

A REPORT FROM JOHN MUIR PROJECT AND
CENTER FOR SUSTAINABLE ECONOMY

OCTOBER 2021: VERSION 2

RUNNING BACKWARDS

**LOGGING PROVISIONS IN THE INFRASTRUCTURE &
BUDGET RECONCILIATION PACKAGES WOULD
WORSEN THE CLIMATE CRISIS AND THREATEN
PUBLIC HEALTH**



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Cover Photo Attribution: In this April 28, 2015, file photo, a machine stacks logs in the Coconino National Forest just outside Flagstaff, Arizona as part of the 4 Forests Restoration Initiative (4FRI) Logging Project. Felicia Fonseca, File/AP Photo

Back Cover Image: Natural forest regeneration at 10 years post-fire in a high-intensity fire patch within the 2002 McNally fire, Sequoia National Forest. Photo by Chad Hanson,

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Updates to the Executive Summary, pp. 17-20 and p. 22.

John Muir Project of Earth Island Institute: a non-profit public education and scientific research organization dedicated to protecting forest ecosystems through science and fighting climate change with natural climate solutions so all people and species can flourish.

Center for Sustainable Economy: a 26-year-old environmental economics think tank that advances solutions that protect and restore the diversity of life on earth.

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EXECUTIVE SUMMARY

KEY FINDINGS

- Logging in the U.S. currently emits at least 723 million metric tons of CO₂ annually, which is over 14% of total U.S. greenhouse gas emissions, and is more than the commercial and residential sectors combined.
- The Infrastructure and Reconciliation bills, if passed in their current form, would increase annual CO₂ emissions from logging by 48%, pushing emissions from logging well over 1 gigaton per year.
- The logging provisions in the Infrastructure and Reconciliation bills, combined with the new highway construction provisions in Infrastructure and the loss of the Clean Energy Performance Program (CEPP), would **erase all of the estimated gains in carbon emissions reduction** from the emission reducing/clean energy provisions in both bills. In fact, the net effect would be an annual increase in CO₂ emissions of 80 million metric tons by 2030, taking us farther away from the minimum climate change mitigation goal of a 50% emissions reduction of 2005 levels by 2030.
- Logging conducted under the guise of “thinning” emits three times more carbon into the atmosphere than wildfire alone.
- Over 200 scientists conclude that the best available science indicates that “thinning” and other logging is not a wildfire solution and does not stop wildfires, often making fires burn more intensely.

EXECUTIVE SUMMARY

RECOMMENDATIONS

- Eliminate the logging/forest management provisions, from both the Infrastructure and Budget Reconciliation bills, and instead incorporate provisions to eliminate all logging and fossil fuel subsidies.
- Restore the Clean Energy Performance Program without weakening it.
- Remove provisions which would allow the building of new highways through wildlands.
- Redirect logging and fossil fuel subsidies into:
 1. a major expansion of protected public forestlands through acquisition and easements;
 2. funding a civilian climate corps to create jobs: staffing newly established public lands; creating communities resilient to wildfire through home hardening and defensible space; and installation of rooftop and community solar.

CLIMATE CONTEXT



October 2020 North Carolina, Clearcut for Wood Pellet Production on Private Lands

CURRENTLY, atmospheric CO₂ equivalents are at 419 parts per million and they need to be well below 350 parts per million in order to avoid the most catastrophic impacts of the climate crisis on human health and the biosphere. Once we put CO₂ into the atmosphere it stays up there for many decades, even centuries, if it is not drawn out of the atmosphere. (1) Thus, even as we substantially cut emissions from fossil fuels, atmospheric CO₂ levels will continue to increase, albeit more slowly, unless we do more. If we focus only on fossil fuel emissions, we will be stuck with levels over 419 parts per million of CO₂, and the consequences that are flowing from it, throughout most of the 21st Century. The cheapest and most efficient way to draw CO₂ out of our atmosphere is through the natural function of ecosystems such as forests, wetlands, and oceans. (2) This means to tackle the climate crisis we must immediately scale up protection of these ecosystems from extraction and development, especially our forests.

IN 2020, total US greenhouse gas emissions were approximately 5.2 billion tons of CO₂ equivalents (CO₂-e). **Annual emissions from logging in US forests are now at least 723 million tons of CO₂-e, which is larger than the commercial and residential sectors combined (3)** and equates to 14% of current U.S. greenhouse gas emissions. However, when reduced carbon sequestration of forests due to logging is factored in, the annual climate impact of logging in U.S. forests is even larger (closer to 1 billion tons of CO₂-e), and now exceeds the annual emissions from burning coal in the U.S. (4)

THIS is precisely why over 200 scientists (3), led by the nation's top climate scientists and ecologists, sent a letter to the U.S. Congress alerting lawmakers to the following:

"The growing consensus of scientific findings is that, to effectively mitigate the worst impacts of climate change, we must not only move beyond fossil fuel consumption but must also substantially *increase* protection of our native forests in order to absorb more CO₂ from the atmosphere and store more, not less, carbon in our forests...We are hopeful that a new and more scientifically sound direction will be considered by Members that emphasizes increased forest protections, and a shift away from consumption of wood products and forest biomass energy, to help mitigate the climate crisis." (*emphasis in original*)

Ensuring that government policies or investments do not allow the climate crisis to worsen is now more important than ever. Just this month (September 2021), **over 200 medical journals took the unprecedented step of jointly and simultaneously publishing a letter concluding that the climate crisis, and the interrelated degradation of nature by resource extraction, now represent the primary threat to human health globally, and lower-income communities and communities of color are being disproportionately threatened.** (5) This threat is manifesting in terms of skyrocketing heat-related mortality, air pollution stemming from burning of carbon fuels, zoonotic spillover of deadly viruses, extreme weather, and disruption of food production, among other impacts.



A similarly historic report, “[Making Peace with Nature](#)”, was issued in February of 2021 by the United Nations Environment Programme, concluding that human health is fundamentally and increasingly threatened by the interconnected climate, biodiversity, and pollution crises. The UN concluded that, in order to overcome the climate crisis, (6) we must rapidly transition away from fossil fuels while, simultaneously, dramatically increasing protection of natural ecosystems, especially forests, as part of natural climate solutions to draw down excess atmospheric carbon and increase carbon storage in nature. This entails protecting vast areas of forest and other habitats from logging and other development, and reducing logging levels.



PUT simply, we cannot afford to increase carbon emissions from logging, especially when that logging removes the very trees and damages the very ecosystems that we need to increase the drawdown of atmospheric carbon. Rather, we must dramatically reduce emissions rapidly, while protecting our forests as carbon sinks to draw down the dangerously excessive levels of greenhouse gases in our atmosphere.

DESPITE a vast body of scientific opinion from the United Nations, national and global medical experts, and the nation's top climate scientists and ecologists, Congress is currently proposing a substantial increase in logging for wood products and biomass energy in both the Infrastructure and Budget Reconciliation legislative packages and is doing so under the false banner of climate solutions and action. If passed and signed into law, these provisions would significantly undermine our climate crisis mitigation goals, further degrade nature and harm biodiversity, and exacerbate threats to human health. The legislative packages also maintain, and increase, subsidies for the fossil fuel industry.

WHAT ABOUT WILDFIRE?



Figure 1. (a) (left) Climate scientist, Dr. James Hansen (on left), and forest ecologist, Dr. Chad Hanson, in typical natural post-fire forest regeneration, and (b) (right), Drs. Hansen and Hanson standing in an adjacent area where post-fire logging and artificial tree planting had occurred under the guise of "restoration" and "reforestation"

THE 200+ climate scientists and ecologists, who warned Congress in 2020 that we must increase forest protections from logging to mitigate the climate crisis, also warned that wildfires are being deceptively and opportunistically used as a ruse and justification to promote increased logging (3) (Currently commercial logging, including clearcutting, is being funded by Congressional appropriations under the deceptive headings of "fuel reduction", "wildfire risk reduction", "restoration", "forest health", "vegetation management", "thinning", and other euphemisms). The best available science finds that logging,

including commercial “thinning”, does not stop weather/climate-driven wildfires, and will “tend to make wildland fires burn *more* intensely” (3 - emphasis in original). This is so because thinning and other types of logging change a forests’ microclimate, reducing the cooling shade of the forest canopy and creating hotter, drier, and windier conditions on the forest floor. (7) Unfortunately, with each successive year, the failure of this strategy - removing trees and vegetation to “reduce fire risk” or stop climate and weather-driven fires - is becoming a lived experience for many.

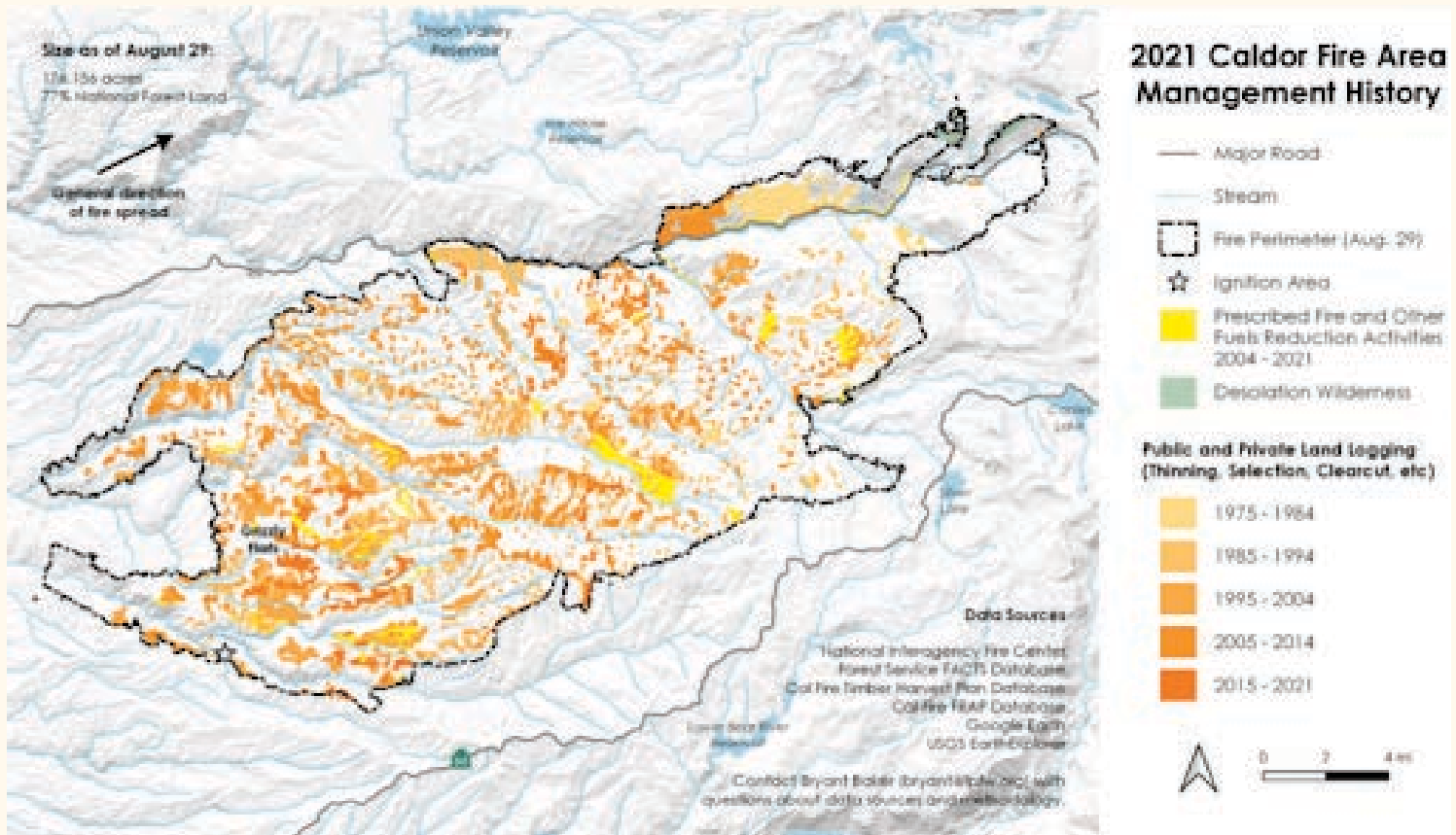
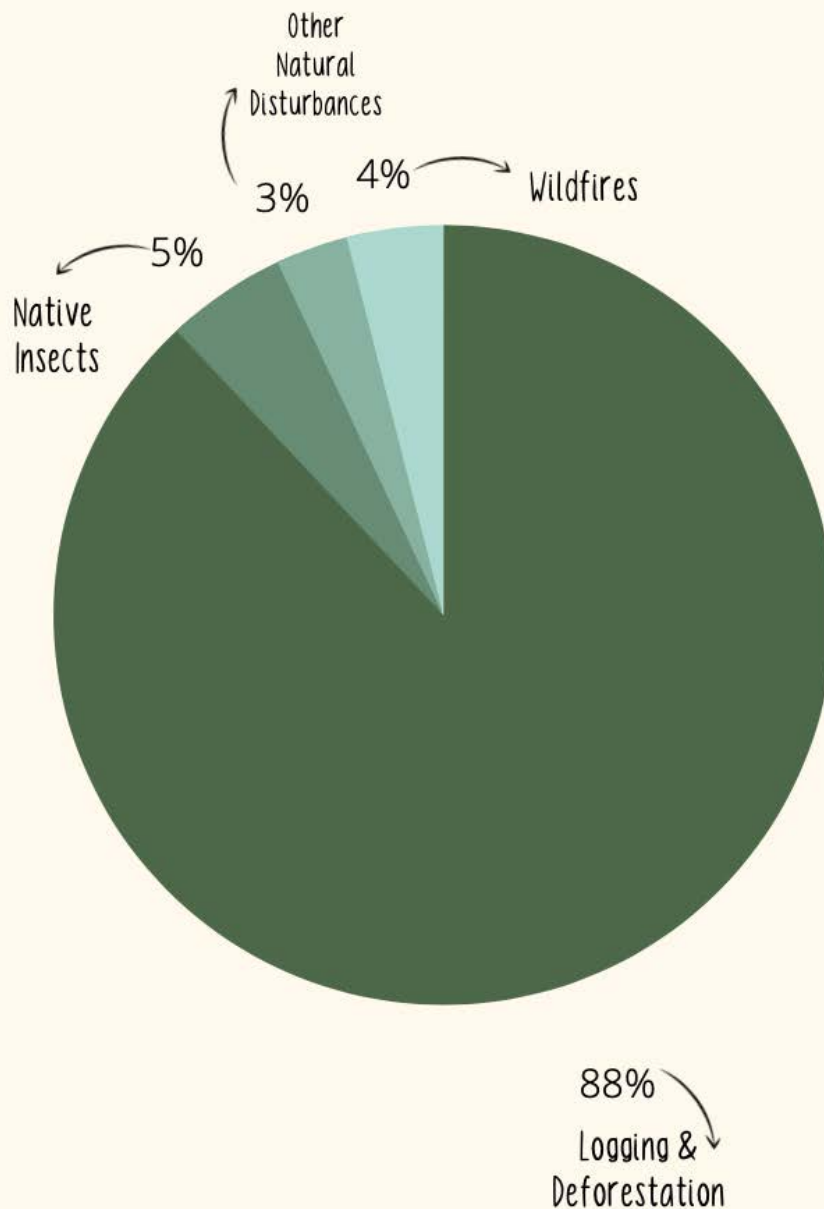


Figure 1. The Caldor fire of 2021 swept rapidly through many thousands of acres that had been previously logged, mostly under the guise of “thinning”, “fuel reduction”, and “fuelbreaks”, burning down most of the town of Grizzly Flats. Similar results occurred in the Camp Fire of 2018 (which burned through post-fire logging and “thinning” for “fuels reduction” to tragic consequences in the town of Paradise), as well as in the Dixie fire of 2021, which burned fast through thousands of acres of “thinning” before devastating Greenville, California. The science is clear that the only effective way to protect homes and communities from wildfire is through home hardening and defensible space within 100 feet of homes.

When it comes to climate change, carbon emissions from “thinning” far exceed those of wildland fire alone. In fact, **logging in U.S. forests emits 10 times more carbon than fire and native insects combined each year.** (8)

Annual Carbon Emissions from US Forests

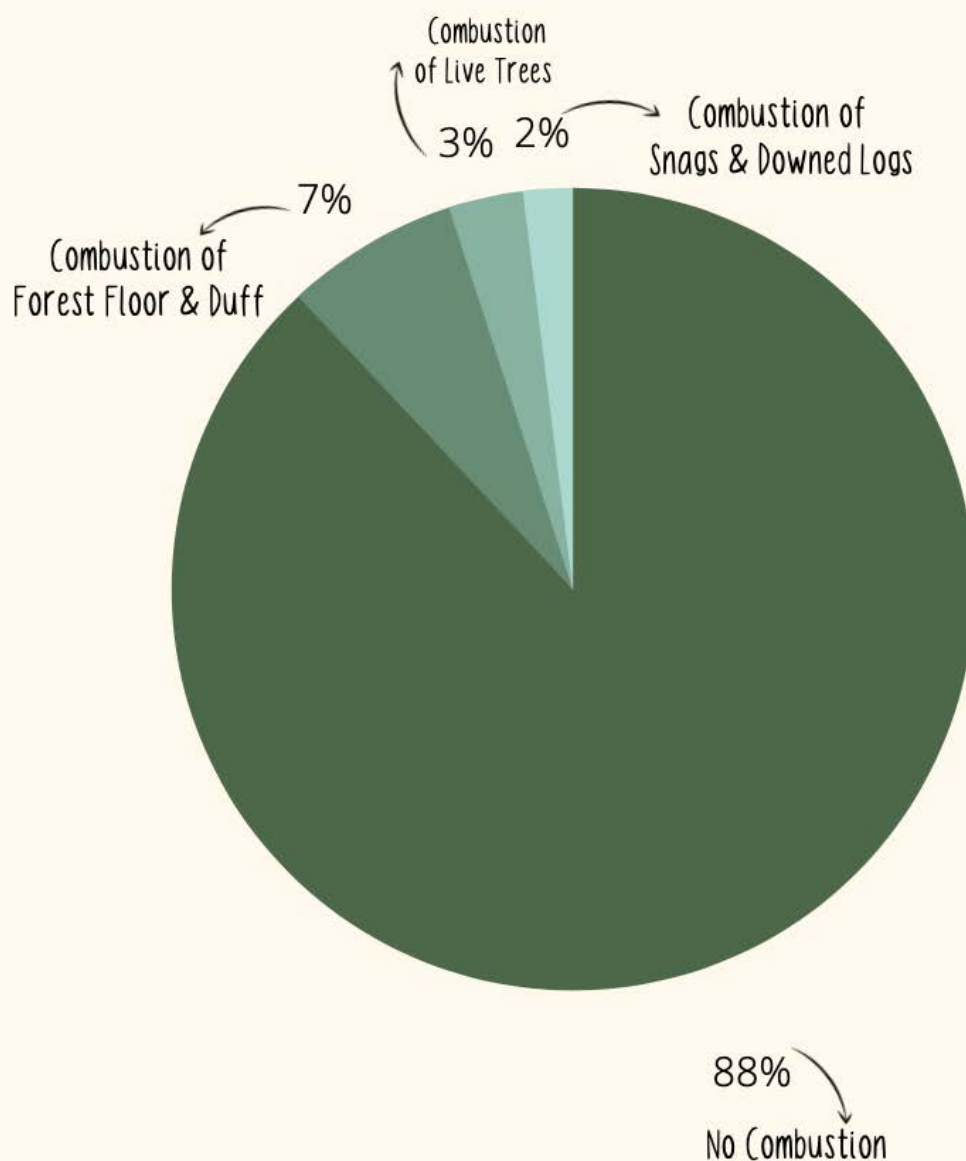
Source: Harris et al. (2016). Carbon Balance and Management 11:24



Even the largest forest fires burn mostly at low and moderate-intensity. (9)(10) In such wildfires, only about 12% of *all* above-ground carbon is actually consumed, and any carbon emitted into the atmosphere is rapidly recouped due to accelerating post-fire natural forest growth and new, regenerating trees, aided by nutrient cycling from the fire. (9)(10)

Combustion of Aboveground Carbon in a Very Large Forest Fire

Source: Campbell et al. (2007)



CLIMATE-HARMING LOGGING PROVISIONS IN THE INFRASTRUCTURE AND RECONCILIATION PACKAGES

HEEDLESS of the repeated warnings from climate scientists, Congress has inserted numerous provisions into the Infrastructure and Reconciliation packages that would dramatically scale up logging for lumber and bioenergy, while accelerating carbon emissions, and undermining the capacity of forests to absorb atmospheric carbon, in the process.

For example, the Senate Infrastructure bill mandates 10 million acres of logging on public lands over the next 6 years (Sec. 40803(b)), and mandates an additional 20 million acres of logging on public lands over the subsequent 9 years (Sec. 40803(j) (2)), while allocating over \$1.6 billion in subsidies for logging (Sec. 40803(c)), including post-fire clearcutting, which is extremely destructive, ecologically and emits extensive amounts of carbon while eliminating carbon storage and undermining sequestration. (7 - see chapter 5)

Which post-fire area is storing and sequestering more carbon?



Naturally Regenerating Habitat
High-Intensity Burn
Star Fire, Tahoe National Forest



Post-fire "Restoration" Logging
High-Intensity Burn
Rim Fire, Stanislaus National Forest

BUDGET BREAKDOWN

A summary of The Climate Harming **Logging Provision Funding** in the Infrastructure & Reconciliation Packages

IN addition to the \$1.6 Billion for logging and the millions of acres mandated to be logged over the next 15 years, the Infrastructure bill also allocates \$400 million in subsidies for biomass and wood pellet facilities, \$400 million in general subsidies for logging on public and private lands, and \$50 million specifically to subsidize logging in inaccessible forests (Sec. 40804), which are often primary and old-growth forests. Further, the bill would weaken environmental laws to create new categories of logging on public lands that would be exempt from environmental analysis and eliminate the public's right to file administrative objections opposing logging proposals (Secs. 40806, 40807).

SIMILARLY

the House Budget Reconciliation bill proposes \$11.5 billion in additional logging subsidies to increase logging on national forests (Sec. 11001(a)(1, 3-4)) over the next 10 years, with few substantive or enforceable limits on the felling and removal of mature and even old-growth trees from public lands. The Reconciliation bill also proposes \$10 billion in new subsidies for logging on private forestlands, including \$9 billion in general subsidies for logging (Sec. 11002(a)(1)), and \$1 billion in subsidies for "wood innovation" (Sec. 11002(a)(16)), much or most of which would fund the biomass and wood pellet sectors of the logging industry, or to production of "mass timber", both of which the climate scientists and ecologists have warned will make the climate crisis worse, since most of the carbon in trees removed for these industries quickly goes into the atmosphere, and logging reduces the carbon sequestration capacity of forests due to nutrient removal and soil compaction by logging machinery.

INFRASTRUCTURE BILL

\$400 million in subsidies for biomass and wood pellet facilities

\$400 million in general subsidies for logging on public and private lands

\$50 million specifically to subsidize logging in inaccessible forests

Weakens environmental laws to create new categories of logging on public lands that would be exempt from environmental analysis

Eliminates the public's right to file administrative objections opposing logging proposals

Exacerbates the Climate Crisis & Funds Extractive Industries

HOUSE BUDGET RECONCILIATION BILL

\$11.5 billion in additional logging subsidies to increase logging on National Forests

\$10 billion in new subsidies for logging on private forestlands

\$9 billion in general subsidies for logging

\$1 billion in subsidies for "wood innovation" most of which would go to the Biomass and wood pellet sectors, and to production of "mass timber",

Allows millions of mature trees, and even old-growth trees, to be felled and removed from public lands

Exacerbates the Climate Crisis & Funds Extractive Industries

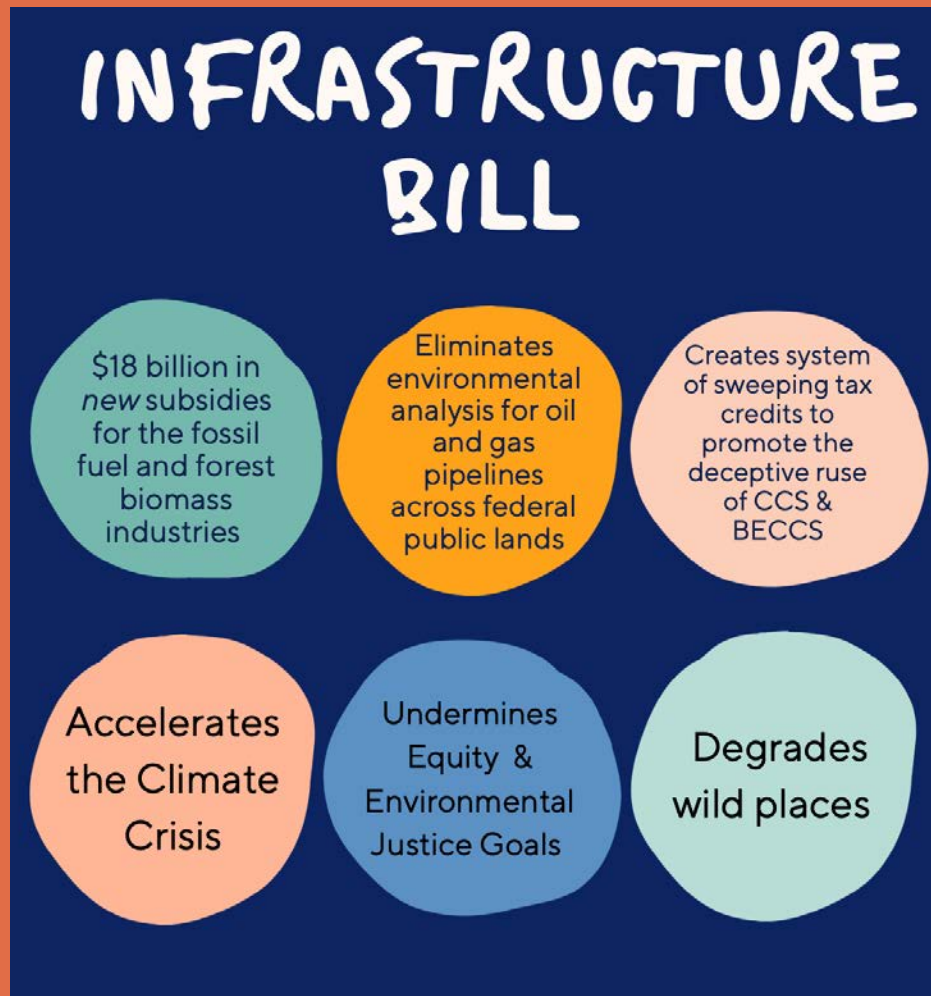
BUDGET BREAKDOWN

A summary of The Climate Harming Provisions for **Dirty Fuels Funding** in the Infrastructure & Reconciliation Packages

MAKING matters worse, the Infrastructure and Reconciliation bills are bad on dirty fuels too. Though the Reconciliation bill was widely touted as the legislative vehicle that would end fossil fuel subsidies, in fact the bill retains almost all existing domestic fossil fuel subsidies, following heavy lobbying by the industry.

THE Infrastructure bill goes one step further—in the wrong direction. It eliminates environmental analysis for oil and gas pipelines across federal public lands (Sec. 11318), and contains \$18 billion in new subsidies for the fossil fuel and forest biomass industries (Secs. 40301-40303), and a system of sweeping tax credits (Sec. 80402), to promote the false solution known as “carbon capture and storage” (CCS) and Biomass Energy with Carbon Capture and Storage (BECCS). Hundreds of climate scientists, and conservation, environmental justice, and climate justice groups, have strongly condemned CCS and BECCS as false climate solutions because:

- a)** it does not work, since it captures only a tiny fraction of emitted carbon while using far more energy and increasing overall net carbon emissions;
- b)** it exacerbates impacts to the health of lower-income communities and communities of color, since fossil fuel and forest biomass facilities are disproportionately located in such communities and create chronic particulate and toxic pollution;
- c)** it depends on the nightmarish scenario of the creation of thousands of miles of CO2 pipelines, which can rupture, threatening human communities and ecosystems with release of deadly CO2 (as we saw recently in Mississippi); and
- d)** when pumped underground, it increases earthquakes, which increases potential for catastrophic release of stored CO2, among other major problems. (11)



INFRASTRUCTURE AND RECONCILIATION FOREST MANAGEMENT PROVISIONS: CO2 EMISSIONS IMPACTS

TO PUT THE CLIMATE CHANGE IMPACTS OF THE FOREST MANAGEMENT PROVISIONS IN THE PROPOSED INFRASTRUCTURE AND RECONCILIATION PACKAGES IN PERSPECTIVE, WE HAVE PROVIDED A FRAMEWORK TO ESTIMATE THE INCREASED CO2 EMISSIONS THAT WOULD RESULT IF THESE BILLS ARE PASSED IN THEIR CURRENT FORM.

The typical forest “thinning” project kills and removes **upwards of 70%** of the trees in a given stand, including a significant portion of mature and old trees. (12) **For example, in California trees as large as 30" to 40" in diameter, or 8 to 10 feet in circumference, are cut on National Forest under the guise of "thinning"!** (13)



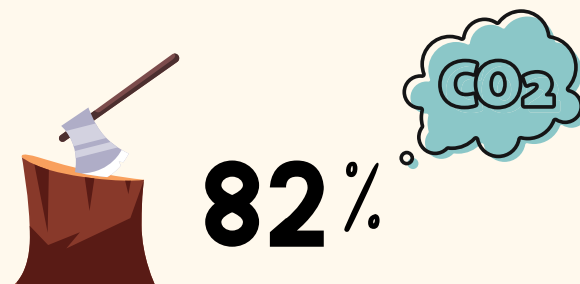
The branches and the top of a tree comprise about 35% to 46% (mid-range of 41%) of its total aboveground carbon, depending on the estimates and region. (13) These portions of the tree **are not useable for lumber**, and are known as “slash debris”. Therefore, when trees are cut in “thinning” operations, the slash debris is typically hauled to forest biomass facilities where it **is incinerated** for energy production (in some cases this material is incinerated in piles in the forest)



The tree trunk is then hauled to a timber mill, where an additional 22% to 25% (mid-range of 24%) of the initial tree carbon is lost as mill residue, which is incinerated for energy at the mill. (14) Only about 35% of the initial tree carbon ends up in a lumber product, and the transportation involved in the logging equates to 17% of the initial tree’s carbon (14.b), **reducing the net stored carbon in lumber products to just 18% of the initial tree.**

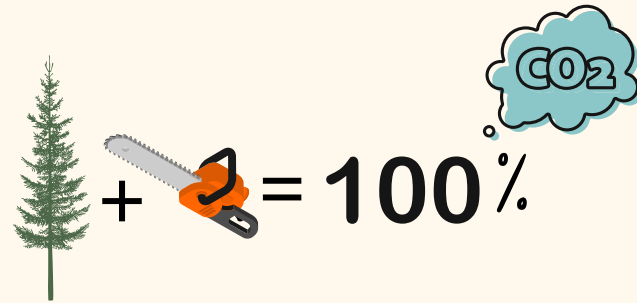


So, the overall net effect is that, for every tree cut in logging projects conducted as “thinning”, the equivalent of 82% of a mature tree’s carbon ends up in the atmosphere almost immediately.



INFRASTRUCTURE AND RECONCILIATION FOREST MANAGEMENT PROVISIONS: CO₂ EMISSIONS IMPACTS

Most smaller trees are also removed in thinning operations, and 100% of the carbon in these trees immediately goes into the atmosphere, as they are incinerated at biomass facilities (or in piles in the forest) for energy, since they are too small to be used for lumber [these small trees, such as those less than 10 inches in diameter, comprise about 20% of the tree carbon in the forest. (15)].



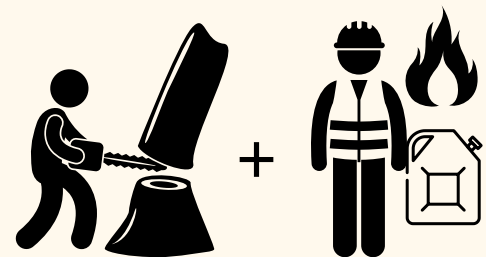
In stark contrast, even in a large wildfire, only about 2% to 3% of tree carbon is actually emitted.

Seedlings and small saplings can be consumed in higher-intensity fire patches, but otherwise only needles, some small twigs, and a superficial outer layer of bark, are consumed, while the vast majority of the tree carbon remains in the forest, even when trees are killed. (16)



“Thinning” is frequently followed by some type of prescribed burning, which emits additional carbon. A detailed review of numerous studies on thinning found that **thinning plus prescribed-burning emits about three times more carbon than wildfire alone on any given acre of forest. (17)** Large wildfires in forests emit about 8 to 10 tons of carbon per acre (mid-range of 9 tons per acre), which equates to 33 tons of CO₂ per acre. Because **emissions from thinning are about three times higher than wildfire alone, a thinning**

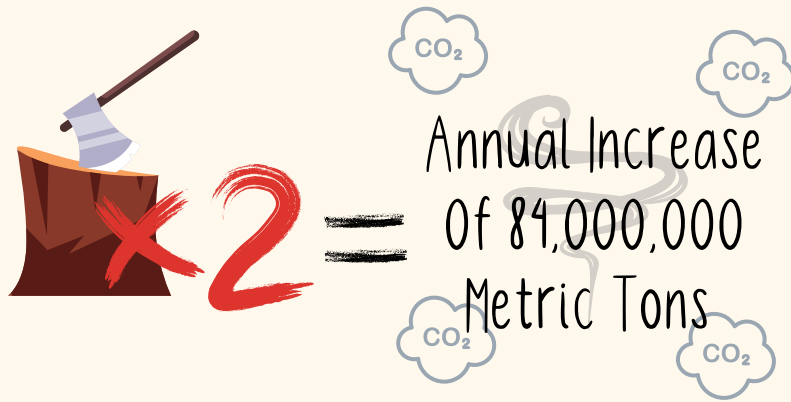
operation will emit on average 90 tons of CO₂ per acre, even after taking into account the relatively minor net percentage of removed trees that end up as temporary carbon storage in lumber products, as discussed above.



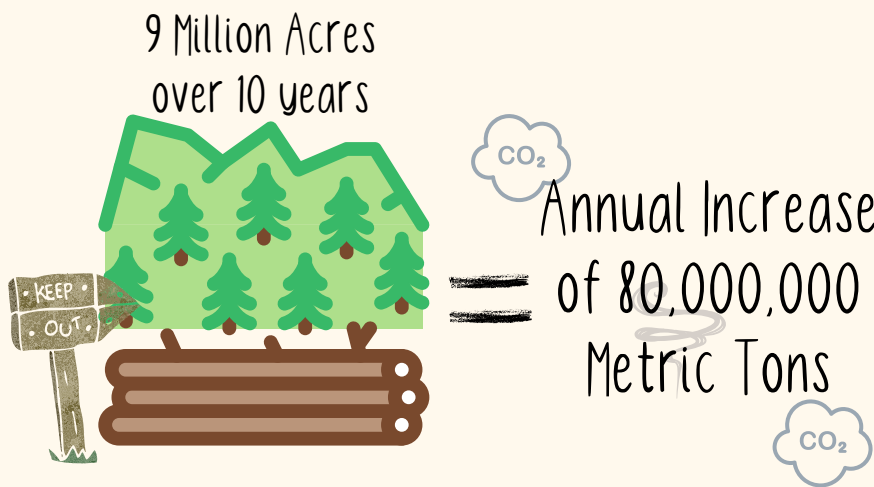
Management emits 3x more carbon than wildfire alone on any given acre of forest

INFRASTRUCTURE AND RECONCILIATION FOREST MANAGEMENT PROVISIONS: DIRECT CO2 EMISSIONS IMPACTS

Since the Reconciliation bill alone would **more than double existing logging levels** on our national forests, by more than doubling existing direct funding for logging over the next decade, from approximately \$1 billion per year to \$2.15 billion per year, this would equate to an **additional 23 million metric tons of annual carbon emissions, or 84 million metric tons of annual CO2 emissions**, (See Method 2 in Appendix below).



The \$9 billion for logging on non-federal lands in the Reconciliation bill, at a standard estimated cost of \$1000/acre for thinning, would equate to **9 million acres logged over the 10-year period**. At 90 tons of CO2 emissions per acre (as discussed above), this would equate to 0.8 gigatons of increased CO2, or 80,000,000 Metric Tons per year.



And, the 30 million acres of mandated increased logging on national forests in the Infrastructure bill, at 90 tons of CO2 emissions per acre (assuming "thinning" only), would equate to 2.7 gigatons of increased CO2 emissions over 15 years or an additional



INFRASTRUCTURE AND RECONCILIATION FOREST MANAGEMENT PROVISIONS: CO2 EMISSIONS IMPACTS

Even if we assume some degree of overlap between the doubled funding for logging on federal lands in the Reconciliation bill and the logging mandates on federal lands in the Infrastructure bill, **the combined effect of the logging provisions in the Infrastructure and Reconciliation packages would be an annual increase in CO2 emissions from logging of 0.344 gigatons or 344,000,000 Metric Tons!**

That would result in a 48% increase in direct emissions from logging above current levels.

Infrastructure Bill
+
Reconciliation Bill

=

48% Increase in
Annual CO₂
Emissions from
Logging

48% Increase in
Annual CO₂
Emissions from
Logging

=



INFRASTRUCTURE AND RECONCILIATION LOGGING/FOREST MANAGEMENT PROVISIONS: CO2 EMISSIONS IMPACTS ON 2030 EMISSIONS REDUCUTION GOAL

2030 Emissions Goal

An essential minimum climate crisis mitigation goal has been set: reducing U.S. greenhouse gas emissions by 50% of 2005 levels by 2030.⁽¹⁸⁾ Emission levels in 2005 were 6.6 gigatons (6.6 billion tons) of annual net CO₂ equivalent emissions, so the 2030 target would be 3.3 gigatons of total U.S. greenhouse gas emissions.

The most recent estimate for annual U.S. emissions was 5.2 gigatons in 2020.⁽¹⁸⁾ This means we will need to reduce our annual CO₂ emissions by at least 1.9 gigatons per year by 2030 in order to meet our minimum climate change mitigation goal.

Impact of Logging Provisions on Emissions Goal

It has been estimated that the provisions in the Reconciliation and Infrastructure packages with the greatest carbon emission-reducing potential (mostly the clean energy provisions), would reduce annual emissions in the U.S. by approximately 0.88 gigatons in 2030, however, the elimination of the Clean Energy Performance Program (CEPP) would lower this to an annual reduction of only 0.38 gigatons in 2030.⁽¹⁹⁾ Far more would be necessary to achieve the 50% emissions reduction goal in 2030.⁽¹⁸⁾ This is why we must not increase emissions while we are simultaneously trying to substantially reduce them.

However, clean energy is not the only climate issue here. The other key question pertains to the climate impact of the logging provisions in the Infrastructure and Reconciliation packages. Specifically, the extent to which these logging provisions undermine the annual emission reduction gains (now 0.38-gigatons) of these bills.

Based on the analyses detailed in Methods 1 and 2 below, using two different methodologies, the logging provisions in the Infrastructure and Reconciliation packages would, through increased CO₂ emissions due to higher logging levels, erase between 0.250 and 0.344 gigatons (midrange 0.30 gigatons CO₂) of the estimated 0.38 gigaton reduction in CO₂ emissions from remaining clean energy provisions in 2030.

INFRASTRUCTURE AND RECONCILIATION FOREST MANAGEMENT PROVISIONS: CO₂ EMISSIONS IMPACTS ON 2030 EMISSIONS REDUCTION GOAL

The result is progress of only a 0.08 gigaton reduction of CO₂ toward our 2030 CO₂ emissions reduction goal. But when the 0.16 gigatons of annual CO₂ increase from new highways, as discussed below, is included the overall result of the Infrastructure and Budget Reconciliation packages is a net increase in annual CO₂ emissions of 80 million metric tons by 2030. This means that instead of reducing annual CO₂ emissions by 1.9 gigatons from current levels to meet our 2030 climate target, we would actually be increasing annual emissions by 80 million metric tons by 2030.

How to Use Infrastructure and Reconciliation to Close the Emissions Reduction Gap

Closing the gap in meeting our 2030 emission reduction goal is essential and if we refocus policies and funding on natural climate solutions we can get there. Below are funding recommendations that would accelerate emissions reduction, while creating jobs and communities that are resilient to climate change.

- Reducing annual U.S. carbon emissions from logging in the U.S. by 50% in 2030 by eliminating funding for logging on federal public lands and allocating tens of billions of dollars to a large-scale expansion of protected public forestlands through acquisition from willing sellers and conservation easements, especially in parts of the country that lack public lands and access to nature.
- Restoring the Clean Energy Performance Program.

INFRASTRUCTURE AND RECONCILIATION FOREST MANAGEMENT PROVISIONS: CO2 EMISSIONS IMPACTS ON 2030 EMISSIONS REDUCTION GOAL

- Eliminating all fossil fuel subsidies and the \$18 billion in subsidies in the Infrastructure bill for the false climate solutions of carbon capture and storage and biomass energy with carbon capture.
- Redirecting all of these subsidies into rooftop and community solar energy, as well as a major civilian climate corps jobs program to create and install the solar energy expansion and staff the newly-acquired public lands near communities.
- In the transportation section of the Infrastructure bill, limit the highway provisions to repairing and maintaining existing highways, rather than building new highways through wildlands.

The forest protection measures described above would reduce CO₂-e by an additional 0.36 gigatons in 2030, based on figures pertaining to current annual carbon emissions from logging in US forests (8), and adding 17% for CO₂ emissions from the transportation associated with logging. And, ending fossil fuel subsidies would equate to a reduction in emissions of 0.18 gigatons of CO₂-e in 2030. Additional carbon emissions reductions could be achieved by modifying the Transportation section of the Infrastructure bill to focus the funds on repair and maintenance of existing highways, instead of energy-intensive and destructive construction of new highways through wildlands.

As reported by the Washington Post, in 2019, \$19 billion, about a third of states' capital spending on roads that year, went towards expanding the road network rather than addressing the maintenance backlog. Despite federal intentions, states retain the right to use transportation funding as they see fit and new highways often have a much higher political payoff than routine maintenance or repairs. So it could be expected that a third (\$37 billion) of the \$110 billion line item would be used to pay for new or expanded highways. At roughly \$4 million per mile, that's enough funding for over 9,250 miles of new pavement.

INFRASTRUCTURE AND RECONCILIATION FOREST MANAGEMENT PROVISIONS: CO2 EMISSIONS IMPACTS ON 2030 EMISSIONS REDUCTION GOAL

But what's the climate cost? According to a useful analysis by Seattle's Sightline Institute, each new mile of highway generates between 117,000 and 186,000 tons of CO2 associated with construction activities and new traffic even after deducting some carbon savings from less congestion. If the Infrastructure spending results in 9,250 miles of new roads, that's a carbon price tag of another 1.1 to 1.7 gigatons of CO2 (mid-range of 1.4 gigatons of CO2 or 156 million tons of CO2 in 2030).

Therefore, in addition to the estimated 0.88-gigaton reduction in annual CO2 emissions from the clean energy provisions of the bills, if CEPP is restored, these three additional key steps would bring us to 1.58 gigatons of reduced CO2 annual emissions by 2030—within 0.32 gigatons of our 2030 climate goal. While no current estimate exists for the carbon emissions reduction that would result from redirecting all existing fossil fuel subsidies into community and rooftop solar, it would be substantial, and would likely make up most or all of the remaining 0.32 gigatons of needed emissions reduction to meet our 2030 target.

This is a path that Congress could take to successfully reach our emissions reduction goals. However, if the Infrastructure and Reconciliation bills are passed in their current form, we will fall far short of the 2030 emissions reduction target that we must meet to avoid the most catastrophic impacts of the climate crisis, protect public health, and maintain our ecosystems and biodiversity.

End Notes

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End Notes (Continued)

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- 17: 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.
- 18: E&E News, "Study: Dem plan could overhaul energy, cut GHGs by a gigaton." September 15, 2021; see report at: <https://rhg.com/research/build-back-better-congress-budget/>
19. Roy, N., et al. 2021. Cost analysis and emissions projections under power sector proposals in Reconciliation. Resources for the Future. Washington, D.C. Accessed at: <https://www.rff.org/publications/issue-briefs/cost-analysis-and-emissions-projections-under-power-sector-proposals-in-reconciliation/>. NOTE: There are a range of estimates about the annual CO₂ emissions reduction from the CEPP (ranging from 350 million metric tons of CO₂ per year from the Biden administration to over 700 million metric tons per year as described in a report from Energy.Innovation). The estimate we used represents the midrange of the current estimates.

APPENDIX

METHODOLOGICAL NOTES

Method 1:

Federal reconciliation and infrastructure packages – carbon emissions associated with increased logging and burning of woody biomass

1. Logging related emissions associated with the reconciliation bill

The reconciliation package contains several categories of spending on programs that will increase logging on both public and private forestlands. Total forestry investments in the package total \$40 billion, with about \$21 billion funding line items associated with logging. These include line items related to hazardous fuels (\$10 billion) and vegetation management (\$2 billion) on federal lands and another \$9 billion for similar activities on non-federal lands. Based on historical experience with the programs funded, it is likely that about \$15.7 billion will finance various forms of commercial thinning and the remainder (\$5.3 billion) will finance more conventional logging activities.

Without knowing the precise configuration of projects that will be funded, it is difficult to estimate the volume of timber produced by these expenditures and the associated carbon emissions. However, this can be approximated by using national logging cost averages per thousand board feet (mbf) logged coupled with carbon emission factors (tons CO₂-e released per mbf) from the literature.

Arney (2016) compiled actual cost data from a nationwide survey and reported a range of \$100-\$440/mbf for commercial thinning and \$80-\$300/mbf for conventional (final harvest) logging. Using midpoints from these ranges suggests that the reconciliation package could generate roughly 86 billion board feet (bbf) of new logging through 2030 - 58 bbf from commercial thinning and 28 bbf from conventional logging.

In terms of emissions factors, Law et al. (2018) and Talberth (2017) analyzed fourteen years of data from Oregon and came up with similar estimates of statewide logging related emissions – about 34 million metric tons CO₂-e per year despite using different methodologies. The emission factors estimated by the studies range from 7.5 to 8.8 mt CO₂-e/mbf. Across the two studies, emissions associated with decay of end use products, manufacturing losses, decay and combustion of logging residuals, chemicals, fertilizers, and energy use were considered. Talberth (2017) also considered foregone sequestration – a form of indirect emissions calculated in several regulatory contexts, such as when forestland is permanently converted to urban land uses. Using a similar method, Talberth et al. (2019) estimated an emission factor of 17.8 mt CO₂-e/mbf from the logging activities in North Carolina. A midpoint between estimates from Oregon and North Carolina is 12.65 mt CO₂-e/mbf, and one we adopt here pending further analysis.

Further support for this figure comes through use of a method often used by researchers and regulators. The general rule is that, depending on end use (short lived vs. long lived wood products), between 5% and 35% (20% average) of the carbon removed from the forest is stored over a 100-year period in wood products or landfills, and the remainder is lost to the atmosphere. An emissions factor can be derived with relative ease. Douglas fir provides a useful example. On average, Douglas fir weighs approximately 5.5 tons per mbf. Wood is half carbon by weight. Half of this weight (2.75 tons) translates into 10.1 mt CO₂-e. If 20% of this is retained after 100 years, then an initial emissions factor is about 8.1 mt CO₂-e/mbf. But this figure does not account for indirect emissions, decay and combustion of logging residuals, or other variables noted above. If included, the final emissions factor would fall squarely within the range we are using in this analysis.

By applying the midpoint emissions factor of 12.65 mt CO₂-e/mbf to the amount of logging stimulated by the reconciliation package (86,000,000 mbf) we can ballpark the associated carbon emissions at 1,087,000,000 metric tons, i.e., about 1.1 gigatons CO₂-e, or about 0.12 gigatons of increased CO₂-e in 2030.

APPENDIX

METHODOLOGICAL NOTES

Method 1 (Continued):

Federal reconciliation and infrastructure packages – carbon emissions associated with increased logging and burning of woody biomass

2. Logging-related emissions associated with the infrastructure bill

The current version of the Senate infrastructure bill also promotes logging. But instead of a funding allocation, the bill mandates a certain number of acres to be treated with conventional and commercial logging activities. Our analysis suggests that at least 17 million acres would be treated by 2030. The associated carbon emissions can be estimated in a relatively straightforward fashion.

Carbon density on federal forestlands is well above the national average. Smith et al. (2019) estimate above ground carbon stocks on federal forestlands to average 56.8 metric tons carbon per hectare. This translates into 23 metric tons carbon per acre, or 84 metric tons per acre in CO₂ equivalent units. Conventional logging removes approximately 90% of this carbon while commercial thinning removes roughly 50%. We assume that the infrastructure logging provisions would treat an equal acreage (8.5 million) with these techniques, with the caveat that biomass retained on site for the conventionally logged acres would be a bit more than usual due to more stringent standards written into the infrastructure bill. Here, we assume the removal of 80% rather than 90% of the biomass on these acres through logging.

Based on these figures, 8.5 million acres of commercial thinning would likely remove 357,000,000 mt CO₂-e from US forests while 8.5 million acres of conventional logging would likely remove 516,800,000 mt CO₂-e. Total removals are thus likely to be about 874 million mt CO₂-e. Of this, and using the standard 'rule of thumb' for storage in harvested wood products, about 699 million mt CO₂-e is likely to enter the atmosphere. But what about indirect emissions?

A good working figure – derived from USDA Forest Inventory and Analysis data – for average sequestration rates on mid-aged stands across the US is 4.6 mt CO₂-e per acre per year. If conventionally treated acres lose 80% of this capacity for ten years and commercially thinned acres about 50%, it implies an indirect emission from lost sequestration of about 508,300,000 mt CO₂-e. Taken together, logging on 17 million acres of federal forests through 2030 would likely result in both direct and indirect emissions of over 1.2 gigatons CO₂-e, or 0.13 gigatons of increased CO₂-e in 2030, for a combined total (Reconciliation plus Infrastructure) of 0.25 gigatons of increased CO₂-e in 2030.

1. The agriculture and forestry section of the reconciliation package can be reviewed here: <https://docs.house.gov/meetings/AG/AG00/20210913/114043/BILLS-1175ConRes14pp.pdf>.

2. Arney, J.D., 2016. The Economic Results of a PNW Silvicultural Costs Survey: Are you swimming above or below the financial waterline? Portland, OR: Forest Biometrics Research Institute.

3. Detailed calculations are as follows: \$15,625,000,000 buys 57,870,370 mbf (about 58 billion board feet) at a price of \$270/mbf from commercial thinning. \$5,375,000,000 buys 28,289,474 mbf (about 28 billion board feet) at a price of \$190/mbf from conventional logging.

4. Law, B., Hudiburg, T.W., Berner, L.T., Kent, J.J., Buotte, P.C., Harmon, M.E., 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. PNAS April 3, 2018 115 (14) 3663-3668; Talberth, J., 2017. Oregon Forest Carbon Policy: Technical brief to guide legislative intervention. Portland, OR: Center for Sustainable Economy.

5. For roughly 10-15 years after logging, the decay of logging residuals and emissions from soil disturbance overshadow sequestration by seedlings. Carbon sequestration goes negative. This is known as negative net ecosystem productivity and is well documented in forest ecosystems across North America. See, e.g. Turner, Turner, D.P., Guzy, M., Lefsky, M.A., Ritts, W.D., Van Tuyl, S., Law, B.E., 2004. Monitoring forest carbon sequestration with remote sensing and carbon cycle monitoring. Environmental Management 33(4): 457-466.

6. Talberth, J., Davis, S., 2019. Climate Impacts of Industrial Forest Practices in North Carolina. Part I. Asheville, NC: Dogwood Alliance.

7. Smith, J.E., Heath, L.S., Skog, K.E., Birdsey, R.A., 2006. Methods for Calculating Forest Ecosystem and Harvested Carbon with Standard Estimates for Forest Types of the United States. Gen Tech. Rpt. NE-343. Morgantown, WV: USDA Forest Service, Northeastern Research Station.

8. Washington Department of Revenue, Tax Reporting Instructions and Stumpage Value Determination Tables: Available online at: <https://dor.wa.gov/sites/default/files/legacy/Docs/pubs/forestatx/fh98/981inste.htm>.

9. Smith, J.E., Domke, G.M., Nichols, M.C., Walters, B.F., 2019. Carbon stocks and stock change on federal forest lands of the United States. Ecosphere 10(3). Article e02637.

10. Talberth, J., 2017; 2019, notes 4 and 5.

APPENDIX

METHODOLOGICAL NOTES

Method 2:

Overall, for the reasons described in the body of this report, a detailed review of numerous studies on thinning found that thinning plus prescribed-burning emits about three times more carbon than wildfire alone on any given acre of forest. (1) Large wildfires in forests emit about 8 to 10 tons of carbon per acre (mid-range of 9 tons per acre), which equates to 33 tons of CO₂ per acre. (2) Therefore, because emissions from thinning are about three times higher than wildfire alone, a thinning operation will emit about 90 tons of CO₂ per acre, even after taking into account the relatively minor net percentage of removed trees that end up as temporary carbon storage in lumber products, as discussed above (this is based upon the conservative assumption that the increased logging will be "thinning", as opposed to clearcutting: though it is likely that both green tree and post-fire clearcutting would also occur, which would increase CO₂ emissions even more.) This estimate uses figures derived from studies focused on "thinning" and wildfires in western U.S. forests, and estimates are based upon the assumption that most of the increased logging would occur in the West.

Since the Reconciliation bill alone would more than double existing logging levels on our national forests, by more than doubling existing direct funding for logging over the next decade, from approximately \$1 billion per year (3) to \$2.15 billion per year, this would equate to an additional 23 million metric tons of annual carbon emissions, or 84 million metric tons of annual CO₂ emissions, extrapolating from a detailed scientific analysis of the climate change impacts of doubling current logging levels on U.S. national forests (4), or 0.084 gigatons of increased CO₂ in 2030. The \$9 billion for logging on non-federal lands in the Reconciliation bill, at a standard estimated cost of \$1000/acre for thinning⁵, would equate to 8 million acres logged over the 9-year period from now until 2030. At 90 tons of CO₂ emissions per acre (as discussed above), this would equate to 80 million tons per year, or 0.08 gigatons of increased CO₂ in 2030. The 17 million acres of mandated increased logging on national forests in the Infrastructure bill that would occur between now and 2030, at 90 tons of CO₂ emissions per acre, would equate to 1.5 gigatons of increased CO₂ emissions over the next 9 years, or 0.17 gigatons of increased CO₂ emissions in 2030. Together, the logging provisions in the Infrastructure and Reconciliation packages would, therefore, cause increased emissions from logging of 0.344 gigatons in 2030, which would reduce the 0.88 gigatons in CO₂ emission reductions from the clean energy provisions down to a mere 0.55 gigatons of reduced CO₂ emissions—nearly two and a half gigatons short of our minimum climate change mitigation goal.

This may be a conservative estimate of the increased CO₂ emissions that would occur as a result of these legislative packages, in light of the fact that it does not include the increased CO₂ emissions that would result from the \$400 million in subsidies for the forest biomass and wood pellet industry in the Infrastructure bill or the \$1 billion in subsidies for biomass/pellets and mass timber in the Reconciliation bill under the rubric of "wood innovation". Nor does the above estimate include the increased CO₂ emissions from the tax breaks for logging, as discussed above. These provisions would certainly increase logging, and associated carbon emissions, substantially but to an unknown degree, given the difficulties in estimating the impacts of tax breaks and direct subsidies to individual biomass/pellet facilities.

1. 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 Ecol. and Environment* 10: 83-90.

2. (a) Meigs, G., et al. 2009. Forest fire impacts on carbon uptake, storage, and emission: The role of burn severity in the Eastern Cascades, Oregon. *Ecosystems* 12:1246-1267; and (b) 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.

3. U.S. Forest Service, Fiscal Year 2021 Budget Justification (Note: includes "Hazardous Fuels", "Forest Products", "Vegetation Management", and "Collaborative Forest Landscape Restoration" line items).

4. Depro, B.M., et al. 2008. Public land, timber harvests, and climate mitigation: Quantifying carbon sequestration potential on U.S. public timberlands. *Forest Ecol. and Management* 255: 1122-1134.

5.(a) U.S.F.S. 2003. A strategic assessment of forest biomass and fuel reduction treatments in western states. U.S. Forest Service, Washington, D.C.; and (b) TNC. 2021. Wildfire resilience funding: building blocks for a paradigm shift. The Nature Conservancy, Arlington, VA.



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