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Portland Eugene Bend Enterprise

1 Nov 2024

TO: Reviewing Official, Eric Watrud, Umatilla National Forest

Attn: Tiger-Mill Project

VIA: <https://cara.fs2c.usda.gov/Public//CommentInput?Project=62658>

Subject: 36 CFR 218 objection of the Tiger-Mill Project EA and Draft DN

Dear Forest Service:

In accordance with 36 CFR 218, Oregon Wild hereby objects to the project described below.

DOCUMENT TITLE: Tiger-Mill Project, Environmental Assessment, Finding of No Significant Impact, and Draft Decision Notice.

<https://www.fs.usda.gov/project/?project=62658>

PROJECT DESCRIPTION: The draft DN adopts Modified Alternative A, but never describes it in detail, except to say that it's like the proposed action with several (unquantified) modifications, making the description in the EA inaccurate and uncertain.

Alternative A involves:

- 13,392 acres of thinning
 - 4,619 acres of non-commercial thinning <10" dbh (544 acres by machine)
 - Non-commercial thinning in IRA will allow removal up to 12" dbh)
 - 9,343 acres of commercial thinning
 - 1,175 acres of commercial logging within the Mill Creek inventoried roadless area
 - 4,240 acres of skyline/tethered logging (much on steep slopes)
 - 100-300 ft stream buffers (No mechanical treatments are being proposed in RHCA Categories 1 [fish bearing] and 2 [perennial]. Non-commercial hand thinning treatment of material <9" DBH is being proposed in category 4 [intermittent] RHCAs following the Blue Mountain Project Design Criteria where consistent with PACFISH riparian management objectives ...)
- 4,147-7,002 acres of "treatment" in undeveloped areas [EA (p 82) has contradictory information]
- 10.64 miles of temporary road construction (~3.4 miles on existing template)
- [undisclosed] "... road maintenance, reconstruction, use of temporary roads and decommissioning activities.")
- On average, "treatments" would remove 58% of the basal area and ≤38% of the total carbon (and a greater portion of the above ground carbon).

- 21,736 acres prescribed fire

Relevant modifications to Alt A include:

- Temporary road modifications led to adjusting proposed activities in some units. Commercial thinning within Fire Regime 4 in the Mill Creek Watershed Inventoried Roadless Area (IRA) was removed.
- Cable-assist commercial thinning was replaced with non-commercial thinning within the Research Natural Area.
- Commercial thinning within Old Forest single stratum in dry forest was replaced by non-commercial thinning.
- Areas of unstable slopes were switched from commercial thinning to non-commercial thinning or no treatment.

PROJECT LOCATION (Forest/District): Umatilla National Forest, Walla Walla Ranger District, 13 miles east of Walla Walla, WA. The project area straddles the Washington/Oregon border. A majority of the proposed logging is in Oregon.

NAME AND TITLE OF RESPONSIBLE OFFICIAL: Johnny Collin, District Ranger and Responsible Official, Walla Walla Ranger District

LEAD OBJECTOR: Oregon Wild

REQUEST FOR MEETING TO DISCUSS RESOLUTION: Oregon Wild hereby requests a meeting to discuss potential resolution of the issues raised in this objection.

NARRATIVE DESCRIPTION OF THOSE ASPECTS OF THE PROPOSED DECISION ADDRESSED BY THE OBJECTION:

Oregon Wild objects to:

- commercial logging in the inventoried roadless area and undeveloped areas larger than 1,000 acres, especially the Mill Creek IRA and the Tiger Creek and Webb Creek watersheds,
- logging in moist and cold vegetation types that do not need restoration via commercial logging,
- canopy reduction via commercial logging as a method of fuel reduction when non-commercial thinning and prescribed fire would be more effective and have far fewer trade-offs,
- failure to prepare an EIS to consider potentially significant effects of logging and road construction on soil, water, fish & wildlife, carbon, fire hazard, unroaded values, etc.,
- failure to take a hard look at the adverse effects of logging, machine piling, pile burning, road building, maintenance treatments, and road use, on soil, water, carbon, fire hazard, fish & wildlife (including snag-associated wildlife and ESA-listed steelhead and bull trout and their critical habitat),

- misleading analysis of carbon and climate change, and the failure to harmonize climate change mitigation and adaptation,
- lack of NEPA documentation showing compliance with substantive requirements including the Umatilla LRMP as amended, and
- lack of response to public comments.

SUGGESTED REMEDIES THAT WOULD RESOLVE THE OBJECTION:

The City Walla Walla received a significant grant (\$300,000) from FEMA for a Watershed Resiliency Master Planning effort that will not be completed until the end of 2025. See WW2050,

https://www.ezview.wa.gov/Portals/_1962/Documents/wallawalla2050/CityWWProjectSummary.pdf. The Forest Service is putting the cart before the horse by doing a huge vegetation management project before the watershed resiliency master plan is complete. This project will treat a large fraction of the watershed before the plan is barely begun, raising the question – what’s the point of a plan if the action precedes the plan? Forest Service efforts within this municipal watershed should be paused until it can be harmonized with the forthcoming Master Plan.

Oregon Wild respectfully requests that the Forest Service withdraw the recommended project and —

1. Wait for the Watershed Resiliency Master Plan to be completed;
2. Issue a clear decision that avoids logging and road building in roadless and undeveloped areas >1,000 acres, and protects mature and old-growth trees and stands, and protects important habitat features for native species of terrestrial and aquatic flora and fauna. Our suggestions for avoiding adverse impacts and improving this project are set forth below; or
3. Prepare an EIS to address the significant impacts and unresolved conflicts and fully complies with the requirements of NEPA and the CEQ regulations and addresses the specific concerns expressed below.

Oregon Wild is not opposed to non-commercial thinning and careful use of prescribed fire in appropriate locations, especially shaded fuels breaks that maintain significant forest canopy to reduce slash production and associated impacts with slash piling and burning, maintain cool/moist conditions under the canopy, help suppress growth of surface and ladder fuels, and reduce long-term maintenance costs.

DESCRIBE HOW THE OBJECTIONS RELATE TO PRIOR COMMENTS:

Oregon Wild’s scoping comments raised concerns about the effects of logging and roads on roadless and undeveloped areas, wildfire hazard reduction, fish & wildlife, carbon & global climate change, soil, water quality, and the need for proper NEPA analysis of these issues.

Oregon Wild also brought up significant concerns with logging in the undeveloped Tiger Creek/Webb Creek watersheds during the scoping process for the Tiger-Webb Fuels Project in 2014. We incorporate those comments by reference.

Understand, that when the Forest Service fails to provide a comment period on an informative NEPA document, and just offers an objection period after scoping, the public cannot be expected to raise each issue in detail in scoping comments.

SPECIFIC ISSUES RELATED TO THE PROPOSED ACTION:

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Background

This area is simply not a high priority for commercial logging. 87% of the project area is not previously logged, and there is usually a good reason that forests have remained unlogged for so long, e.g., they are not appropriate for logging due to unsuitable soils, steep slopes, watershed sensitivity, etc. Previously unlogged areas are generally still functioning hydrologically and ecologically. This project takes extra risks in sensitive watersheds by using ground-based logging equipment on steep slopes relying on untested cable-assist, or tethered logging methods.

In addition, 93% of the project area is moist and cold forest vegetation types. These forest types tend to develop dense vegetation and infrequent fire. The frequently-shared 1935 historic picture of the watershed is merely a snapshot in time, and does not accurately represent the natural range of conditions in these cold and moist forests.

This project area is also a mosaic of forest and non-forest patches, which means that fuels are naturally heterogeneous and less prone to carry canopy fire over large areas.

The municipal watershed is threatened more by logging than by wildfire. Landscapes like this can burn and still produce high quality water. Logging, machine piling, pile burning, road building, and maintenance treatments on the other hand cause far more soil disturbance and chronic erosion risk. A fire could also do good ecological work, such as fuel reduction, without the many trade-offs associated with commercial logging and roads.

Logging the IRA Violates the Roadless Rule (and NEPA)

EA Table 33 (p 89) discloses that Alternative A proposes 1,175 acres of commercial logging within the Mill Creek inventoried roadless area. We are unsure if this reflects modifications made in the Draft DN.

The National Forest Roadless Rule prohibits logging in inventoried roadless areas. The only potentially relevant exception here is removal of small trees to “maintain or restore the characteristics ecosystem composition and structure, such as reducing the risk of uncharacteristic wildfire effects.” (36 CFR 294.13(b)(1)(ii)). Close examination shows this exemption is not applicable, for several reasons.

First, the Forest Service has determined that anything smaller than 21” dbh is a “small tree.” This is not supported by science. Most science says large trees are 20” dbh and larger, so using a 21” dbh limit puts large trees at risk.

Second, the Forest Service has arbitrarily decided there are only two categories of trees, large and small, ignoring the likely intent of the roadless rule to protect both large (>20” dbh) and medium-sized trees (12-20” dbh), and allowing removal of “small” trees (<12” dbh). The 21” dbh limit applies everywhere on the eastside National Forests. Applying that limit in the IRA gives this special roadless area, no special consideration.

Third, logging cold and moist forests is not addressing uncharacteristic “composition and structure” or “uncharacteristic fire.” Thinning cold/moist forests is imposing an artificial low density condition and an artificial fire regime on forests that are naturally dense and tend to burn relatively infrequently compared to dry, low-density forests which are uncommon in this project area.

In addition, the Tiger Mill EA analysis of IRA logging is flawed. The EA analysis of effects to the IRA discusses the values or IRAs generically, but does not describe in any detail the site-specific roadless values present in the Mill Creek IRA, nor how those values may be affected by logging, other than brief discussions of effects mostly by “incorporating by reference” the analysis of those resources in other parts of the EA. In fact, the term “incorporated by reference” is used 16 times in the Inventoried Roadless Analysis Report. This approach views impacts to roadless areas just like impacts to roaded and developed areas, which fails to account for the

disproportionate biophysical values provided by roadless areas, and the disproportionate impacts of logging on those values.

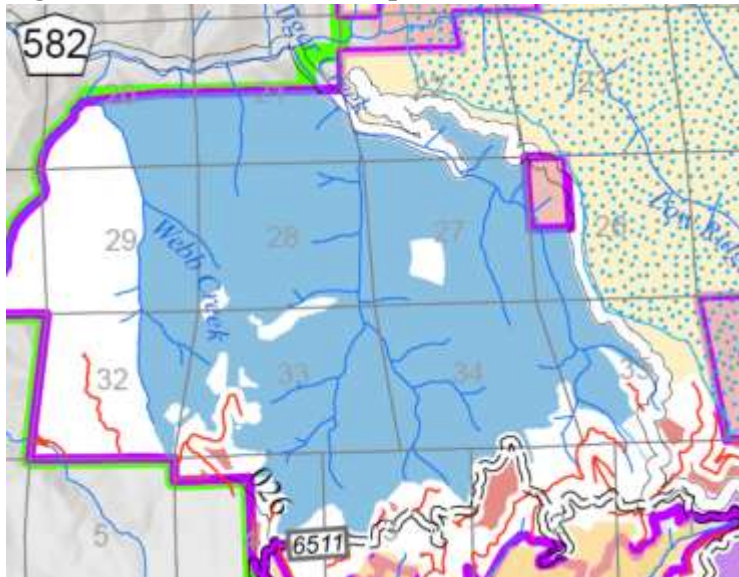
The Tiger Mill EA (p 91) denies any cumulative effects on roadless values, even though stumps will be created and heavy equipment will impact over 1,000 acres and the logged area will be disqualified from consideration as wilderness. This incremental loss of roadless areas is exactly how we came to the current situation where roadless values are exceedingly rare and under-represented. This violates NEPA's mandate for high quality information and accurate analysis.

The EA Failed to Consider the Disproportionate Biophysical Values Provided by Uninventoried Roadless Areas >1,000 Acres and the Disproportionate Impacts of Logging Them.

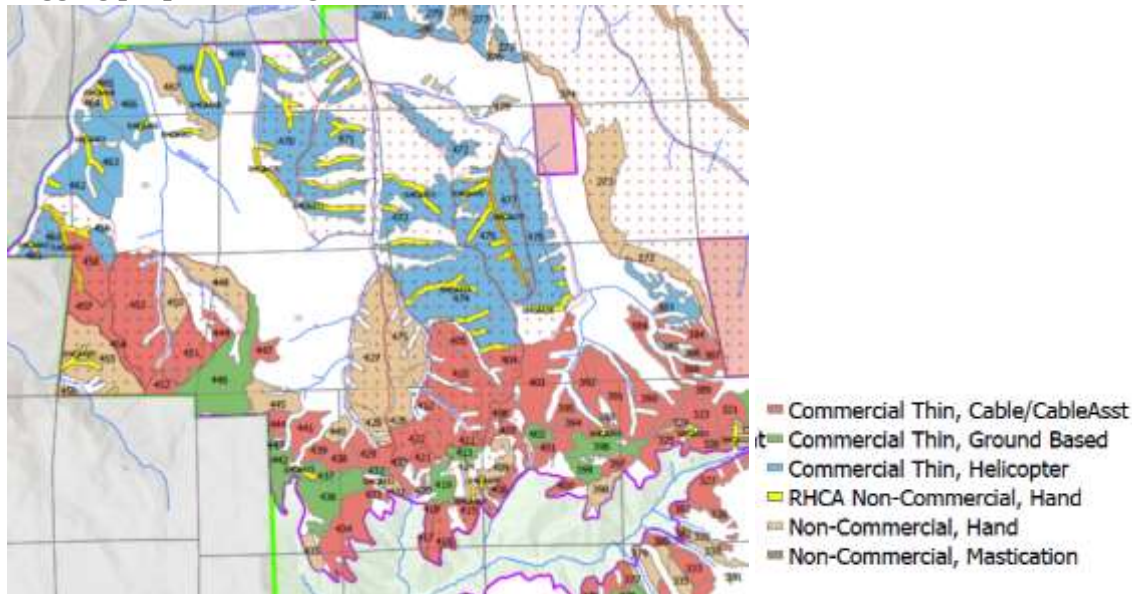
In spite of detailed scoping comments raising the issue, the Tiger Mill EA made no effort to analyze the existence of undeveloped areas other than inventoried roadless areas. This is improper. The agency cannot limit its analysis of roadless areas to inventoried areas >5,000 acres, because smaller roadless areas that were not inventoried are ecologically relevant and potentially significant. The NEPA analysis must reflect the growing scientific evidence (cited below) indicating the significant value of roadless areas smaller than 5,000 acres and larger than 1,000 acres. Recent scientific literature emphasizes the importance of unroaded areas greater than 1,000 acres as strongholds for the production of fish and other aquatic and terrestrial species, as well as sources of high quality water. Commercial logging and/or road building within large unroaded areas threatens these significant ecological values.

We are particularly concerned about logging in the Tiger Creek/Webb Creek watershed which has an undeveloped areas almost 3,000 acres in size, and separated from the 25,000 acre Mill Creek IRA by a single road.

Tiger/Webb Creeks Undeveloped areas:



Logging proposed in Tiger/Webb Creeks area.



There are several flaws with the Tiger Mill EA analysis of undeveloped areas and the effects of logging -

1. The Tiger Mill EA (p 80) inventory of undeveloped areas applied an arbitrary 300 foot buffer from roads. Our scoping comments noted ...

The FS must avoid using the contrary policy of excluding 300 foot buffers along roads even when those areas otherwise qualify as potential wilderness.

The 300 foot buffers often used by Region 6 to determine the boundaries of “potential wilderness areas” are exceedingly large and unsupported by logic and evidence. The FS must remember that they are preparing an inventory of “potential” wilderness, so they should be inclusive. Congress has on many occasions established wilderness boundaries much closer than 300 feet from roads in many instances. The FS should not prejudge wilderness potential by excluding from its NEPA analysis areas that Congress might later decide to include in wilderness.

Habitat adjacent to roads may be somewhat modified by edge effects but it is still “roadless” right up to the edge of the road (e.g., soil and vegetation are essentially intact; wildlife movement is not encumbered; hydrology is generally functioning, the imprint of man is generally unnoticeable, etc). Tellingly, when constructing new roads, the FS never admits and discloses adverse effects extending 300 feet on either side of the road.

The 2007 FS Handbook also recommends “locat[ing] boundaries at prominent natural or semi-permanent human-made features to facilitate easy on-the-

ground identification.” A road is a much more clearly identifiable boundary than an arbitrary line 300 feet away from the road.

To justify the wide, exclusionary buffers, the FS seems to rely on the fact that firewood cutting is allowed within 300 feet of roads; however, this does not justify eliminating huge swaths of otherwise roadless forests from the PWA analysis. Many roads are closed and not accessible to firewood cutters. Many open roads are not typically used for firewood access. Some areas adjacent to roads are too steep. There are conditions on firewood permits that limit the effects of firewood cutting. And most importantly, a few stumps visible within an unroaded area does not render the area ineligible for wilderness.

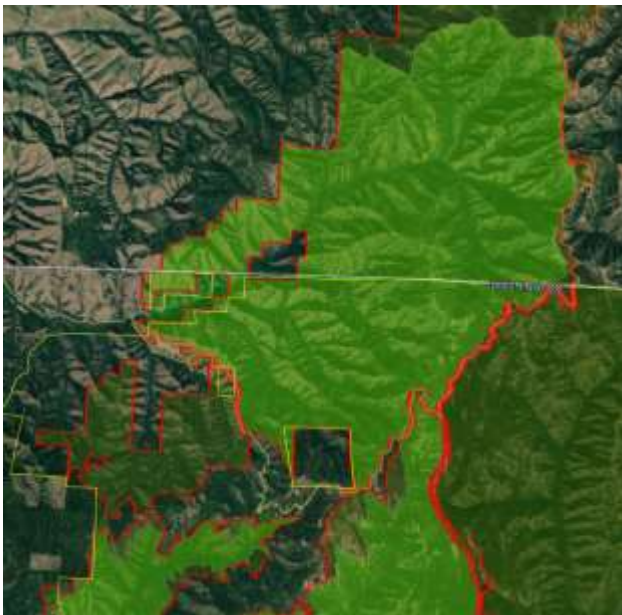
Even though this comment is addressed to inventory of potential wilderness, it logically applies to inventory of undeveloped areas as well. The Tiger Mill EA did not provide an explanation for excluding *de facto* undeveloped areas within 300 feet of roads.

2. The FS inventory does not distinguish between small undeveloped areas (as small as 1 acre) and larger undeveloped areas that have much more significant ecological values. The values of undeveloped area do not increase in a linear scale. Since large undeveloped areas are so rare, the few that remain are more valuable (provide greater ecosystem services, such as clean water, habitat, soil integrity, climate stability, recreation, lower wildfire ignition risk, opportunities for operation of natural fire regimes, etc.) than a collection of smaller areas that add up to the same acreage.
3. The Tiger Mill EA is contradictory. EA Table 31 (p 82) says that 4,147 acres of undeveloped areas would be treated, but the text just below that says that 7,002 acres would be treated. We can't find clear information in the EA how much commercial logging is proposed in the undeveloped areas. We are most concerned about commercial logging because it has much more significant adverse trade-offs (habitat loss, heavy equipment impact on soils, etc.) compared to non-commercial thinning and prescribed fire. NEPA requires high quality information and accurate analysis.
4. The Tiger Mill EA failed to address significant new information indicating the presence of significant biophysical values associated with undeveloped areas larger than 1,000 acres. See a sampling of that evidence below, and shared in scoping on this project and the 2014 Tiger-Webb Project.
5. The Tiger Mill EA (p 80) says “There are no forest-wide or management area standards specific to undeveloped lands in the Umatilla Forest plan. All lands, including other undeveloped lands, are managed consistent with forest-wide standards and guidelines and by designated Forest Plan Management Area allocations.” This is true but it does not waive the Forest Service responsibility to comply with NEPA and take a hard look at the disproportionate ecosystem values in undeveloped areas and the impacts of logging and roads on those values. Undeveloped areas are special features of the landscape, much in the same way as old growth or wetlands are. Undeveloped areas provide unique values, and they are vastly under-represented compared to the historic norm, so they deserve careful consideration and mitigation. Undeveloped areas are adversely affected by logging and roads so they need to be carefully considered in the NEPA analysis.
6. The Tiger Mill EA analysis of effects to undeveloped area focused on a small subset of the values associated with undeveloped areas, namely recreation and visuals, when in reality

undeveloped areas provide disproportionate contributions to clean water, stable water flows, carbon storage that stabilizes the climate, soil integrity, slope stability, high quality fish & wildlife habitat, lower risk of human-caused wildfire ignitions, greater opportunity for perpetuation of natural fire regimes, AND recreation and scenic values. The Tiger Mill EA did not address these values or the effects of logging and roads on them.

7. The Tiger Mill EA does not disclose the effects of the Alt A-Modified in the Draft DN. It appears to describe the effects of Alt A, and it's hard to know what the FS is actually proposing to do.
8. Reading the effects of Alt B it appears that Alt A includes road construction in the undeveloped areas. "Alternative A included 5.83 miles of temporary road construction to facilitate harvest activities" (EA p 83). The Tiger Mill EA never discloses the disproportionate adverse effects of road construction in undeveloped areas, not just on scenery, but on all the other values provided by undeveloped areas. The Tiger Mill EA should have considered an Alternative with no roads in undeveloped areas larger than 1,000 acres, such as Tiger/Webb Creeks.
9. The Tiger Mill EA failed to address Oregon Wild's detailed scoping comments on the values of unroaded areas and the impacts of commercial logging. We hereby incorporate by reference our scoping comments, as portion of which are set forth below.

Significant portion of this project area appear to be unroaded (Mill Creek IRA (bright green in the map below), Tiger Creek Unroaded Area and Forks of the Walla Walla Unroaded Area (darker green below). We urge the FS to avoid commercial logging and road construction in inventoried and uninventoried roadless areas >1,000 acres. Unroaded areas are rare on the landscape and provide disproportionately important ecological values, including wildlife, fish, carbon storage, water quality, snag habitat, recreation, and natural processes. Commercial logging is particularly adverse to these values.



The agency cannot limit its analysis of roadless areas to inventoried areas >5,000 acres, because smaller roadless areas that were not inventoried are ecologically relevant and potentially significant. The NEPA analysis must reflect the growing scientific evidence (cited below) indicating the significant value of roadless areas smaller than 5,000 acres and larger than 1,000 acres. Recent scientific literature emphasizes the importance of unroaded areas greater than 1,000 acres as strongholds for the production of fish and other aquatic and terrestrial species, as well as sources of high quality water. Commercial logging and/or road building within large unroaded areas threatens these significant ecological values.

Boakes et al (2009) explained why it is important to retain large unroaded areas.

Abstract: Habitat clearance remains the major cause of biodiversity loss, with consequences for ecosystem services and for people. In response to this, many global conservation schemes direct funds to regions with high rates of recent habitat destruction, though some also **emphasize the conservation of remaining large tracts of intact habitat**. If the pattern of **habitat clearance is highly contagious**, the latter approach will help **prevent destructive processes gaining a foothold** in areas of contiguous intact habitat. Here, we test the strength of spatial contagion in the pattern of habitat clearance. Using a global dataset of land-cover change at 50x50 km resolution, we discover that intact habitat areas in grid cells are refractory to clearance only when all neighbouring cells are also intact. The **likelihood of loss increases dramatically as soon as habitat is cleared in just one neighbouring cell**, and remains high thereafter. **This effect is consistent for forests and grassland, across biogeographic realms and over centuries, constituting a coherent global pattern**. Our results show that landscapes become vulnerable to wholesale clearance as soon as **threatening processes begin to penetrate**, so actions to prevent any incursions into large, intact blocks of natural habitat are key to their long-term persistence.

Elizabeth H. Boakes, Georgina M. Mace, Philip J. K. McGowan and Richard A. Fuller 2009. Extreme contagion in global habitat clearance. *Proceedings of the Royal Society B: Biological Sciences*. November 25, 2009. doi: 10.1098/rspb.2009.1771.

<https://www.landscapepartnership.org/maps-data/climate-context/cc-resources/ClimateSciPDFs/ProcRSocBo9How%20to%20save%20wilderness.pdf/app-download-file/file/ProcRSocBo9How%20to%20save%20wilderness.pdf>

World Wildlife Fund and the Conservation Biology Institute summarized the important attributes of small roadless areas (1,000-5,000 acres).

- Small roadless areas share many of attributes in common with larger ones, including:
- Essential habitat for species key to the recovery of forests following disturbance such as herbaceous plants, lichens, and mycorrhizal fungi
 - Habitat refugia for threatened species and those with restricted distributions (endemics)
 - Aquatic strongholds for salmonids
 - Undisturbed habitats for mollusks and amphibians
 - Remaining pockets of old-growth forests
 - Overwintering habitat for resident birds and ungulates
 - Dispersal “stepping stones” for wildlife movement across fragmented landscapes

DellaSala, Dominick and James Strittholt. 2002. Scientific Basis For Roadless Area Conservation. World Wildlife Fund. Ashland, OR; Conservation Biology Institute. (June 2002 - Updated October 2003) [https://consbio.org/wp-content/uploads/2022/05/Scientific Basis For Roadless Area Conservation.pdf](https://consbio.org/wp-content/uploads/2022/05/Scientific-Basis-For-Roadless-Area-Conservation.pdf).

In a 1997 letter to President Clinton, 136 scientists said:

There is a growing consensus among academic and agency scientists that existing roadless areas—irrespective of size—contribute substantially to maintaining biodiversity and ecological integrity on the national forests. The Eastside Forests Scientific Societies Panel, including representatives from the American Fisheries Society, American Ornithologists' Union, Ecological Society of America, Society for Conservation Biology, and The Wildlife Society, recommended a prohibition on the construction of new roads and logging within existing (1) roadless regions larger than 1,000 acres, and (2) roadless regions smaller than 1,000 acres that are biologically significant.... Other scientists have also recommended protection of all roadless areas greater than 1,000 acres, at least until landscapes degraded by past management have recovered.... As you have acknowledged, a national policy prohibiting road building and other forms of development in roadless areas represents a major step towards balancing sustainable forest management with conserving environmental values on federal lands. In our view, a scientifically based policy for roadless areas on public lands should, at a minimum, protect from development all roadless areas larger than 1,000 acres and those smaller areas that have special ecological significance because of their contributions to regional landscapes.

Letter to President Clinton from 136 scientists (Dec. 10, 1997).

https://drive.google.com/file/d/oB4L_-RD-MJwrRzhFcm5QcFRoMHM/view?usp=sharing&resourcekey=0-2-sbGMN3bOUBQGGMDBQM1Q

To the list of special values found within unroaded areas must be added carbon storage. European policy leaders consider roadless areas effective for carbon storage and climate mitigation:

[T]he European Parliament has agreed to raise the issue of roadbuilding in intact forests at the UN Climate Change Conference to be held next month in Warsaw (Poland); it calls on parties to use the existence of roads in forest areas as an early negative performance indicator of REDD+ projects, and to prioritise the allocation of REDD+ funds towards road free forests.

Oct 24, 2013 Press release: EUROPEAN PARLIAMENT BACKS THE PROTECTION OF ROADFREE AREAS. <http://kritonarsenis.gr/eng/actions/view/european-parliament-backs-the-protection>. Federal land managers should recognize the tremendous carbon values in unroaded/unmanaged forests and avoid actions that would threaten these values. See also, William R. Moomaw, Susan A. Masino, and Edward K. Faison. 2019. Intact Forests in the United States: Proforestation Mitigates Climate Change and Serves the Greatest Good Front. *For. Glob. Change*, 11 June 2019 | <https://doi.org/10.3389/ffgc.2019.00027>; <https://www.frontiersin.org/articles/10.3389/ffgc.2019.00027/full>. See also, Kun, Z., DellaSala, D., Keith, H., Kormos, C., Mercer, B., Moomaw, W.R. and Wiezik, M. (2020), Recognising the importance of unmanaged forests to mitigate climate change. *GCB Bioenergy*. Accepted Author Manuscript. doi:10.1111/gcbb.12714 <https://onlinelibrary.wiley.com/doi/pdfdirect/10.1111/gcbb.12714>. (“The most effective means for keeping carbon out of the atmosphere to meet climate goals is to protect primary forests (Mackey et al. 2020) and continue growing secondary forests to accumulate additional carbon (proforestation) (Moomaw et al. 2019) while reducing emissions from all sources including bioenergy. ... The importance of primary (unlogged) forests lies in the magnitude and longevity of their carbon stock. In order to reverse the decreasing forest carbon stocks in Europe (EEA, 2019), the largest forest carbon stores must be protected and additional forests must be allowed to continue accumulating carbon (proforestation).”).

“While primary forests of all extents have conservation value, areas of greater extent warrant particular attention where they persist, as they support more biodiversity, contain larger carbon stocks, provide more ecosystem services, encompass larger-scaled natural processes, and are more resilient to external stresses. The significance of large areas of primary forests has been highlighted by the global mapping of Intact Forest Landscapes (IFL) greater than 500 km² in extent. While suitable for many purposes, other thresholds may be more suitable at regional and national levels that reflect local ecological factors.”

IUCN Policy Statement on Primary Forests,

https://www.iucn.org/sites/dev/files/content/documents/iucn_pf-ifl_policy_2020_approved_version.pdf

There are tremendous co-benefits from conserving large blocks of unmanaged forests, such as climate mitigation and biodiversity conservation.

Based on the species–area relationship, regarded as one of ecology’s few universal laws, protection of [too] little habitat will condemn thousands of species to extinction if habitat outside them is converted, degraded or lost. It is this logic that underpins calls for ‘Nature Needs Half’ [26], together with an understanding that ecosystem processes and services of the scale needed to sustain the well-being of life on Earth require large wildlife populations and huge expanses of intact and restored habitat. ... Climate change adds a new dimension to the question of how much protected area coverage is needed to assure conservation of wild nature. Climate change is already reducing wildlife population sizes and forcing range shifts as conditions alter [28,29]. Protected areas counter such stresses by building up populations, and connectivity of populations and habitats is emerging as a key property in securing species persistence and resilience to rapid change [5]. Hence networked protected areas, especially where embedded within well-managed land or seascapes, provide crucial stepping stones to accommodate range shifts and, where no further movements are possible, refuges of last resort [5]. Analyses suggest that adequate levels of population viability and connectivity can be achieved only with marine protected area coverages of 30% or more [27]. ... [G]iven that many ecosystems are already degraded, ensuring continued provision of ecosystem services requires not only the precautionary protection of currently intact habitats, but also large-scale habitat restoration.

Providing greater space for recovery of intact, vibrant nature is not altruistic conservation, but is, we argue, an indispensable act of self- preservation, producing a cascade of benefits that will help maintain the habitability of the biosphere as the climate changes, thereby securing the well-being of generations to come.

Roberts CM, O’Leary BC, Hawkins JP. 2020 Climate change mitigation and nature conservation both require higher protected area targets. *Phil. Trans. R. Soc. B* 375: 20190121.

<https://royalsocietypublishing.org/doi/pdf/10.1098/rstb.2019.0121>. See also, Soto-Navarro C et al. 2020 Mapping co-benefits for carbon storage and biodiversity to inform conservation policy and action. *Phil. Trans. R. Soc. B* 375: 20190128. <http://dx.doi.org/10.1098/rstb.2019.0128> showing the congruence of high carbon value and high biodiversity value in PNW forests.

Law et al (2022) make a strong case that conservation of intact forests advances the twin goals of protecting the climate and biodiversity, and that broad-scale thinning to reduce fire severity conflicts with climate and biodiversity goals.

“While primary forests of all extents have conservation value, areas of greater extent warrant particular attention where they persist, as they support more biodiversity, contain larger carbon stocks, provide more ecosystem services, encompass larger-scaled natural processes, and are more resilient to external stresses. The significance of large

areas of primary forests has been highlighted by the global mapping of Intact Forest Landscapes (IFL) greater than 500 km² in extent. While suitable for many purposes, other thresholds may be more suitable at regional and national levels that reflect local ecological factors.” (IUCN Policy Statement on Primary Forests, https://www.iucn.org/sites/dev/files/content/documents/iucn_pfi-fl_policy_2020_approved_version.pdf, accessed on 22 April 2020).

...

Instead of regularly harvesting on all of the 70% of U.S. forest land designated as “timberlands” by the U.S. Forest Service, setting aside sufficient areas as Strategic Reserves would significantly increase the amount of carbon accumulated between now, 2050 and 2100, and reestablish greater ecosystem integrity, helping to slow climate change and restore biodiversity. The 2022 IPCC AR6 report stated that “Recent analyses, drawing on a range of lines of evidence, suggest that maintaining the resilience of biodiversity and ecosystem services at a global scale depends on effective and equitable conservation of approximately 30% to 50% of Earth’s land, freshwater and ocean areas, including currently near-natural ecosystems (high confidence).” Continuing commercial timber harvest on a portion of the remaining public lands and tens of millions of hectares of private lands would continue to adequately supply a sustainable forestry sector. Preserving and protecting mature and old forests would not only increase carbon stocks and growing carbon accumulation, they would slow and potentially reverse accelerating species loss and ecosystem deterioration, and provide greater resilience to increasingly severe weather events such as intense precipitation and flooding.

...

Many of the existing forest management practices allegedly protect forests and homes from wildfire and are having severe adverse effects on forest ecosystem integrity and resilience, and are worsening climate change and diminishing biodiversity.

...

To summarize, harvest-related emissions from thinning are much higher than potential reduction in fire emissions. In west coast states, overall harvest-related emissions were about 5 times fire emissions ...

Law, Beverly E., William R. Moomaw, Tara W. Hudiburg, William H. Schlesinger, John D. Sterman, and George M. Woodwell. 2022. Creating Strategic Reserves to Protect Forest Carbon and Reduce Biodiversity Losses in the United States. *Land* Vol. 11, no. 5: 721. <https://doi.org/10.3390/land11050721>, <https://www.mdpi.com/2073-445X/11/5/721/html>.

Law et al (2022) describe a strategic reserve approach to protect water, biodiversity, and carbon in Oregon’s forests. Existing unroaded areas could make a significant contribution to such an approach.

Our study demonstrated that Oregon has high carbon density forests that also have high biodiversity and connectivity for species movement. When these characteristics were prioritized within each ecoregion, it identified sufficient forestland to meet both the 30% protection by 2030 and 50% by 2050 targets that are important nationally and internationally. ... the climate resilience rank highlights large areas within the ecoregions with larger landscape features that are important for resilience (Figure 2D), such as the topography of mountain ranges in southwest Oregon, the Coast Range, Cascades, and Blue Mountains in the northeast. ... Meeting the forest preservation targets would substantially increase protection of tree carbon stocks, animal and tree species’ habitat, and surface drinking water source areas. ... Meeting these forest preservation targets would substantially increase forest habitat protection for threatened and endangered (T&E) species and other species of interest ... Mitigation strategies need to explicitly protect existing oldgrowth forests, and allow mature secondary forests to regrow to their

carbon capacity. For climate mitigation using natural climate solutions, effectiveness is based on the time that a unit of biomass carbon is resident in a forest ecosystem stock and thus kept out of the atmosphere (Körner, 2017; Mackey et al., 2020). ... We also found that limiting harvest to half of current levels on public lands and doubling harvest cycles to 80 years on private lands was three times more effective as a land use strategy than replanting and reforestation after cutting within current forest boundaries in Oregon (Law et al., 2018). ... There is concern that protecting areas that are vulnerable to increased drought and fire will be ineffective, however, species diversity, and threatened and endangered species still need habitat, refugia and connectivity with other protected areas. Wildfires tend to be patchy, and a majority of trees survive low to mixed-severity fires (Halofsky et al., 2011) that can be critical habitat, and burned forests still retain the vast majority of their carbon (Hudiburg et al., 2009; Law et al., 2018). ... Older forests in Oregon's watersheds exhibit greater water retention and improved late summer stream flows compared to managed plantations (Segura et al., 2020). Intact forests also tend to harbor more large and old trees, bolstering carbon stores and biodiversity services that large trees provide (Lutz et al., 2018; Plumtre et al., 2021). ... The most important action Oregon can take to mitigate climate change, reduce biodiversity losses, and protect watersheds for drinking water is to set aside existing forests.

Law BE, Berner LT, Mildrexler DJ, Bloemers RO and Ripple WJ (2022) Strategic reserves in Oregon's forests for biodiversity, water, and carbon to mitigate and adapt to climate change. *Front. For. Glob. Change* 5:1028401. doi: 10.3389/ffgc.2022.1028401.
<https://www.frontiersin.org/articles/10.3389/ffgc.2022.1028401/pdf>.

In 1994, several scientific societies submitted a report to Congress and the President recommending conservation of roadless areas larger than 1,000 acres. This report is described by the Interior Columbia Ecosystem Management Project as a "Major Stud[y] of Eastside Ecosystems and Management."

Because roads crisscross so many forested areas on the Eastside, existing roadless regions have enormous ecological value. ... Although roads were intended as innocuous corridors to ease the movement of humans and commodities across the landscape, they harm the water, soils, plants, and animals in those landscapes. [p 6]

...

4. Do not construct new roads or log within existing (1) roadless regions larger than 1000 acres or (2) roadless regions smaller than 1000 acres that are biologically significant.

Roadless regions constitute the least-human-disturbed forest and stream systems, the last reservoirs of ecological diversity, and the primary benchmarks for restoring ecological health and integrity. Roads fragment habitat; alter the hydrological properties of watersheds; discharge excessive sediment to streams; increase human access and thus disturbance to forest animals; and influence the dispersal of plants and animals, especially exotic species, across the landscape. Because many forested areas in eastern Oregon and Washington are heavily dissected by roads, the ecological value of existing roadless regions is especially high. [pp 8, 202]

...

Our analysis defined a roadless region as any region where all points within an LS/OG stand were at least 100 meters from a road or trail.

...

What remains of ponderosa pine and Douglas fir LS/OG is the least protected today. In the four national forests within the Blue Mountains, 48% of the land base above 6000 feet lies in wilderness areas, whereas only 10% of the land below 6000 feet, where ponderosa pine occurs, receives such protection ... [p 110]

... Fifth, roads, whose impact on aquatic and terrestrial resources is well documented, are widely distributed in eastside forests. Road densities in western Colville, Winema, and Ochoco National Forests average 2.5, 3.5, and 3.7 miles per square mile, respectively. Densities reach 8.8 and 11.9 miles per square mile in some watersheds. In the national forests of Oregon's Blue Mountains (Table 5.2), less than 10% of roadless regions on slopes steeper than 60% are now protected, less than 15% on slopes of 30-60%. Moreover, roadless regions, like LS/OG patches, are extensively fragmented. In northern Ochoco National Forest, nearly one-third (38,882 acres) of 128,140 acres of roadless region consists of patches smaller than 1000 acres. (RARE II surveys underestimated total roadless area in this region [45,700 acres] because they considered only areas larger than 5000 acres.) [p 110]

...
CONCLUSIONS

Watersheds outside wilderness and roadless regions in eastern Oregon and Washington are highly degraded. Without an intensive restoration effort on federal and private lands, many native aquatic stocks and species risk extinction. [p 160]

...
Because the distribution of many native fishes in Oregon's national forests has receded into steep headwater areas, USPS has a vital role in protecting the few remaining watershed refugia and preventing further damage to already degraded habitats downstream. Critical to securing eastside [aquatic diversity areas] ADAs as aquatic refugia are the remaining roadless regions, sources of large wood from LS/OG forests, and the integrity of riparian corridors on national forestlands. [p 168]

...
7. High road densities harm many forms of wildlife.
The ecological integrity of existing LS/OG patches and other roadless regions can only be maintained if these sites are not disturbed by the construction of roads. Roadless regions serve as critical refuges for terrestrial wildlife sensitive to human disturbance. Road densities in LS/OG patches that already have roads should be reduced to less than 1 mi/mi². Achieving this goal is vital to rehabilitation of eastside fisheries and terrestrial resources. [p 197]

Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt and E. Beckwitt. 1994. Interim Protection for Late-Successional Forests, Fisheries, and Watersheds: National Forests East of the Cascade Crest, Oregon and Washington. A Report to the Congress and President of the United States. Eastside Forests Scientific Society Panel.

Failure to Prepare an EIS to Address Potentially Significant Effects

NEPA requires preparation of an EIS to address potentially significant effects from proposed federal actions.

The draft EA and FONSI failed to carefully consider potentially significant effects of this project's logging, yarding, road construction, machine piling, pile burning, and associated activities including:

- unproven ground-based cable-assist logging on unsuitable areas that are steep and prone to erosion, especially significant because much of the project area is a municipal watershed,

- adverse effects of logging inventoried roadless area, and undeveloped areas that have not been previously logged and provide disproportionate ecosystem services,
- unnecessary logging to reduce fuels on cold/moist forests that are naturally more dense and relatively less prone to frequent fire,
- complex and uncertain effects of commercial logging that removes canopy fuels that can actually make fire hazard worse if removed and help reduce fire hazard if retained. Such logging may be contrary to the purpose and need,
- potential violation of the LRMP (as amended) standards & guidelines and other laws, such as logging in the IRA and logging in the RNA,
- logging-related greenhouse gas emissions that contribute to the global climate crisis,
- potential impacts to ESA-listed species, including steelhead and bull trout,
- taking action to address fire hazard while a community-based watershed resiliency plan is under development, but not yet completed,
- even the Forest Service's proclaimed beneficial effects may be significant and worthy of an EIS.

The Tiger Mill EA does not provide a balanced view of all the effects of logging and roads. The Tiger Mill EA uses motivated reasoning to over-estimate project benefits, and under-estimate adverse effects described in this objection and or comments. The Tiger Mill EA and FONSI never meaningfully weigh the alleged benefits and harms.

Failure to Document Compliance with Substantive Requirements

The National Forest Management Act requires the agency to follow the LRMP. The majority of the project area is in land allocations that discourage commercial logging, such as:

- **C4 – Wildlife Habitat** – “All timber management practices and intensities consistent with achieving the primary wildlife habitat management goals will be permitted. ... Road construction, reconstruction, and maintenance are permitted, consistent with the primary overall objective of wildlife habitat management.” pp 4-166-167. The Tiger Mill EA does not explain how so much logging is consistent with the primary wildlife objective. Wildlife have specific habitat needs that logging typically degrades, such as removal of cover and depletion of snags and dead wood. Just saying its more resilient is not enough.
- **D2 - Research Natural Area** - “The ecological community will continue to evolve through natural processes ... Timber management use and practices are excluded. Cutting and removal of vegetation is prohibited,” Umatilla LRMP pp 4-181-182. During scoping the Forest Service said there would be 779 acres of commercial logging in the RNA, but the EA does not say if this number has changed. In any case, the EA does not explain whether and how logging may affect the RNA and meet the LRMP requirements.
- **F2 - Municipal Watershed – Undeveloped** - “Natural vegetative conditions will occur throughout the watershed ... No scheduled timber harvest activities are permitted.” Umatilla LRMP p 4-193. During scoping the Forest Service said there would be 330 acres of commercial logging in this land allocation, but the EA does not say if this number has changed. The Tiger Mill EA does not explain whether and how logging may affect the

“natural vegetative conditions” of F2 and meet the LRMP requirements. Nor does it explain whether logging and future maintenance activities represent “scheduled” activities.

- **F4 - Walla Walla River Watershed** – “primarily undeveloped area. ... Some additional logging and timber management will be evident only in areas where past harvest has occurred. ... [T]imber will be managed on a scheduled basis only on designated lands, as mapped. The area encompasses a total of 34,950 acres, of which 3,382 acres are suitable for timber management.” Umatilla LRMP pp 4-198-200. The Tiger Mill EA does not explain whether this project is located in the small portion of the land allocation that is suitable for timber harvest and was subject to prior timber harvest.
- **Inventoried roadless area** – Logging prohibited with exceptions. The Tiger Mill EA fails to take a hard look at whether logging naturally dense cold/moist forests moves them toward or away from characteristic structure and composition and fire regimes. See above.
- **Eastside Screens** – Do not log Late Old Structure (LOS) forest unless it is above the historic range of variability. Maintain large trees >21” dbh both inside and outside LOS. Outside LOS, “maintain and/or enhance LOS components in stands subject to timber harvest ... Manipulate vegetative structure that does not meet late and old structural (LOS) conditions, ... in a manner that moves it towards these conditions as appropriate to meet HRV.” Identify connectivity corridors at least 400 feet wide that link all LOS stands in at least 2 directions. Such corridors must be maintained as dense as possible with medium and large trees, or in the top third of site-potential and at least 50% canopy cover. EA Appendix C says “Treatments within old growth will maintain or improve old growth characteristics,” but this is unsupported. The definition of LOS includes both accumulated dead wood and multiple canopy layers¹, so logging narrowly designed to reduce fire hazard will often simplify forest structure and violate the Eastside Screens. Note: The definition of LOS includes both accumulated dead wood and multiple canopy layers, so logging narrowly designed to reduce fire hazard will often simplify forest structure and violate the Eastside Screens. The EA does not appear to provide a map of LOS or connectivity corridors, or describe whether logging prescriptions were adjusted to maintain required canopy cover, or how logging moves stands toward LOS conditions, so there is no way to determine compliance with the Eastside Screens.

The EA does it disclose how logging and road building are compatible with these land allocations. In fact, the EA does not even provide a clear description of the management objectives and standards & guidelines for each of these land allocations.

All site-specific activities must comply with the governing forest plan. National Forest Management Act, 16 U.S.C. § 1604(i).

NEPA requires disclosure of information necessary to determine compliance with legal requirements such as the Endangered Species Act, Clean Water Act, National Forest Management Act, and applicable Forest Plan Standards & Guidelines. See 40 CFR 1508.27(b)(10) and *NW Indian Cemetery Protective Association v. Peterson*, 795 F2d 688 (9th Circ. 1986). In this G-O Road case, the NEPA document described water quality changes

¹ USDA/USDI. ICBEMP SDEIS. Appendix 17a – Definitions of Old Forest.
<https://web.archive.org/web/20161221104651/http://www.icbemp.gov/pdfs/sdeis/volume2/appendix17a.pdf>.

resulting from a road project in terms of 7-day average changes, whereas the applicable WQ standard was defined by daily peak changes. The court found this to be a NEPA violation.

The USDA Office of General Counsel agrees that project level analysis must document “Project Compliance With Other Laws.”

In addition to consistency with the LRMP each project must be in compliance with NEPA, CWA, CAA and other laws. Simply being consistent with the LRMP does not fulfill the site-specific requirements of Federal law. Project level analysis is to “determine findings for NFMA, to ensure compliance with NEPA, and to meet other appropriate laws and regulations.” Forest Service Land and Resource Management Planning, FSM 1920 and Forest Service Handbook 1909.12, 5.31. 53 Fed. Reg. 26807, 26836 (July 15, 1988).

OGC, “Forest Plan and Project Level Decisionmaking— Overview of Forest Planning and Project Level Decisionmaking,”

<http://web.archive.org/web/2003011060230/http://www.fs.fed.us/forum/nepa/decisionm/p4.html>

<http://web.archive.org/web/20060829000705/http://www.fs.fed.us/emc/nfma/includes/overview.pdf>

The CEQ NEPA regulations also require an analysis of legal requirements in order to determine whether an action may cause significant impacts on the environment. 40 CFR §1508.27(b)(10) (“*Significantly*, as used in NEPA, requires considerations of both context and intensity: ... The following should be considered in evaluating intensity: ... Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.” *Emphasis added.*) The NEPA documents must make a showing of compliance with substantive legal requirement in order to support a valid Finding of No Significant Impact. *SAS v. Mosely*, 798 F.Supp. 1473 (W.D. Wash. May 1992) (“The FEIS has thus mentioned what appears to be a major consequence of the plan jeopardy to other species that live in the old growth forests without explaining the magnitude of the risk or attempting to justify a potential abandonment of conservation duties imposed by law. An EIS devoid of this information does not meet the requirements of NEPA.” *Emphasis added.*)

The Forest Service NEPA Handbook also requires that Decision Notices explain complete[ly] and comprehensive[ly]” how the NEPA decision complies with applicable legal requirements including the LRMP land allocations and Standards & Guidelines.

FSH 1909.15 Chapter 40, 43.21 - **Format and Content**

Decision notices document the conclusions drawn and the decision(s) made based on the analysis in the EA. Decision notices should conform to the following format and content. While sections may be combined or rearranged in the interest of clarity and brevity, the information needs to be complete and comprehensive.

...

6. Findings required by other laws and regulations. Include any findings required by any other laws which apply to the decision being made. Cite the project record or environmental analysis document that contains the information being used to support the findings. Describe how the decision is consistent with applicable laws and regulations. For example, findings regarding consistency with the forest plan (allocation, and standards and guidelines), suitability for timber production, and vegetation management criteria required by the National Forest Management Act and 36 CFR part 219. (emphasis added)

http://web.archive.org/web/20090118192937/http://www.fs.fed.us/im/directives/fsh/1909.15/1909.15_40.doc

See also, Judge King's October 2003 Decision in *ONRC Action v. U.S. Forest Service*, CV. 03-613-KI (“The underlying EAs for the timber sales at issue did not properly frame the Forest Service’s survey and manage duties, they did not analyze a range of alternatives based upon these duties, they did not evaluate completed surveys, they did not demonstrate that the Forest Service had all of the proper information before it before allowing logging, and they did not provide for public influence over the decisions. For all of these reasons, the underlying EAs are legally deficient.” *Emphasis added.*)
<http://web.archive.org/web/20041105214752/http://www.onrc.org/press/ONRCv.USFS.pdf>

And also Judge Hogan’s ruling in *Klamath Siskiyou Wildlands Center v. Boody* (D. Or. #03-3124-CO. May 18, 2004) where he held “plaintiffs have raised a serious question as to whether BLM violated NEPA in failing to disclose sufficient information in the EA to confirm compliance with ... the RMP.” (Order at page 18). <https://casetext.com/case/klamath-siskiyou-wildlands-center-v-boody-2>.

Failure to Take a Hard Look at Logging Effects on Snag Habitat.

The EA failed to take a hard look at issues that we raised in our scoping comments related to the long-term adverse effect of logging on snags and dead wood habitat. This violates NEPA’s mandate for high quality information and accurate analysis.

Snags and dead wood provide important valuable for a variety of wildlife and fish. They also serve a variety of other ecosystem services, including erosion control, slope stability, carbon storage, capture/store/release water/sediment/nutrients, etc. See Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. *Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management*, Chapter 24 in *Wildlife-Habitat Relationships in Oregon and Washington* (Johnson, D. H. and T. A. O’Neil. OSU Press. 2001)
<http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf>. Logging will remove 58% of the basal area in treated stands (more in some areas) and will significantly deplete the pool of green trees available for recruitment of snag habitat. The EA (p 74) contains misleading and incomplete statements like “snags are expected to be retained in thinned stands.” This misses the fact that many snags will in fact be removed for safety reasons, and more significantly, the long-term recruitment of snags is affected for a very long time by the removal of more than half of the green trees.

The EA (p 74) says “Pileated woodpeckers appear to tolerate considerable tree mortality and canopy closure reductions when abundant large snags and down wood remain” But this statement is made in relation to prescribed fire which does not remove trees. The EA remains silent about the effects on wildlife that thrive in areas with abundant snags after removal of the majority of trees by logging.

The EA (pp 74-75) says “trees that remain after thinning are expected to accelerate growth and be less susceptible to mortality. In the long term this could provide future levels of large trees, snags, and down wood which would provide valuable habitat features that seldom develop in existing high density, stem exclusion condition found throughout much of the project area.” This

is inaccurate and misleading. The EA fails to provide any evidence to support this assertion that logging is better than not logging. There are modelling tools available (such as FVS) to help the Forest Service get past its myopic thinking that logging is good for snags. Virtually every quantitative analyses we are aware of shows that unlogged stands produce more large snags than logged stands. For example, this graph from the Curran Junetta Thin EA shows that heavy thinning delays by more than 60 years the attainment of habitat objectives for large snags (i.e. mid-point of the gray band representing 30-80% tolerance level).

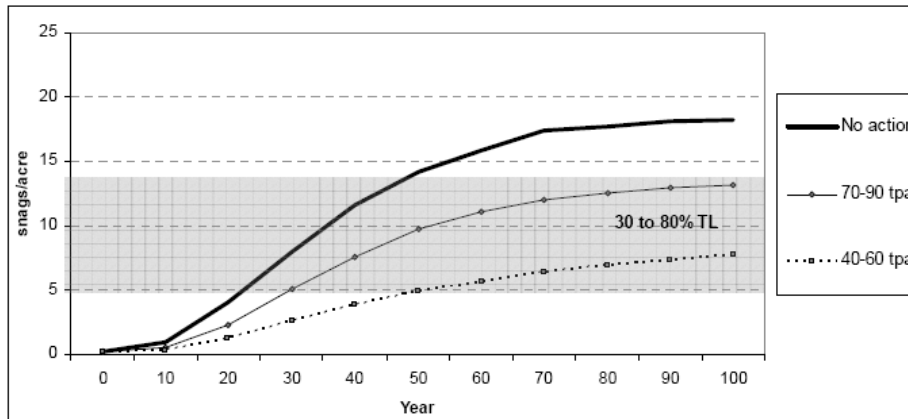


Figure 15. Short and long-term changes to ≥20" dbh snags.

<https://usfs-public.app.box.com/v/PinyonPublic/folder/158152590920>.

The analysis in the Tiger Mill EA emphasizes continued growth on a minority of trees that are retained, while de-emphasizing the fact that trees continue to grow even when they are not thinned, and logging removes the majority of trees so they can never be recruited as snags. The trees removed from the forest by logging are trees that would continue growing and provide future large snags. The EA never meaningfully addresses the effects of logging on snags and dead wood habitat.

The EA says “Overall, there would be no meaningful departures from reference conditions or reduction in primary cavity excavator distribution or abundance.” The ES does not provide meaningful analysis to support these conclusions. The FS failed to use best available science, such as DecAID, to disclose the effects of logging on wildlife that thrive in areas with abundant snags. The Wildlife BE (p 16) cites DecAID, but the tool does not appear to be discussed anywhere in the NEPA record.

Failure to Take Hard Look at Whether Fuel Reduction via Commercial Logging is Appropriate in Cold/Moist Forests.

93% of the project area is moist and cold forest vegetation types. These forest types tend to develop relatively dense vegetation and experience relatively infrequent fire. Many forest and fire experts recommend that fuel reduction focus on warmer/dryer areas mainly at lower elevations, and they de-prioritize fuel reduction in cool/moist areas. Where resources for fuel reduction are limited, the FS appears to be using scarce resources in an inefficient manner. NEPA requires the agency to consider and discuss responsible opposing viewpoints.

Forests with infrequent, stand-replacing fire regimes are not good candidates for fuel reduction. Many of the stands where restoration of historical forest conditions is needed are open canopy and located on south facing slopes and at lower elevations. In contrast, many closed canopy stands are often located at higher elevations and on north-facing slopes where restoration of historical forest conditions is not needed.

R. V. Platt, T. T. Veblen, and R. L. Sherriff. 2008. Spatial Model of Forest Management Strategies and Outcomes in the Wildland–Urban Interface Natural Hazards Review, Vol. 9, No. 4, November 1, 2008. DOI:10.1061/(ASCE)1527-6988(2008)9:4(199)
http://public.gettysburg.edu/~rplatt/Platt%20et%20al._NatHazReview08.pdf.

To date, most climate adaptation guidance has focused on recommendations for frequent-fire forests, leaving few published guidelines for forests that naturally experience infrequent, stand-replacing wildfires. Because most such forests are inherently resilient to stand-replacing disturbances, and burn severity mosaics are largely indifferent to manipulations of stand structure (i.e., weather-driven, rather than fuel-driven fire regimes), we posit that pre-fire climate adaptation options are generally fewer in these regimes relative to others. Outside of areas of high human value, stand-scale fuel treatments commonly emphasized for other forest types would undermine many of the functions, ecosystem services, and other values for which these forests are known.

Halofsky, J. S., D. C. Donato, J. F. Franklin, J. E. Halofsky, D. L. Peterson, and B. J. Harvey. 2018. The nature of the beast: examining climate adaptation options in forests with stand-replacing fire regimes. *Ecosphere* 9(3):e02140. DOI:10.1002/ecs2.2140.
<https://esajournals.onlinelibrary.wiley.com/doi/pdf/10.1002/ecs2.2140>

Fewer options exist for reducing fire severity in wetter, high-elevation and coastal forests of the Pacific Northwest, historically characterized by infrequent, stand-replacement fire regimes. In these ecosystems, thinning and hazardous fuel treatments are unlikely to significantly affect fire behavior, because fuels are abundant and fires typically occur under extreme weather conditions (i.e., during severe drought).

Joanne J. Ho, Robert A. Norheim, Jessica E. Halofsky, David L. Peterson, Brian J. Harvey 2019. Changing Wildfire, Changing Forests - How climate change is affecting fire regimes and vegetation in the Pacific Northwest (storymap)
<https://uw.maps.arcgis.com/apps/Cascade/index.html?appid=9cof8668f47c4773b56c9b9ae6c301e3> based on Jessica E. Halofsky, David L. Peterson, and Brian J. Harvey. 2018. Changing Wildfire, Changing Forests: A Synthesis on the Effects of Climate Change on Fire Regimes and Vegetation in the Pacific Northwest. Seattle: Northwest Climate Adaptation Science Center.
<https://nwcasc.uw.edu/science/project/changing-fires-changing-forests-the-effects-of-climate-change-on-wildfire-patterns-and-forests-in-the-pacific-northwest/>

Restoration of Moist Forests is not intended to alter their historical wildfire behavior. Rather it is intended to accelerate the development of older complex forest ... Forests that have dominantly high-severity fire regimes (Moist Forests) have no ecological requirement for management to alter fuels and fire behavior, including old-growth stands. ... Calls to log forests to save them (Tuckey 2001) are overly simplistic. In this case, fire and forest management recipes suitable in one situation (e.g., for restoring the natural fire regime of a dry forest) might be inappropriate (and even counter productive) in another (e.g., a relatively moist forest) (Brown et al. 2004).

Johnson K.N., Franklin, J.F. 2009. Restoration of Federal Forests in the Pacific Northwest: Strategies and Management Implications.
<https://web.archive.org/web/20170221082525/http://www.blm.gov/or/districts/medford/plans/files/FranklinJohnson.pdf>.

The agency has an obligation to respond in the final NEPA document to responsible opposing viewpoints concerning the consequences of the proposed action. The law requires agencies to include a “reasoned discussion of major scientific objections” to the reasoning that underlies an EIS. Moseley, 798 F. Supp. at 1482. Indeed, NEPA regulations demand that an agency “insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements.” 40 C.F.R. § 1502.24.

The Ninth Circuit has repeatedly confirmed that NEPA requires the government to “disclose and discuss” scientific controversy in the NEPA documentation for the proposed project. See *Center for Biological Diversity v. Forest Serv.*, 349 F.3d 1157, 1169 (9th Cir. 2003). When the Forest Service claimed that the northern goshawk was a habitat generalist and failed to respond to comments to the contrary, the Ninth Circuit said—

While the agency is not required to publish each individual comment in the final statement, *Cal. v. Block*, 690 F.2d at 773 (internal citation omitted); 40 C.F.R. § 1503.4(a), the regulations clearly state that the agency must disclose responsible opposing scientific opinion and indicate its response in the text of the final statement itself. 40 C.F.R. § 1502.9(b). The mere presence of the information in the record alone does not cure the deficiency here. See *False Pass v. Watt*, 565 F. Supp. 1123, 1141 (D. Alaska 1983) (holding that neither the administrative record outside of the environmental impact statement itself nor any other evidence may be used to remedy deficiencies in the environmental impact statement) (citing *Grazing Fields Farm v. Goldschmidt*, 626 F.2d 1068, 1074 (1st Cir. 1980)), *aff’d sub nom. False Pass v. Clark*, 733 F.2d 605 (9th Cir. 1984).

Accordingly, we find that the Final EIS fails to disclose and discuss responsible opposing scientific viewpoints in the final statement itself in violation of NEPA and the implementing regulations.

Center for Biological Diversity v. United States Forest Service, No. 02-16481 (9th Cir., Nov. 18, 2003). Available at: <http://caselaw.findlaw.com/us-9th-circuit/1173711.html>.

In *Sierra Club v. Eubanks* (Civ. S 03-1238 MCE PAN; E.D. Cal. August 20, 2004) the court rejected an EIS where the Forest Service failed to disclose and consider evidence expressed in scientific studies that logging-generated slash could increase fire hazard. The Forest Service relied on various published scientific papers to support the idea that removal of fuels through logging, regardless of fuel size, would reduce fire hazard, but the court said

[T]here is no indication that any views they expressed contrary to the logging proposed by the Red Star Project were duly weighed. ... [W]hile the FEIS concludes that ‘the preponderance of peer reviewed scientific information indicates that the proposed activities will help speed the recovery of the burned areas while also reducing future wildland fire severities.’ without proper analysis of all the available scientific literature that conclusion appears suspect. ... By failing to adequately consider and evaluate adverse scientific opinion, the Red Star Project FEIS fails to meet NEPA requirements for taking the requisite ‘hard look’ In *Sierra Club v. Bosworth*, 199 F. Supp. 2d 971 (N.D. Cal 2002), like the present case the ... court concluded that the EIS at issue in that case violated NEPA ‘by failing to disclose and analyze scientific opinion in support of and in opposition to the conclusion that the ... project will reduce the intensity of future wildfires in the project area.’ ... NEPA specifically requires Defendants to objectively

evaluate and disclose credible scientific evidence that contradicts its proposed course of action. 40 C.F.R. § 1502.9(b).

Failure to Take a Hard Look at the Relative Efficacy of Removing Canopy Fuels vs Surface and Ladder Fuels.

The Tiger Mill EA failed to take a hard look at issues that we raised in our scoping comments, including the relative ineffectiveness of commercial logging that mainly removes less hazardous canopy fuels versus non-commercial thinning and prescribed fire that mainly removes more hazardous surface and ladder fuels. This violates NEPA's mandate for high quality information and accurate analysis.

The Forest Service can meet its objectives to reduce fire hazard while mitigating effects of commercial logging on water, wildlife, and carbon, by doing lighter treatments such as non-commercial thinning and prescribed fire. Oregon Wild scoping comments raised concerns about the fact that canopy fuels are not very hazardous because they are high above the forest floor where most fires burn. When canopy fuels carry across the landscape it is due to high winds, and thinning does little to mitigate fire spread in such circumstances. Logging also has complex effects on fire and fuels. Removing canopy fuels makes the forest hotter/drier/winder, moves more hazardous fine fuels from the canopy to the ground where they are more vulnerable to surface fires, stimulates the growth of surface and ladder fuels, and makes follow-up treatments more expensive. Commercial logging also requires roads and more heavy equipment that have significant effects on soil and watershed integrity. Roads also increase fire ignition risk. Focusing on non-commercial thinning and prescribed fire avoids many of the worst trade-offs of logging and still achieves objectives. The Tiger Mill EA failed to take a hard look at these issues, and failed to weigh the marginal benefits of canopy removal versus the significant costs in terms of complex fire effects, and effects to water, wildlife, carbon, soil, etc.

Before embarking on an aggressive strategy of crown fuel reduction, the agency must address the responsible opposing viewpoints regarding the manifold values of retaining more canopy to retain cooler temperatures and moisture. Responsible opposing experts say that reducing surface fuels and ladder fuels should be the first priority and reducing canopy fuels a lesser priority.

The NEPA analysis needs to account for the fact that canopy fire risk is greatly reduced by treating surface and ladder fuels because of the increased spatial gap in the vertical continuity of fuels as well as the reduced preheating of canopy fuels by burning fuels below the canopy.

An implicit assumption of many logging proponents is that less fuels means less fire. This is not supported by the evidence. Less fuel does NOT mean less fire. Some fuel can actually help reduce fire, such as deciduous hardwoods that act as heat sinks (under some conditions), and dense canopy fuels that keep the forest cool and moist and help suppress the growth of surface and ladder fuels, and those canopy fuels are connected to large tree boles with thick bark that do not readily burn.

Omi and Martinson (2012) prepared a review of the literature for managers and concluded —

That no relationship ($r^2 < 0.06$) was found between canopy fuel variables and the effectiveness of either surface reduction treatments without thinning or thinning treatments without subsequent slash treatment supports the assertion that surface fuel reduction is of primary importance in influencing treatment effectiveness.

Omi & Martinson 2012. Effectiveness of Fuel Treatments for Mitigating Wildfire Severity: A Manager-Focused Review and Synthesis. Joint Fire Science Program. Final Report. JFSP Project Number 08-2-1-09

https://web.archive.org/web/20121014013021/http://www.firescience.gov/projects/08-2-1-09/project/08-2-1-09_finalreport08-2-1-09.pdf.

Opening up the stand significantly will dry surface fuels due to increased light levels, surface winds and temperatures. This may increase surface fire intensity and rate of spread unless total surface fuel loading is reduced. In addition, thinning that allows significant light to reach the forest floor may result in the regrowth of small trees and shrubs, which over time become new ladder fuels.

Stephen Fitzgerald and Max Bennett. 2013. A Land Manager's Guide for Creating Fire-Resistant Forests. EM 9087. OSU Extension.

<http://www.nwfirescience.org/sites/default/files/publications/A%20Land%20Managers%20Guide%20for%20Creating%20Fire-resistant%20Forests%20.pdf>

“Defoliation of upper canopies will likely increase understorey light availability on the forest floor, and subsequently promote the rapid growth of subcanopy species.” Choi, D. H., LaRue, E. A., Atkins, J. W., Foster, J. R., Matthes, J. H., Fahey, R. T., Thapa, B., Fei, S., & Hardiman, B. S. (2023). Short-term effects of moderate severity disturbances on forest canopy structure. *Journal of Ecology*, 111(9), 1866-1881. <https://doi.org/10.1111/1365-2745.14145>. The proliferation of understories after logging has significant implications for fuel hazard and fire control.

Removing canopy fuels creates canopy gaps and thus “radiation reaching the forest floor and air movement beneath the residual live tree canopy are increased, and both contribute to fuel drying. More open canopies also contribute to greater understory vegetation growth. The consequences of these changes on fire behavior are not fully understood, but such conditions may favor ignition and spread of fire more readily than in forests having few canopy gaps ...” Kaufmann M.R., G.H. Aplet, M. Babler, W.L. Baker, B. Bentz, M. Harrington, B.C. Hawkes, L. Stroh Huckaby, M.J. Jenkins, D.M. Kashian, R.E. Keane, D. Kulakowski, C. McHugh, J. Negron, J. Popp, W.H. Romme, T. Schoennagel, W. Shepperd, F.W. Smith, E. Kennedy Sutherland, D. Tinker, and T.T. Veblen. 2008. The status of our scientific understanding of lodgepole pine and mountain pine beetles – a focus on forest ecology and fire behavior. The Nature Conservancy, Arlington, VA. GFI technical report 2008-2. http://csfs.colostate.edu/pdfs/LPP_scientific-LS-www.pdf.

“Thinning is most effective when it removes understory trees, because larger overstory trees are more resistant to heat injury (Agee and Skinner 2005). In addition, shade and competition from larger trees slows the recruitment of younger trees in the understory.” Keeley, J.E.; Aplet, G.H.; Christensen, N.L.; Conard, S.C.; Johnson, E.A.; Omi, P.N.; Peterson, D.L.; Swetnam, T.W. 2009. Ecological foundations for fire management in North American forest and shrubland ecosystems. Gen. Tech. Rep. PNW-GTR-779. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 92 p. https://www.fs.usda.gov/pnw/pubs/pnw_gtr779.pdf.

In areas with relatively high productivity that can support shrubs, canopy removal via thinning is very likely to stimulate the proliferation of shrubs and create the very conditions that favor more severe crown damage during fire. This study also challenges the very popular notion that dense forests are a fire hazard. A meta-analysis of the effects of partial cutting showed that understory growth was stimulated in all cases. D. Zhou, S. Q. Zhao, S. Liu, and J. Oeding. 2013. A meta-analysis on the impacts of partial cutting on forest structure and carbon storage. *Biogeosciences*, 10, 3691–3703, 2013. <https://www.biogeosciences.net/10/3691/2013/bg-10-3691-2013.pdf>. (“Understory C was stimulated significantly by partial cutting in all of the studies. This stimulation can be mostly attributed to an increase in the availability of light, water, and nutrients to the understory because of tree removal (Aussenac, 2000; Kleintjes et al., 2004; Deal, 2007)”)

Models show that maintaining canopy cover is a useful way to reduce fire hazard, while removing canopy increases fire hazard.

Compared with the original conditions, a closed canopy would result in a 10 percent reduction in the area of high or extreme fireline intensity. In contrast, an open canopy has the opposite effect, increasing the area exposed to high or extreme fireline intensity by 36 percent. Though it may appear counterintuitive, when all else is equal open canopies lead to reduced fuel moisture and increased midflame windspeed, which increase potential fireline intensity.

Rutherford V. Platt, Thomas T. Veblen, and Rosemary L. Sherriff. 2006. Are Wildfire Mitigation and Restoration of Historic Forest Structure Compatible? A Spatial Modeling Assessment. *Annals of the Association of American Geographers*, 96(3), 2006, pp. 455–470. http://www.colorado.edu/geography/class_homepages/geog_4430_f10/Platt%20et%20al_Wildfire%20Mitigation_AnAAG_2006.PDF.

Modeling shows that canopy fuel reduction is accomplished at the expense of increasing surface fire intensity.

Modifying canopy fuels as prescribed in this method may lead to increased surface fire intensity and spread rate under the same environmental conditions, even if surface fuels are the same before and after canopy treatment. Reducing CBD to preclude crown fire leads to increases in the wind adjustment factor (the proportion of 20-ft windspeed that reaches midflame height). Also, a more open canopy may lead to lower fine dead fuel moisture content. These factors increase surface fire intensity and spread rate. Therefore, canopy fuel treatments reduce the potential for crown fire at the expense of slightly increased surface fire spread rate and intensity.

Scott, Joe. 2003. Canopy Fuel Treatment Standards for the Wildland-Urban Interface. USDA Forest Service Proceedings RMRS-P-29. 2003. https://web.archive.org/web/2011025035919/http://www.fs.fed.us/rm/pubs/rmrs_p029/rmrs_p029_029_038.pdf.

The Tiger Mill EA contains highly simplified analysis that equates canopy removal with fire risk reduction without acknowledging the trade-offs and complexities of the issue.

Bottom line: non-commercial thinning and prescribed fire are relatively non-controversial with fewer trade-offs, while commercial logging has marginal benefits, significant adverse trade-offs, and deserves much more careful scrutiny. Just because timber sales are the Forest Service’s bread and butter, does not waive their responsibility to conduct careful NEPA analyses.

***Stabilizing* Forest Carbon is not a Climate Solution.**

The Tiger Mill EA (p 84) says that the project would “contribute to more stable forest carbon stocks” suggesting that logging provides a climate benefit by stabilizing carbon stocks. However, the EA fails to recognize that stabilizing carbon at the stand scale is not scientifically supported as a climate solution. The EA thus violates NEPA’s requirement for high quality information and accurate analysis.

"Stabilizing" forest carbon is becoming a buzzword and a new goal for forest management, but it is NOT a climate solution. In order to address the global climate crisis, we need to *reduce* atmospheric carbon at the *global* scale, not *stabilize* forest carbon at the *local* scale. This is because Earth’s atmosphere is well-mixed. It does not matter if forest carbon booms and busts at the scale of stands or even landscapes. What matters is the total amount of carbon in the atmosphere, which is the net result of both carbon emissions in some locations, and carbon uptake in the rest of the living landscape that is still growing. From a climate perspective, it might make more sense to let forests grow and accumulate carbon in vegetation and soils (let forest carbon *boom*), even if it is not considered "sustainable" over the long term because it will eventually burn (the carbon might go *bust*), because every day/week/month/year that carbon stays in forests and soils is a day/week/month/year with less solar forcing.

The goal of stabilizing carbon is especially suspect when the proposed activities required to stabilize carbon themselves emit carbon. The first problem is that emissions come first and alleged carbon benefits from avoided disturbance are delayed. This time lag conflicts with the urgent need to avoid emissions and store carbon in the near term.

The second problem is that the carbon emissions from efforts to stabilize carbon very likely exceed the carbon “savings” from those stabilizing actions. This is because it is impossible to predict where or when natural destabilizing events such as wildfire might occur. Only a small fraction of deliberate actions taken to stabilize forest carbon will actually interact with natural disturbance events and provide carbon benefits. Most individual efforts to stabilize carbon will cause carbon emissions without any offsetting carbon benefits, so collectively, efforts to stabilize carbon will emit more carbon than just letting forest carbon accumulate, and eventually boom and bust.

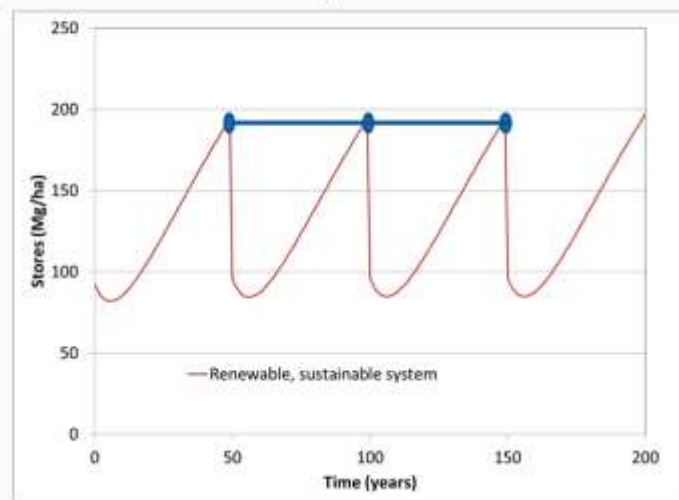
Some forests may be storing more carbon than the carbon carrying capacity projected under climate change. Such forests are providing a great climate service to humanity (as well as great benefits to threatened & endangered species that rely on such forests), especially in the short-term, while the global need to reduce GHG emissions is most urgent. There are significant trade-offs related to any proposal to artificially remove medium and large trees from carbon-rich forests in order to help them match their projected carbon carrying capacity. We must carefully consider the cumulative effects of doing so across large areas, because it would cause tremendous additional and unneeded GHG emissions.

Some NEPA analyses say that logging is *carbon neutral* because the forest captures and stores the same pre-harvest amount of carbon after a period of regrowth. This is highly misleading.

The proper analysis requires comparison of the amount of carbon *with* the project and *without* the project, not *before* and *after* logging. This is not only required to accurately determine the effect of vegetation removal on forest carbon storage but it is also consistent with NEPA requirements to compare *action* and *no action* alternatives.

Comparing carbon in the system at two points in time is unscientific. A proper analysis requires measuring carbon in the system of interest over time compared to a reference or control.

- **Using a control or independent reference**



The approach shown above is improper. As explained by Mark Harmon:

All too often explanations of forest carbon dynamics are not science-based. Why? They involve using the system as its own reference or control. That is not a scientific assessment method. So while it sounds scientific to explain how after a harvest the forest regrows and hence there is no carbon impact, one cannot tell the impact. We can tell over time that the amount returns to the original level, but we still cannot assess the impact scientifically. The fact the system is renewable and sustainable is largely irrelevant in answering the question of whether the system is carbon neutral.

Mark Harmon 2020. Forest Carbon Basics: Five Key Guidelines, Presentation to Many Rivers Group of the Sierra Club, Banking on Carbon Webinar, Oct 13, 2020.

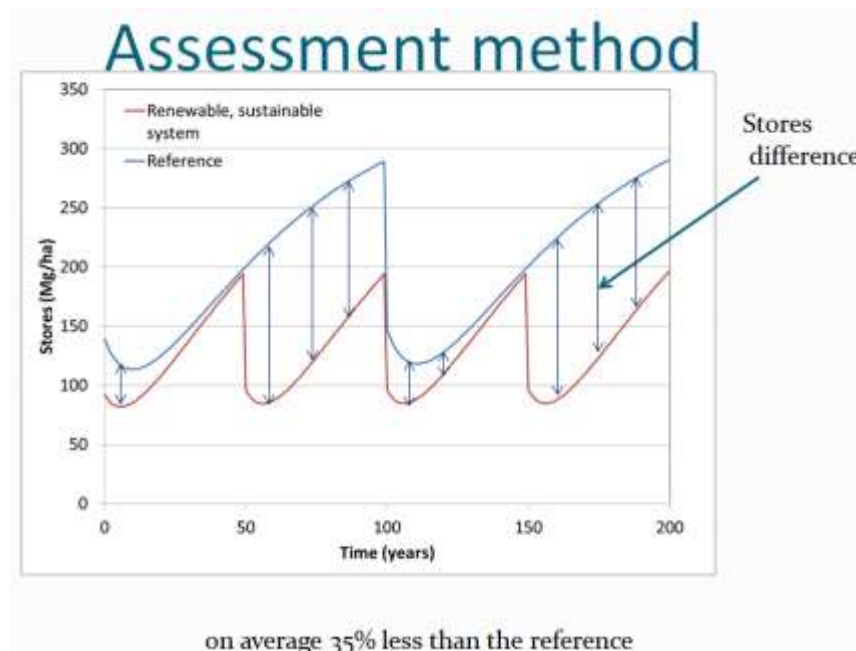
A better approach is shown below, and explained by Mark Harmon:

Here is an example in which there is an independent control or alternative. We can see that there is a difference between the two systems and that the so-called renewable, sustainable system stores on average 35% less than the reference. So if we switch from the reference system to the renewable, sustainable system we must lose carbon from that part of the system.

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NEPA requires comparison of alternatives based on high quality information and accurate scientific analysis, which requires evaluating the carbon consequences of different forest management systems and comparing that to the carbon consequences of not logging.

Similarly, Cardellichio et al (2010) explain:

The only way to properly evaluate the net carbon impacts of energy from forest biomass [or any vegetation management] is to estimate ... net change in atmospheric CO₂ levels over time *with* and *without* the harvest of wood biomass for energy. ...[I]t is necessary to construct a baseline, or control, scenario (that is no biomass harvest). ... Once a baseline is established, one can assess how switching to wood biomass would change atmospheric carbon levels. ... [T]he information provided by only comparing forest carbon stocks before and after biomass harvest could be a very misleading indicator of the impact of biomass energy on the atmosphere.

Cardellichio, P., Walker, T. 2010. Commentary: The Manomet Study Got the Biomass Carbon Accounting Right. The Forestry Source. 4 Nov 2010.

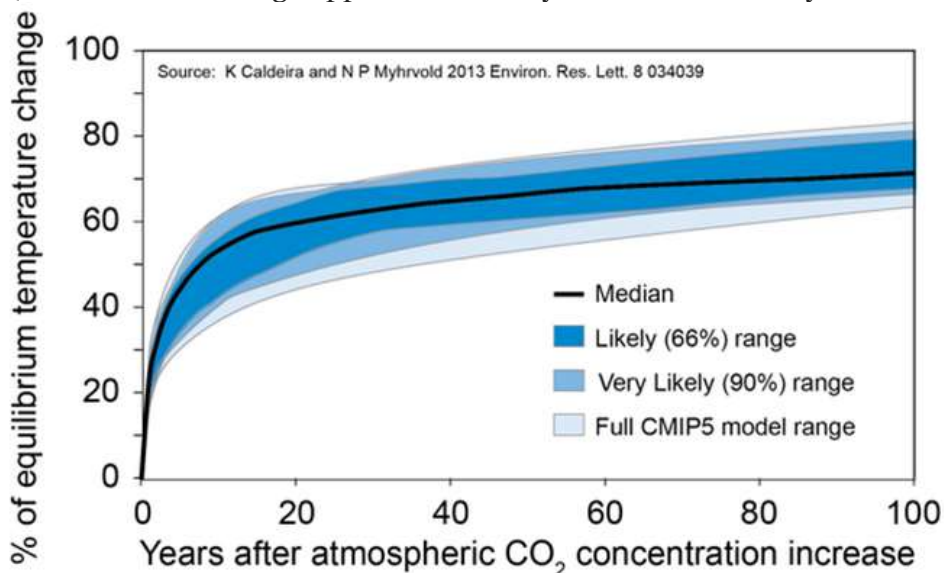
https://web.archive.org/web/20110420145203/http://www.nxtbook.com:80/nxtbooks/saf/for_etrysource_201011/index.php.

Even a before-after ecological study design should employ a control. See Krebs, C. J. 1999. Ecological methodology. Second edition. Addison Wesley Longman Inc., Menlo Park, California, USA.

Any analysis that asserts that carbon uptake via future forest growth will mitigate for GHG emissions caused by logging must carefully account for several factors:

1. The climate impacts of the extra GHG in the atmosphere during the period of regrowth. Logging causes a real and significant transfer of GHG to the atmosphere and those emissions have greenhouse effects that begin immediately and do not subside until the forest has fully regrown (or more accurately reaches *climate parity*), which might take decades or hundreds of years. A proper NEPA analysis requires accounting for the additional warming caused by extra GHG in the atmosphere during the regrowth period.

2. Future climate benefits from future carbon uptake must be discounted. Under well-established economic principles of uncertainty and discounting, it is clear that the net present value of current carbon storage in existing mature forests exceeds the net present value of distant future benefits of forest regrowth or substitution. This graph shows why the near term matters (most of the warming happens within 20 years and then slowly continues to increase):



3. Near-term carbon storage (and avoided emissions) are far more valuable as a climate solution compared to carbon uptake in the distant future. Near-term climate solutions are critically important while the economy transitions to low carbon technologies, yet it will take over a century for forest regrowth or substitution to off-set the initial carbon debt caused by logging.

The IPCC made a policy decision to place more emphasis on emissions in the near-term because the majority of warming happens within 10-20 years after emissions. The importance avoiding emissions in the near-term highlights the fact that forests are more valuable as places to store carbon and wood products are less valuable. This is because every effort to transfer carbon from the forest into wood products results in a net near-term pulse of carbon to the atmosphere, and this carbon "debt" is not repaid until the distant future when the replacement forest grows (not to the point that it stores the same amount of carbon as before harvest, but rather to a point that recaptures all the carbon PLUS mitigates for the climate impacts caused during the "carbon debt" payback period.) See Katsumasa Tanaka & Brian C. O'Neill. 2018. The Paris Agreement zero-emissions goal is not always consistent with the 1.5 °C and 2 °C temperature targets. *Nature Climate Change* (2018) doi:10.1038/s41558-018-0097-x.

<https://www.nature.com/articles/s41558-018-0097-x#Abs1>, and see Brack, Duncan 2017.

Woody Biomass for Power and Heat: Impacts on the Global Climate. Chatham House.

<https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2017-02-23-woody-biomass-global-climate-brack-embargoed.pdf>.

The Tiger Mill EA's analysis of environmental justice and climate change is flawed because it does not weigh and balance the fact that GHG emissions from logging will make global climate change incrementally worse, while it attempts to reduce effects from fire and flooding. The benefits of reduced fire and flooding are marginal and local, while the adverse climate effects from increased GHG emissions have global impacts that are cumulatively significant.

The EA Misleadingly Says Fuel Reduction Logging Increases Carbon Storage.

The Tiger Mill EA (p 86) says “Studies indicate treated stands generally retain more carbon than untreated stands (Hessburg et al. 2020) when affected by subsequent wildfire.” This statement is highly misleading because it fails to account for the vast amounts of carbon that is emitted from the majority of logging units that do not experience wildfire during the brief period before fuels regrow. The Tiger Mill EA emphasizes the carbon effects from the minority of fuel reduction units that may experience wildfire, while ignoring the carbon effects from the majority of fuel reduction units that not do experience wildfire. This violates NEPA mandate for high quality information and accurate analysis.

The EA essentially claims that logging will increase carbon storage in the forest by limiting carbon emissions caused by wildfire. This is simply counter-factual. In most cases, managing forests in an effort to control natural processes that release carbon will only make things worse by releasing MORE carbon. This is mostly because no one can predict where fire or insects will occur, so the treatments must be applied to broad landscapes, yet the probability of fire or insects at any given location remains low, and only a small fraction of the treated areas will actually experience fire or insects. As a result, many acres will be treated "unnecessarily" and therefore the cumulative carbon emissions from logging to control fire and insects (plus the carbon emissions from fire and insects that occur in spite of control efforts) are greater than emissions from fire and insects alone. A careful analysis shows that logging to control fire and expecting to increase carbon storage is analogous to rolling a die and expecting to roll a six every time.

This is an example of the “base rate fallacy” or “neglecting priors” from Bayesian statistics. The probability of a forest NOT burning are far greater than the probability of a forest burning. Attempts to address a problem that is unlikely to occur, such as by thinning a forest that is unlikely to burn, runs a high risk that unintended negatives effects will overwhelm beneficial effects. https://en.wikipedia.org/wiki/Base_rate_fallacy

[T]here is no guarantee that thinning across vast landscapes will stabilize carbon stores. Rather the best available scientific study has shown that thinning reduces carbon stores more than fire itself and reduces carbon stores whether or not fire burns that particular forest.

Law, B. 2021. Response to Questions for the Record, *attached to* Statement Of Dr. Beverly Law, Professor Emeritus, Oregon State University, Before The United States House Of Representatives, Subcommittee On National Parks, Forests And Public Lands, April 29, 2021, Concerning “Wildfire In A Warming World: Opportunities To Improve Community Collaboration, Climate Resilience, And Workforce Capacity” <https://naturalresources.house.gov/imo/media/doc/Law,%20Beverly%20-%20Testimony%20-%20NPFPL%20Ov%20Hrg%2004.29.21.pdf> (link to Statement, without Response to Questions).

The 2018 US Forest Service Northwest Forest Plan Science Synthesis concluded that fuel reduction is unlikely to be an effective climate mitigation strategy.

Some studies from other regions in the Western United States (i.e., the Southwest and Sierra Nevada) suggest that thinning and fuel reduction can mitigate carbon loss from fire. Fuel reduction may reduce losses of carbon at stand levels compared with the consequences of high-severity wildfire burning in stands with high fuel loads (Finkral and Evans 2008; Hurteau and North 2009; Hurteau et al. 2008, 2011, 2016; North and

Hurteau 2011; North et al. 2009, Stephens et al. 2009). However, because the probability of treated areas burning is generally low (Barnett et al. 2016), and most biomass is not consumed by fire, slight differences in losses resulting from combustion in fire compared with losses from fuel reduction are unlikely to make fuel reduction a viable mitigation strategy (Ager et al. 2010, Campbell et al. 2012, Kline et al. 2016, Mitchell et al. 2009, Restaino and Peterson 2013, Spies et al. 2017).

USDA 2018. Synthesis of Science to Inform Land Management Within the Northwest Forest Plan Area. General Technical Report. PNW-GTR-966 Vol. 1. June 2018.
https://www.fs.usda.gov/pnw/pubs/pnw_gtr966.pdf.

Let's start with a simple truism of risk management:

Speculative negative emissions technologies may be worse than chimeras if they result in the false comfort that continued ... emissions can simply be offset, thereby diverting financial and policy resources from conventional mitigation. This would be reckless. It is clearly less risky not to emit a tonne of CO₂ in the first place, than to emit one in expectation of being able to sequester it for an unknown period of time, at unknown cost, with unknown consequences, at an unknown date and place in the future.

Carbon Brief staff 2016. In-depth: Experts assess the feasibility of 'negative emissions' *citing* Rob Bailey, Director of Energy, Environment and Resources, Chatham House.
<http://www.carbonbrief.org/in-depth-experts-assess-the-feasibility-of-negative-emissions#bailey>

Law & Harmon (2011) conducted a literature review and concluded ...

Thinning forests to reduce potential carbon losses due to wildfire is in direct conflict with carbon sequestration goals, and, if implemented, would result in a net emission of CO₂ to the atmosphere because the amount of carbon removed to change fire behavior is often far larger than that saved by changing fire behavior, and more area has to be harvested than will ultimately burn over the period of effectiveness of the thinning treatment.

Law, B. & M.E. Harmon 2011. Forest sector carbon management, measurement and verification, and discussion of policy related to mitigation and adaptation of forests to climate change. Carbon Management 2011 2(1).
<https://archives.corvallisoregon.gov/public/ElectronicFile.aspx?dbid=0&docid=4256162>.

Bartowitz et al (2022) found

... [S]ome recent policies have proposed diameter increases in fuel reduction strategies. While the primary goal is fire risk reduction, these policies have been interpreted as strategies that can be used to save trees from being killed by fire, thus preventing carbon emissions and feedbacks to climate warming. This interpretation has already resulted in cutting down trees that likely would have survived fire, resulting in forest carbon losses that are greater than if a wildfire had occurred. ... [H]arvest of mature trees releases a higher density of carbon emissions (e.g., per unit area) relative to wildfire (150–800%) because harvest causes a higher rate of tree mortality than wildfire. Our results show that increasing harvest of mature trees to save them from fire increases emissions rather than preventing them. ... On public lands, management aimed at less-intensive fuels reduction (such as removal of “ladder” fuels, i.e., shrubs and small-diameter trees) will help to balance reducing catastrophic fire and leave live mature trees on the landscape to continue carbon uptake.

...

Many new policy discussions on fire and forest management are being based upon the misconception that harvest will protect forests from mortality and carbon loss (Executive

Order, 2018; Zinke, 2018; Infrastructure Investment and Jobs Act, 2021; Newhouse, 2021), and decrease fire risk (Forest Climate Action Team, 2018; Figure 1) despite substantial uncertainty over long-term impacts to forest climate resilience (i.e., forest treatments may decrease forest resilience in the era of climate change). Our results and the majority of full-carbon accounting studies conclude that any type of harvest (logging or commercial thinning) decreases forest carbon storage (Law et al., 2013), and this research shows harvest emits more carbon per unit area than fire at all scales ...

... Locations with high-harvest rates and carbon dense forests, such as the Pacific Northwest United States, see higher carbon losses from harvest than fire compared to areas in the Southwest United States with low harvest rates and carbon sparse forests (e.g., Oregon versus Arizona). Forest management needs to be specific to forest type and region; old-growth and wet forests in the Northwest are best left preserved while dry, fire-prone forests or areas in the Wildland Urban Interface benefit from fire risk-reduction strategies like small-diameter thinning and prescribed fires (Law et al., 2018; Case et al., 2021). Inclusion of specific diameter limits in policy for public lands could help prevent large-diameter tree removal and subsequent unintended consequences.

... The most effective forest management strategy to protect forest carbon stocks on public lands is to preserve forests through decreased harvest and thinning, lengthened harvest rotations, increased proportion of long-term wood products, reduced harvest and mill waste, and working toward afforestation and reforestation (Hudiburg et al., 2013; Law et al., 2018; Buotte et al., 2020; Figure 1).

Bartowitz KJ, Walsh ES, Stenzel JE, Kolden CA and Hudiburg TW (2022) Forest Carbon Emission Sources Are Not Equal: Putting Fire, Harvest, and Fossil Fuel Emissions in Context. *Front. For. Glob. Change* 5:867112. doi: 10.3389/ffgc.2022.867112.
<https://www.frontiersin.org/articles/10.3389/ffgc.2022.867112/full>

Most analyses of mid- to long-term thinning impacts on forest structure and carbon storage show there is a multi-decadal biomass carbon deficit following moderate to heavy thinning ... As to the effectiveness and likelihood that thinning might have an impact on fire behavior, the area thinned at broad scales to reduce fuels has been found to have little relationship to area burned, which is mostly driven by wind, drought, and warming. ... The goals of restoring ecosystem processes and/or reducing risk in fire-prone regions can be met by removing small trees and underburning to reduce surface fuels, not by removal of larger trees, which is sometimes done to offset the cost of the thinning.

...
 Many of the existing forest management practices allegedly protect forests and homes from wildfire and are having severe adverse effects on forest ecosystem integrity and resilience, and are worsening climate change and diminishing biodiversity.

...
 Hardening home structures in areas with high risk of wildfires such as the wildland-urban interface has been found to be the most effective means to reduce property damage from wildfires.

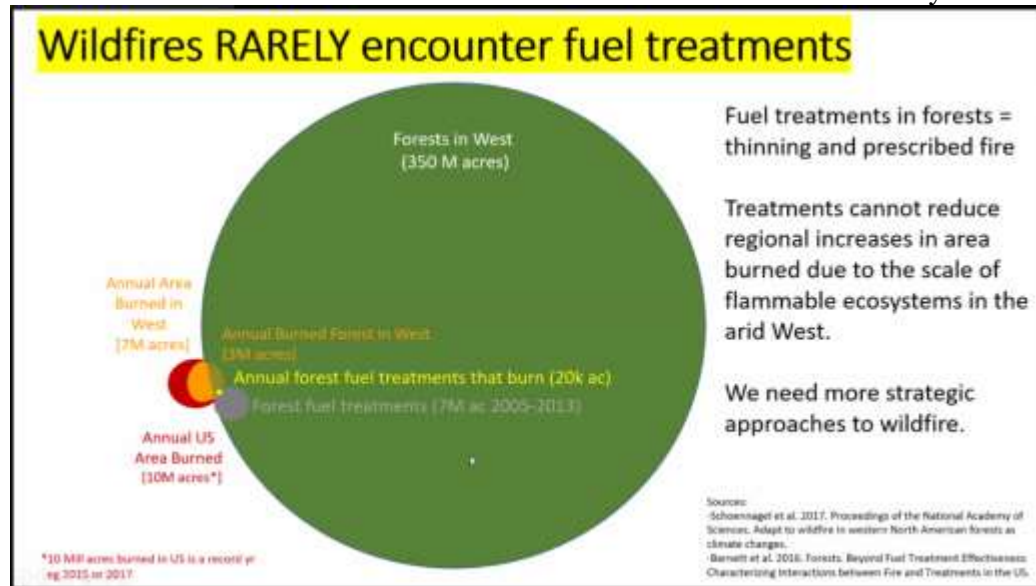
Law, Beverly E., William R. Moomaw, Tara W. Hudiburg, William H. Schlesinger, John D. Sterman, and George M. Woodwell. 2022. Creating Strategic Reserves to Protect Forest Carbon and Reduce Biodiversity Losses in the United States. *Land* Vol. 11, no. 5: 721.
<https://doi.org/10.3390/land11050721>, <https://www.mdpi.com/2073-445X/11/5/721/htm>.

Campbell and Agar (2013) conducted a sensitivity analysis and found robust results indicating that fuel reduction does not increase forest carbon storage.

... we attempt to remove some of the confusion surrounding this subject by performing a sensitivity analysis wherein long-term, landscape-wide carbon stocks are simulated under a wide range of treatment efficacy, treatment lifespan, fire impacts, forest recovery rates, forest decay rates, and the longevity of wood products. Our results indicate a surprising insensitivity of long-term carbon stocks to both management and biological variables. After 80 years, ... a 1600% change in either treatment application rate or efficacy in arresting fire spread resulted in only a 10% change in total system carbon. This insensitivity of long-term carbon stocks is due in part by the infrequency of treatment/wildfire interaction and in part by the controls imposed by maximum forest biomass. None of the fuel treatment simulation scenarios resulted in increased system carbon.

Campbell, J, Agar, A (2013) Forest wildfire, fuel reduction treatments, and landscape carbon stocks: A sensitivity analysis. *Journal of Environmental Management* 121 (2013) 124-132
http://fes.forestry.oregonstate.edu/sites/fes.forestry.oregonstate.edu/files/PDFs/Campbell_2013_JEM.pdf

This graph shows that logging for fuel reduction rarely interacts with wildfire, which explains why the carbon emissions from widespread fuel reduction logging vastly exceeds the carbon emissions avoided in the rare cases where fuel reduction does interact favorably with wildfire.



There are now webtools available that can help the agencies deal with uncertainty surrounding the efficacy of fuel reduction. For instance, this web-based spreadsheet (<http://getguesstimate.com/>) allows users to create models with confidence intervals around input variables. Then it runs thousands of Monte Carlo simulations to come up with estimates of model behavior. The agencies could use this to better estimate the improbability that fuel treatments would interact with fire and estimate the improbable carbon benefits of fuel reduction logging.

Before attributing carbon benefits to fuel reduction logging please consider the conclusions of:

- John L Campbell, Mark E Harmon, and Stephen R Mitchell. 2011. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? *Front Ecol Environ* 2011; doi:10.1890/110057 <http://forestpolicy.com/wp-content/uploads/2011/12/campbell-2011.pdf>. (Results suggest that the protection of one

unit of C from wildfire combustion comes at the cost of removing three units of C in fuel treatments.)

- Mitchell, Harmon, O'Connell. 2009. Forest fuel reduction alters fire severity and long-term carbon storage in three Pacific Northwest ecosystems. *Ecological Applications*. 19(3), 2009, pp. 643–655.
https://web.archive.org/web/2011024074629/http://www.fs.fed.us/pnw/pubs/journals/pnw_2009_mitchello001.pdf. (“...reducing the fraction by which C is lost in a wildfire requires the removal of a much greater amount of C, since most of the C stored in forest biomass (stem wood, branches, coarse woody debris) remains unconsumed even by high-severity wildfires. For this reason, all of the fuel reduction treatments simulated for the west Cascades and Coast Range ecosystems as well as most of the treatments simulated for the east Cascades resulted in a reduced mean stand C storage.... We suggest that forest management plans aimed solely at ameliorating increases in atmospheric CO₂ should forego fuel reduction treatments ...”)
- Reinhardt, Elizabeth, and Lisa Holsinger 2010. Effects of fuel treatments on carbon-disturbance relationships in forests of the northern Rocky Mountains. *Forest Ecology and Management* 259 (2010) 1427–1435.
http://www.fs.fed.us/rm/pubs_other/rmrs_2010_reinhardt_e002.pdf (“Although wildfire emissions were reduced by fuel treatment, the fuel treatments themselves produced [carbon] emissions, and the untreated stands stored more carbon than the treated stands even after wildfire. ... Our results show generally long recovery times ...”)
- Law, B. & M.E. Harmon 2011. Forest sector carbon management, measurement and verification, and discussion of policy related to mitigation and adaptation of forests to climate change. *Carbon Management* 2011 2(1).
<https://archives.corvallisoregon.gov/public/ElectronicFile.aspx?dbid=0&docid=4256162> (“Thinning forests to reduce potential carbon losses due to wildfire is in direct conflict with carbon sequestration goals, and, if implemented, would result in a net emission of CO₂ to the atmosphere because the amount of carbon removed to change fire behavior is often far larger than that saved by changing fire behavior, and more area has to be harvested than will ultimately burn over the period of effectiveness of the thinning treatment.”)
- Restaino, Joseph C.; Peterson, David L. 2013. Wildfire and fuel treatment effects on forest carbon dynamics in the western United States. *Forest Ecology and Management* 303:46–60.
http://www.fs.fed.us/pnw/pubs/journals/pnw_2013_restiano0001.pdf (“... C costs associated with fuel treatments have can exceed the magnitude of C reduction in wildfire emissions, because a large percentage of biomass stored in forests (i.e., stem wood, branches, coarse woody debris) remains unconsumed, even in high-severity fires (Campbell et al., 2007; Mitchell et al., 2009). ... Wildfire occurrence in a given area is uncertain and may never interact with treated stands with reduced fire hazard, ostensibly negating expected C benefits from fuel treatments. Burn probabilities in treated stands in southern Oregon are less than 2%, so the probability that a treated stand encounters wildfire and creates C benefits is low (Ager et al., 2010).”)
- Goslee, K., Pearson, T., Grimland, S., Petrova, S., Walls, J., Brown, S., 2010. Final Report on WESTCARB Fuels Management Pilot Activities in Lake County, Oregon. California Energy Commission, PIER. DOE Contract No.: DE-FC26-05NT42593.
<https://escholarship.org/content/qt9xg9n2pj/qt9xg9n2pj.pdf?t=r15vej>; AND Pearson, T.R.H., Goslee, K., Brown, S., 2010. Emissions and Potential Emission Reductions from Hazardous Fuel Treatments in the WESTCARB Region. California Energy Commission, PIER. CEC-500-2014-046. <https://winrock.org/wp-content/uploads/2016/03/WCHazardousFuelsReport.pdf>. (Summarized by Restaino & Peterson (2013) as follows: “Pearson et al. (2010) and Goslee et al. (2010) developed methodologies to evaluate C dynamics associated with fuel treatment projects in low to mid-

elevation forest in northern California and Oregon. The authors, with consultation from teams of scientists, quantify C storage and release within the context of a six-point conceptual framework: annual fire risk, treatment emissions, fire emissions, forest growth and re-growth, re-treatment, and the shadow effect (i.e., treatment effect outside the treated area). Results indicate that the mean annual probability of wildfire for the study region is less than 0.76%/year, and treatments reduce C stocks by an average of 19%. Where timber is removed, 30% of extracted biomass is stored in long-lasting wood products. Wildfire emissions in treated stands, quantified with the Fuel Characteristic Classification System, are reduced by 6% relative to untreated stands. Growth estimates for a 60-year simulation horizon, derived from FVS, indicate that in the absence of wildfire, untreated stands sequester 17% more C than treated stands. However, in simulations that include wildfire, treated stands sequester 63% more C than untreated stands. The shadow effect is unlikely to be large enough to affect net GHG emissions. In summary, initial reductions in C stocks (e.g., thinning), combined with low annual probability of wildfire, preclude C benefits associated with fuel treatments, even if harvest residues are used for biomass energy.”)

- Chiono, Lindsay 2011. Balancing the Carbon Costs and Benefits of Fuels Management. Research Synthesis for Resource Managers. Joint Fire Science Program Knowledge Exchange.
https://static1.squarespace.com/static/545a90ede4b026480c02c5c7/t/5527ebd9e4bof620docb5b58/1428679641640/CFSC_Chiono_Carbon_and_Fuel_Mngmt.pdf (“[T]he net carbon impact of fuel treatments is further complicated by the probabilistic nature of wildfire occurrence and the impermanence of post-treatment stand conditions ... [T]reatment activities produce an immediate carbon emission while future wildfire emissions are uncertain ... Depending on the intensity of treatment, the quantity of carbon removed may be substantial enough to negate gains from avoided wildfire emissions. ... cumulative emissions from fuels reduction activities repeated in order to maintain low hazard conditions over time can overwhelm avoided wildfire emissions, resulting in a net carbon loss.”)
- Dina Fine Maron 2010. FORESTS: Researchers find carbon offsets aren't justified for removing understory (E&E Report 08/19/2010, reporting on the WESTCARB Project) <https://pacificforest.org/pft-in-the-media-2010-climatewire-8-19-10.html>. (“The take-home message is we could not find a greenhouse gas benefit from treating forests to reduce the risk of fire,” said John Kadyszewski, the principal investigator for the terrestrial sequestration projects of the West Coast Regional Carbon Sequestration Partnership. WESTCARB, ... Since there is a relatively low risk of fire at any one site, large areas need to be treated -- which release their own emissions in the treatment process. The researchers have concluded that the expected emissions from treatments to reduce fire risk exceed the projected emissions benefits of treatment for individual projects.”)
- Rachel A. Loehman, Elizabeth Reinhardt, Karin L. Riley 2014. Wildland fire emissions, carbon, and climate: Seeing the forest and the trees – A cross-scale assessment of wildfire and carbon dynamics in fire-prone, forested ecosystems. *Forest Ecology and Management* 317 (2014) 9–19.
https://web.archive.org/web/20170531073954/https://www.fs.fed.us/rm/pubs_other/rmrs_2014_loehman_roo1.pdf (“... management of carbon in fire-prone and fire-adapted forests is more complex than simply minimizing wildfire carbon emissions and maximizing stored carbon in individual stands. The stochastic and variable nature of fires, the relatively fine scale over which fuels treatments are implemented, and potentially high carbon costs to implement them suggest that fuel treatments are not an effective method for protecting carbon stocks at a stand level (Reinhardt et al., 2008; Reinhardt and Holsinger, 2010).”)

- Jim Cathcart, Alan A. Ager, Andrew McMahan, Mark Finney, and Brian Watt 2009. Carbon Benefits from Fuel Treatments. USDA Forest Service Proceedings RMRS-P-61. 2010. https://www.fs.usda.gov/rm/pubs/rmrs_p061/rmrs_p061_o61_o79.pdf.
- Chiono, L. A., D. L. Fry, B. M. Collins, A. H. Chatfield, and S. L. Stephens. 2017. Landscape-scale fuel treatment and wildfire impacts on carbon stocks and fire hazard in California spotted owl habitat. *Ecosphere* 8(1):e01648. 10.1002/ecs2.1648. <https://esajournals.onlinelibrary.wiley.com/doi/10.1002/ecs2.1648> (“We used a probabilistic framework of wildfire occurrence to (1) estimate the potential for fuel treatments to reduce fire risk and hazard across the landscape and within protected California spotted owl (*Strix occidentalis occidentalis*) habitat and (2) evaluate the consequences of treatments with respect to terrestrial C stocks and burning emissions. Silvicultural and prescribed fire treatments were simulated on 20% of a northern Sierra Nevada landscape in three treatment scenarios ... [A]ll treatment scenarios resulted in higher C emissions than the no-treatment scenarios.”)
- Stenzel, J. E., Berardi, D. B., Walsh, E. S., & Hudiburg, T. W. (2021). Restoration thinning in a drought-prone Idaho forest creates a persistent carbon deficit. *Journal of Geophysical Research: Biogeosciences*, 126, e2020JG005815. <https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2020JG005815> (“Forest thinning in a young ponderosa pine plantation resulted in observed and modeled decreases in ecosystem and forest sector carbon storage over unmanaged control plots through the year 2050. Despite increased tree-level production and water use in a location characterized by growing season drought stress, this study affirms inherent site tradeoffs between individual tree vigor and stand carbon storage over time. We estimate that thinned plot carbon stocks will return to prethinned levels by 2035 (Figure 6), but forest sector carbon parity (Mitchell et al., 2012) with untreated plots will not occur by 2050 and therefore represents a relative carbon source to the atmosphere in the absence of disturbance. ...[A] carbon deficit relative to control remained due to the removal of ~40% of live ecosystem carbon as well as the subsequent release of ~60% of removed biomass by 2050. Despite the continued storage of a portion of removed biomass in long-lived wood products, large immediate and short-term emissions were associated with slash combustion, on-site decomposition, and short-term product chain emissions (i.e., waste and paper), and do not represent avoided emissions through 2050. A multidecadal ecosystem biomass (i.e., carbon) deficit following moderate and heavy partial harvest is supported by most analyses of mid to long-term thinning structural impacts (James et al., 2018; Zhou et al., 2013), ...”).
- Harmon, M.E.; Hanson, C.T.; DellaSala, D.A. 2022. Combustion of Aboveground Wood from Live Trees in Megafires, CA, USA. *Forests* 2022, 13, 391. <https://doi.org/10.3390/f13030391>; <https://www.mdpi.com/1999-4907/13/3/391/pdf> (“Biomass combustion is a major biogeochemical process, but uncertain in magnitude. We examined multiple levels of organization (twigs, branches, trees, stands, and landscapes) in large, severe forest fires ... [C]ombustion rates are very low overall at the stand (0.1%–3.2%) and landscape level (0.6%–1.8%), because large trees with low combustion rates comprise the majority of biomass, and high severity fire patches are less than half of the area burned. Our findings of low live wood combustion rates have important implications for policies related to wildfire emissions and forest management.”).
- John W Coulston et al 2023. Near-term investments in forest management support long-term carbon sequestration capacity in forests of the United States, *PNAS Nexus* (2023). DOI: 10.1093/pnasnexus/pgad345 ([pdf](#)). (“Fuel treatments are designed to temporarily reduce carbon from forests through thinning, prescribed fire, or other mechanical means, and under a fuel high-treatment (FHT) scenario [10–50% of basal area removed] (Fig. 1D), 288 MMT of aboveground carbon will be removed from western forests by 2032 (Fig. 2B). Under a fuel low-treatment (FLT) scenario [10–25% of basal area removed] (Fig. 1D), 194 MMT of

carbon will be removed (Fig. 2B). The fuel-treatment scenarios have two additional short-term (2022–2032) effects: (i) lost sequestration potential from live tree removal and (ii) decreased wildfire carbon emissions (Fig. 2B). ... Results for the fuel-treatment scenarios suggest a negative mitigation potential in the near-term largely due to the removal of live trees. In the longer term, projections suggest a positive, but small, mitigation potential largely due to increased growth of thinned stands and reduced fire mortality. Under the FHT scenario, in 2032, projections suggest a -31 MMT yr^{-1} mitigation potential, indicating that forests would have less net annual carbon accumulation with the fuel treatments. Conversely, by 2050, the FHT fuel treatments may lead to a $+6 \text{ MMT yr}^{-1}$ mitigation potential (about 4.5% of current flux). These results highlight that carbon accumulation through net forest growth is unlikely to offset carbon removal and loss of sequestration potential from fuel treatments in the near term. In the longer term, the treatments may lead to small increases in annual accumulation rates due to avoided wildfire emissions and improved growth in thinned forests. However, the projected cumulative 2022–2050 carbon sequestered under the FLT and FHT scenarios is 200 and 310 MMT less, respectively, than the baseline (Fig. 2D), indicating a reduced capacity of US forests to offset emissions from other sectors over the projection period.”)

The EA Erred by Viewing Wood Products as Beneficial Carbon Storage Instead of as a Net Source of Carbon Emissions.

The Tiger Mill EA (p 86) says “some carbon removed would be stored for long periods of time in harvested wood products.” This is highly misleading. The EA focuses on the small fraction of the forest carbon that is transferred temporarily to wood products, while de-emphasizing the larger fraction of forest carbon that is put on an accelerated path to the atmosphere by logging.

The EA fails to disclose that from a climate perspective, wood products represent net carbon emissions, NOT net carbon sequestration, because only a small fraction of the carbon in a logged forest ends up in wood products. Logging to create wood products causes the majority of forest carbon to be transferred to the atmosphere, not to wood products. Science clearly shows that carbon is more safely stored in forests, not in wood products.

More than 200 scientists recently wrote to Congress saying –

We find no scientific evidence to support increased logging to store more carbon in wood products, such as dimensional lumber or cross-laminated timber (CLT) for tall buildings, as a natural climate solution. 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 (Depro et al. 2008, Harris et al. 2016, Woodwell 2016, Erb et al. 2018, IPCC 2018, Law et al. 2018, Harmon 2019, Moomaw et al. 2019).

Moomaw et al 2020. Scientists Letter to Congress Urging Protection of Forests to Mitigate the Climate Crisis. May 13, 2020. <https://96a.96e.myftpupload.com/wp-content/uploads/2020/05/200TopClimateScientistCongressProtectForestsForClimateChange13May20.pdf>.

Carbon emissions from the forest sector are often reported as net emissions which account for forest growth. This is not a proper way to account for emissions. The emissions from logging and the wood products supply chain must be reported separately, because carbon uptake via forest growth occurs whether forests are logged or not. Bysouth, D., Boan, J. J., Malcolm, J. R., &

Taylor, A. R. (2024). High emissions or carbon neutral? Inclusion of “anthropogenic” forest sinks leads to underreporting of forestry emissions. *Frontiers in Forests and Global Change*, 6, 1297301. <https://doi.org/10.3389/ffgc.2023.1297301>; Polanyi, Skeene, and Simard 2024. LOGGING EMISSIONS UPDATE - Reported greenhouse gas (GHG) emissions from logging in Canada double after revision to government data. <https://naturecanada.ca/wp-content/uploads/2024/09/2024-Logging-Emissions-Update-Report.pdf>. The NEPA analysis must accurately disclose to the public and the decision-maker the benefits of forest growth and continued carbon sequestration if the forest is conserved, versus all the GHG emissions from logging and associated activities.

World Resources Institute conducted a thorough analysis and concluded that increased use of wood does not provide climate benefits and has significant trade-offs, such as adverse effects on biodiversity.

- 1) Most wood (and its stored carbon) is lost during production.
- 2) Harvesting wood is not carbon-neutral.
- 3) Using wood in construction will most likely increase climate warming for decades.
- 4) Relying only on plantation forests in warm climates for mass timber might yield climate benefits from a specific hectare, but not when factoring in the growing needs for wood.
- 5) Mass timber would have large adverse effects on the world’s forests.

Tim Searchinger, Liqing Peng, Richard Waite and Jessica Zions. July 20, 2023. Wood Is Not the Climate-friendly Building Material Some Claim it to Be.

<https://www.wri.org/insights/mass-timber-wood-construction-climate-change>, citing Timothy Searchinger, Liqing Peng, Jessica Zions, And Richard Waite 2023 The Global Land Squeeze: Managing The Growing Competition For Land. World Resources Institute.

<https://doi.org/10.46830/wrirpt.20.00042>;

<https://files.wri.org/d8/s3fs-public/2023-07/the-global-land-squeeze-report.pdf> (“Initiatives to increase demands for bioenergy and mass timber for construction would vastly increase land-use competition.

- Wood use is not “carbon neutral,” even if forests are managed “sustainably,” once one accounts for the loss in forest carbon from harvests. In most scenarios, harvesting additional wood, even for construction, will likely increase atmospheric carbon for decades.

- Solutions require strategies that produce, protect, reduce, and restore: produce more food and wood on already managed land, protect native habitats, reduce demand for land-intensive products, and, if successful, restore forests and other habitats.

- In general, policies should not increase demand for land-based products until the world shows that it can meet rising food and wood demands without additional land conversion.

Our analysis also shows that “sustainable forest management,” as conventionally understood, does not mean that wood use is carbon neutral or that using wood in construction in place of concrete and steel necessarily provides a net climate benefit. Harvesting wood comes with a time-discounted cost in lost carbon in the forest. The climate benefits of harvesting wood include the storage of some of that forest carbon elsewhere and avoided emissions from other carbon-intensive products such as concrete and steel. But the climate costs are reduced storage of carbon in the forest.

According to our analysis, large net climate benefits from wood harvesting probably require that a high percentage of this wood is used to replace concrete and steel in construction—perhaps at levels not realistic—and that the wood come from or be associated with the establishment of fast-growing forest plantations. If these plantations come at the expense of natural forests, they would have high biodiversity costs.”).

Applying discounting to the carbon costs of forest management improves accuracy. Peng, L., Searchinger, T.D., Zions, J. et al. The carbon costs of global wood harvests. *Nature* (2023). <https://doi.org/10.1038/s41586-023-06187-1>. <https://www.nature.com/articles/s41586-023-06187-1.pdf> (“[H]arvests of wood have major, although often ignored, carbon costs that should be attributed to human activity. ... [W]e present results of a new model that uses [4%] time discounting to estimate the present and future carbon costs of global wood harvests under different scenarios. We find that forest harvests between 2010 and 2050 will probably have annualized carbon costs of 3.5–4.2 Gt CO₂e yr⁻¹. ... These findings are, in a sense, good news because they imply that if people could reduce forest harvests, forest growth could do more to reduce atmospheric carbon, a potential mitigation ‘wedge’ that is rarely identified in climate strategies.”).

Various forest management mitigation strategies based on modifying conventional management of forests for commodity production in ways that reduce logging emissions and take account of the carbon stored in wood products have been proposed as constituting the most effective mitigation (Fusset al 2020, Verkerk et al 2020). However, other empirical case studies have challenged these proposals (Keith et al 2015) and shown that alternative forest management practices such as reduced impact logging do little to reduce atmospheric CO₂ compared to forest protection and regrowth (i.e. allowing growth to continue) whereas tree harvesting immediately releases large amounts of CO₂ (Law et al 2018).

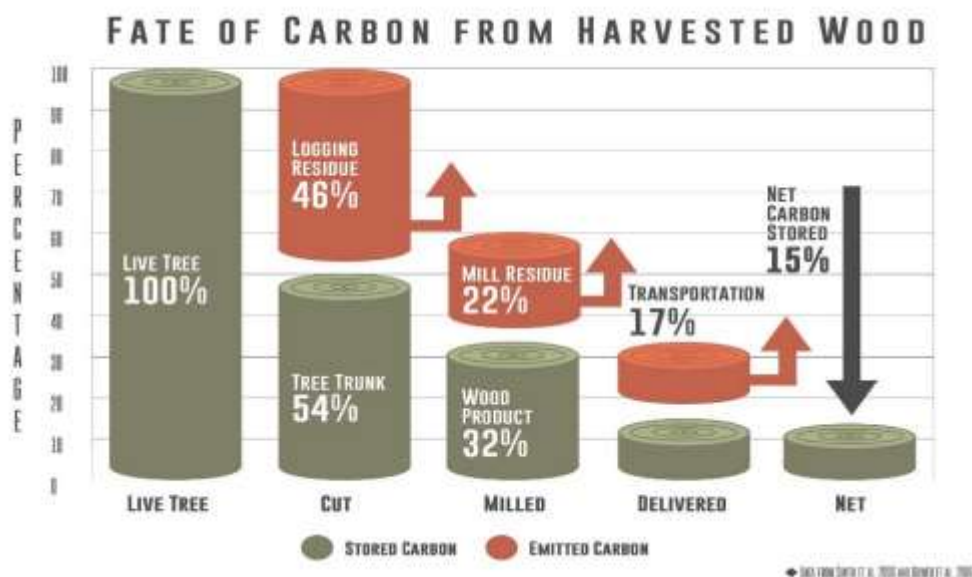
Brendan Mackey et al 2022. Net carbon accounting and reporting are a barrier to understanding the mitigation value of forest protection in developed countries. *Environ. Res. Lett.* 17 054028. DOI 10.1088/1748-9326/ac661b. <https://iopscience.iop.org/article/10.1088/1748-9326/ac661b/pdf>.

Some argue that wood products are a good place to store carbon. This is a counter-productive climate strategy, because –

Only a small fraction of carbon from logged forests ends up in long-term storage in wood products, most is transferred to the atmosphere. Of all the carbon that is killed and/or exposed to accelerated decay in a logging operation only a small fraction ends up as durable goods and buildings -- most ends up as slash, sawdust, waste/trim, hog fuel, and non-durable goods like paper. Some say that converting forest to wood products "delays" emissions, but in fact logging accelerates emissions because they are the result of a process that kills trees that would continue to actively sequester carbon if not logged, and logging involves tremendous waste in the logging process, milling process, construction/manufacturing process.

OFRI says “in 2013. Of the [log] volume delivered to sawmills, 49.4% became finished lumber or other sawn products and 48% became mill residues...” Kuusela, Rossi et al 2019. *Forest Resources And Markets: Trends And Economic Impacts*. The 2019 Forest Report. OFRI. <https://theforestreport.org/wp-content/uploads/2019/07/OFRI-2019-Forest-Sector-Economic-Report-Web.pdf>. There are additional losses throughout the wood products supply chain, resulting in logging waste, milling waste, plus GHG

emissions from processing and transportation.



Carbon remains stored much longer in forests than in wood products. Much of the wood products which can reasonably be considered "durable" are in fact less durable than leaving the carbon stored safely inside a mature tree that might live to be hundreds of years old. Most of our wood products are disposable. It turns out that well-conserved forests on average store carbon more securely than our "throw-away" culture and economy does. Law, B. & M.E. Harmon 2011. Forest sector carbon management, measurement and verification, and discussion of policy related to mitigation and adaptation of forests to climate change. Carbon Management 2011 2(1). <https://archives.corvallisoregon.gov/public/ElectronicFile.aspx?dbid=0&docid=4256162> ("To the extent that management can direct carbon into longer lived pools, it can increase the stores of carbon in the forest sector. Harvest of carbon is one proposed strategy to increase carbon stores. However, harvesting carbon will increase the losses from the forest itself and to increase the overall forest sector carbon store, the lifespan of wood products carbon (including manufacturing losses) would have to exceed that of the forest. Under current practices this is unlikely to be the case. A substantial fraction (25–65%) of harvested carbon is lost to the atmosphere during manufacturing and construction depending on the product type and manufacturing method. The average lifespan of wood buildings is 80 years in the USA, which is determined as the time at which half the wood is no longer in use and either decomposes, burns or, to a lesser extent, is recycled. However, many forest trees have the potential to live hundreds of years (e.g. 800 years in the Pacific northwest USA). Mortality rates of trees are generally low, averaging less than 2% of live mass per year in mature and old forests; for example, in Oregon, mortality rates average 0.35–1.25% in forests that are older than 200 years in the Coast Range and Blue Mountains, respectively [8]. Moreover, the average longevity of dead wood and soil carbon is comparable to that of live trees. When the loss of carbon associated with wood products manufacturing is factored in, it is highly unlikely that harvesting carbon and placing it into wood products will increase carbon stores in the overall forest sector. This explains why in all analyses conducted to date, wood products stores never form the majority of total forest sector stores.")

"Of the cumulative wood harvested in the past 115 years, 65% is in the atmosphere, 16% is in landfills, and 19% is in long-lived products (Hudiburg et al. 2019)." Law, B. 2021. Response to Questions for the Record, *attached to* STATEMENT OF DR. BEVERLY LAW, PROFESSOR EMERITUS, OREGON STATE UNIVERSITY, BEFORE THE UNITED STATES HOUSE OF

REPRESENTATIVES, SUBCOMMITTEE ON NATIONAL PARKS, FORESTS AND PUBLIC LANDS, APRIL 29, 2021, CONCERNING “WILDFIRE IN A WARMING WORLD: OPPORTUNITIES TO IMPROVE COMMUNITY COLLABORATION, CLIMATE RESILIENCE, AND WORKFORCE CAPACITY”

<https://naturalresources.house.gov/imo/media/doc/Law,%20Beverly%20-%20Testimony%20-%20NPFPL%20Ov%20Hrg%2004.29.21.pdf> (link to Statement, without Response to Questions) citing Hudiburg, T.W, B.E. Law, W.R. Moomaw, M.E. Harmon, J.E. Stenzel. 2019. Meeting GHG reduction targets requires accounting for all forest sector emissions. *Env. Res. Lett.* 14: 095005. <https://iopscience.iop.org/article/10.1088/1748-9326/ab28bb/pdf>.

Reliance on wood products prevents forests from reaching their full potential for carbon storage. Shanks (2008) said “There are also losses of carbon that occur during the creation of forest products. These losses to decay and wood products make carbon sequestration slower when harvesting is allowed. The young timberlands that replace older harvested lands grow quickly, but hold less in total carbon stores than their older counterparts; the net sequestration from forest products adds to total carbon stores, but does not come close to the vast amounts of carbon stored in non-harvested older timberlands. This finding differs from other papers that have shown that the highest carbon mitigation can be reached when high productivity lands are used exclusively for wood products creation (Marland and Marland, 1992). The wood products considered in these studies were either long lasting or used for fuel purposes. Allowing harvested timber to be allocated to all types of wood products increases carbon emissions and results in no harvest regimes sequestering more carbon.” Alyssa V. Shanks. 2008. Carbon Flux Patterns on U.S. Public Timberlands Under Alternative Timber Harvest Policies. MS Thesis. March 2008.

http://ir.library.oregonstate.edu/dspace/bitstream/1957/8326/1/A_Shanks_Thesis_04%2002%2008_final.pdf.

Careful scientific study and analysis has demonstrated that timber harvest is not increasing removal of carbon from the atmosphere by terrestrial systems nor is it reducing emissions. In Oregon, for example, private industrial timberland is storing less than half the total carbon potential of the sites. This is because, in many cases, the trees are harvested on a 35-40 year rotation, and very little downed or dead wood is left on site. The soil profile and the amount of carbon it stores is also impacted by intensive, short rotation forestry.

...

[W]estern states are net sinks because there is a positive net balance of forest carbon uptake exceeding losses due to harvest, wood product use and combustion by wildfire. However, wood product use is reducing the potential annual sink by ~21%, suggesting forest carbon storage can become more effective in climate mitigation through reduced harvest, longer rotations and more efficient wood product use, ...

Law, B. 2021. Response to Questions for the Record, *attached to* STATEMENT OF DR. BEVERLY LAW, PROFESSOR EMERITUS, OREGON STATE UNIVERSITY, BEFORE THE UNITED STATES HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON NATIONAL PARKS, FORESTS AND PUBLIC LANDS, APRIL 29, 2021, CONCERNING “WILDFIRE IN A WARMING WORLD: OPPORTUNITIES TO IMPROVE COMMUNITY COLLABORATION, CLIMATE RESILIENCE, AND WORKFORCE CAPACITY”

<https://naturalresources.house.gov/imo/media/doc/Law,%20Beverly%20-%20Testimony%20-%20NPFPL%20Ov%20Hrg%2004.29.21.pdf> (link to Statement, without Response to Questions).

“[W]ood product usage is reducing the potential annual sink by an average of 21%, suggesting forest carbon storage can become more effective in climate mitigation through reduction in harvest, longer rotations, or more efficient wood product usage. ... Allowing forests to reach their biological potential for growth and sequestration, maintaining large trees (Lutz et al 2018), ... will remove additional CO₂ from the atmosphere. Global vegetation stores of carbon are 50% of their potential including western forests because of harvest activities (Erb et al 2017). Clearly, western forests could do more to address climate change through carbon sequestration if allowed to grow longer.” Tara W Hudiburg, Beverly E Law, William R Moomaw, Mark E Harmon and Jeffrey E Stenzel 2019. Meeting GHG reduction targets requires accounting for all forest sector emissions. 23 August 2019. Environmental Research Letters, Volume 14, Number 9. <https://iopscience.iop.org/article/10.1088/1748-9326/ab28bb/pdf>.

Diaz et al (2018) showed that Washington's forest practice rules are better for the climate than Oregon's forest practice rules, in part because Washington requires greater riparian retention. This study accounted for the total carbon stored both in the forest and in wood products. Riparian retention does nothing more than allow trees to grow and accumulate more carbon. If some retention is good for the climate, more retention is better, and 100% retention is best. Diaz, D.D.; Loreno, S.; Ettl, G.J.; Davies, B. 2018. Tradeoffs in Timber, Carbon, and Cash Flow under Alternative Management Systems for Douglas-Fir in the Pacific Northwest. *Forests* 2018 9, 447. <https://www.mdpi.com/1999-4907/9/8/447>, <https://www.sierraclub.org/sites/www.sierraclub.org/files/program/documents/ECOTRUST%20FSC%20v%20BAU%20forestry%20study.pdf>. (“In general, policies encouraging or incentivizing increased riparian protections, green tree retention, or the extension of rotation ages are likely to translate into greater carbon storage. ... Both green tree retention and greater RMZ protections are likely to correspond to other additional values including water quality and habitat for fish and wildlife that are not quantified here. ... Our work clearly demonstrates that the adoption of certain forest practices including expanded riparian protections, increased green tree retention, and the extension of rotation ages can translate into substantially higher carbon storage than contemporary common practice for Douglas-fir management in the Pacific Northwest.”).

See also, Anderson, Kate 2022. YES, LONG ROTATIONS CAN YIELD REAL CLIMATE GAINS FOR CASCADIA - Harvesting trees at 80 years, instead of 40, stores more carbon and yields more timber. <https://www.sightline.org/2022/03/17/yes-long-rotations-can-lead-real-climate-gains-for-cascadia/> (“As far as ecosystem modelers are concerned, extended rotations as a top climate priority for Cascadia is settled science. In California, Oregon, and Washington, extending forest harvest rotations on industrial forestlands offers the highest potential carbon gains of any natural carbon solution. ... The key to the biological growth maximum is not wasting the sunshine. After a clear-cut, the sun pours down its photons, but they fall on stumps and seedlings. There are hardly any tree leaves or needles to photosynthesize sunlight and carbon into wood and oxygen. As a result, the photons are wasted, and the land's capacity to grow timber and store carbon is squandered. In round numbers, it takes at least ten years for a replanted clear-cut to green up and begin to look like a forest again. A 40-year rotation, driven more by a financial rotation age, means that 25 percent of the rotation is spent in the factory rebuilding stage, with timber production and carbon storage on hold.” citing Beverly E. Law, Tara W. Hudiburg, Logan T. Berner, Jeffrey J. Kent, Polly C. Buotte, Mark E. Harmon. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. Proceedings of the National Academy of Sciences Mar 2018, 201720064; DOI: 10.1073/pnas.1720064115 <https://web.archive.org/web/20180727130028/http://www.pnas.org/content/pnas/115/14/3663.full.pdf>.)

The amount of carbon missing from our forests vastly greater than the amount of carbon that can be accounted for in wood products storage. BLM's Western Oregon Plan Revision FEIS shows that decades of converting old growth forests to plantations has reduced current forest carbon stores on BLM lands in western Oregon by 149 million tons, while some of that wood was converted into wood products, only 11 million tons of that carbon remains stored in wood products today, so logging our public forests to make wood products results in approximately 13 times more carbon emissions than carbon storage. This is pieced together from BLM's Western Oregon Plan Revision FEIS Figures 3-17 (p 3-221) and Figure 3-18 (p 3-224). Further logging of mature forests will exacerbate this outcome. See also, Tara W Hudiburg, Beverly E Law, William R Moomaw, Mark E Harmon and Jeffrey E Stenzel 2019. Meeting GHG reduction targets requires accounting for all forest sector emissions. Environmental Research Letters, Volume 14, Number 9. <https://iopscience.iop.org/article/10.1088/1748-9326/ab28bb/pdf> ("... over 100 years of wood product usage is reducing the potential annual sink by an average of 21%, suggesting forest carbon storage can become more effective in climate mitigation through reduction in harvest, longer rotations, or more efficient wood product usage. Of the ~10,700 million metric tonnes of carbon dioxide equivalents removed from west coast forests since 1900, 81% of it has been returned to the atmosphere or deposited in landfills.")

The Forest Service estimates that carbon storage in wood products is only 5.25% of total carbon associated with National Forests in the Pacific Northwest. "... [W]e estimate that the Pacific Northwest Region HWP [harvested wood products] carbon stocks represent roughly 5.25% of total forest carbon storage associated with national forests in the Pacific Northwest Region in 2012." USDA Forest Service. 2015. Baseline Estimates of Carbon Stocks in Forests and Harvested Wood Products for National Forest System Units; Pacific Northwest Region. 48 pp. Whitepaper. <https://www.fs.usda.gov/sites/default/files/pacific-northwest-region-carbon-assessment.pdf>. Meanwhile, Depro et al (2008) estimate that a no harvest scenario applied to public forests in the US could add as much as 43% to the current carbon stocks. Depro, B., Murray, B., Alig, R., Shanks, A. 2008. Public land, timber harvests, and climate mitigation: quantifying carbon sequestration potential on U.S. public timberlands. Forest Ecology and Management. 255(3-4): 1122-1134. <https://pubag.nal.usda.gov/download/21039/PDF>.

A lot of wood products are "stored" in landfills where they emit methane which has a global warming effect much greater than CO2. Ingerson, A. 2009 Wood Products and Carbon Storage: Can Increased Production Help Solve the Climate Crisis? Washington, D.C.: The Wilderness Society. <http://web.archive.org/web/20100601080813/http://wilderness.org/files/Wood-Products-and-Carbon-Storage.pdf>. ("Key Points - 1. When wood is removed from the forest, most of it is lost during processing. The amount lost varies tremendously by region, tree species and size, and local infrastructure. 2. The majority of long-term off-site wood carbon storage occurs in landfills, where decomposing wood gives off significant amounts of methane, a gas with high global warming potential. 3. In addition to wood processing losses, fossil fuels are required to turn raw logs into finished products and ship them from forest to mill to construction site to landfill. 4. Once wood losses and fossil emissions are accounted for, the process of harvesting wood and turning it into products may release more greenhouse gases than the emissions saved by storing carbon in products and landfills. ... 9. Properly managed, wood can be a renewable source of building materials and fuels, but solving the climate crisis will require reducing the use of all materials and energy.")

Living trees store and accumulate carbon better than dead wood products. Even a suppressed tree stores carbon better than a dead tree after it is logged, limbed, bucked, debarked, milled, planed, processed, trimmed, manufactured, used, and then discarded. Recent evidence shows that slower-growing older trees tend to channel their energy into structural support and defense

compounds to “maximize durability while minimizing ... damage”. Colbert & Pederson. 2008. Relationship between radial growth rates and lifespan within North American tree species. *Ecoscience* 15(3), 349-357 (2008).

http://fate.nmfs.noaa.gov/documents/Publications/Black_et_al_2008_Ecoscience.pdf. See also, University of Montana. June 18, 2019. Cell structure linked to longevity of slow-growing Ponderosa Pines. <https://www.sciencedaily.com/releases/2019/06/190618174358.htm> (“Slow-growing ponderosa pines may have a better chance of surviving longer than fast-growing ones, especially as climate change increases the frequency and intensity of drought, according to new research from the University of Montana. ... [A] key difference between fast and slow growers resides in a microscopic valve-like structure between the cells that transport water in the wood, called the pit membrane. The unique shape of this valve in slow-growing trees provides greater safety against drought, but it slows down water transport, limiting growth rate.”) *citing* Beth Roskilly, Eric Keeling, Sharon Hood, Arnaud Giuggiola, Anna Sala. Conflicting functional effects of xylem pit structure relate to the growth-longevity trade-off in a conifer species. *Proceedings of the National Academy of Sciences*, 2019; 201900734 DOI: 10.1073/pnas.1900734116.

The “substitution” value of wood products is vastly over-estimated. Some say that using wood as a building material is better for the climate than using steel and cement because steel and cement are so energy intensive. It is important to recognize that steel and cement may be energy intensive but energy is fungible and can be produced renewably, so these alternative building materials can theoretically be decarbonized, whereas wood is *made* of carbon and is an integral part of the global carbon cycle. It can never be decarbonized.

In May 2020, over 200 scientists wrote to Congress, saying:

The wood products industry claims that substituting wood for concrete and steel reduces the overall carbon footprint of buildings. However, this claim has been refuted by more recent analyses that reveal forest industries have been using unrealistic and erroneous assumptions in their models, overestimating the long-term mitigation benefits of substitution by 2 to 100-fold (Law et al. 2018, Harmon 2019). The climate impact of wood is even worse if the reduced forest carbon sequestration and storage caused by nutrient loss and soil compaction from logging is included ...

Moomaw et al 2020. Scientists Letter to Congress Urging Protection of Forests to Mitigate the Climate Crisis, May 13, 2020. <https://96a.96e.myftpupload.com/wp-content/uploads/2020/05/200TopClimateScientistCongressProtectForestsForClimateChange13May20.pdf>.

The timber industry vastly over-states the alleged climate benefit of storing carbon in wood products or using wood as a *substitute* for alternative building materials. While wood may be preferable to other materials in some applications and there is a grain of truth in the substitution analysis, the timber industry’s efforts to show a “substitution” benefit from short-rotation forestry is severely flawed. Most of the analyses that tout this effect are produced and advocated by the timber industry with unreasonable assumptions that don’t stand up to scrutiny. Note that the mission of the CORRIM group is to promote the use of wood products, not to develop sound forest policy or climate policy. The substitution argument is an example of the timber industry carefully choosing assumptions to guarantee a certain result and then stopping the analysis short of a complete picture of the issue.

Substitution of wood for more fossil carbon intensive building materials has been projected to result in major climate mitigation benefits often exceeding those of the forests themselves. A reexamination of the fundamental assumptions underlying these projections indicates long-term mitigation benefits related to product substitution may

have been overestimated 2- to 100-fold. This suggests that while product substitution has limited climate mitigation benefits, to be effective the value and duration of the fossil carbon displacement, the longevity of buildings, and the nature of the forest supplying building materials must be considered. ... Conversion of older, high carbon stores forests to short rotation plantations would over the long term likely lead to more carbon being added to the atmosphere despite some of the harvested carbon being stored and production substitution occurring.

Mark E Harmon 2019. Have product substitution carbon benefits been overestimated? A sensitivity analysis of key assumptions. *Environ. Res. Lett.* *in press*
<https://doi.org/10.1088/1748-9326/ab1e95>.

NEPA analyses must give fair treatment to the merits of the competing ideas by disclosing the flaws and caveats associated with the substitution argument.

Law et al (2018) said:

Increased long-term storage in buildings and via product substitution has been suggested as a potential climate mitigation option. Pacific temperate forests can store carbon for many hundreds of years, which is much longer than is expected for buildings that are generally assumed to outlive their usefulness or be replaced within several decades (7). By 2035, about 75% of buildings in the United States will be replaced or renovated, based on new construction, demolition, and renovation trends (31, 32). Recent analysis suggests substitution benefits of using wood versus more fossil fuel-intensive materials have been overestimated by at least an order of magnitude (33). Our LCA accounts for losses in product substitution stores (PSSs) associated with building life span, and thus are considerably lower than when no losses are assumed (4, 34). While product substitution reduces the overall forest sector emissions, it cannot offset the losses incurred by frequent harvest and losses associated with product transportation, manufacturing, use, disposal, and decay. Methods for calculating substitution benefits should be improved in other regional assessments.

Beverly E. Law, Tara W. Hudiburg, Logan T. Berner, Jeffrey J. Kent, Polly C. Buotte, Mark E. Harmon. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. *Proceedings of the National Academy of Sciences* Mar 2018, 201720064; DOI: 10.1073/pnas.1720064115
<https://web.archive.org/web/20180727130028/http://www.pnas.org/content/pnas/115/14/3663.full.pdf>.

Shafer et al (2011) state:

An alternative to increasing carbon stores within the forest is to harvest wood and store some of this carbon within wood products (Perez-Garcia et al., 2005). Under current manufacturing, use, and disposal practices this alternative is unlikely to increase the overall carbon store of the forest sector, which includes the forest and wood products derived from the forest (Harmon et al., 2009). Manufacturing, use, and disposal of harvested wood all entail significant carbon losses that are either as large as or larger than those in the forest itself (Krankina and Harmon, 2007). Wood products carbon offsets associated with biofuels and substitution of wood for more energy intensive building materials, such as steel and concrete, can theoretically increase the carbon “stores” of wood products beyond that stored in the forest itself (Perez-Garcia et al., 2005; Lippke et al. 2010). However, **several issues need to be recognized regarding these offsets. First, most analyses have presented theoretical maximum product substitution offsets** and ignored the effects of additionality (i.e., degree to which practices differ from business as usual or statutory requirements),

permanence and replacement of existing wood products, and end-user preferences for building materials. If these factors are included, then **substitution effects are substantially lower than the theoretical maximum and unlikely to surpass carbon stores in forests for many centuries if at all. Second**, depending on the starting condition of the forest, both product **substitution and forest-related biofuels can create carbon debts that delay carbon benefits**. For example, biofuels harvested from existing forests could offset fossil fuel releases of carbon, but recent studies have indicated that carbon debts associated with the energy used during biofuel harvests, decreased carbon stores in forests, and differences in carbon to energy ratios could persist for decades to centuries, implying a significant temporal lag in net carbon uptake (Fargione et al., 2008; Searchinger et al., 2009). **Third**, being offsets, the **effectiveness of both biofuel and product substitution will vary with the duration of the offset**; the longer the delay in releasing fossil fuel carbon, the more effective offsets become: An offset with a 1 year delay would have little impact on atmospheric CO₂ concentrations, whereas an offset of hundreds of years would have a much greater impact. **Unfortunately, the duration of offsets is not well understood at this point, but it is unlikely to be infinite as tacitly assumed in many current analyses**. Finally, while offsets are often counted as carbon stores, they are difficult to directly inventory because they are not physically in an identifiable location, whereas carbon stored in forests can be more directly inventoried and quantified.

Sarah L. Shafer, Mark E. Harmon, Ronald P. Neilson, Rupert Seidl, Brad St. Clair, Andrew Yost 2011. Oregon Climate Assessment Report (OCAR) <http://occri.net/ocar> Chapter 5. The Potential Effects of Climate Change on Oregon's Vegetation. <http://occri.net/wp-content/uploads/2011/04/chapter5ocar.pdf>.

If the agency wishes to rely on substitution to justify carbon emissions from logging, they cannot assume the project will result in the theoretical maximum substitution benefits. They must instead consider and analyze the real world substitution effects based on several key factors.

Fain et al (2018) explain--

[S]ubstitution is a key variable in determining cumulative carbon benefits over time. Franklin et al. discuss 6 key factors in determining the magnitude of substitution effects through time: (1) the amount of product-in-use created from the harvest, (2) the displacement factor, (3) percent of the harvest that will substitute for non-wood products like concrete or steel, (4) the cumulative nature of the substitution effects, (5) the length of time the substitution effect accumulates, and (6) the effect on the average lifespan of buildings if wood is substituted for fossil fuel intensive materials. ... The displacement factor ... varies depending on the building system and the embedded GHG emissions factor within displaced materials. ... [E]ngineering studies found the average displacement factor value to be 2.1, ... [T]his number is a global reference average and likely not accurate for any given place and time. Uniquely local and dynamic biological and socio-economic factors such as, silvicultural systems, tree species, form and age of trees, amount of wood degrade, mortality rates, market demand, economics of transporting to processing facilities, and supply quota agreements, greatly influence commercial wood products and thus any attempts to quantify substitution rates and life cycles. ... [A]s technology, wood use, and energy sources evolve into the future, so will the displacement factor associated with substitution, most likely declining.

Fain, S.J.; Kittler, B.; Chowyuk, A. Managing Moist Forests of the Pacific Northwest United States for Climate Positive Outcomes. *Forests* 2018; 9(10):618. <https://www.mdpi.com/1999-4907/9/10/618> citing Franklin, J.; Johnson, N.; Johnson, D. *Ecological Forest Management*; Waveland Press: Long Grove, IL, USA, 2018.

... benefits attributed to product substitution are commonly overestimated. Substituting wood for aluminum and steel can displace fossil fuel emissions, but the displacement period needs to be part of the accounting. Displacement occurs until the building is replaced, and then the substitution can be renewed by a new building or it can be lost by using a material with a higher energy cost. In addition, it is often assumed that product substitution will reduce the demand for fossil fuel. However, due to human behavior and current economic systems that ignore adverse externalities, reducing resource consumption through substitution or improvements in efficiency rarely reduce fossil fuel use (York, 2012). Therefore, benefits may be substantially lower and the payback period much longer and smaller for the carbon debt from intensified management and avoided fossil fuel combustion than commonly assumed (Haberl et al., 2013).

Law, B.E., Waring, R.H. 2015. Review and synthesis - Carbon implications of current and future effects of drought, fire and management on Pacific Northwest forests. *Forest Ecology and Management* 355 (2015) 4–14. <http://people.forestry.oregonstate.edu/richard-waring/sites/people.forestry.oregonstate.edu.richard-waring/files/publications/Law%20and%20Waring%202015.pdf>

Law & Harmon conducted a literature review and concluded ...

Most LCA [life cycle analysis] studies rely heavily on wood product substitution for GHG benefits, and these have been grossly overestimated, with many ambiguous assertions that gloss over forest carbon dynamics; for example:

- Biofuel emissions are assumed to be zero because they are balanced by net growth, yet this would depend on the state of the preceding forest system – they could be positive, neutral or negative;
- Old forests are assumed to always be carbon sources, while young forests are always assumed to be carbon sinks, contrary to forest carbon dynamics findings;
- Dead wood and soil carbon stores are either not included or assumed to be constant;
- In one LCA, dead wood is not present in older forests, contrary to findings in the extensive ecological literature;
- The wood product pool is assumed to be an increasing carbon stock over time.

...

Substitution of more energy-intensive building materials with a less energy intensive one can, in theory, result in a fossil fuel offset; for example, when wood replaces a construction material with higher emissions (e.g., concrete or steel), the fossil CO₂ emission avoided by choosing wood is credited as an offset. Thus, harvest of forest carbon and placement into buildings can impact the overall carbon balance of the forest sector [33,42]. However, several additional factors need to be considered. First, changes in the carbon stores of the forest ecosystem have to be considered relative to a base case that includes a lower level of harvests. As noted above, decreasing the interval between harvests, or increasing harvest intensity will lower the carbon store in the forest [9–11,31]; the question is whether stores in forest products combined with substitution offsets surpass losses from shorter rotations. Since the forest has a maximum carrying capacity, just the growth in carbon stores and offsets would seem to eventually exceed old forest carbon, although it could take centuries to happen, even using the most generous substitution effects. With more realistic substitution effects, it may never happen. In some cases, the amount of live and dead biomass in unharvested forests was grossly underestimated leading to an overestimation of the relative benefits of substitution. Second, in substitution effects calculations, it is often tacitly assumed that wood that is removed from forests and used in long-term wood products, specifically buildings, continues to accumulate infinitely over time. While building carbon stores

have increased in many areas (e.g., the USA), this is largely because more forest area is being harvested and not because the harvest-related stores per harvest area are increasing. The trend that is being used as evidence of increasing building stores is based on the fact that because a greater area has been harvested, the total store has increased. This is not the same thing as the increase associated with a particular area of forest. A fixed per area basis is how substitution effects have largely been evaluated in the past, so arguing on an expanding area basis is inappropriate. The reason that wood products saturate is that housing and other wood products have a finite lifespan and are eventually replaced [43]. Although there can be some reuse of wood, essentially assuming an infinite lifespan or 100% reuse of wood products is completely unrealistic. Carbon is always lost as wood products are used or disposed of, which means release of CO₂ to the atmosphere. Since long-term storage in forest products saturates over time (i.e., eventually does not increase), the effect of substituting wood for fossil fuel energy is also likely to saturate. Third, in most cases, the substitution offset was calculated based on the assumption that each time a house is to be built, the preference is for nonwood materials. This results in an estimate of the maximum substitution effect possible, but does not account for actual preferences for building materials. Granted, preferences vary by region and over time, but without accounting for these one cannot possibly estimate realistic substitution benefits. Fourth, current substitution accounting appears to violate a key principle of carbon offsets, namely permanence. In fact the ever-increasing substitution offset presented in these analyses appears to depend on impermanence of wooden buildings. Fifth, most, if not all, current analyses of substitution effects ignore the effects of additionality and whether wooden buildings are initially present. Given that many forests have already been harvested to produce wood products, replacing wooden buildings with more wooden buildings results in no additional substitution effect. Finally, these studies assume that it is a permanent benefit to GHG removal from the atmosphere. That is, they assume there is a continual increase in the carbon credit, and maintenance of a sustainable productive forest dedicated to providing substitutes for nonwood fuels and materials [44].

These caveats all suggest that while there is likely to be some building material substitution effect that is valid, it is far lower than generally estimated and as subject to saturation as other forest-related carbon pools. In summary, the substitution effect appears to have been grossly overestimated. Substitution is an offset, not a store. Offsets depend on the use of appropriate accounting rules. Until rules such as permanence, additionality and leakage are followed, the values being presented in many analyses are not credible.

...

Life cycle analysis (including substitution, proposed considerations)

...

- **Substitution of more energy intensive building materials with less energy intensive ones can in theory result in a fossil fuel offset, but important considerations suggest that the substitution effect is substantially lower than estimated, and is subject to saturation.**

Beverly Elizabeth Law & Mark E Harmon 2011. Forest sector carbon management, measurement and verification, and discussion of policy related to mitigation and adaptation of forests to climate change. Carbon Management.

<https://archives.corvallisoregon.gov/public/ElectronicFile.aspx?dbid=0&docid=4256162>.

Failure to Respond to Public Comments

The Tiger-Mill EA failed to document any consideration of public comments. The Forest Service's notice-comment-objection regulations state unambiguously "Consideration of comments. (1) The responsible official shall consider all written comments submitted in compliance with paragraph (a) of this section." [36 CFR 218.25 \(b\)](#). The rules define "*Specific written comments*" as –

Written comments are those submitted to the responsible official or designee during a designated opportunity for public participation (§218.5(a)) provided for a proposed project. Written comments can include submission of transcriptions or other notes from oral statements or presentation. For the purposes of this rule, specific written comments should be within the scope of the proposed action, have a direct relationship to the proposed action, and must include supporting reasons for the responsible official to consider."

[36 CFR 218.2.](#)

In order to assure compliance with the requirements to "consider" comments, it is only logical that the Forest Service must document in writing its fulfillment of the requirement. Without a record of the consideration of comments, administrative and judicial review of these requirements would be impossible, rendering these requirements meaningless.

In addition, NEPA has a separate requirement that federal agencies must respond to comments on NEPA documents. "An agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond by one or more of the means listed below, stating its response in the final statement. ..." 40 CFR 1503.4(a).

This section is addressed to EISs, but the CEQ regs are in fact applicable to EAs as well. "These regulations, unlike the predecessor guidelines, are not confined to sec. 102(2)(C) (environmental impact statements)." 40 CFR 1500.3.

In *City of Davis v. Coleman*, 521 F.2d 661 (9th Cir., 1975) the court said that in a statute requiring the social and environmental effects of projects be considered — "considered means to investigate and analyze; 'consideration' encompasses an affirmative duty to investigate and compile data, and a further duty to incorporate that data into a detailed reasoned analysis..."

Finally, independent of NEPA, the APA also requires agencies to adequately respond to all significant public comment as a "fundamental tenet of administrative law" *NRDC v. EPA*, 859 F.2d 156, 188 (D.C. Cir. 1988); *see also ACLU v. FCC*, 823 F.2d 1554, 1581 (D.C. Cir. 1987); *Sierra Club v. EPA*, 353 F.3d 976, 986 (D.C. Cir. 2004); *Am. Iron & Steel Inst. V. EPA*, 115 F.3d 979, 1005 (D.C. Cir. 1997). This principle ensures that agencies consider all material points raised by the public. *NRDC*, 859 F.2d at 188. Failure to respond to public comment can be grounds for invalidation of a decision as arbitrary and capricious. *Id.* A comment is "significant" when "if true, [it] raise[s] points relevant to the agency's decision and which, if adopted, would require a change in an agency's proposed rule." *Home Box Office Inc. v. FCC*, 567 F.2d 9, 35, n.58 (D.C. Cir. 1977). The comment must "step over a threshold requirement of materiality" by explaining why the agency's error is relevant and not "merely stat[ing] that a particular mistake was made." *Portland Cement Ass'n v. Ruckelshaus*, 486 F.2d 375, 394 (D.C. Cir. 1973).

The Supreme Court's decision in [Ohio v EPA](#) (S.Ct. June 27, 2024) increases the agency's burden to meaningfully respond to public comment, especially comments that raise concerns about the rationale for the proposed action given the circumstances. ("When faced with

comments like the ones it received, EPA needed to explain why it believed its rule would continue to offer cost-effective improvements in downwind air quality with only a subset of the States it originally intended to cover.”).

Sincerely,

A handwritten signature in cursive script that reads "Doug Heiken". The ink is dark and the signature is fluid, with a large 'D' and 'H'.

Doug Heiken