Santa Cruz Mountains Post-Fire Redwood Defect Study

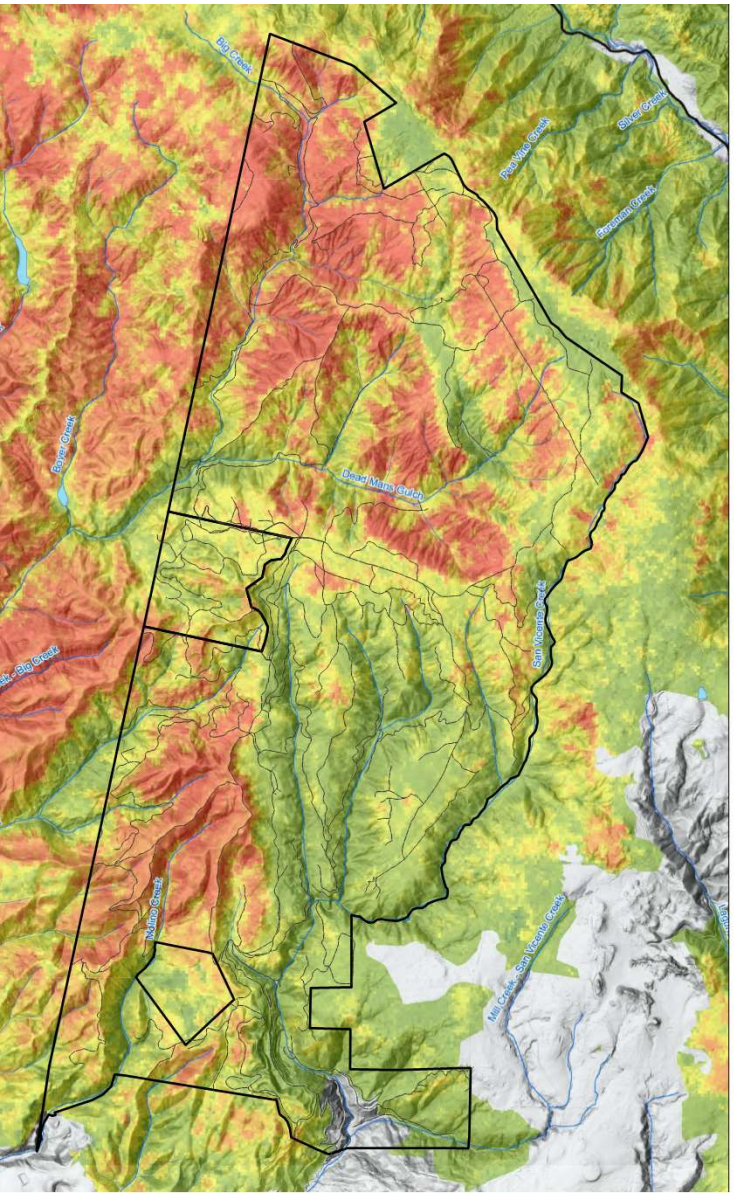
Nadia Hamey, Hamey Woods

CZU Lightning Complex Fire

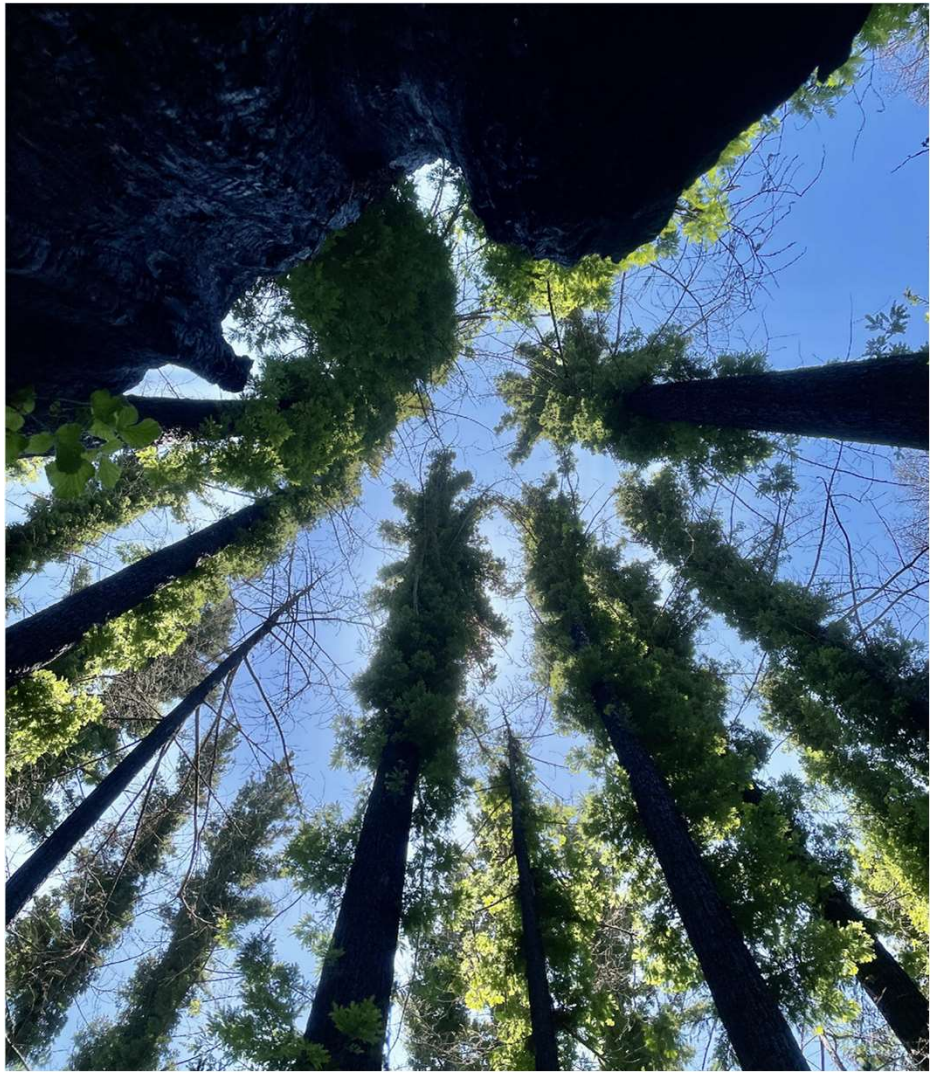
August 2020

CZU Lightning Complex Fire

- August 2020
- 11,000 lightning strikes in Santa Cruz Mountains became one massive fire
- 86,509 acres burned
- 911 homes destroyed



POST-FIRE CONDITIONS ON THE GROUND



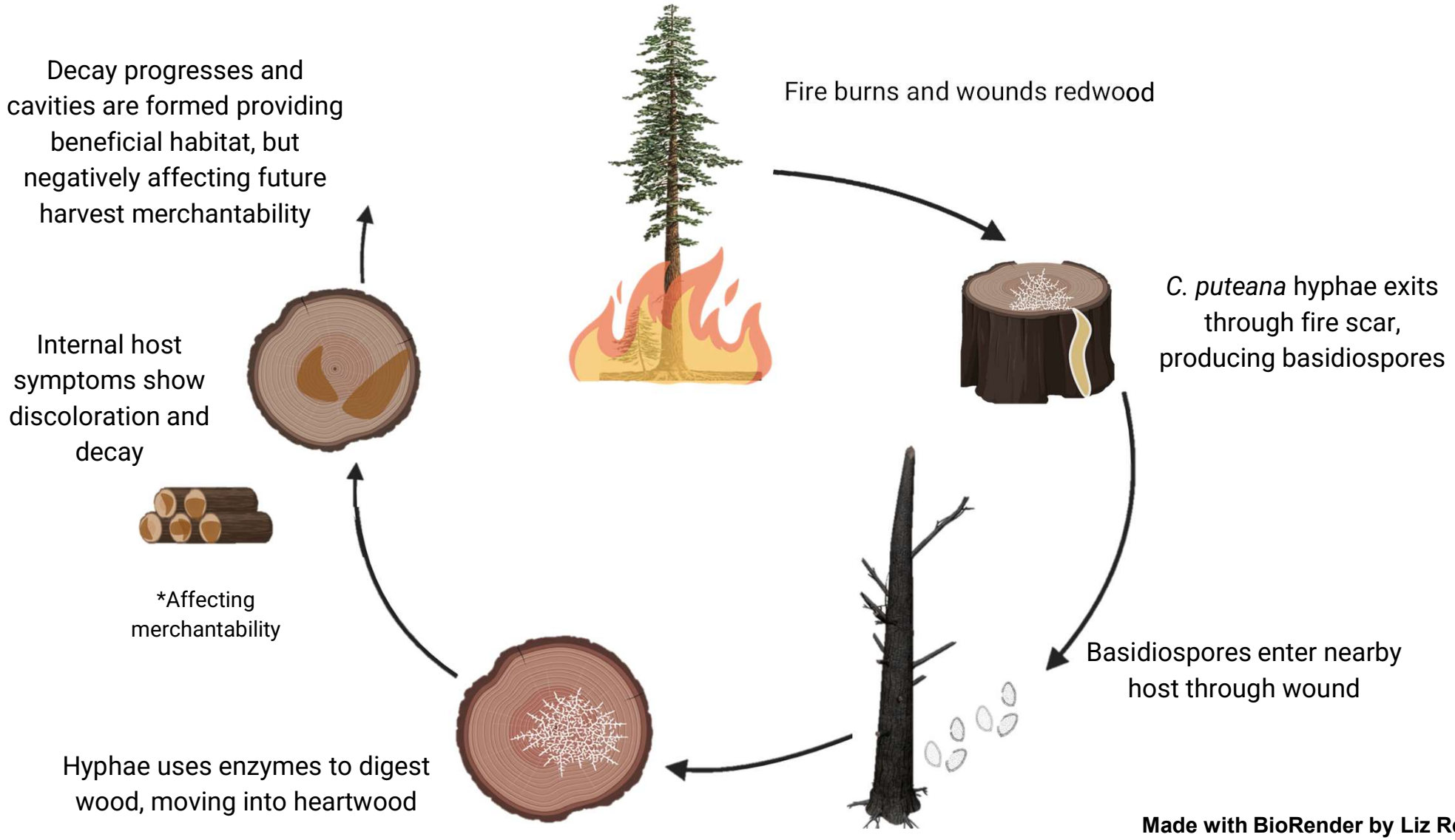

Big Creek Lumber

Post-Fire Effects

- Crown Scorch/Crown Torch
- Pre-Fire Live Canopy Retained
- Scorch Height
- Torch Height
- Maximum Height of Bole Char
- Sprouting on Branches and/or Bole
- Sprouts at Base
- Area and Height of wet rot *C. puteana*
- Dead Top? Root damage?

Coniophora puteana, ‘wet rot’

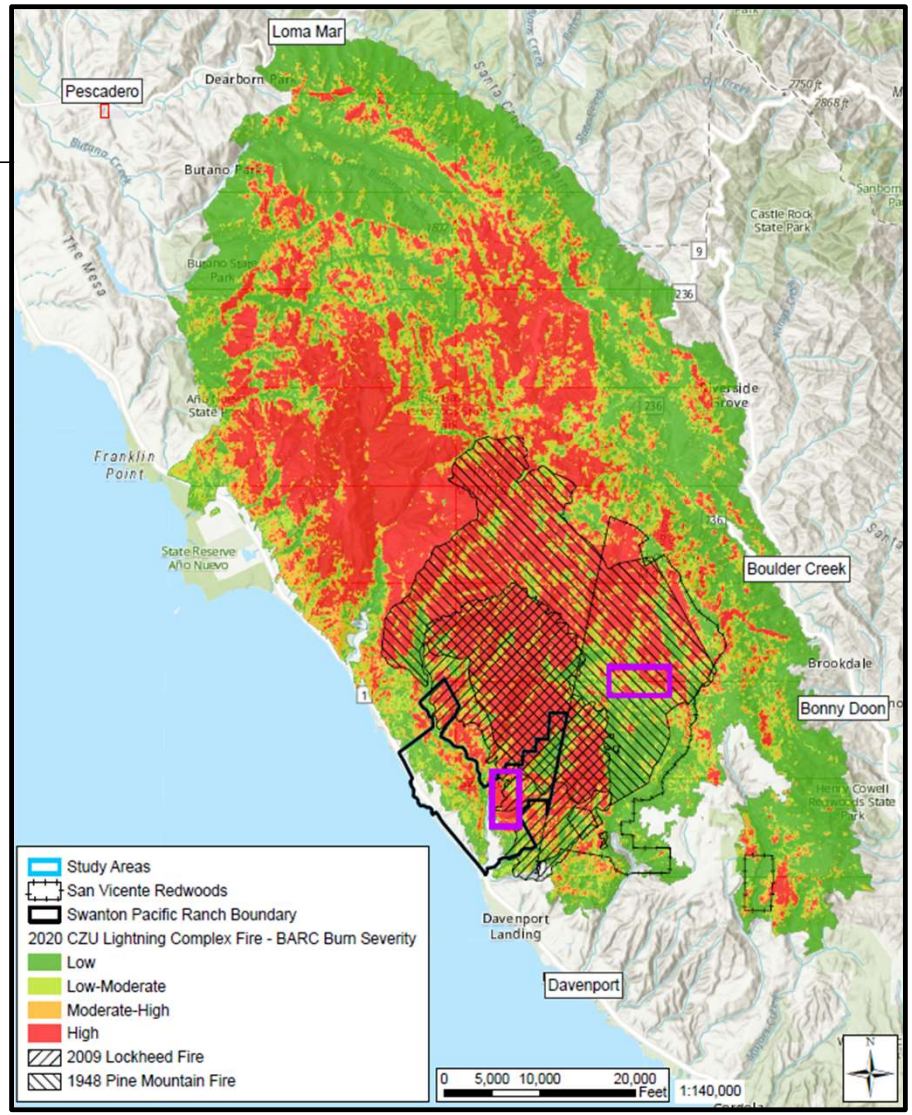
- Brown wet rot at base of stem
- Needs high water content (50-60%)
- **Signs:** No external indicators unless host is injured
  - Brown–black Mycelial cords
  - Cream–brown center bounded by white margins



Made with BioRender by Liz Rennie
Select images: National Park Service

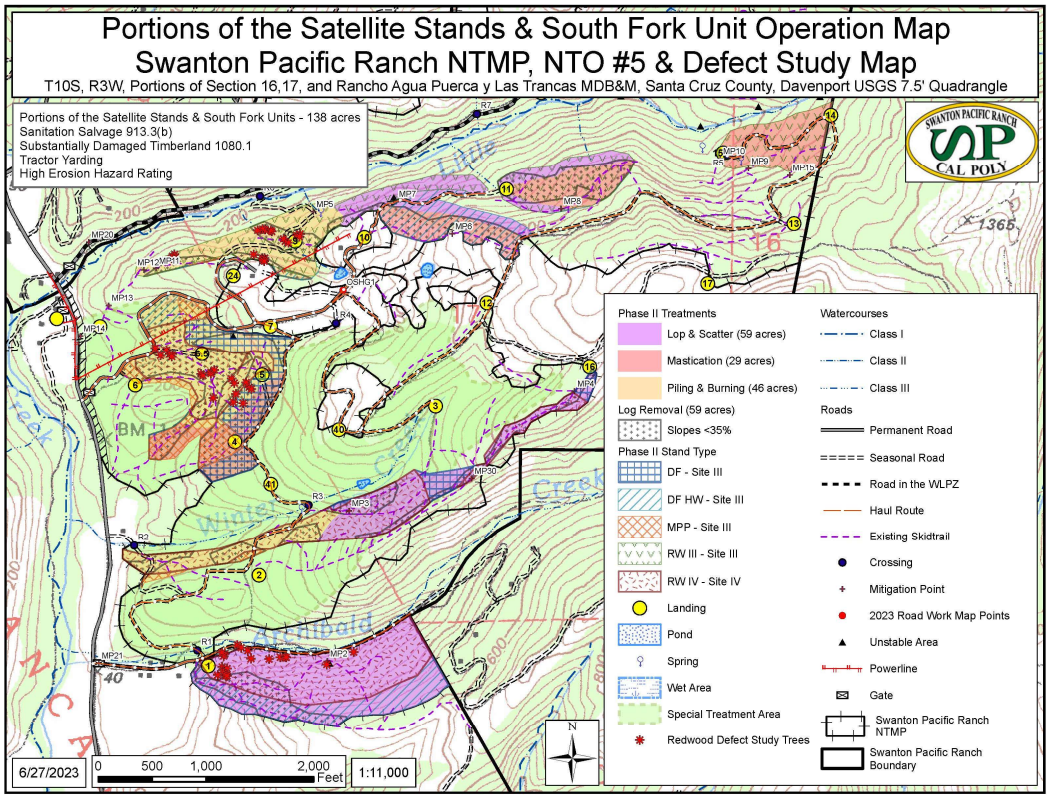
Study Area

- Cal Poly's Swanton Pacific Ranch
- San Vicente Redwoods



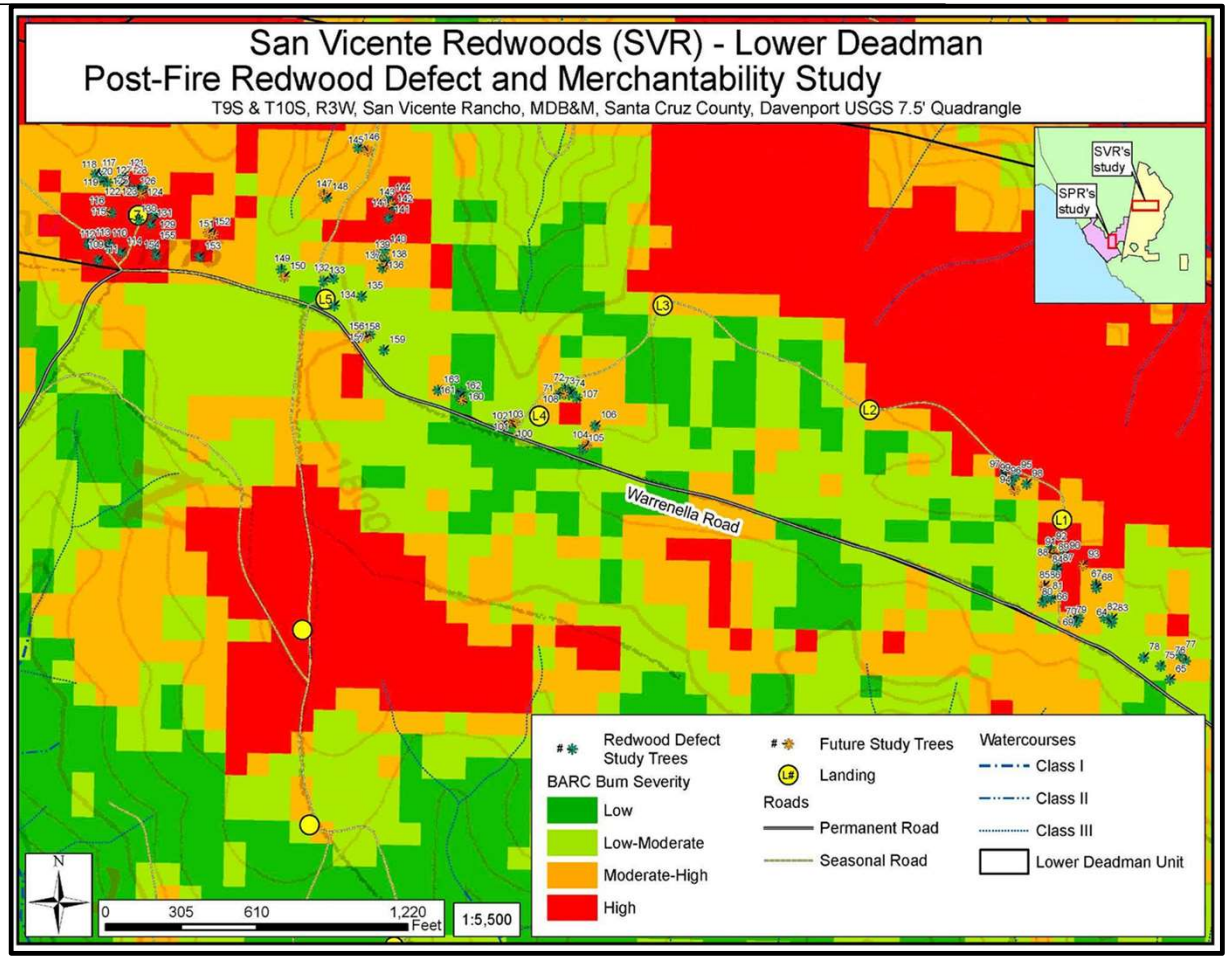
Swanton Pacific Ranch

- Swanton Pacific Ranch NTMP, #1-07NTMP-020-SCR, NTO #5
  - 60 trees tagged and assessed for burn damage



San Vicente Redwoods

- Lower Deadman Emergency Notice, #1-23-EM-0085 SCR
- 100 trees
  - 75 trees harvested
  - 25 trees retained



Visual data collection

- Crown Scorch/Crown Torch
- Pre-Fire Live Canopy Retained
- Scorch Height
- Torch Height
- Maximum Height of Bole Char
- Sprouting on Branches and/or Bole
- Sprouts at Base
- Area and Height of wet rot *C. puteana*
- Dead Top? Root damage?

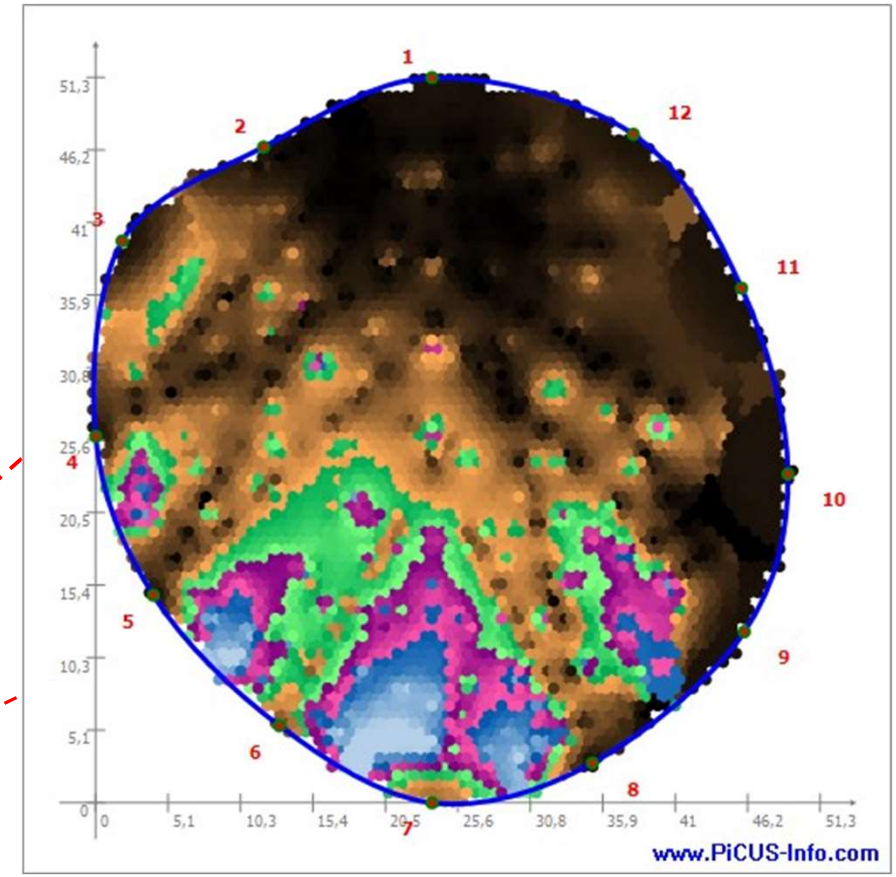
Cambium checks

North
Dead,
Fungus

West
Alive,
Fungus

East
Dead,
No fungus

South
Alive,
No fungus



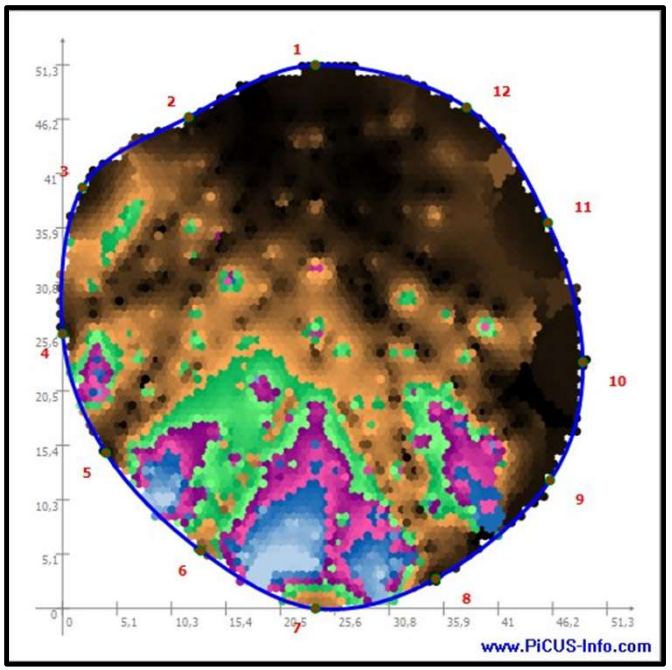
= Decay

= Healthy

= Severe Decay

Sonic tomography

- Noninvasive technology, PiCUS 3 Sonic Tomograph
- Structural integrity at 1m from base
- Measures velocity of sound
- Sound travels faster in solid wood



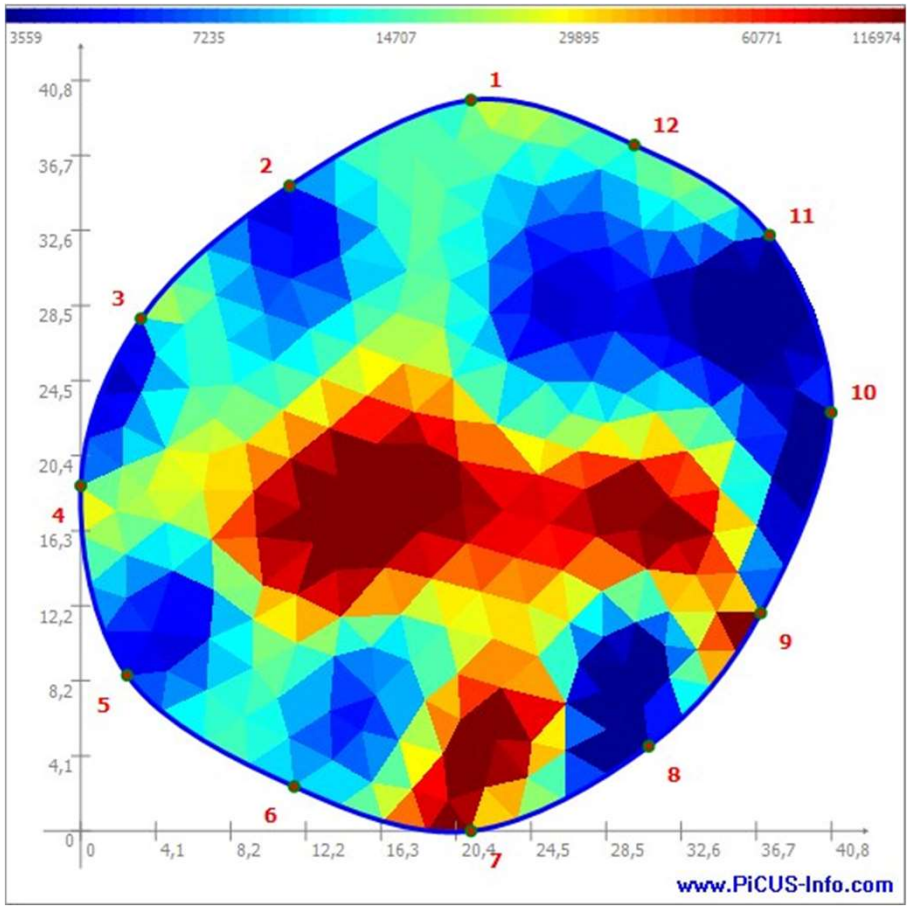
= Decay

= Healthy

= Severe Decay

Electrical impedance

- Noninvasive technology, PiCUS treetronic
- Scan shows the water content of the same cross section
- Develop electrical conductivity ‘map’



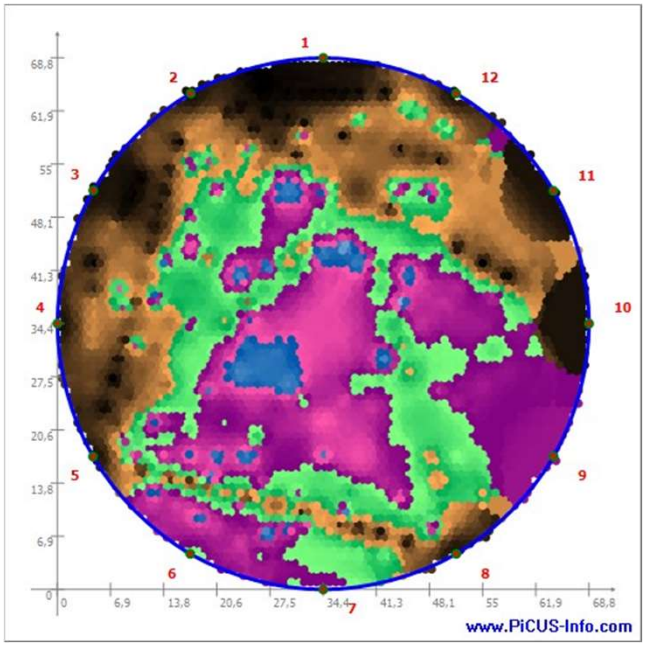
= Moist

= Dry

= Very Moist

= Very Dry

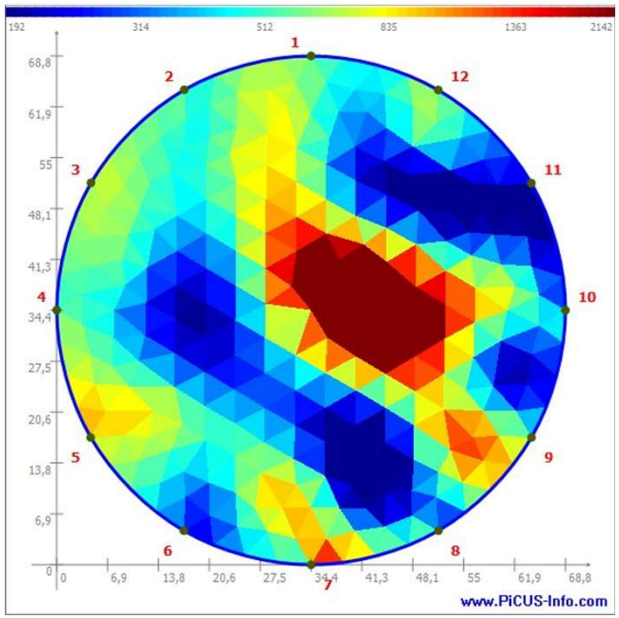
Sonic Tomography



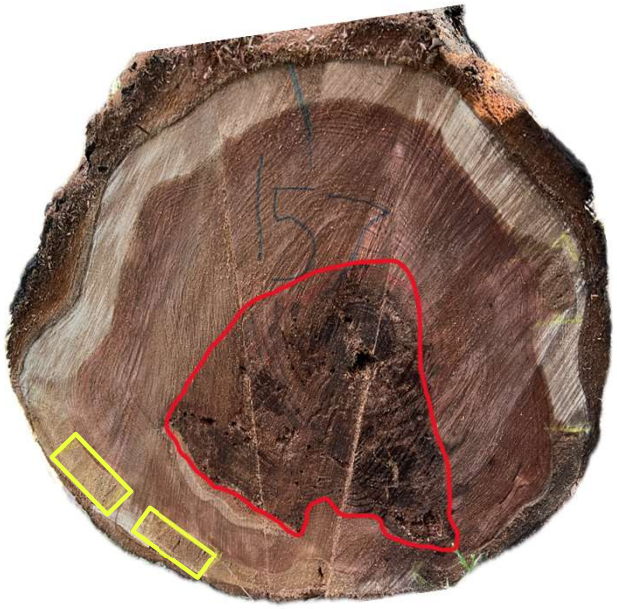
62% Decay

35% Severe Decay

Electrical Impedance



Cross-section



= Sapwood Rot

= Heartwood Rot

Research questions

1) *How much decay is out there? Can we predict the level of defect caused by a fire by looking at post-fire effects of Coast redwood?*

2) *Is sonic tomography and electrical impedance an accurate method to detect decay and water content when compared to a cross section of Coast redwood?*

Logging

Tree #64

Alive/Fungus

Dead/No Fungus

Alive/No Fungus

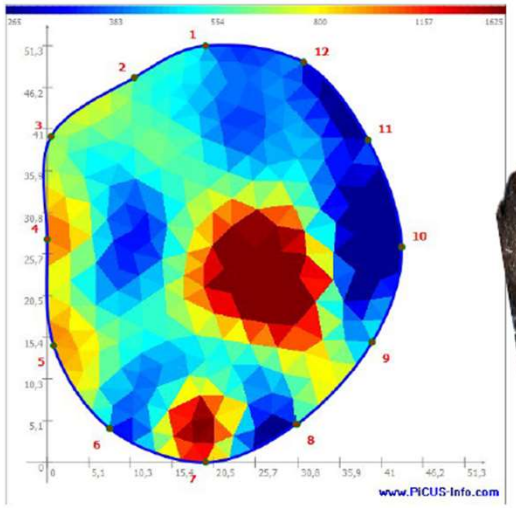
Alive/No Fungus

Full Tree and Fungus Photos

- ~64 sq. in of white rot
- ¼ quadrants of fungus
- ¼ quadrants of dead cambium
- Branch & Bole Sprouting
- Low-Moderate Burn Severity Zone

Cambium Checks at North, East, South, and West Quadrants

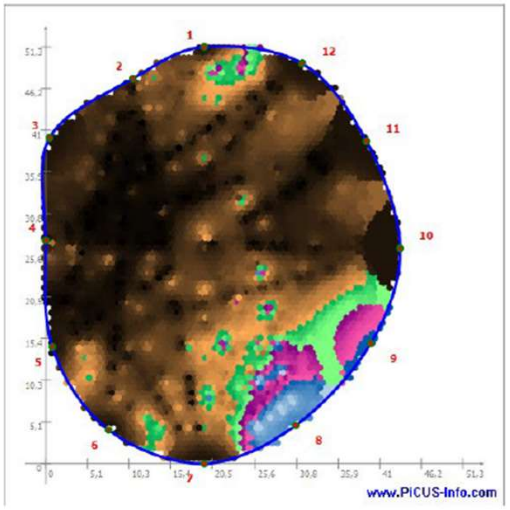
Electrical Impedance Tomography Scan



Tree #64

Log #1- Big End:

Sonic Tomography Scan



I = North [ ] = Sapwood rot

Log #1 Small End/ Log #2 Big End

Log #2 Small End

Log #1 Big End

- 17" Inside Bark (IB) before deductions
- 1-2" of sapwood rot around 45% circumference to the edge of heartwood
- Yellowing sapwood

Log #1 Small End/ Log #2 Big End

- 11" IB
- Healthy sapwood and heartwood

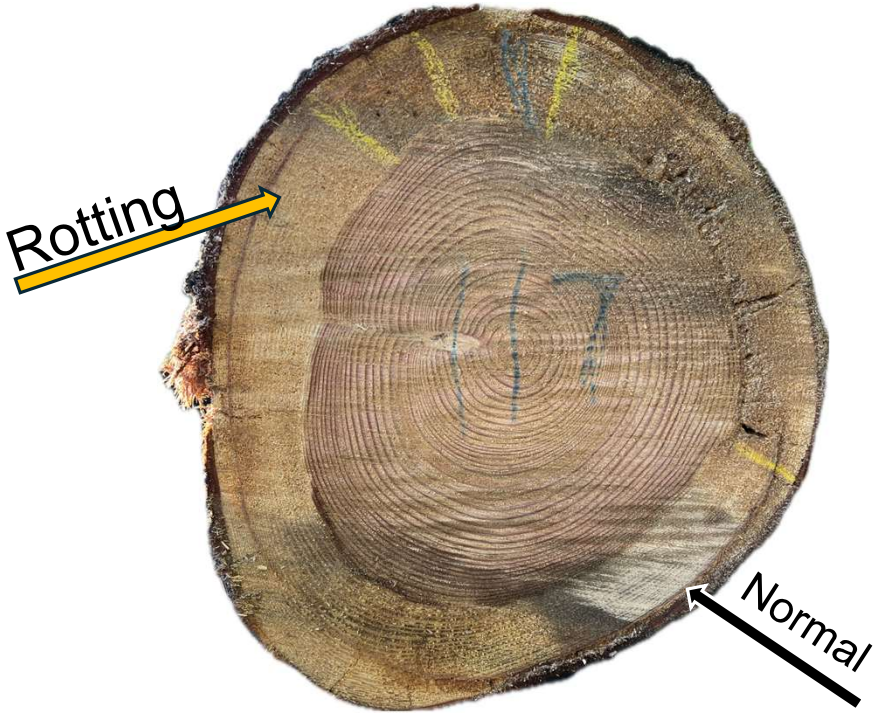
Log #2 Small End

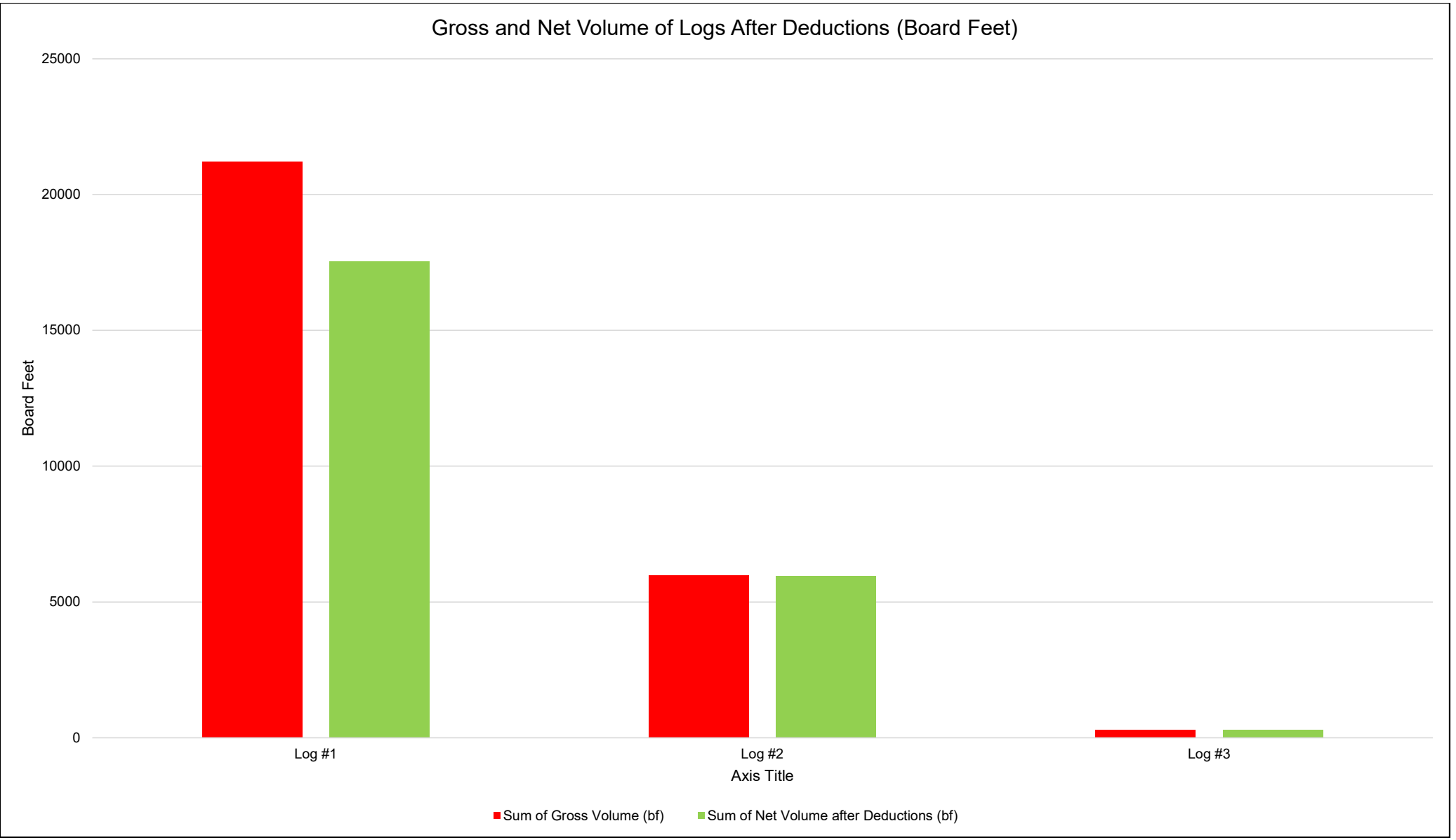
- 9" IB
- Healthy sapwood and heartwood
- Slight mechanical damage

	Volume	Volume After Deductions
Log #1	220 bf	110 bf
Log #2	80 bf	80 bf

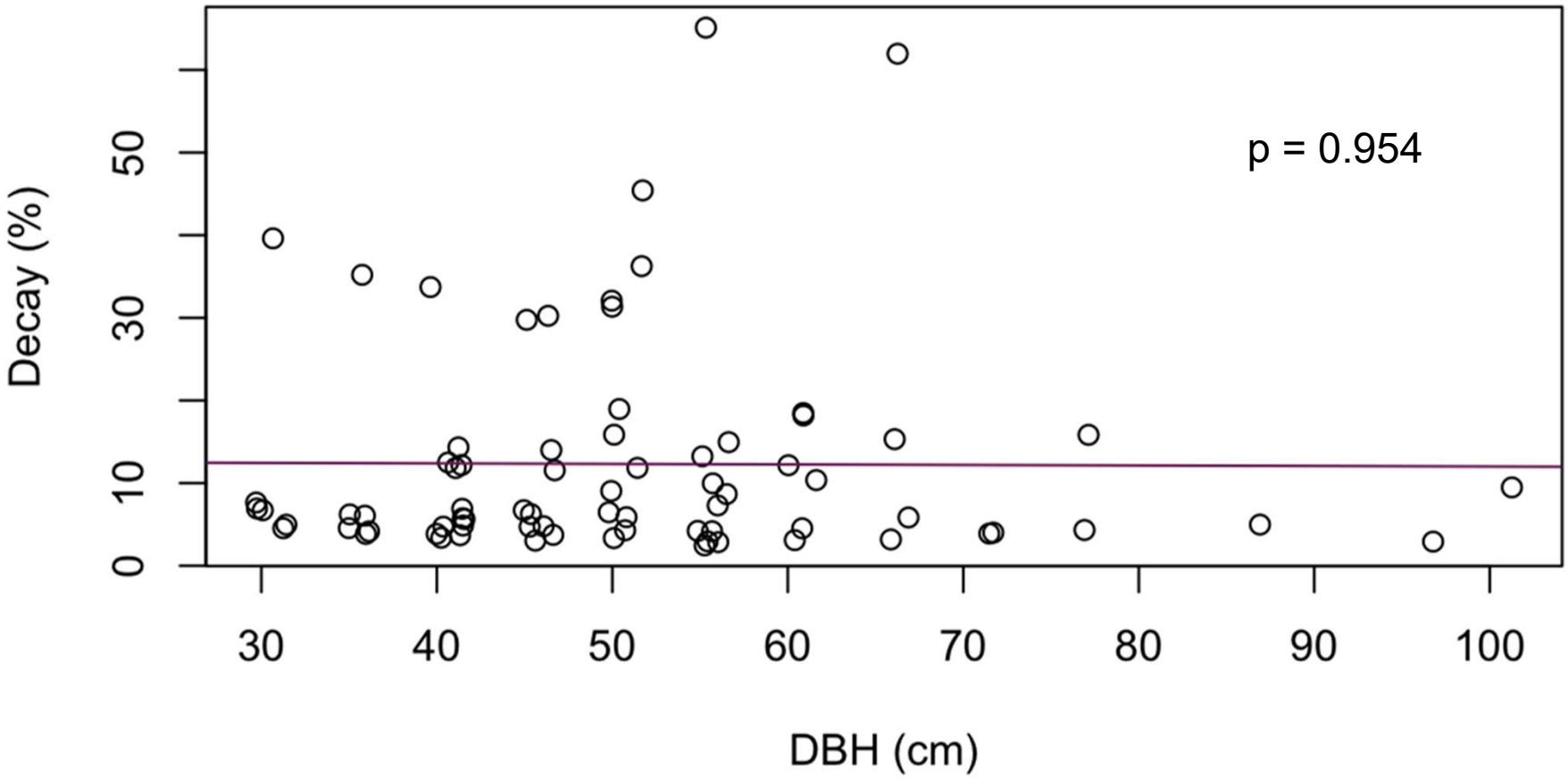
Preliminary Results

- Majority of logs showed discoloration of the sapwood
- The big end of the first log had an average circumference decay of 34%
- The average % volume deduction in the first log was 21%

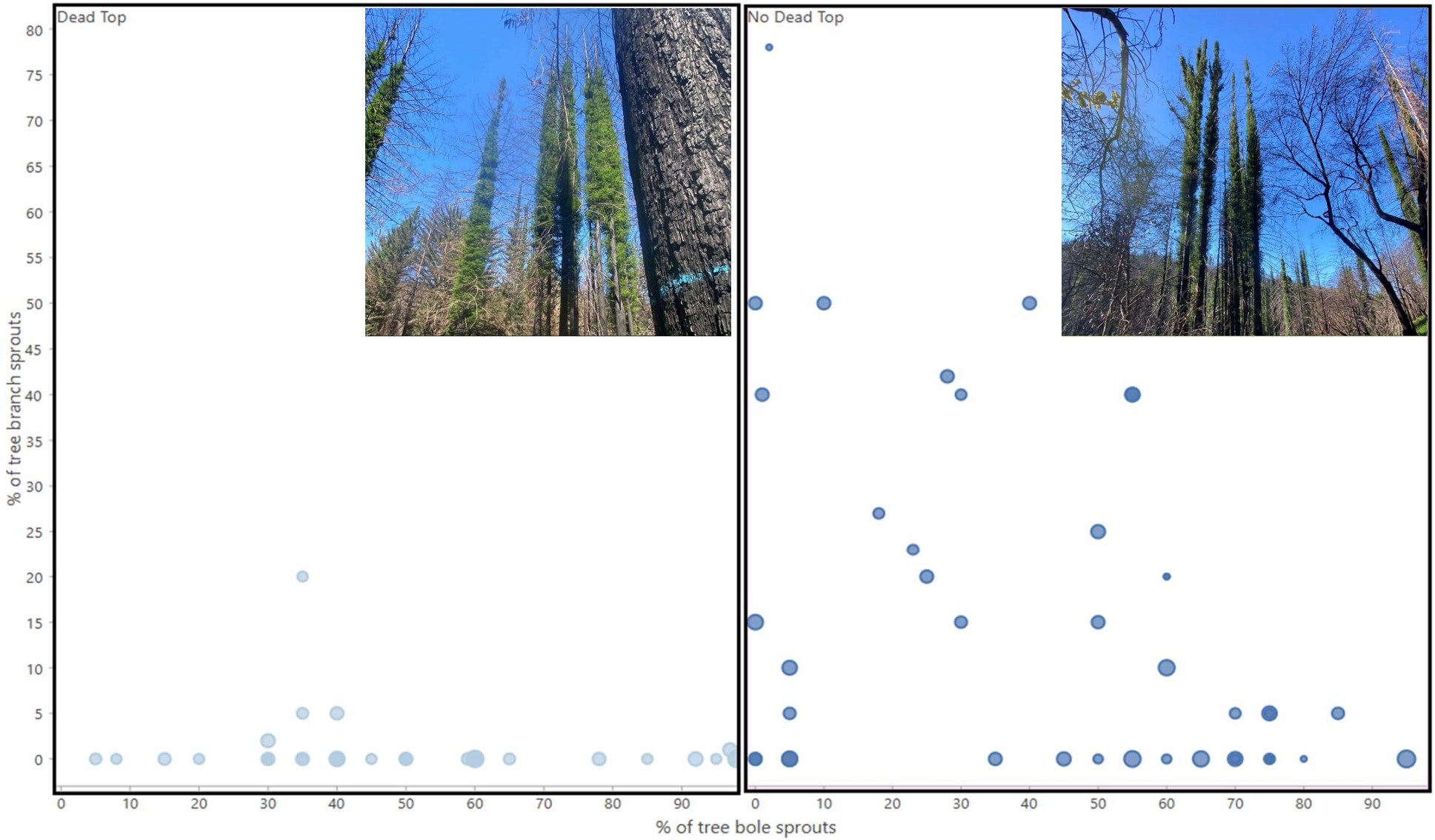


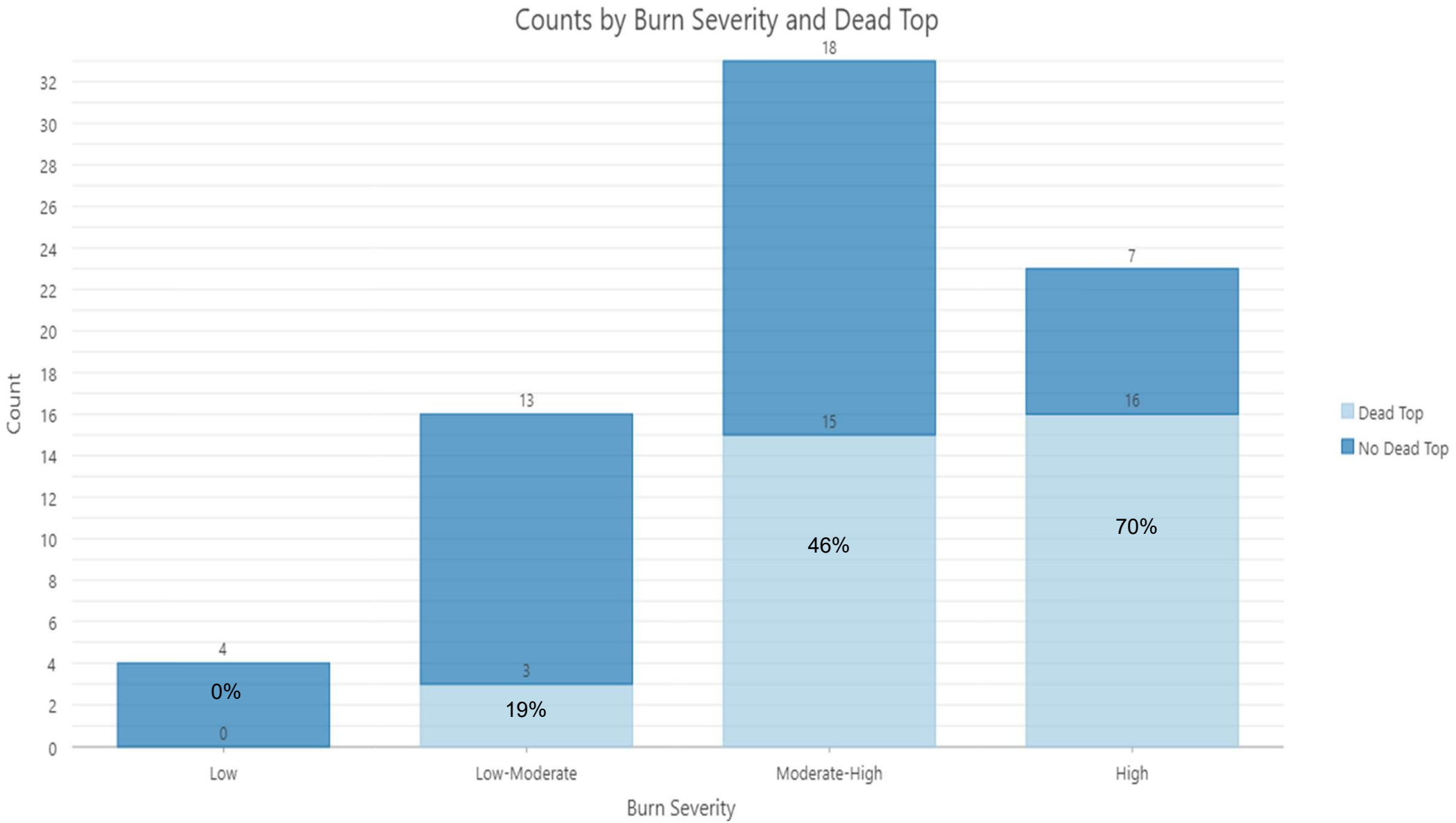

Gross and Net Volume of Logs After Deductions (Board Feet)
25000
20000
15000
10000
5000
0
Board Feet
Log #1
Log #2
Log #3
Axis Title
Sum of Gross Volume (bf)
Sum of Net Volume after Deductions (bf)

Results: decay (%) vs. DBH

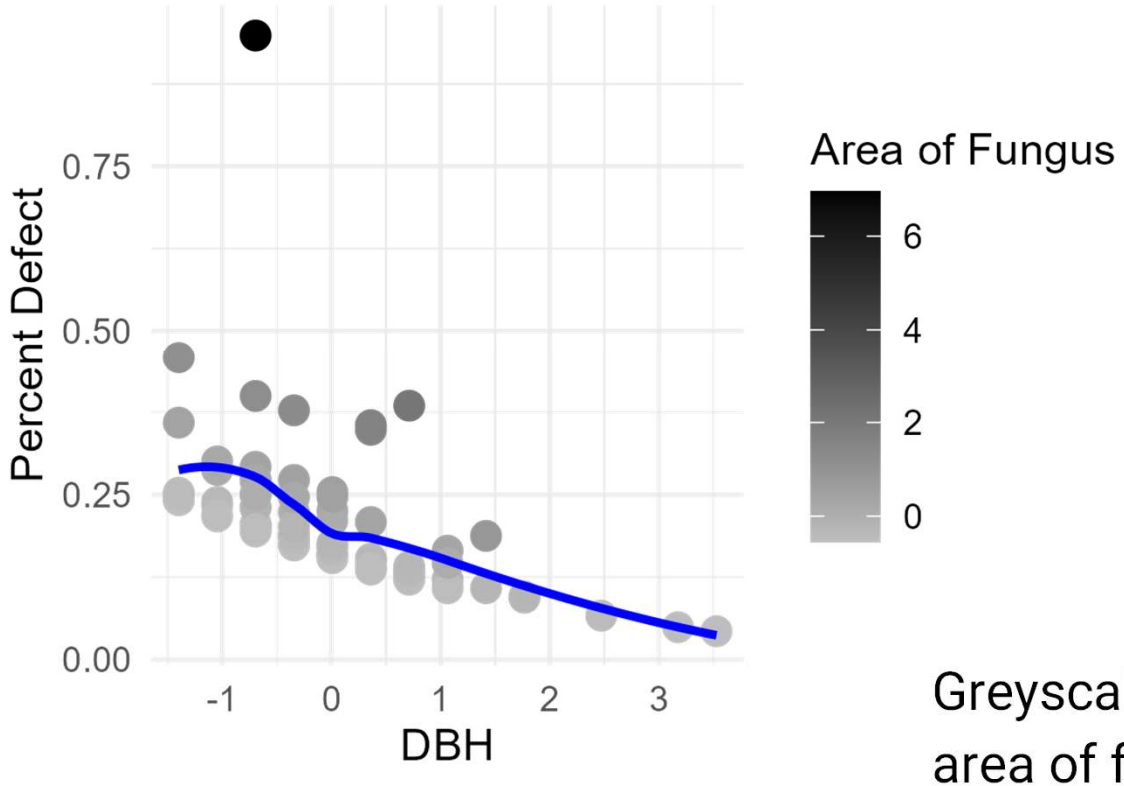


Relationship between % of tree bole sprouts and % of tree branch sprouts by Dead Top




Counts by Burn Severity and Dead Top
Count
Burn Severity
Low
Low-Moderate
Moderate-High
High
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
4
0
0%
13
3
19%
18
15
46%
7
16
70%
Dead Top
No Dead Top

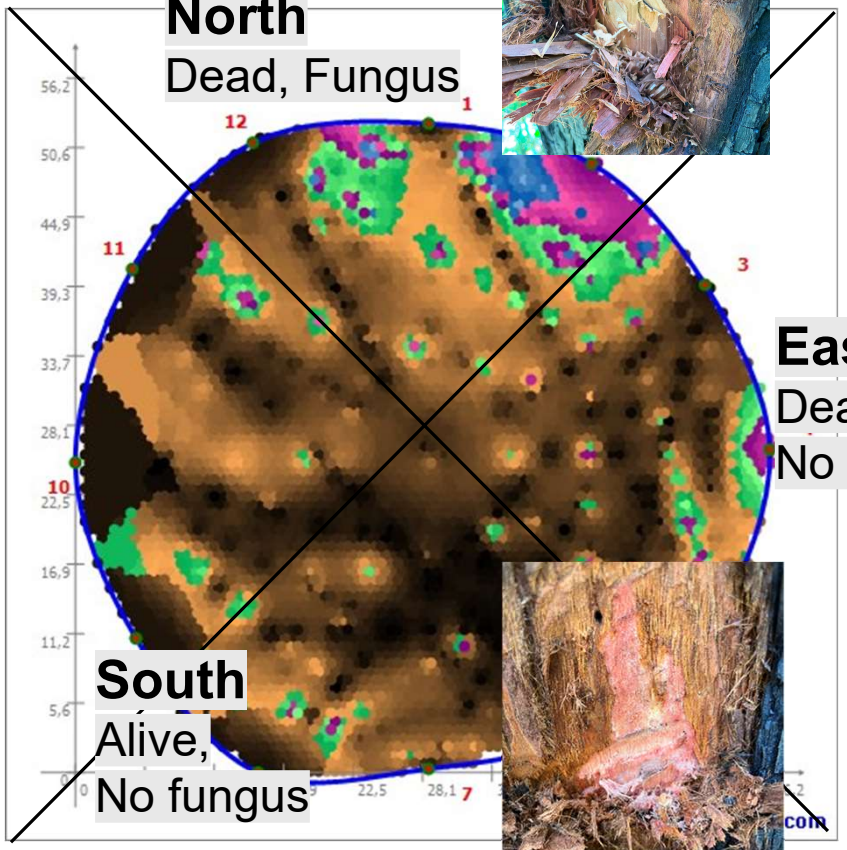
Percent defect across a scaled gradient of DBH



Greyscale indicates surface area of fungus

Cambium check

West
Alive,
Fungus

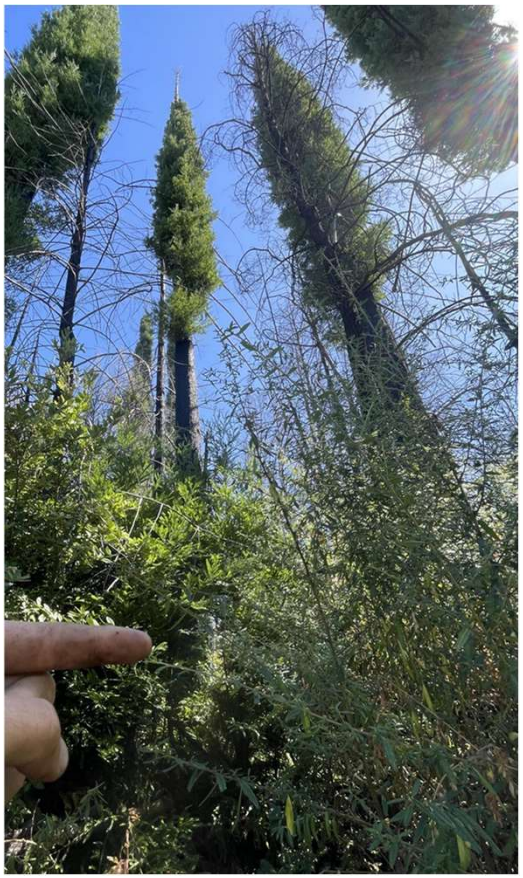


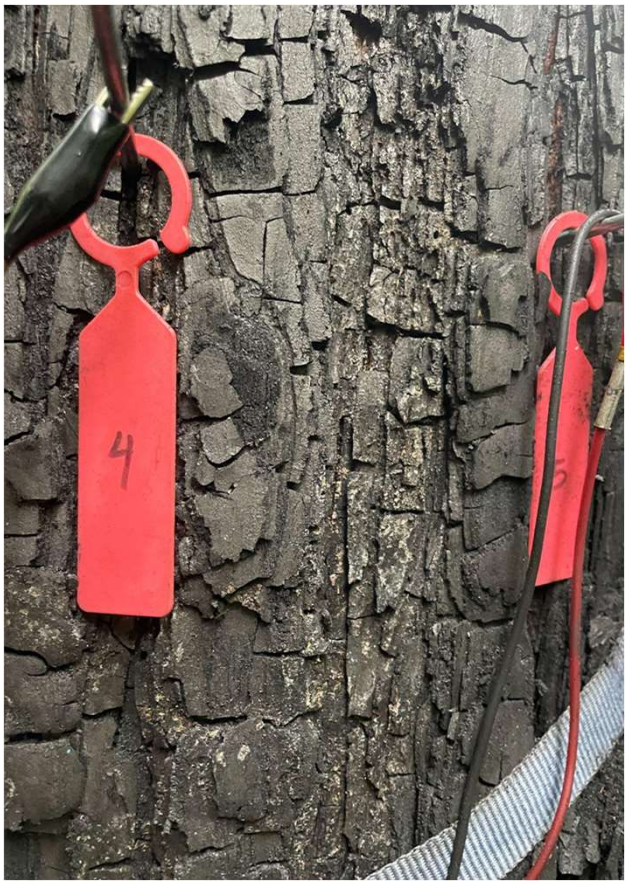
North
Dead, Fungus

East
Dead,
No fungus

South
Alive,
No fungus

Data collection for the future





Acknowledgments

Board Of Forestry – Effectiveness Monitoring Committee

Hamey Woods
Nadia Hamey
Clare Lacy
Kristy Swor
Spike Campbell (UC Berkeley)
Lex Bernal (UC Berkeley)

Landowners
Peninsula Open Space Trust
Sempervirens Fund
California Polytechnic State University-San Luis Obispo

UC Santa Cruz
Dr. Gregory Gilbert
Liz Rennie
Madison Evanow
Kirra McColl
Klaire Richardson

Contractors
Santa Cruz Timber Co.
Ventana Forestry
Dan Guffie
Brett Lambert
Louie Fusari (Big Creek)