Our results suggest mature ponderosa pine shift source water from a mean depth of 50 – 100 cm in June and source water from greater than 100 cm in September, when soil moisture is at an annual minimum.

Seasonal changes in ponderosa pine water source depth and the impacts of forest thinning

We investigated seasonal variation in the depth from which healthy, mature ponderosa pine source water in the subsurface using stable isotope composition of precipitation, soil, and xylem waters. We addressed the following specific monitoring questions:

1. Does the depth of root water uptake by ponderosa pine vary throughout the growing season?
2. Do group selection and diversity thinning treatments impact the depth from which mature ponderosa pine uptake soil water as compared to an unthinned forest?

Ben driving a manual soil auger to collect soil samples from the 50-100 cm depth interval in the Diversity West

Key Findings

- Ponderosa pine source water depth shifted in response to seasonal soil moisture recession:
  - 50-100 cm depth in June
  - >100 cm depth in September
- Group selection and diversity thinning treatments did not impact water source depth dynamics in large ponderosa pine.
- Group selection treatment likely increased bare soil evaporation.

For more information, follow the link below:

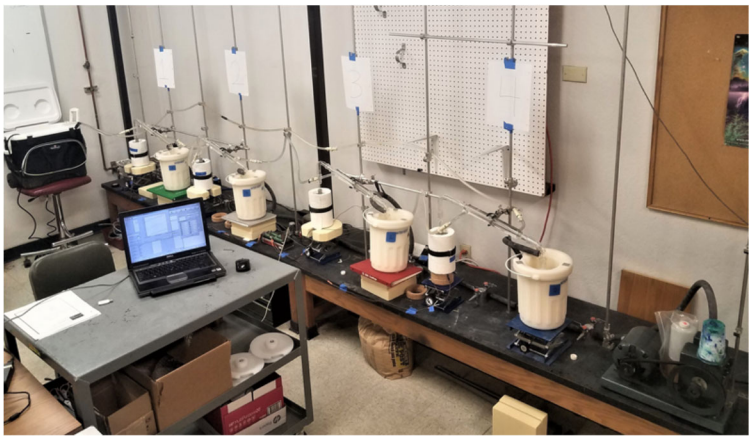
https://unr.idm.oclc.org/login?url=https://www-proquest-com.unr.idm.oclc.org/docview/2445937369?accountid=452

This project addressed the following monitoring question from the Burney Hat Creek CFLRP Ecological Monitoring Strategy:

HYD.1.2. How do management activities, such as thinning and hydrologic restoration, influence soil moisture?

Contact: Ben Serpa, benjamin.serpa@usda.gov

Project Overview

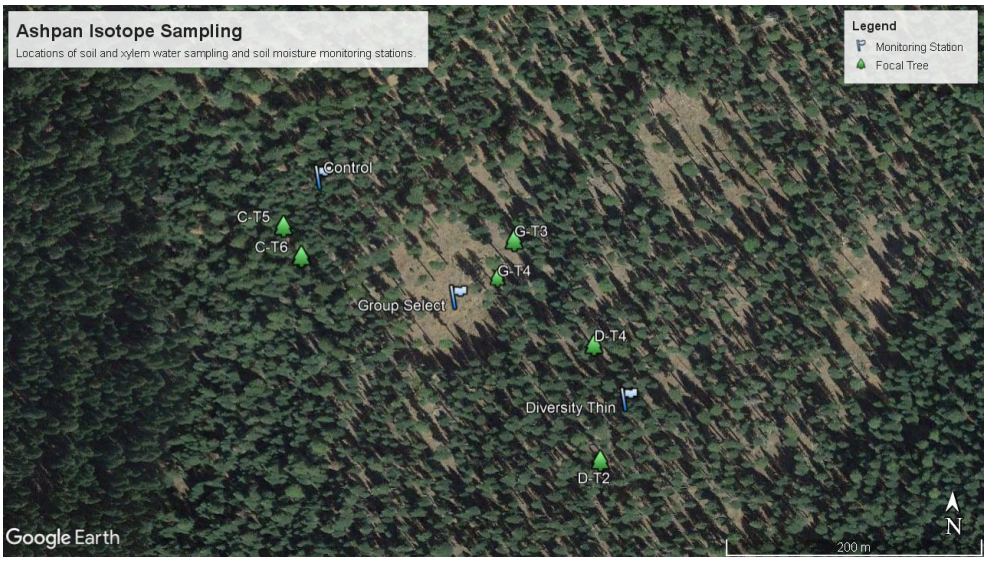


Overview of the cryogenic vacuum extraction system employed to extract water from soil and tree core samples for isotopic analysis in the Nevada Stable Isotope Lab.

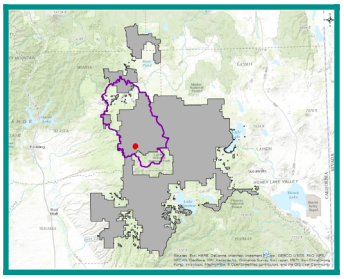
Forest water use is complex; however, stable isotopes can be used as natural tracers to investigate tree water source dynamics. Here we employ stable isotopes of water, O^{18} and H^{2}, to evaluate impacts of two thinning treatments, group selection and diversity thinning, on tree water source depth and seasonal changes in water source depths. We collected tree cores and adjacent soil samples from trees in the group selection (n=2), diversity thinning (n=2), and unthinned (n=2) treatment units at the Ashpan monitoring site in April, June, and September of 2019. Isotopic signatures of soil and xylem water, extracted via cryogenic vacuum extraction, were compared to isotopic composition of precipitation during the 2019 water year, collected at Manzanita Lake, CA. Results show changes in forest density and structure do not influence mean source depth of root water uptake and suggest that mature ponderosa pine at the Ashpan site source water from 50 – 100 cm depth in June, then shift to mean source depths greater than 100 cm in September in response to annual soil moisture recession. Forests with shallower soil columns may not allow for the same plasticity in root water uptake, due to less storage capacity. Our results may help forest managers predict the impacts of these vegetation management treatments on forest transpiration dynamics based on surveys of soil depth and textural characteristics.

Management Implications:

- Group selection and diversity thinning treatments are **unlikely to impact water source depth** of large ponderosa pine rooted **in deep (>100cm) soils**.
- Group selection treatments may **increase bare soil evaporation.**
- Mature ponderosa pine **shift water source depth** in response to **soil moisture recession**.



Overview of xylem and soil sampling locations, as well as soil moisture monitoring stations



Project location, the Basins CFLRP, and Lassen National Forest (above)

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