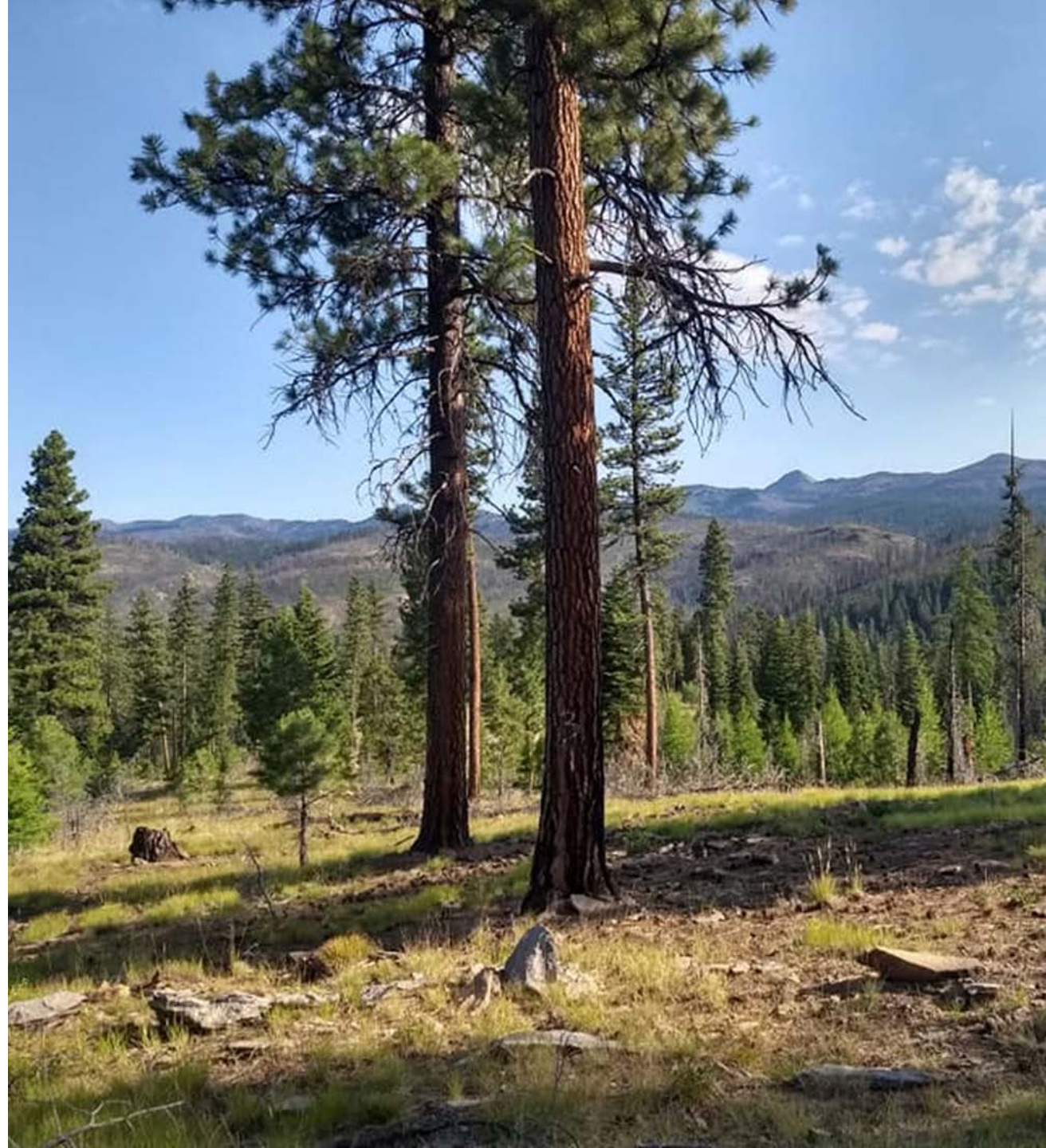


# How do individual trees respond to thinning and wildfire?

Christy Johnson, Oregon State University





Background





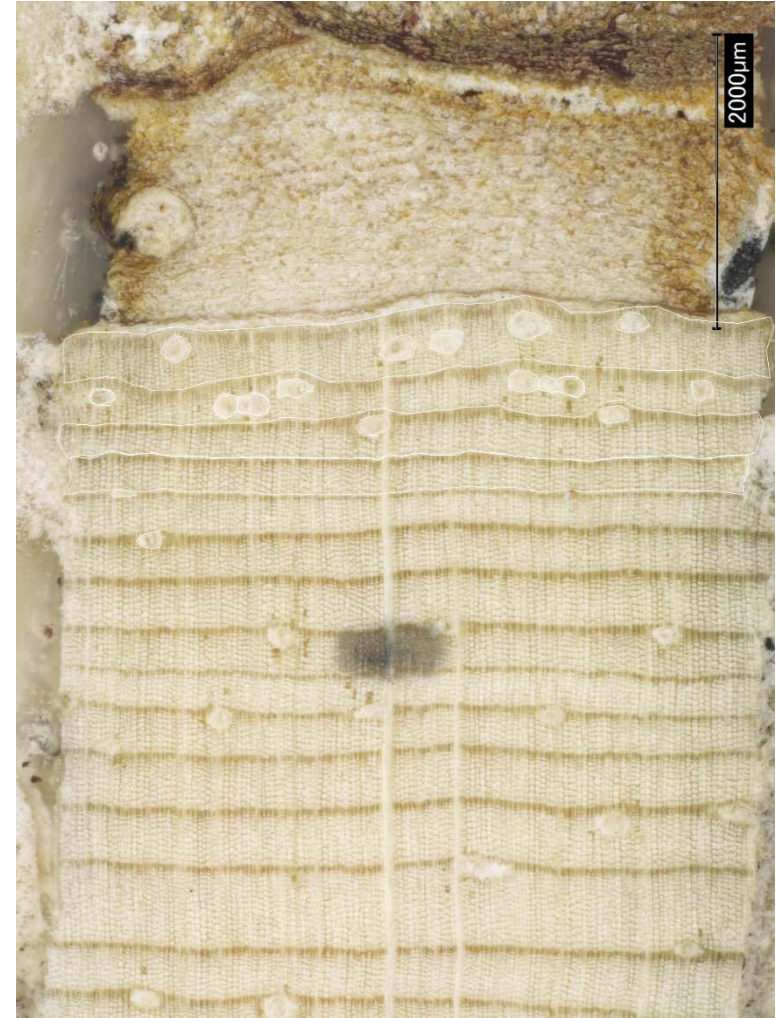
# Tree growth



# Resin flow



# Resin ducts



# Trees have limited resources to allocate

- Trees with better access to resources:



Growth



Reactive  
defenses



Proactive  
defenses

- Trees with greater risk of/vulnerability to disturbances:



Proactive  
defenses

...unless they have too much environmental stress to increase investment in defenses.



Low-Severity  
Burn



Moderate-to-High-  
Severity Burn



Harvest



Control





# Some terms

## Tree size

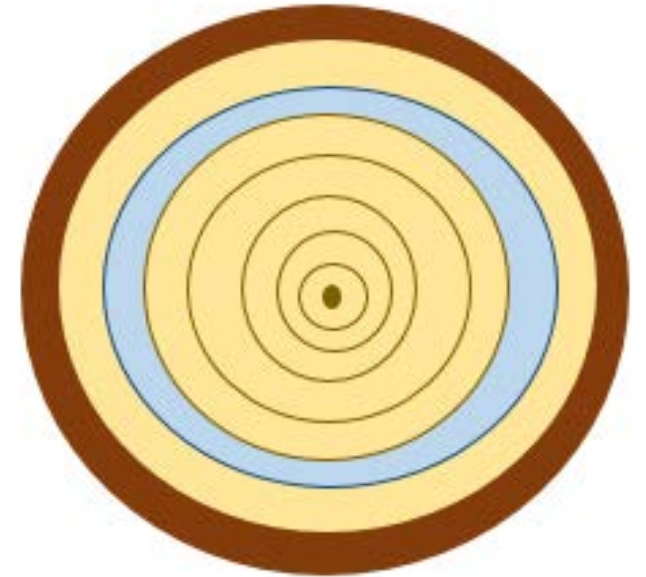
- DBH = Diameter at Breast Height

## Disturbance impacts

- Severity = % basal area mortality

## Tree growth

- BAI = Basal Area Increment





# Results



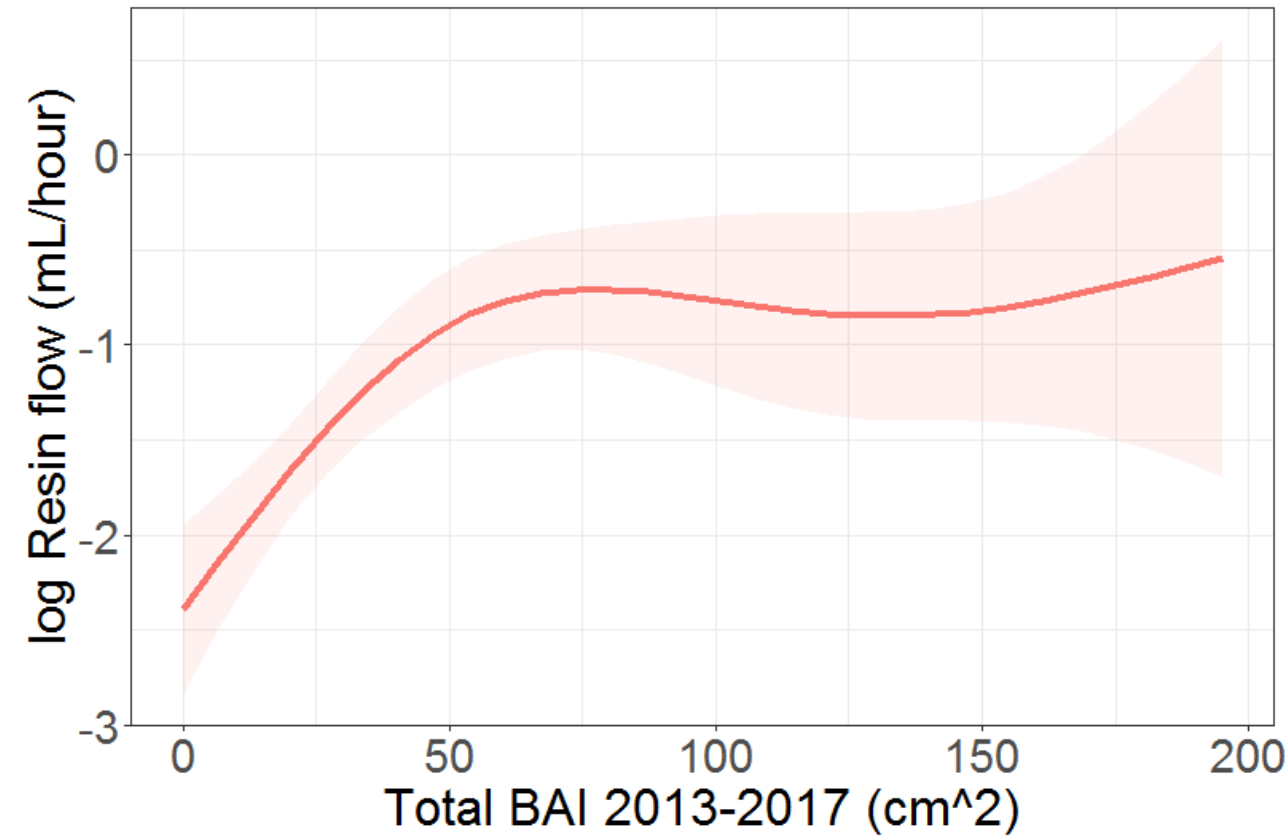
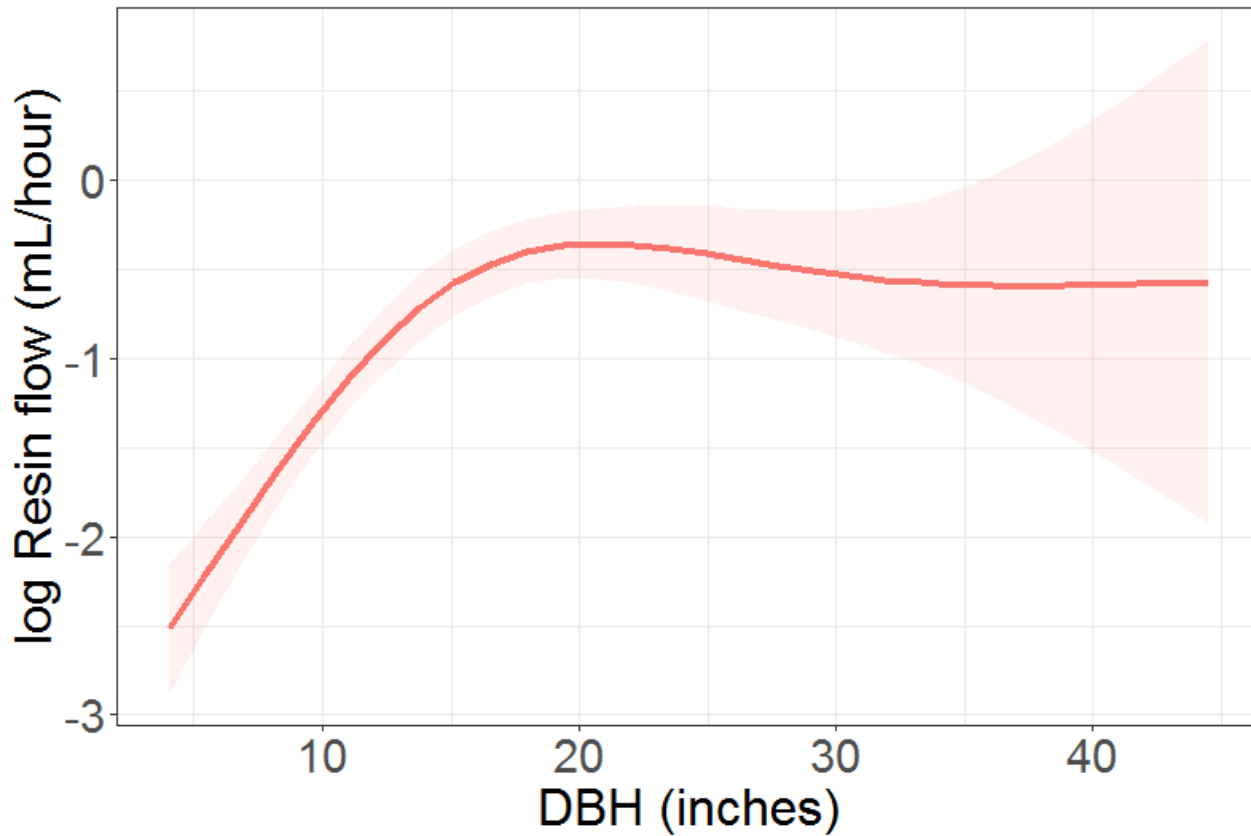


# Factors Influencing Tree Defenses



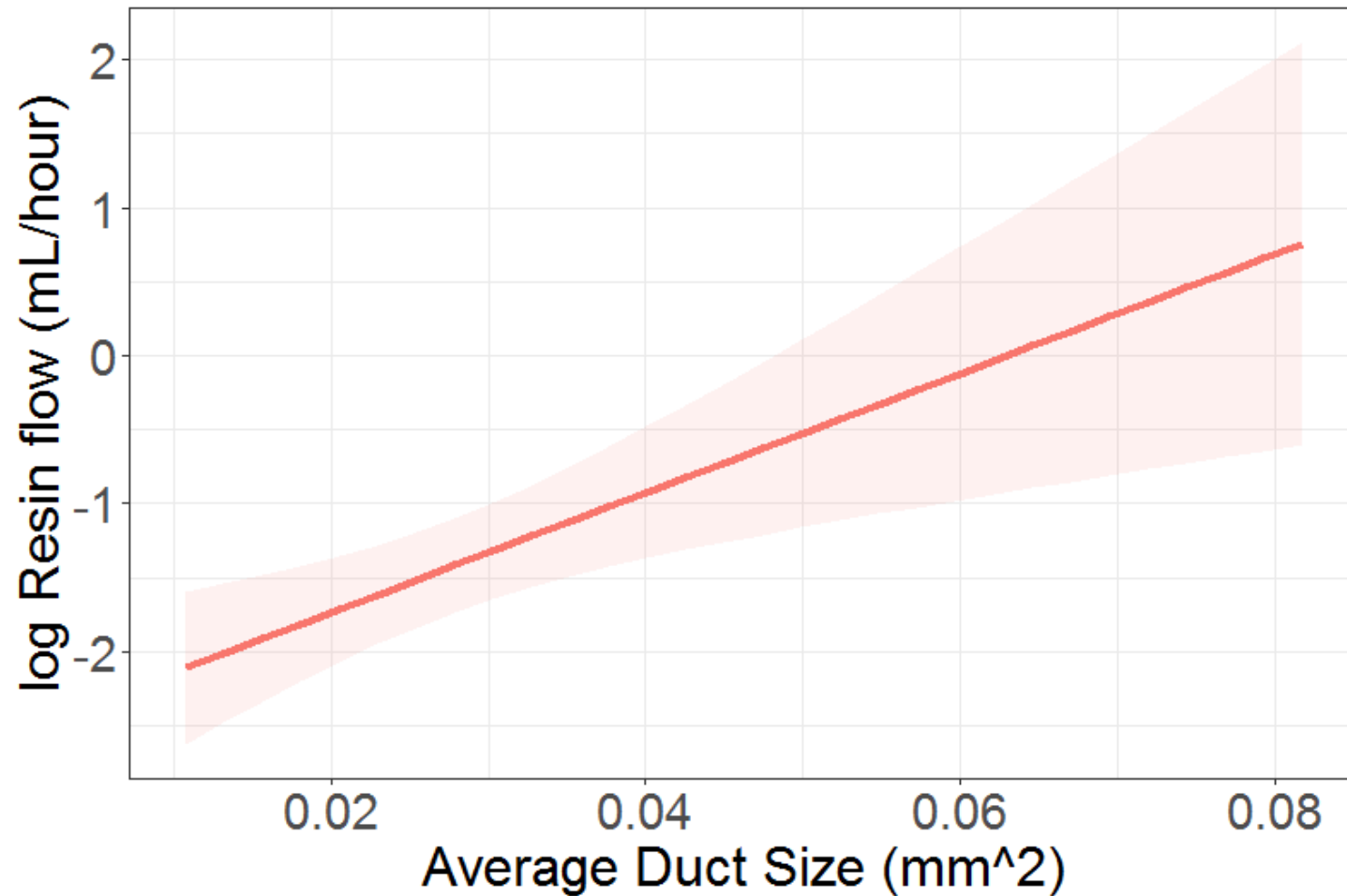


Mean resin flow increases, up to a point, with increasing tree size and tree growth rate





Mean resin flow increases linearly with resin duct size





# Changes after harvest and after fire



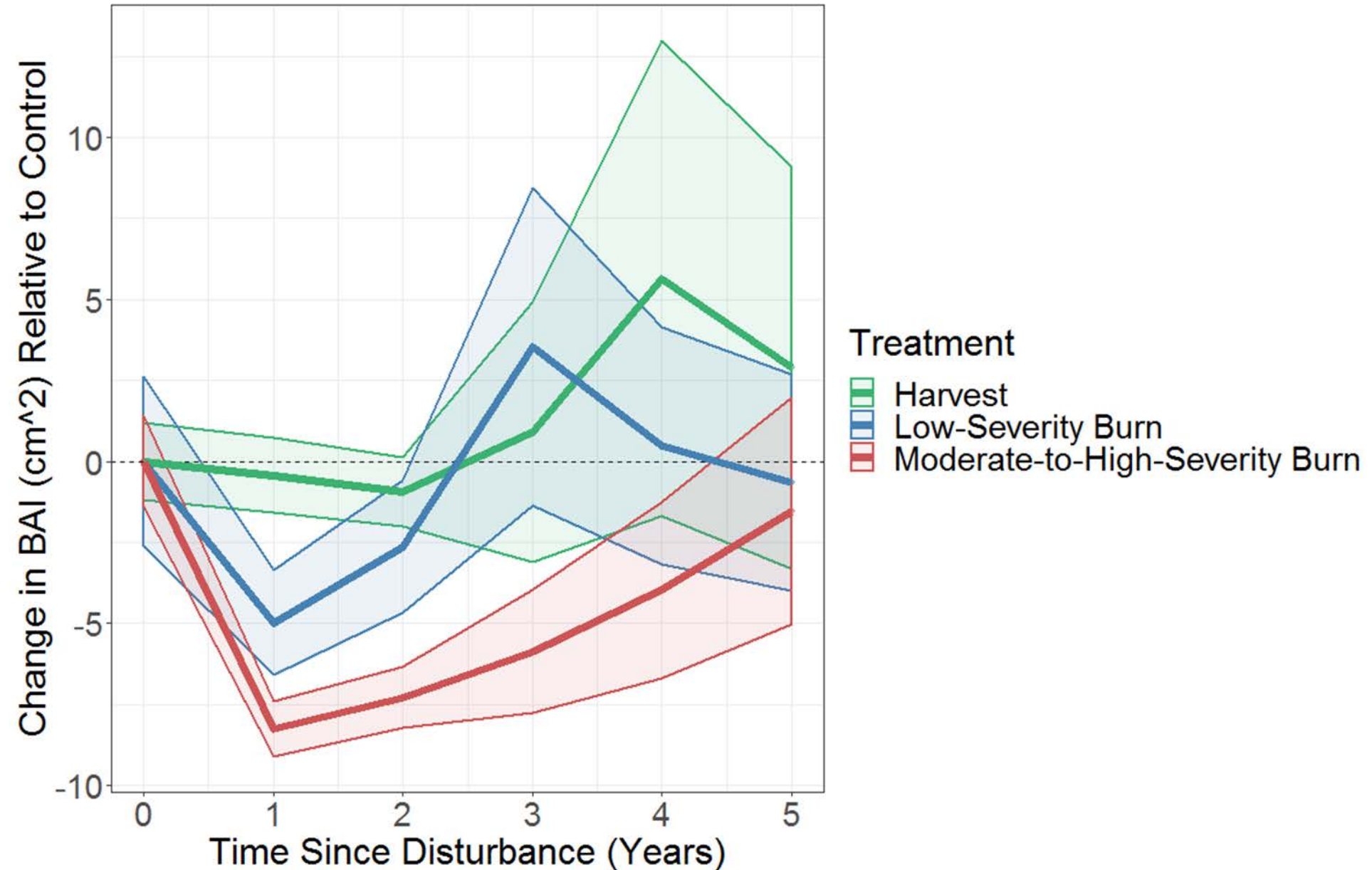


Tree growth



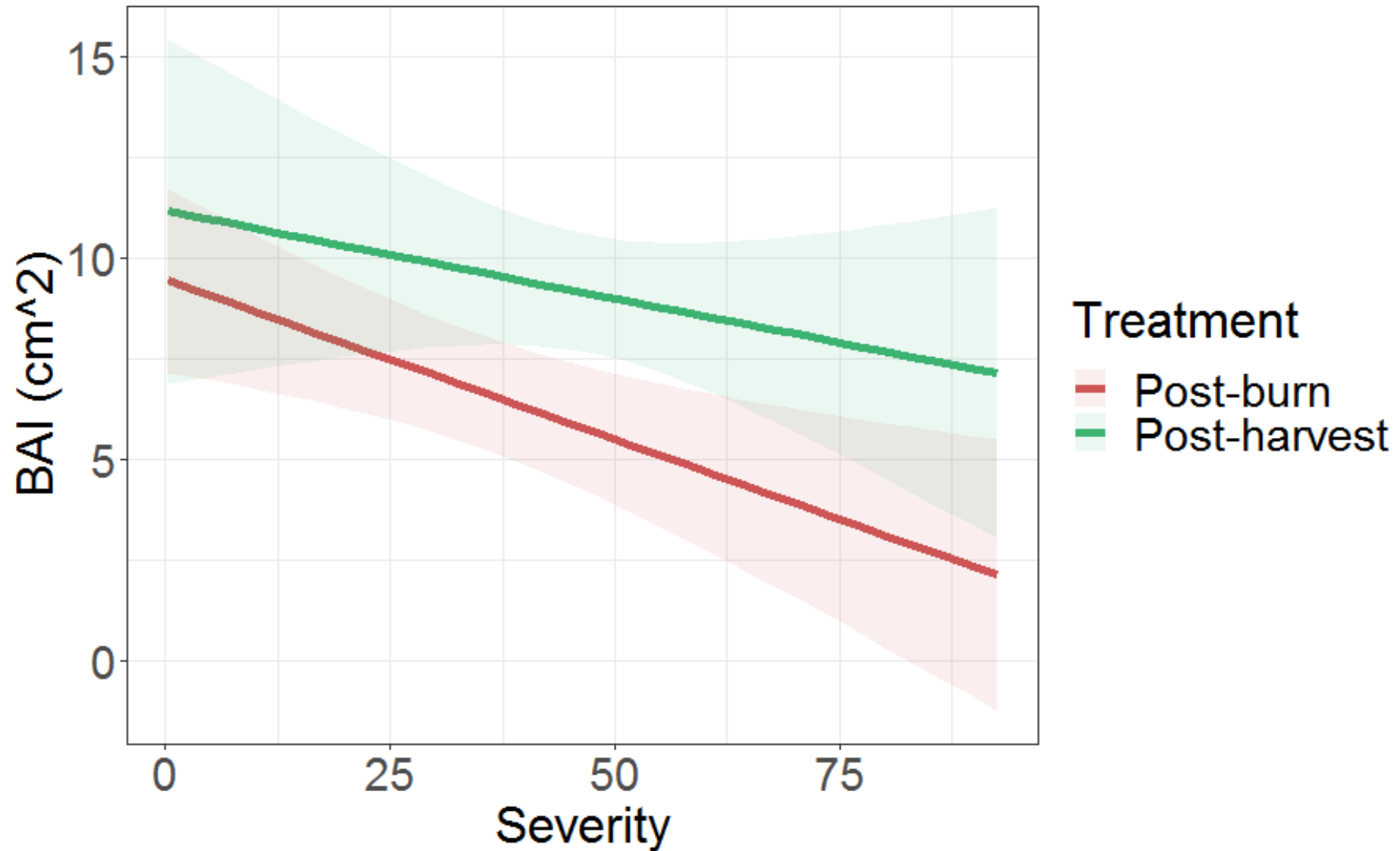


Fire damage took a toll on growth. Fire severity impacted how quickly growth recovered.





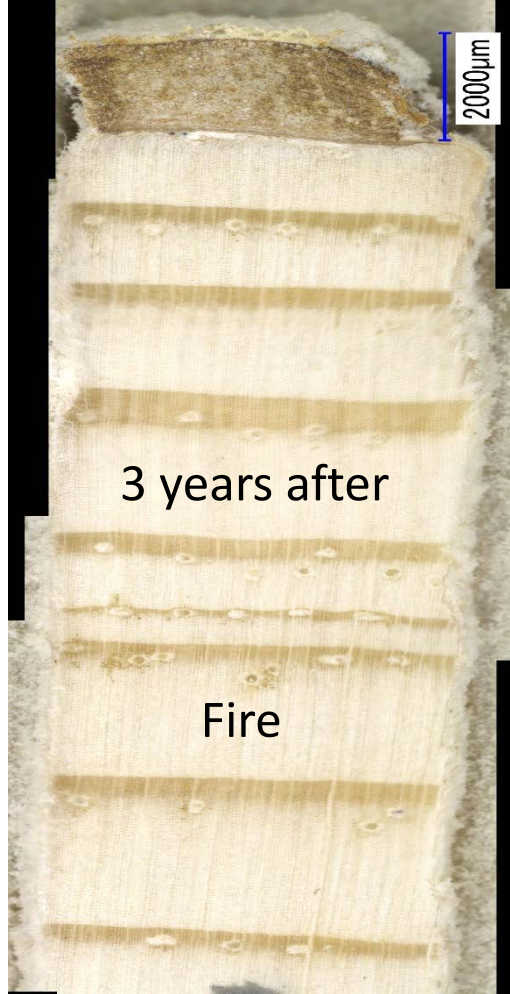
As fire severity increased, growth decreased. Thinning intensity had a lesser impact on post-harvest growth.





2012

Low-severity  
burn



2012

Moderate-  
severity burn



2012

Harvest



Control

Note: 2013 and 2014 are  
generally narrower on all trees

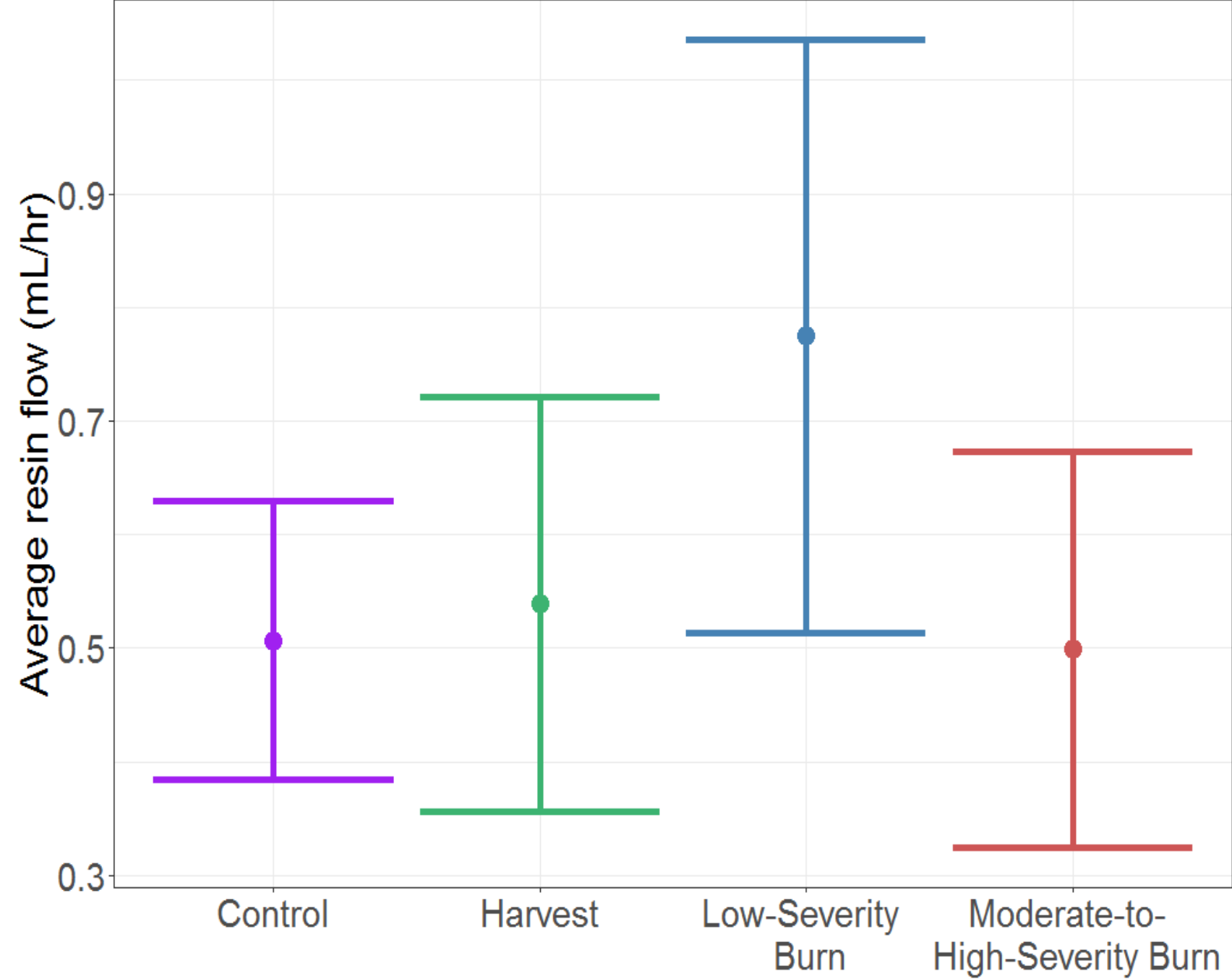




Resin flow

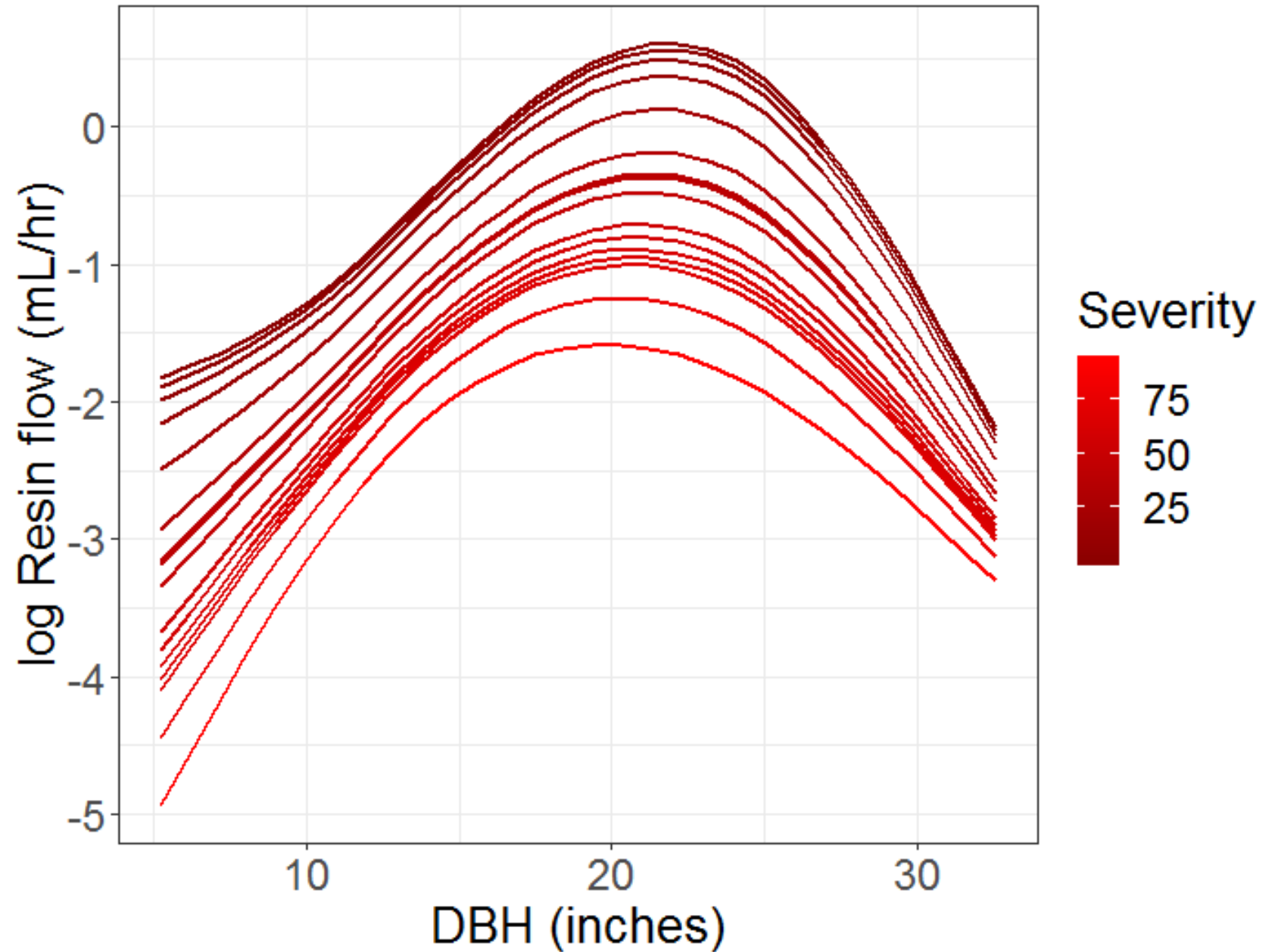


2018 resin flow was slightly (but not significantly) higher for sites with low-severity burn in the last 3-6 years





- For sites that burned in the last 3-6 years, resin flow decreased as fire severity increased
- Increasing fire severity had less impact on resin flow in large trees

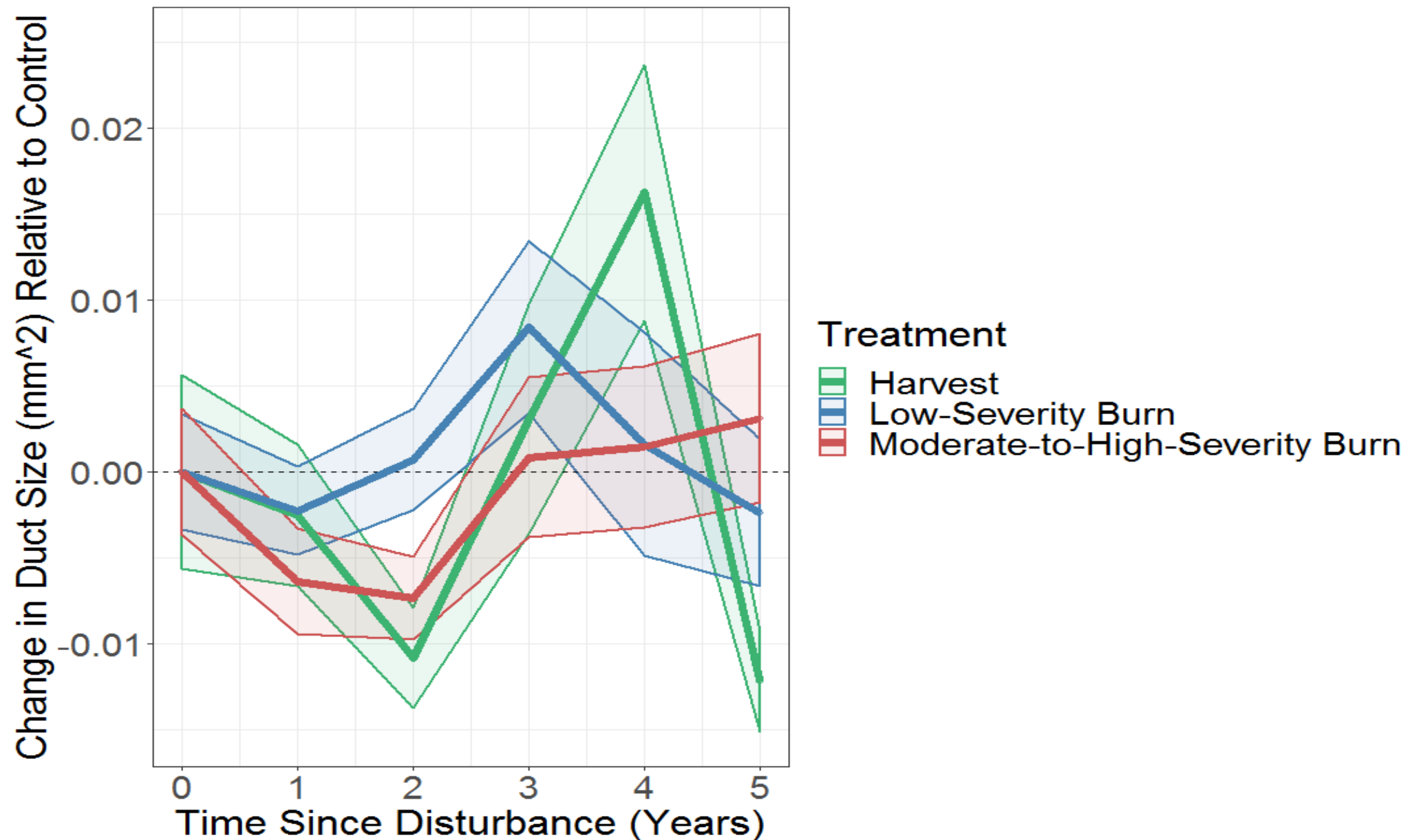


# Resin ducts

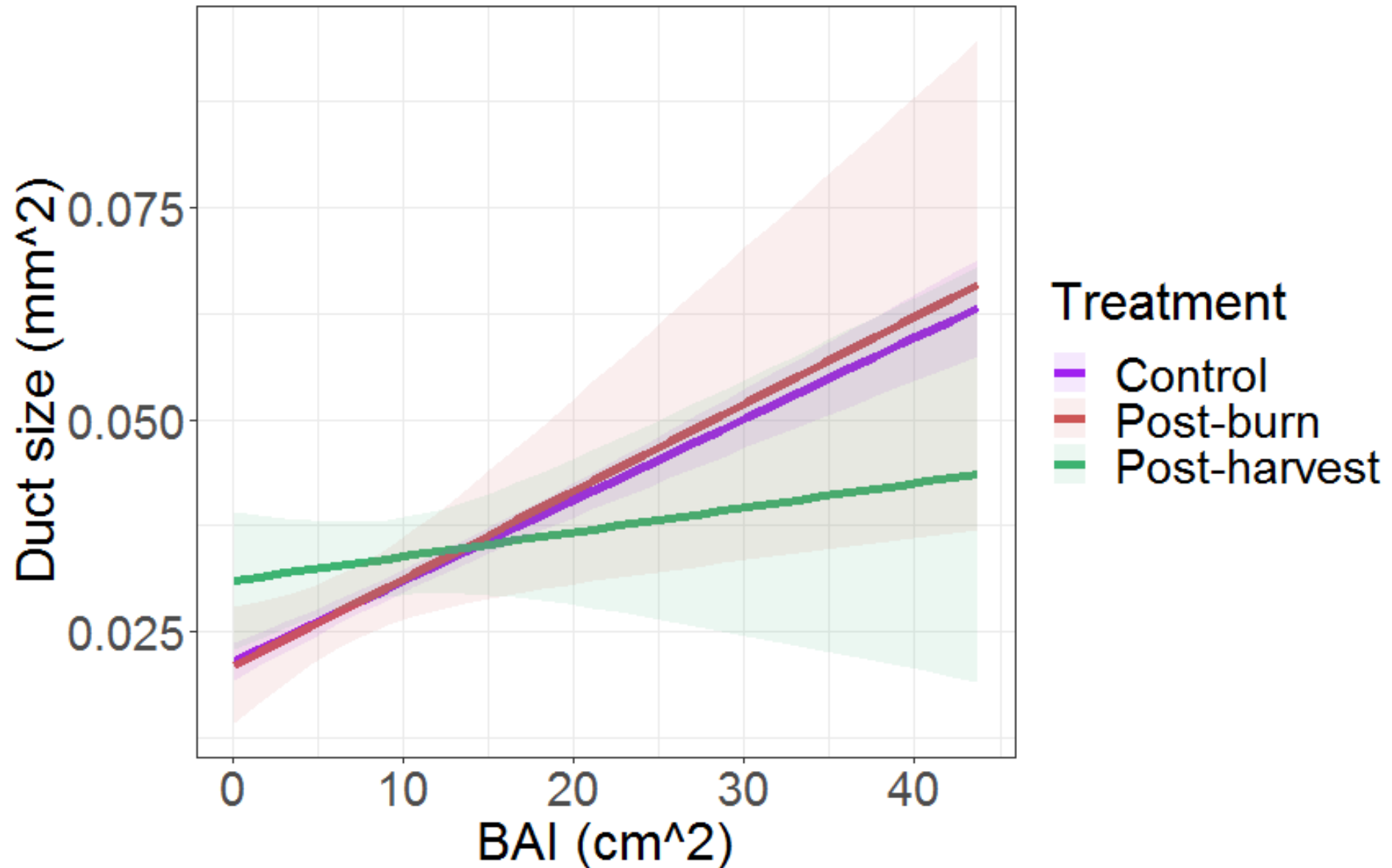




Duct size was maintained after low-severity burn, but suffered at higher burn severities. Harvest initially triggered lower duct size.

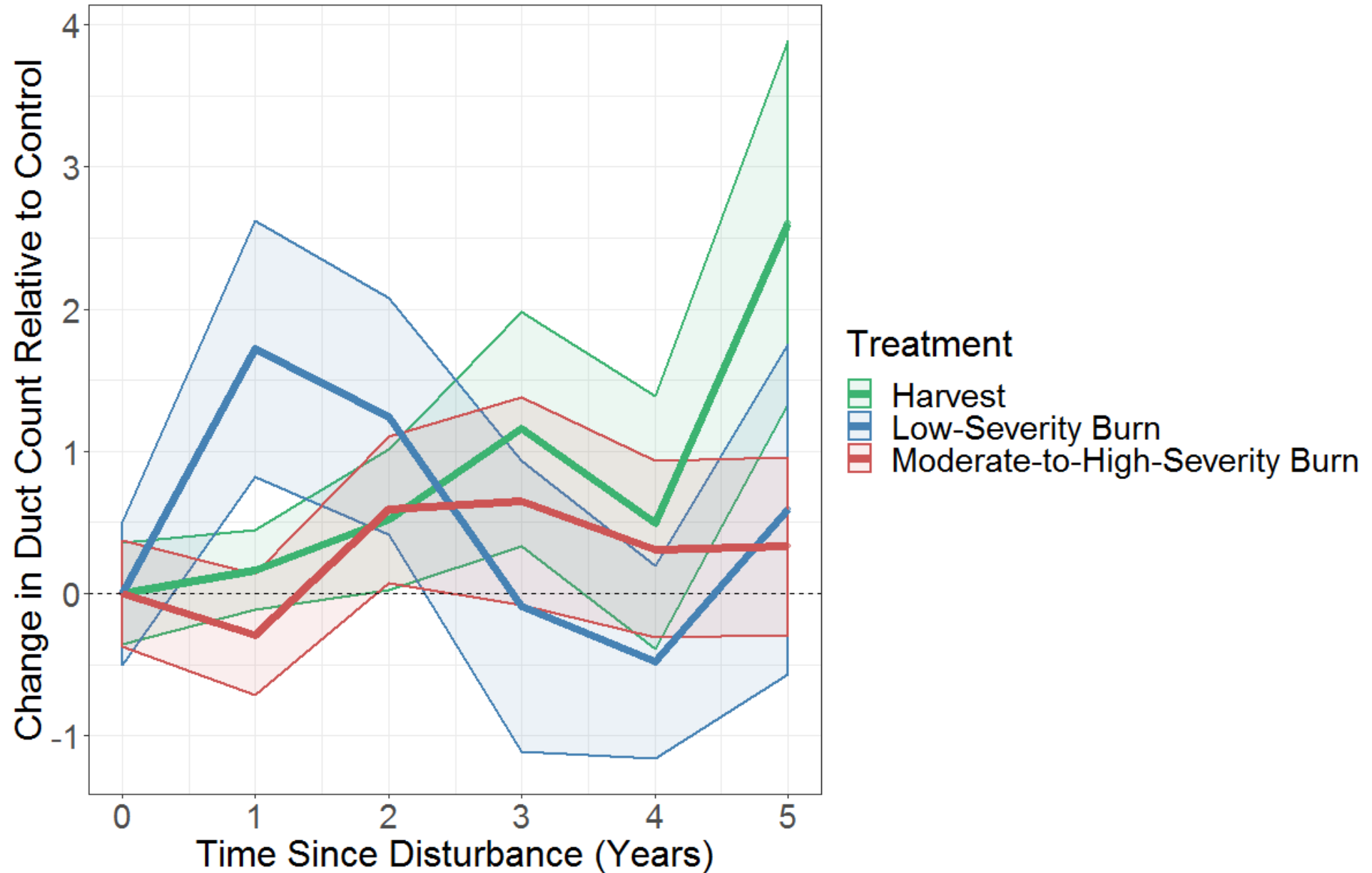


Trees with higher growth showed less increase in duct size at harvested sites.

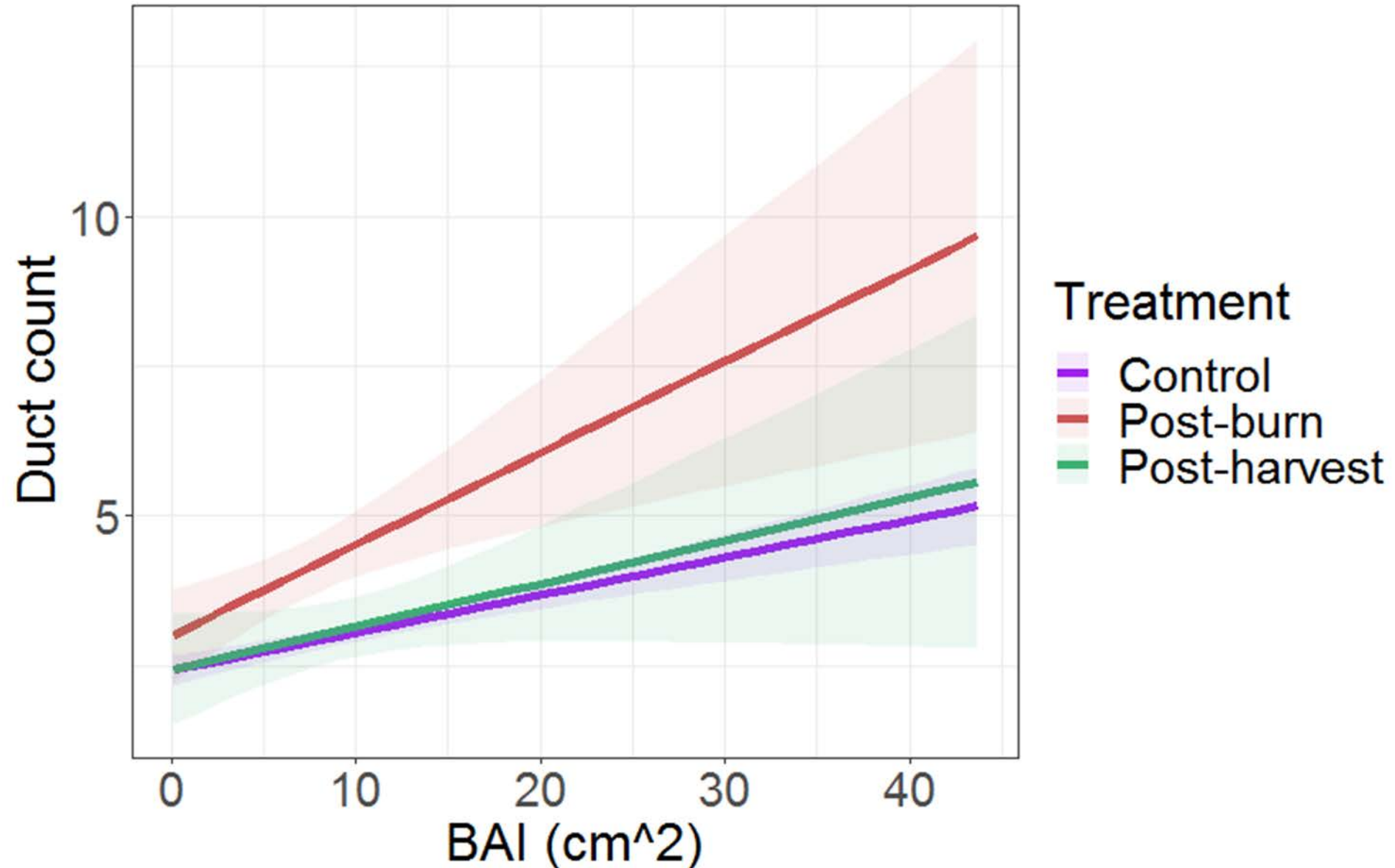




Trees increased duct counts after low-severity fire.



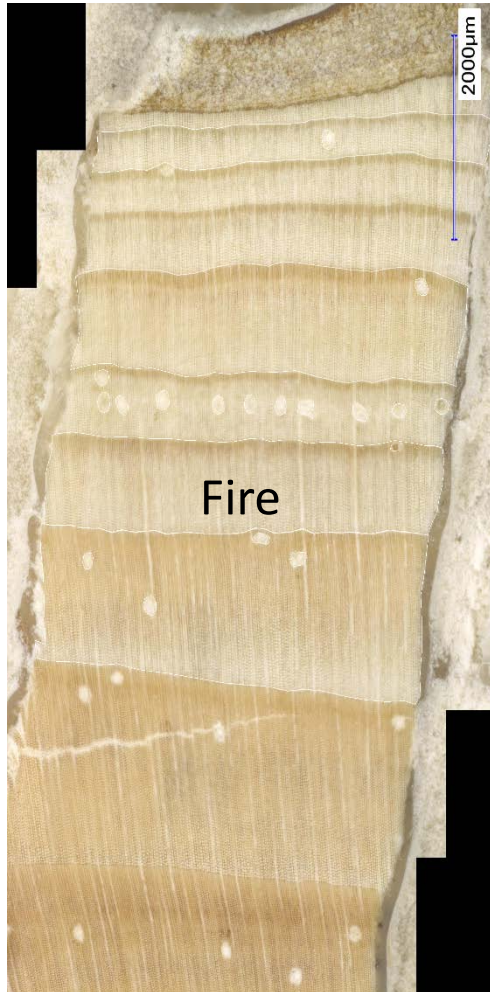
At burned sites, trees that were growing well invested more in duct production than trees at other sites.





2012

Low-severity  
burn



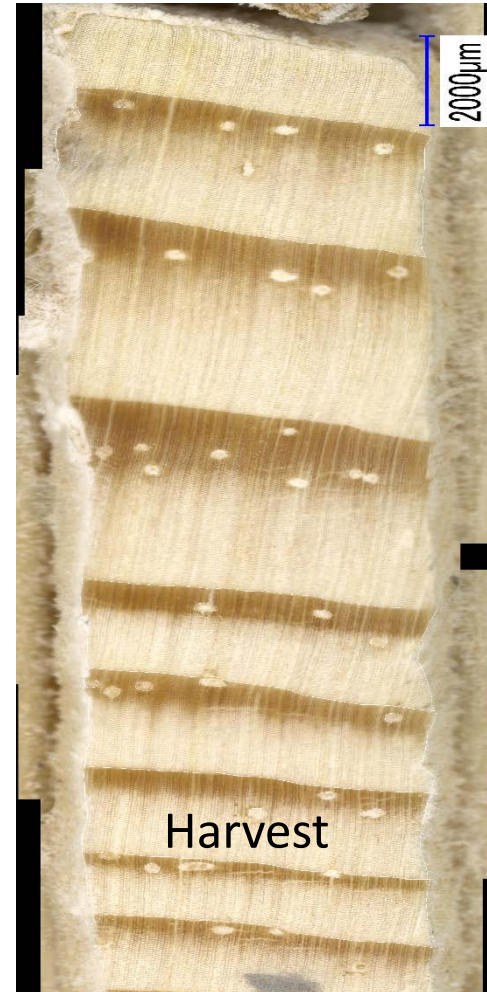
2012

High-severity  
burn



2012

Harvest



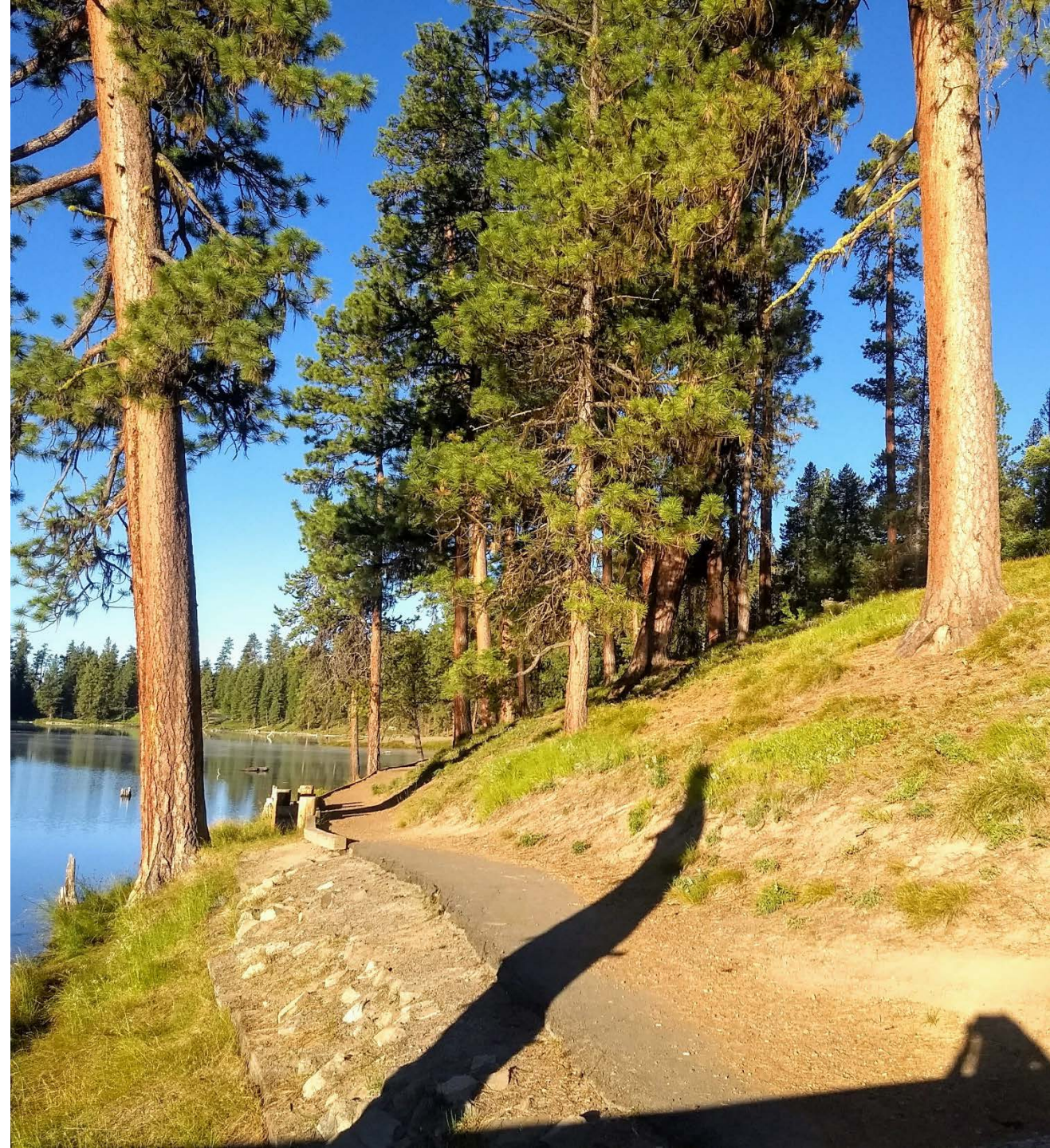
Control





# Summary

- Resin flow is affected by tree diameter, growth rate, and duct size.
- Tree growth and resin flow are both negatively impacted by increasing fire severity.
- Resin flow in larger trees is less impacted by increasing fire severity.
- After fire, trees show a stronger increase in duct count with growth.
- After harvest, trees show less increase in duct size with growth.





# ...Remember this?

- Trees with better access to resources:



Growth



Reactive  
defenses



Pro-active  
defenses

- Trees with greater risk of/vulnerability to disturbances:



Pro-active  
defenses

...unless they have too much environmental stress to increase investment in defenses.

# Conclusions

- Low-severity fire may have benefits for tree defenses against beetles and other disturbances.
- Treatments that increase average tree diameter can increase stand-level defenses and decrease impacts of higher severity fire.
- Treatments that increase tree growth (e.g. thinning) may also increase defenses, but may reduce relative investment in defenses. A tree with high growth at a burned site will tend to have better defenses than a tree with high growth at a harvested site.

