Progress Report

Determination of crown morphological traits using laser scanning in Douglas-fir and loblolly pine genetics trials

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Project Overview

- Based on intensive sampling within Douglas-fir realized gain trials, improved performance of genetically select trees has been associated with specific crown morphological traits.
  - High leaf area density
  - Short branches, narrow crowns

- Accounting for crown traits within growth and yield equations would provide a means of predicting the benefits of deploying specific families of known traits

Project Overview

Objectives:

- From laser scan point data, develop an algorithm for identification of heritable crown morphological traits associated with enhanced growth rates (leaf area density, crown width)

- Using increment and allometric data from measurement of families representing contrasts in crown density and width, attempt to account for genetically-relevant crown morphological traits in pertinent growth model equations

Current Progress

- **Collect drone-based 450 ppm laser scans of pure family blocks at three western Oregon sites containing improved stock**
- **Analyze point cloud, develop algorithm for identifying traits of interest (FPC)**
- **Measure pure family blocks of interest at three sites, collecting** data on dbh, height, HCB, and two crown widths on each tree.
- Fit modifier equations for max/largest CW
- Test for crown trait-adjustments to pertinent G&Y equations: diameter increment, height to crown base, and crown recession.
- Using any significant changes, produce model simulations of ideotype-based plantations.

Current Progress

Production of Laser scans and orthomosaics

Current Progress

Variables estimated from laser point cloud

- Tree height
- HTLC: Estimate of height to the live crown
- Convex hull crown area
- Largest diameter of crown
- Convex-hull volume of top 10, 20, 30, 40, and 50% of returns
- Convex-hull surface area of top 10, 20, 30, 40, and 50% of returns
- Understory height
- LAI estimation model from Almeida et al. (2019)
- LAI estimation model from Sumnall et al. (2021)
- Alpha-shape volume of all tree classified points
- Alpha-shape surface area of all tree classified points

Future Plans

- Link tree-level estimates from point cloud to individual trees
- Complete tree measurements
- Assess ideotype-level differences in max crown width/largest crown width
- Test for crown trait-adjustments to pertinent G&Y equations: diameter increment, height to crown base, and crown recession
- Simulate pure-ideotype plantings and assess the implications