

# Ponderosa pine water stress and oleoresin production in three forest conditions in northern Arizona

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## Abstract

We measured leaf predawn water potential and oleoresin production of ponderosa pines (*Pinus ponderosa*) during summer 2003 flights of *Dendroctonus brevicomis* and *Ips pini* in three forest conditions (shown at right) in the Coconino National Forest near Flagstaff, Arizona. We measured trees in four replicate stands of each forest condition. Consistent with our hypothesis, trees in unmanaged stands had significantly more negative predawn water potential compared to trees in thinned and thinned + burned stands. Predawn water potential did not differ between thinned and thinned + burned stands. Contrary to our hypothesis of greater oleoresin production in managed forest stands, resin production did not significantly differ among forest conditions. In an experiment where we baited trees with synthetic *D. brevicomis* pheromones, all trees were attacked and mortality was 80-85% over all stand conditions. Trap catches of *Ips pini* increased throughout June to the end of our monitoring period in early July and did not differ strongly among forest conditions. *D. brevicomis* catches peaked in the second week of July and were greatest in the unmanaged forest condition. Our results suggest that thinning 10-13 years ago reduced tree water stress in year 2003, but did not influence oleoresin production or tree resistance to mass attack of *D. brevicomis*.



Unmanaged (UN)

- Four stands not treated in last 30 years
- Greater than 90% crown closure



Thinned (TH)

- Four stands thinned between 1987 and 1993
- Greater than 30% basal area removal



Thinned + Burned (TB)

- Same treatment as thinned stands, but also received a broadcast burn within 3-4 years of thinning (four stands)

## Objectives

- Determine the effects of operational thinning and prescribed burning on ponderosa pine water stress and oleoresin production in northern Arizona
- Evaluate tree resistance to bark beetles in managed and unmanaged forest conditions in northern Arizona
- Compare flight activity of *Ips pini* and *Dendroctonus brevicomis* between managed and unmanaged forest conditions

## Methods

### Measurement trees:

- 10 trees in the middle of each forest stand DBH 27 – 33 cm

### Predawn water potential:

- Leaves removed from mid-canopy before sunrise (4 – 5 am) in the last week of June
- Water potential measured in lab within 2 hours using a pressure chamber

### Tree resin production:

- Tree phloem severed 1 m above tree base using a 2.5 cm circular punch
- Resin collected in a 15 ml vial and measured at 24 hrs and 1 week periods



### Bark beetle trapping:

- Bark beetles trapped using baited 12-unit Lindgren funnel traps and monitored weekly
- 2 traps baited with *Ips pini* lure and 2 traps baited with *D. brevicomis* lure per forest stand



### Baited trees:

- 5 trees baited per forest stand with *brevicomis* lure
- Bark beetle attacks counted on the lower 4 m of tree bole bi-weekly

## Results

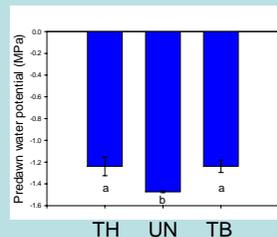


Figure 1. Tree predawn water potential in late June was significantly lower in the unmanaged stands compared with the thinned and thinned + burned stands, indicating greater water stress in unmanaged stands.

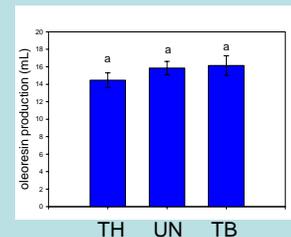


Figure 2. Oleoresin production one week after wounding in July was not significantly different among forest conditions, indicating no management effect on tree resin production.

Table 1. Results from the tree baiting experiment showed no difference in percent of trees attacked or tree mortality among forest conditions.

Forest Condition	Number of baited trees	Average # of attacks per tree (lower 4 m of bole)	Percent trees attacked	Percent tree mortality (10/9/2003)
TH	20	106	100	80
UN	20	104	100	80
TB	20	123	100	85

## Conclusions

- Thinning 10-13 years ago with or without prescribed burning reduced water stress of ponderosa pine in 2003 in northern Arizona.
- Ponderosa pine oleoresin production in 2003 was not significantly influenced by past thinning or prescribed burning in northern Arizona.
- Tree survival following pheromone-mediated mass attack of *D. brevicomis* did not differ among forest conditions in 2003.
- Trap catches of *D. brevicomis* were higher in the unmanaged forest condition than the thinned and thinned + burned forest conditions; catches of *Ips pini* did not differ strongly among forest conditions.

## Acknowledgements

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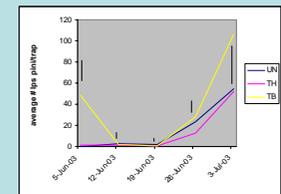


Figure 3. Average *Ips pini* catches per trap did not differ strongly among forest conditions. The bars for each date represent the average SE.

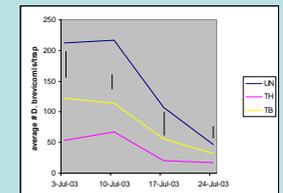


Figure 4. Average *Dendroctonus brevicomis* catches per trap were greater in the unmanaged (UN) forest conditions compared with both thinned (TH + TB) conditions. The bars for each date represent the average SE.