Growth and yield response of *Pinus taeda* to *Leptographium terebrantis*

John K. Mensah[1], Ryan L. Nadel[1], George Matusick[2], Zhaofei Fan[1], Mary A. Sword Sayer[3] and Lori G. Eckhardt[1]

[1]School of Forestry and Wildlife Sciences, Auburn University, Auburn, Alabama; [2]The Nature Conservancy, Fort Benning, Georgia; [3]USDA Forest Service, Southern Research Station, Pineville, Louisiana

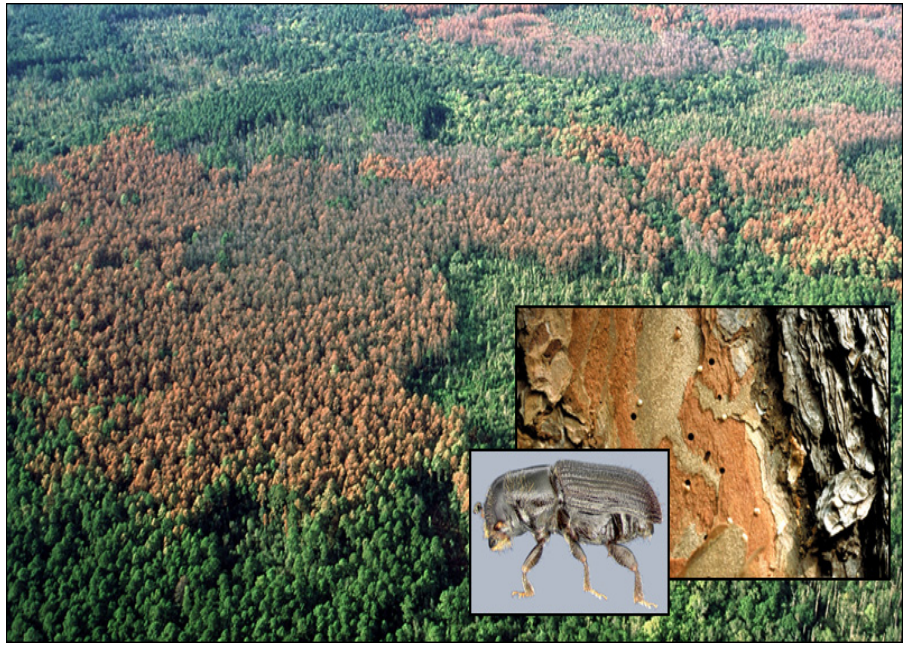
Background - Loblolly Pine

Veit, J. 2016

https://www.barkbeetles.org/spb/spbbook/Chapt4.html

Background - Problem

- Pest and diseases - threat to forest productivity and sustainability
- On annual basis large acres of forest is loss
- > 6 million of acres of tree mortality - 2015
- 9% loss of forest product

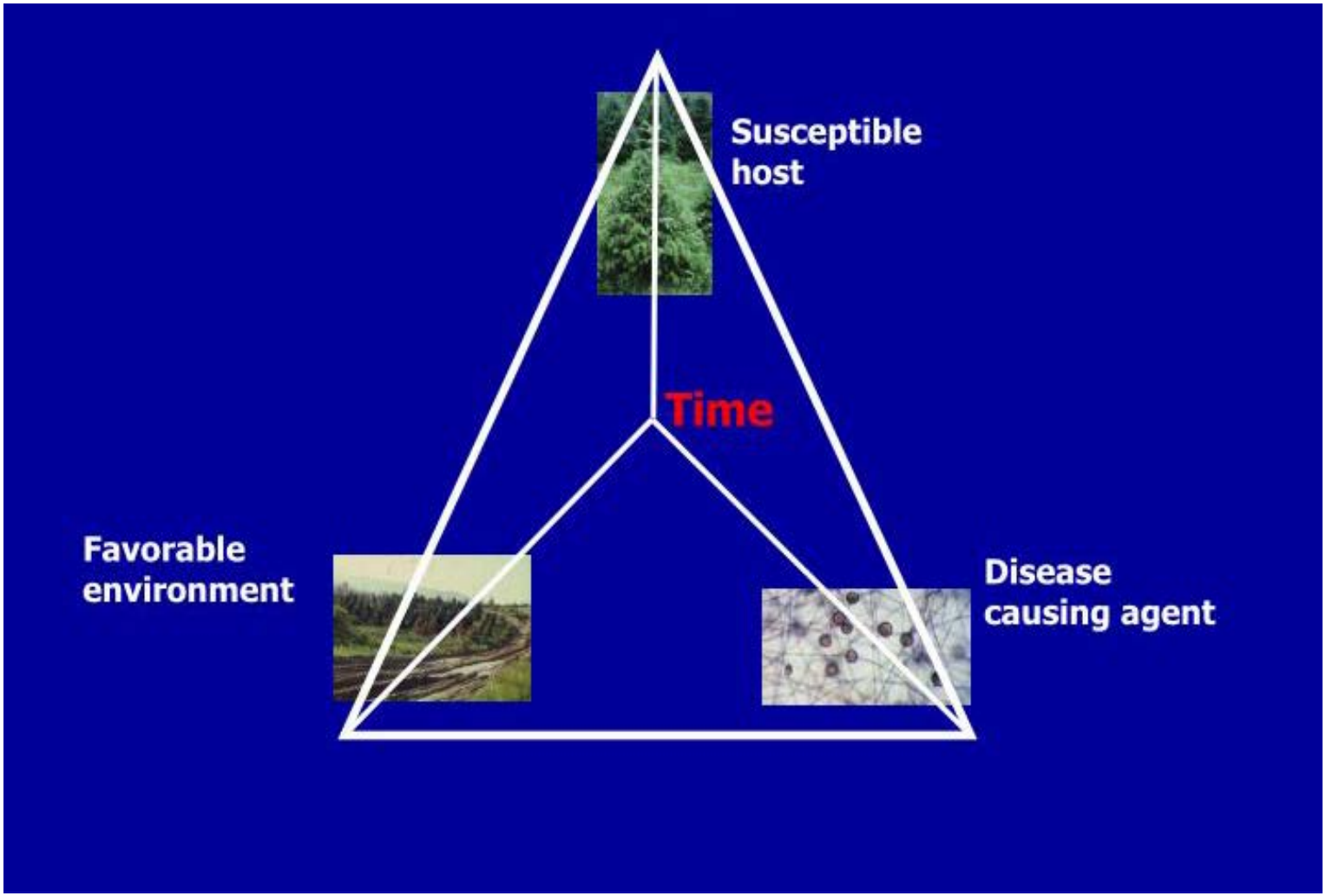


Annapolis, M.D 2015

Background - Problem

- SPD - A disease complex
  - Bark beetle - Ophiostomatoid fungi
  - Fungal interferes - H_2O transport
  - Affect physiological processes
  - Growth reductions and mortality

Background – Disease pyramid



https://www.slideserve.com/lynley/epidemiology

Objectives

- Assess growth and yield response of *P. taeda* to *L. terebrantis* inoculum density
- Determine the threshold of fungal inoculum density needed to cause growth reduction and mortality

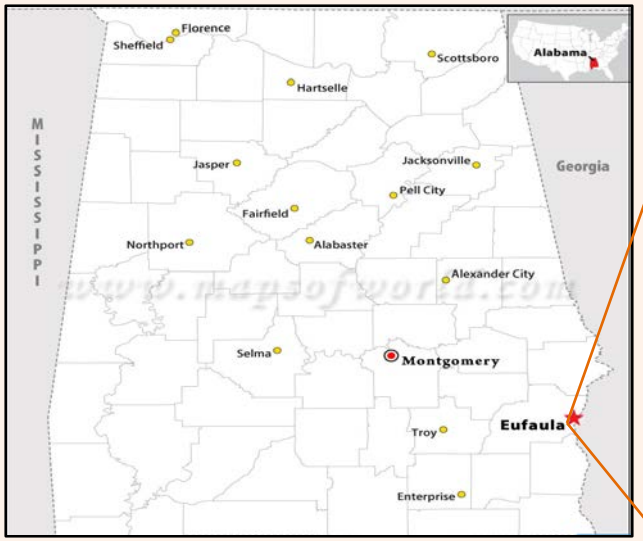
Hypotheses

- *L. terebrantis* infectivity will affect physiological functions and negatively impact tree growth and productivity
- Growth reductions and stand productivity will parallel the severity of *L. terebrantis* infection

Approach - Plot establishment

- 15 Plots were demarcated within 13 year old loblolly pine stand with 20 trees per plot
- Dendrometer bands were installed on 10 randomly selected trees per plot
- Radial and height growth were measured before treatment application

Approach - Site location and map



Pre-inoculation measurements

- DBH; Height; LAI

Approach - Treatment application

- Five treatments were randomly applied to five plots with three replications
- A total of 15 trees per treatment
- Treatments
  - Low (1 inoculation per 10cm i.e. circumference)
  - Medium (1 inoculation per 2.5cm)
  - High (1 inoculation per 1.3cm)
  - Wound (1 inoculation per 1.3cm)
  - Control

Inoculation Process

Approach - LAI measurement

- Leaf Area Index (LAI) was measured with a ceptometer
- $L = [(1 - 1/2K) f_b - 1] * \ln\tau / (A (1 - 0.47 f_b))$
  - L – Leaf area index
  - τ – Ratio of PAR below to PAR above
  - f_b – fraction of incident PAR
  - K – Extinction coefficient for the canopy

Results - DBH

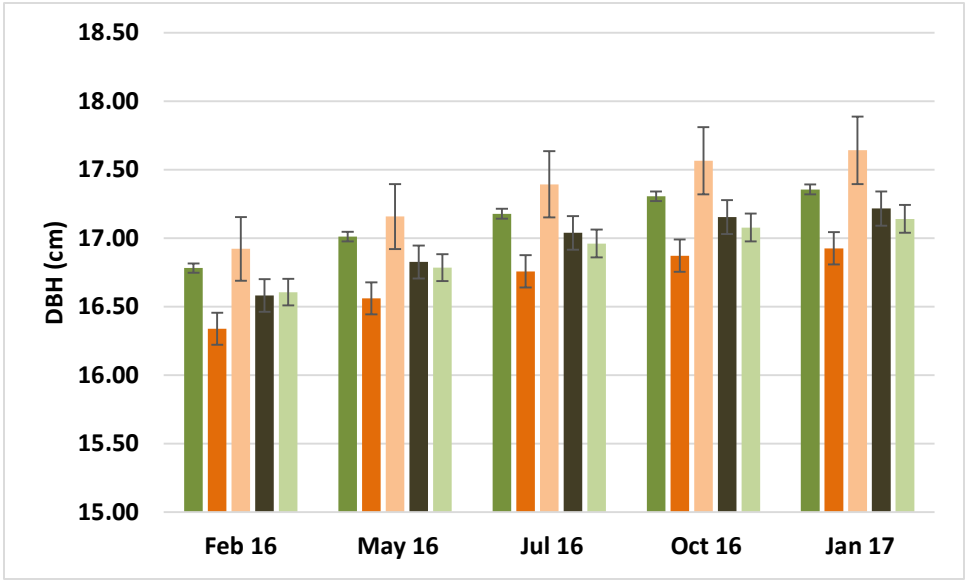


Figure 1: Before treatment

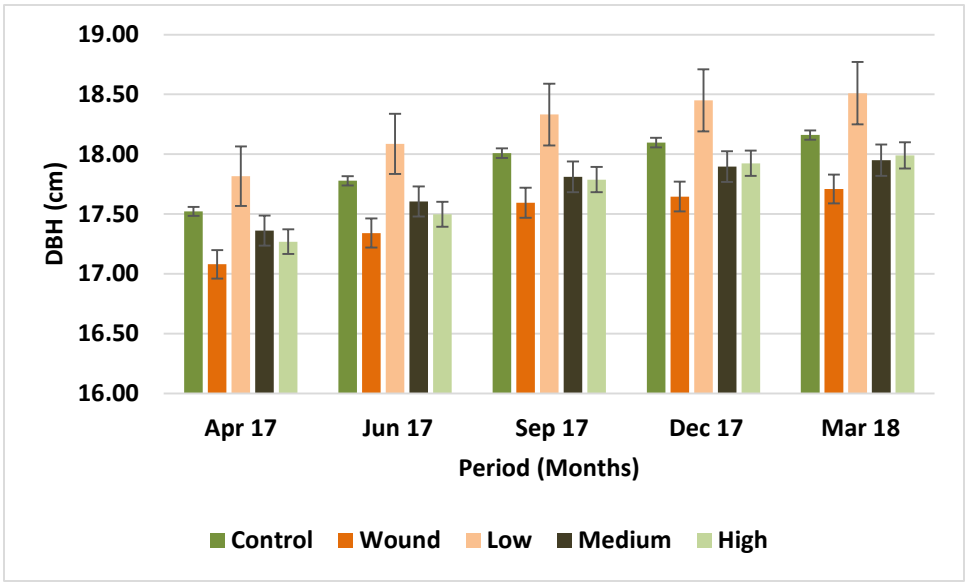


Figure 2: After treatment

Results - RBAI

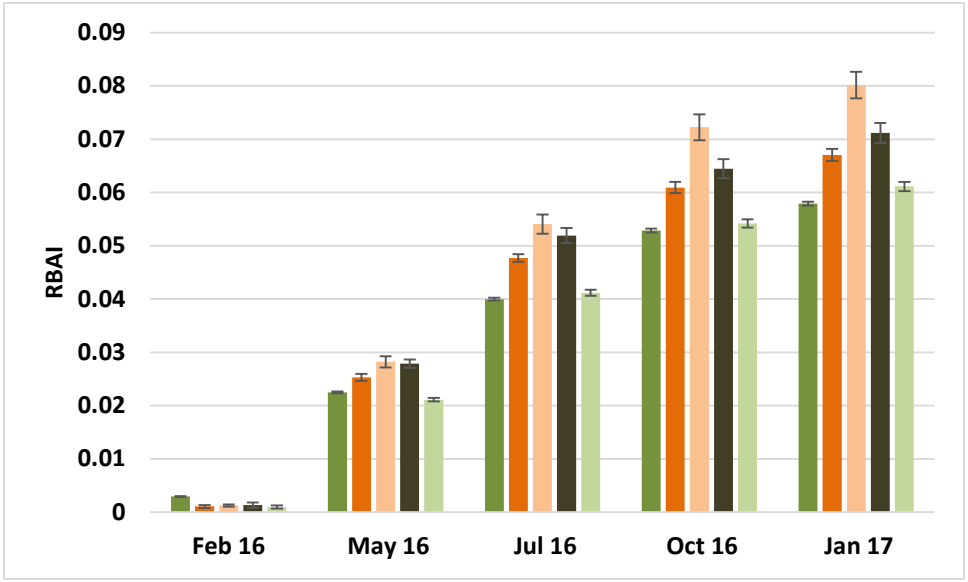


Figure 3: Before treatment

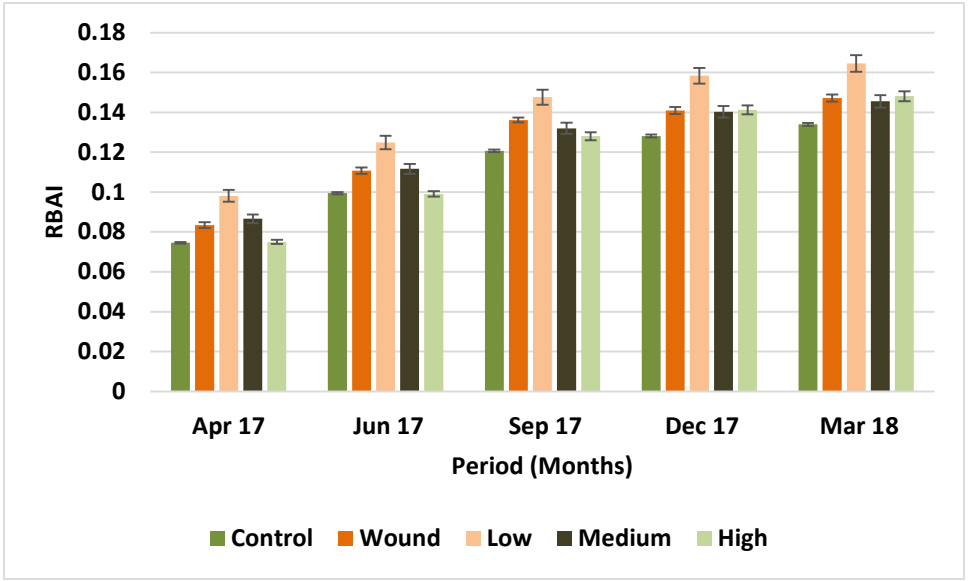


Figure 4: After treatment

Results - Height

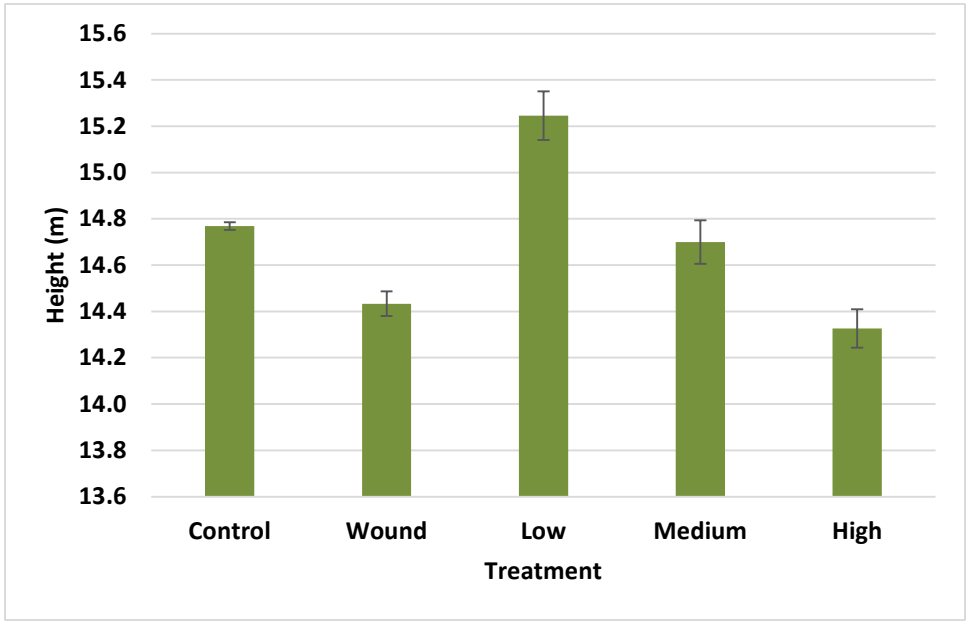


Figure 3: Before treatment

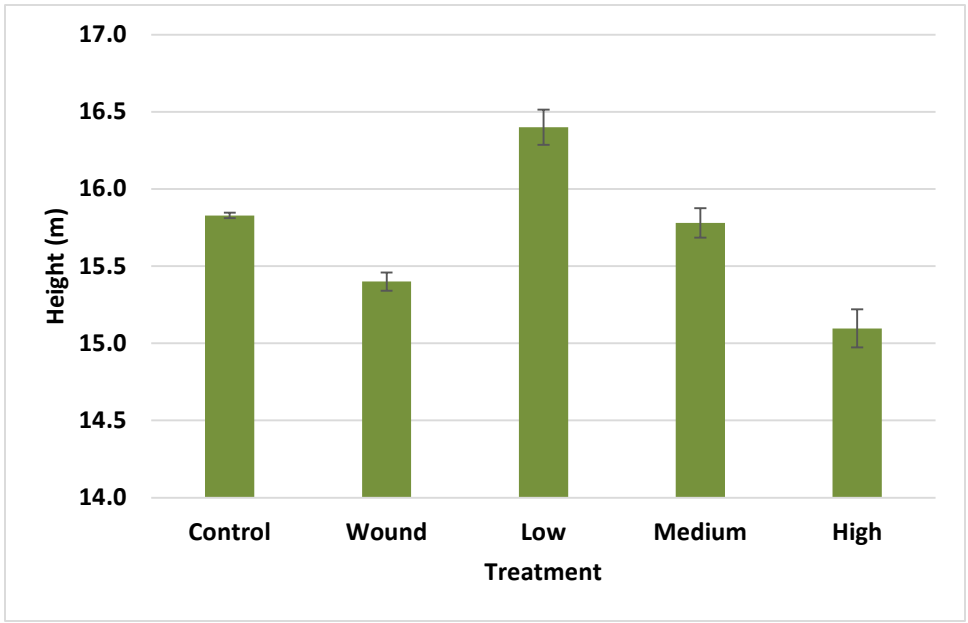


Figure 4: After treatment

Results - Yield

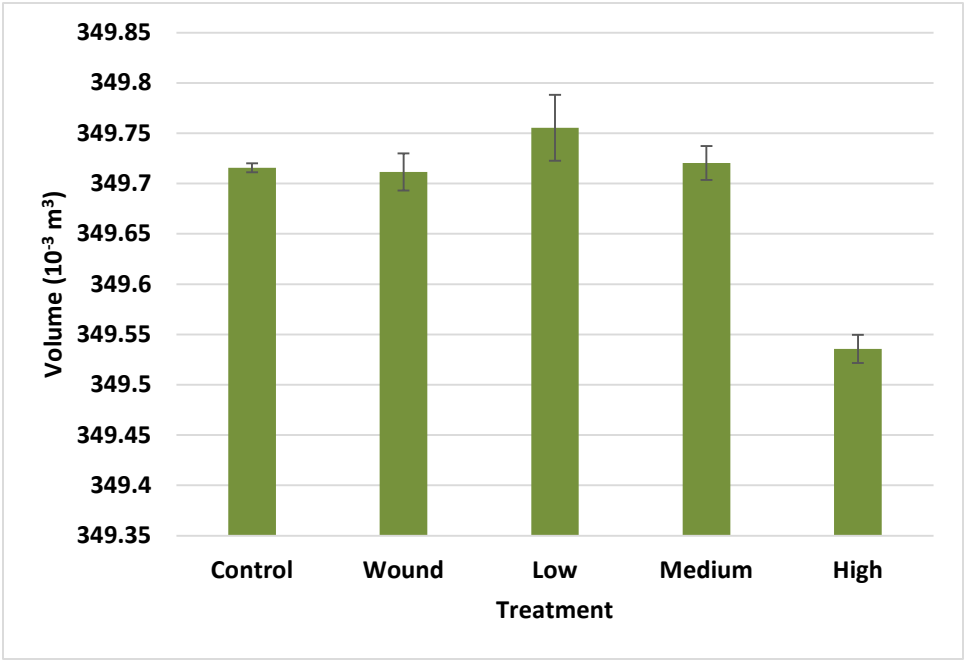


Figure A: Before treatment

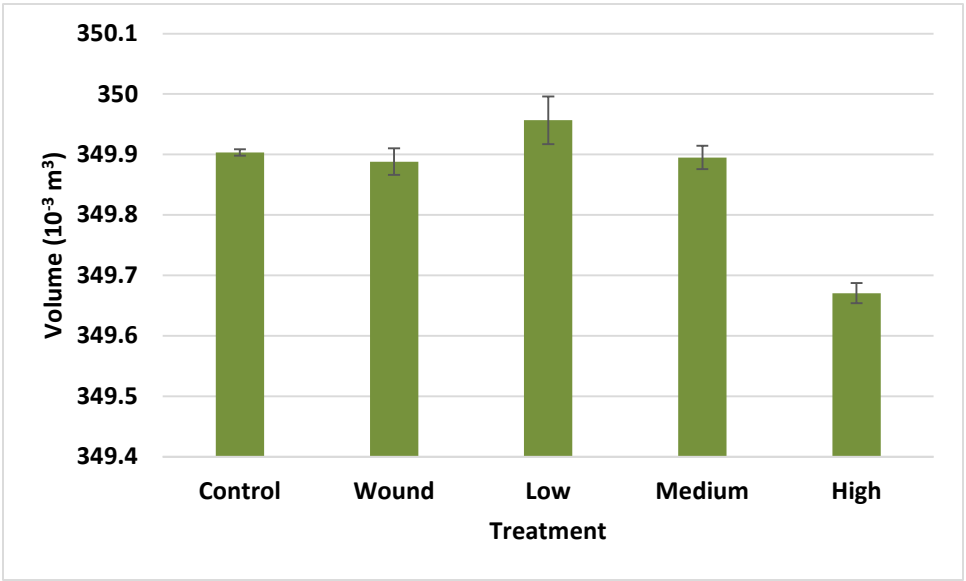
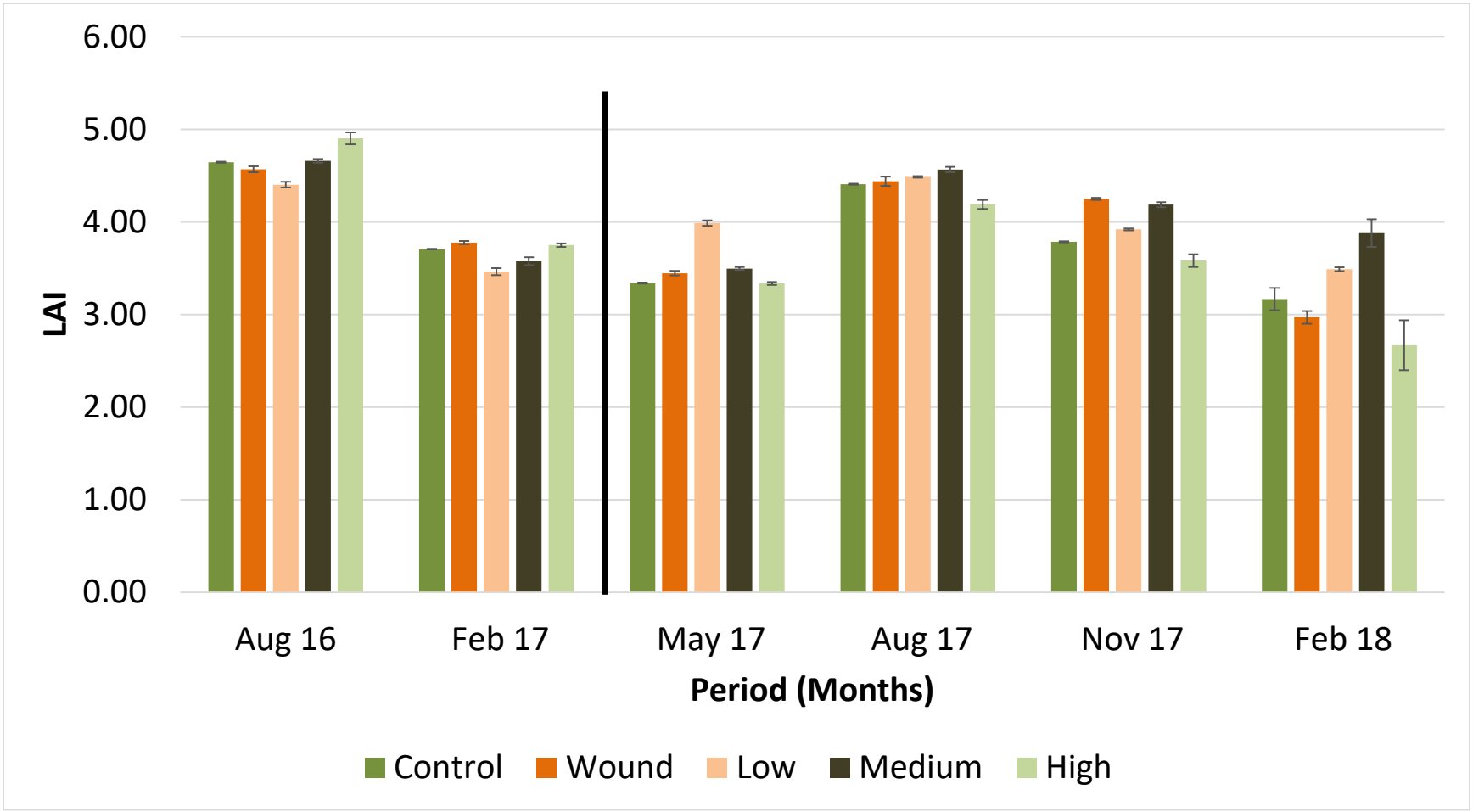


Figure B: After treatment

Results - LAI


6.00
5.00
4.00
3.00
2.00
1.00
0.00
LAI
Aug 16
Feb 17
May 17
Aug 17
Nov 17
Feb 18
Period (Months)
Control
Wound
Low
Medium
High

Conclusions

- The trees selected for low and wound treatments had the highest and lowest DBH respectively
- DBH, RBAI and yield showed a consistent trend and there was no significant difference before and after treatment application
- The average LAI did not differ among the treatments but was affected by the period
- Nonetheless, a year after fungal treatment may be a short period to detect any significant growth reduction
- Unfavorable environmental conditions may have affected *L. terebrantis* growth and development to impact growth and productivity

Acknowledgements

- Luis Mendez
- Dalton Smith
- Andrea Cole
- Shrijana Duwadi
- Jessica Ahl
- Charles Essien
- Pratima Devkota
- Undergraduate Student

AUBURN UNIVERSITY

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

Forest Health Cooperative

Rayonier