# The role of common mycorrhizal networks in ameliorating drought stress in Douglas-Fir (*Pseudotsuga menziesii*)

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## Introduction

Although mycorrhizal fungi connect plants belowground via a common mycorrhizal network (CMN), it is not known whether these networks can transport water from nurse trees to receiver seedlings under drought conditions.

## Hypothesis & Approach

To test this hypothesis that plants connected via a CMN will experience reduced effects of drought compared to trees not connected to a CMN, we compared photosynthetic rate, transpiration rate, and stomatal conductance of Douglas-fir (*Pseudotsuga menziesii)* seedlings connected via a CMN to a nurse tree during an experimental dry down.

## Methods

### *Design*

Mesocosms were constructed, each of which contained four Douglas-fir receiver seedlings, and a nurse tree. Stainless steel mesh was installed between each outer chamber and the nurse tree to apply four water pathway treatments: 1) Mycorrhizal+Soil; 2) Mycorrhizal only; 3) Soil only; and 4) No pathway.

Trees were maintained from April 2018 to June 2019 in a greenhouse. A dry down was enforced over the course of 8 days in June 2019. Data was collected during the course of the dry down.

### *Water Introduction*

The trunk of each nurse tree was cut in transverse section above the base to expose the xylem for water introduction. Tire inner tubes were wrapped around the cut line to form a reservoir for introduced water. Acid fuchsin dye was added to the reservoir water to detect CMN formation.

### *Physiological Measurements*

A WALZ gas exchange chamber was used to measure photosynthetic rate, transpiration rate and stomatal conductance.

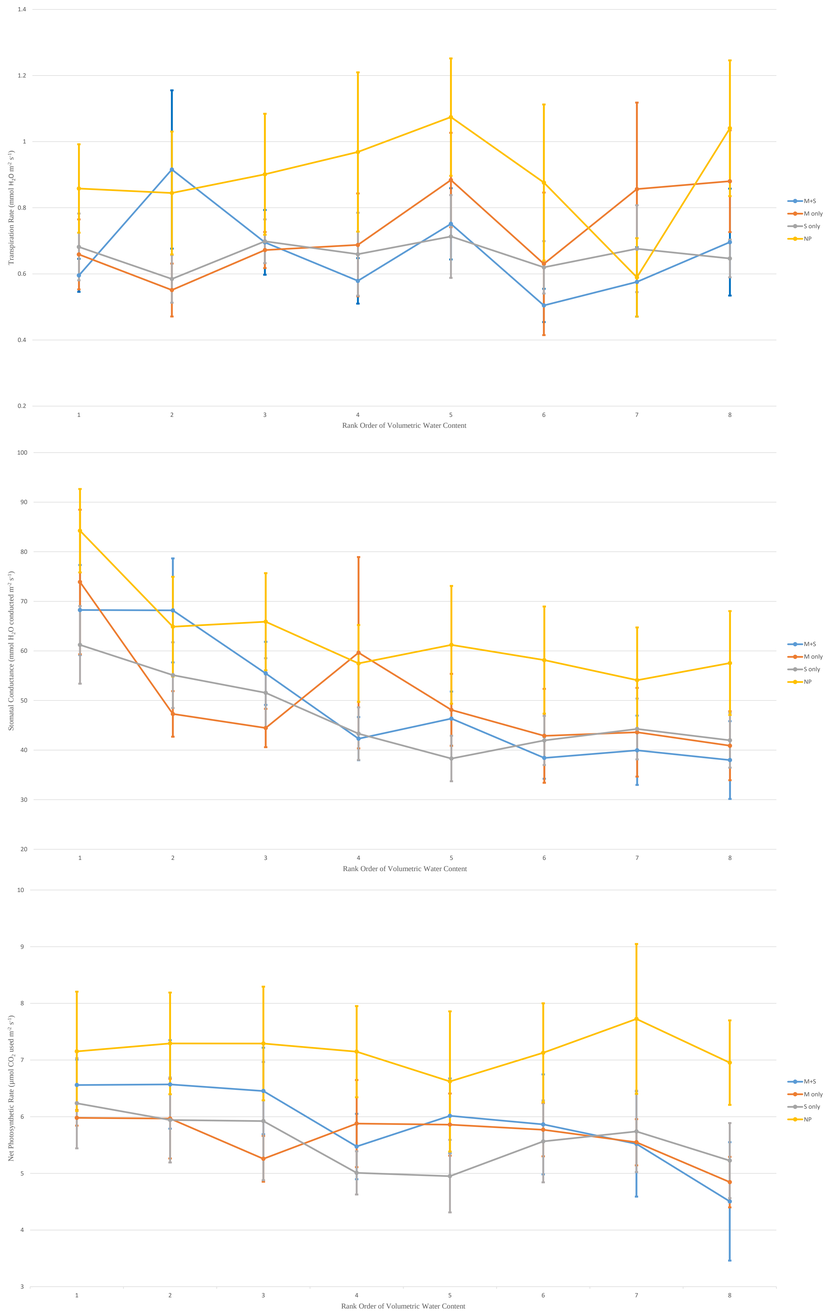


**Figure 1:** Physiological responses to rank ordered volumetric water content. Top figure: transpiration rate; Middle figure: stomatal conductance; Bottom figure: net photosynthetic rate

### *Data Analysis*

A repeated measures ANOVA was conducted to test for significant differences within and among treatments. All tests used the physiological measure in response to rank ordered volumetric water content (ROVWC), an ordinated value of increasing dryness from 1 to 8.

## Results

- No significant difference was observed within or among any water treatment pathway (fig. 1)
- Stomatal conductance and net transpiration rate declined significantly in response to ROWVC (fig. 1)
- Vapor pressure deficit data from greenhouse corresponds well with stomatal conductance (fig.2)

## Conclusions

- Complications regarding network formation make conclusions tenuous.
- Interference from a malfunctioning greenhouse climate control system (fig. 2) likely masked any physiological response to network.

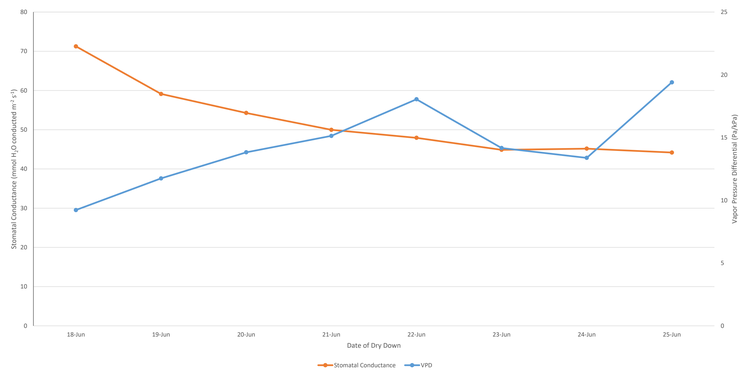


**Figure 2:** Relationship between stomatal conductance and air-to-leaf vapor pressure differential during the experiment.

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