Heterobasidion root disease emergence and impacts over fifty years in montane California forests: A comparison of three host-pathogen systems.

Richard Cobb – Cal Poly SLO

With contributions from Alex Flores, Patricia Maloney, Matteo Garbelotto, Susan Frankel, Heather Mehl, Dave Rizzo, Lisa Bentley, Garey Slaughter

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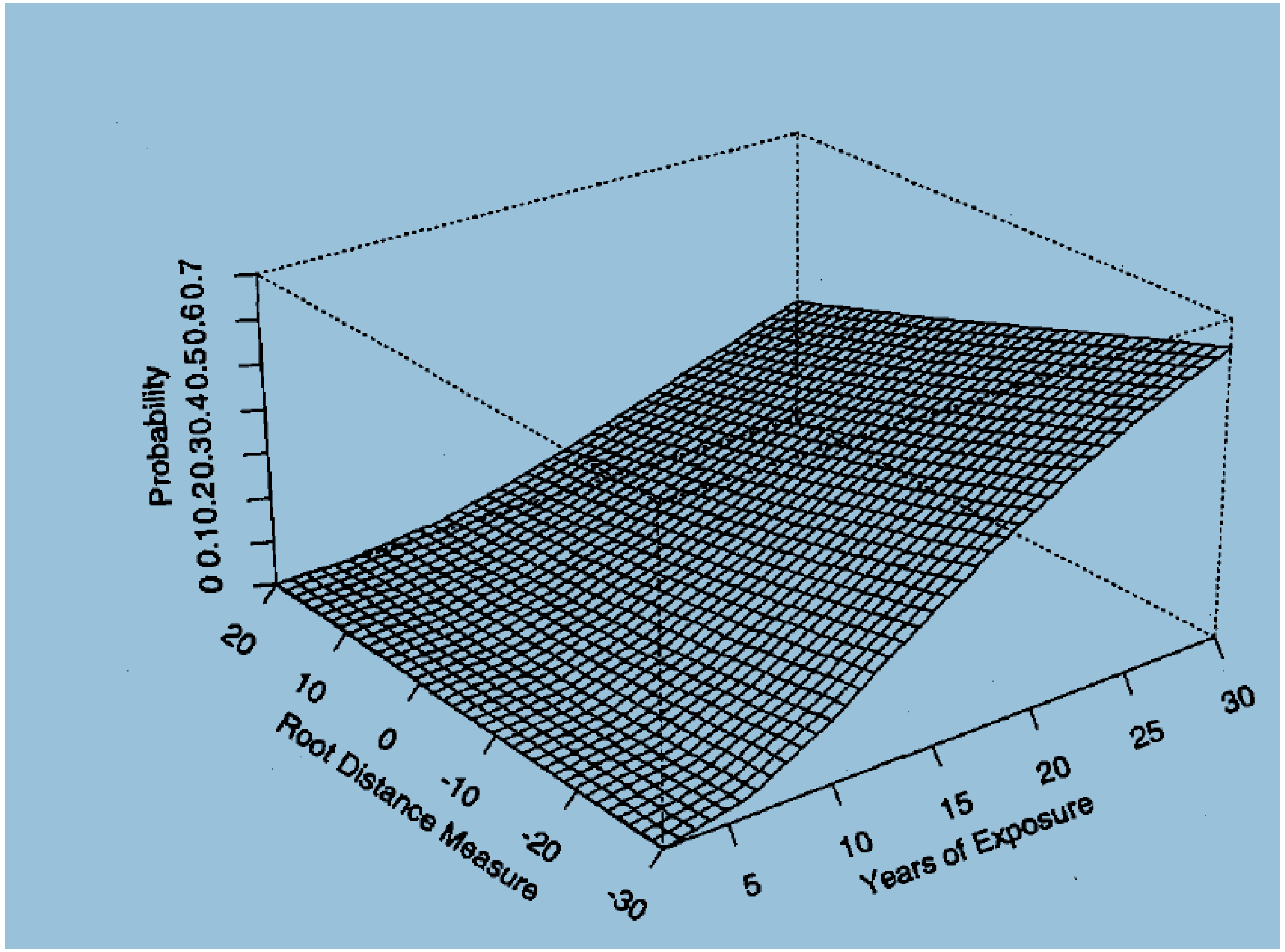
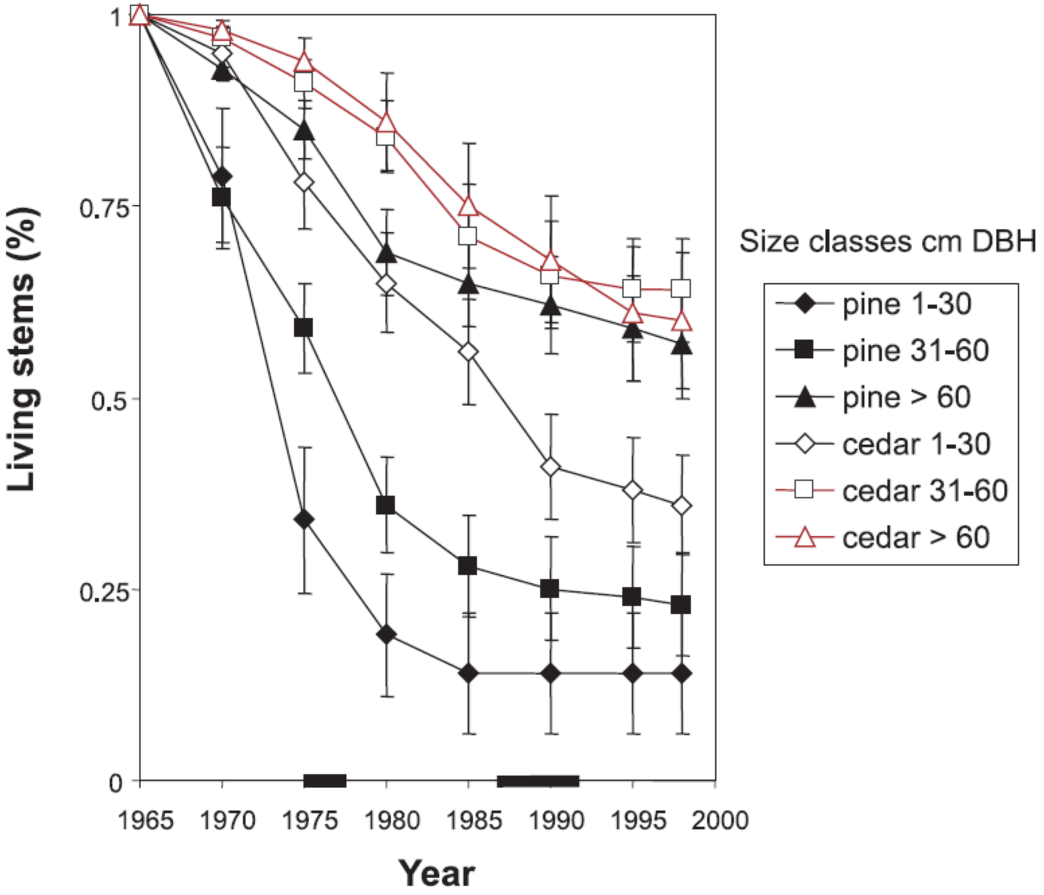
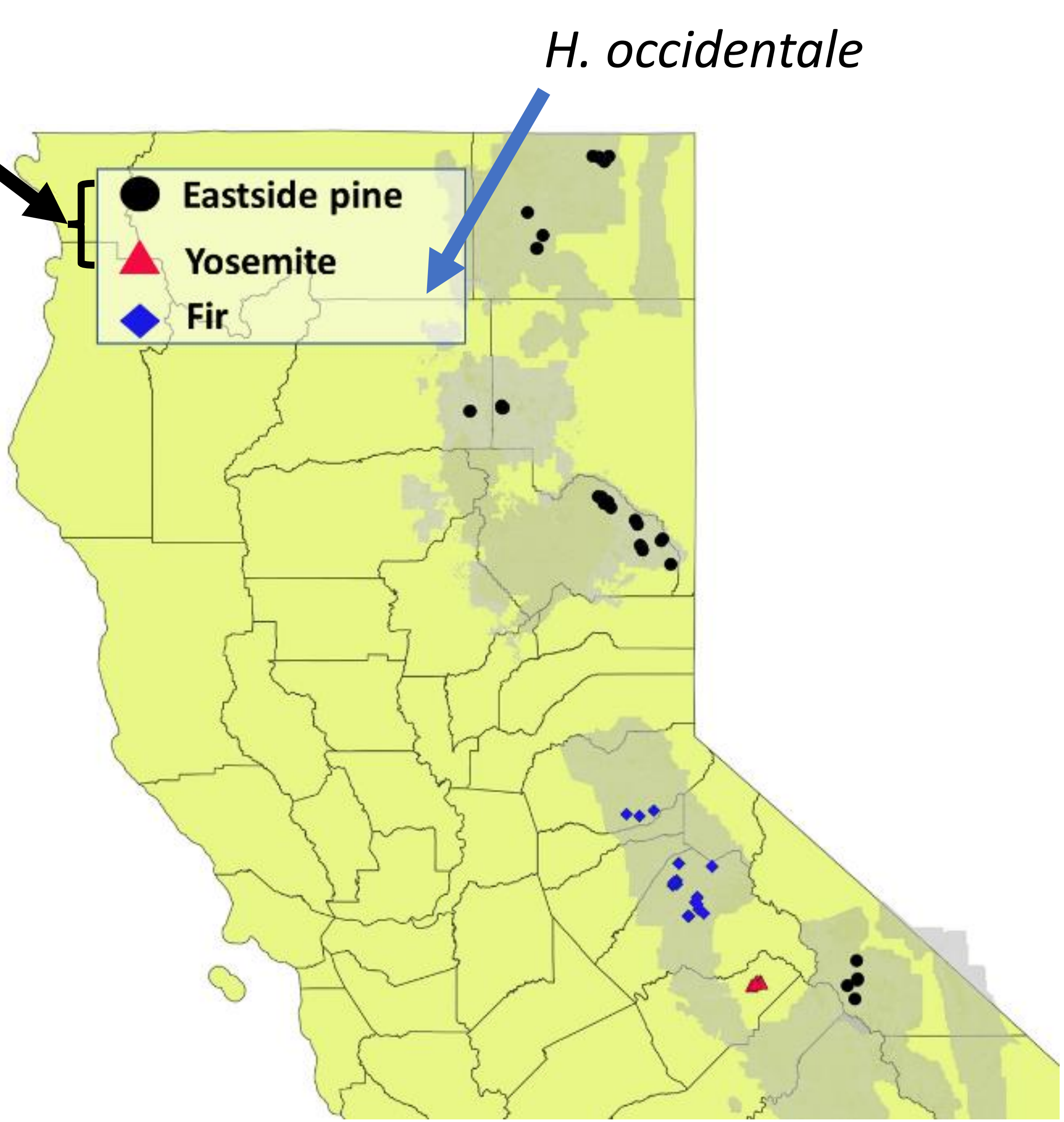
Preisler and Slaughter – 1997
Tree mortality is a function of exposure time and distance to source (inoculum)

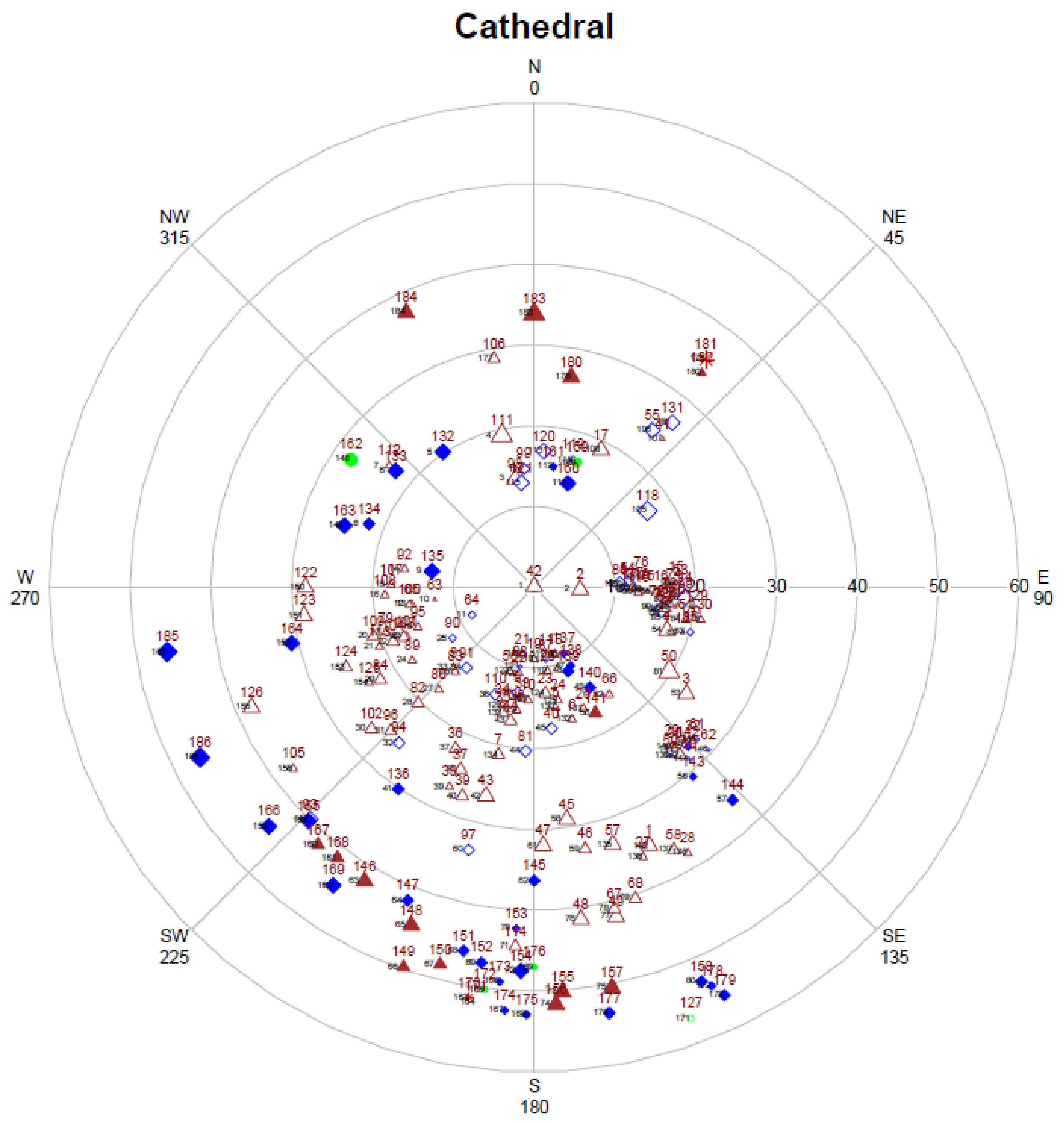


Rizzo et al – 2000
Mortality rates vary by species and across size classes



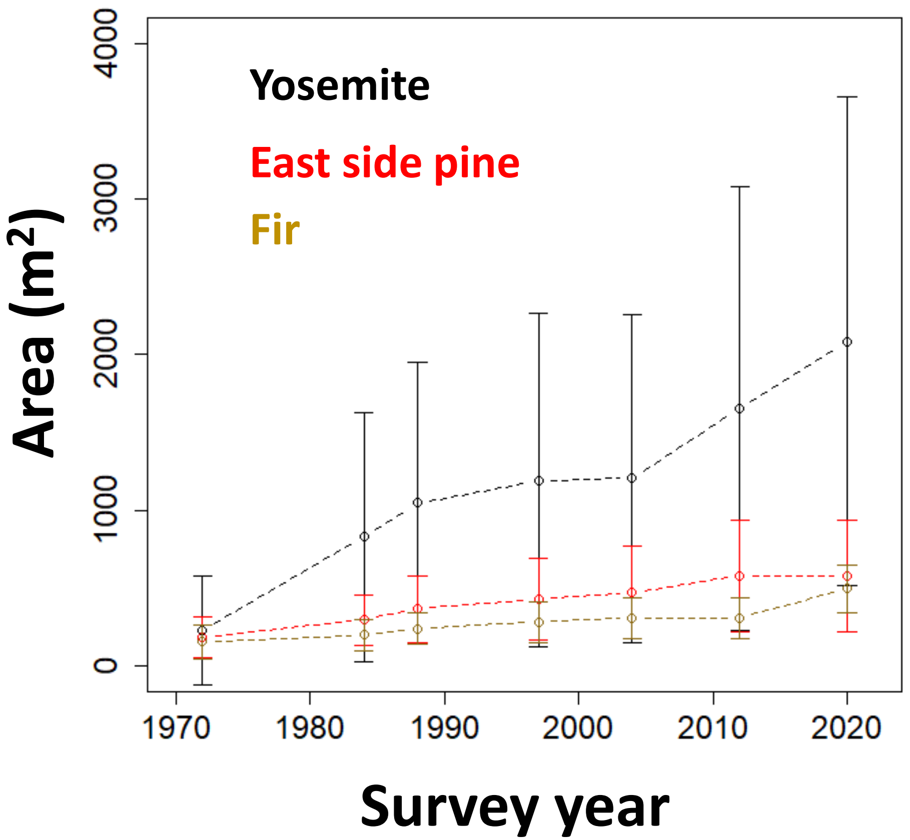
- What drives Heterobasidion disease patterns over long periods (~50 yrs)?
- How do root disease centers change over time?
- What are the implications for management including wildfire?




Cathedral
N
0
NE
45
E
90
SE
135
S
180
SW
225
W
270
NW
315
20
30
40
50
60

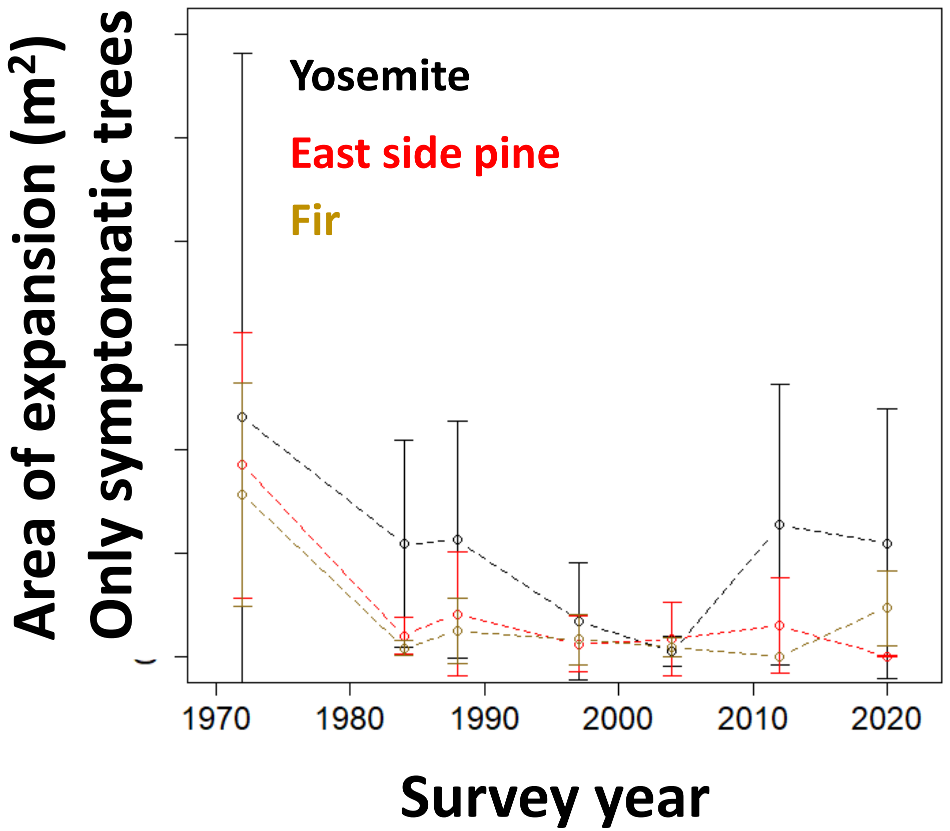
What drives Heterobasidion disease patterns over long periods (~50 yrs)?

- Pathogen and ecosystem impacted
- H. irregulare disease centers crew faster and ended larger, particularly in Yosemite Valley
- H. occidentale disease centers were consistently the smallest
- All disease centers reached quiescence after ~30 yrs and became active after 2004



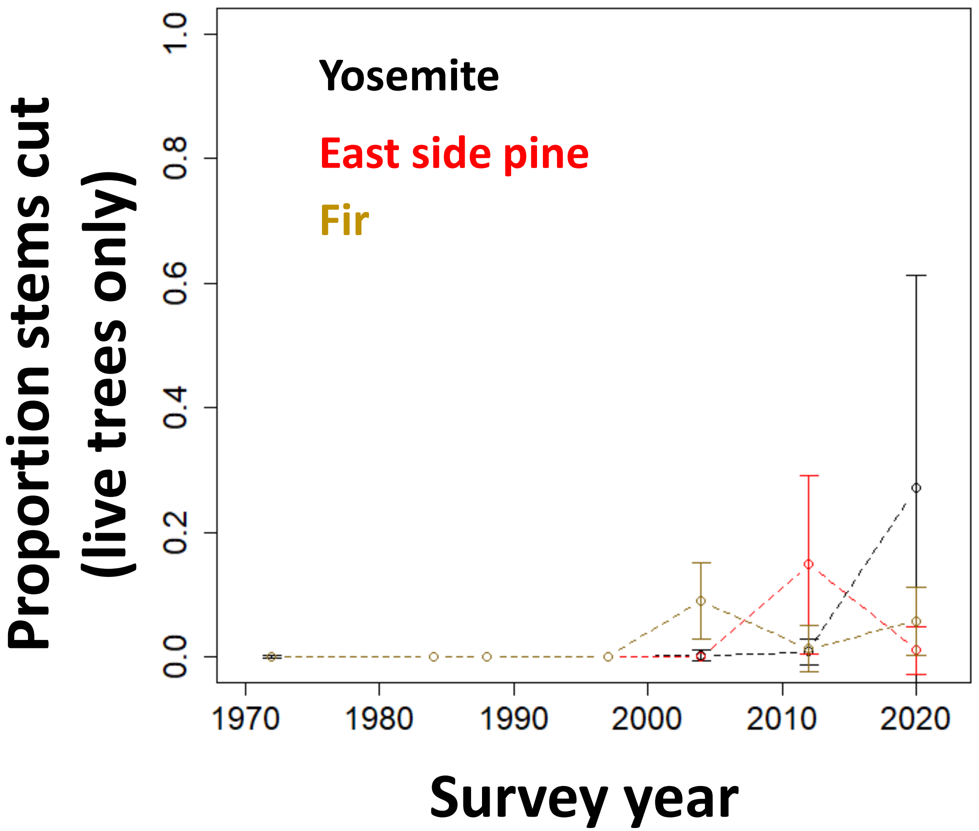
What drives Heterobasidion disease patterns over long periods (~50 yrs)?

- Disease center growth is most rapid in early stages ***and*** these early rates of expansion are the best predictors of final size
- Disease exited quiescence in the last 10-15 yrs, why?



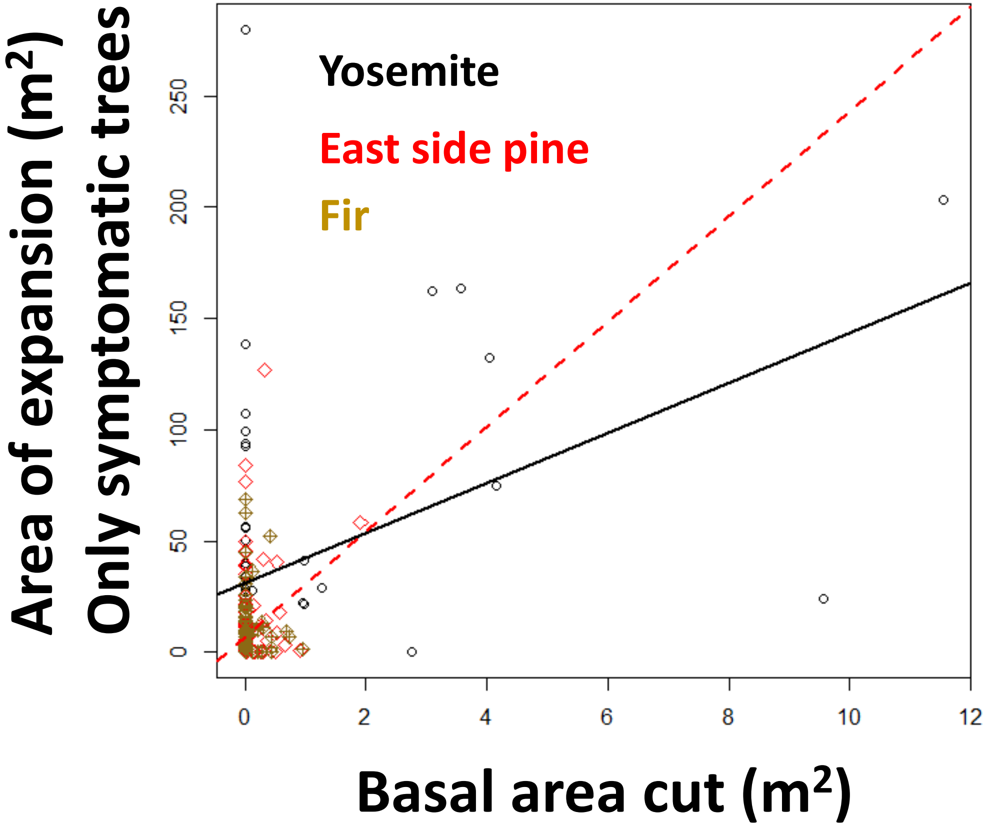
What drives Heterobasidion disease patterns over long periods (~50 yrs)?

- Many things happen in a long term plot network, including, and especially fuels management
- Live tree removal occurred in all three plot networks, particularly during the last 20 yrs
- Dead tree removal was also common



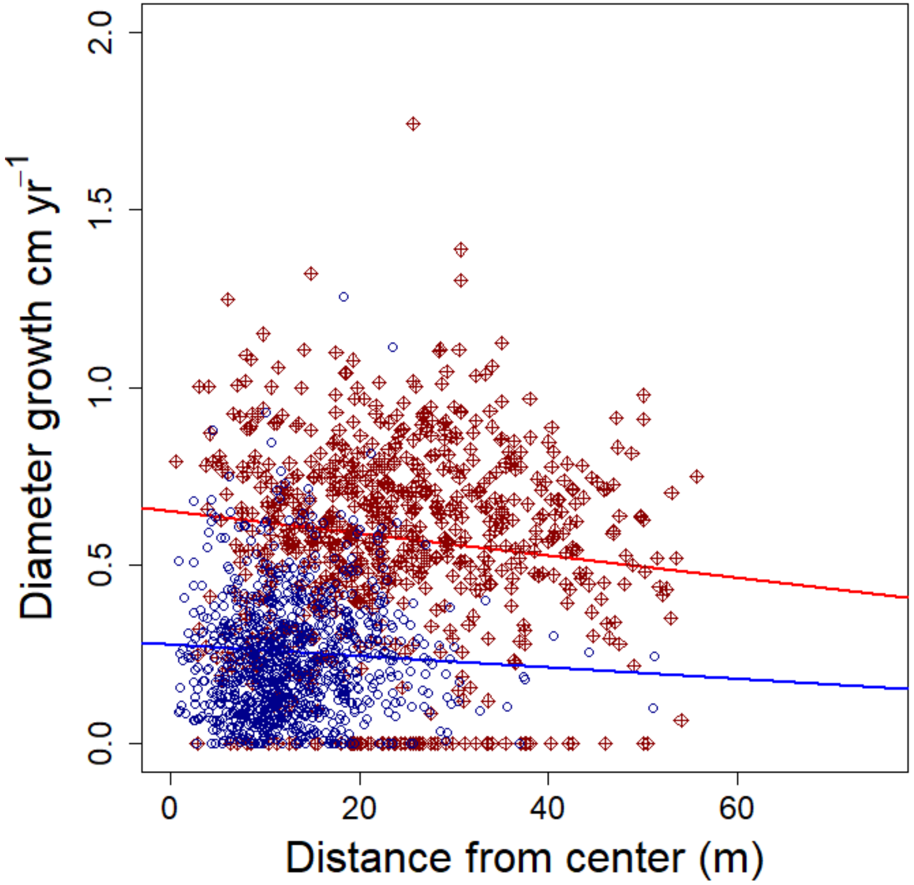
What drives Heterobasidion disease patterns over long periods (~50 yrs)?

- In the last 20 yrs, the total basal area of cut live trees was significantly associated with disease center expansion
- Evidence is strongest in the Yosemite Valley plot network, weak but present in the east side pine system, and speculative (very weak) in the fir plot network



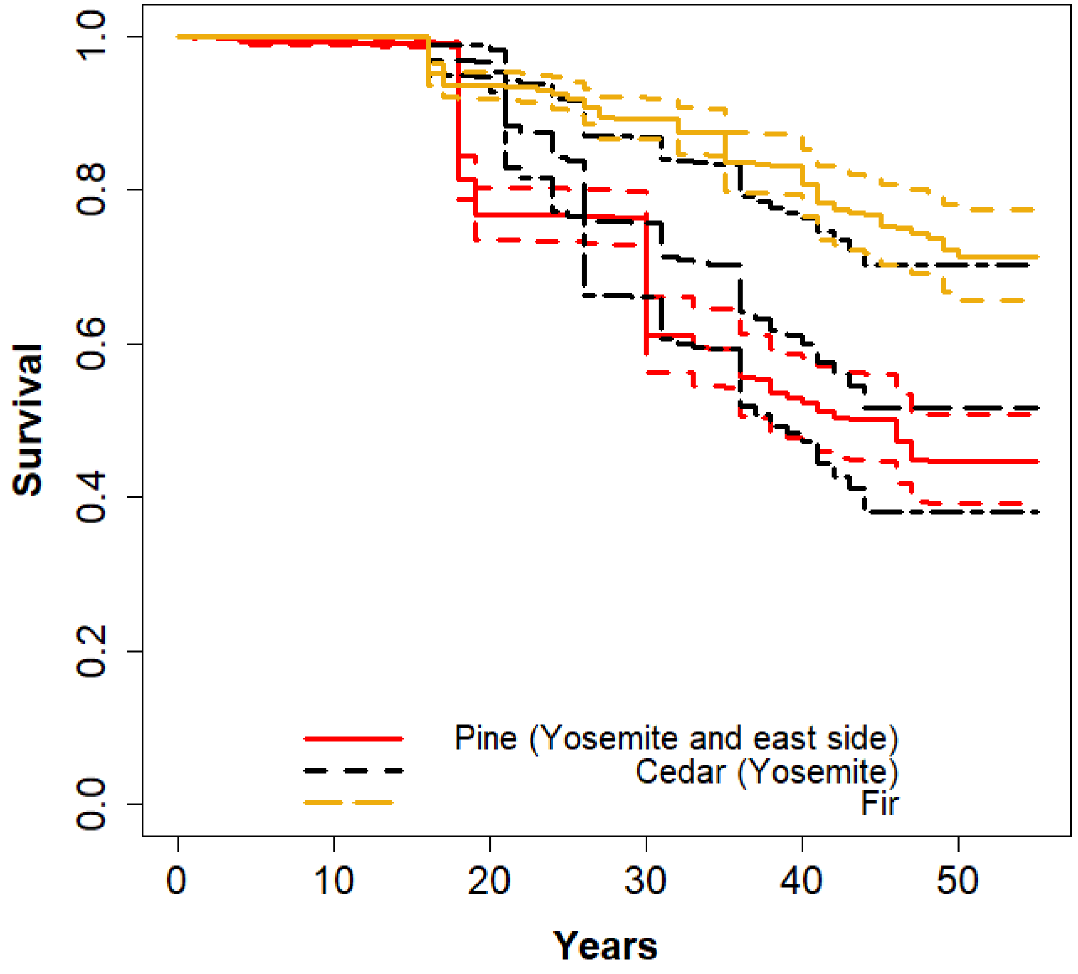
How do root disease centers change over time?

- Within disease center tree growth
- Within disease centers growth increases over time (Yosemite and East Side pine only)
- No effect in *H. occidentale* disease centers
- Pathogen exposure is bad for growth, but so is being overtopped



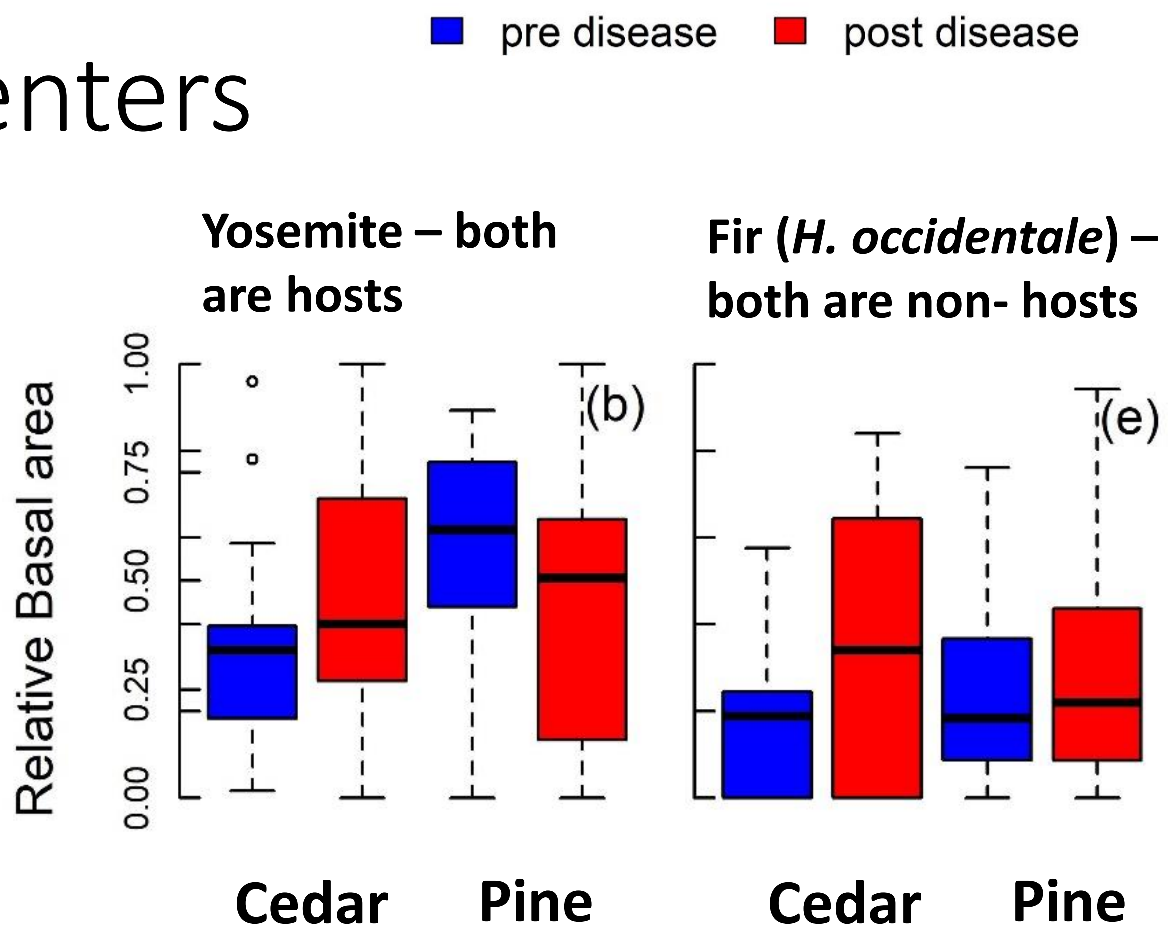
How do root disease centers change over time?

- Survival times vary across host species
- Mortality is rapid in ponderosa and Jeffrey pine
- Incense cedar mortality is slower and variable
- Fir mortality is slow and often confined to one or a few trees



How do root disease centers change over time?

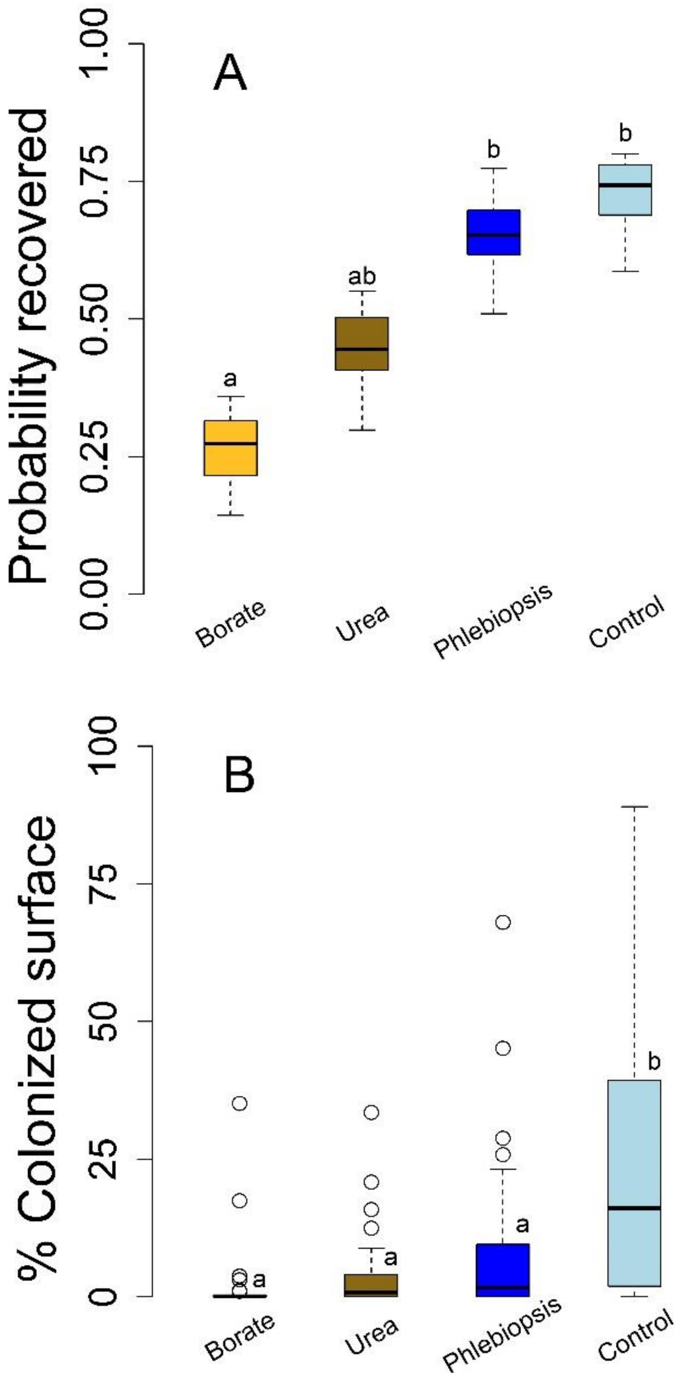
- Rapid mortality of pine leads to increased dominance of incense cedar, particularly where it is a **non-host**
- No changes in composition occur in systems where all trees are hosts (East side pine)



Flores et al 2023

What to do about Heterobasidion root disease?

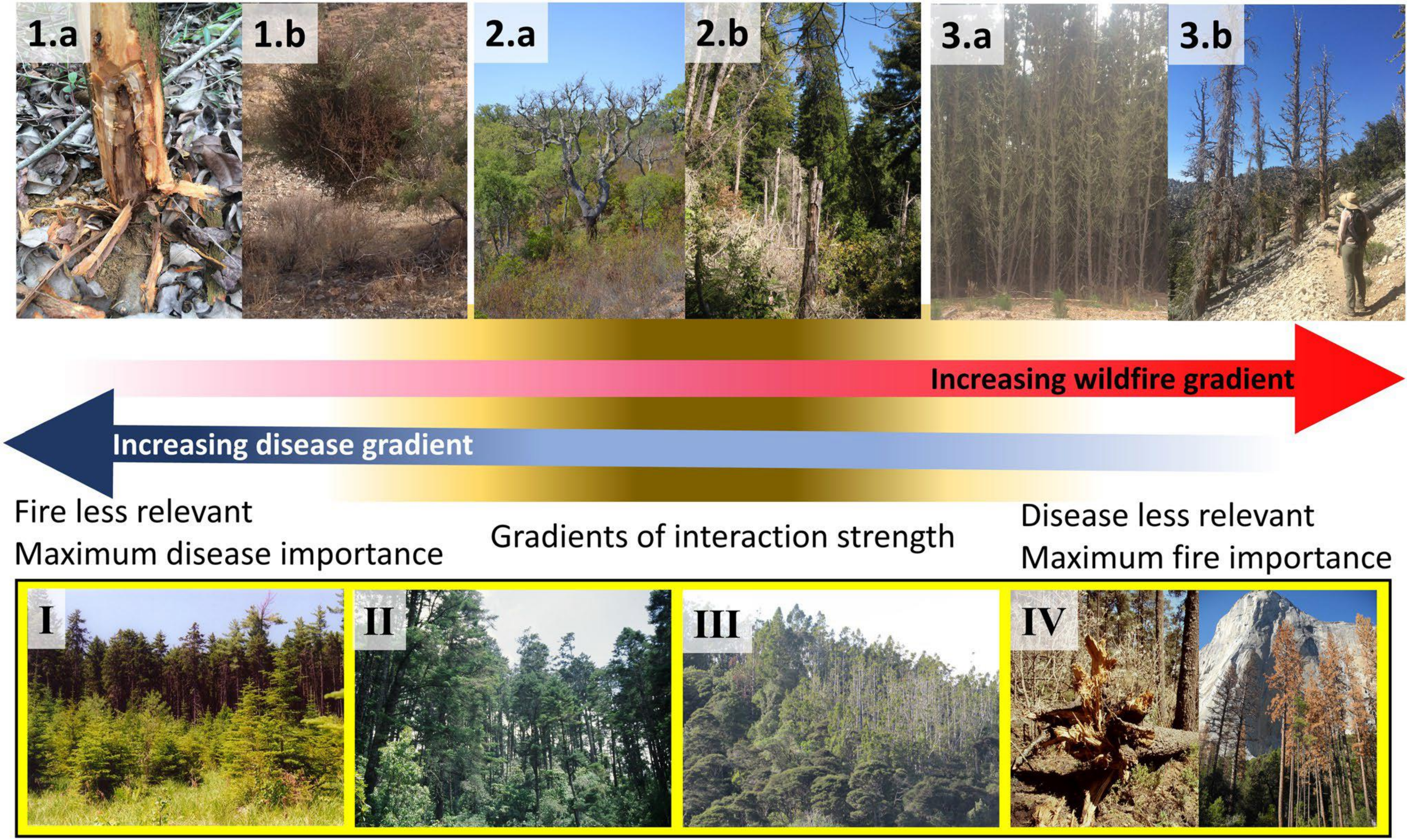
- Phlebiopsis biological control limits pathogen growth
- Chemical treatments (Borate and Urea) prevent pathogen establishment and reduce pathogen growth
- An experimental one-week delay between inoculation and chemical/biological control had no effect
- [Poloni et al. 2021]




HDX


GEM

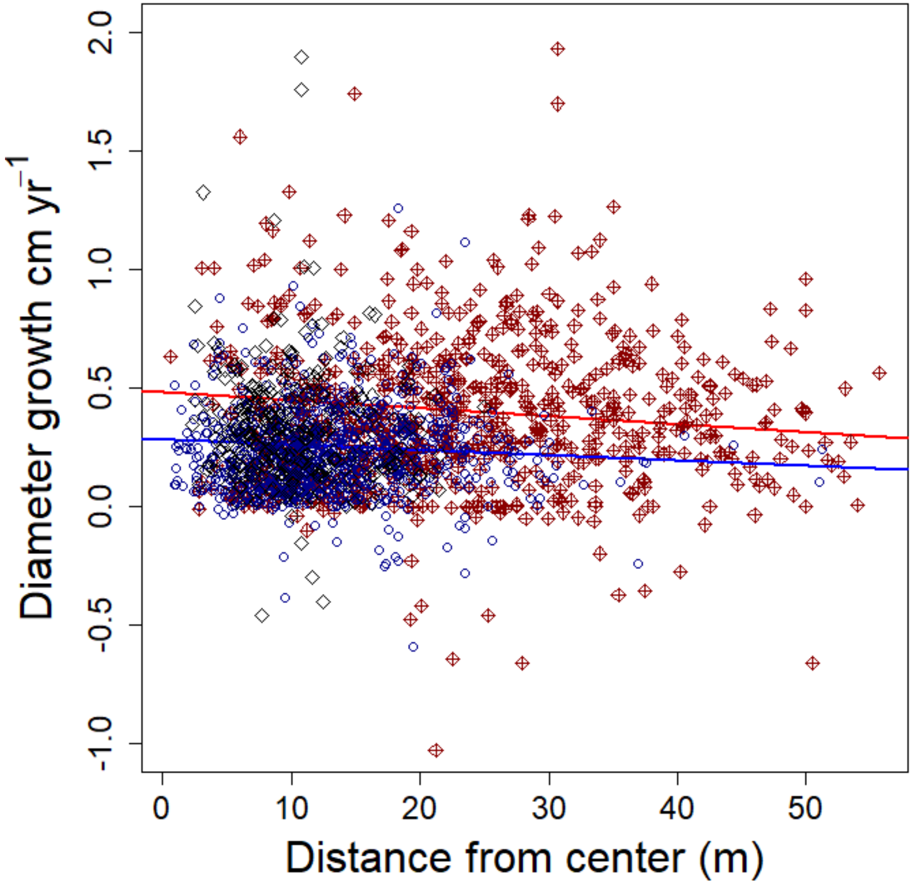
2021 Dixie Fire – California's largest in history
Fire impacts in Persistent Heterobasidion Gaps


1.a
1.b
2.a
2.b
3.a
3.b
Increasing wildfire gradient
Increasing disease gradient
Fire less relevant
Maximum disease importance
Gradients of interaction strength
Disease less relevant
Maximum fire importance
I
II
III
IV

[Cobb 2022]

Tree growth for all surviving trees

- Only trees with a second diameter measurement (includes dead but remeasured trees)




PLEASE DO


ETLE TRAP

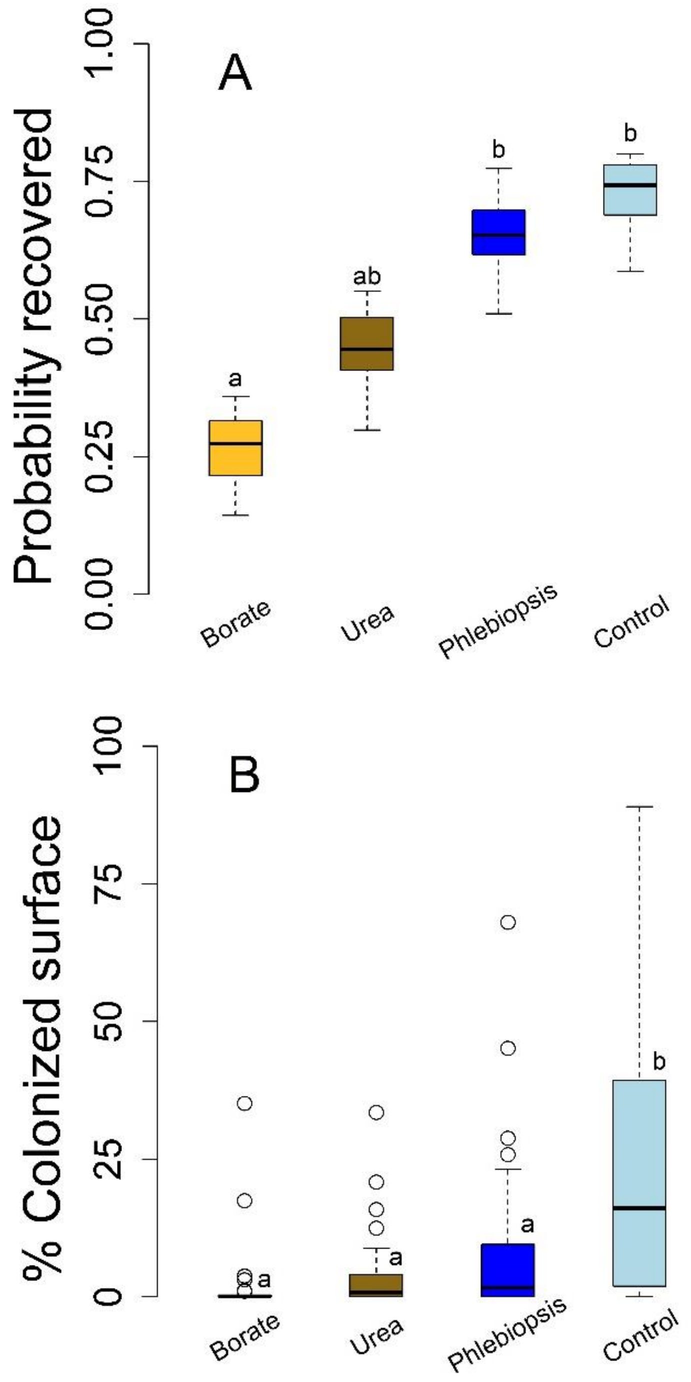
Phlebiopsis gigantea Stump treatment (Aim 2)

- *Phlebiopsis* (Pg – Rotstop®) is registered with an Eastern US strain, USFS has placed a moratorium on using Rotstop in Western forests
- Works **very** effectively in humid temperate forests; what about western forests with drier climate?
- Garbelotto collected 8 strains of Pg in California (<u>two from Blodgett!!!</u>)

Photos: Luana Giordano

Results – stump treatments

- Study results (1 yr post treatment)
- Biocontrol (Pg) provided comparable reduction in pathogen growth to Borates and Urea compared to no treatment
- Borates and Urea were more effective in preventing pathogen establishment overall
- Results were confirmed by the laboratory block experiment
- [Poloni et al. 2021]



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