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

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@ Five Climate Pillars
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<table>
<thead>
<tr>
<th>Specific Sectors</th>
<th>Forests</th>
<th>Forest Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (2) (3)</td>
<td></td>
<td>Bioenergy (50% of CA harvest by volume in 2012)</td>
</tr>
<tr>
<td>Transportation (1), Land Use, Fuels (1), and Infrastructure</td>
<td>Reduced forest conversion, urban forests</td>
<td>Bio transportation fuels</td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td>Also produces biomass for fuel</td>
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<tr>
<td>Water</td>
<td>Watershed Protection</td>
<td></td>
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<tr>
<td>Waste (4)</td>
<td></td>
<td>Wood and paper go to landfills or bioenergy</td>
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<tr>
<td>Natural and Working Lands (5)</td>
<td>‘maximize their carbon benefits while also ensuring landscape resilience’</td>
<td>CA Forest Practice Rules Sec 897 – Harvest ≤ growth while protecting co-benefits</td>
</tr>
<tr>
<td>Short-lived Climate Pollutants (4)</td>
<td>Wildfire black carbon emissions</td>
<td>Methane emissions from poorly designed landfills</td>
</tr>
<tr>
<td>Green Buildings (3)</td>
<td></td>
<td>C efficient wood buildings – single and multiple units</td>
</tr>
</tbody>
</table>
Enterprise-wide California forest C life cycle
IPCC (2014) compliant

Forest growth model

Disturbance

Mortality – slow CO$_2$ release

50% wood products 50% bioenergy

Net new GHGs

Uncaptured GHGs

Methane emitting landfills

Methane capturing landfills

Energy plants

Recycle

Live Tree MgC/ha

Forest growth model

Long term sequestration

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

<table>
<thead>
<tr>
<th>Forest Type</th>
<th>Acres</th>
<th>FIA plots</th>
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</thead>
<tbody>
<tr>
<td>Redwood</td>
<td>0.6</td>
<td>118</td>
</tr>
<tr>
<td>Douglas fir</td>
<td>0.9</td>
<td>187</td>
</tr>
<tr>
<td>Mixed conifer</td>
<td>6.4</td>
<td>1,374</td>
</tr>
<tr>
<td>Pond. Pine</td>
<td>1.9</td>
<td>263</td>
</tr>
</tbody>
</table>

### Other forests

- 10 million acres

### Woodlands

- 10 million acres

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

- fire
- beetles
- other insects
- disease
- weather
- animals
- suppression
- other

Allocation of Gross Growth
Pacific Northwest

Net Change in live C inventory
Harvest
Natural non-fire mortality
Fire mortality
Net change is forest C sequestration/ac/yr

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

A climate goal could be to capture mortality and put into products

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.
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