Factors impacting resin production: Quantifying potential bark beetle resistance in burned, harvested, and untreated ponderosa pine forest

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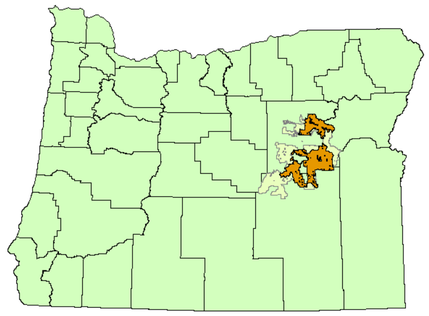
Background

- Ponderosa pine (*Pinus ponderosa*) produce resin as a defense mechanism to expel bark beetles and kill beetle larvae, which can overwhelm and kill trees.
- Research suggests that resin production may be impacted by a variety of factors, including past disturbances, tree growth rate, and tree diameter.
- Forest management to increase resin production, and thereby increase bark beetle resistance, is not well-understood or widely practiced.
- The Collaborative Forest Landscape Restoration Program provides an area in eastern Oregon where work is being done to restore forest conditions and promote forest health. This allows an opportunity to study resin production in different forest treatments and disturbance histories, and to potentially guide future management.



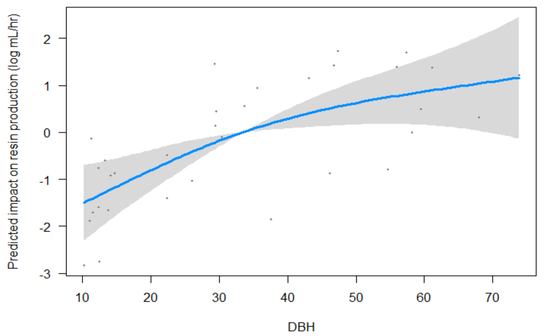
Methods

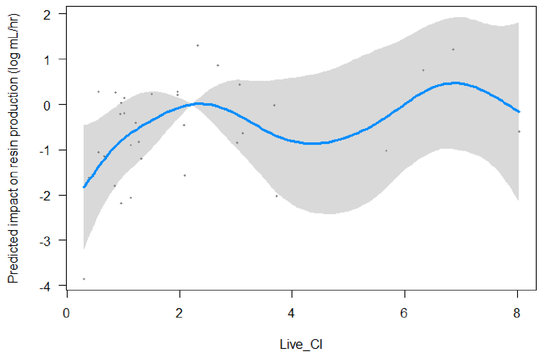
- Selected sites to represent timber harvested, low severity burned, moderate severity burned, high severity burned, and untreated forest sites, with treatment years 2006-2015.
- Selected trees to represent different diameter classes at each site, and set up resin collectors for 24 hours.
- Collected data on stand density, mortality, and competition levels.
- Created generalized additive models (GAMs) of resin production in mL/hr. GAMs are additive models that include smoothing terms to allow for non-linear responses to predictor variables. Resin production was log transformed to create equal variance for models.

Results

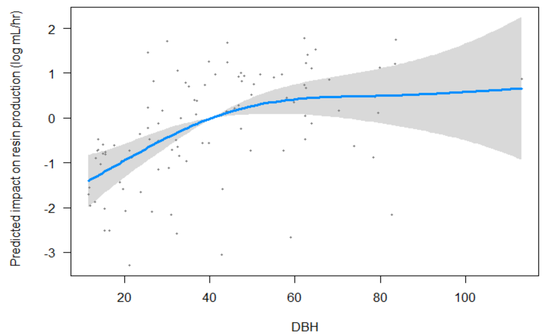
- Across all sites, resin production increases with tree diameter and breast height (DBH), but begins to level off for the largest trees.
- In burned and timber harvested sites, there was a seasonal component to resin production, with higher resin flow mid-summer.
- At untreated sites, the seasonal effect was not significant. Instead, resin production fluctuated with the amount of competition that a tree faced from other live trees.
- Treatment type, severity, and timing did not have significant impacts on resin production in these models.

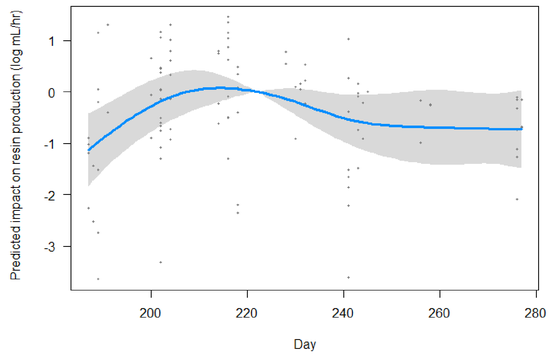
Factors impacting resin production at Untreated sites





Factors impacting resin production at Burned and Harvested sites





Blue lines show the fitted value for the impact that the x-variable has relative to mean resin production. Points are observed values. Grey envelopes are a 95% confidence interval for the fitted value.

Conclusions and Future Work

- While resin production did not differ significantly between treatments, trees at treated sites were less sensitive to impacts of competition.
- Promoting and retaining larger diameter trees may increase resin production and bark beetle resistance.
- Models may be further improved in the future through tree ring analysis, which will allow tree growth to be included in resin models, and will allow observation of numbers and sizes of resin ducts in each tree.
- Treatment impacts on tree growth and leaf area index will also be examined in future work.

Acknowledgements

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