Sudden Oak Death and Fire

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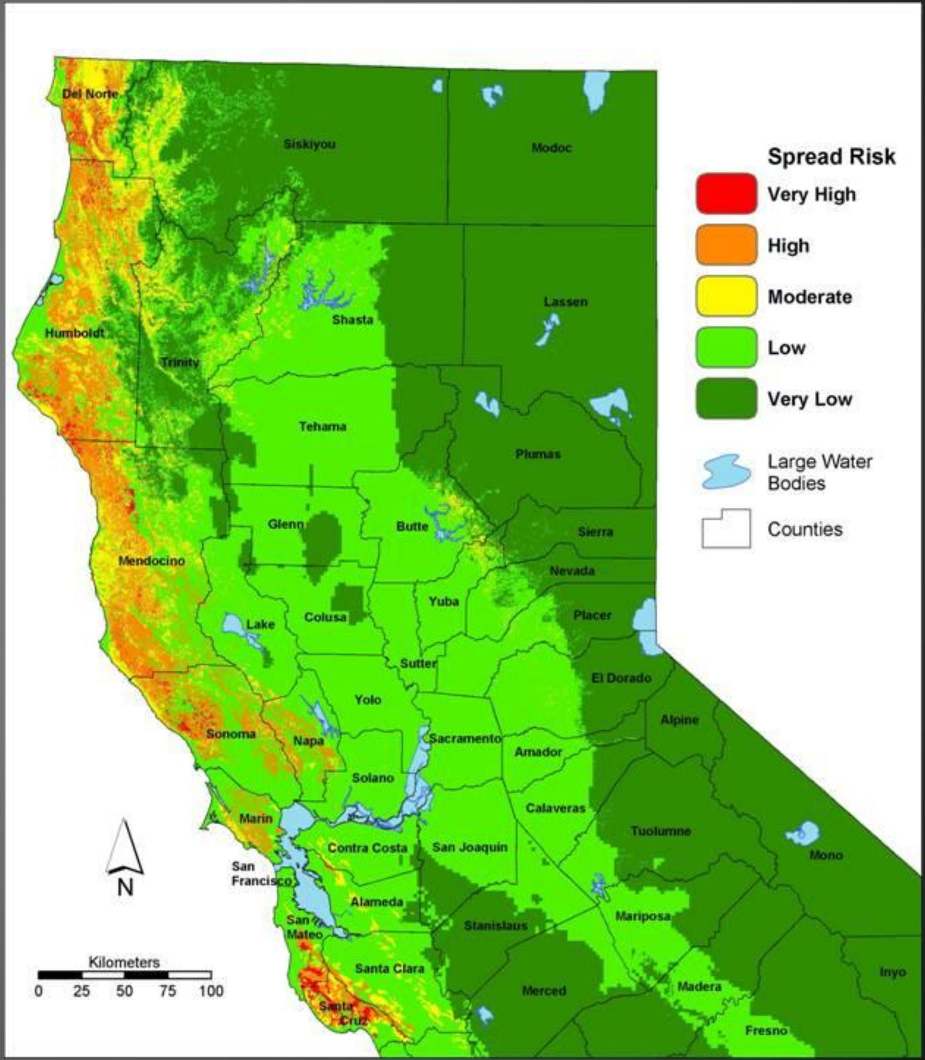
What do we know about fire & SOD?

- SOD has been in CA less than 20 years
- Fire/SOD is a new area of research
- Limited spatially and temporally
  - Long-term fuels implications?
  - How will things play out in wildfire scenarios?



From Meentemeyer et al. 2004

Fire & SOD in California

- Fire/SOD research focused on wildfire-prone ecosystems and landscapes, and on most susceptible tree species
  - Douglas-fir-tanoak
  - Redwood-tanoak
  - Mixed evergreen

Today's Presentation

Foliar moisture and crown fire

Surface fuels and fire behavior

SOD-related mortality & fire severity

P. ramorum survival after wildfire

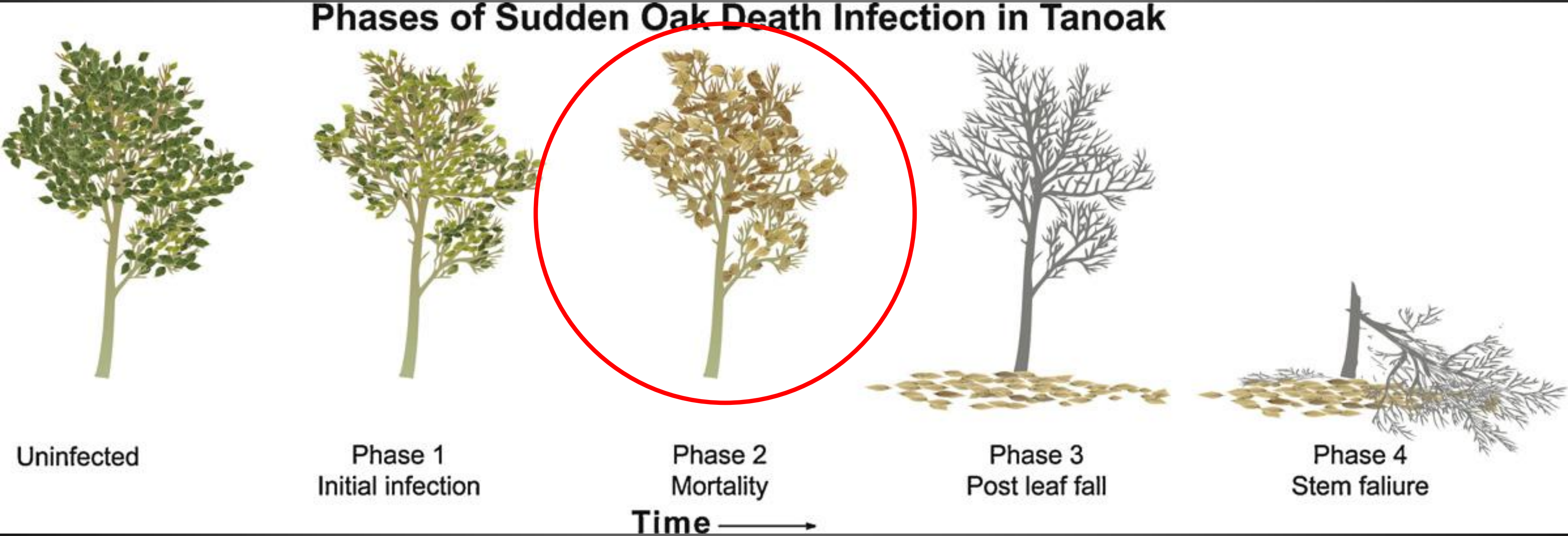
SOD, Fuels, & Fire Behavior

Understanding Fuels

- Fuel Type
  - Live fuels vs. dead fuels
- Fuel/Foliar Moisture
- Fuel Structure
  - Surface fuels
  - Ladder fuels
  - Aerial/canopy fuels
- Fuel Size & Loading

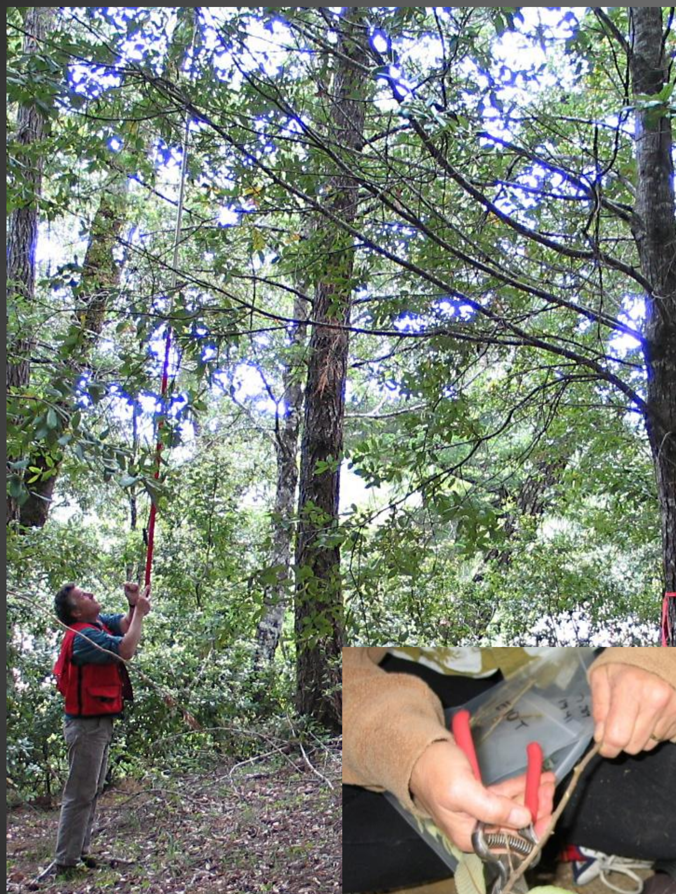
Foliar moisture and crown fire

How does sudden oak death affect foliar moisture content (FMC) and crown fire potential in tanoak?



Kuljian and Varner 2010

Foliar moisture and crown fire



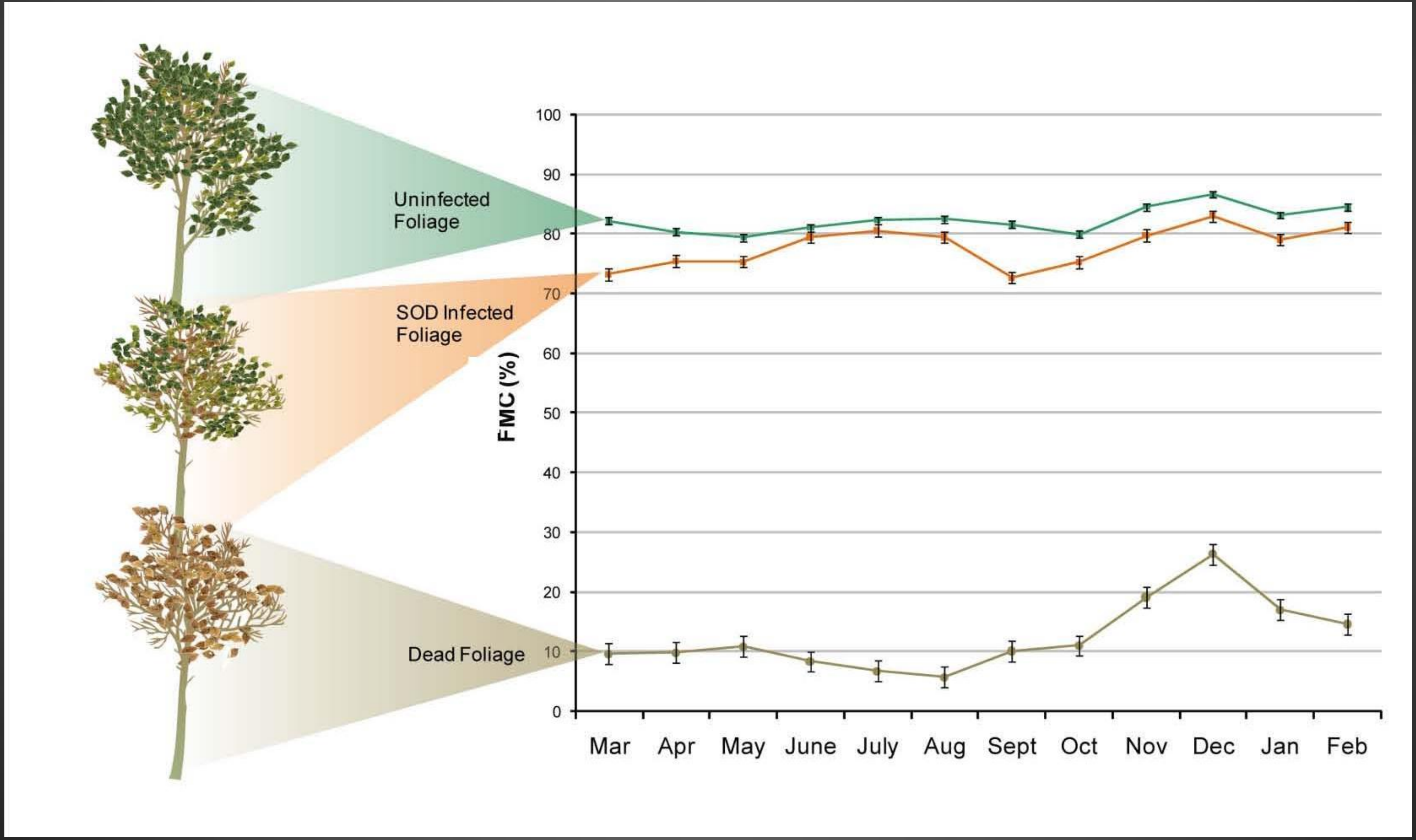
Methods

- Tracked FMC of 25 tanoaks every month for one year
- Collected from 8 uninfected trees, 10 SOD-infected trees, and 7 standing dead trees (SOD killed with leaves still attached)
- Used FMC values to model crown fire ignition

Kuljian and Varner 2010

Foliar moisture and crown fire

Found major differences in FMC between phases of infection

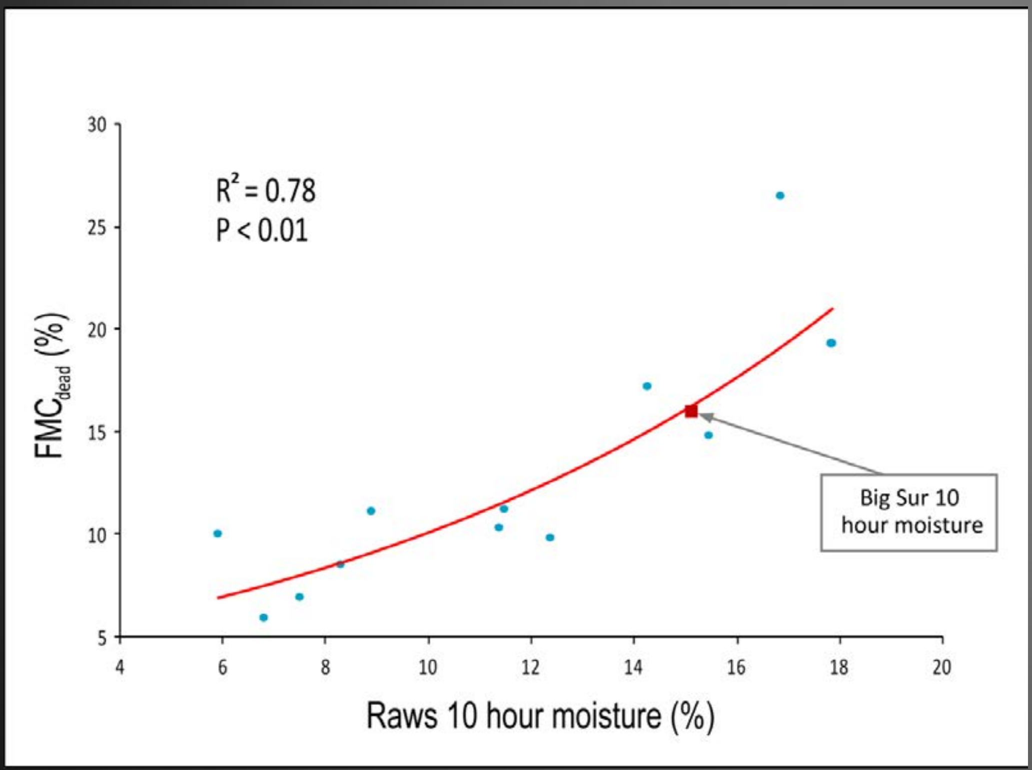


Kuljian and Varner 2010

Foliar moisture and crown fire

Other findings

- Cured canopy fuels increase risk of crown fire ignition



- FMC of standing dead trees same if not lower than surface litter
- RAWS 10 hr fuel moisture shows potential as predictor of FMC on standing dead trees

Kuljian and Varner 2010

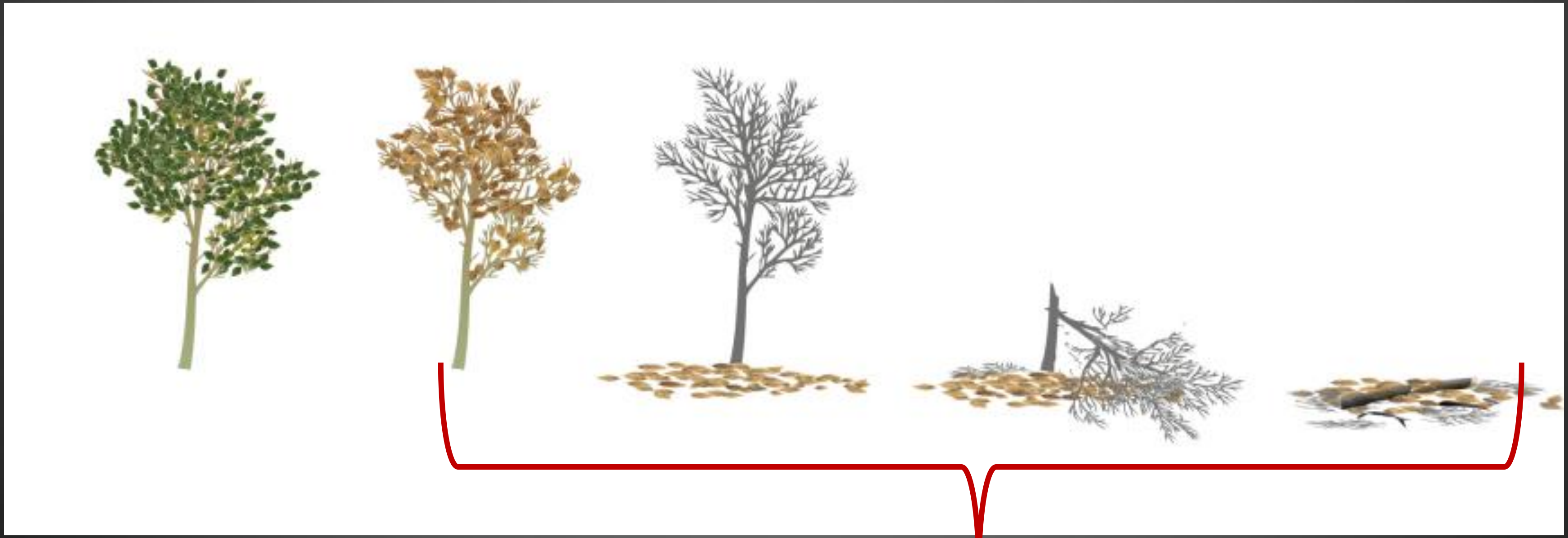
Surface fuels and fire behavior

How does sudden oak death change surface fuel loading and potential fire behavior in Douglas-fir-tanoak forests?

Valachovic et al. 2011

Surface fuels and fire behavior

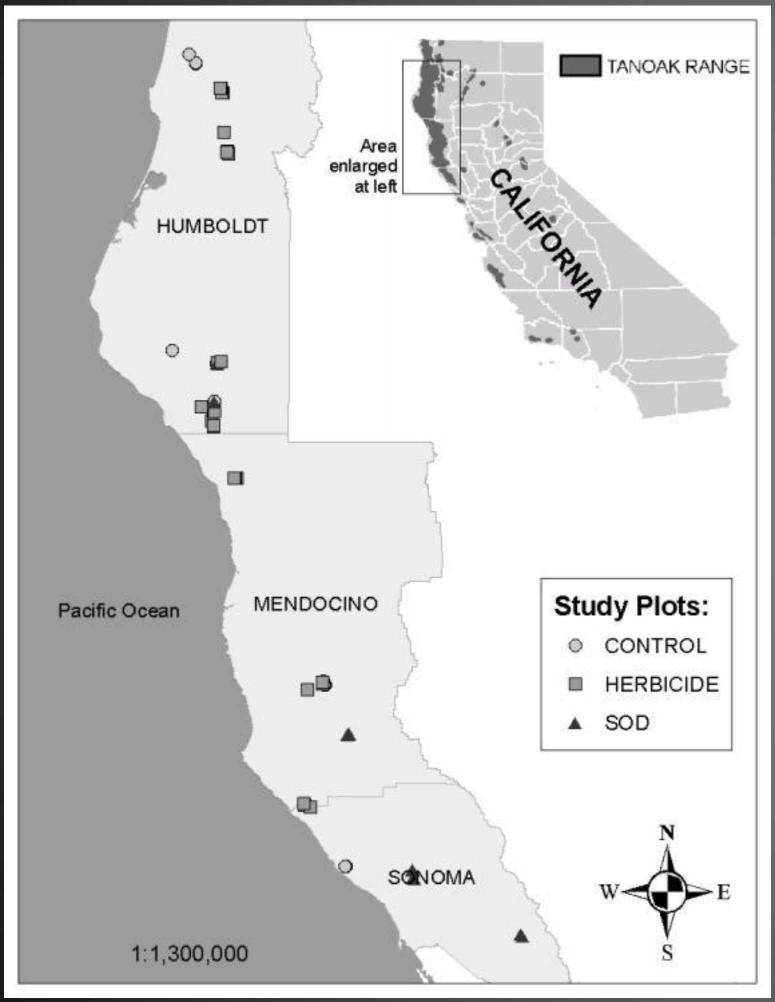
- What is the long-term fuels forecast for these forests?
- How will fuelbed changes affect firefighter responses?



How long does this process take?

Valachovic et al. 2011

Surface fuels and fire behavior



The goal: to compare surface fuels in SOD-infested and uninfested forests over different time horizons in 3 north coast counties that have SOD

Complication: SOD has been present in the 3 counties for different amounts of time

Solution: use herbicide-treated tanoak stands as a surrogate for the effects of SOD

Valachovic et al. 2011

Surface fuels and fire behavior

Surrogate Approach

Herbicide treated or SOD infested?

Valachovic et al. 2011

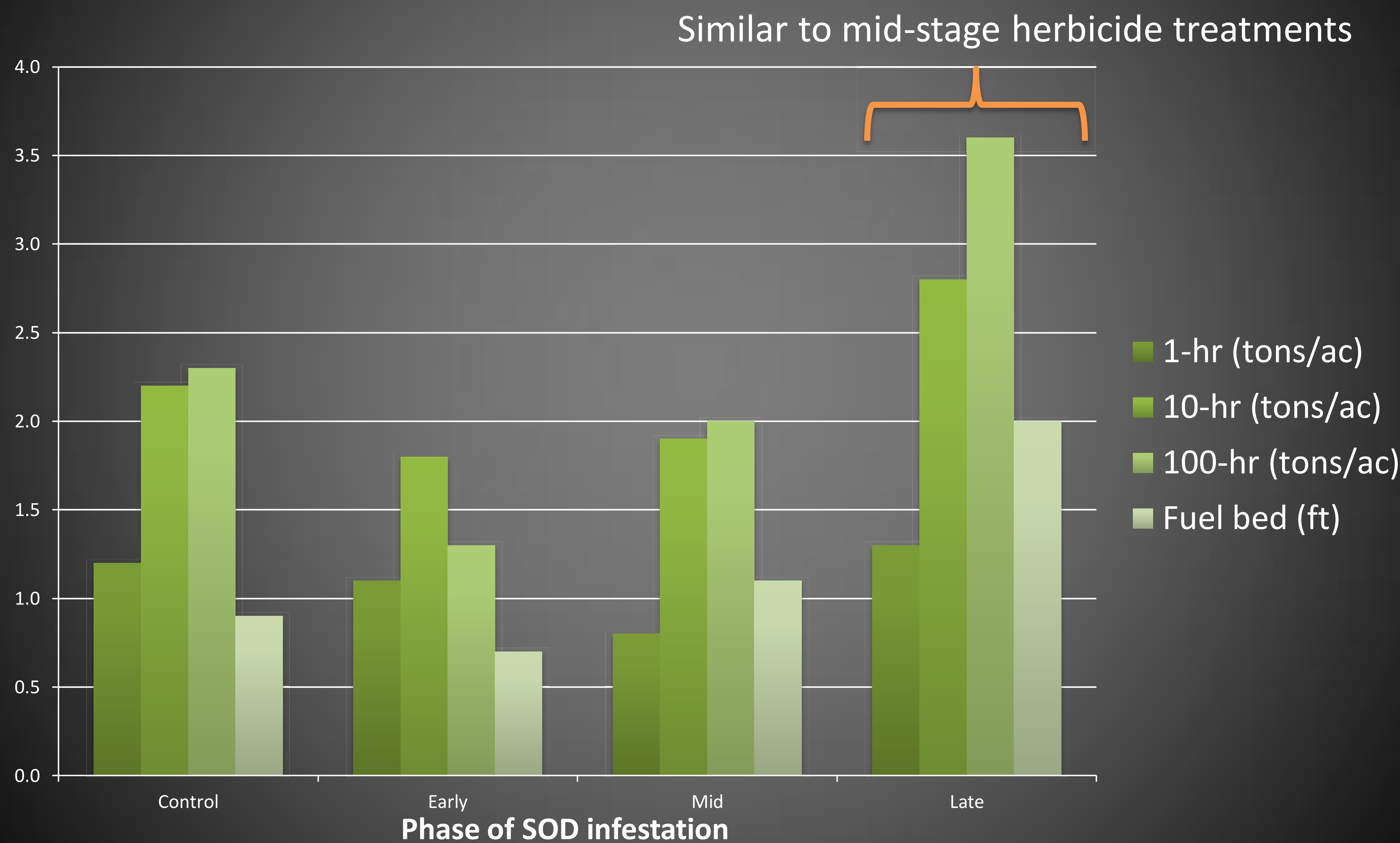
Surface fuels and fire behavior

Methods

- Collected fuels and stand data in SOD-infested, herbicided, and uninfested (control) stands
- Compared custom fuel models to standard fuel models
  - Can standard models adequately predict fire behavior in infested areas?
- Performed fire suppression operations safety analysis
  - Will the disease affect firefighter responses in infested areas?

Valachovic et al. 2011

Surface fuels and fire behavior



Valachovic et al. 2011

Fuel Models & Fire Behavior

- Standard fuel model (SB2) fit the control plots
- Standard models did not accurately predict SOD-infested or herbicide-treated plots
- Made sense to look at plots based on fuel structure
  - Fuels on surface or in canopy (aerial)?

Valachovic et al. 2011

Surface fuels and fire behavior

Conclusions

SOD-related surface fuel accumulations take place over an extended period of time (at least 8-12 years post-infection for significant accumulation)

Valachovic et al. 2011

Surface fuels and fire behavior

Conclusions

Tanoak fuels may take a long time to break down (large log piles still present and sound in some plots 12 years after herbicide treatment)

Valachovic et al. 2011

Surface fuels and fire behavior

Conclusions

SOD-related fuel accumulations may have important implications for fire suppression. Firefighters should be aware of whether or not stands are infested, and how fuels are structured (surface or aerial).

Photo courtesy of Kerri Frangioso, UC Davis

Valachovic et al. 2011

Surface fuels and fire behavior

Conclusions

The effects of herbicide treatment may approximate the most extreme effects of SOD.

However, SOD is chronic, long-term, and unpredictable

Herbicide treatment is a one-time pulse of material

Valachovic et al. 2011

SOD-related mortality & fire severity

How do these concepts play out in a wildfire setting?

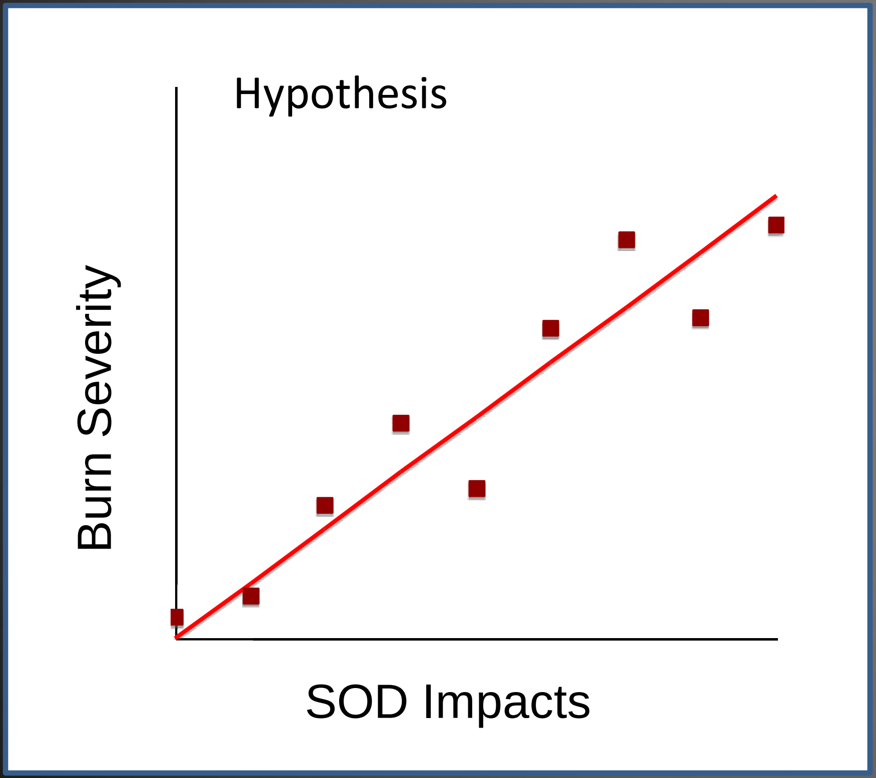
The 2008 wildfires in Big Sur provided a rare opportunity to test assumptions about SOD-related tree mortality and fire severity

A pre-existing plot network provided detailed pre-wildfire measurements of standing dead woody stems and downed woody debris

Metz et al. 2011

SOD-related mortality & fire severity

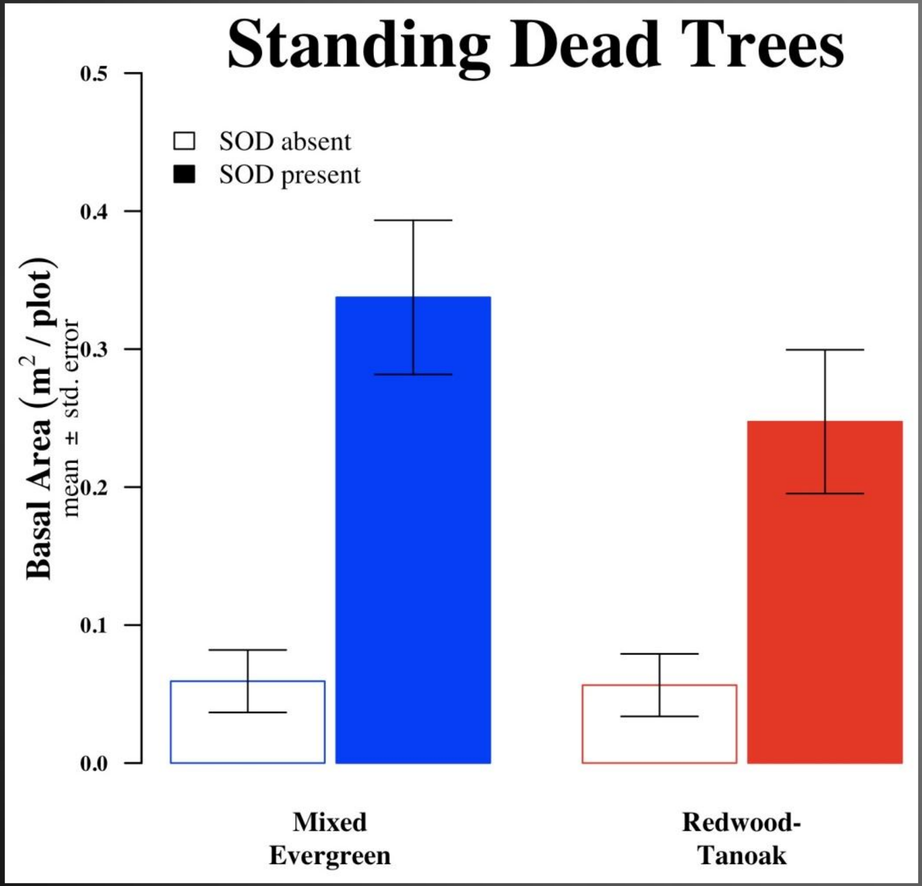
Testing a widespread assumption

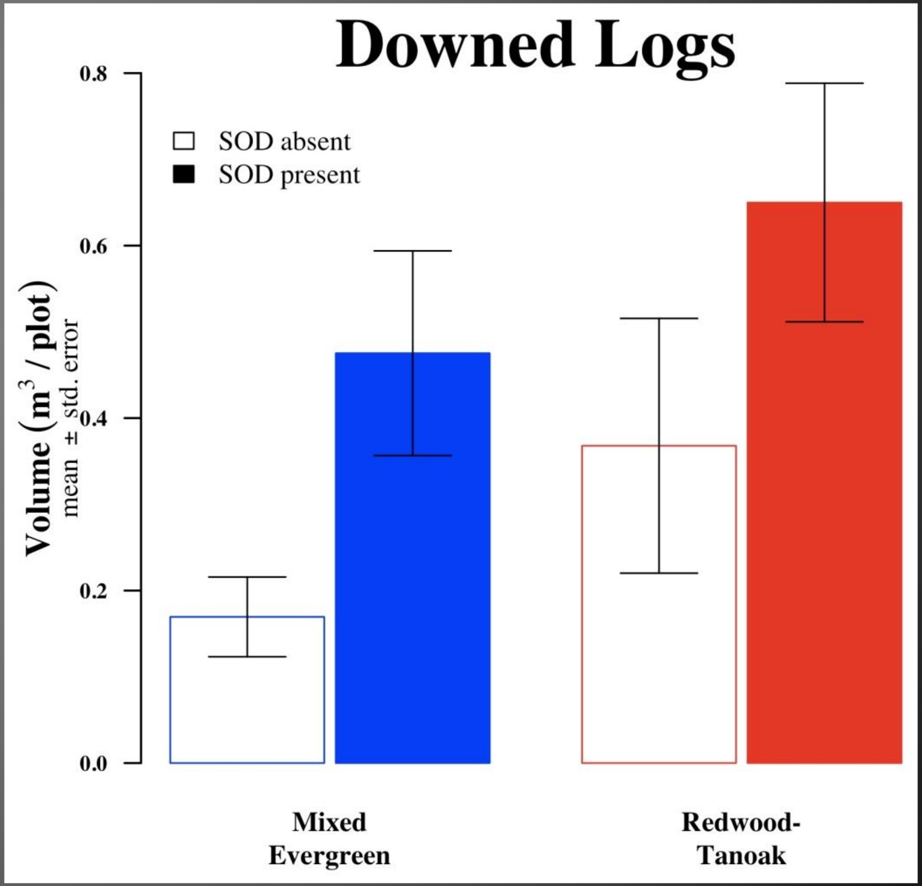


Metz et al. 2011

SOD-related mortality & fire severity

Pre-fire fuels elevated with SOD

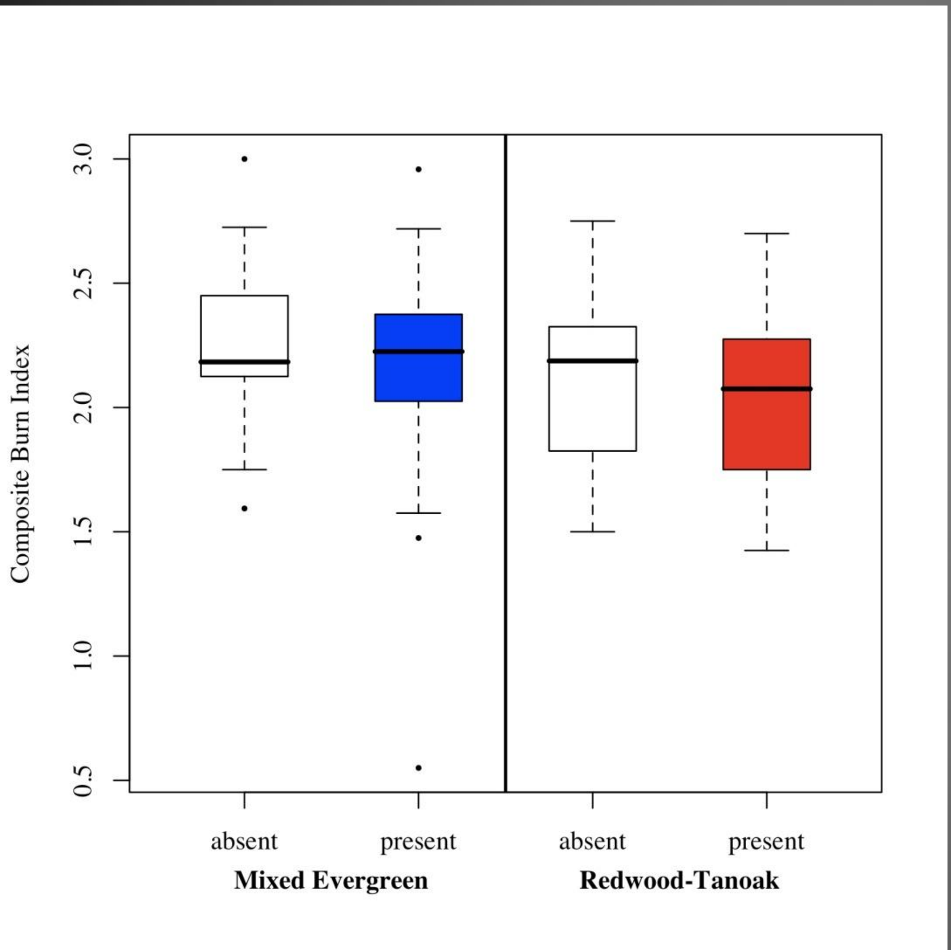


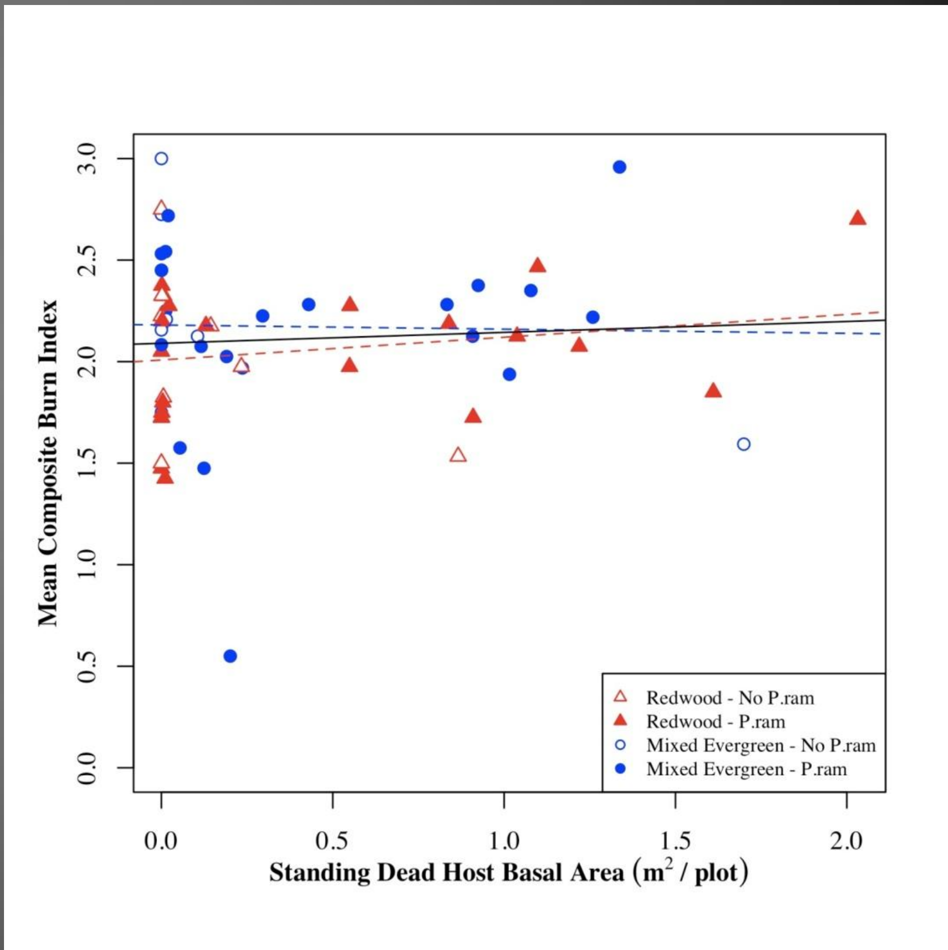


Metz et al. 2011

SOD-related mortality & fire severity

Burn severity and SOD impacts





Metz et al. 2011

SOD-related mortality & fire severity

- Found relationships between severity and different stages of disease
  - In plots with recent mortality, where dead trees still had leaves attached, severity was high
  - In plots with older mortality (with lots of downed wood), fire severity was high in the soil

Metz et al. 2011

SOD-related mortality & fire severity

Conclusions

- Links between SOD and fire severity are not straightforward
- Fire severity dependent on many factors, including topography, weather, fuels, and stand health
  - Stage of disease influences fuel structure, fuel moisture, and fuel loading

Metz et al. 2011

P. ramorum survival following wildfire

How does wildfire affect survival of *P. ramorum*?

Beh 2011

P. ramorum survival following wildfire

Methods

- Used same plot network as Metz et al. (2011) to look at post-wildfire survival of *P. ramorum*
- Surveyed pathogen survival in 63 plots in Big Sur known to be infested with the pathogen
  - Included 45 plots that had burned in 2008, and 18 outside of fire perimeter
  - Plots surveyed in 2009 and 2010
- Looked at importance of burn severity, pre-fire host density, and pre-fire disease prevalence in pathogen persistence

Beh 2011

P. ramorum survival following wildfire

Results

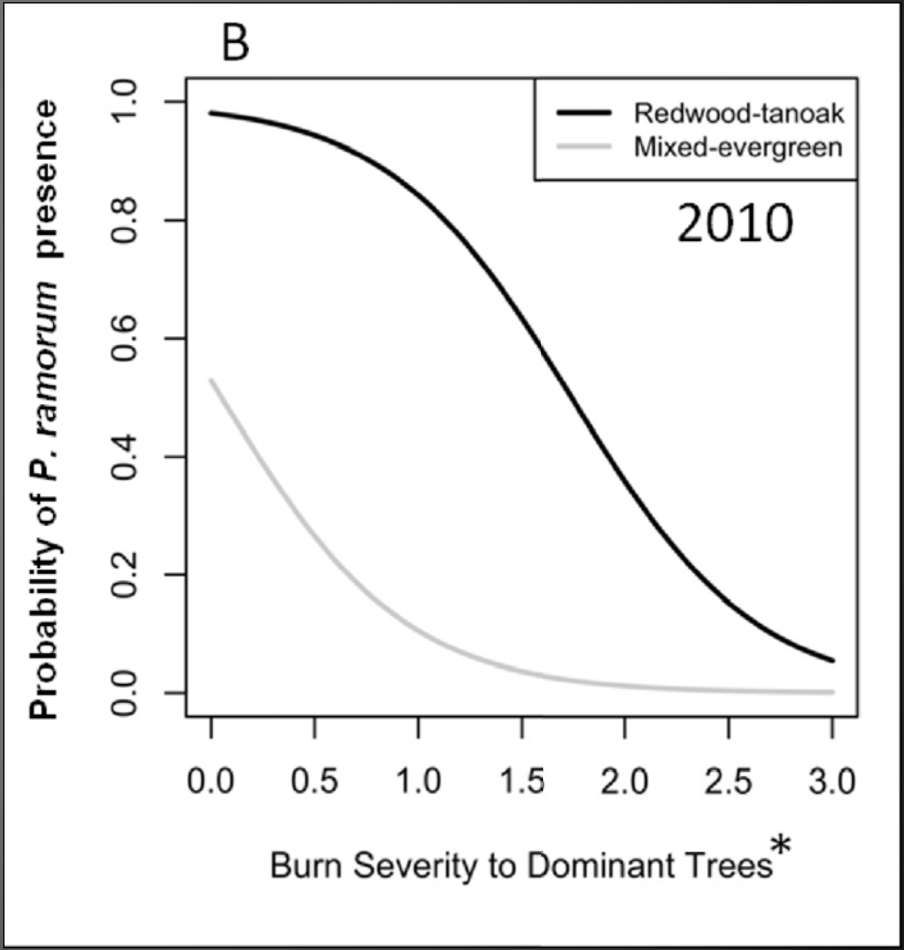
- One year following wildfire, *P. ramorum* was:
  - 72 times more likely to be found in unburned plots
  - 10 times more likely in redwood-tanoak plots
  - More likely in plots with more symptomatic bay trees before 2008

Beh 2011

P. ramorum survival following wildfire

Results

- Two years following wildfire, *P. ramorum* was:
  - More likely to be recovered in burned plots with lower severity
  - More likely in redwood-tanoak plots and plots with more pre-fire symptomatic bay trees, as in 2009
- Pathogen remains in burned areas



Beh 2011

P. ramorum survival following wildfire

Summary

- The 2008 wildfires in Big Sur suppressed *P. ramorum*, but did not eradicate it
  - Similar to results in OR using controlled burns
- Wildfire decreased host materials for the pathogen, but patchy fire severity created refugia

- Surviving bay trees provide inoculum source capable of infecting new post-wildfire vegetation
- Sprouts very vulnerable

Beh 2011

Management Implications

- There are a number of serious fire-related concerns associated with SOD
  - Decreased fuel/foliar moisture
  - Increased surface fuels and standing dead trees
  - Increased fire severity, from substrate to canopy
  - Important changes to fire suppression tactics
- However, fire behavior is complicated
  - Dependent on weather, topography, fuel availability, stage of disease, species composition
  - Important to understand how SOD can influence fire behavior, and incorporate these considerations into fuels planning and other fire mitigation efforts

For more information

Kuljian, H. and J. M. Varner. 2010. The effects of sudden oak death on foliar moisture content and crown fire potential in tanoak. *Forest Ecology and Management*, 259: 2103-2110.

Valachovic, Y.S.; Lee, C.A.; Scanlon, H.; Varner, J.M.; Glebocki, R.; Graham, B.D.; and D.M. Rizzo. 2011. Sudden oak death-caused changes to surface fuel loading and potential fire behavior in Douglas-fir-tanoak forests. *Forest Ecology and Management*, 261: 1973-1986.

Metz, M.R.; Frangioso, K.M.; Meentemeyer, R.K.; and D.M. Rizzo. 2011. Interacting disturbances: wildfire severity affected by stage of forest disease invasion. *Ecological Applications*, 21(2): 313-320.

Beh, M.M. 2011. Consequences of wildfire in the sudden oak death-impacted forests of the Big Sur Region, California: Survival of *Phytophthora ramorum* and elevated landing rates in ambrosia beetles. Master's Thesis, UC Davis. 130 pages.

THANK YOU!

SOD, Fuels, & Fire Behavior

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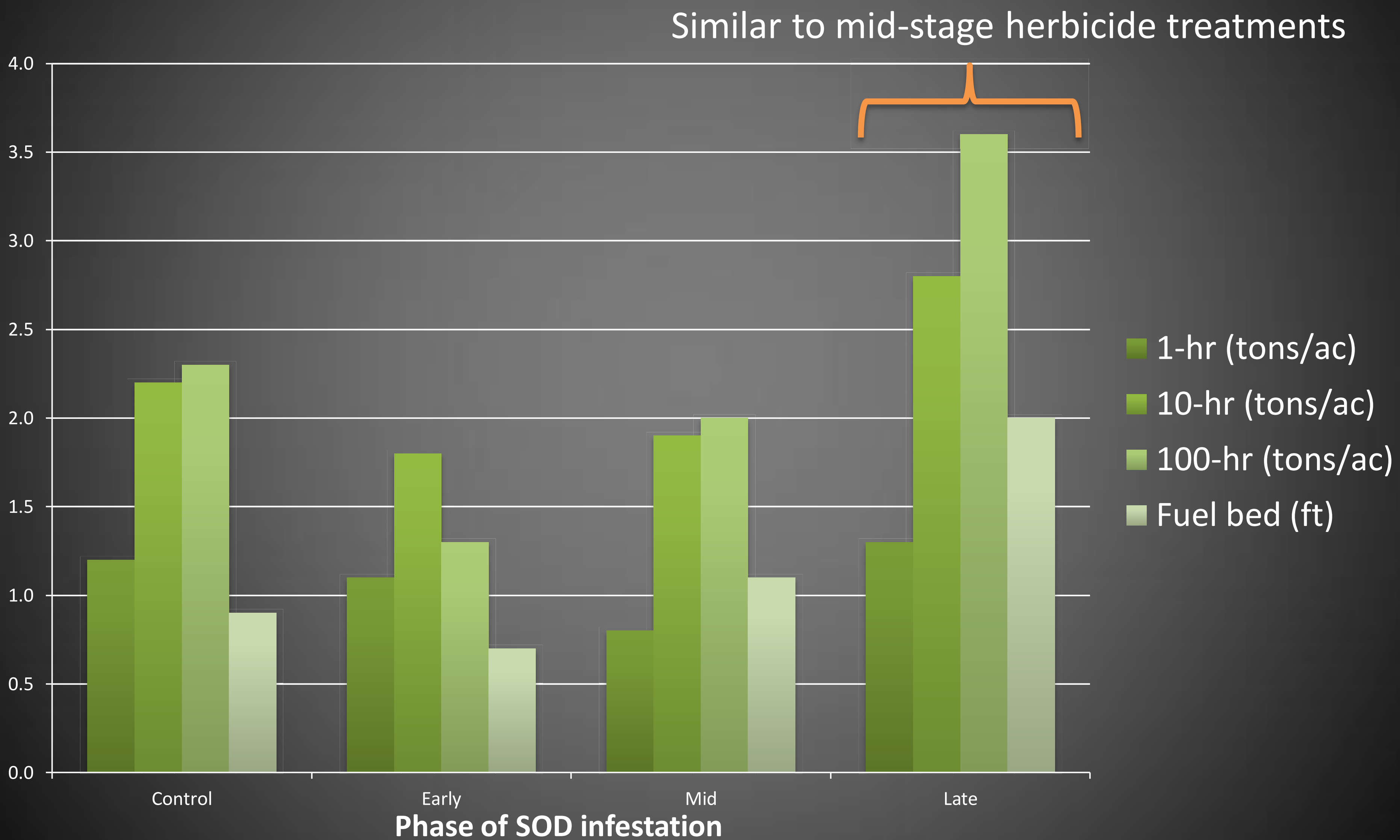
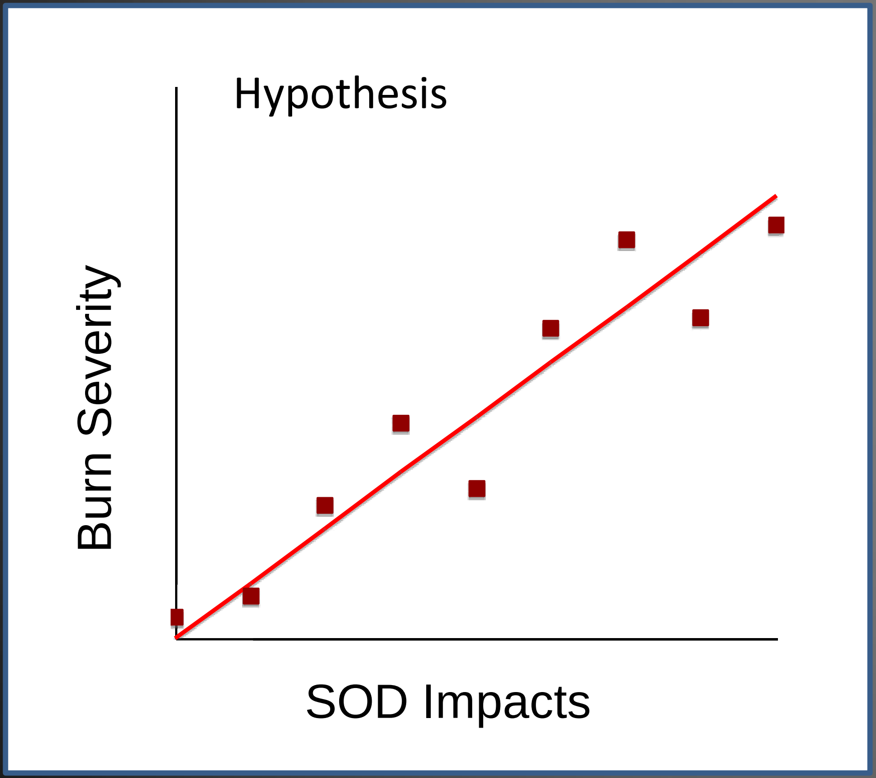
Surface fuels and fire behavior



Valachovic et al. 2011

SOD-related mortality & fire severity

Testing a widespread assumption



Metz et al. 2011

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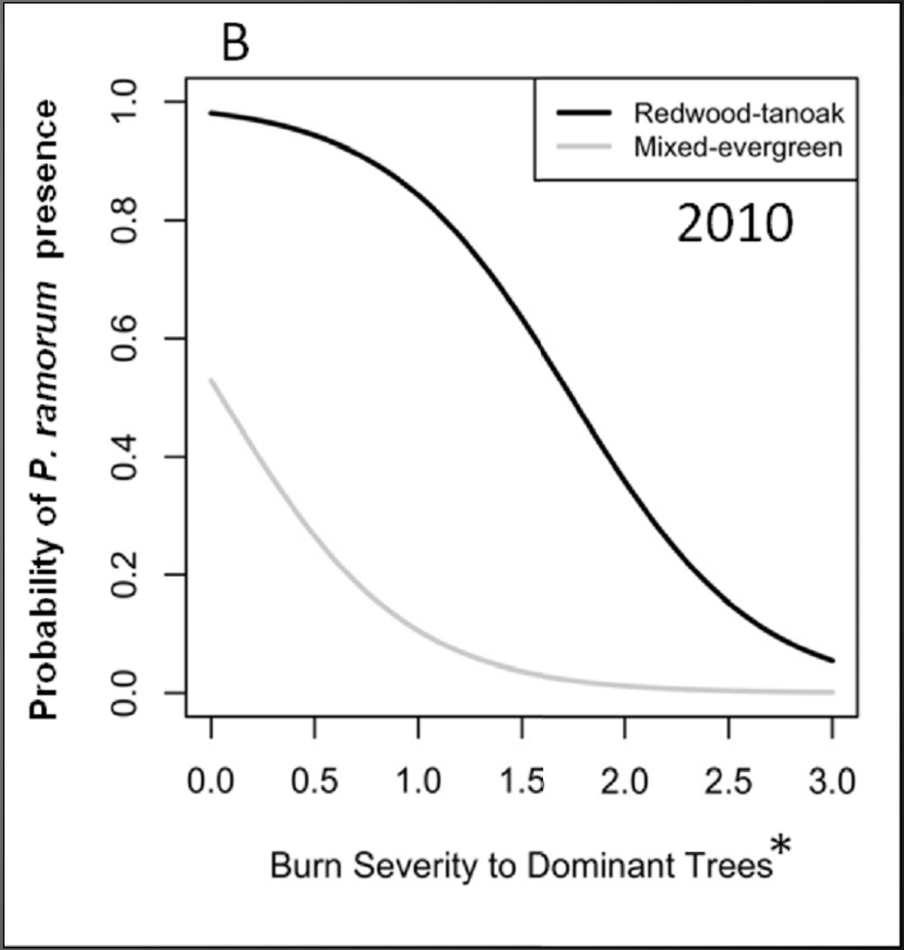

Beh 2011

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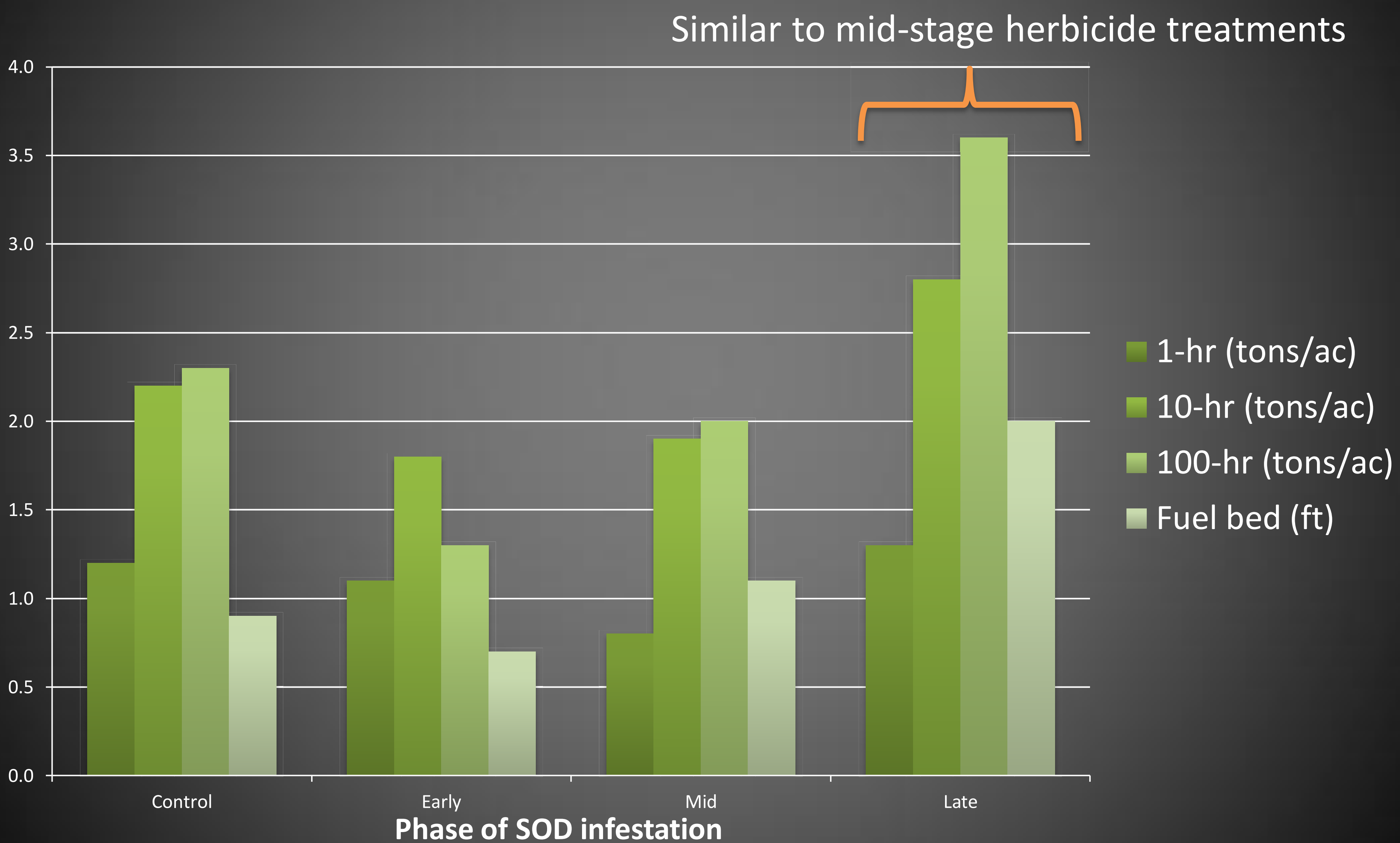

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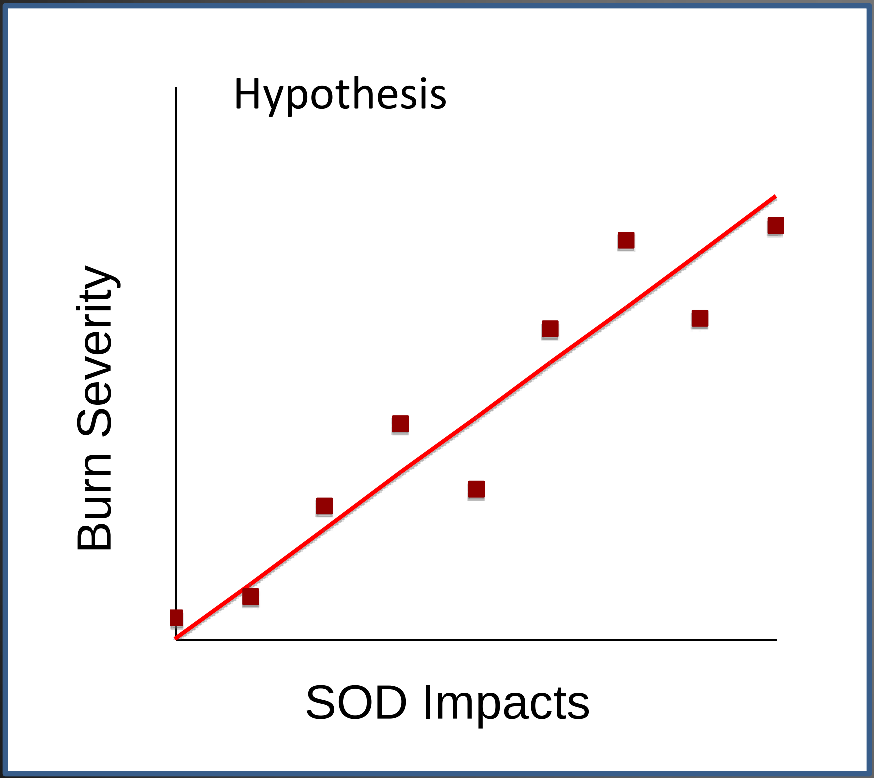

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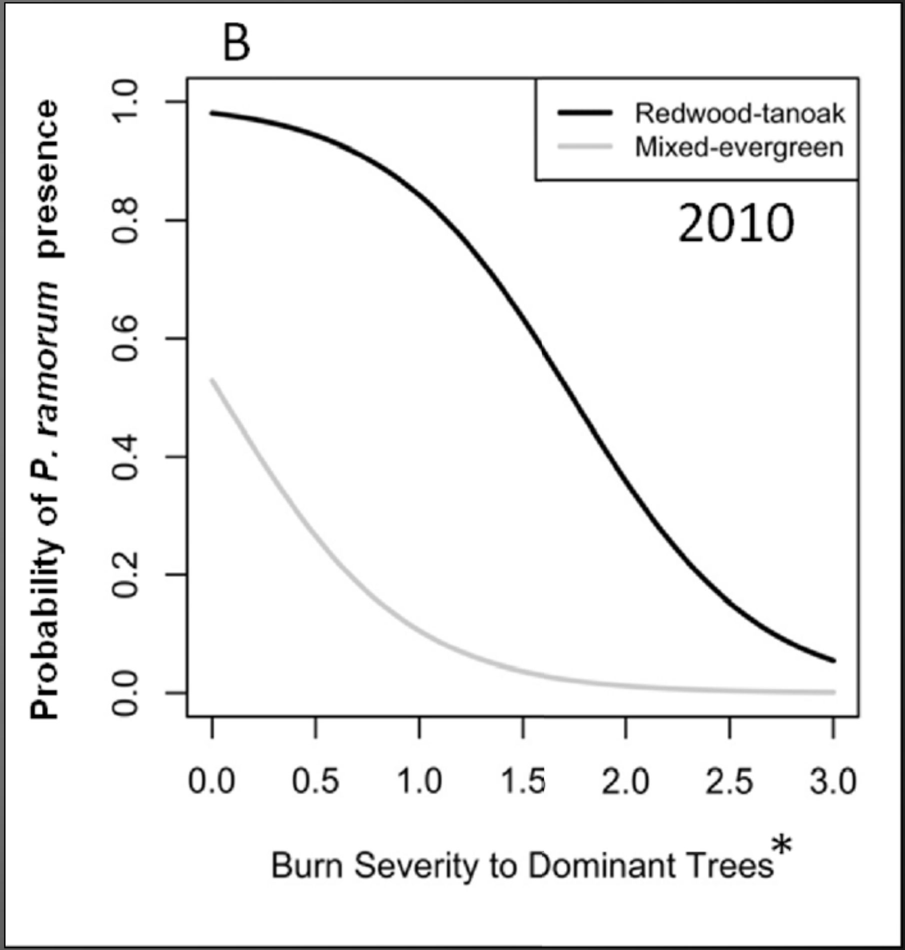

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