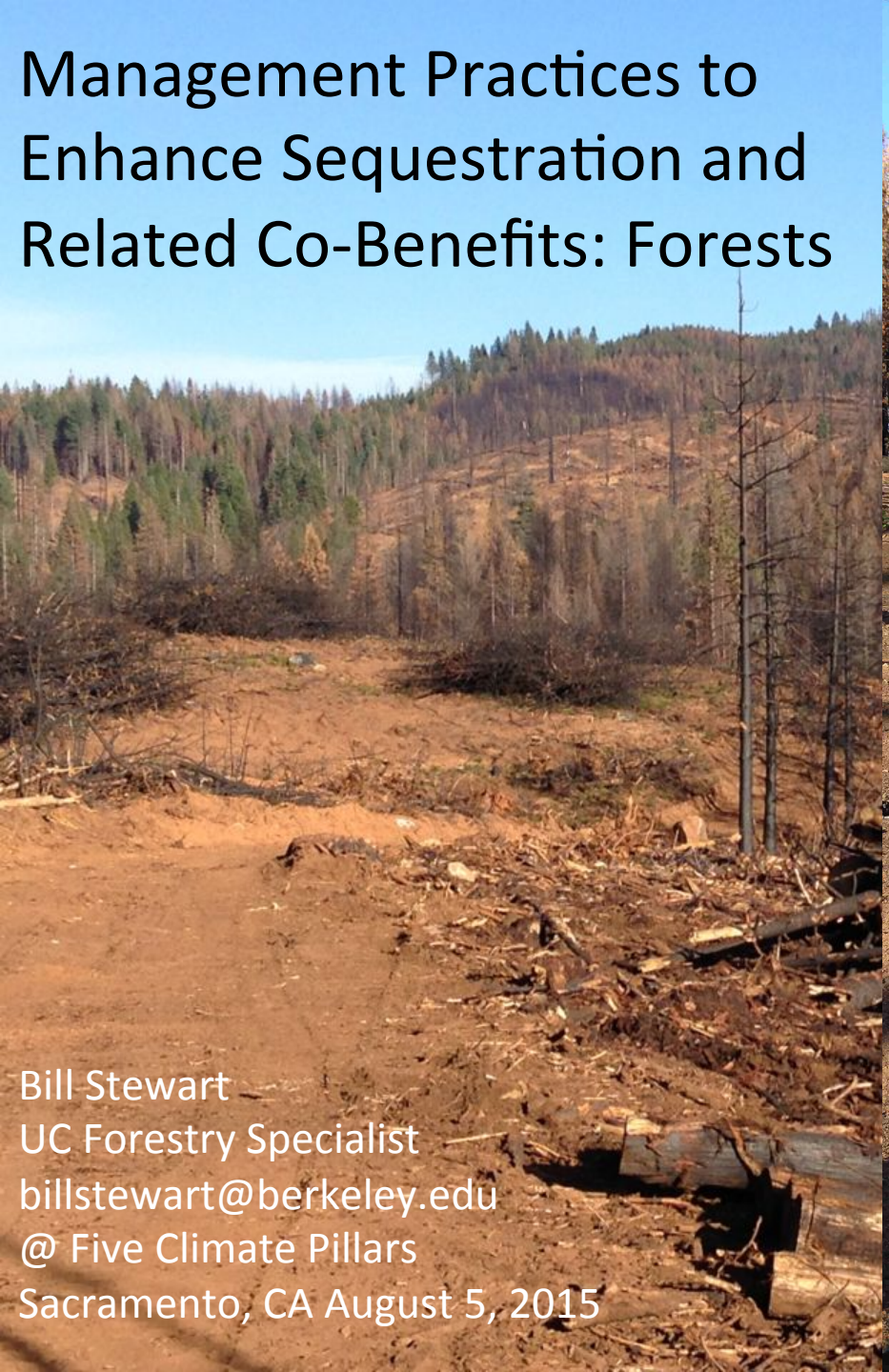
Management Practices to Enhance Sequestration and Related Co-Benefits: Forests



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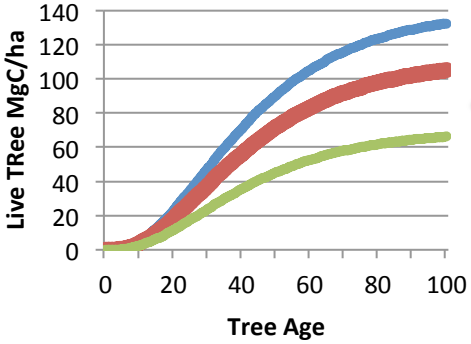
@ Five Climate Pillars
Sacramento, CA August 5, 2015

Climate Change Scoping Plan Update (ARB 2014) and Governor's Five Pillars (1)-(5)

Specific Sectors	Forests	Forest Products
Energy (2) (3)		Bioenergy (50% of CA harvest by volume in 2012)
Transportation (1), Land Use, Fuels (1), and Infrastructure	Reduced forest conversion, urban forests	Bio transportation fuels
Agriculture		Also produces biomass for fuel
Water	Watershed Protection	
Waste (4)		Wood and paper go to landfills or bioenergy
Natural and Working Lands (5)	**'maximize their carbon benefits while also ensuring landscape resilience'**	CA Forest Practice Rules Sec 897 – Harvest ≤ growth while protecting co-benefits
Short-lived Climate Pollutants (4)	Wildfire black carbon emissions	Methane emissions from poorly designed landfills
Green Buildings (3)		C efficient wood buildings – single and multiple units

Enterprise-wide California forest C life cycle IPCC (2014) compliant



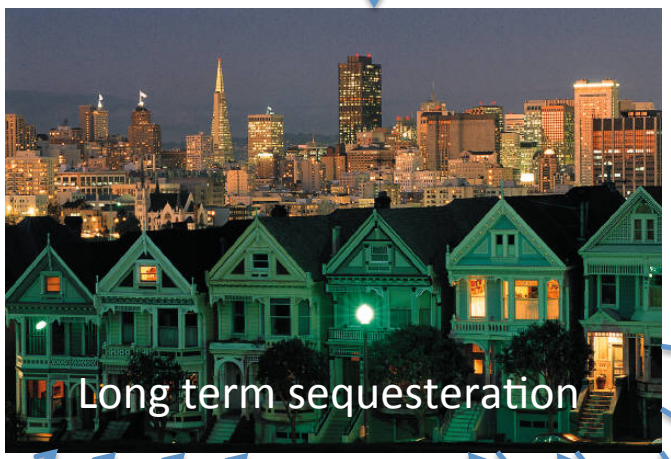
Forest growth model

Disturb-ance

Mortality – slow CO_2 release

50% wood products
50% bioenergy

Net new GHGs



Uncaptured GHGs

Methane emitting landfills

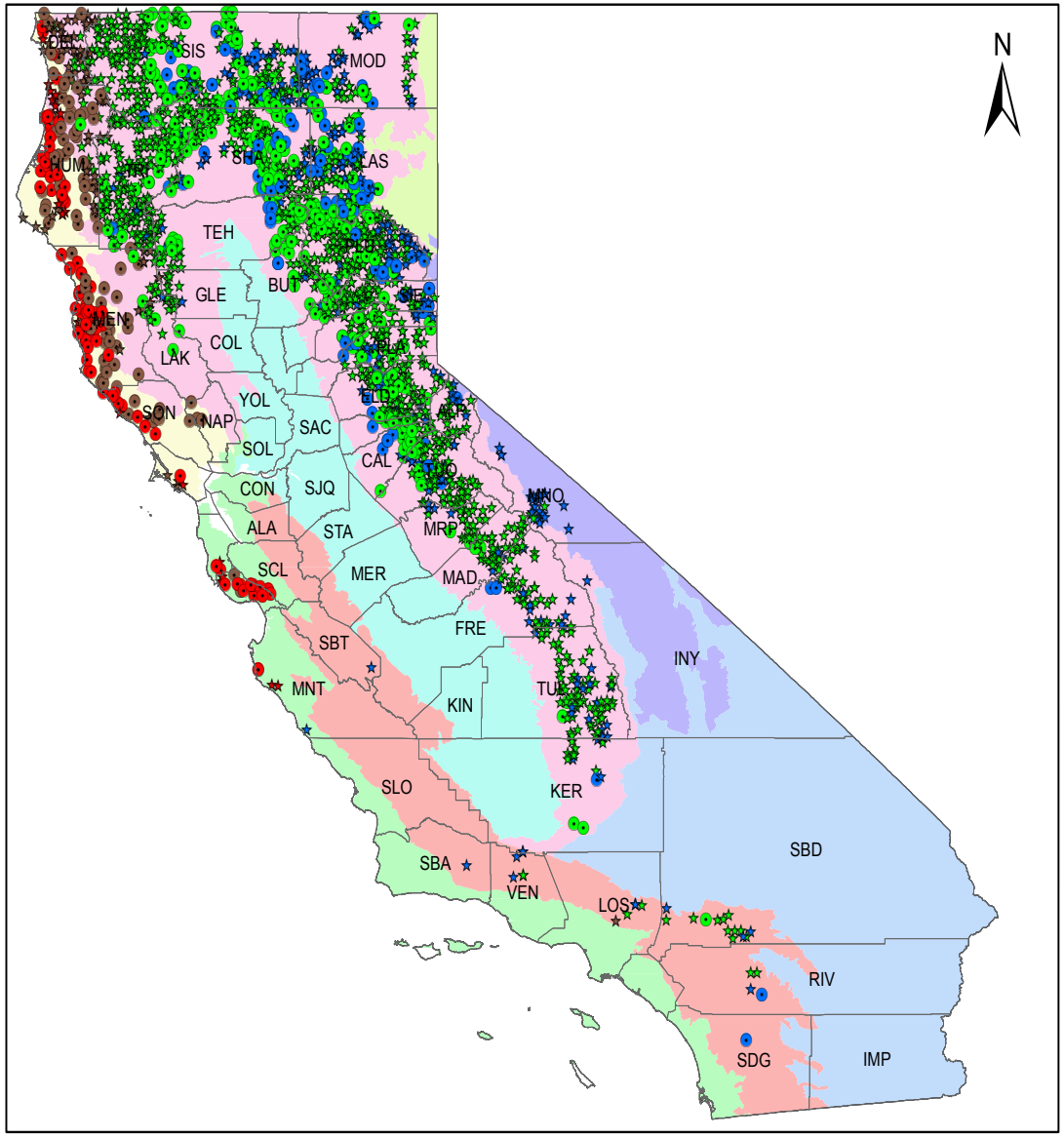
Methane capturing landfills

Energy plants

Recycle

Wood/Paper Imports
>4x domestic production

Remeasuring trees on FIA or ownership specific plots – rather than remeasuring the top of tree canopy height classes with satellites – is the most accurate way to measure change in live and dead tree C in forests



Dominant forest in FIA Timberland Plots

Pvt Fed

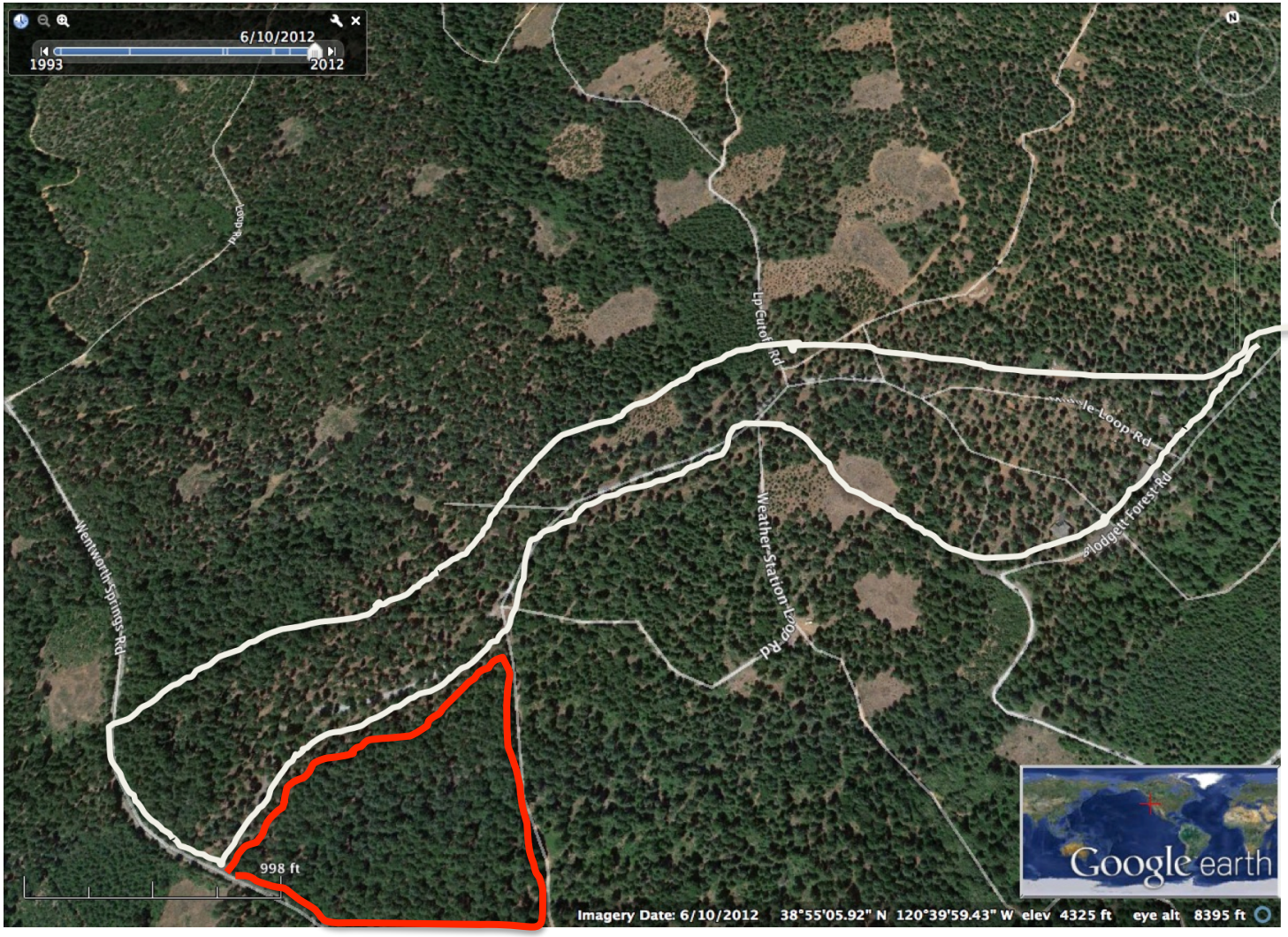
- Redwood
- Douglas fir
- Mixed Conifer
- P. Pine

Timberland Forests	Million Acres	FIA plots
Redwood	0.6	118
Douglas fir	0.9	187
Mixed conifer	6.4	1,374
Pond. Pine	1.9	263

Timberlands	10 million acres
Other forests	10 million acres
Woodlands	10 million acres

Stewart et al. 2015. *Forestry* in **Ecosystems of California**. Mooney and Zavleta eds. University of California Press

Blodgett Research Forest Station – White unit harvested every decade, Red unit is reserve unit with no harvesting. You can see the inventories records on our website and see the trees for yourself.



Unit	Tree Ht.
Red	123’
White	139’ pre
White	141’ post

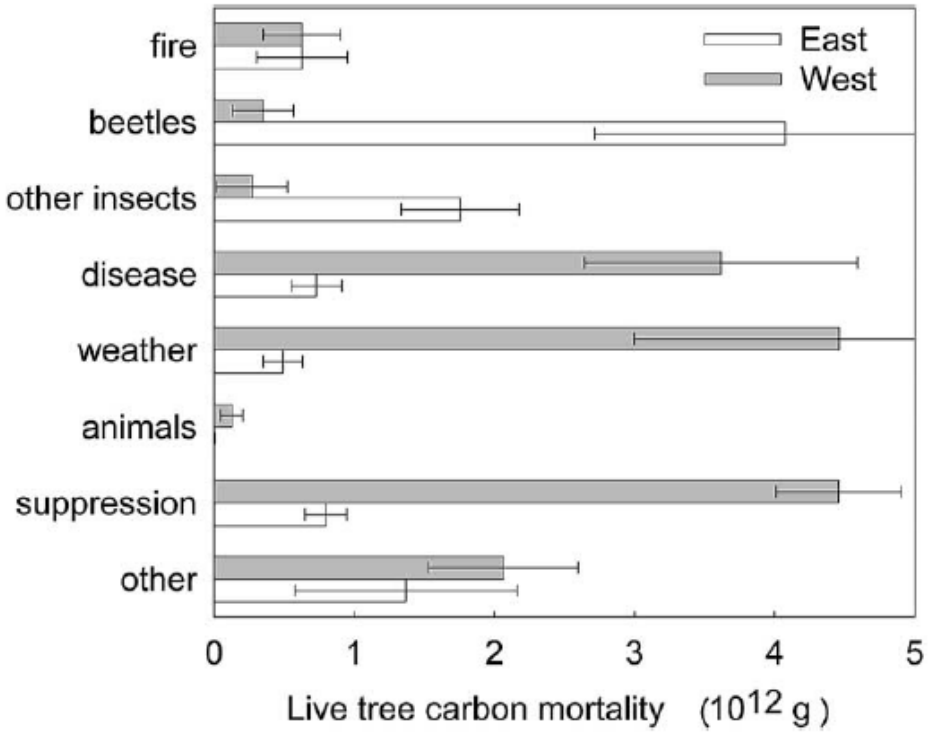
Gonzalez et al. 2015
Tree Ht. classes
0-18’
19-33’
34’-82’
83’-164’ ←
164’+

Blodgett height growth would register zero growth in Gonzalez 2015 tree size class analysis highlighted by ARB on their website

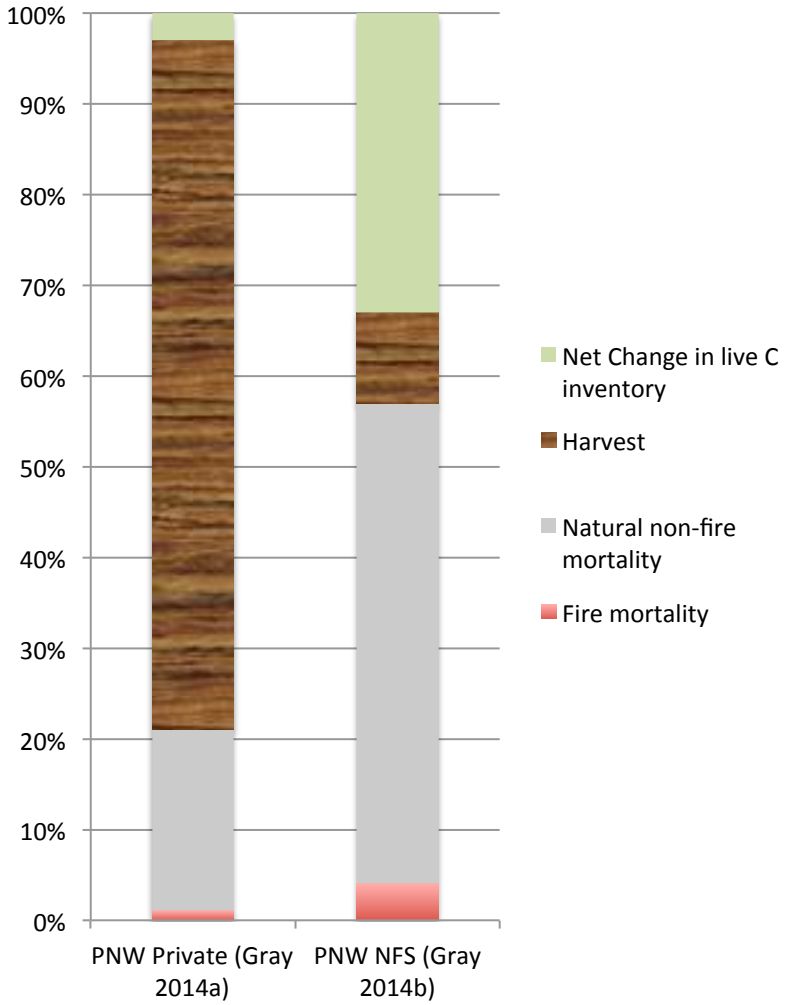
http://forestry-dev.berkeley.edu/blodgett/compartment_map1.html
http://www.arb.ca.gov/cc/inventory/sectors/forest/forest.htm ←

Causes of Mortality Losses on pvt land in OR
Comparison of public v pvt lands in OR

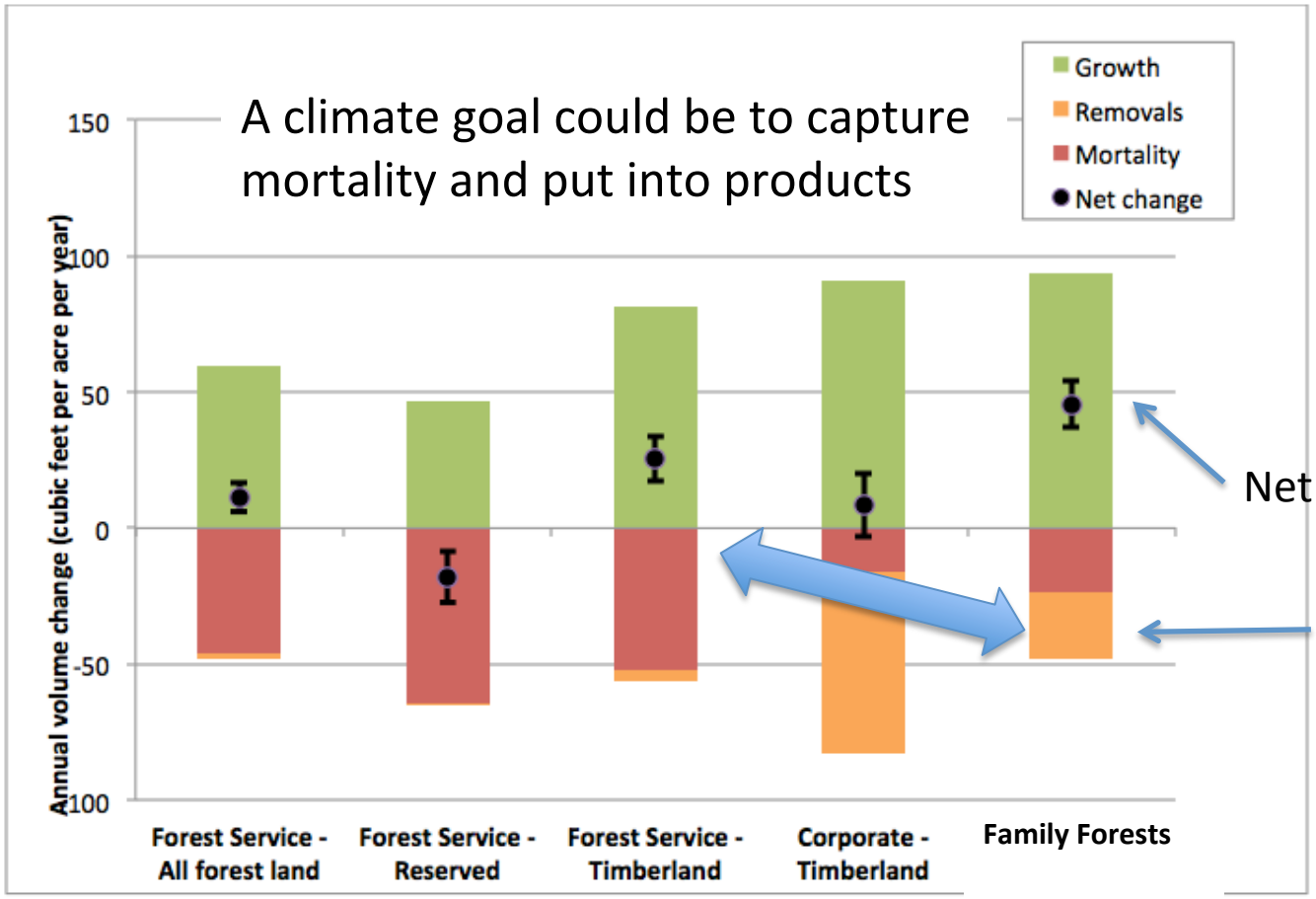
Sources of Mortality on Oregon Private Timberlands



Allocation of Gross Growth Pacific Northwest



Net change is forest C sequestration/ac/yr
Net change + Removals is enterprise-wide forest C sequestration/ac/yr



Statewide FIA and TPO
Carbon sequestration
In mmtCO2/yr
10-15 in-forest
20-25 enterprise-wide

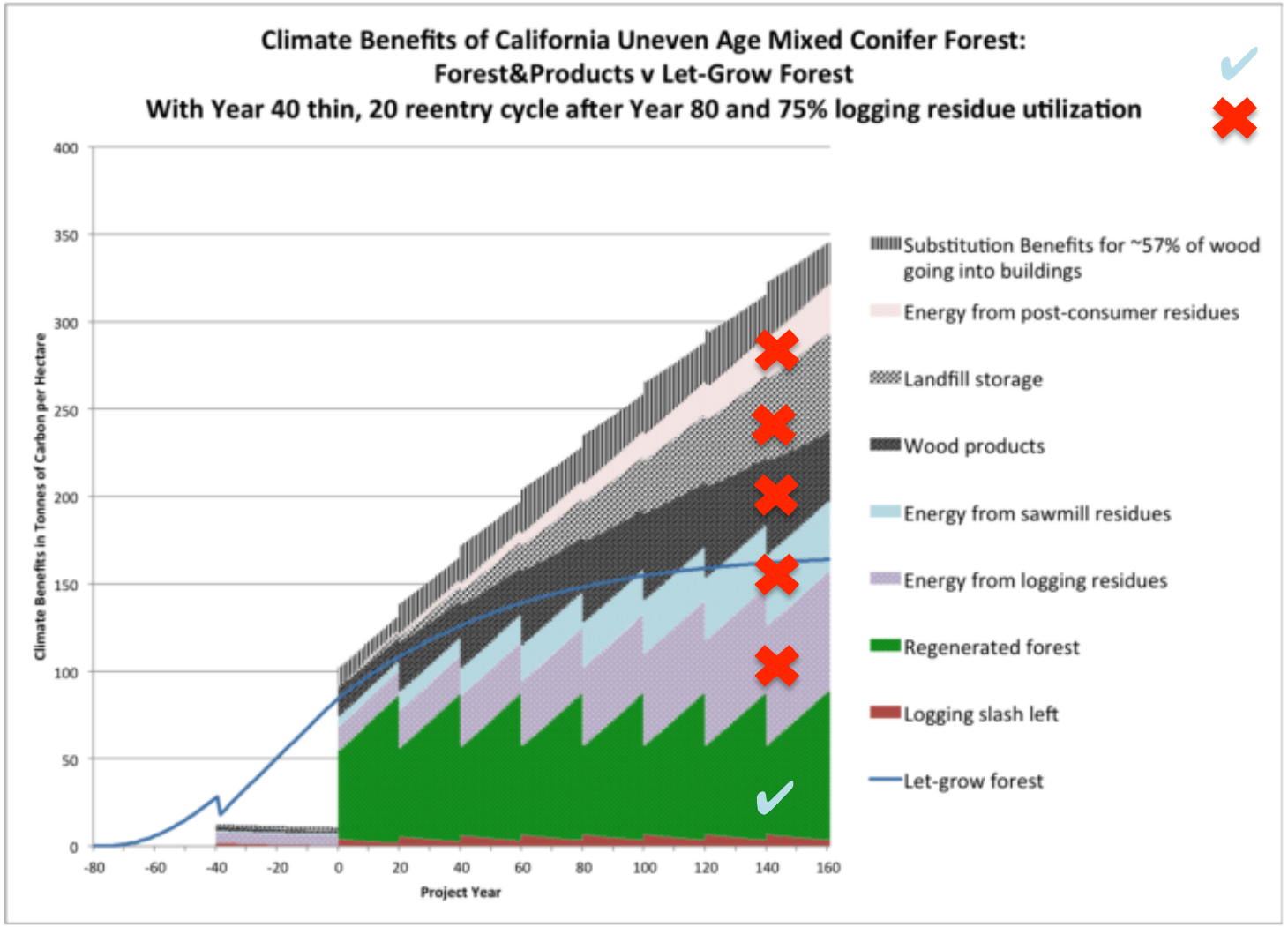
Net Change

USFS could have more enterprise-wide benefits if they managed more like family forests

California's Forest Resources: Forest Inventory and Analysis, 2001-2010. USFS FIA (Christensen, in press)

IPCC 2014 Good Guidance : Developed countries can no longer use 'instantaneous oxidation' and ignore harvested products. If you have empirical data on products and energy, you must use it.

Carbon Sequestration Tool for THPs



✔ ARB = IPCC

✖ ARB ≠ IPCC

http://ucanr.edu/sites/forestry/Carbon_Sequestration_Tool_for_THPs/

Five potential management practices to enhance C sequestration across the full life cycle

1. Family forests – Grants and cost-share programs to reduce future mortality in their forest stands (preferably with low transaction costs for approved practices)
2. Large timber companies – 'BCAP/Oregon tax credit' like tools to get more logging residues to energy plants
3. Forest Service – Implement wildlife-friendly silviculture pilot projects to reduce mortality
4. Build more buildings with wood, less with concrete
5. Reduce methane emissions from uncapped landfills (cap them and/or divert waste to energy facilities)

References

- California Air Resources Board. 2014. First update to the Climate Change Scoping Plan: Building on the Framework Sacramento, CA, p. 159. and http://www.arb.ca.gov/cc/inventory/sectors/forest/forest.htm
- Christensen, G., Waddell, K., Stanton, S. and Kuegler, O. In Press. California's Forest Resources: Forest Inventory and Analysis, 2001-2010. U.S. Forest Service, Pacific Northwest Research Station, Portland, OR.
- Eurostat. 2015. Municipal Waste Statistics. http://ec.europa.eu/eurostat/statistics-explained/index.php/Municipal_waste_statistics
- Gonzalez, P., Battles, J.J., Collins, B.M., Robards, T. and Saah, D.S. 2015 Aboveground live carbon stock changes of California wildland ecosystems, 2001–2010. *Forest Ecology and Management*, **348**, 68-77.
- Gray, A., Whittier, T. and Azuma, D. 2014 Estimation of aboveground forest carbon flux in Oregon: adding components of change to stock-difference assessments. *Forest Sci*, **60**, 317 - 326.
- Gray, A. and Whittier, T. 2014 Carbon stocks and changes on Pacific Northwest national forests and the role of disturbance, management, and growth. *Forest Ecol Manag*, **328**, 167 - 178.
- IPCC. 2014. 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol. T.K. Takahiko Hiraishi, Kiyoto Tanabe, Nalin Srivastava, Baasansuren Jamsranjav, Maya Fukuda and Tiffany Troxler (eds) (ed), Kanagawa, Japan. http://www.ipcc-nggip.iges.or.jp/public/kpsg/index.html
- McIver, C.P., Meek, J.P., Scudder, M.G., Sorenson, C.B., Morgan, T.A. and Christensen, G.A. In Press. California's Forest Products Industry and Timber Harvest, 2012 PNW-GTR-908. USDA US Forest Service PNW.
- Morgan, T.A., Brandt, J.P., Songster, K.E., Keegan, C.E., III and Christensen, G.A. 2012 California's forest products industry and timber harvest, 2006. PNW-GTR-866. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR, p. 48.
- Smyth, C.E., Stinson, G., Neilson, E., Lemprière, T.C., Hafer, M., Rampley, G.J. *et al.* 2014 Quantifying the biophysical climate change mitigation potential of Canada's forest sector. *Biogeosciences*, **11**, 3515-3529.
- Stewart, W.C. and Sharma, B.D. 2015 Carbon calculator tracks the climate benefits of managed private forests. *California Agriculture*, **69**, 21-26. DOI#10.3733/CA.V069N01P21
- Stewart, W., Sharma, B., York, R., Diller, L., Hamey, N., Powell, R. *et al.* 2015. Forestry. In: *Ecosystems of California*. E. Zavaleta and H. Mooney (eds). University of California Press, Berkeley, CA.
- U.S. Environmental Protection Agency. 2015 Inventory of U. S. Greenhouse Gas Emissions and Sinks: 1990 – 2013. http://epa.gov/climatechange/emissions/usinventoryreport.html
- York, R.A. 2015 Large-tree removal in a mixed-conifer forest halves productivity and increases white fir. *California Agriculture*, **69**, 27-35. DOI#10.3733/CA.V069N01P27