Quantifying the impact of pine decline in the southeastern United States

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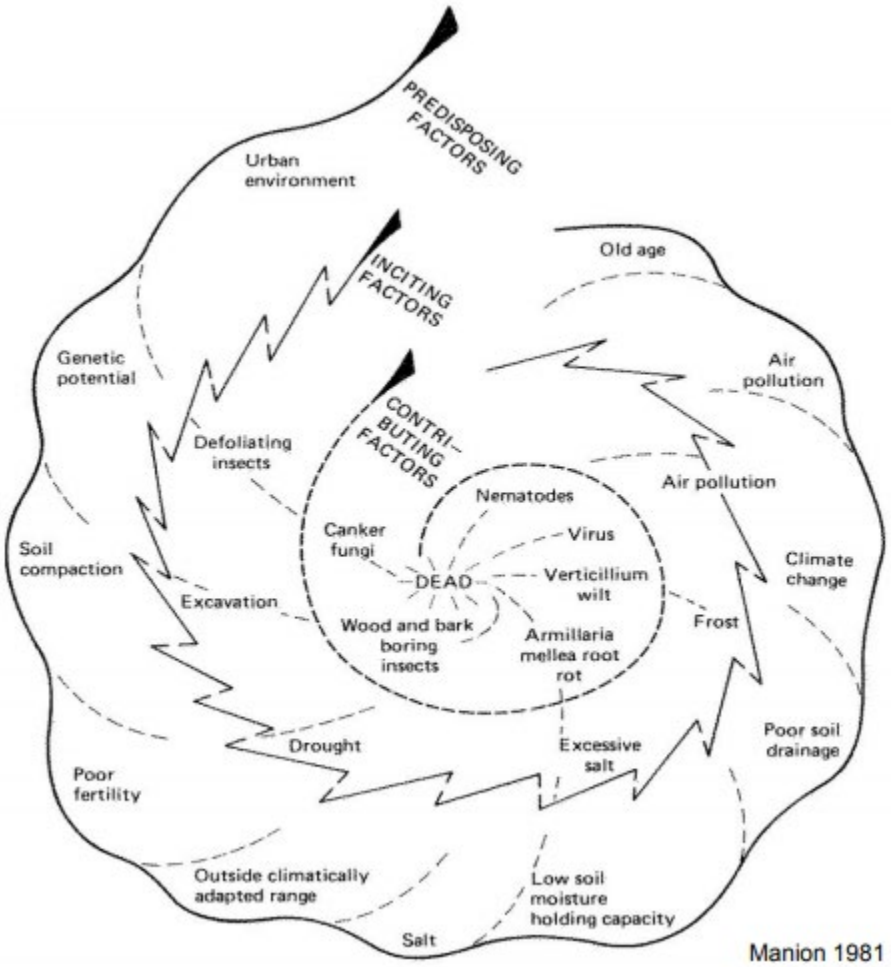
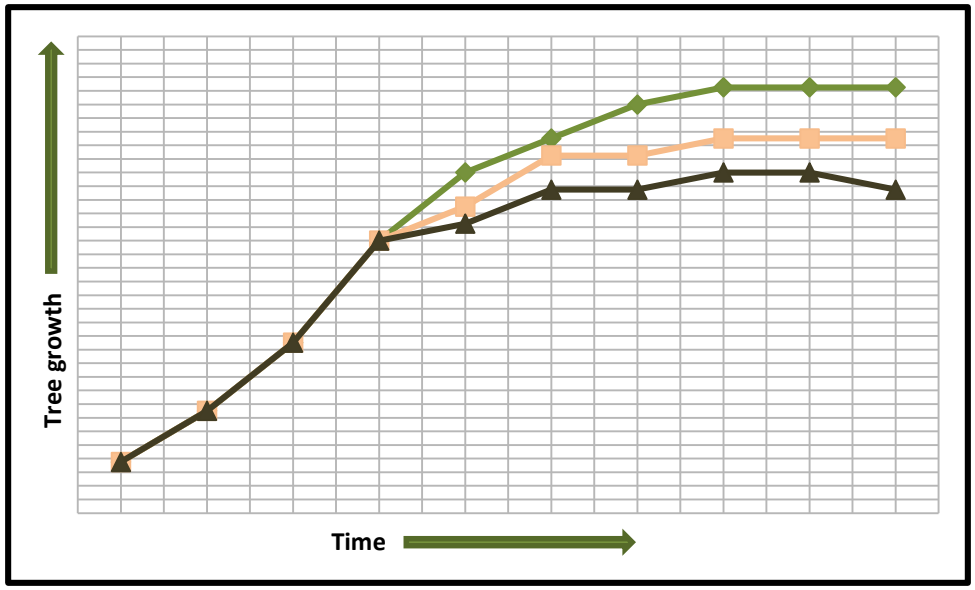
Introduction - Forest decline

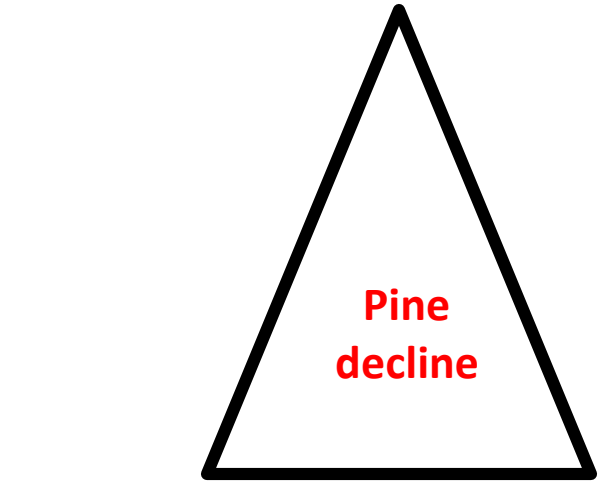


Introduction

- Southern pine decline
- *Leptographium terebrantis*
- Forest productivity



Pathogen: Ophiostomatoid fungi



Long term goal

Quantify the impact of pine decline on forest productivity so as to enable forest managers to make accurate predictions and appropriate management decisions about commercial stands that are affected by certain pest and pathogens

Objectives

- Quantify the impact of fungal root infection on tree and plantation productivity and investigate early detection potential of a subset of variables
- Determine the threshold level of fungal root infection required to cause growth reductions and mortality of plantation trees
- Examine the role of fungal root infection and its interaction with the water, nutrient, and carbon relations of plantation trees to determine the cause(s) of tree mortality and growth losses by the pine decline process
- Determine the impact of fungal root infection on the behavior of bark beetles and other pests within affected stands

Experimental approach

Site characteristics

Tube Installation


4x4

Experimental approach

Weather station

Tree and plot growth

Inoculations

- Physiological measurements
- Fine root growth
- Soil microbial biomass and nutrition
- Insect diversity

Key milestone

- Devkota, P., Mensah, J. K., Nadel, R. L., Matusick, G., & Eckhardt, L. G. (2019). *Pinus taeda* L. response to differential inoculum density of Leptographium terebrantis colonized toothpicks. *Forest Pathology*, 49 (1), e12474

- Mensah, J. K., Sayer, M. A. S., Nadel, R. L., Matusick, G., & Eckhardt, L. G. (2020). Physiological response of *Pinus taeda* L. trees to stem inoculation with *Leptographium terebrantis*. *Trees*, 34:869-880

Key milestone

- Ahl, J.B., Eckhardt, L. G. (Submitted) Identifying fungal spores on the pine bark beetle with hyperspectral interferometry. Microscope Research and Technique – Under Review

- Mensah, J. K., Sayer, M. A. S., Nadel, R. L., Matusick, G., & Eckhardt, L. G. (In preparation). *Leptographium terebrantis* inoculation and associated crown symptoms and tree mortality in *Pinus taeda*

- Mensah, J. K., Sayer, M. A. S., Nadel, R. L., Matusick, G., & Eckhardt, L. G. (In preparation). Effect of *Leptographium terebrantis* and drought on foliage, new root dynamics and stemwood growth in plantation *Pinus taeda* L.

Key milestone

- Two master's degree thesis completed:

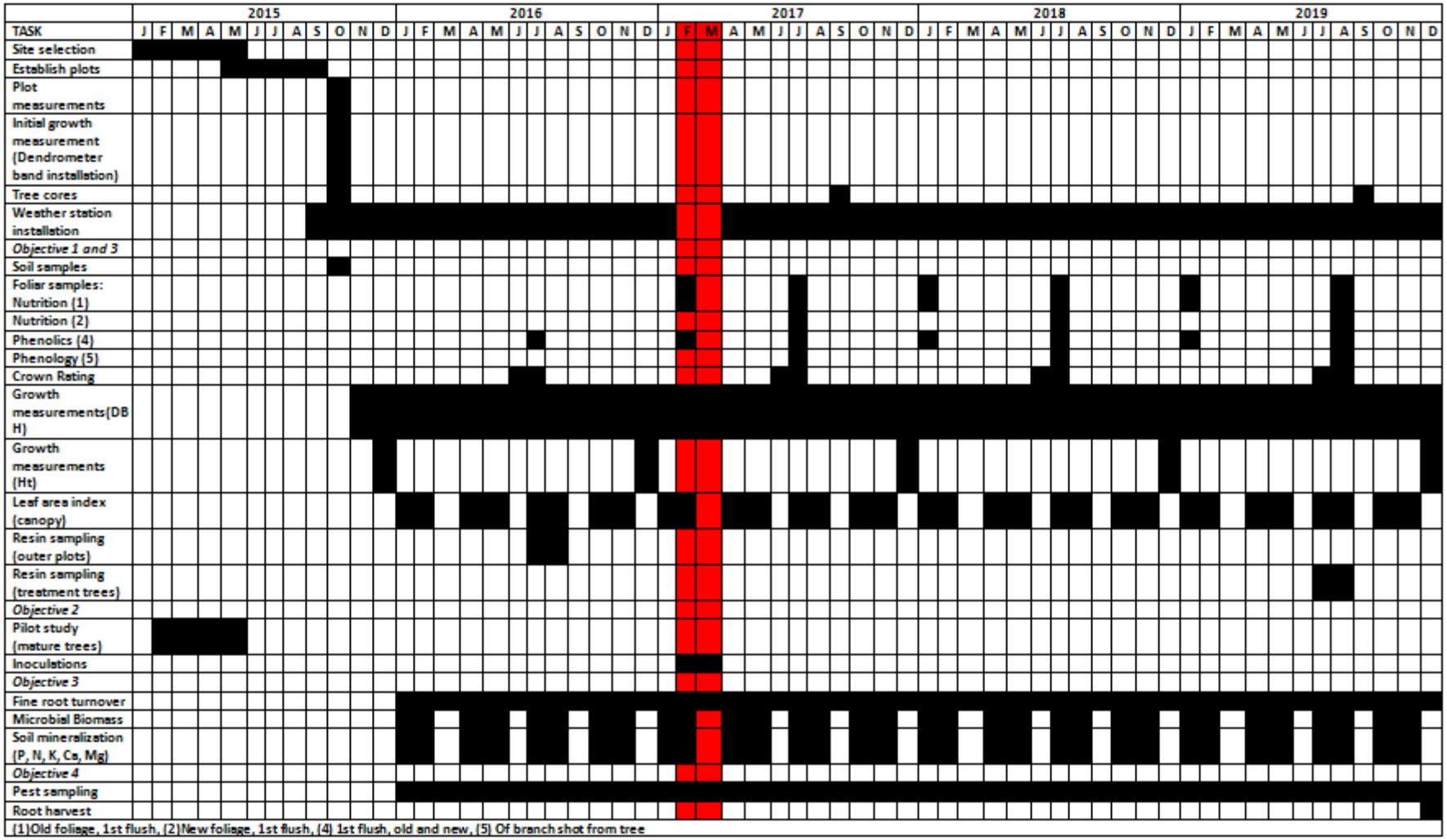
  Impact of Tree Inoculation by *Leptographium terebrantis* on Soil Microbial Communities in Commercial Loblolly Pine Stand

  Ophiostomatoid Fungal Infection and Insect Diversity in a Mature Loblolly Pine Stand

- One PhD dissertation completed:

  Influence of *Leptographium terebrantis* S.J. Barras and T.J. Perry on *Pinus taeda* L. physiology, growth and productivity

Timelines


2015
2016
2017
2018
2019
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TASK
Site selection
Establish plots
Plot measurements
Initial growth measurement (Dendrometer band installation)
Tree cores
Weather station installation
Objective 1 and 3
Soil samples
Foliar samples: Nutrition (1)
Nutrition (2)
Phenolics (4)
Phenology (5)
Crown Rating
Growth measurements(DBH)
Growth measurements (Ht)
Leaf area index (canopy)
Resin sampling (outer plots)
Resin sampling (treatment trees)
Objective 2
Pilot study (mature trees)
Inoculations
Objective 3
Fine root turnover
Microbial Biomass
Soil mineralization (P, N, K, Ca, Mg)
Objective 4
Pest sampling
Root harvest
(1)Old foliage, 1st flush, (2)New foliage, 1st flush, (4) 1st flush, old and new, (5) Of branch shot from tree

Upcoming activities

- Soil Chemical analysis
- Microbial analysis

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