(d \times dist_i)$$

Figure 2. Conceptual Model of Red Butte Competition Index

Why Does This Matter?

- Forest water use efficiency important for survival of forests (important carbon sink) as climate changes
- Interspecific vs. intraspecific competition, encouraging ecosystem biodiversity

Results

- **Intraspecific**: Competition treatment had lower WUE than solo
- **Interspecific**:
  - Individual species: not statistically significant (Spearman's rho), but evidence of decreased WUE with competition
  - Average: CI increases, WUE improves
    - Janzen-Connell Hypothesis

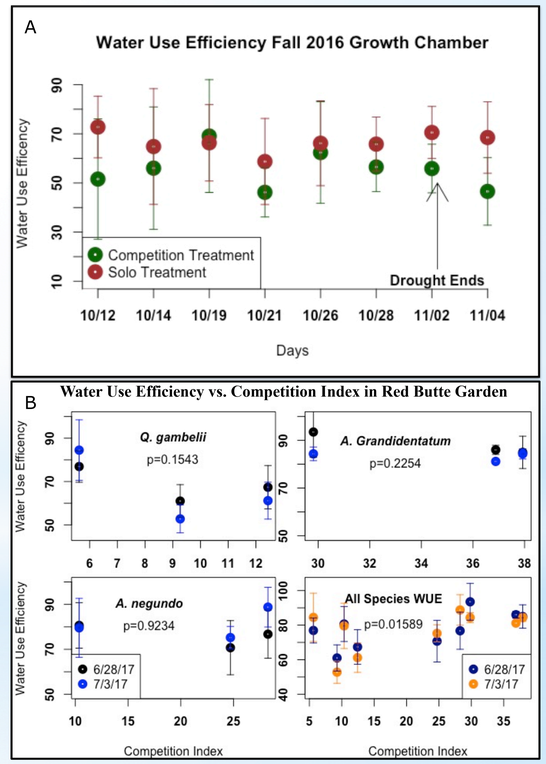


Figure 3 (A) WUE of *P. tremuloides* in the growth chamber experiment with solo and competition treatments. (B) WUE of individual species and averages vs. competition index in Red Butte Garden

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