

# Forest Health and Mortality Trends Across Three Elevation Zones in the Lake Tahoe Basin

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# Factors Affecting Forest Health

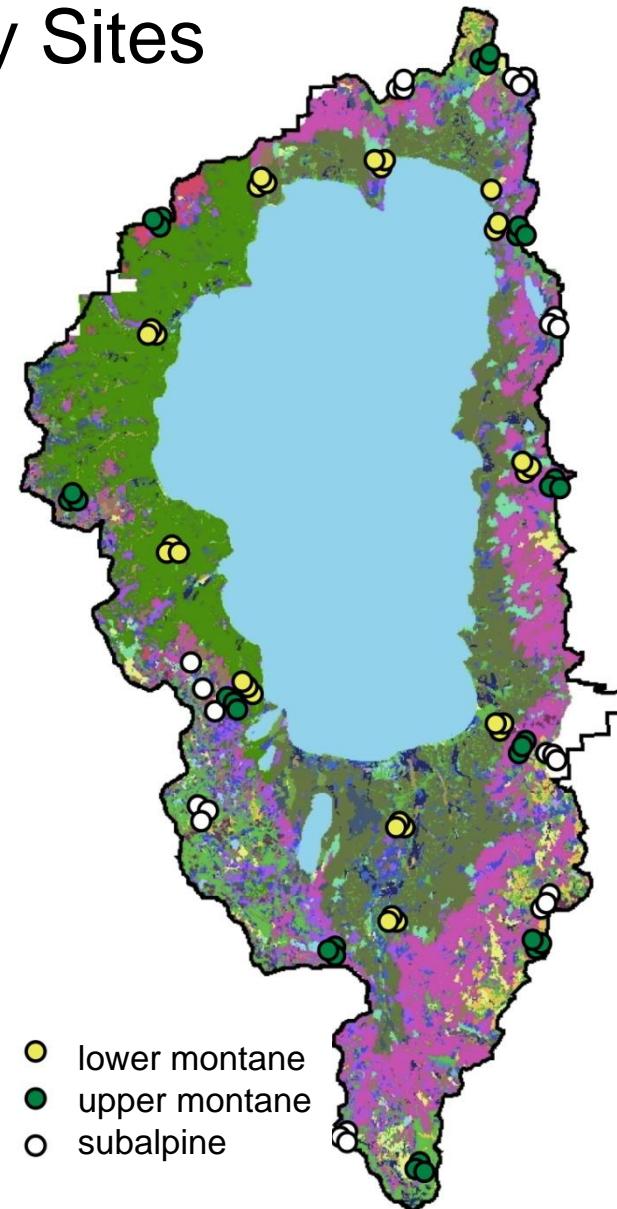
- insect pests
- pathogens
- parasitic plants
- invasive plants
- fire
- tree density
- land-use (grazing, clearing)
- soil (compaction)
- climate (precipitation, temperature)

- 2008-2010 plots established
- data collected

## Objectives

- Determine mortality levels  
(associated variables)
- Assess damage  
(caused by insects/diseases)
- Identify declining populations

## Study Sites



2800m (9190ft)



2450m (8040ft)



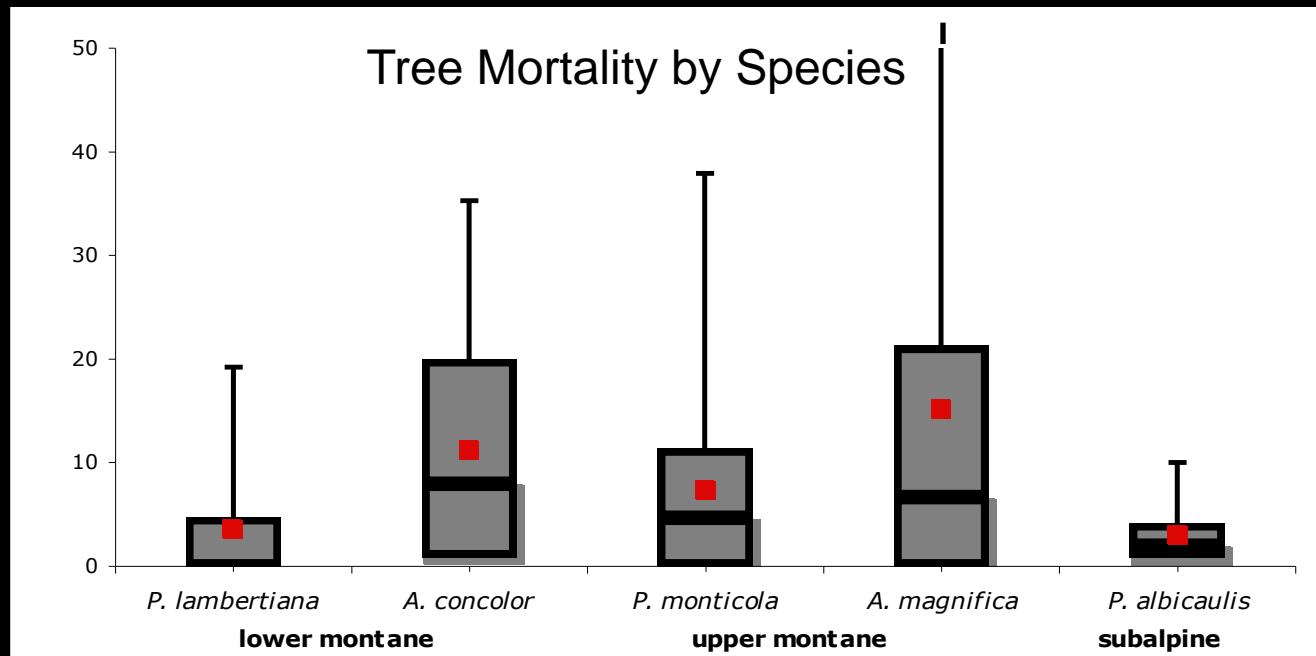
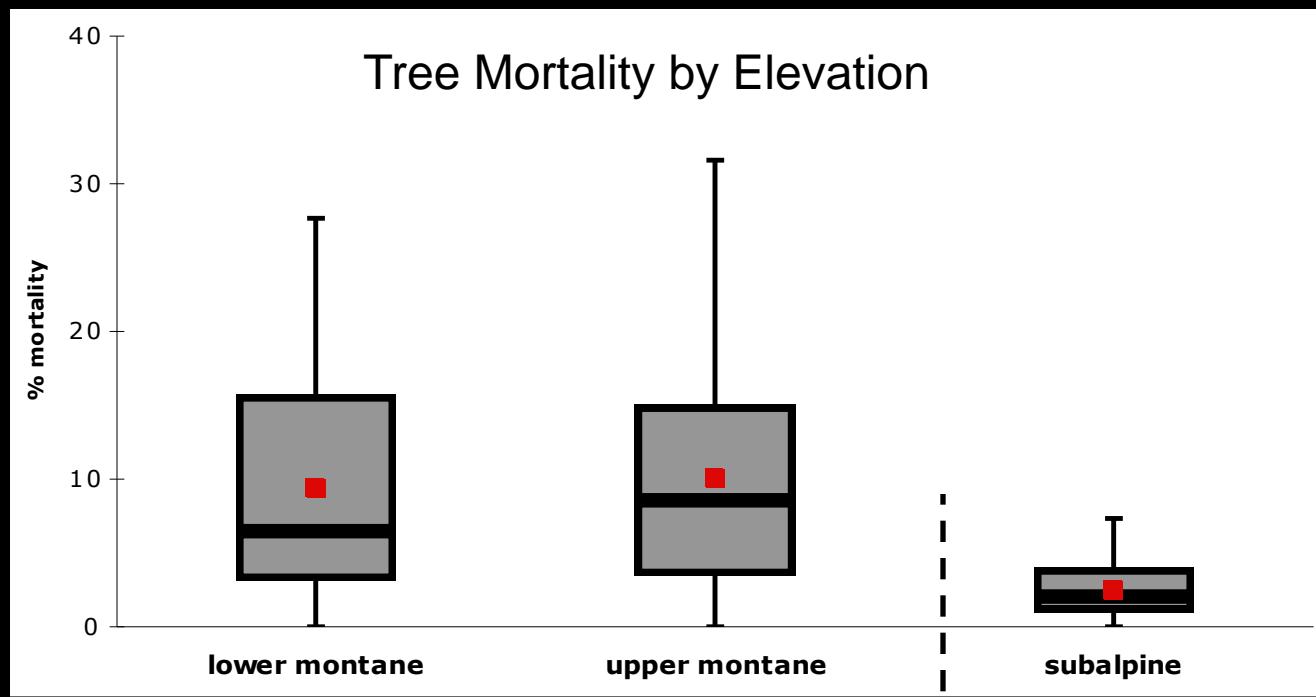
2000m (6560ft)



# Summary of Stand and Environmental Data at Three Elevation Zones in the Lake Tahoe Basin

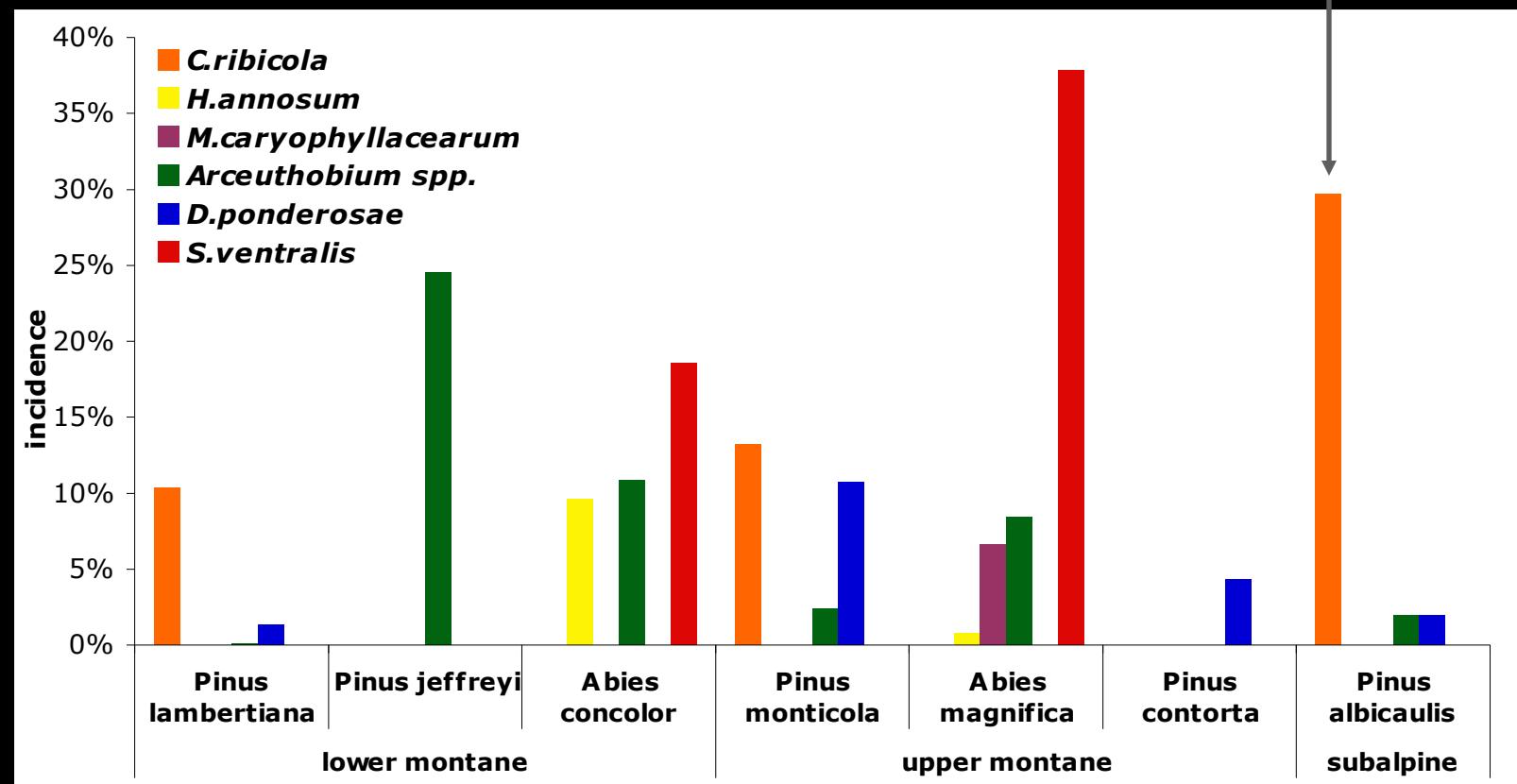
Elevation Zone	Mean elev m	Assoc. spp(%)	Min-Max temp °C	Ann ppt mm	AWC 50	Density st/ha	Basal Area m²/ha	Mortality %	Land-use (%)
<b>subalpine</b>	2805	pial (89) tsme (4) pico (3)	7.5-22.2	1209	2.8	607 (461-846)	26 (18-35)	2.6 (0.5-4)	REC(20) WF (10)
<b>upper montane</b>	2450	pimo(46) abma(36) pico(10)	7.4-22.7	1123	4.2	179 (98-269)	26 (11-47)	10.8 (0.7-21)	RT (20) WF (20)
<b>lower montane</b>	2026	abco(52) pila(27) pije(14)	7-23.7	802	5.2	235 (62-360)	20 (5-42)	9.4 (3-20)	HL (90) RT (20) PF (20)

Notes: Means displayed for each elevation zone (range); Soil data source: USDA NRCS (<http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>)  
 Climate average for each region based on PRISM data for 30-year averages (Daly et al. 1994 and FHTET), AWC 50 = available water in top 0-50 in;  
 Land-use: HL=historical logging, RT=recent thinning, WF=wild fire, PF=prescribed fire, REC=recreation.



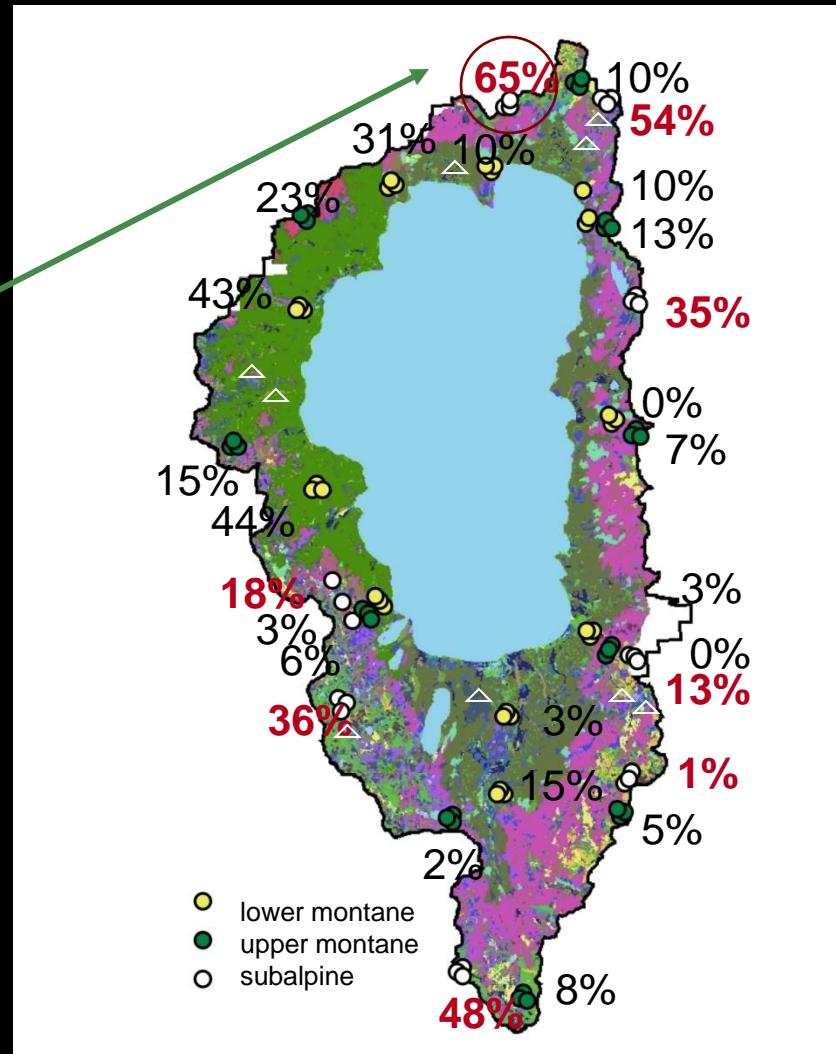
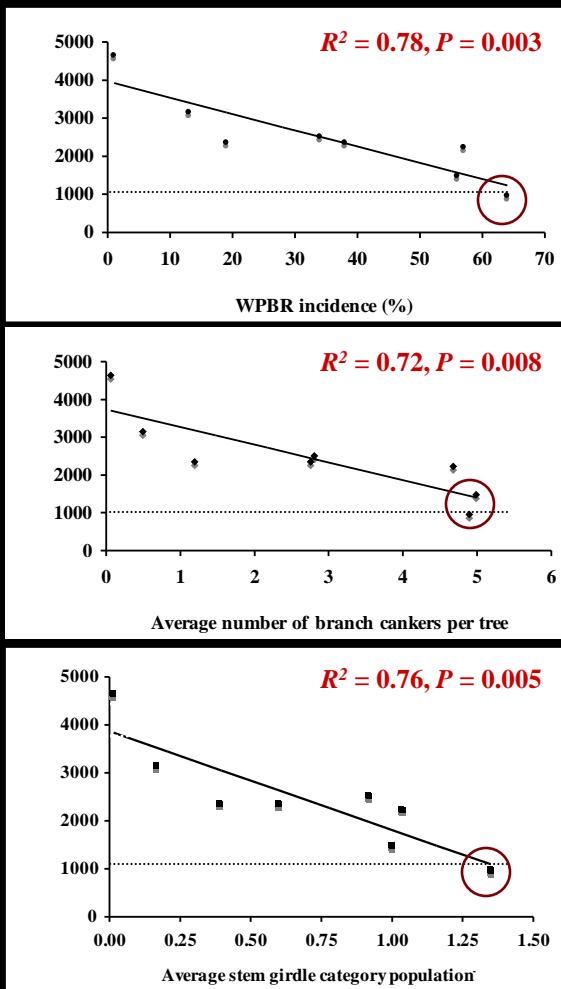
# Insect and Disease Incidence Across Elevation Zones

## White Pine Blister Rust (*Cronartium ribicola*)



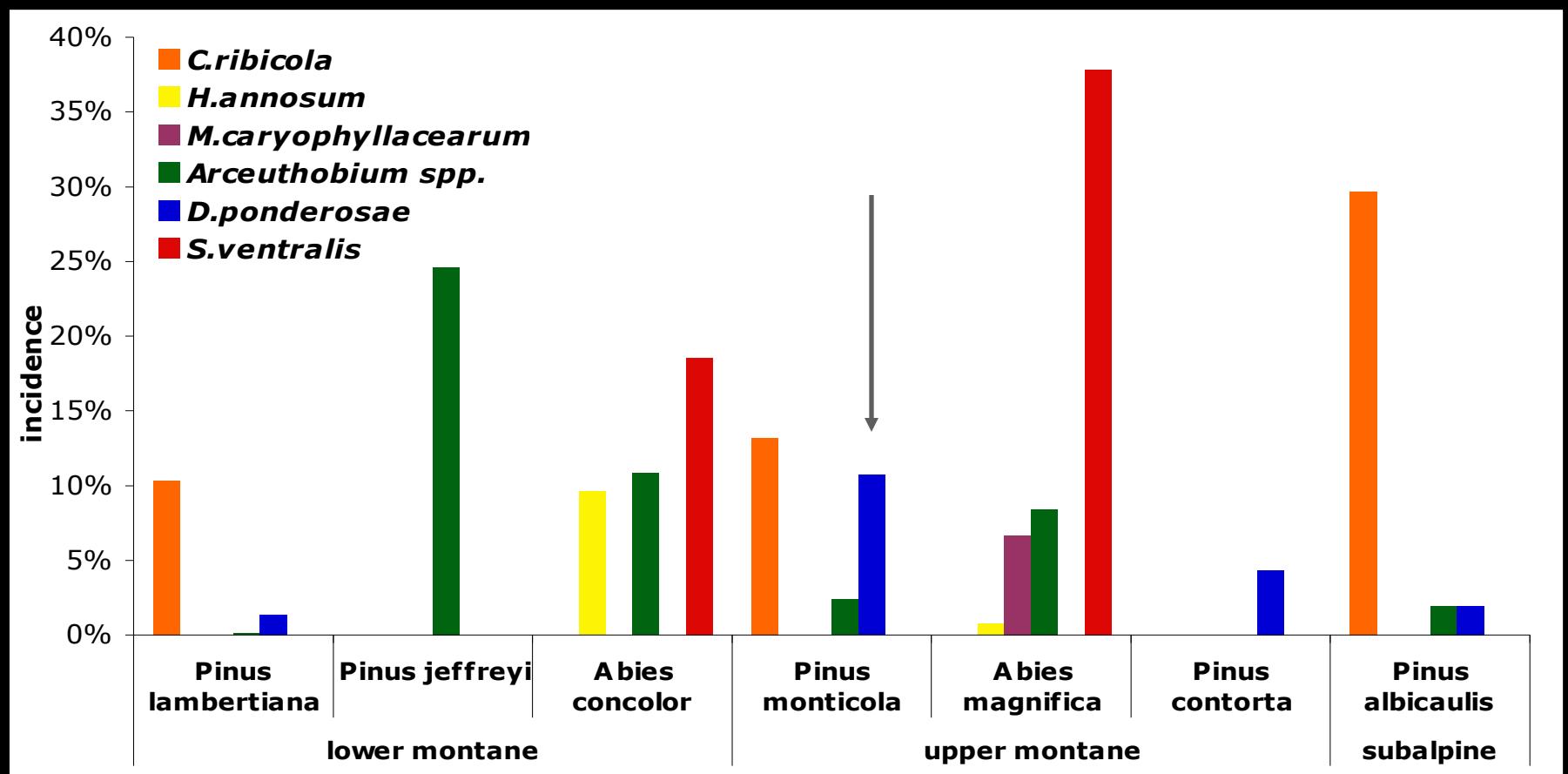
# Subalpine - White Pine Blister Rust (*C. ribicola*)

- Negative relationships between cone production and WPBR incidence and severity
- Percent of individuals infected (incidence), avg number of infected branches per population, and severity of stem girdling - all negatively related with cone production



# Insect and Disease Incidence Across Elevation Zones

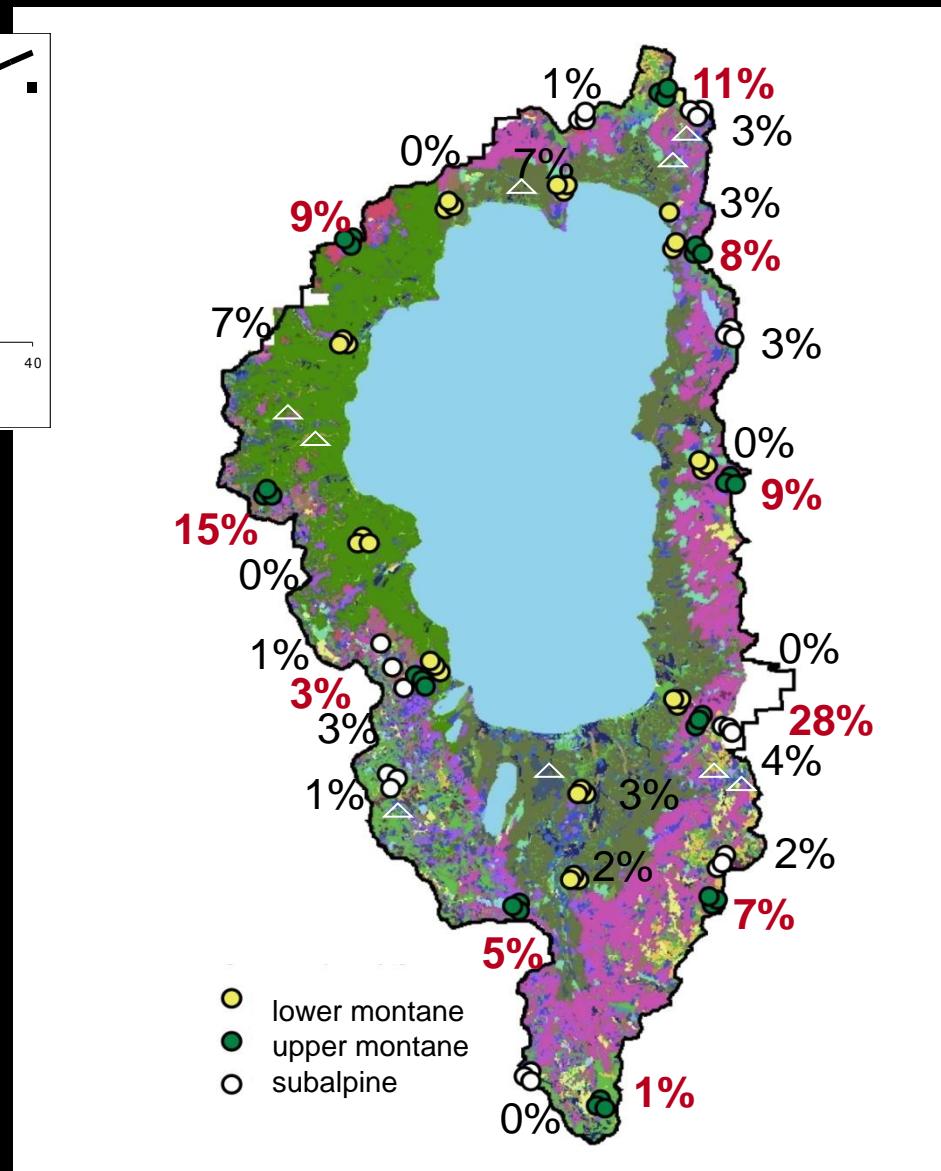
## Mountain Pine Beetle (*Dendroctonus ponderosae*)



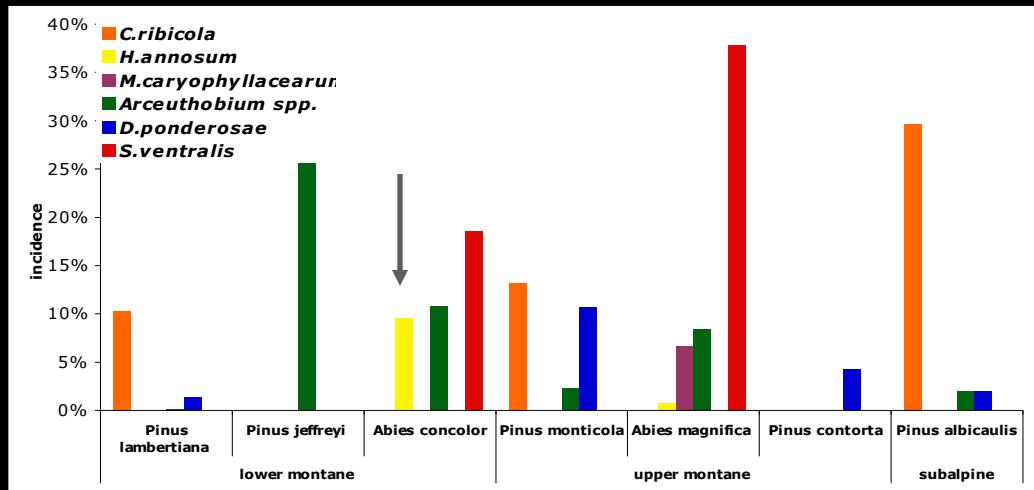
# Upper Montane - Mountain Pine Beetle (*D. ponderosae*)



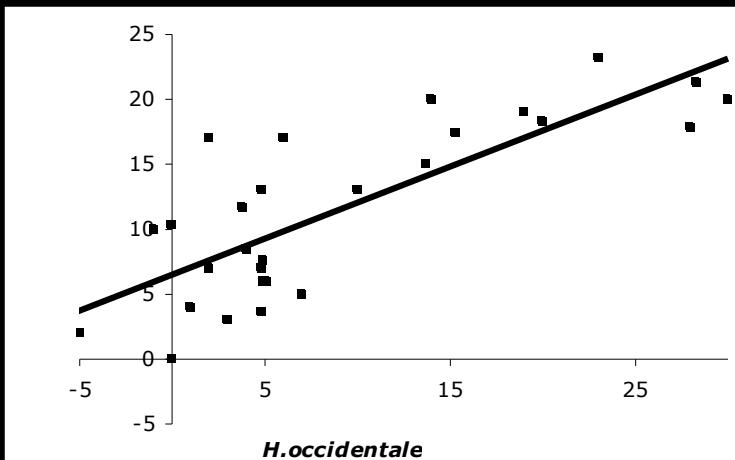
- Positive relationship between % mortality and mt pine beetle (incidence) in the upper montane zone



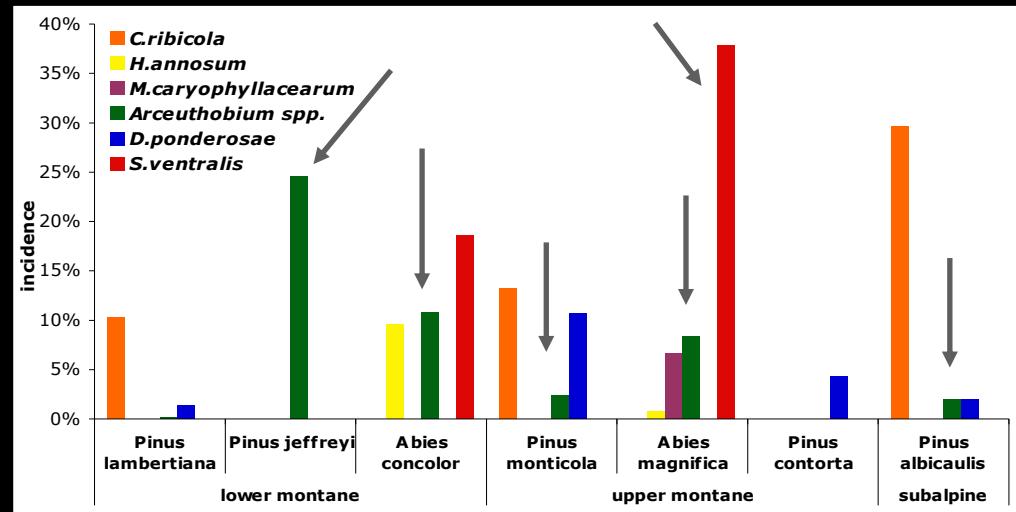
# Lower Montane - *Heterobasidion occidentale* (aka *H. annosum* (S), annosus root rot)



- Positive relationship between *H. occidentale* (incidence) and tree mortality in the lower montane zone



# All Elevation Zones



- 1) *Scolytis ventralis*
- 2) *Melampsorella caryophyllacearum*
- 3) *Arceuthobium* spp.

- Additional insect, pathogen and parasitic plant affecting forest health - no direct relationship to mortality

## Acknowledgements:

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