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Dept of Environmental Science, Policy, and Management
130 Mulford Hall #3114
Berkeley, CA 94720-3114
billstewart@berkeley.edu
(510) 643-3130

To: Natural and Working Lands Working Group
From: William Stewart, billstewart@berkeley.edu . Forestry Specialist
Co-Director Center for Forestry http://forestry.berkeley.edu/
Co-Director Center for Fire Research and Outreach http://firecenter.berkeley.edu/

Reducing mortality losses and ensuring efficient use of harvested products as a productive strategy for managing forest land for carbon sequestration to achieve California's 2030 Climate Commitment

Governor Brown's Executive Order B-30-15 ordered state agencies to give priority to 'actions that both build climate preparedness and reduce greenhouse gas emissions' when making their planning and investment decisions. To strengthen California's forests strong positive role in carbon sequestration, it will be important to consider actions to reduce the often high levels of mortality experienced in some of California's forests. This summer's wildfires and insect outbreaks provide graphic images of the risks of assuming forests with high carbon carrying capacity will be able to provide carbon sequestration benefits over the long term. The following figure compares the allocation of forest growth potential on private and federal forests in California and the Pacific Northwest (Oregon and Washington).

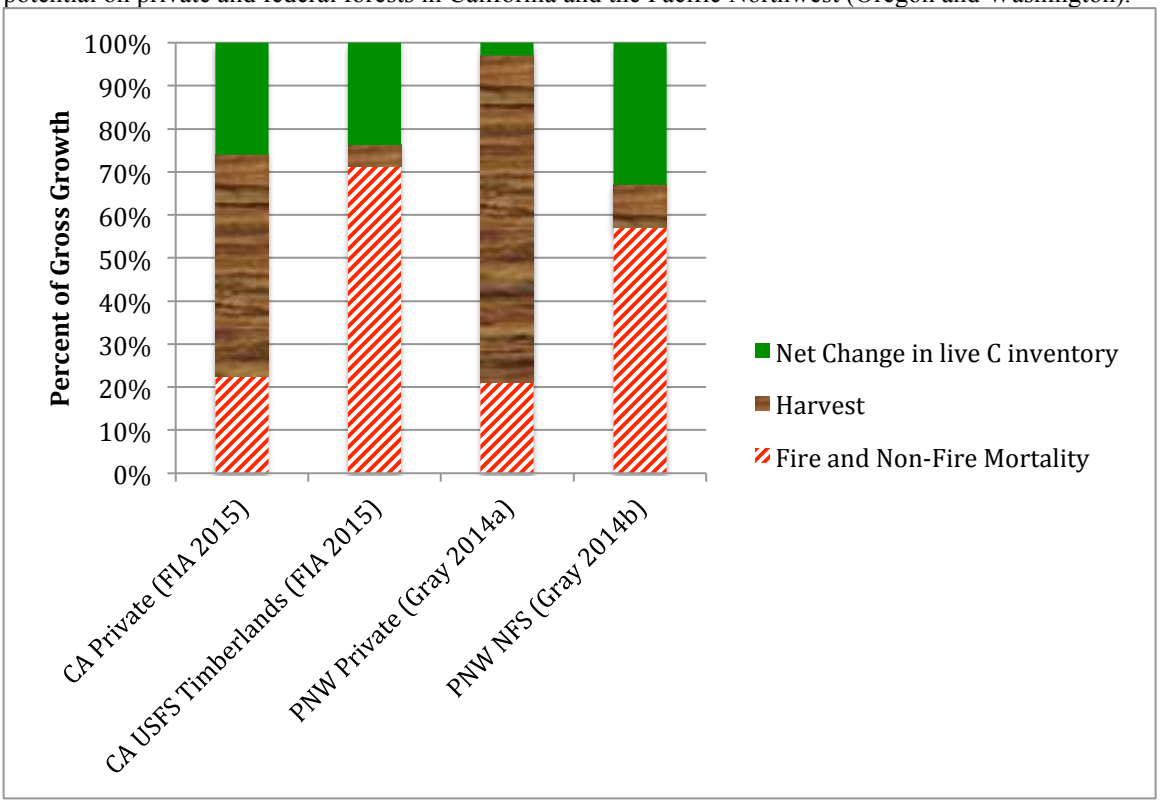

Figure 1: Allocation of forest growth to larger trees, harvest products and mortality based on remeasured Forest Inventory and Analysis (FIA) plots

The pattern in both regions is very similar. Federal timberlands generally have slightly older trees and higher carbon storage per acre volumes, but exhibit much higher levels of mortality from fires, insects, and drought than we see on more actively managed private timberlands. One way to consider this is that sustainably managed timberlands reduce

the probability of mortality by harvesting more trees to generate mainly building products and bioenergy that are used in California. The following figure from the upcoming FIA report (Christensen et al. In Press), summarizes data from more than 3,000 forest plots where all live and dead trees are remeasured each decade. When we compare the 'Forest Service – Timberlands and 'Noncorporate – Timberland" (essentially family owned forests) it appears that the 'Noncorporate – Timberland' forests essentially remove more volume in harvested products rather than lose that volume to mortality.

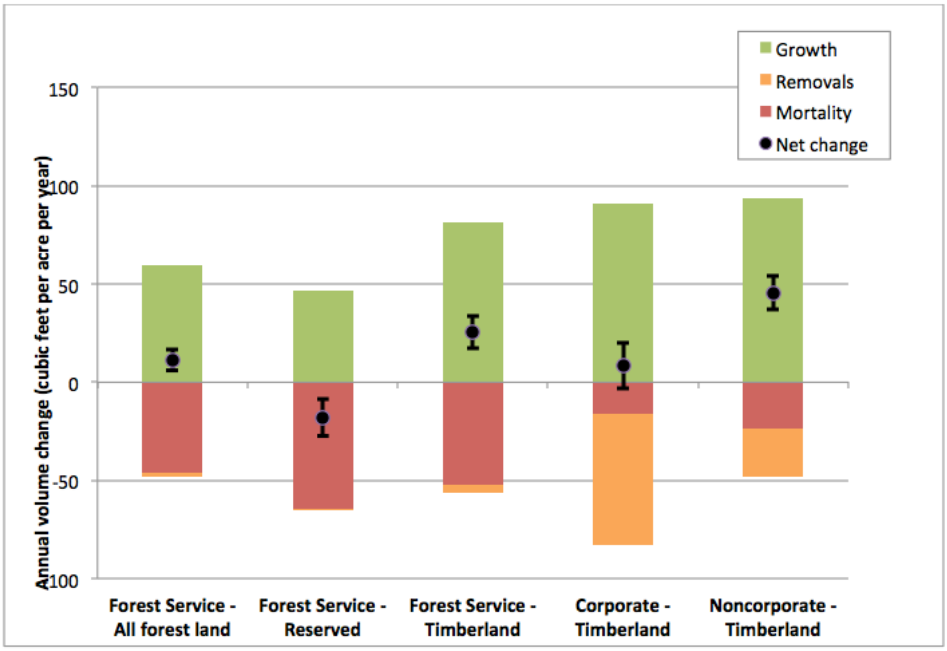

Figure 2: Ownership specific allocation of annual carbon sequestration in California (Source: Christensen et al. In Press)

The assessment of whether the 'sustainable forestry' strategy provides greater overall climate benefits than the 'low/no harvesting' strategy depends on how the climate benefits associated with harvested wood products are counted. Until 2012, the Intergovernmental Panel on Climate Change (IPCC) considered it acceptable to account for carbon in harvested wood products as being 'instantaneously oxidized' and counted as an immediate emission with no life-cycle sequestration benefits (reference). The "2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol" (IPCC 2014), increased the standards so that now the IPCC requires all countries that have 'transparent and verifiable' data on wood products to consider the full life cycle of carbon sequestered in products. Similarly accurate standards of carbon accounting are strongly suggested for carbon in trees killed by disturbances (e.g. wildfires, drought) that still sequester carbon but are losing that carbon as microbes decompose the dead trees (IPCC 2014).

Fortunately, the USFS's Timber Product Output (TPO) studies provide detailed information on what happens to harvested products in California (McIver et al. In Press, Morgan et al. 2012) and the US EPA's annual greenhouse gas emissions inventory reports (US EPA 2015) provides empirical evidence on how long different products stay in use and what percentage of them end in long term carbon storage in engineered landfills or are used to generate more bioenergy.

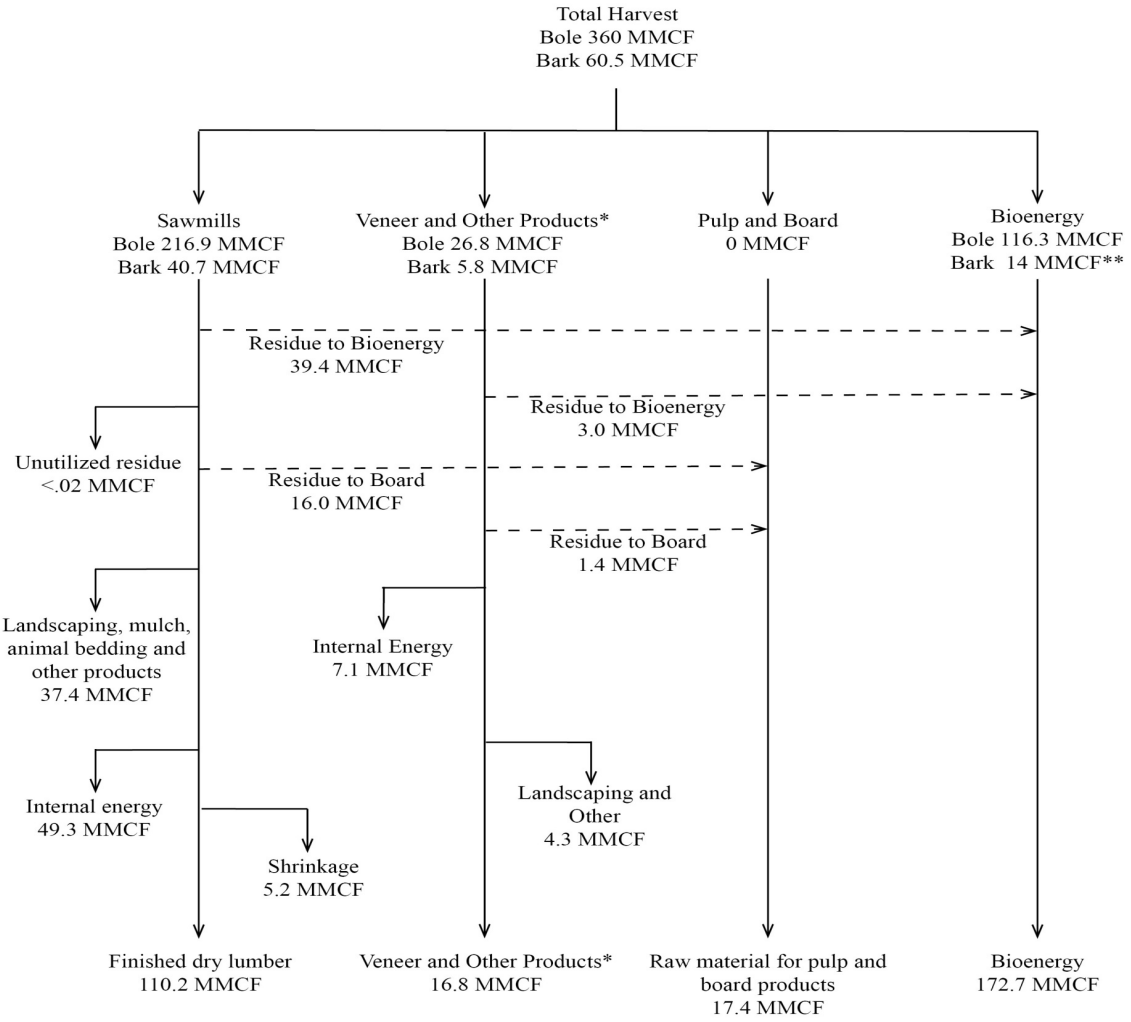

Figure 3– Utilization of California's timber harvest, 2012 in McIver et al. (in press)

The full life-cycle benefits can be tracked in a simple model designed to accompany timber harvest plan documents in California (Stewart and Sharma 2015) or potentially by adapting the state of the art Canadian model (Smyth et al. 2014) that has been used to assess current conditions as well as a variety of scenarios to increase life-cycle benefits from all of Canada's forests.

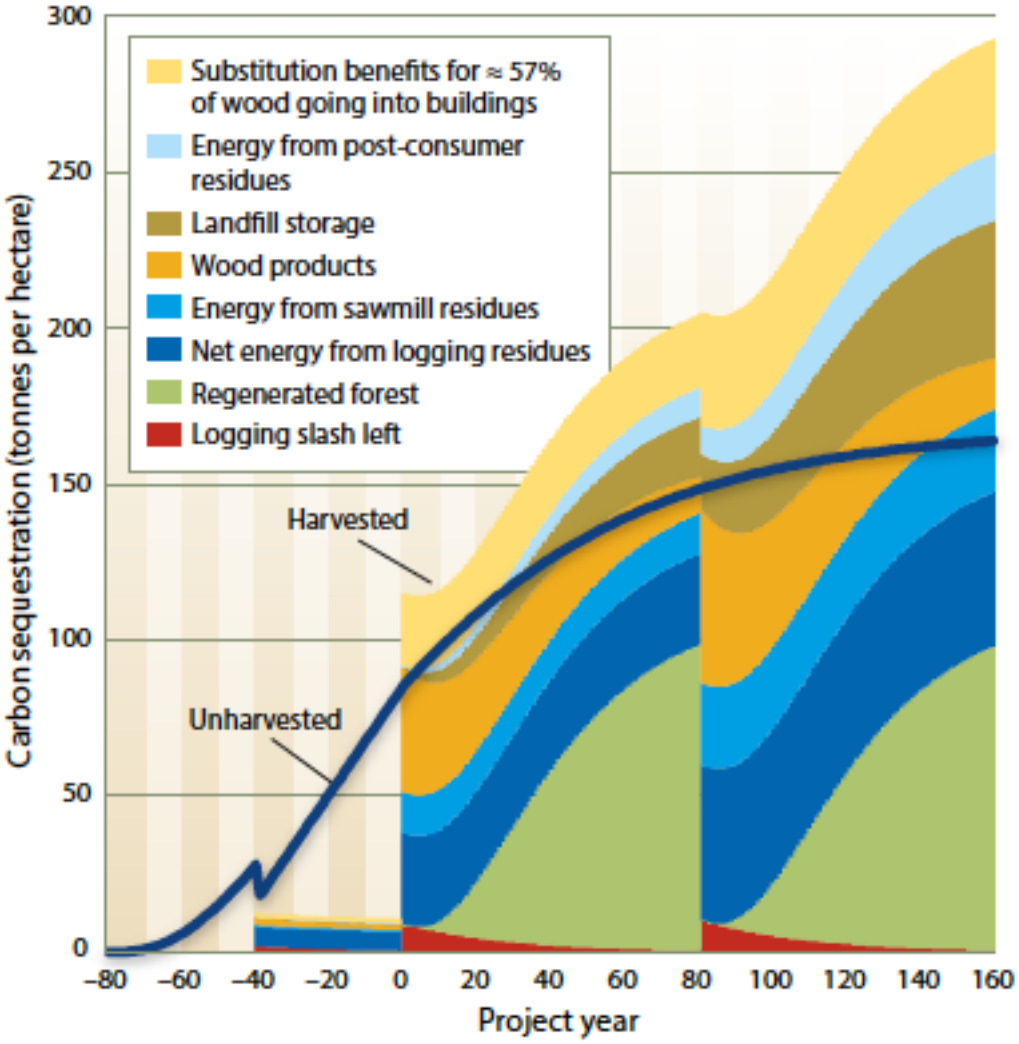

Fig. 1. Sequestration benefits over time from 1 hectare of a mixed-conifer forest under two scenarios: unharvested (or let-grow), and even-aged harvest and regeneration with 75% of slash (logging residues) used for energy at a harvest at year 0. The life cycle includes the 80 years since the forest started from seedlings as well as two cycles of harvesting and replanting.

Figure 4: Best practice scenario of carbon sequestration for a sustainably managed forests versus an unharvested forest (Source: Stewart and Sharma 2015)

Conclusion

Accurately tracking the full life-cycle of carbon in forests and in harvested products is necessary if California's progress towards reduced emissions is to in line with the latest IPCC guidelines. The use of full life-cycle accounting as required by the Governor's executive order matches well with IPCC guidelines. The evidence to date suggests that private and public investments in reducing fire risks and other forest health risks could substantially reduce mortality losses that have been measured in our well stocked forests in regions with hot and dry summers. In addition, promoting the efficient use of harvested products as renewable building products and as bioenergy (for wood pieces that are not big enough to make into building products) would add to the life-cycle benefits of forests as counted with the latest IPCC standards.

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