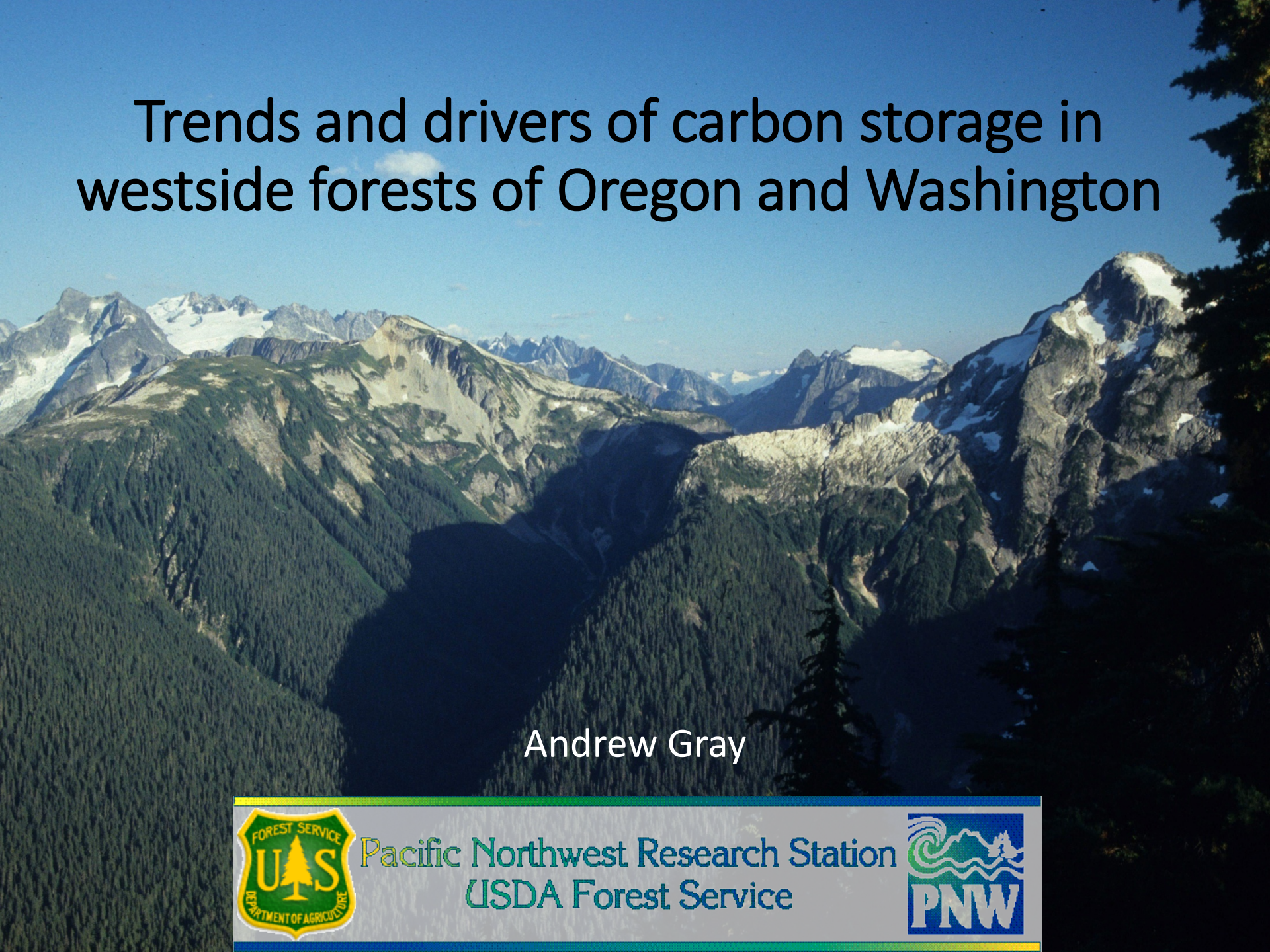
Trends and drivers of carbon storage in westside forests of Oregon and Washington



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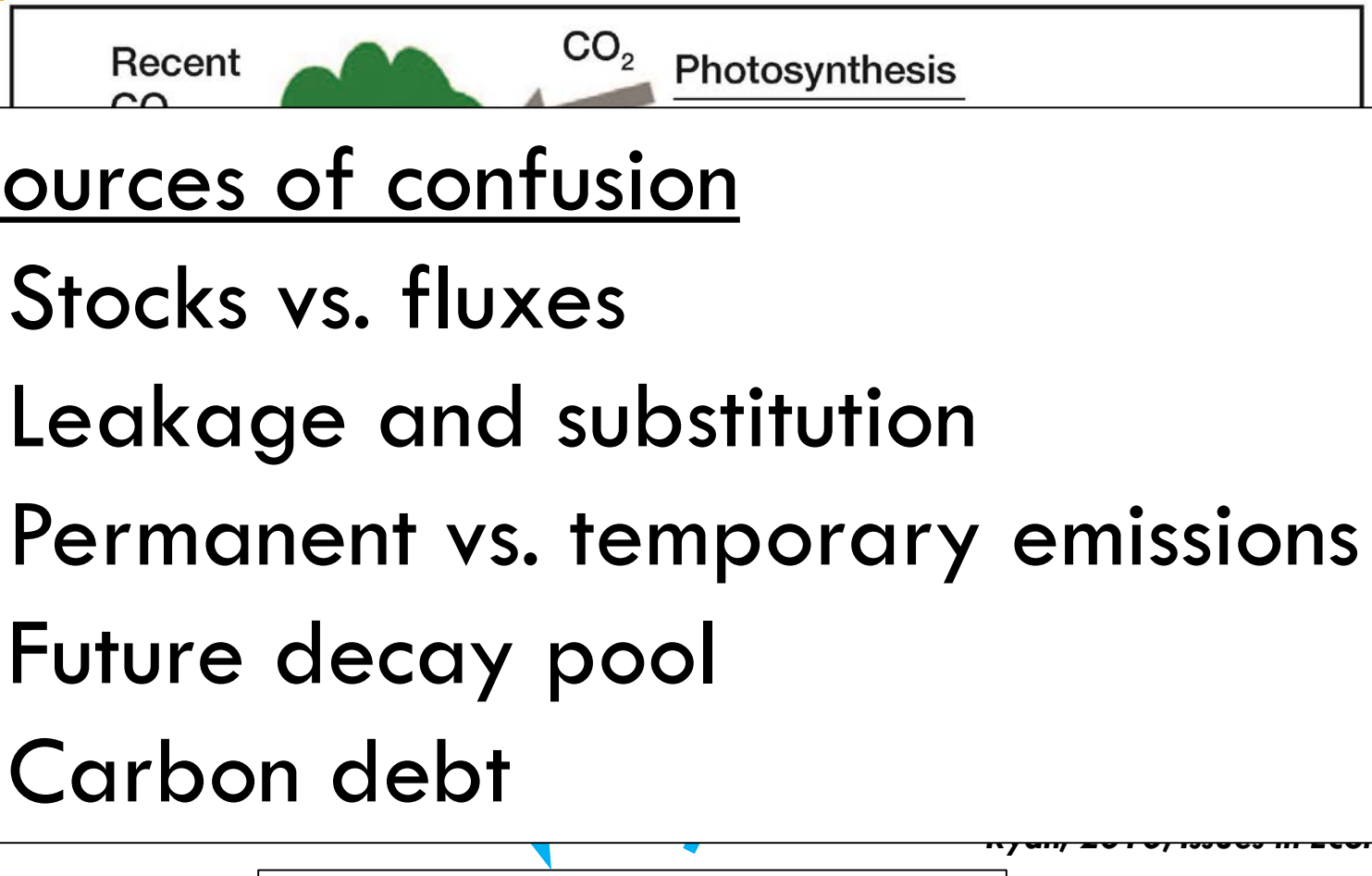
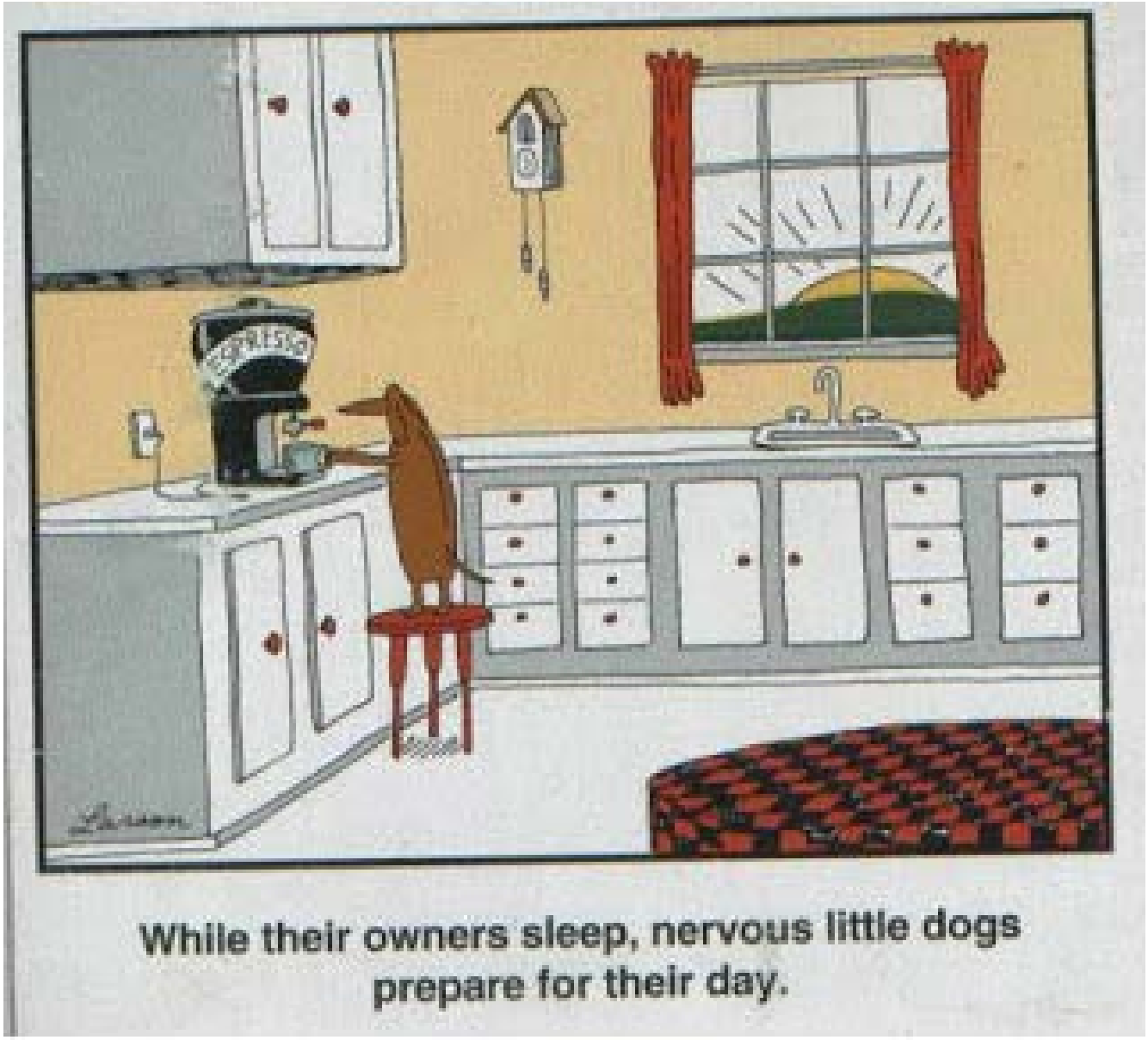
USDA Forest Service

Forest carbon pools and fluxes



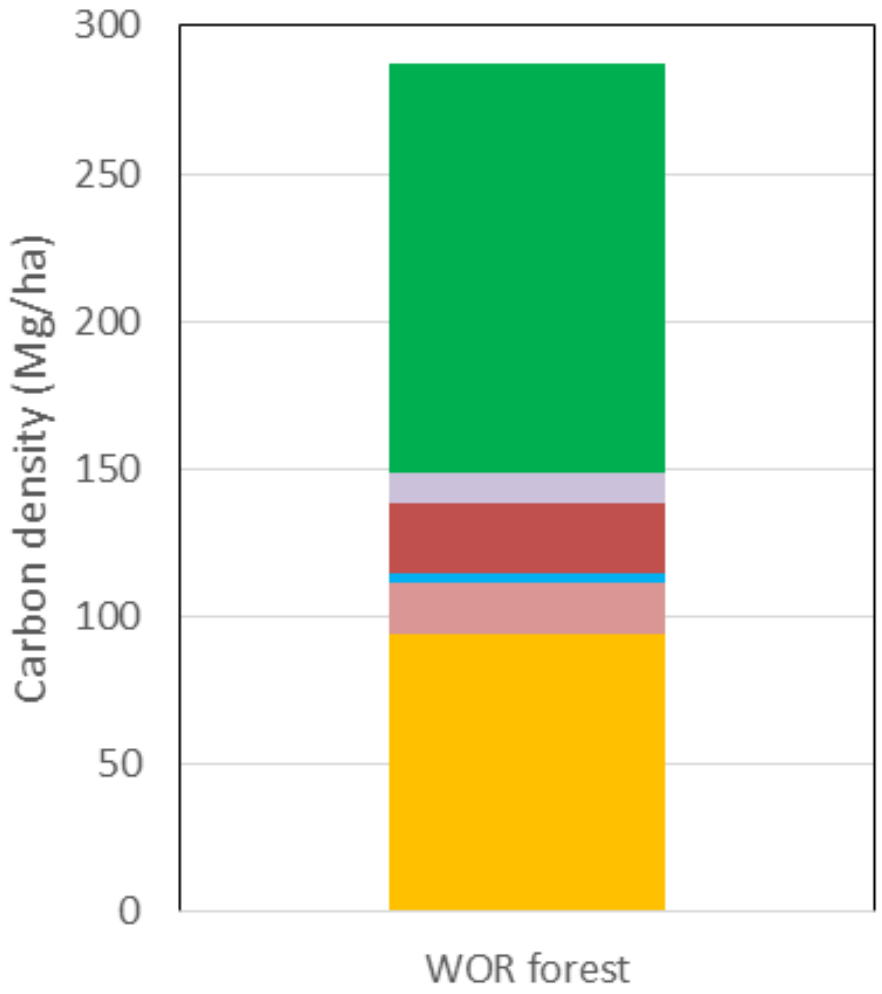
Sources of confusion

- Stocks vs. fluxes
- Leakage and substitution
- Permanent vs. temporary emissions
- Future decay pool
- Carbon debt



Gary Larsen Far Side cartoon

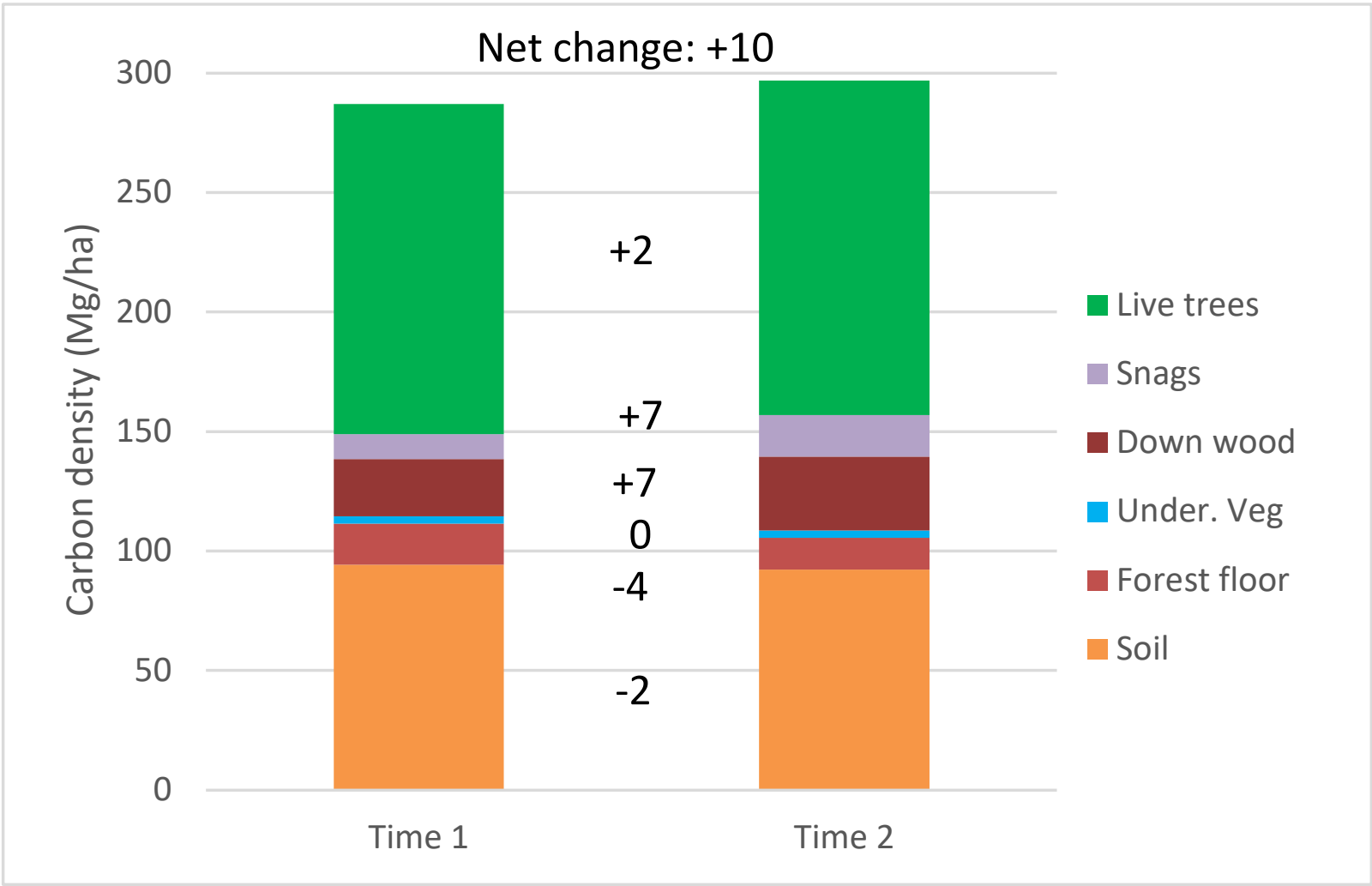
Stocks at one point in time: W. Oregon



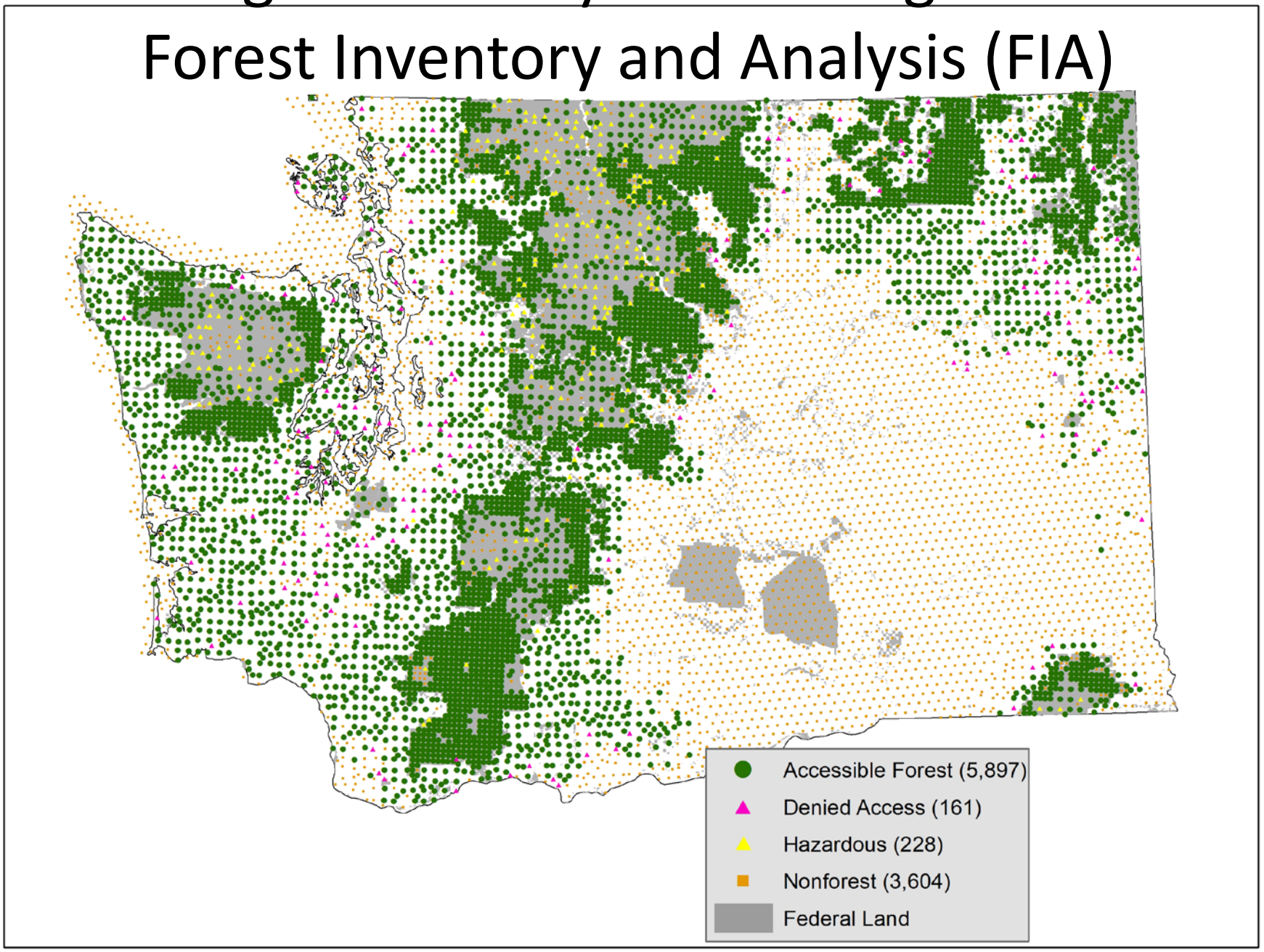
	%total	% non-soil
Live trees	48	72
Snags	4	5
Down wood	8	12
Under. Veg	1	2
Forest floor	6	9
Soil	33	
? HWP	**4?**	**6?**

Stock change avoids most of the fuss

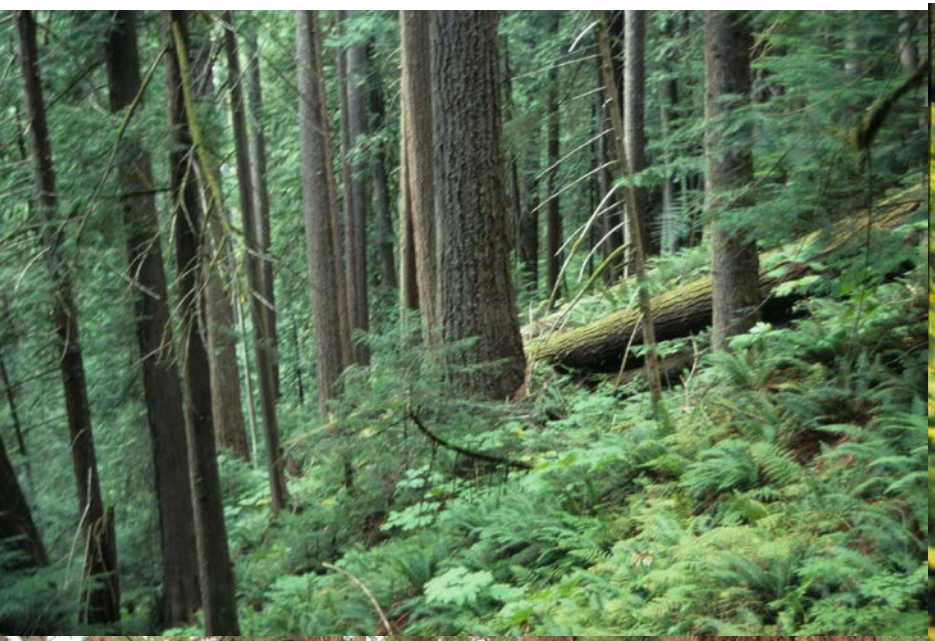
Example: change over 10 years, moderate fire event

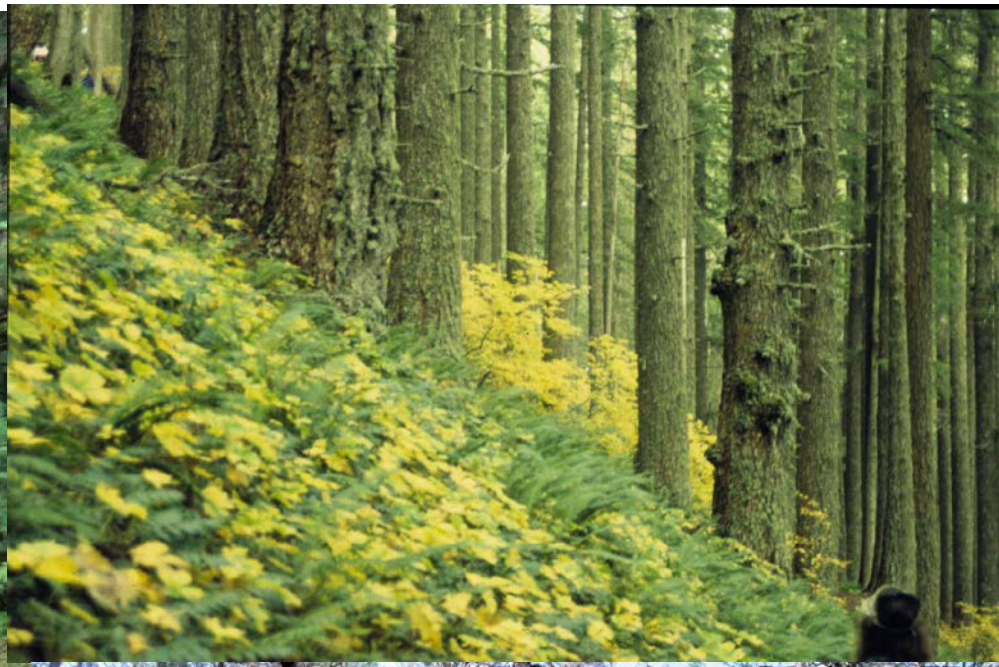


The strategic inventory of Washington's forests: Forest Inventory and Analysis (FIA)

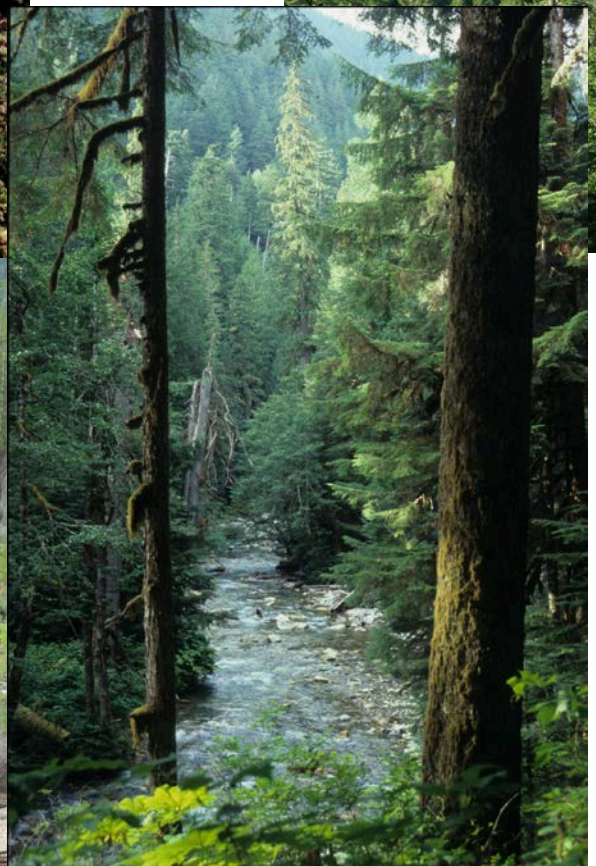


Measuring a nice forest



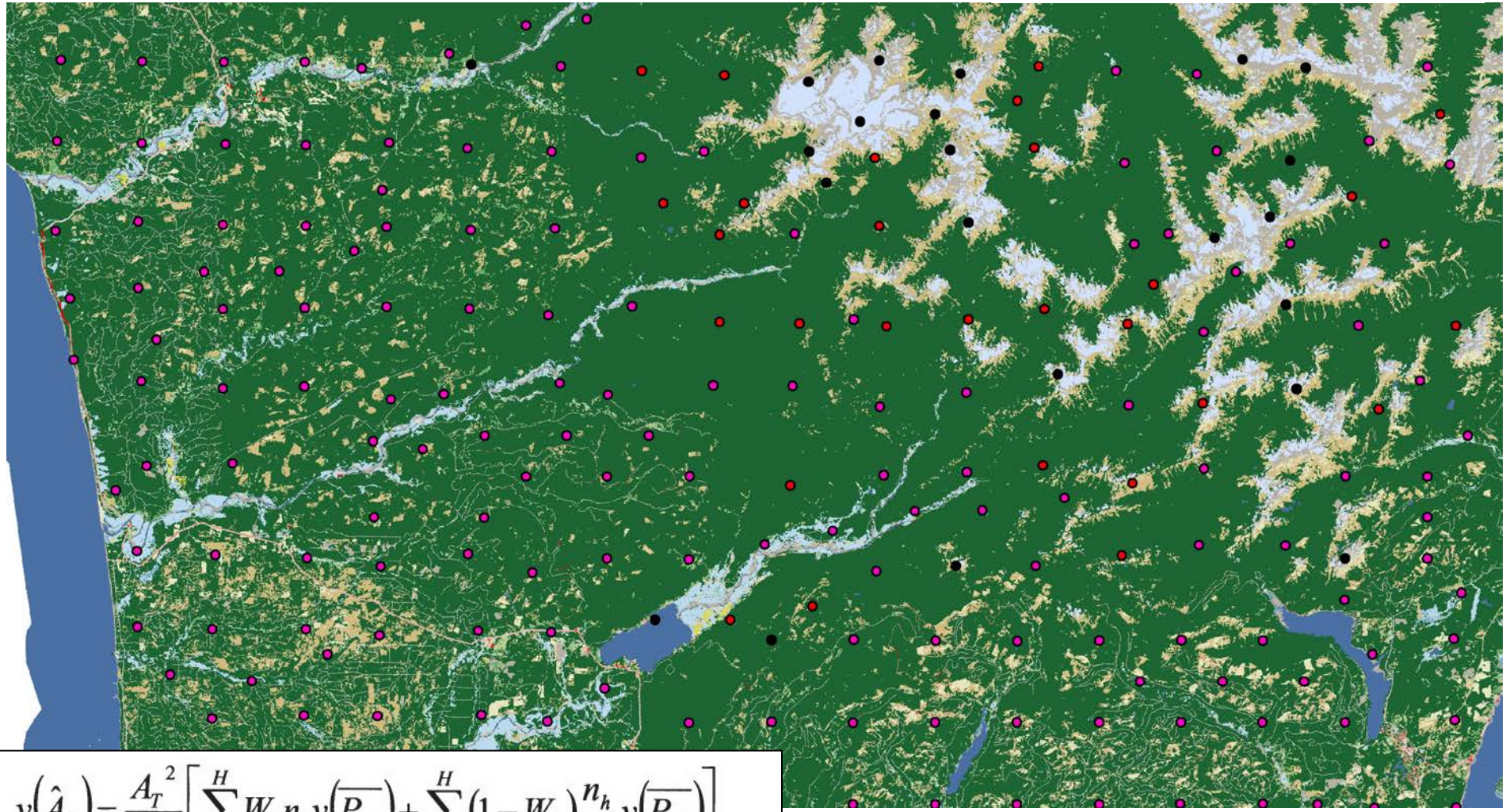


Measuring a real forest



The power of the FIA plot grid:

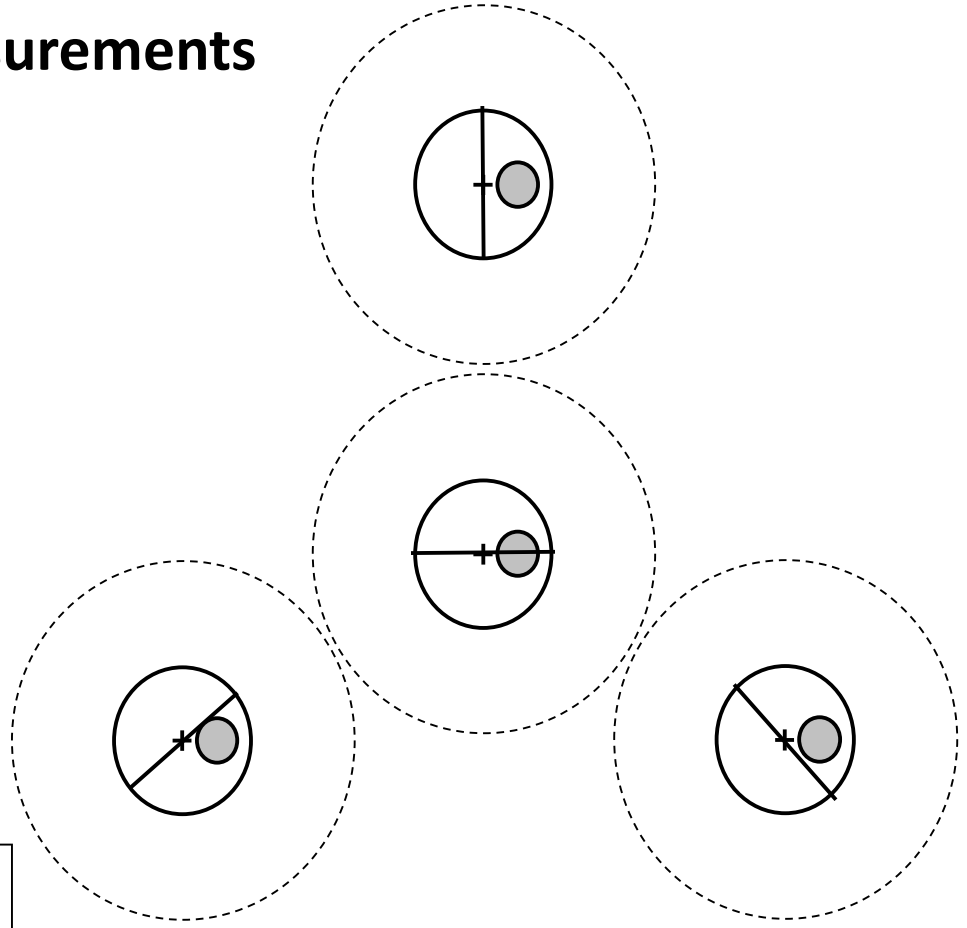
- Representative sample
- Consistent protocols
- Multiple data attributes
- Permanent plots
- Plot confidentiality



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

The FIA Plot Footprint and Measurements

Measurements to estimate carbon stocks
- Trees: DBH, HT, SPP, Defect, DecayClass
- Understory veg: SPP, Cover
- Down wood: DIA, SPP, DecayClass
- Forest floor: Litter + Duff Depths

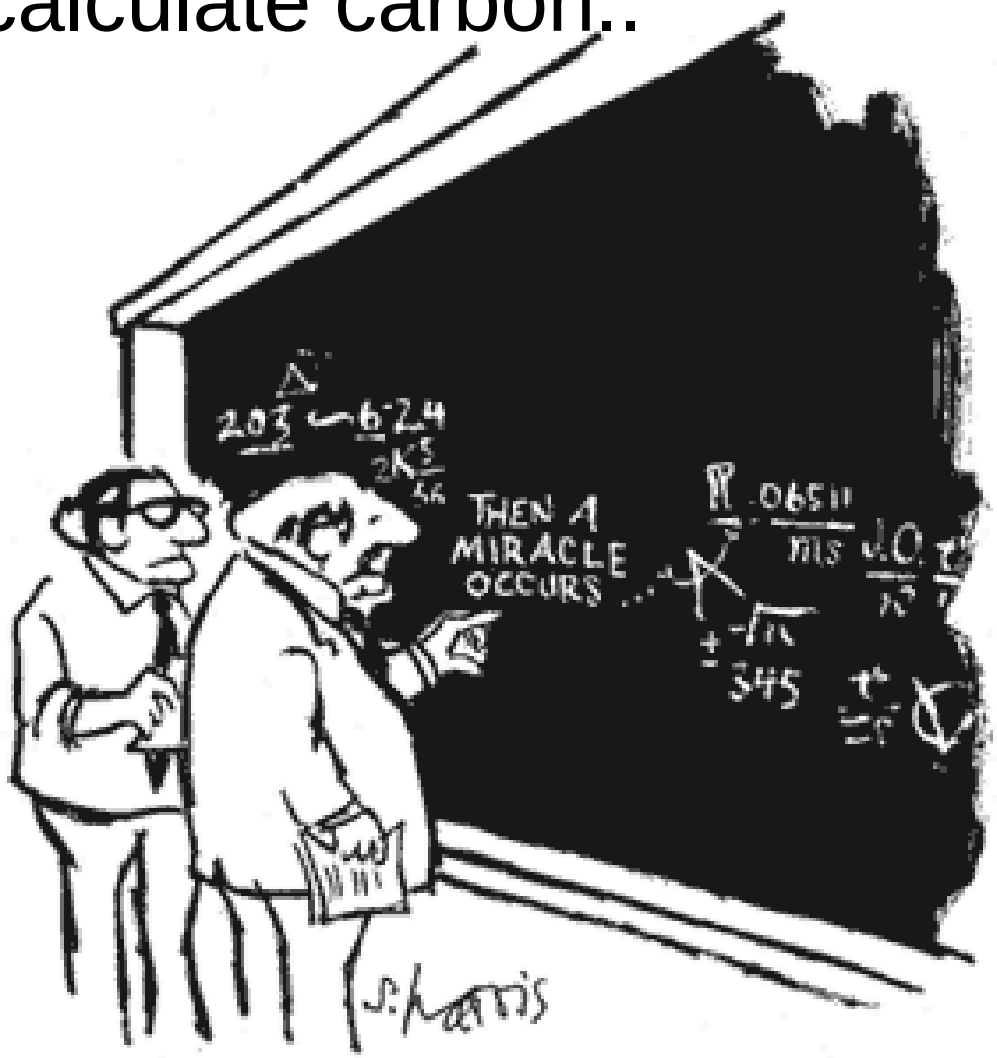


KEY

- 6.8 ft radius microplot (seedlings, live+dead trees1-5” DBH)
- 24.0 ft subplot (live+dead trees>5” DBH, understory vegetation
- 58.9 ft macroplot (live+dead trees>24” E, >30” W)
- Woody materials transects: 2 x 24’ per subplot (>=0.25” DIA, forest floor depth)

* Prior measurements include:
- Soil cores
- Longer CWD transects
- Large trees on hectare (2.4 ac)
- Lichen communities
- Plant diversity

Then we calculate carbon..



"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."

Improving our foundation

Cap and trade

Carbon tax or credits

National carbon monitoring system

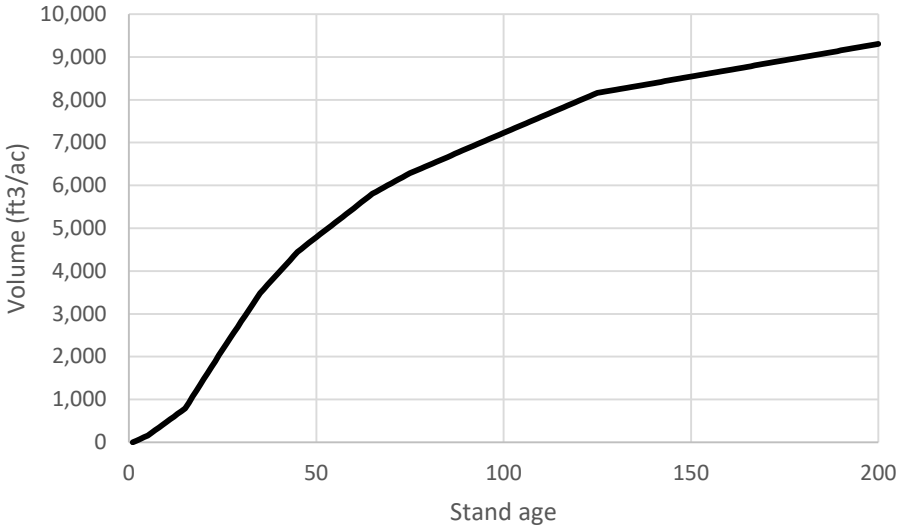
Tree biomass equations

Primary problems: Scope of inference, extrapolation beyond original data, few spp, little belowground

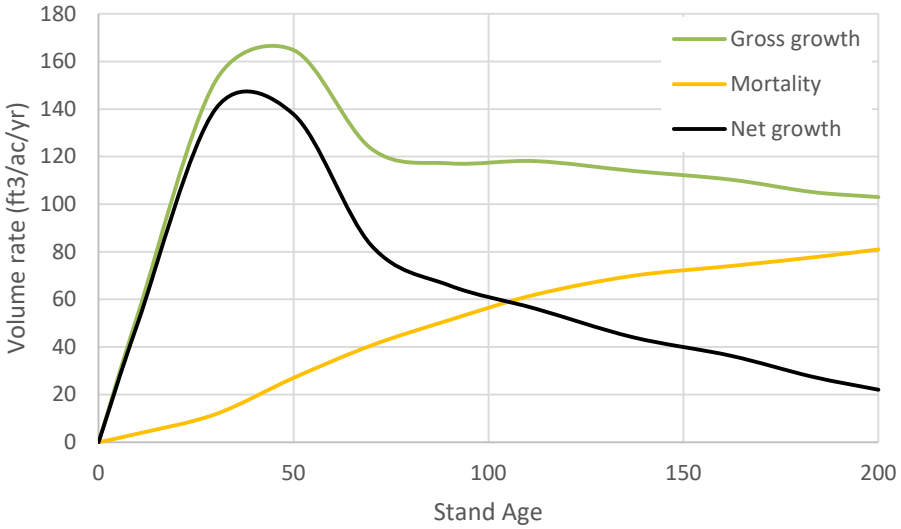
What are we finding?

Mortality and stand development

Total volume

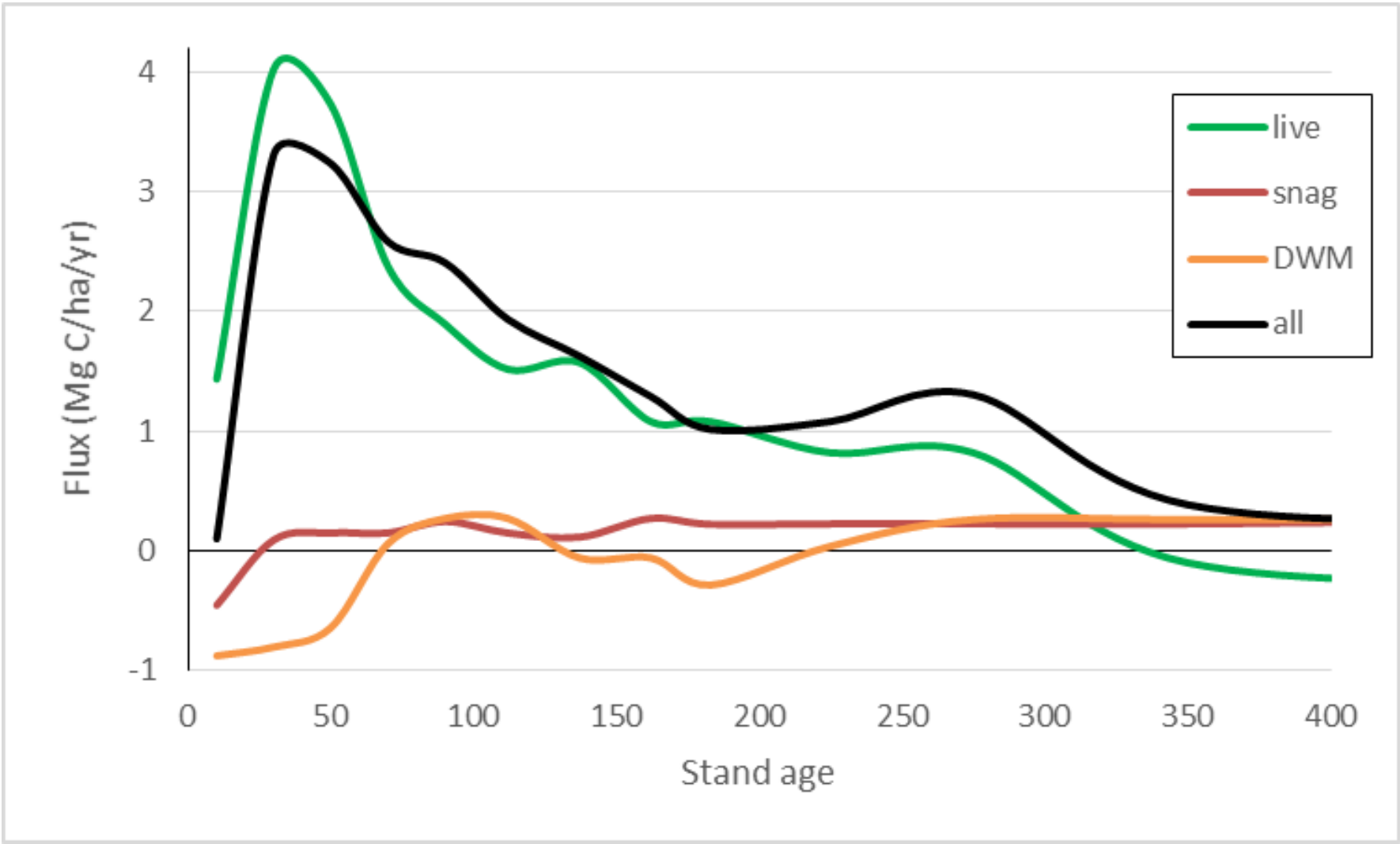


Annual components of change



Live and dead accumulate with age

Undisturbed productive stands



Ecosphere 7:e01224

How prevalent is disturbance?

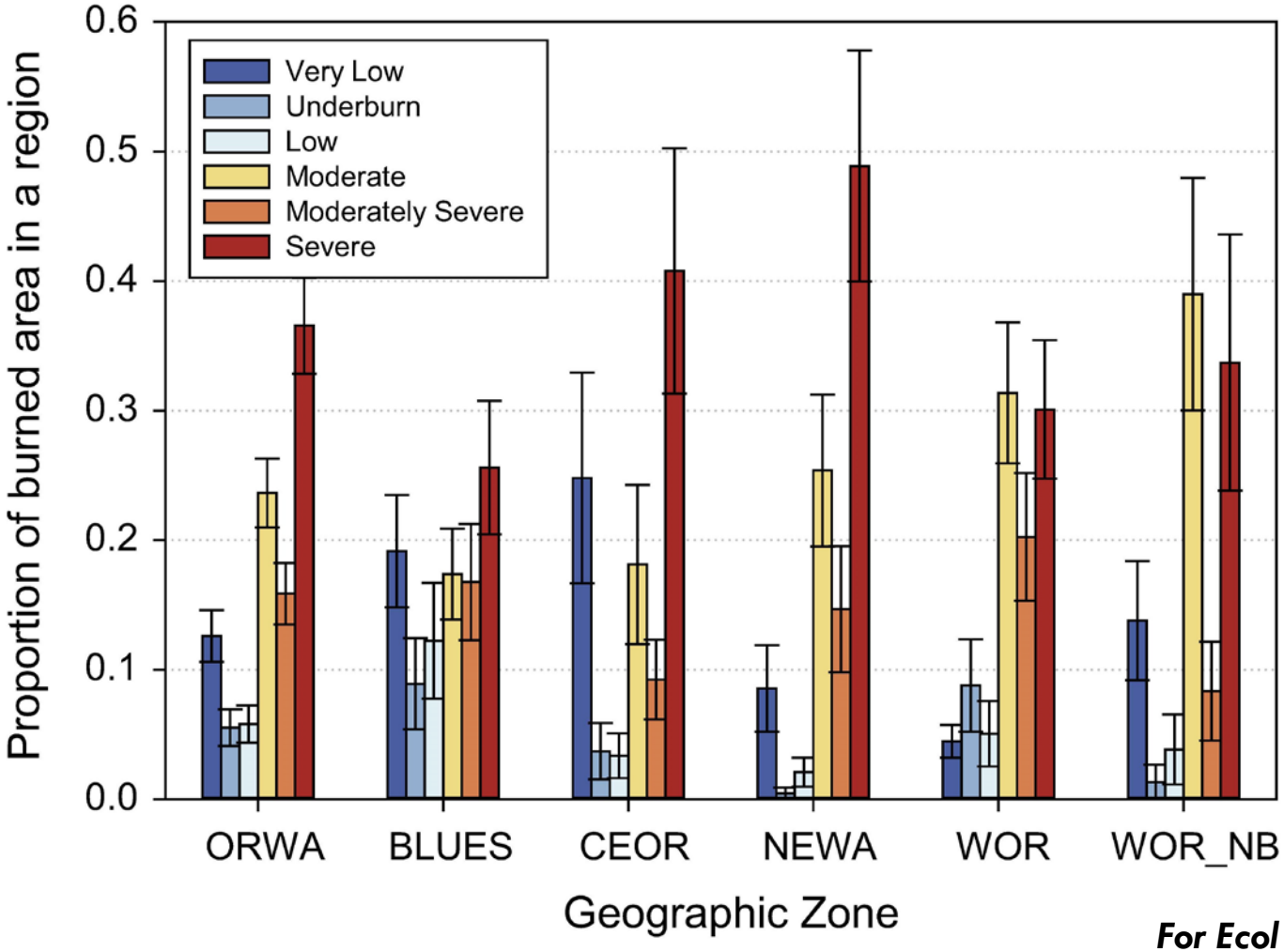
Disturbance	Area (1000 ac)	SE	Percent	Percent/yr
Cut	3,477.6	152.4	11.9%	1.2%
Fire	1,026.1	81.4	3.5%	0.4%
Cut + Fire	161.1	33.9	0.6%	0.1%
Insect or Disease	4,100.5	148.3	14.0%	1.4%
Weather	524.0	62.9	1.8%	0.2%
Incidental Cut	373.7	56.3	1.3%	0.1%
None	19,532.4	254.0	66.9%	
Total	29,195.5	182.9		

2.0%/yr

Many fires are not severe

Area by fire severity class, OR+WA NFS

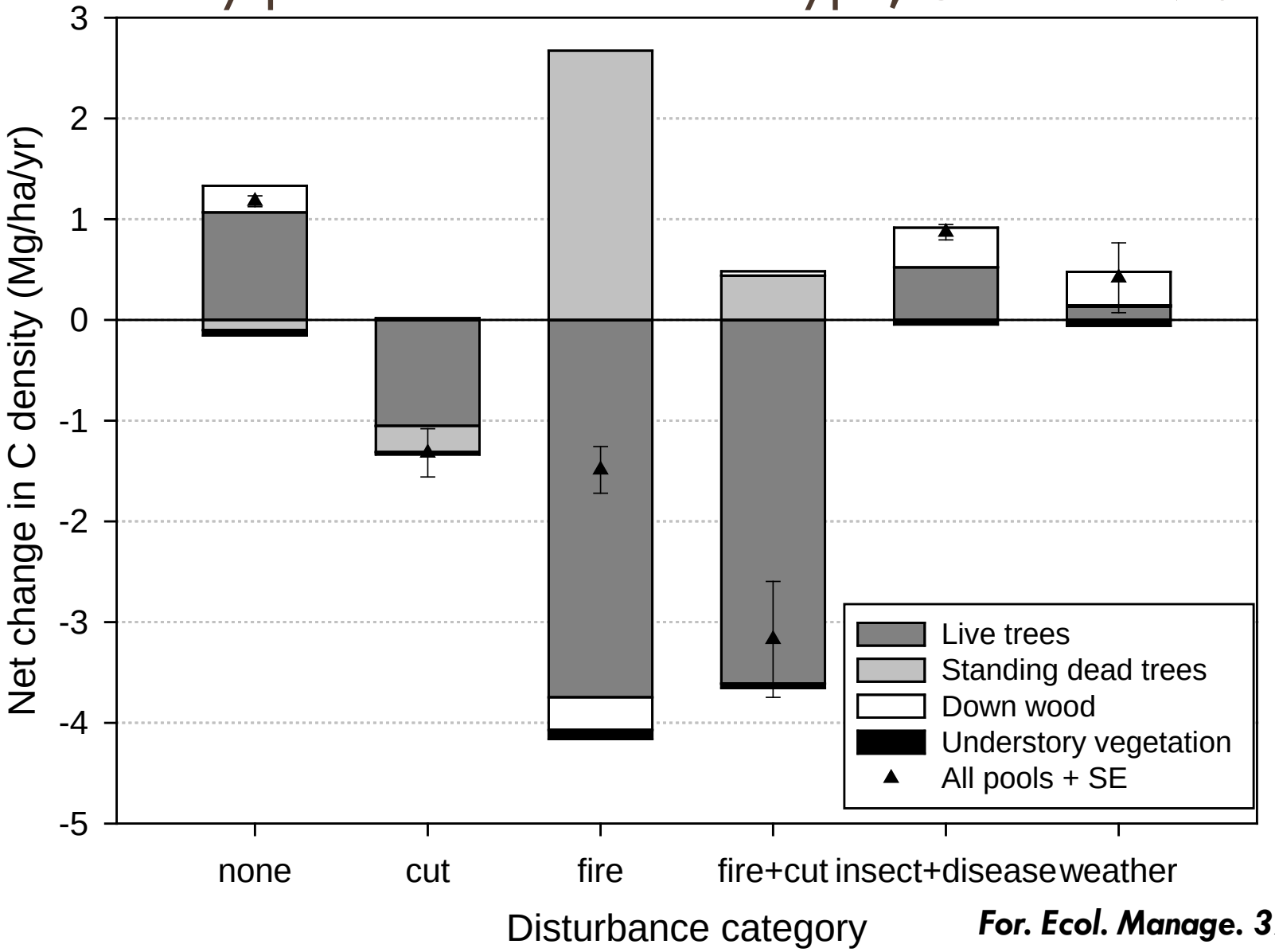
~50% of area burned resulted in >60% overstory mortality



For Ecol Mgmt 359: 199

Most of the carbon is still there

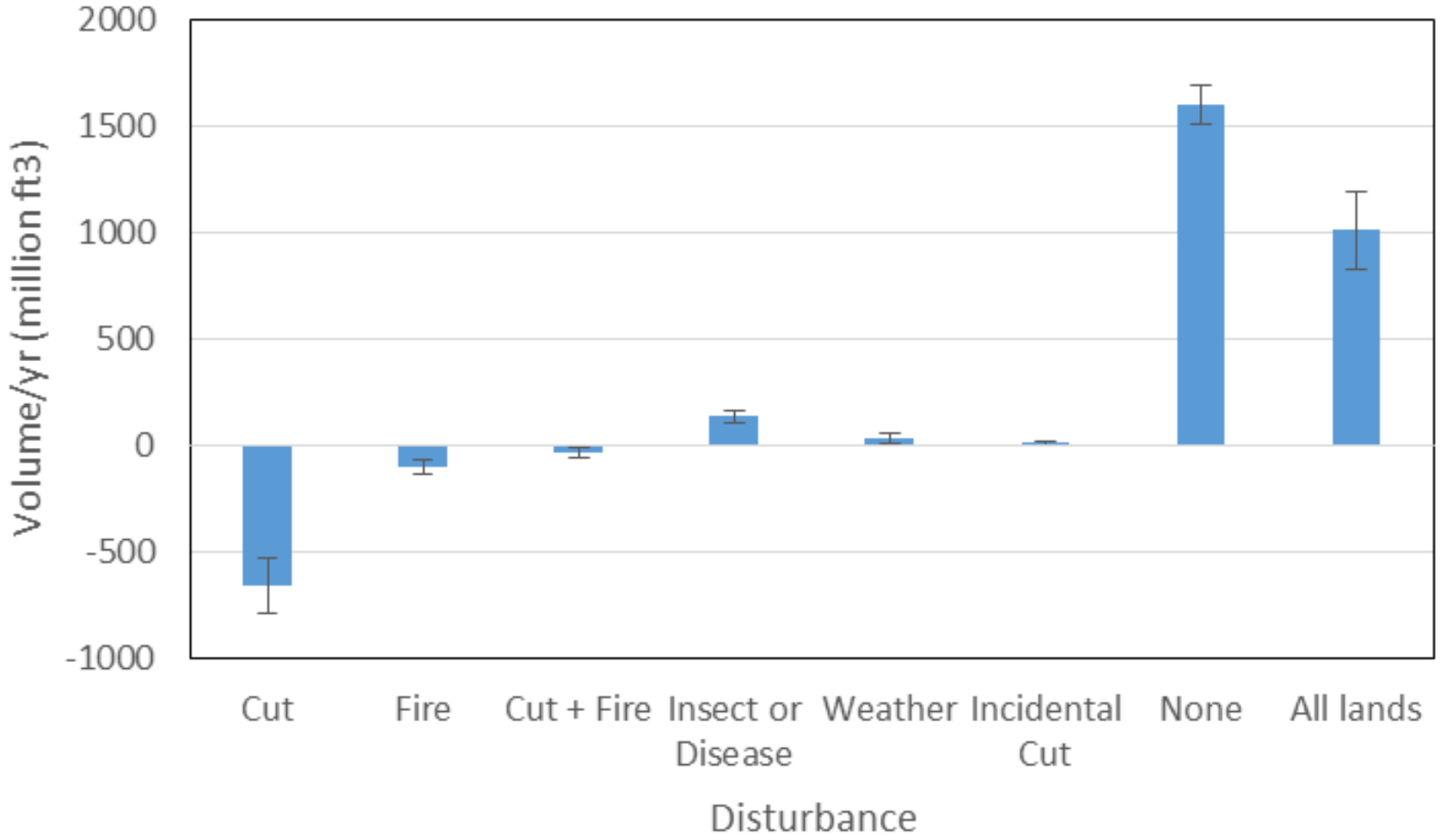
Flux by pool and disturbance type, OR+WA NFS



For. Ecol. Manage. 328:167

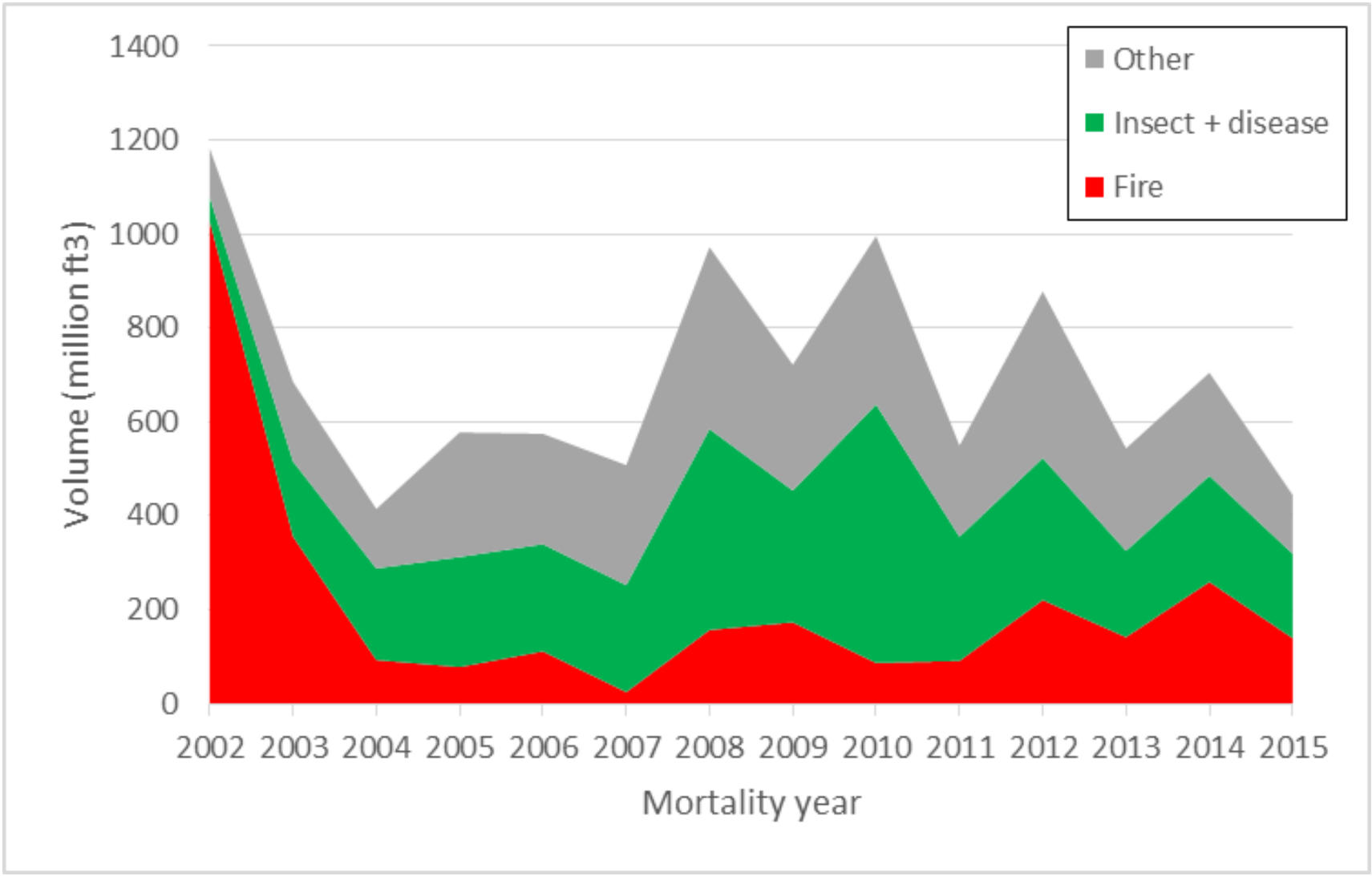
There's still a lot of growing going on

Net change in live trees by disturbance, OR



Teasing out temporal signals

Timing and cause of mortality



Summary

- Strategic inventories track carbon pools and flux at landscape to regional scales
- Inventories inform causes and timing of flux
- Tree mortality is not an emission; dead wood tends to accumulate
- Many fires are not severe and the overall effect on emissions has been minor
- Live tree growth has been the dominant force of C flux in PNW, largely due to reduced harvest
- Detailed forest carbon reports for OR+WA in 2019


Thank you!