

Comments due Aug 3 on CARB 2022 Scoping Plan on Natural and Working Lands (NWL)

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Attribution of net carbon change by disturbance type across forest lands of the conterminous United States

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## Abstract

### Background

Locating terrestrial sources and sinks of carbon (C) will be critical to developing strategies that contribute to the climate change mitigation goals of the Paris Agreement. Here we present spatially resolved estimates of net C change across United States (US) forest lands between 2006 and 2010 and attribute them to natural and anthropogenic processes.

### Results

Forests in the conterminous US sequestered  $-460 \pm 48$  Tg C year<sup>-1</sup>, while C losses from disturbance averaged  $191 \pm 10$  Tg C year<sup>-1</sup>. Combining estimates of net C losses and gains results in net carbon change of  $-269 \pm 49$  Tg C year<sup>-1</sup>. New forests gained  $-8 \pm 1$  Tg C year<sup>-1</sup>, while deforestation resulted in losses of  $6 \pm 1$  Tg C year<sup>-1</sup>. Forest land remaining forest land lost  $185 \pm 10$  Tg C year<sup>-1</sup> to various disturbances; these losses were compensated by net carbon gains of  $-452 \pm 48$  Tg C year<sup>-1</sup>. C loss in the southern US was highest ( $105 \pm 6$  Tg C year<sup>-1</sup>) with the **highest fractional contributions from harvest (92%)** and wind (5%). C loss in the western US ( $44 \pm 3$  Tg C year<sup>-1</sup>) was due **predominantly to harvest (66%), fire (15%),** and insect damage (13%). The northern US had the lowest C loss ( $41 \pm 2$  Tg C year<sup>-1</sup>) with **the most significant proportional contributions from harvest (86%),** insect damage (9%), and conversion (3%). Taken together, these disturbances reduced the estimated potential C sink of US forests by 42%.

### Conclusion

The framework presented here allows for the integration of ground and space observations to more fully inform US forest C policy and monitoring efforts.

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**Are Logging Interests Credible When They Claim that Some US Forests are Now Net Carbon Sources, Rather Than Sinks, Due to Fire and Bark Beetles, and that More Logging is the Solution?** No. Logging in US forests emits 10 times more carbon into the atmosphere than the combined emissions from fire and tree mortality from native bark beetles, and our forests could sequester and store far more carbon if we increased protections from logging (Harris et al. 2016). Recent unpublished reports from the Forest Service, and some state agencies, regarding wildfire carbon emissions are based on a discredited model (FOFEM) that has repeatedly been shown to exaggerate carbon emissions by nearly threefold (French et al. 2011). Further, the FOFEM model falsely assumes that nothing grows back after a fire to pull CO<sub>2</sub> out of the atmosphere. Field studies of large fires find only about 11% of forest carbon is consumed, and only 3% of the carbon in trees (Campbell et al. 2007), and vigorous post-fire forest regrowth absorbs huge amounts of CO<sub>2</sub> from the atmosphere; within a decade after fire, post-fire growth absorbs more carbon from the atmosphere than the fire emitted (Meigs et al. 2009). (1) Fire rejuvenates forests, making nutrients more available and stimulating rapid new growth. If old forests go too long without intense fire that initiates new forest stands, they begin to lose their carbon sequestration and storage capacity (Wardle et al. 2004, Luyssaert et al. 2008), but this capacity is typically doubled in new fire-initiated stands (Luyssaert et al. 2008).

**Is Forest Protection a Climate Change Solution?** Yes, it is just as important as ending fossil fuel consumption. The best available science indicates that, to effectively mitigate climate change, we must not only move beyond carbon fuel consumption, but must also substantially increase forest protection from logging; in fact, increased forest protection can account for *half or more* of our needed climate change mitigation while we quickly transition away from carbon fuel consumption (Erb et al. 2018).

**Do “Thinning” Logging Operations Improve Forest Carbon Storage?** No. In fact, this type of logging results in a large overall net *reduction* in forest carbon storage, and an *increase* in carbon emissions, relative to wildland fire alone (no logging), while protecting forests from logging maximizes carbon storage and removes more CO<sub>2</sub> from the atmosphere (Campbell et al. 2012, Law et al. 2018).

**Does Logging in Forests Distant from Homes Protect Communities?** No. Defensible space work within 100 feet or less from homes, along with making homes themselves more fire-safe, is very effective in protecting homes from wildland fire, but vegetation management activities beyond 100 feet from homes has no additional influence on whether or not a home survives a wildland fire (Syphard et al. 2014, DellaSala and Hanson 2015).

**Do “Thinning” Logging Operations Stop or Slow Wildland Fires?** No. “Thinning” is just a euphemism for intensive commercial logging, which kills and removes most of the trees in a stand, including many mature and oldgrowth trees. With fewer trees, winds, and fire, can spread faster through the forest. In fact, extensive research shows that commercial logging, conducted under the guise of “thinning”, often makes wildland fires spread *faster*, and in most cases also *increases* fire intensity, in terms of the percentage of trees killed (Cruz et al. 2008, 2014).

(1) For example, Campbell et al. (2007) found that the Biscuit fire of 2002 emitted an average of 19 tons of carbon per hectare, and Campbell et al. (2016) found that decay of fire-killed trees in the Biscuit fire emitted an average of about 0.75 tons of carbon per hectare per year over the first 10 years post-fire (there were lower emissions from decay in subsequent decades). Therefore, for the first 10 years post-fire, the total carbon emissions from the Biscuit fire (carbon emissions from the fire itself, plus subsequent emissions from decay) were approximately 26 tons of carbon per hectare. Meigs et al. (2009) (Table 5) report that, by only five years after fire, regrowth was pulling 3.1 tons of carbon per hectare per year out of the atmosphere. Therefore, by 10 years postfire, this equates to approximately 31 tons of carbon pulled out of the atmosphere by regrowth—i.e., an overall net increase in carbon of 5 tons per hectare relative to pre-fire levels. By 20 years after new stand initiation, natural regrowth absorbs over 6 tons of carbon/year (Luyssaert et al. 2008), thus facilitating a large overall net increase in carbon storage, and an overall reduction of atmospheric carbon.

**Does “thinning” need to be conducted prior to prescribed fire or wildland fire use?** The notion that dense, longunburned forests must be “thinned” through logging operations prior to reintroducing fire is simply not scientifically supported, and is directly contradicted by a wealth of scientific data (Keifer 1998; Stephens & Finney 2002; Fule et al. 2004; Schwilk et al. 2006; van Mantgem et al. 2011, 2013, 2016).

**Does Reducing Environmental Protections, and Increasing Logging, Curb Forest Fires?** No, based on the largest analysis ever conducted, this approach increases fire intensity (Bradley et al. 2016). Logging reduces the cooling shade of the forest canopy, creating hotter and drier

conditions, leaves behind kindling-like “slash” debris, and spreads combustible invasive weeds such as cheatgrass.

**Are Our Forests Unnaturally Dense and “Overgrown”, and Do Denser Forests Necessarily Burn More Intensely?** No. We currently have a similar number of trees per acre compared to historical forests (Williams and Baker 2012, Baker 2014, Baker and Hanson 2007), but we have fewer medium/large trees, and less overall biomass—and therefore less carbon (McIntyre et al. 2015). Our forests actually have a carbon deficit, due to decades of logging. Historical forests were variable in density, with both open and very dense forests (Baker et al. 2018).

Recent studies by U.S. Forest Service scientists, regarding historical tree density, omitted historical data on small tree density, and density of non-conifer trees. When these missing data were included, it was revealed that *historical tree density was 7 times higher than previously reported in ponderosa pine forests, and 17 times higher than previously reported in mixed-conifer forests* (Baker et al. 2018). Wildland fire is driven mostly by weather, while forest density is a “poor predictor” of future fire behavior (Zald and Dunn 2018).

**Do Forests with More Dead Trees Burn More Intensely?** Small-scale studies are mixed within 1-2 years after trees die, *i.e.*, the “red phase” (Bond et al. 2009, Stephens et al. 2018), but the largest analysis, spanning the entire western U.S., found no effect (Hart et al. 2015). Later, after needles and twigs fall and quickly decay into soil, and after many snags have fallen, such areas have similar or *lower* fire intensity than areas with fewer dead trees (Hart et al. 2015, Meigs et al. 2016).

**Do We Currently Have an Unnatural Excess of Fire in our Forests?** No. There is a broad consensus among fire ecologists that we currently have far less fire in western US forests than we did historically, prior to fire suppression (Hanson et al. 2015). We also have less high-intensity fire now than we had historically (Mallek et al. 2013, DellaSala and Hanson 2015, Baker et al. 2018).

**Do Current Fires Burn Mostly at High-Intensity Due to Fire Suppression?** Current fires burn mostly at low/moderate-intensity in western US forests, including the largest fires (Mallek et al. 2013, Baker et al. 2018). For example, over 70% of the Rim Fire burned at low and moderate intensity. The most long-unburned forests experience mostly low/moderate-intensity fire (Odion and Hanson 2008, Miller et al. 2012, van Wagendonk et al. 2012).

**Would Landscape-Scale Prescribed Burning Reduce Smoke Particulates?** No, it’s the opposite. Any short-term reduction in potential fire behavior following prescribed fire lasts only 10-20 years, so using low-intensity prescribed fires ostensibly as a means to prevent mixed-intensity wildland fires would require burning a given area of forest every 10-20 years (Rhodes and Baker 2008). This would represent a tenfold increase, or more, over current rates of burning occurring from wildland fire (Parks et al. 2015). Contrary to popular assumption, high-intensity fire patches produce relatively lower particulate smoke emissions (due to high efficiency of flaming combustion) while low intensity prescribed fires produce high particulate smoke emissions, due to the inefficiency of smoldering combustion. Therefore, even though high-intensity fire patches consume about three times more biomass per acre than low-intensity fire (Campbell et al. 2007), low-intensity fires produce 3-4 times more particulate smoke than high-intensity fire, for an equal tonnage of biomass consumed (Ward and Hardy 1991, Reid et al. 2005). As a result, a landscape-level program of prescribed burning would cause at least a ten-

fold *increase* in smoke emissions relative to current fire levels, and it would not stop wildland fires when they occur (Stephens et al. 2009).

**Are Recent Large Fires Unprecedented?** No. Fires similar in size to the Rim fire and Rough fire, or larger, occurred in the 1800s, such as in 1829, 1864, and 1889 (Bekker and Taylor 2010, Caprio 2016). Forest fires hundreds of thousands of acres in size are not unprecedented.

**Do Large High-Intensity Fire Patches Destroy Wildlife Habitat or Prevent Forest Regeneration?** No. Hundreds of peer-reviewed scientific studies find that patches of high-intensity fire create “snag forest habitat”, which is comparable to old-growth forest in terms of native biodiversity and wildlife abundance (summarized in DellaSala and Hanson 2015). In fact, more plant, animal, and insect species are associated with mature forests that burn at high intensity, where most or all of the trees are killed, than any other habitat type in the forest (Swanson et al. 2014).

Forests naturally regenerate in heterogeneous, ecologically beneficial ways in large high-intensity fire patches (DellaSala and Hanson 2015, Hanson 2018).

**Do Occasional Cycles of Drought and Native Bark Beetles Make Forests “Unhealthy”?** Actually, it’s the opposite. During droughts, native bark beetles selectively kill the weakest and least climate-adapted trees, leaving the stronger and more climate-resilient trees to survive and reproduce (Six et al. 2018). In areas with many new snags from drought and native bark beetles, most bird and small mammal species *increase* in numbers in such areas, because snags provide such excellent wildlife habitat (Stone 1995).

**Is Climate Change a Factor in Recent Large Fires?** Yes. Human-caused climate change increases temperatures, which influences wildland fire. Some mistakenly assume this means we must have too much fire but, due to fire suppression, we still have a substantial fire deficit in our forests.

## References

- Baker, W. L. 2014. Historical forest structure and fire in Sierran mixed-conifer forests reconstructed from General Land Office survey data. *Ecosphere* 5: article 79.
- Baker, W.L., and C.T. Hanson. 2017. Improving the use of early timber inventories in reconstructing historical dry forests and fire in the western United States. *Ecosphere* 8: Article e01935.
- Baker, W.L., C.T. Hanson, and M.A. Williams. 2018. Improving the use of early timber inventories in reconstructing historical
- Bekker, M.F., Taylor, A.H., 2010. Fire disturbance, forest structure, and stand dynamics in montane forest of the southern Cascades, Thousand Lakes Wilderness, California, USA. *Ecoscience* 17: 59–72.
- Bond, M.L., D.E. Lee, C.M. Bradly, and C.T. Hanson. 2009. Influence of pre-fire mortality from insects and drought on burn severity in conifer forests of the San Bernardino Mountains, California. *The Open Forest Science Journal* 2: 41-47.

- Bradley, C.M. C.T. Hanson, and D.A. DellaSala. 2016. Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western USA? *Ecosphere* 7: article e01492.
- Campbell, J., D. Donato, D. Azuma, and B. Law. 2007. Pyrogenic carbon emission from a large wildfire in Oregon, United States. *Journal of Geophysical Research Biogeosciences* 112: Article G04014.
- Campbell, J.C., J.B. Fontaine, and D.C. Donato. 2016. Carbon emissions from decomposition of fire-killed trees following a large wildfire in Oregon, United States. *Journal of Geophysical Research: Biogeosciences* 121: 718-730.
- Campbell, J.L., M.E. Harmon, and S.R. Mitchell. 2012. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? *Frontiers in Ecology and Environment* 10: 83-90.
- Caprio, A.C. 2016. A historical perspective on large fires in the southern Sierra Nevada: rare or everyday events? *Proceedings of the Association for Fire Ecology, Annual Conference*, November 2016, Tucson, Arizona.
- Cruz, M.G., M.E. Alexander, and J.E. Dam. 2014. Using modeled surface and crown fire behavior characteristics to evaluate fuel treatment effectiveness: a caution. *Forest Science* 60: 1000-1004.
- Cruz, M.G., M.E. Alexander, and P.A.M. Fernandes. 2008. Development of a model system to predict wildfire behavior in pine plantations. *Australian Forestry* 71: 113-121.
- DellaSala, D.A., and C.T. Hanson (Editors). 2015. *The ecological importance of mixed-severity fires: nature's phoenix*. Elsevier Inc., Waltham, MA, USA.
- Erb, K.H., et al. 2018. Unexpectedly large impact of forest management and grazing on global vegetation biomass. *Nature* 553:73-76.
- French, N.H.F., et al. 2011. Model comparisons for estimating carbon emissions from North American wildland fire. *Journal of Geophysical Research* 116: Article G00K05.
- Fulé, P.Z., Cocke, A.E., Heinlein, T.A., Covington, W.W., 2004. Effects of an intense prescribed forest fire: is it ecological restoration? *Restoration Ecology* 12, 220–230.
- Hanson, C.T. 2018. Landscape heterogeneity following high-severity fire in California's forests. *Wildlife Society Bulletin* 42:264-271.
- Hanson, C.T., R.L. Sherriff, R.L. Hutto, D.A. DellaSala, T.T. Veblen, and W.L. Baker. 2015. Chapter 1: Setting the stage for mixed- and high-severity fire. In: DellaSala, D.A., and C.T. Hanson (Editors). *The ecological importance of mixed severity fires: nature's phoenix*. Elsevier Inc., Waltham, MA, USA.
- Harris, N.L., et al. 2016. Attribution of net carbon change by disturbance type across forest lands of the conterminous United States. *Carbon Balance Management* 11: Article 24.
- Hart, S.J., T. Schoennagel, T.T. Veblen, and T.B. Chapman. 2015. Area burned in the western United States is unaffected by recent mountain pine beetle outbreaks. *Proceedings of the National Academy of Sciences of the USA* 112: 4375–4380.

- Keifer, M.B., 1998. Fuel load and tree density changes following prescribed fire in the giant sequoia-mixed conifer forest: the first 14 years of fire effects monitoring. In: Proceedings of the Tall Timbers Fire Ecology Conf., vol. 20. pp. 306–309.
- Law, B.E., et al. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. *Proceedings of the National Academy of Sciences of the United States of America* 115: 3663-3668.
- Luysaert, S., E. Detlef Schulze, A. Borner, A. Knohl, D. Hessenmoller, B.E. Law, P. Ciais, and J. Grace. 2008. Old growth forests as global carbon sinks. *Nature* 455: 213-215.
- Mallek, C., H. Safford, J. Viers, and J. Miller. 2013. Modern departures in fire severity and area vary by forest type, Sierra Nevada and Southern Cascades, USA. *Ecosphere* 4: Article 153.
- McIntyre, P.J., et al. 2015. Twentieth-century shifts in forest structure in California: Denser forests, smaller trees, and increased dominance of oaks. *Proceedings of the National Academy of Sciences of the United States of America* 112: 1458-1463.
- Meigs, G., D. Donato, J. Campbell, J. Martin, and B. Law. 2009. Forest fire impacts on carbon uptake, storage, and emission: The role of burn severity in the Eastern Cascades, Oregon. *Ecosystems* 12:1246–1267.
- Meigs, G.W., H.S.J. Zald, J.L. Campbell, W.S. Keeton, and R.E. Kennedy. 2016. Do insect outbreaks reduce the severity of subsequent forest fires? *Environmental Research Letters* 11: 045008.
- Miller, J.D., Skinner, C.N., Safford, H.D., Knapp, E.E., Ramirez, C.M., 2012. Trends and causes of severity, size, and number of fires in northwestern California, USA. *Ecological Applications* 22: 184–203.
- Odion, D.C., and C.T. Hanson. 2008. Fire severity in the Sierra Nevada revisited: conclusions robust to further analysis. *Ecosystems* 11: 12-15.
- Parks, S.A., et al. 2015. Wildland fire deficit and surplus in the western United States, 1984–2012. *Ecosphere* 6: Article 275.
- Reid, J.S., R. Koppmann, T.F. Eck, and D.P. Eleuterio. 2005. A review of biomass burning emissions part II: intensive physical properties of biomass burning particles. *Atmospheric Chemistry and Physics* 5: 799-825. Rhodes, J.J., and W.L. Baker.
2008. Fire probability, fuel treatment effectiveness and ecological tradeoffs in western U.S. public forests. *The Open Forest Science Journal* 1: 1-7.
- Safford, H.D. 2013. Natural Range of Variation (NRV) for yellow pine and mixed conifer forests in the bioregional assessment area, including the Sierra Nevada, southern Cascades, and Modoc and Inyo National Forests. Unpublished report.
- USDA Forest Service, Pacific Southwest Region, Vallejo, CA.
- Schwilk, D.W., Knapp, E.E., Ferrenberg, S.M., Keeley, J.E., Caprio, A.C., 2006. Tree mortality from fire and bark beetles following early and late season prescribed fires in a Sierra Nevada mixed-conifer forest. *Forest Ecology and Management* 232, 36–45.
- Show, S.B., and E.I. Kotok. 1925. Fire and the forest (California pine region). Circular 358, United States Department of Agriculture Department Washington, DC.

- Six, D.L., C. Vergobbi, and M. Cutter. 2018. Are survivors different? Genetic-based selection of trees by mountain pine beetle during a climate-change driven outbreak in a high-elevation pine forest. *Frontiers in Plant Science* 9: Article 993.
- Stephens, S.L., Finney, M.A., 2002. Prescribed fire mortality of Sierra Nevada mixed conifer tree species: effects of crown damage and forest floor combustion. *For. Ecol. Manage.* 162, 261–271.
- Stephens, S.L., et al. 2009. Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. *Ecological Applications* 19: 305-320.
- Stephens, S.L., et al. 2018. Drought, tree mortality, and wildfire in forests adapted to frequent fire. *BioScience* 68: 77-88.
- Stone, W.E. 1995. The impact of a mountain pine beetle epidemic on wildlife habitat and communities in post-epidemic stands of a lodgepole pine forest in northern Utah. Doctoral Dissertation, Utah State University. <https://digitalcommons.usu.edu/etd/79>.
- Swanson, M.E., N.M. Studevant, J.L. Campbell, and D.C. Donato. 2014. Biological associates of early-seral pre-forest in the Pacific Northwest. *Forest Ecology and Management* 324: 160-171.
- Syphard, A.D., T.J. Brennan, and J.E. Keeley. 2014. The role of defensible space for residential structure protection during wildfires. *Intl. J. Wildland Fire* 23: 1165-1175.
- van Mantgem, P.J., J.C.B. Nesmith, M. Keifer, and M. Brooks. 2013. Tree mortality patterns following prescribed fire for *Pinus* and *Abies* across the southwestern United States. *Forest Ecology and Management* 289: 463-469.
- van Mantgem, P.J., A.C. Caprio, N.L. Stephenson, and A.J. Das. 2016. Does prescribed fire promote resistance to drought in low elevation forests of the Sierra Nevada, California, USA? *Fire Ecology* 12: 13-25.
- van Mantgem, P.J., N.L. Stephenson, J.J. Battles, E.K. Knapp, and J.E. Keeley. 2011. Long-term effects of prescribed fire on mixed conifer forest structure in the Sierra Nevada, California. *Forest Ecology and Management* 261: 989–994.
- van Wagtenonk, J.W., van Wagtenonk, K.A., Thode, A.E., 2012. Factors associated with the severity of intersecting fires in Yosemite National Park, California, USA. *Fire Ecology* 8: 11–32.
- Wardle, D.A., L.R. Walker, and R.D. Bardgett. 2004. Ecosystem properties and forest decline in contrasting long-term chronosequences. *Science* 305: 509-513.
- Williams, M.A., and W.L. Baker. 2012. Spatially extensive reconstructions show variable-severity fire and heterogeneous structure in historical western United States dry forests. *Global Ecology and Biogeography* 21: 1042–1052.
- Zachmann, L.J., D.W.H. Shaw, and B.G. Dickson. 2018. Prescribed fire and natural recovery produce similar long-term patterns of change in forest structure in the Lake Tahoe basin, California. *Forest Ecology and Management* 409: 276-287.
- Zald, H.S.J., and C.J. Dunn. 2018. Severe fire weather and intensive forest management increase fire severity in a multi ownership landscape. *Ecological Applications* 28: 1068-1080