

Fall 2021 Progress Report

Intraspecific Hydraulic Responses of Commercial Tree Seedlings to Nursery Drought Conditioning

CAFS.20.78

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Project Overview

Our **objective** is to examine seedling physiology, root system architecture and field performance in response to nursery-induced drought conditioning of coastal Douglas-fir, western larch, and black walnut from seed sources across a range of maternal tree environments.



Current Progress

Purdue University Controlled Environment Phenotyping Facility

- ❖ Nondestructive analysis of simulated post-planting root development and architecture using 3D imaging based on X-ray computed tomography (CT)

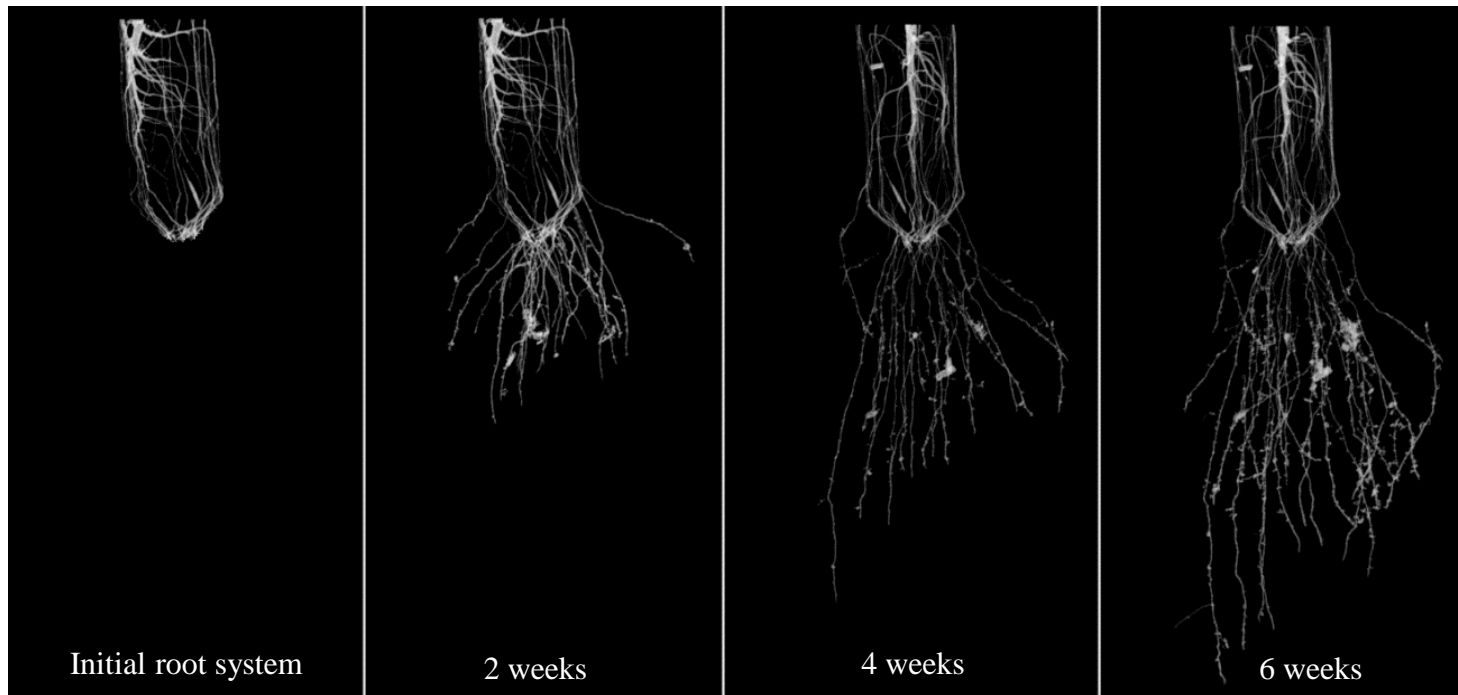


Figure: 3D root segmentation of one-year old Douglas-fir seedlings using an X-ray computed tomography root scanner.



Current Progress

Outplanting across multiple forest systems relevant to CAFS members



Black walnut, Indiana



Western larch, Idaho



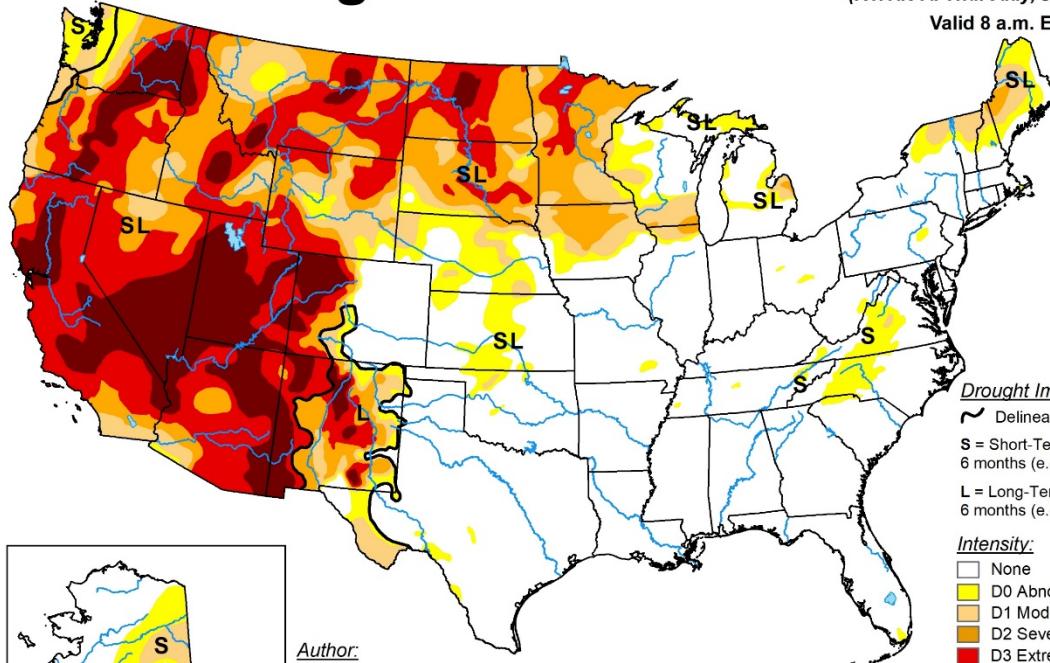
Douglas fir, Oregon



Exceptional Summer Drought

U.S. Drought Monitor

July 20, 2021
(Released Thursday, Jul. 22, 2021)
Valid 8 a.m. EDT



Drought Impact Types:

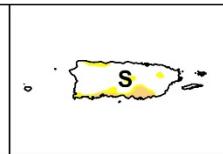
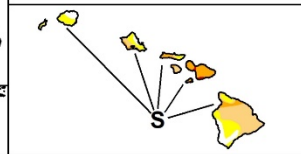
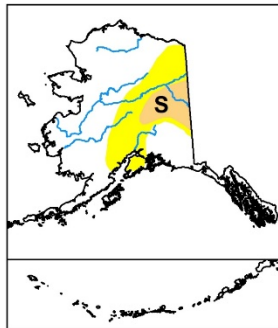
- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

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The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>



droughtmonitor.unl.edu



Field performance measurements

- Pre-dawn and Mid-day water potential
- Growth (height, diameter and biomass)
- Root development
- Nutrient analysis
- Vigor/Damage (browsing, drought, heat)
- Survival



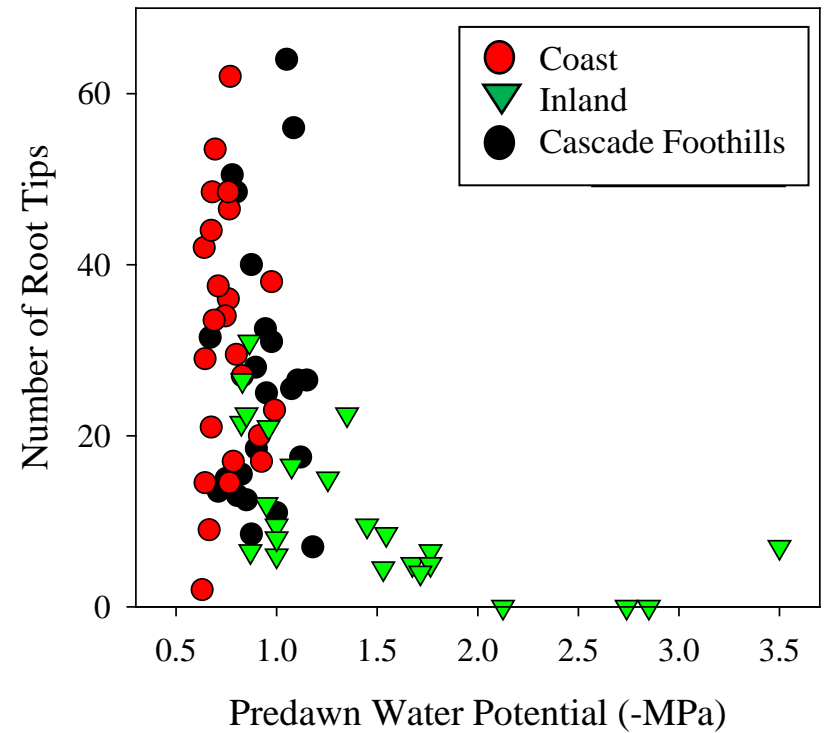
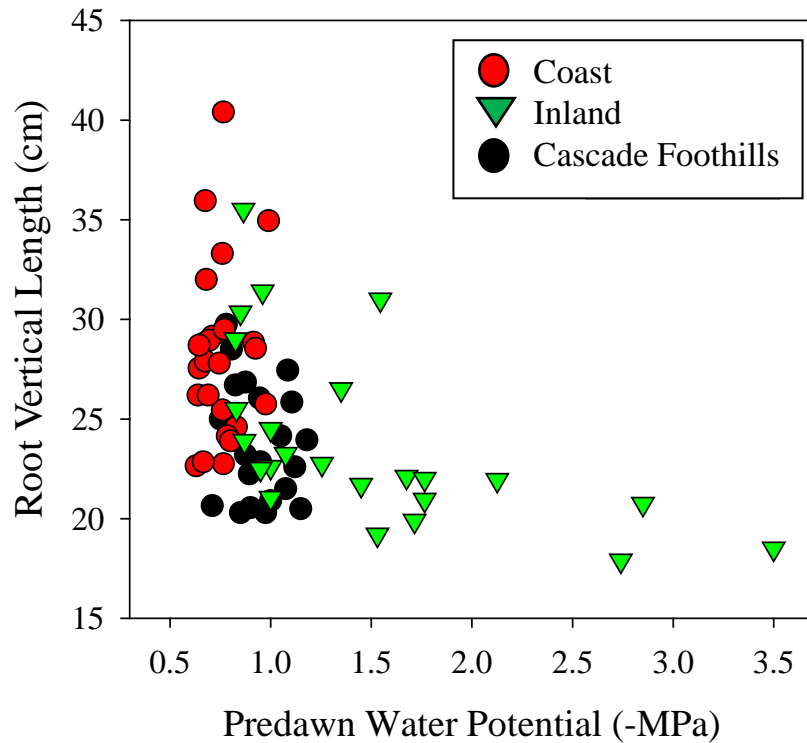
Western larch, Idaho



Current Progress

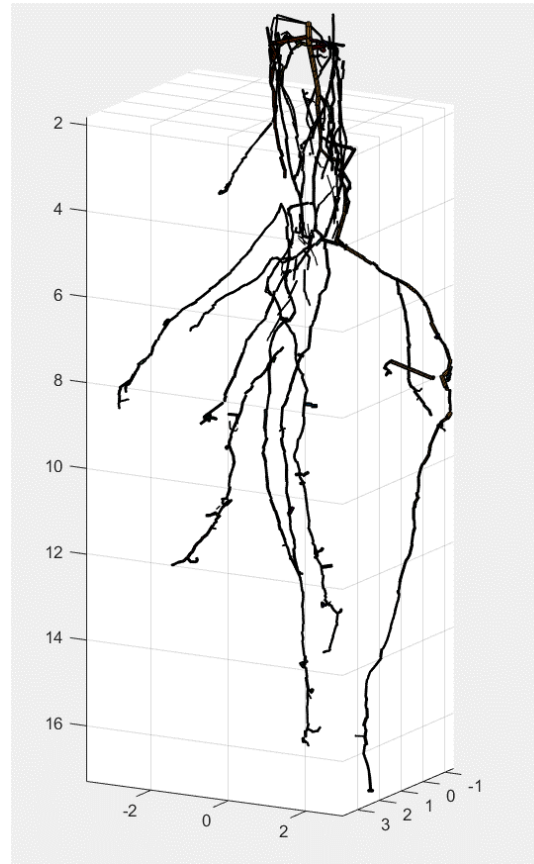
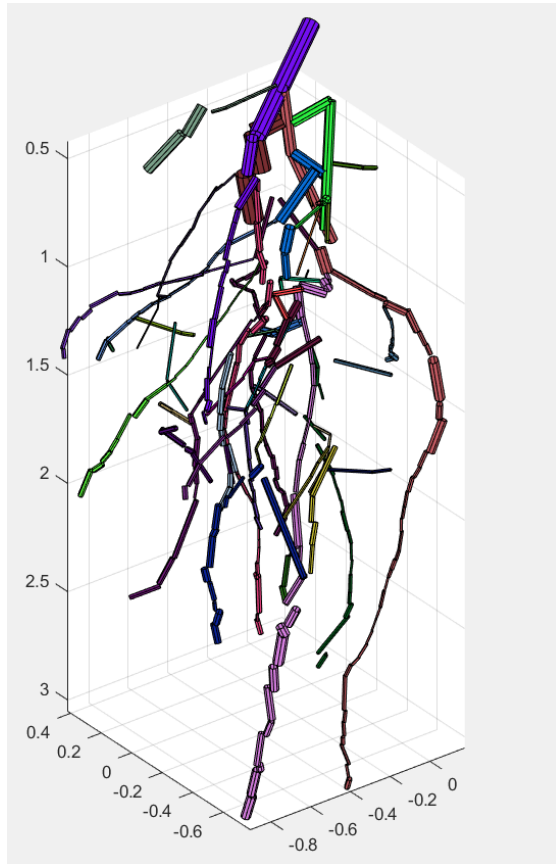
Preliminary results

Douglas-fir, Oregon



Future Plans

Purdue University Controlled Environment Phenotyping Facility



Digital analysis

- Root growth dynamics
- Root branching
- Lateral root angle
- Rooting depth

Laboratory analysis

- Root scanning (Winrhizo)
- Leaf area
- Biomass

Figure: 3D cylinder root models for architectural traits analysis.



Outplanting

Field performance measurements

- Scanning of root systems excavated in the field
- Leaf nutrient analysis

Manuscript preparation

- Nursery
- Hydraulics
- Outplanting



Douglas-fir, Oregon



Western larch, Idaho



Black walnut, Indiana



Is Nursery Drought Conditioning a suitable treatment to promote root development and increase seedling field performance?

Thank you for your attention

