

Progress Report

Physiologic Response to Commercial Fertilization Programs in Pacific Northwest Forest Plantations

CAFS 20.84

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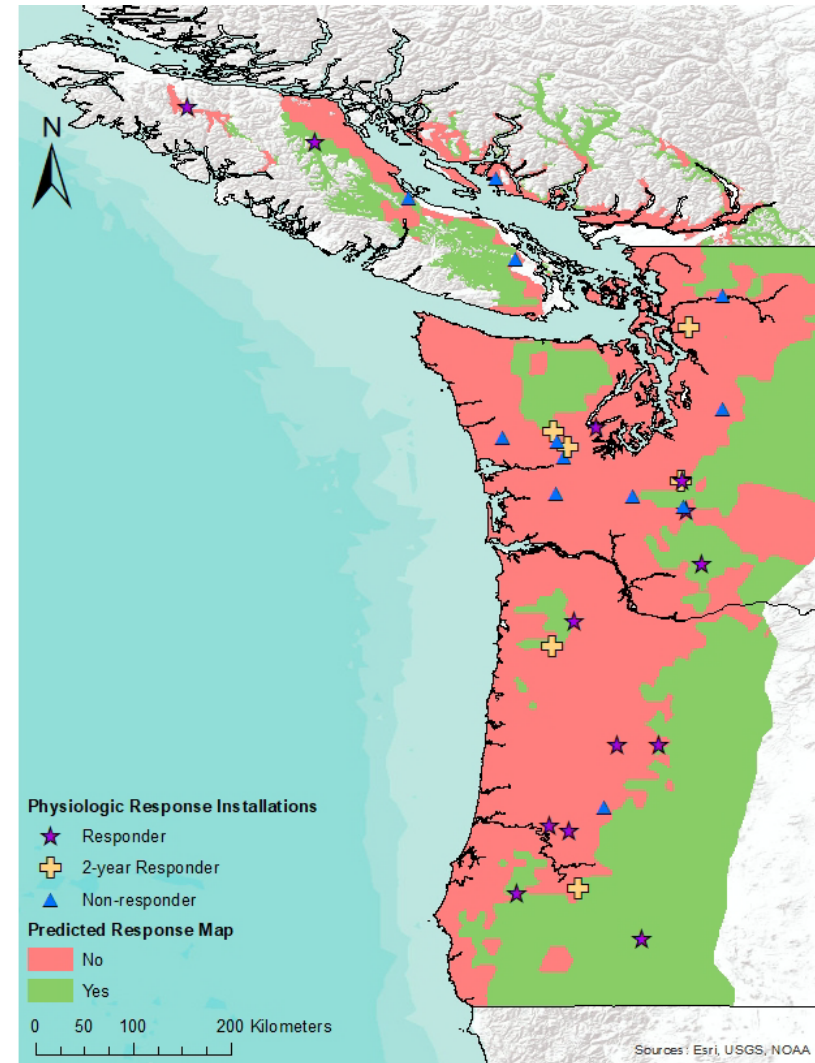
Project Overview

Objectives

1. Investigate mechanisms of physiologic response to fertilization under soil and site conditions
2. Develop regional silvicultural guidelines for commercial forest operations
3. Provide data to inform changes in silvicultural treatments due to future climate change

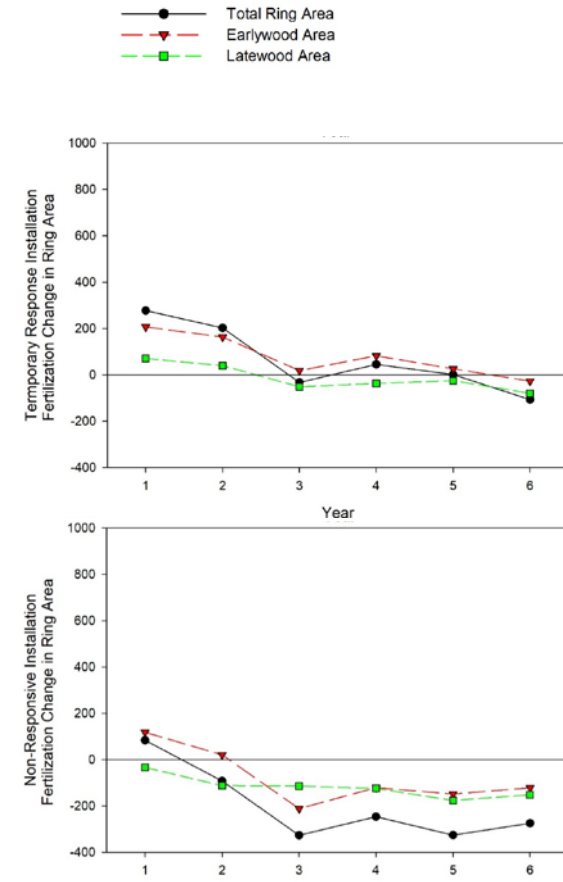
Methods

1. Measure earlywood and latewood growth on previously fertilized Douglas-fir installations
2. Determine change in C and O isotopes due to fertilization up to six years after fertilization
3. Estimate physiologic response to fertilization in responding, temporary responding, and non-responding installations



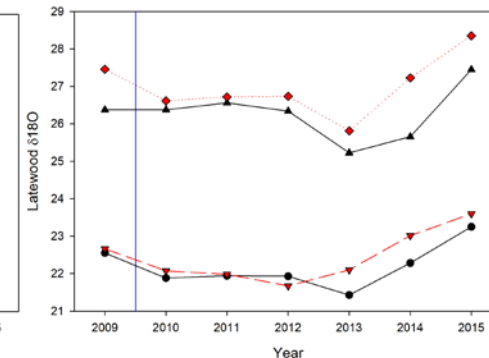
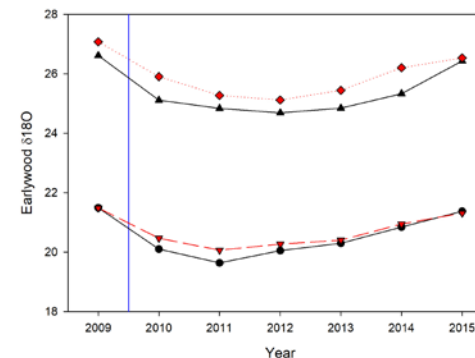
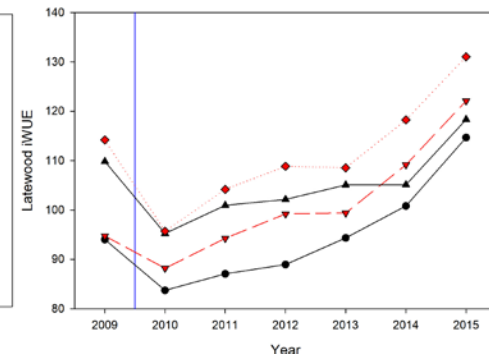
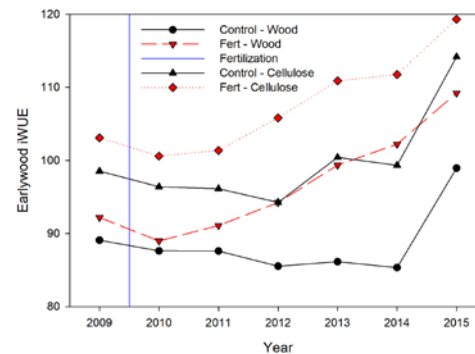
Current Progress

- 21 installations cored, dated, and measured for earlywood and latewood growth
 - Response was greatest in the first 4 years, but continued up to 10 years
 - Responding installations had higher elevation and forest floor C:N ratio and lower NO_3 and Al
 - Temporary responders grew more earlywood or latewood shortly after fertilization, but grew the same as controls after 2 years
 - Some non-responders grew significantly less ring area in fertilized trees
- 15 installations split into earlywood and latewood for -1 - 6 years after fertilization



Current Progress

- One responding installation analyzed for C and O isotopes from wood and alpha cellulose
- Wood ratios are highly correlated with alpha cellulose ratios
- Fertilization decreased $\Delta^{13}\text{C}$ and increased water use efficiency especially in earlywood
 - Greater photosynthetic assimilation
 - Hot and dry spring in 2015 lowered stomatal conductance and increased water use efficiency
- Increasing effect of fertilization on $\delta^{18}\text{O}$ in latewood is likely due to increasing leaf area over time
- Late summer drought reduced stomatal conductance



Future Plans

- Analyze remaining 20 installations for C and O isotopes
- Core 9 installations in Spring 2021
 - Measure tree rings and analyze C and O isotopes in 2022
- Publish peer-reviewed publications from the results of this study

