

# Progress Report

## Stand Response to Thinning:

Enhancing Response Prediction Through Modeling  
CAFS 20.82

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# Project Overview

## Justification

- Forecasting yield is a primary objective of forest managers
- Thinning a stand has a propensity to alter stand allometry
- Stand productivity:  
*Actual → Achievable → Potential*
- Decision space is clearly in zone between *Actual* and *Potential*

## Objectives

- Predict crop & total yields:
  - Trees per Acre (TPA)
  - Basal Area (BA), Quadratic Mean Diameter (QMD) \*
  - Cubic-foot volume including top (CVT)
  - Cubic-foot volume to a 4" top (CV4), to a 6" top (CV6)
  - Board-foot volume to a 4" top (BF4), to a 6" top (BF6)
- Model using Chapman-Richards CDF
  - Fit using Nelder-Mead method
  - Bootstrap and re-fit to identify & eliminate non-significant predictors for *asymptote*, *rate*, *shape* parameters
- Test for differences in yield by:
  - Planting density, site index, species (PSME, TSHE, Mixed), location, elevation, latitude, longitude, PCT effect.



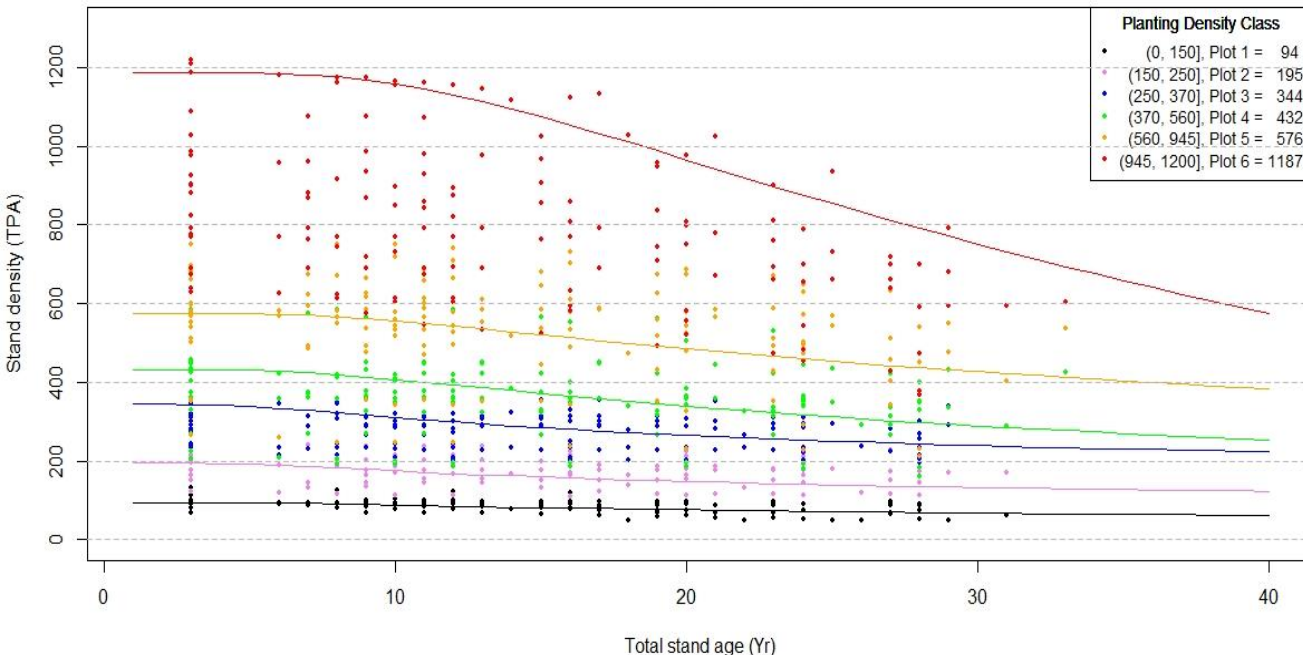
# Current Progress

## Mortality prediction using Schumacher equation:

$$\text{TPA} \sim \exp[\text{amplitude} + (\text{speed} / \text{TOTAGE})]$$

Tree survival by total age with predicted mortality for Installation 922 plots

PS.R2: 98.8% | RMSE: 28.3tpa | MAE: 16.7tpa | MAPE: 5.2%



Currently fitting (in process)

- BA
- CVTS
- CVT

Next up ...

- CV4, CV6
- BF4, BF6

PCT data sets / data frames are built



# Future Plans

- Simultaneous fitting of TPA and BA to derive QMD
- Further investigation of the mechanisms behind the differences in physiographic regions, i.e., WA coast (4), OR coast (7), OR mid-Cascades (8) – site and soil variables will be tested as developed in CAFS 20.83
- Extend PYC v2.0 models to incorporate PCT effects, then thinning
  - Version 2.0 : Baseline Equations
  - Version 2.1 : Version 2.0 + PCT effect
  - Version 2.2 : Version 2.1 + CT effect
- Keep opportunities for cross-region collaboration open

