

Is Tree Mortality Increasing in Oregon's Forests?



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Outline

- What is background mortality?
- What are the patterns of tree mortality over the last decade?
- What is driving mortality in Oregon's forests?
- How does this compare with the previous decade?

Mortality and tree density

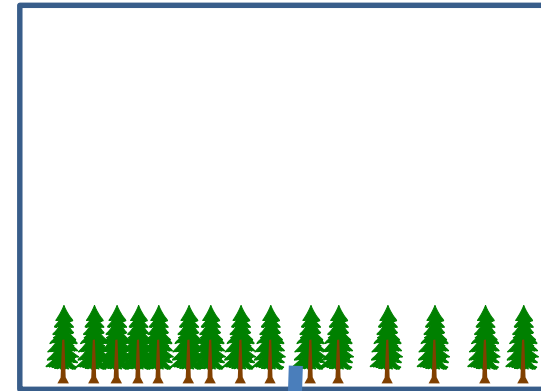
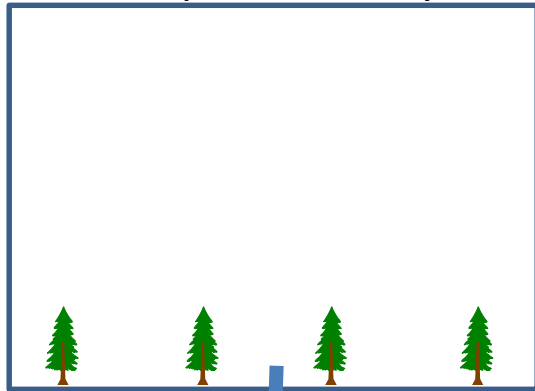
Stand Age

Sparse density

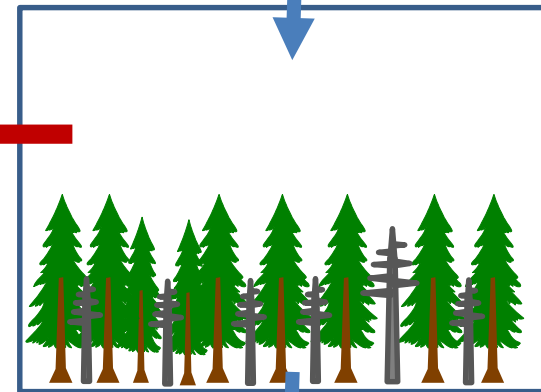
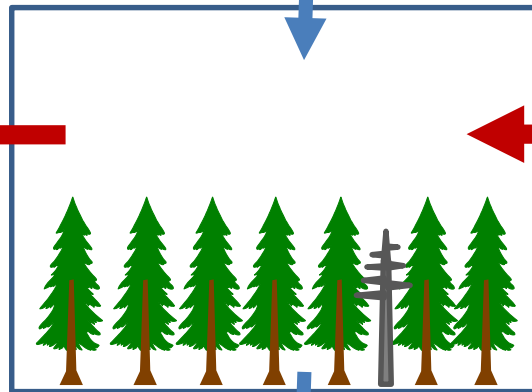
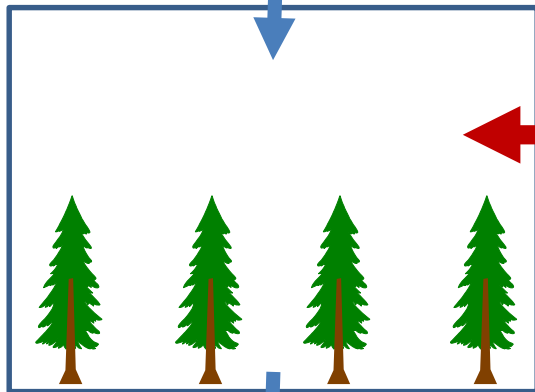
Low density

High density

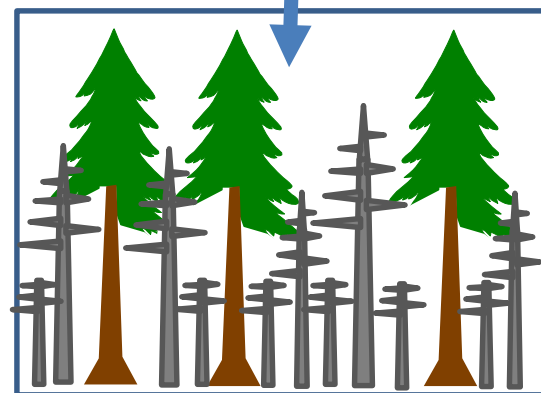
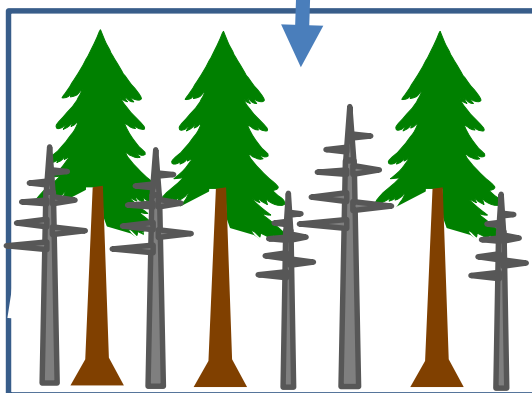
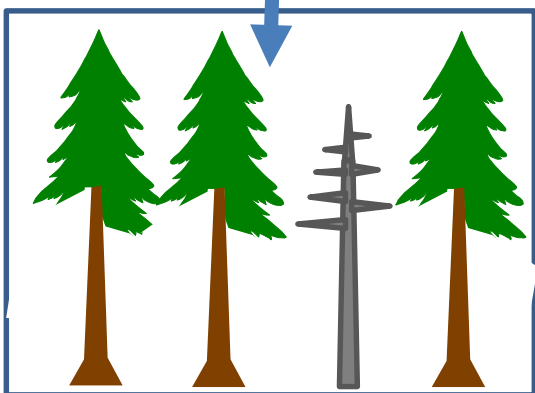
10



60

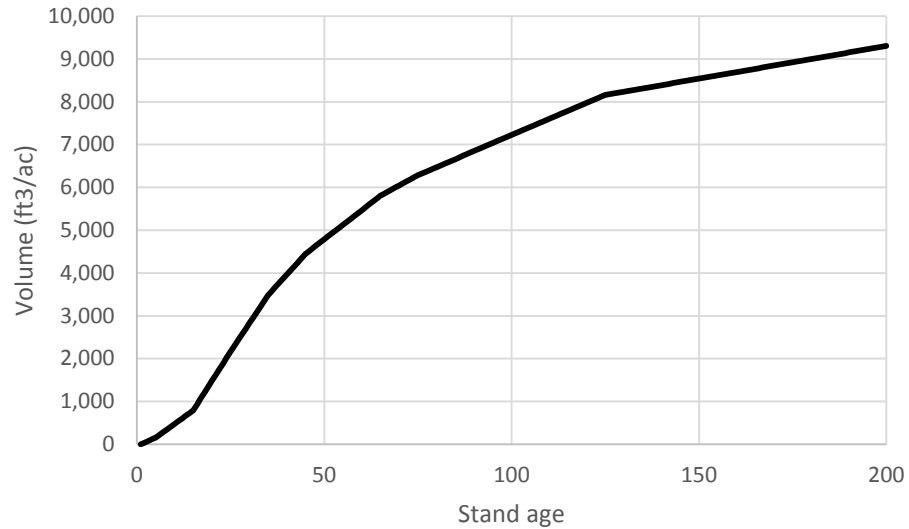


120

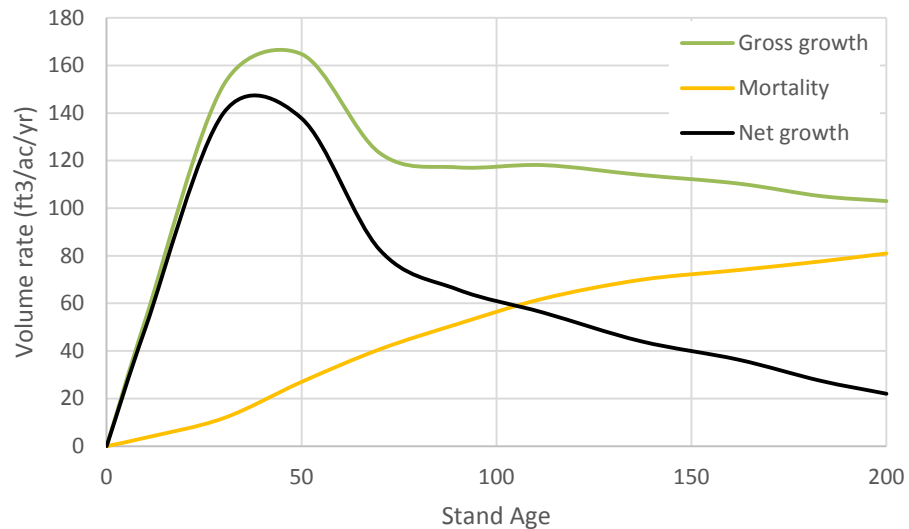


Mortality and stand development

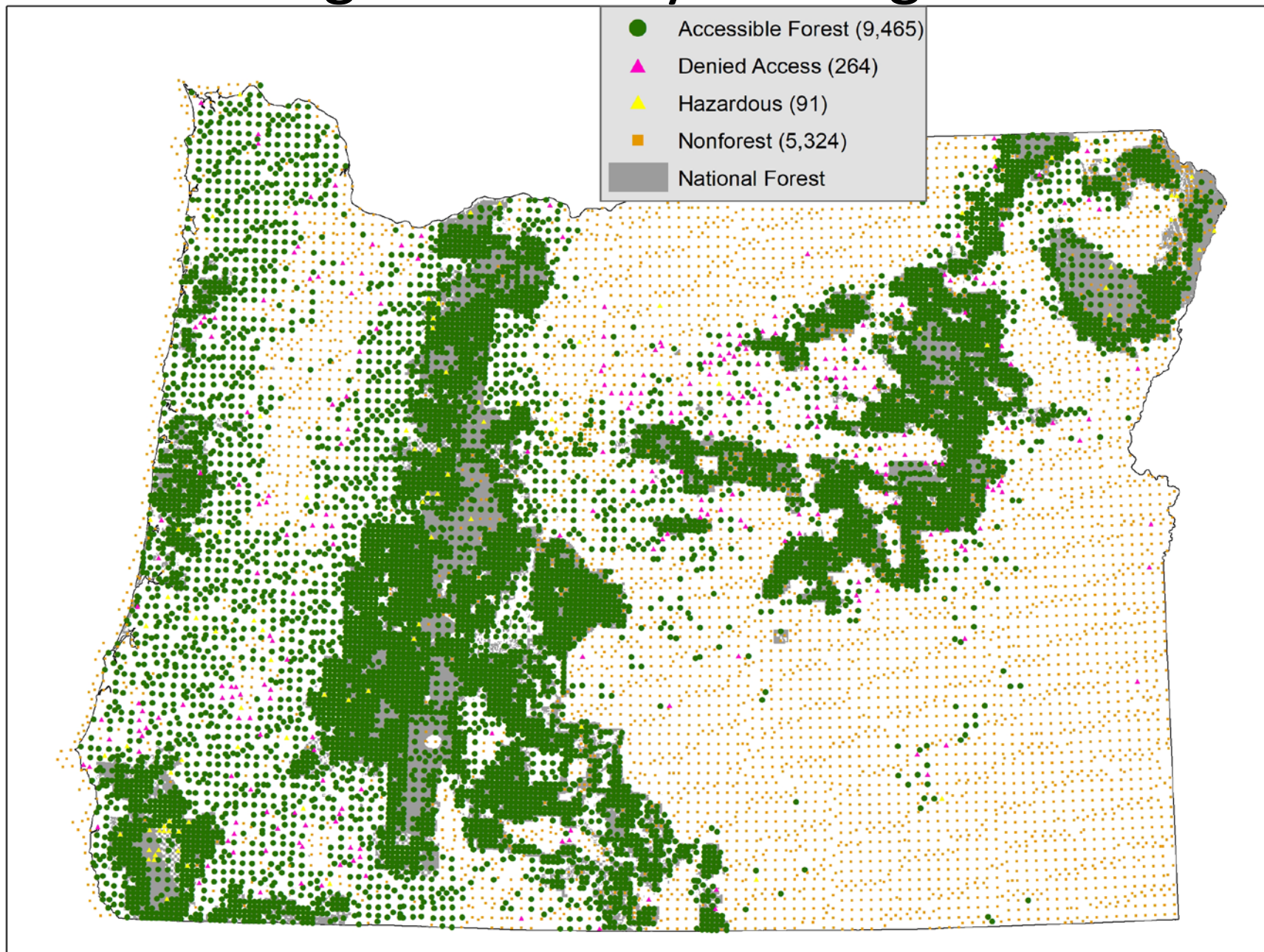
Total volume



Annual components of change

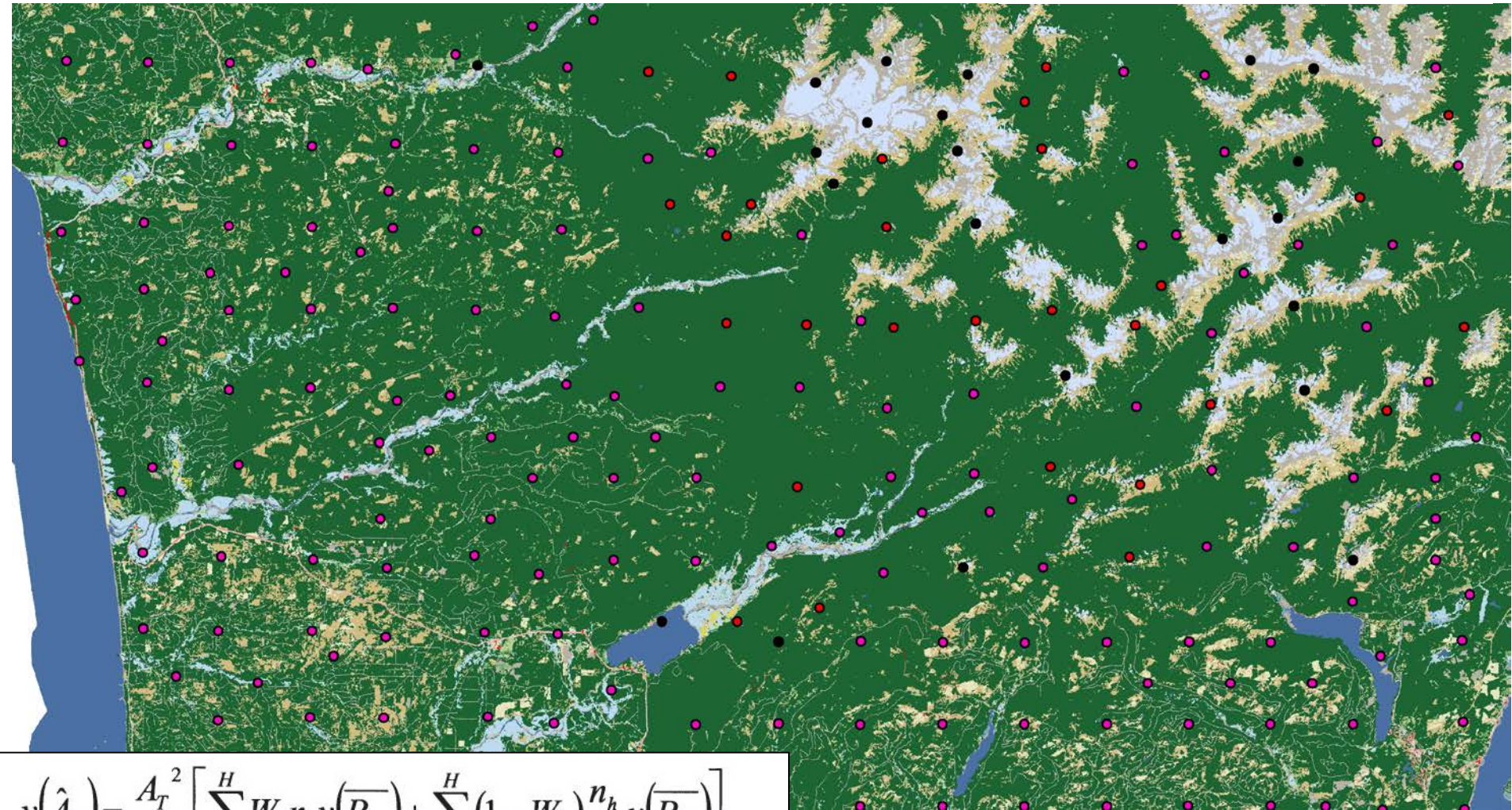


The strategic inventory of Oregon's forests



The power of the FIA plot grid:

- Representative sample
- Consistent protocols
- Multiple data attributes
- Permanent plots
- Plot confidentiality



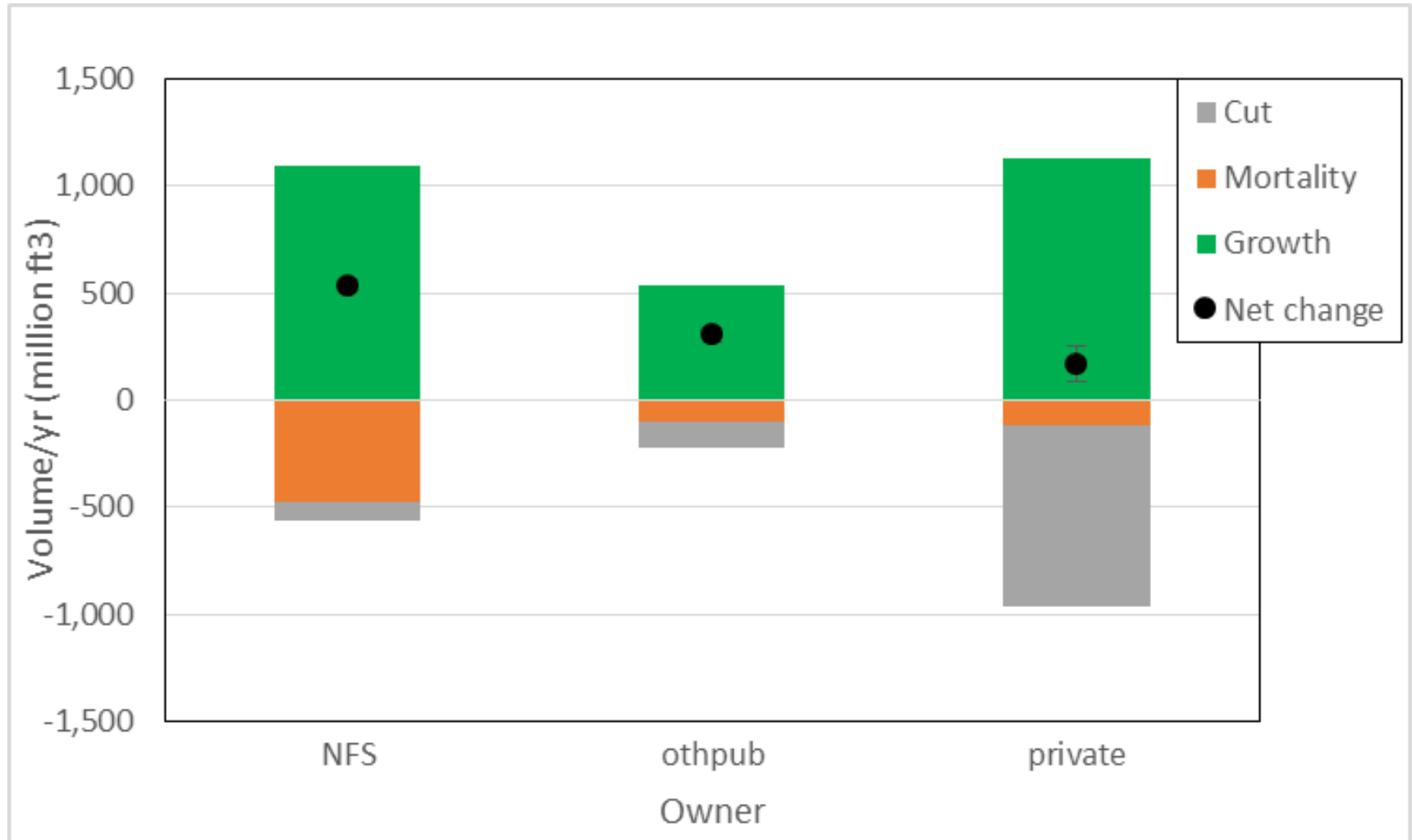
$$v(\hat{A}_d) = \frac{A_T^2}{n} \left[\sum_h^H W_h n_h v(\overline{P}_{hd}) + \sum_h^H (1 - W_h) \frac{n_h}{n} v(\overline{P}_{hd}) \right]$$

The big picture for Oregon

Acres of forestland: 29,195,481

	N trees		Volume	
	(million)	Percent	(million ft ³)	Percent
Live	9,674		98,882	
Mortality / yr	171	1.8%	699	0.7%
Cut / yr	40	0.4%	1,052	1.1%
Overstory / yr	53	1.2%	571	0.7%
Understory / yr	118	2.4%	128	1.4%
	Net growth / yr		1,015	1.0%

Mortality and ownership



Causes of mortality



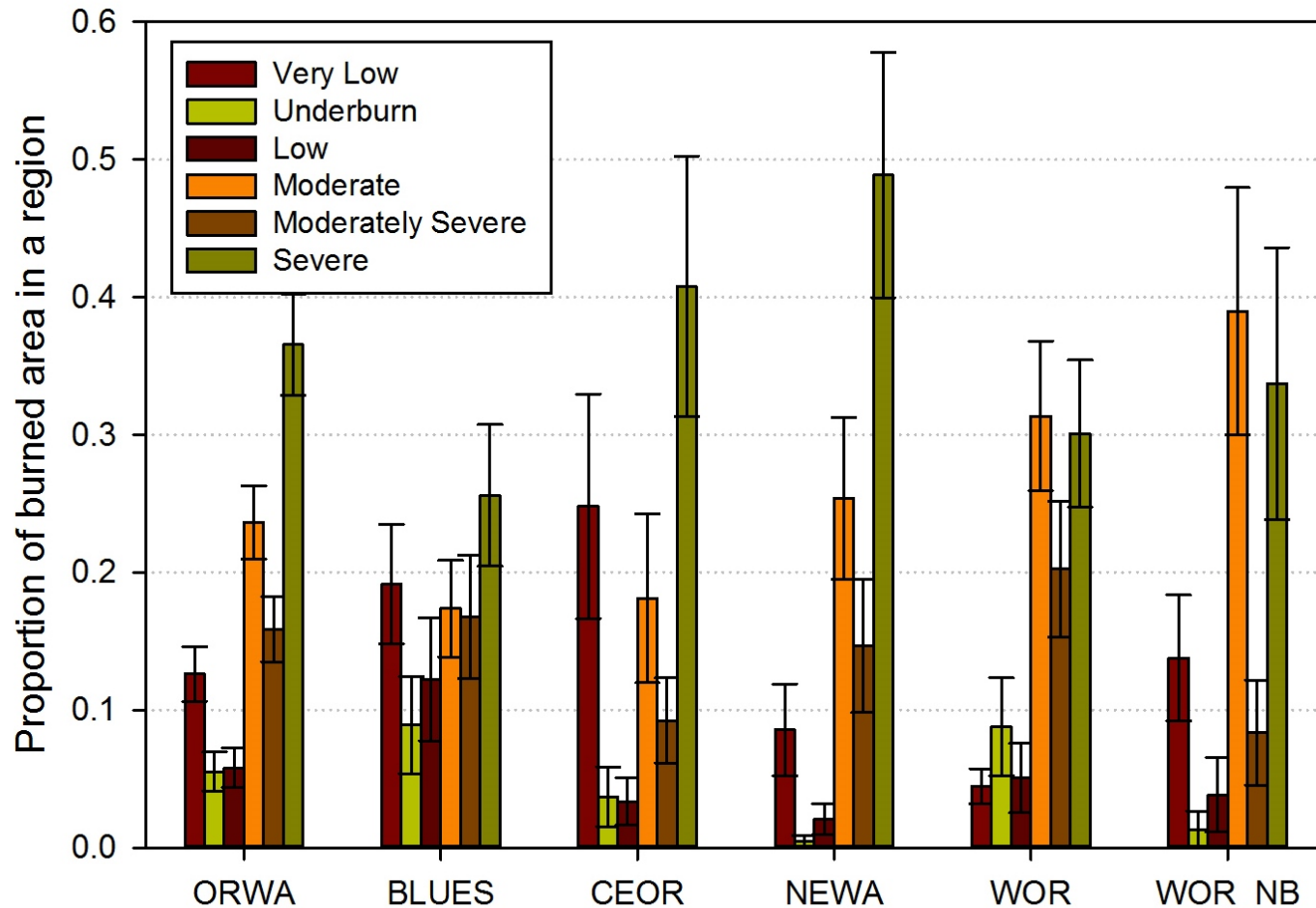
How prevalent is disturbance?

Disturbance	Area (1000 ac)	SE	Percent	Percent/yr
Cut	3,477.6	152.4	11.9%	1.2%
Fire	1,026.1	81.4	3.5%	0.4%
Cut + Fire	161.1	33.9	0.6%	0.1%
Insect or Disease	4,100.5	148.3	14.0%	1.4%
Weather	524.0	62.9	1.8%	0.2%
Incidental Cut	373.7	56.3	1.3%	0.1%
None	19,532.4	254.0	66.9%	
Total	29,195.5	182.9		

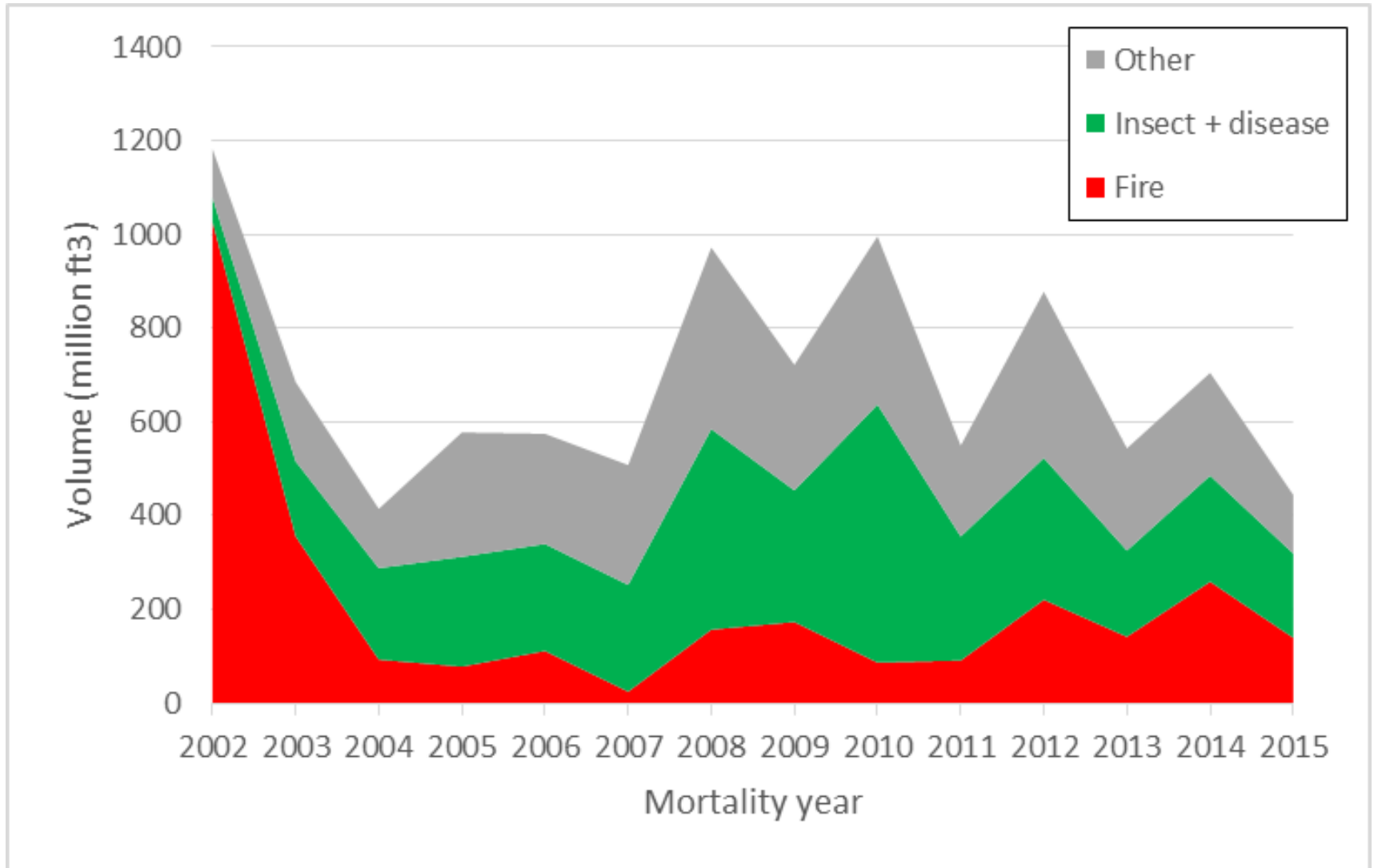
} 2.0%/yr

Area by fire severity class, OR/WA NFS

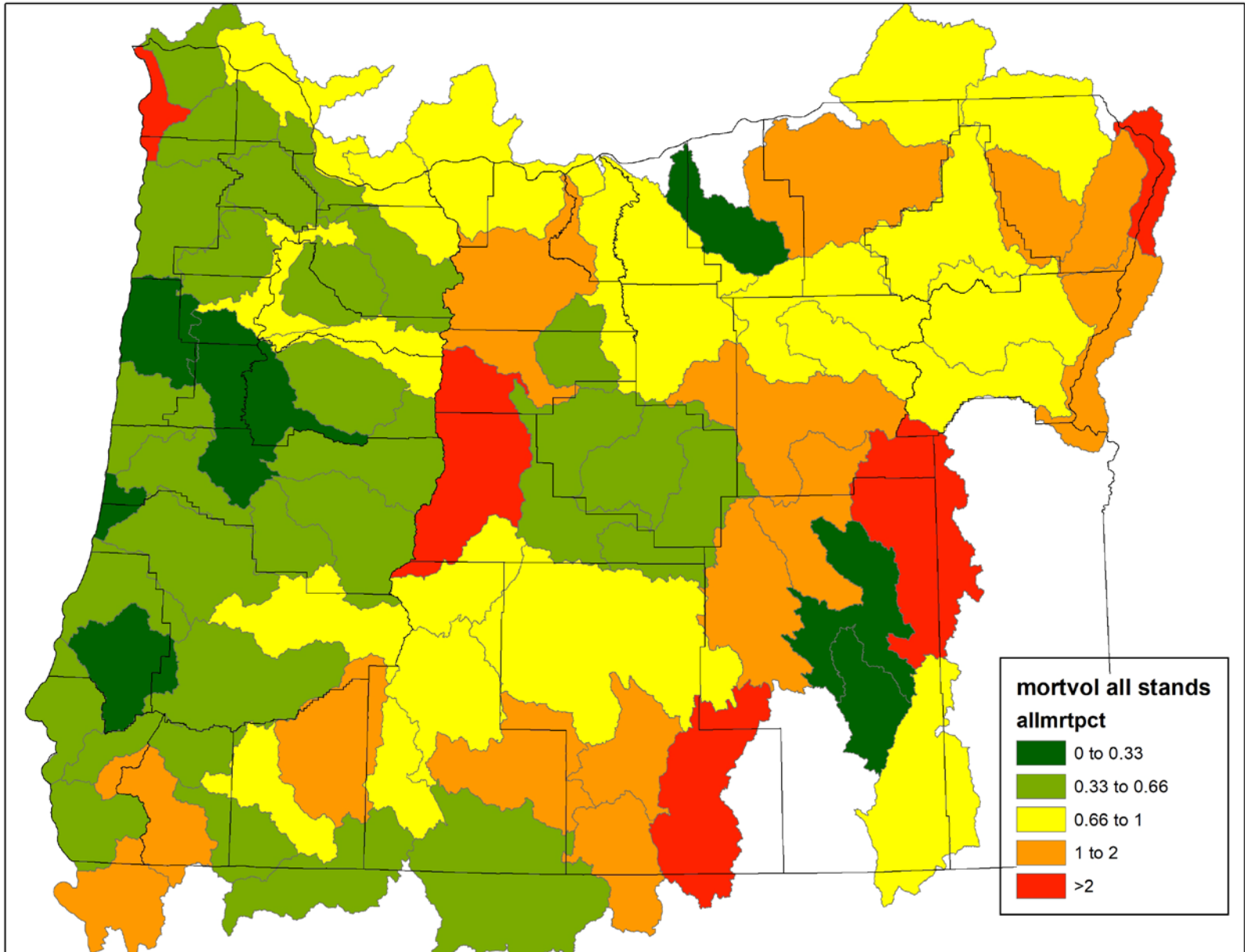
~45% of area burned in fire was moderate or severe (>60% overstory mortality)



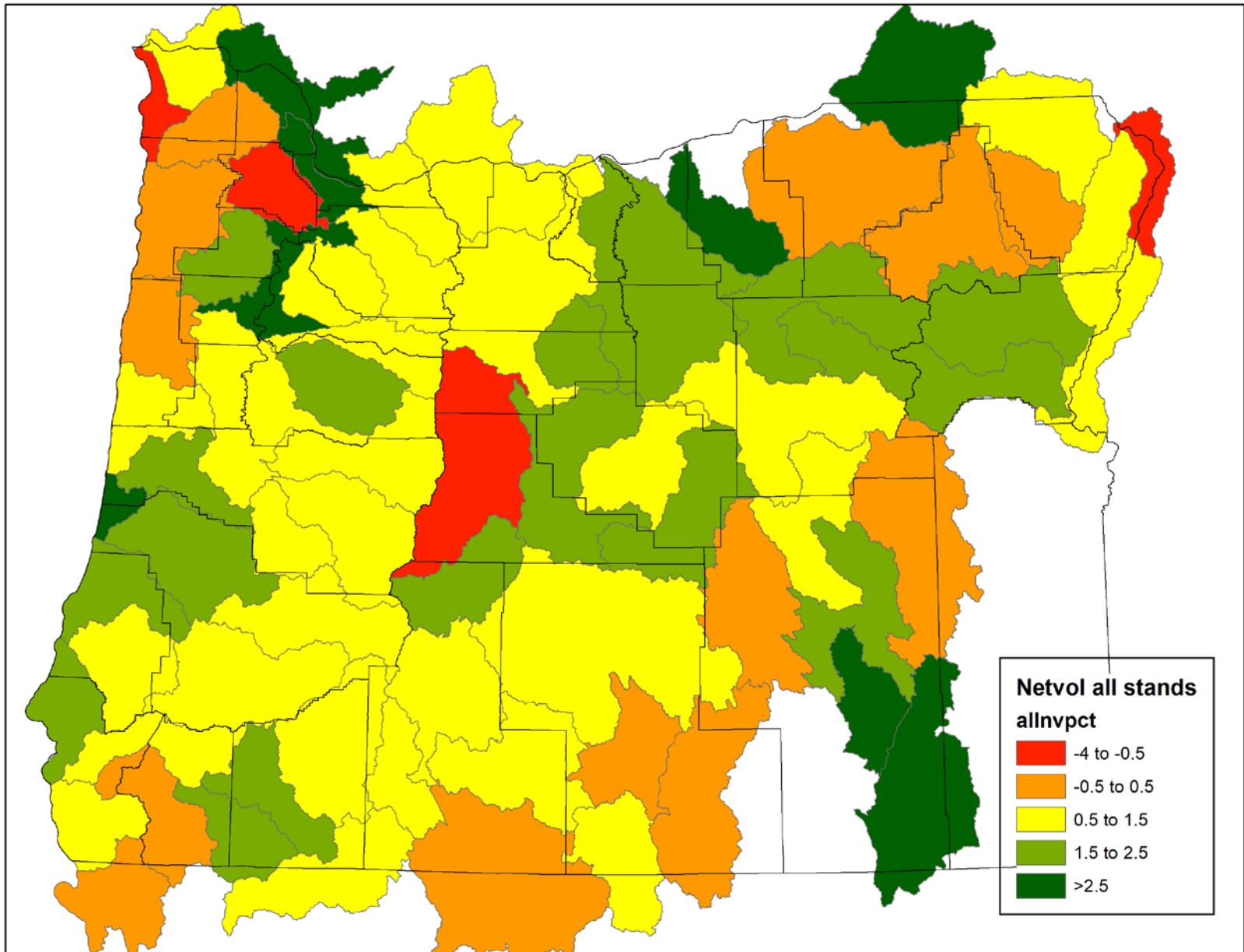
Timing and cause of mortality



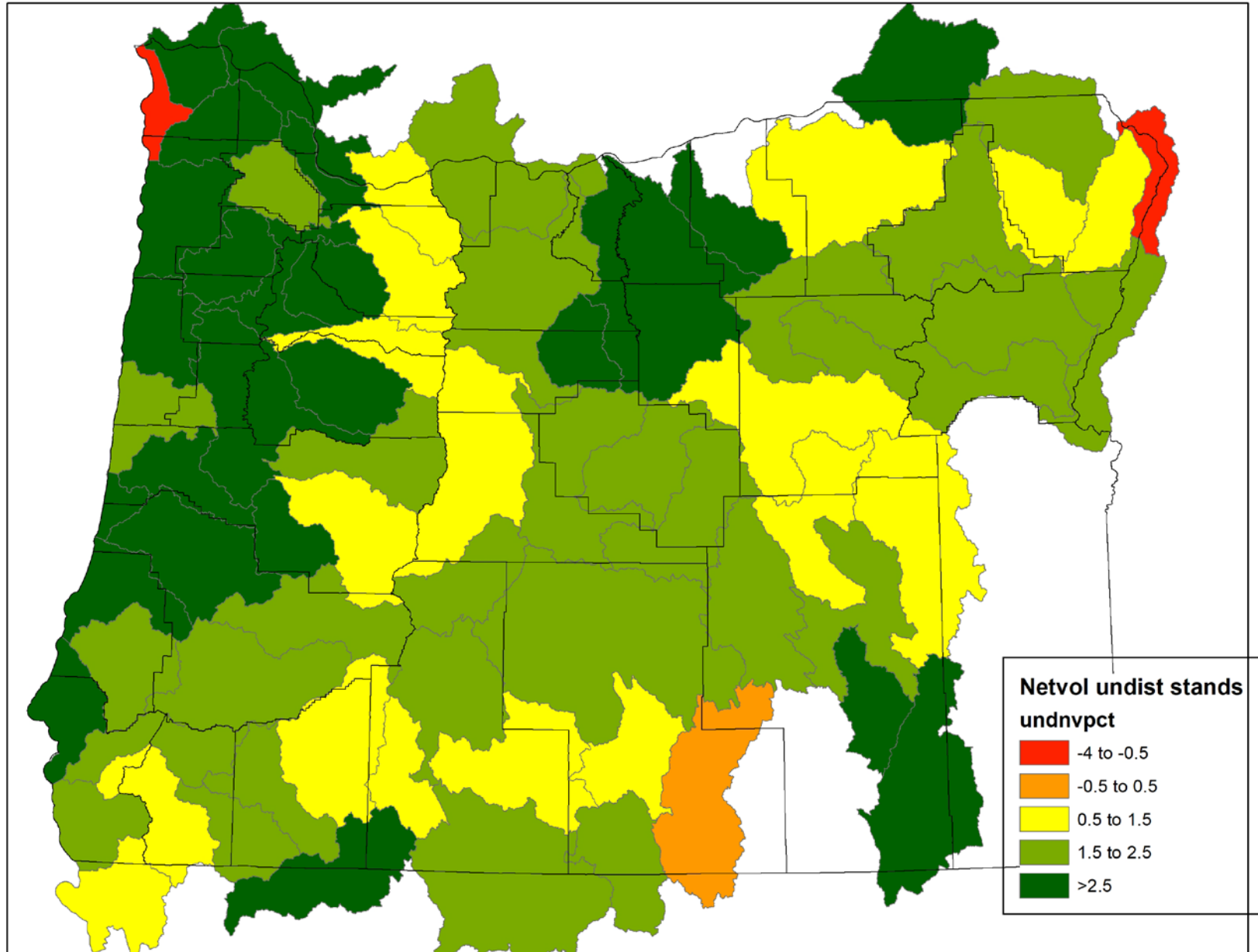
Mortality volume (%) by watershed



Net change volume (%)



Net change volume (%) no fire or cutting



Mortality in the 90s + 00s on NFS

Component	Means 90s	95% CI	Mean 00s	95% CI
		90s		00s
Growth	1.73%	0.04%	2.01%	0.06%
Mortality	-1.11%	0.07%	-0.87%	0.07%
Cut	-0.12%	0.03%	-0.16%	0.03%
Net change	0.50%	0.08%	0.98%	0.10%

Clearly mortality events happen...

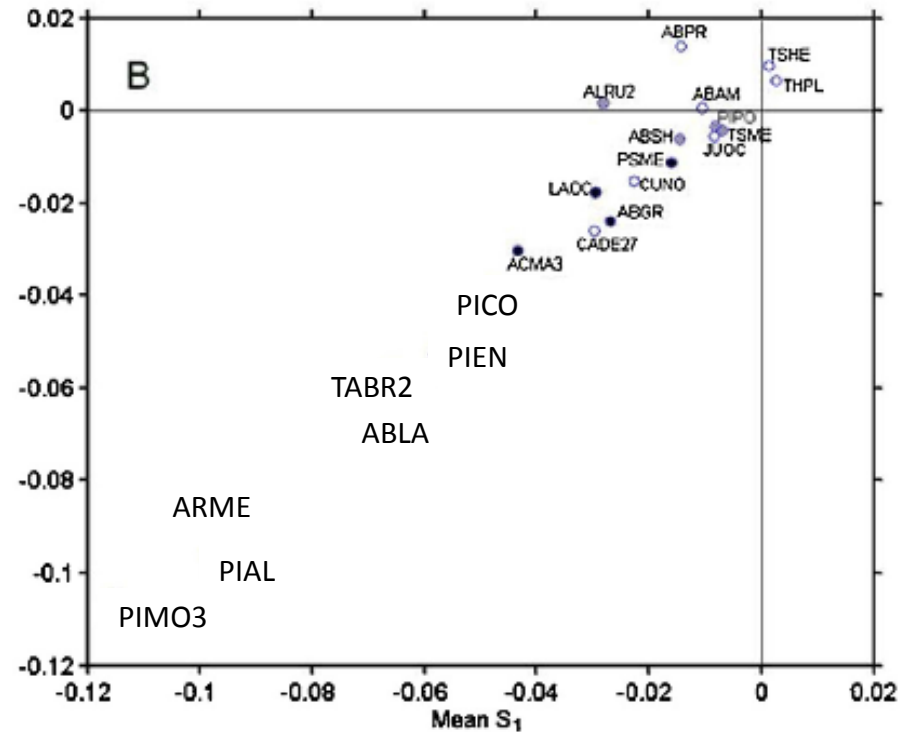
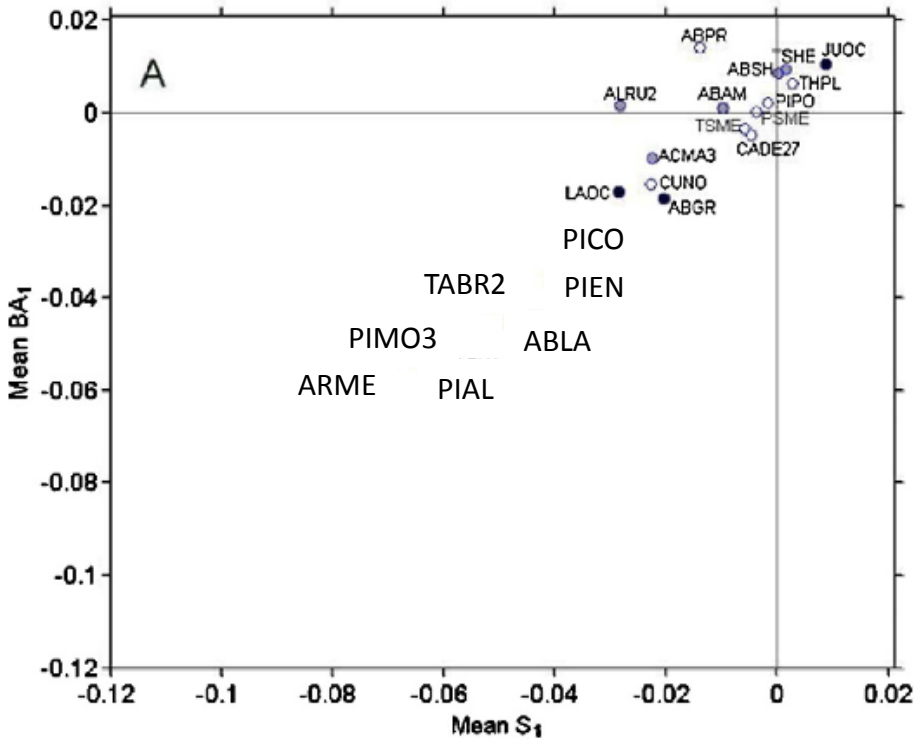


Whitebark pine in Wind Rivers

Species change in the 90s on NFS

Unburned stands

All stands

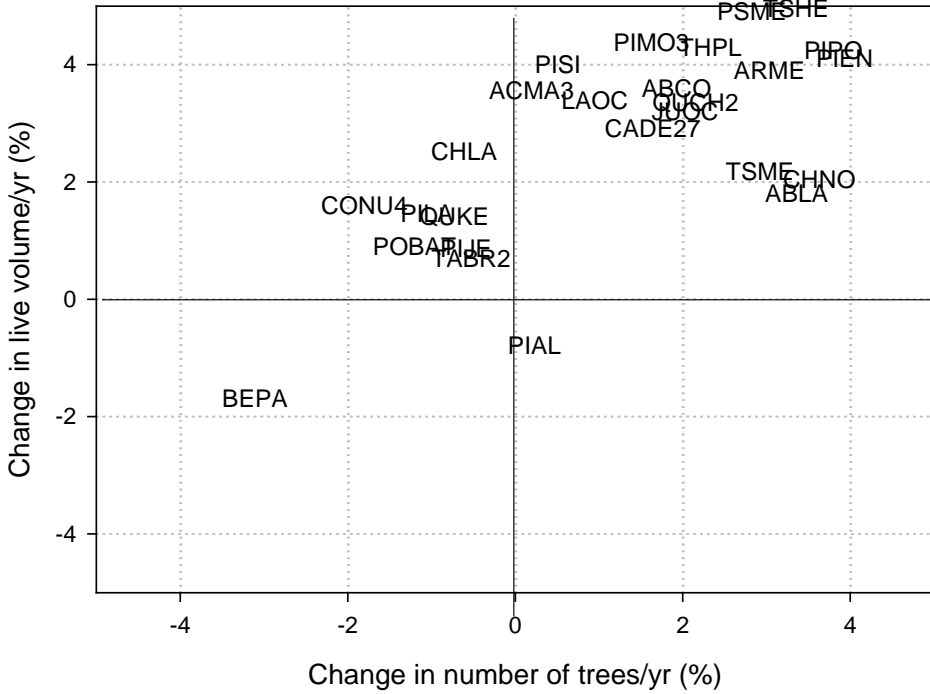


Lintz 2016, Ecol. Ind. 66: 1

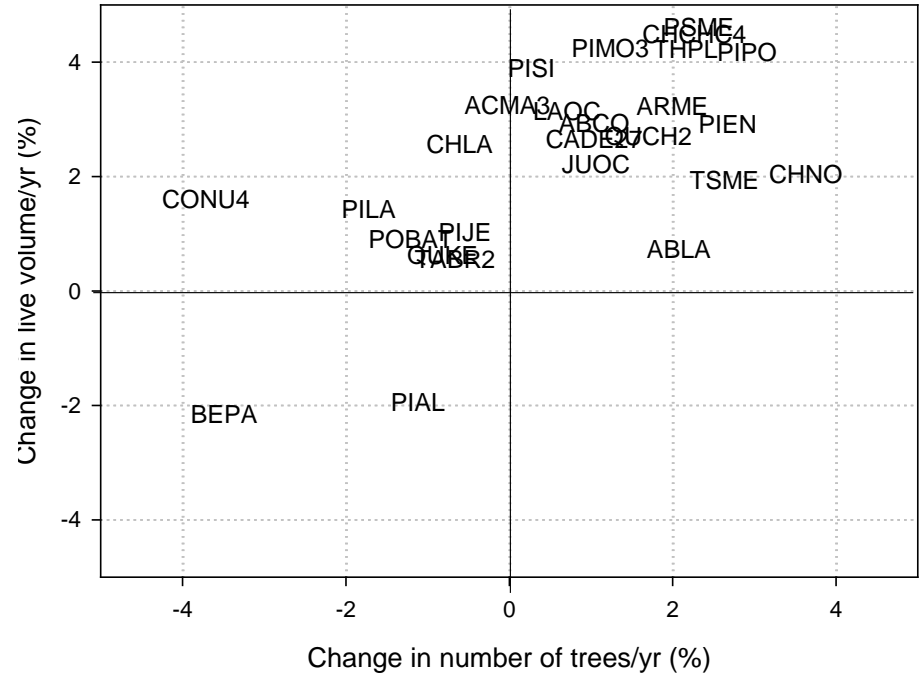
Big losers: madrone, whitebark pine, white pine, subalpine fir, yew, Engelmann spruce, lodgepole

Species change in the 00s on NFS

Unburned stands



All stands

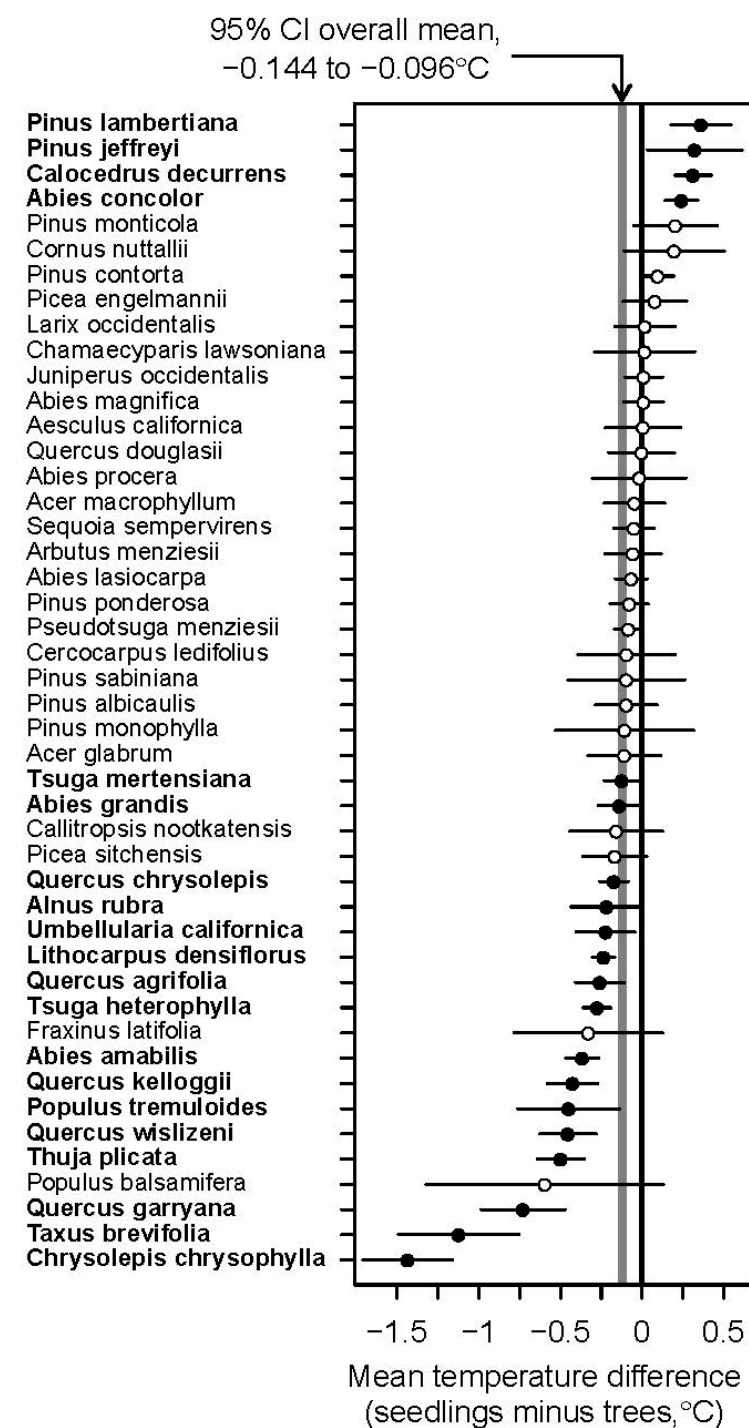


Losers: paper birch, whitebark pine; dogwood + sugar pine losing numbers but gaining volume.

Species migration on the west coast

Opportunity to follow-up with ingrowth and mortality

Monleon & Lintz, 2015. Plos One



Conclusions

- Background mortality is a concept with limited utility
- Most tree mortality in Oregon is from insects, disease, suppression, and other, with relatively little due to fire. Quite different from California
- Mortality has decreased on National Forests from the 90s to 00s, though declines in whitebark pine continue. Lodgepole, white pine, and subalpine fir appear to be recovering.

Thank you!

