

The Significance of Carbon Emissions from Logging on Federal Forests

Scientific research indicates that logging on federal forests is a substantial source of carbon dioxide emissions to the atmosphere that is at least comparable to and likely greater than levels associated with wildfires.

Emissions from logging scale up faster than those from fire. When mature trees are logged, a significant proportion of their carbon is emitted to the atmosphere shortly after logging, even when accounting for carbon stored in wood products that are made from the logged trees.¹ In contrast, when mature trees are affected by fire, they often survive with their carbon stores intact—protected by adaptations such as thick bark² and high crowns³—and continue to grow. Even when severe fire does kill these mature trees, field research indicates that only a relatively small amount of their carbon is combusted into the atmosphere, and the remainder can remain in the forest for decades or even centuries, as the trees slowly decompose.^{4,5,6,7} This is why, even in dry forests, on a per acre basis, emissions from logging are generally greater than those from wildfire and often substantially so—up to 8 times greater in certain circumstances.⁸

As a result, total national carbon emissions from logging exceed those from fire, even though in many areas more acres of land are affected by fire. The government’s own assessment found this to be true on forests owned and managed by the federal government across the country, where overall fire affects many more acres than logging. In a first of its kind assessment from 2018 focused on carbon emissions associated with federal lands, the United States Geological Survey estimated that across the conterminous U.S., carbon emissions from logging of federal forests were more than double those from fire on those lands.⁹

Other assessments of carbon emissions across all forests in the United States, including forests on state and private land, corroborate the disproportionate relationship between logging and fire emissions. A comprehensive 2016 study of forests across all ownerships in the conterminous U.S., for example, found that carbon losses from logging were more than five times higher than from all other disturbance sources combined—including fire, insects, wind, land conversion, and drought.¹⁰ Other independent studies underscore logging’s larger carbon impact.^{11,12} Government reporting on U.S.-wide emissions is similar: wildfire emissions reported in EPA’s greenhouse gas inventory are approximately one-third of the logging emissions reported in the *Second State of the Carbon Cycle Report* from the U.S. Global Change Research Program.^{13,14} And a recent assessment of carbon emissions incorporating the intense 2020 fire season found that even in the more fire-prone western United States, the ten-year average emissions from logging were significant, including in comparison to fire—50 TgCO₂/year and 60 TgCO₂/year respectively.⁸

Taken together, these studies—which approach carbon emission assessment using different assumptions and analytic directions—uniformly demonstrate the ongoing significance of carbon emissions from logging, particularly in the timeframes critical to meeting U.S. commitments under the Paris Agreement. Indeed, they collectively indicate that logging across federal forests remains a source of carbon emissions at least comparable to fire, and likely larger. Given these emissions, the only way USFS and BLM can meet the direction set out in President Biden’s Executive Order to “conserv[e] old growth and mature forests on federal lands,” is by ensuring such forests are protected from logging, while allowing for necessary measures to manage wildfire.

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- ¹ Hudiburg, Tara W., Beverly E. Law, William R. Moomaw, Mark E. Harmon and Jeffrey E. Stenzel. "Meeting GHG reduction targets requires accounting for all forest sector emissions." *Environmental Research Letters* (2019): n.pag. <https://doi.org/10.1088/1748-9326/ab28bb>.
- ² Agee, James. 1993. *Fire Ecology of Pacific Northwest Forests*. Washington, D.C.: Island Press. 121-24.
- ³ Schwilk, Dylan W. and David D. Ackerly. "Flammability and serotiny as strategies: correlated evolution in pines." *Oikos* 94 (2001): 326-336. <https://doi.org/10.1034/j.1600-0706.2001.940213.x>.
- ⁴ Campbell, John L., Daniel C. Donato, David L. Azuma and Beverly E. Law. "Pyrogenic carbon emission from a large wildfire in Oregon, United States." *Journal of Geophysical Research* 112 (2007): n. pag. <https://doi.org/10.1029/2007JG000451>.
- ⁵ Harmon, Mark E., Chad T. Hanson and Dominick A. Dellasala. "Combustion of Aboveground Wood from Live Trees in Megafires, CA, USA." *Forests* (2022): n. pag. <https://doi.org/10.3390/f13030391>.
- ⁶ Meigs, Garrett W., Daniel C. Donato, John L. Campbell, Jonathan G. Martin and Beverly E. Law. "Forest Fire Impacts on Carbon Uptake, Storage, and Emission: The Role of Burn Severity in the Eastern Cascades, Oregon." *Ecosystems* 12 (2009): 1246-1267. <https://doi.org/10.1007/s10021-009-9285-x>.
- ⁷ Stenzel, Jeffrey E., Kristina J. Bartowitz, Melannie D. Hartman, James A. Lutz, Crystal A. Kolden, Alistair Matthew Stuart Smith, Beverly E. Law, Mark E. Swanson, Andrew J Larson, William J. Parton and Tara W. Hudiburg. "Fixing a snag in carbon emissions estimates from wildfires." *Global Change Biology* 25 (2019): 3985-3994. <https://doi.org/10.1111/gcb.14716>.
- ⁸ Bartowitz, Kristina J., Eric S. Walsh, Jeffrey E. Stenzel, Crystal A. Kolden and Tara W. Hudiburg. "Forest Carbon Emission Sources Are Not Equal: Putting Fire, Harvest, and Fossil Fuel Emissions in Context." *Frontiers in Forests and Global Change* (2022). <https://doi.org/10.3389/ffgc.2022.867112>. Reporting that per acre emissions of logging are two to eight times more than those of fire in western U.S. forests, depending on the type of logging.
- ⁹ Merrill, Matthew D., Benjamin M. Sleeter, Philip A. Freeman, Jinxun Liu, Peter D. Warwick and Bradley C. Reed. "Federal lands greenhouse emissions and sequestration in the United States—Estimates for 2005–14." *Scientific Investigations Report* (2018). <https://doi.org/10.5066/F7KH0MK4>. Reporting 43 TgCO₂/year for logging and 21 for fire.
- ¹⁰ Harris, N. L., S. C. Hagen, S. S. Saatchi, T. R. H. Pearson, Christopher W. Woodall, Grant M. Domke, B. H. Braswell et al. "Attribution of net carbon change by disturbance type across forest lands of the conterminous United States." *Carbon balance and management* 11, no. 1 (2016): 1-21. <https://doi.org/10.1186/s13021-016-0066-5>.
- ¹¹ Williams, Christopher A., Huanghe Gu, Richard G. MacLean, Jeffrey G. Masek and George J. Collatz. "Disturbance and the carbon balance of US forests: A quantitative review of impacts from harvests, fires, insects, and droughts." *Global and Planetary Change* 143 (2016): 66-80. <https://doi.org/10.1016/j.gloplacha.2016.06.002>. Reporting, for all conterminous U.S. ownerships, that mortality from logging is more than triple that from fire.
- ¹² Zheng, Daolan, Linda S. Heath, Mark J. Ducey and James Smith. "Carbon changes in conterminous US forests associated with growth and major disturbances: 1992–2001." *Environmental Research Letters* 6 (2011): 019502. <https://doi.org/10.1088/1748-9326/6/1/014012>. Reporting, for all conterminous U.S. ownerships, that the effect of logging on carbon stocks is 14 times larger than that of fire.
- ¹³ EPA. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020. U.S. Environmental Protection Agency, EPA 430-R-22-003 (2022): 6-1 – 6-179. <https://www.epa.gov/ghgemissions/draft-inventory-us-greenhouse-gas-emissionsand-sinks-1990-2020>. Reporting an average of 108.8 TgCO₂/year for 2006-2020. The relevant time series can be found in the Table 6-11 data file for Chapter 6.
- ¹⁴ Domke, G., C. A. Williams, R. Birdsey, J. Coulston, A. Finzi, C. Gough, B. Haight, J. Hicke, M. Janowiak, B. de Jong, W. A. Kurz, M. Lucash, S. Ogle, M. Olguín-Álvarez, Y. Pan, M. Skutsch, C. Smyth, C. Swanston, P. Templer, D. Wear, and C. W. Woodall,. 2018. Chapter 9: Forests. In *Second State of the Carbon Cycle Report (SOCCR2): A Sustained Assessment Report* [Cavallaro, N., G. Shrestha, R. Birdsey, M. A. Mayes, R. G. Najjar, S. C. Reed, P. Romero-Lankao, and Z. Zhu (eds.)]. Washington, D.C.: U.S. Global Change Research Program. 365-398. <https://doi.org/10.7930/SOCCR2.2018.Ch9>. Reporting an average of 326.6 TgCO₂/year for 2000-2014 in Table 9.3 (the table reports emissions in TgC/year, requiring conversion to CO₂ to match EPA's data). The most recent data from the Food and Agriculture Organization of the United Nations on U.S. forestry indicates that U.S. logging levels did not change significantly between 2016 and 2020. FAO. *Forestry Production and Trade*. License: CC BY-NC-SA 3.0 IGO. Extracted from: <https://www.fao.org/faostat/en/#data/FO>. Date of Access: 10-07-2022.