Continuing Project

The Effect of Silvicultural Treatment on Douglas-fir Stem Form

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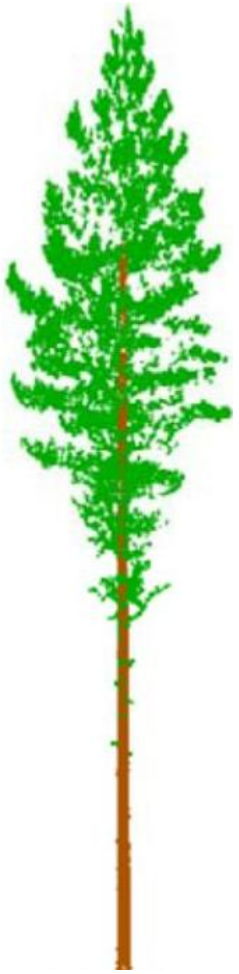
Justification

- Current cohort of DF trees approaching harvest age are different from those used to construct commonly used taper equations
- Thinning, enhanced genetics, and intensive vegetation management are current treatments unrepresented in commonly used taper equations
- Incorporation of any significant treatment effects to taper estimates would improve yield estimates and financial analysis

Justification

- Ground-based LiDAR provides an opportunity for expanding the potential sample size of upper stem diameters available for taper modeling

- Coupling traditional upper stem diameter measurements with SLAM-LiDAR upper stem diameter estimates from point data would provide a dataset for testing the fitness for such data, and, if necessary, for calibrating it.



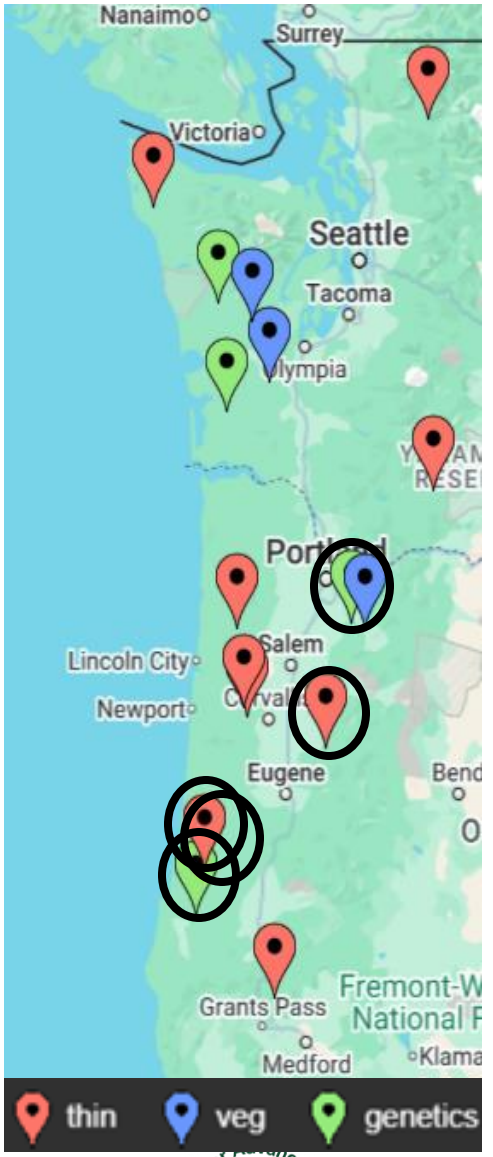
Objectives

- Objective 1 will be to test for significant treatment effects on stem form, and where pertinent, to construct taper modifier equations to adjust a conventional taper prediction

- Objective 2 will be to collect SLAM LiDAR data on standing trees subject to felled or climbed upper stem diameter measurements, and to validate the remotely collected data and/or calibrate it to correct for any bias.

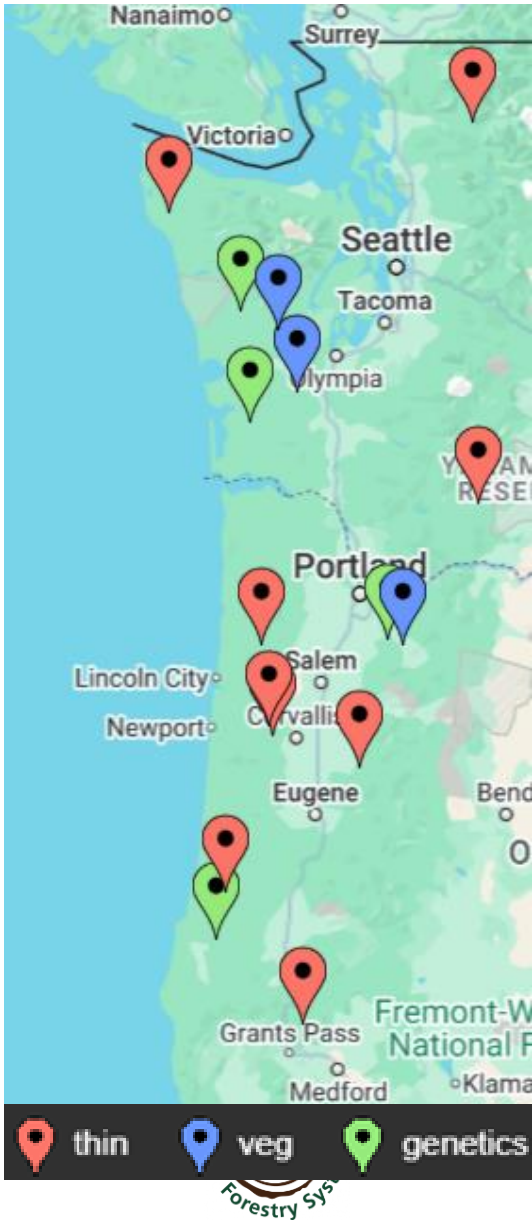
Methods

- Upper stem diameter measurements were made on trees on paired treatment plots in Oregon and Washington
  - 4 or 8 trees per treatment per site distributed evenly among 4 quartiles of the diameter distribution
  - 8-13 interwhorl diameter measurements/tree
- SLAM LiDAR scanning of the same trees was conducted where scanner availability and weather conditions intersected (circled sites)



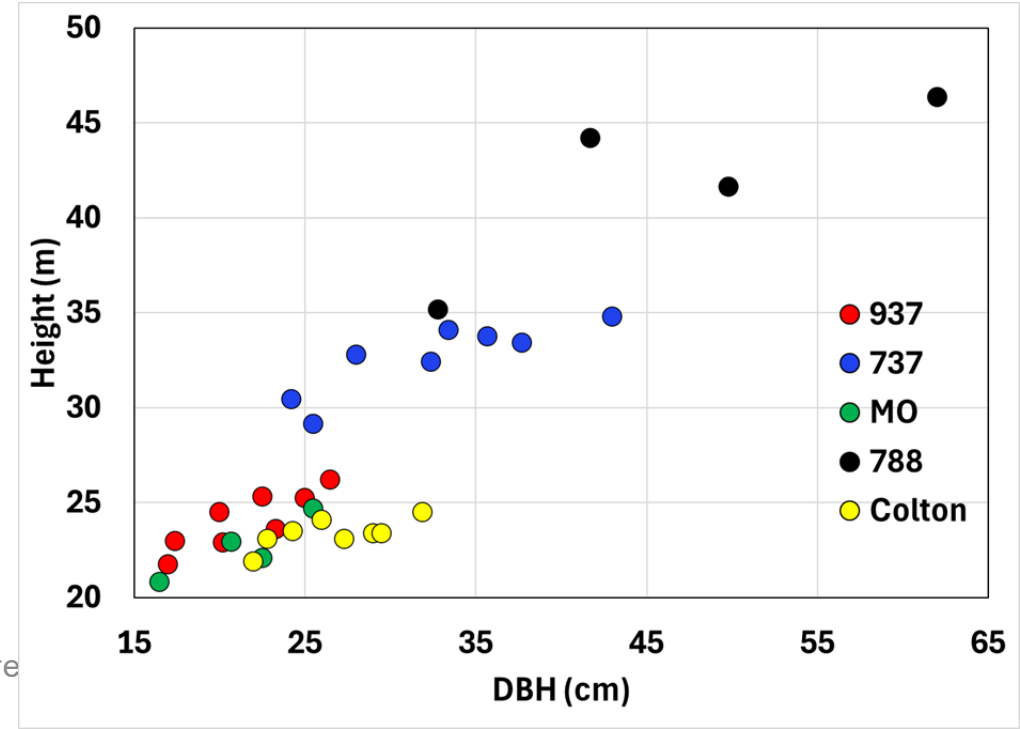
Methods

- Thinned sites (rotation-aged) (80 trees)
  - Thinned vs. unthinned
  - Current age 30-45
  - Thinned 8-20 years previously
  - Generally thinned from RD 55 → 35
- Intensive veg control (mid-rotation) (48 trees)
  - 5 veg treatments vs. none
  - Current ages 19-20
  - Spacing 10x10
- Genetically select (mid-rotation) (60 trees)
  - Mixed or pure family high gain plantings vs. woods run
  - Current age 20-28
  - Spacings: 9x9, 10x10, 12x12



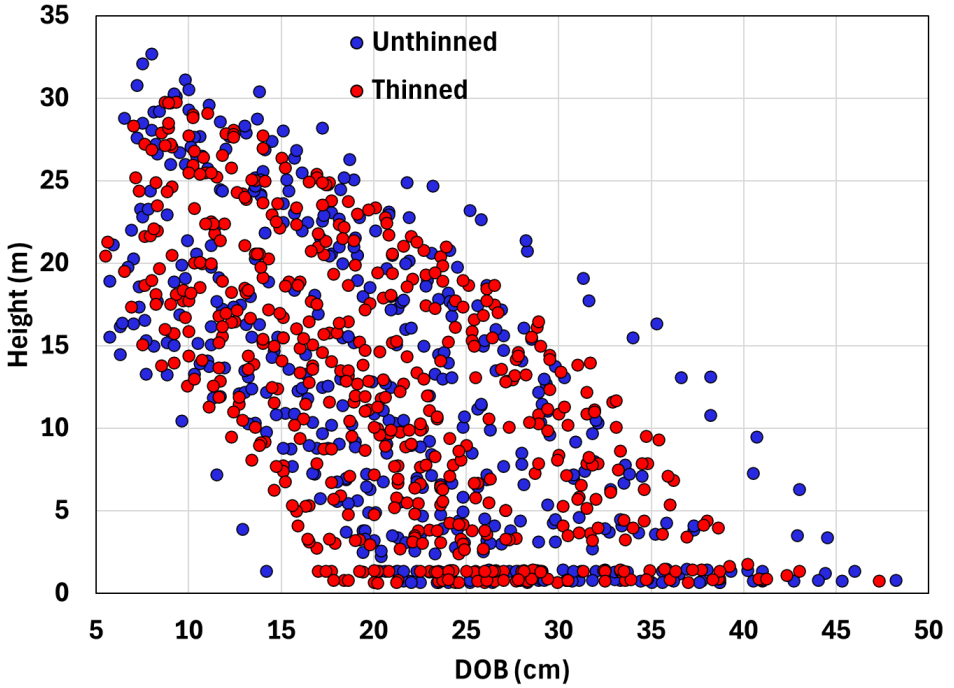
Laser scanning of sample trees

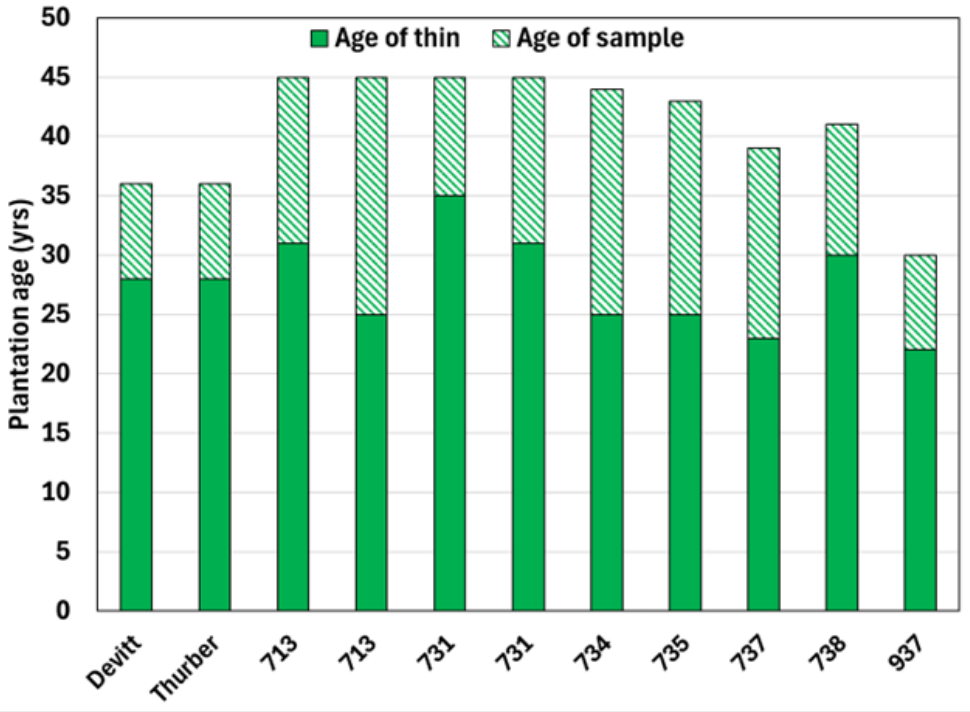
- Collaboration with IFC and Mark Kimsey
- Opportunistic sampling when weather and scanner availability intersected
- 32 trees were scanned twice
  - Sample tree as target…direct view
  - Sample tree as one of many…peripheral view
- Scans awaiting processing



Results, thinned stands

- **Used Kozak 02 with…**
  - Categorical treatment variable (I_{thin})
  - Years since thinning (YST)
  - CR, HCB, or HCM with and without treatment interaction
  - Contrast in dominants vs. sub-dominants
  - Contrast in YST=8 vs. YST>17
    - ***Thinning was not significant in the prediction of upper stem diameter***

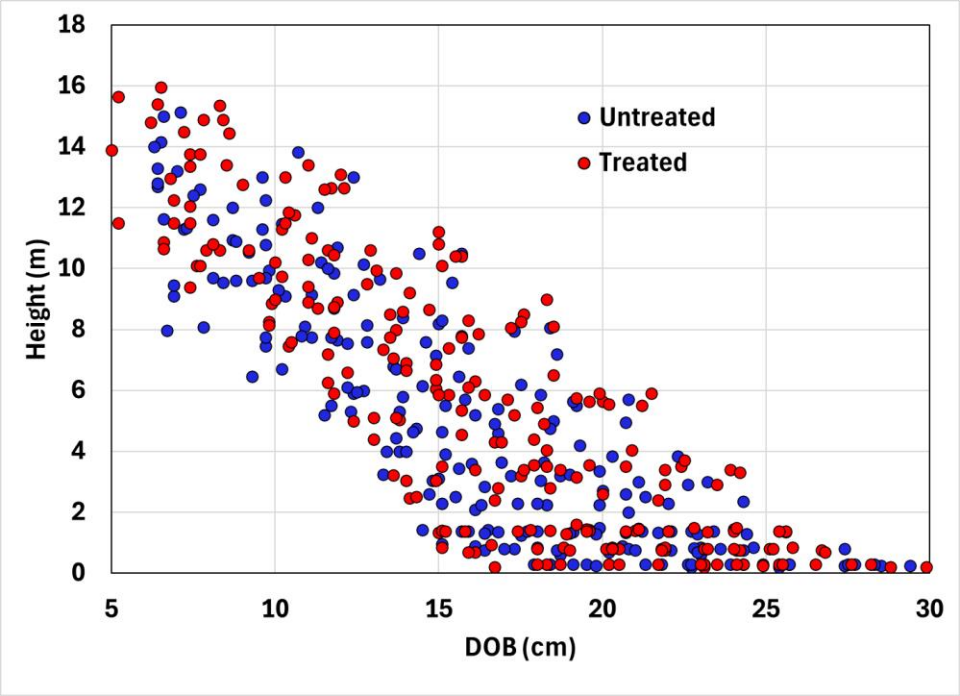




Results, veg managed stands

- **Used Kozak 02 with…**
  - Categorical treatment variable (I_{veg})
  - CR, HCB, or HCM with and without treatment interaction

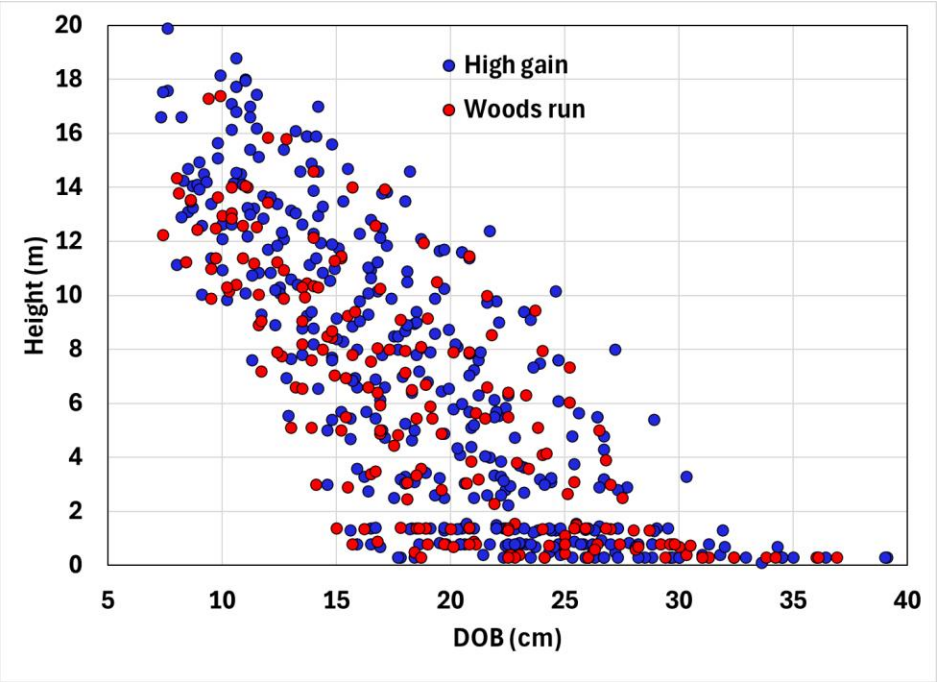
- ***Intensive vegetation treatment was not a significant factor for mid-rotation stem form***



Results, genetically select stands

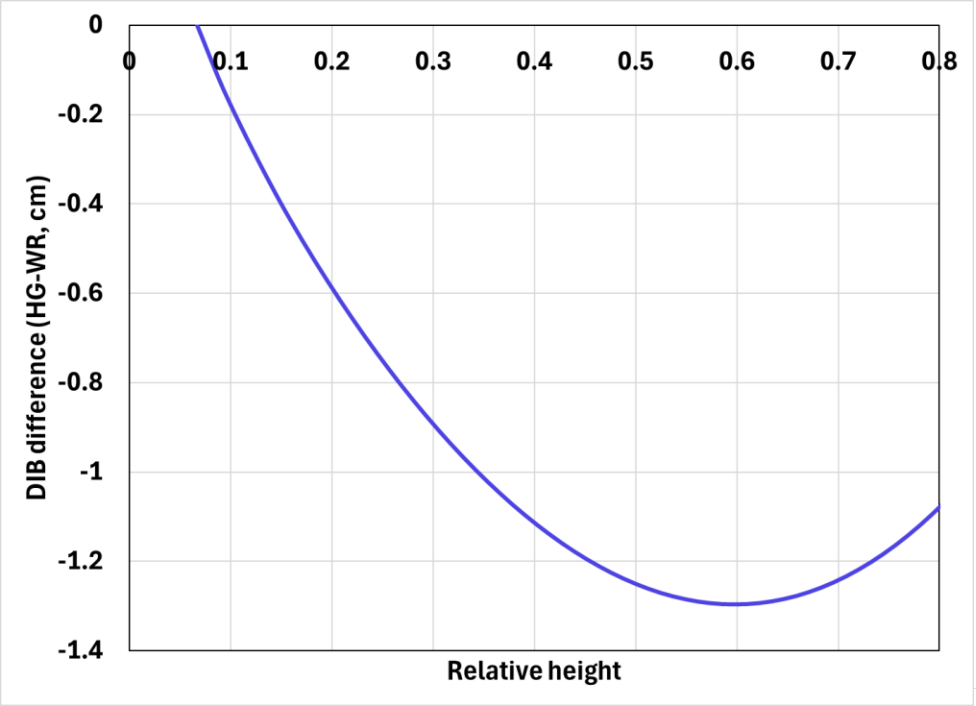
- **Used Kozak 02 with…**
  - Categorical treatment variable (I_{gen})
  - CR, HCB, or HCM with and without treatment interaction
  - Quartile-level interaction with treatment

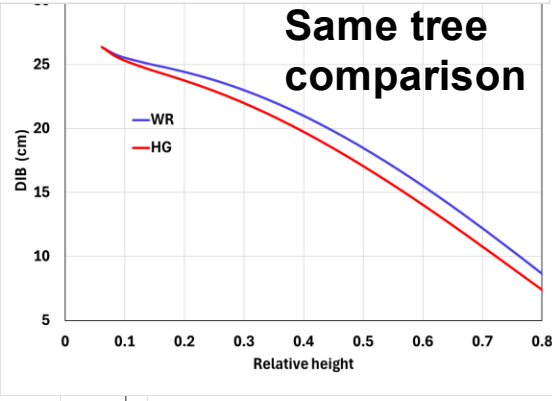
- ***Select genetics was a significant factor for mid-rotation stem form***

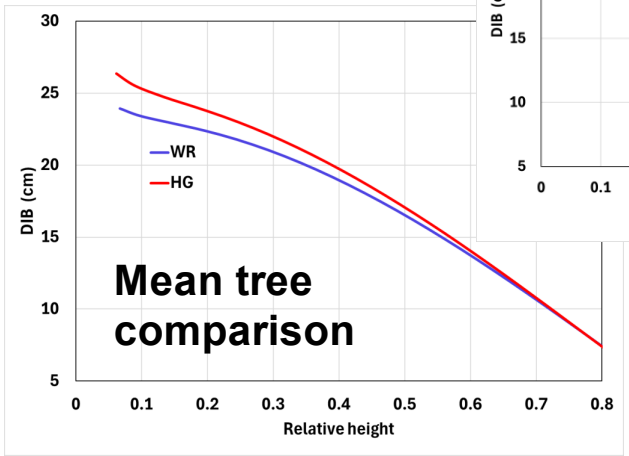


Results, genetically select stands

- **Final model: Kozak 02 with…**
  - Categorical treatment variable (I_{gen})
  - HCM
  - $I_{quartile\_1}$*I_{gen} interaction
- **Largest quartile trees had a smaller upper stem diameter, all else being equal**
- **No significant treatment difference between trees of other quartiles**





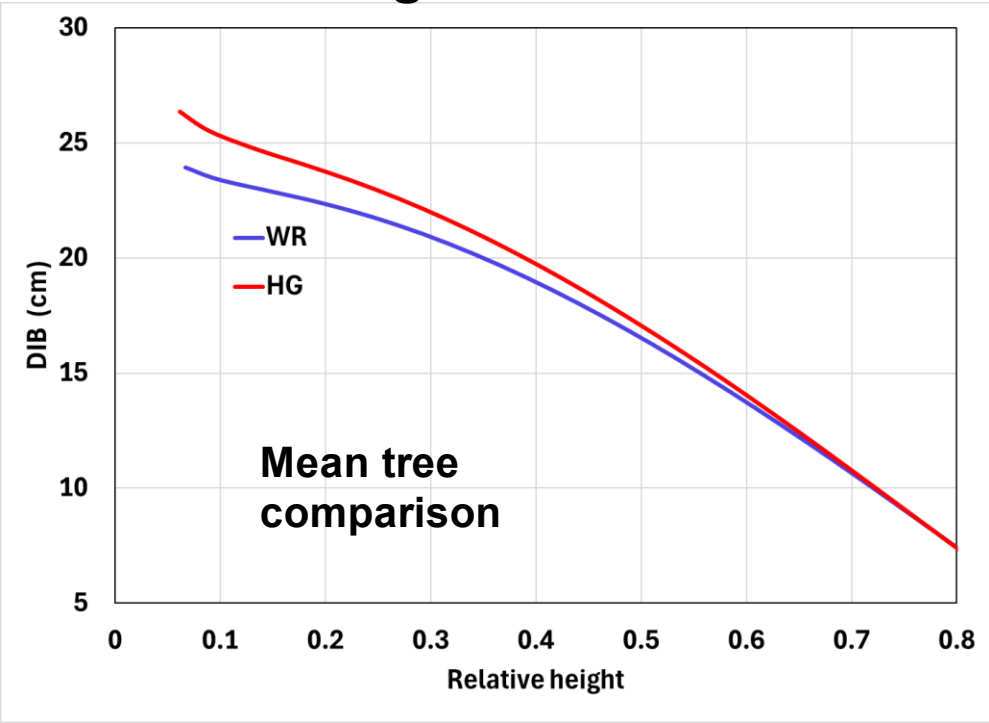


Results, genetically select stands

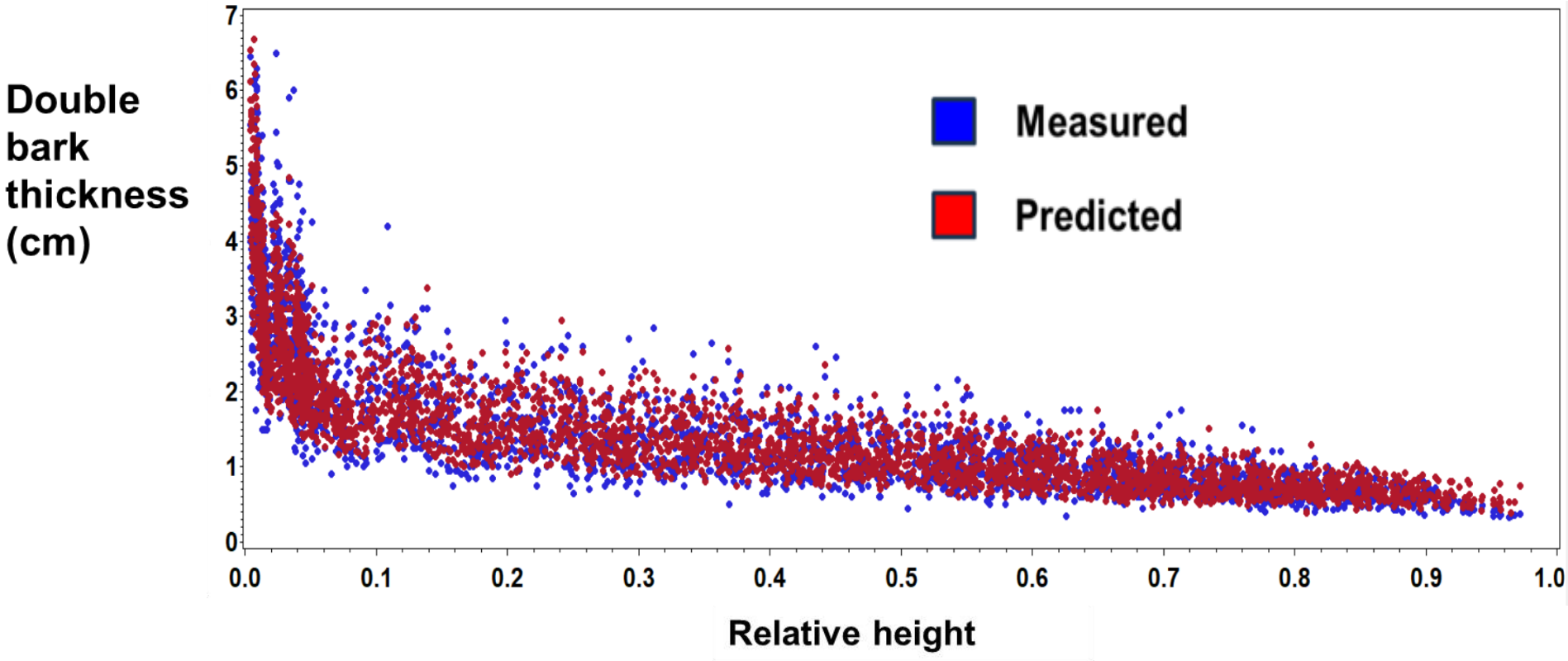
- Results applied to 5 HG and 5 WR plots @ age 23
- Standing BFV gain noticeably reduced (10.7% to 2.5%)

Genetics	BA (ft2/ac)	H40 (ft)	Scribner vol_original	Scribner vol_modified
HG	191.2	78.4	13786	12755
WR	187.6	76.5	12450	12450

- Reduction in CFV or tonnage would be less than Scribner

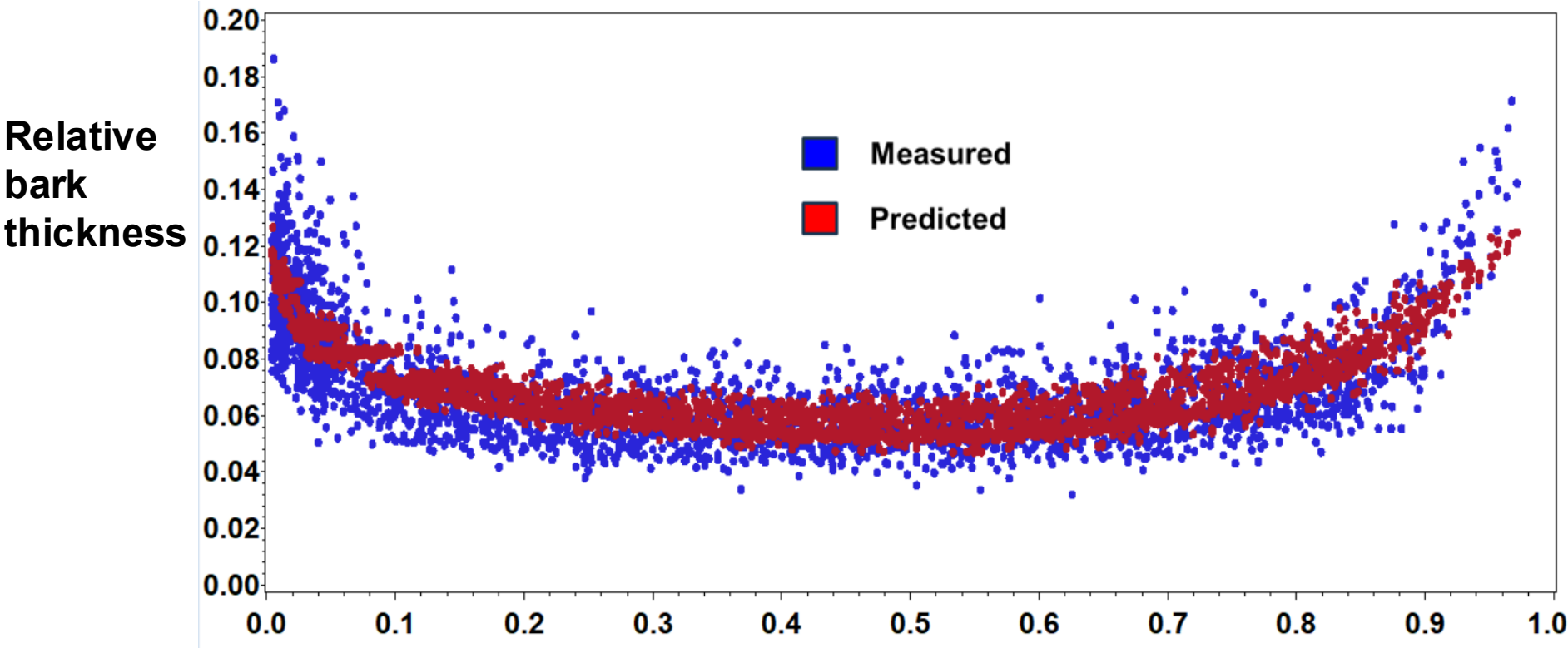


Absolute double bark thickness dataset



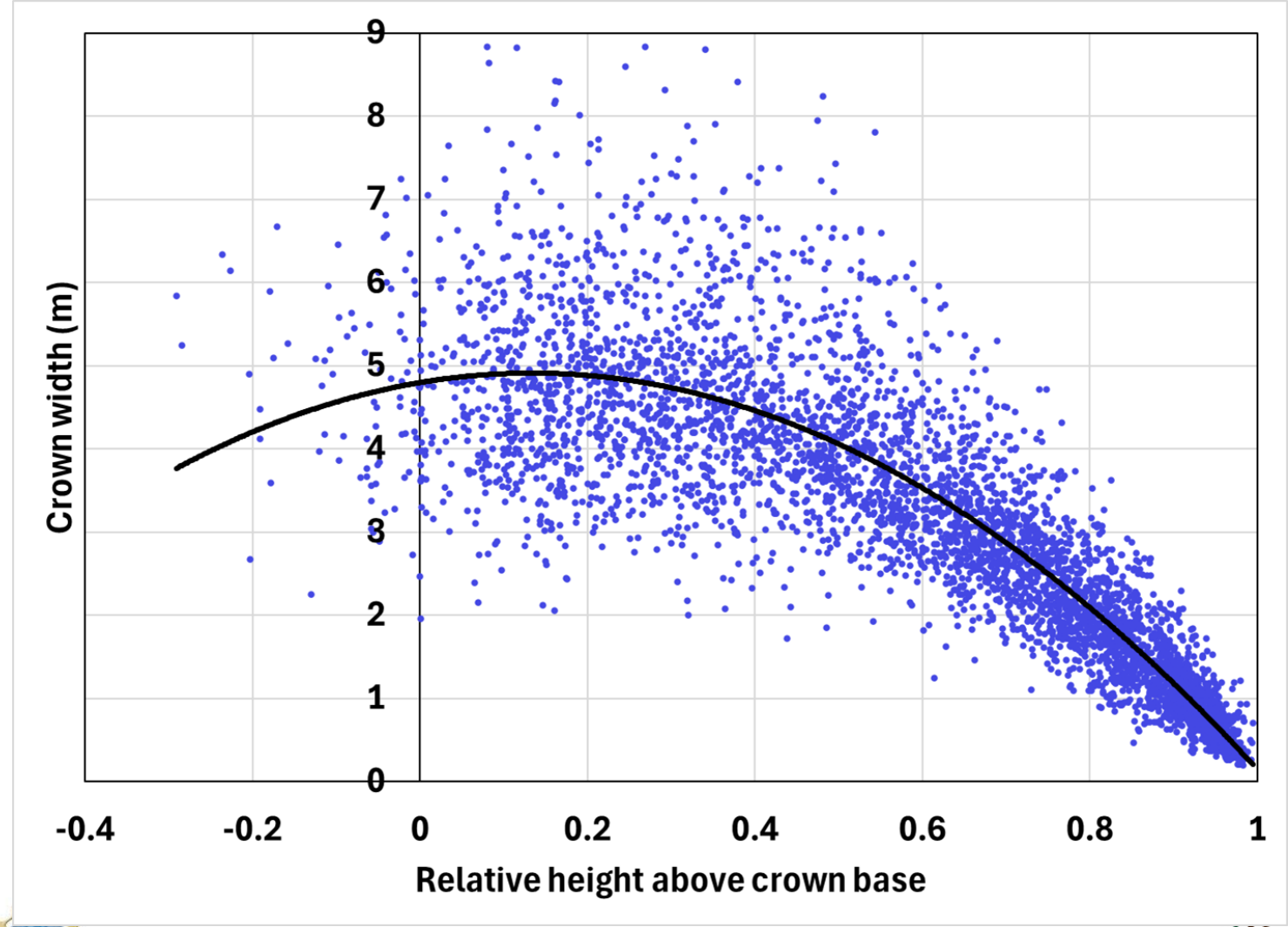
Other benefits from this sampling

Relative double bark thickness dataset



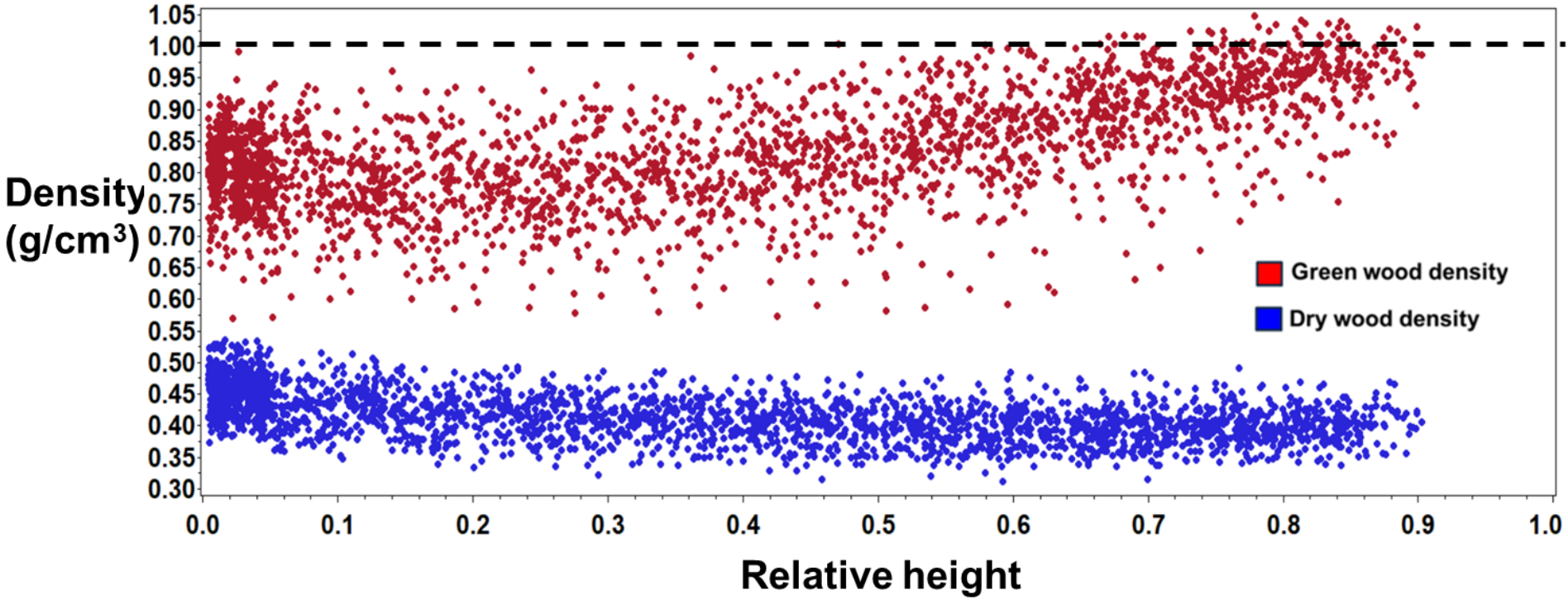
Opportunistic measurement of destructively sampled trees

New crown profile dataset



Opportunistic measurement of destructively sampled trees

New vertical density profile dataset



Company Benefits

- Model adjusting stem form predictions for elite genetics
- Improved assessment of financial benefit of genetics at mid-rotation
- Assessment of fitness for SLAM-LiDAR upper stem diameter measurements and adjustments for any shortcomings
- Validation dataset to compare SMC measurements with data from operational stands (WTVWC)
- Expanded datasets for double bark thickness, wood density, and crown profile from additional measurements
- Incorporation of results into regional growth models

Future Plans

- Processing of LiDAR point clouds
- Assessment of hand-held laser scanner ability to accurately estimate upper stem diameter
- Further exploration (expansion of dataset?) into a proper continuous variable for predicting USD of genetically select tree taper

Summary

- Typical thinning treatments in intensively managed Douglas-fir stands did not significantly alter Douglas-fir stem form, 8-20 years post-thinning
- Early and aggressive vegetation management did not significantly alter mid-rotation Douglas-fir stem form
- Despite the larger overall size of genetically elite trees relative to woods run, the largest elite trees had significantly smaller USD, all else being equal.