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23 June 2026

TO: North Fork John Day Ranger District

ATTN: Arden Simpson and Diane Shirley

VIA: <https://cara.fs2c.usda.gov/Public/CommentInput?Project=285597>

Subject: Battle Bruin IVM ESD Project — scoping comments

Please accept the following comments from Oregon Wild concerning the Battle Bruin IVM ESD Project, <https://www.fs.usda.gov/ro6/umatilla/projects/285597>. Oregon Wild represents 20,000 members and supporters who share our mission to protect and restore Oregon's wildlands, wildlife, and water as an enduring legacy. Our goal is to protect areas that remain intact while striving to restore areas that have been degraded. This can be accomplished by moving over-represented ecosystem elements (such as logged and roaded areas) toward characteristics that are currently under-represented (such as roadless areas and complex old forest).

This proposal involves:

- Located along the NF Desolation Creek proposed WSR and sandwiched between a roadless area and the NFJD Wilderness. Includes uninventoried roadless areas contiguous to inventoried roadless areas.
- Land Allocation: mostly MA C7 - Special Fish Management Area
- No trees >21" dbh proposed for removal, but 21-30" dbh grand fir may be felled or girdled and retained on-site (maybe 282 ac?)
 - 8,557 ac commercial logging (CT, STS, Sanitation, Shelterwood)
 - regen in lodgepole (won't manage toward LOS)
 - 15,883 ac small diameter (non-commercial? thinning up to 9" dbh)
 - 75 miles of shaded fuel breaks, 300-500 ft on each side of roads (100-130 tpa retained)
 - 4,693 ac shaded fuel breaks via commercial logging
 - 6,196 ac shaded fuel breaks via non-commercial thinning
 - 12,550 ac hand thinning
 - 36k ac site prep, prescribed fire, and planting/seeding
 - 27 miles temporary road construction (19 mi new) outside of the 500 ft buffer on Class 1 streams
 - danger tree removal
 - 2,210 ac special forest products: firewood and post & poles

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Purpose and Need

The project title says integrated management plan, but several important issues do not appear to be part of the integrated plan, including: snag habitat recruitment, managing toward LOS, avoiding GHG emissions, conserving/restoring the natural range of variability for large unroaded areas, conserving big game habitat and connectivity, avoiding the harms of road construction, avoiding problems with regen and heavy thinning (stimulating surface and ladder fuels, increasing evaporative demand, carbon emissions), etc.

Ironically, this project's purpose and need is "vegetation management (other than forest products)" yet this project includes almost 9,000 acres of commercial logging which has significant trade-offs on soil, water, climate, and habitat that compromise the desired future condition and standards and guidelines for the dominant MA C7- Special Fish Management area. The non-timber goals are likely best met with non-commercial thinning and prescribed fire, rather than commercial logging and road construction.

The Emergency Determination is Not Warranted.

Emergency interpretive memo says

“In certain situations, an agency may determine that an emergency exists that warrants immediate Federal action to address imminent threats to life, property, or important natural, cultural, or historic resources. ... ‘Where emergency circumstances make it necessary to take an action with reasonably foreseeable significant effects without observing the provisions of these procedures, [agency] will consult with CEQ about alternative arrangements for compliance with NEPA § 102(2)(C)), 42 U.S.C. § 4332(2)(C).’ Agencies should develop these alternative arrangements based on emergency-specific facts and circumstances during consultation with CEQ.”

<https://ceq.doe.gov/docs/ceq-regulations-and-guidance/Emergencies-and-NEPA-Guidance-2026.pdf>.

When diagnosing and treating forest health problems, it is more essential to consider alternative treatments. There is a maxim in medical field which says “If it’s not in the differential it won’t be in the diagnosis” which highlights that making a correct diagnosis is impossible unless all of the possible alternative diagnoses are considered. This is known as a “comprehensive differential diagnosis” and is essential to prevent improper or potentially harmful treatments. This is precisely why NEPA requires consideration of all reasonable alternatives, so that the environmental conditions are accurately assessed, and the most appropriate “treatment” plan can be identified. This analogy is particularly apt when the agency claims to be addressing forest “health” concerns such as fire, insects, disease, drought stress, etc.

Given the complex effects of logging on fire and fuels, we think it is wise to use the full NEPA process to consider alternatives that resolve complex trade-offs in different ways. It is absurd to think there is only one way to get this project done, and to pretend there are no trade-offs from using commercial logging as the tool for the job here.

- Logging will make fire hazard worse, not better, by making the stands hotter/drier/windier, moving hazardous fuels from the canopy to the ground where they are more hazardous, stimulating growth of hazardous fuels, and making future maintenance treatments more expensive. The agency often lacks funds and personnel to treat activity fuels so they often sit on the ground for a long time, raising fire hazard compared to no action.
- Logging will make the forest less resilient because species that depend on dead wood will be put at further risk, carbon emissions will exacerbate global climate change and worsen weather extremes that the forests must endure. Road construction also makes the watershed less resilience hydrologically and may increase the risk of fire ignitions.

The proposed management activities in this case are not likely to meaningfully to address the conditions contributing to the “emergency.” For instance, (i) wildfire is weather driven, not fuel driven. (ii) Logging to reduce competition for soil moisture increases evaporative demand and adds to drought stress. (iii) Forest insects and disease are solutions, not problems. These natural processes thin the forest for free, avoids the harmful effects of roads, and recruit valuable snags and dead wood that are in short supply regionally. Natural mortality also selects against individuals less adapted to the site and current biophysical conditions, and selects for trees that are better adapted.

The Secretary’s Memo declares that our “National Forests are in crisis due to uncharacteristically severe wildfires, insect and disease outbreaks, invasive species, and other

stressors whose impacts have been compounded by too little active management,” and thus requires the Secretary to make an ESD under section 40803 of the IIJA.

Under section 40803 of the IIJA, an emergency situation exists only where “immediate implementation” of authorized emergency actions are necessary to provide “[r]elief from hazards threatening human health and safety” or mitigate “threats to natural resources on National Forest System land or adjacent land.” 16 U.S.C. § 6592c(a)(2)(A) & (B). “Authorized emergency actions” include the following:

1. the salvage of dead or dying trees;
2. the harvest of trees damaged by wind or ice;
3. the commercial and noncommercial sanitation harvest of trees to control insects or disease, including trees already infested with insects or disease;
4. the reforestation or replanting of fire-impacted areas through planting, control of competing vegetation, or other activities that enhance natural regeneration and restore forest species;
5. the removal of hazardous trees in close proximity to roads and trails;
6. the removal of hazardous fuels;
7. the restoration of water sources or infrastructure;
8. the reconstruction of existing utility lines; and
9. the replacement of underground cables.

16 U.S.C. § 6592c(b)(2). Unfortunately, a majority of these authorized actions intended to address the threat of severe wildfire and insect and disease outbreaks boil down to one action: increased logging.

We agree that our forests are suffering, but the main cause is logging, fire suppression, and climate change. This project does not address those problems. If fact, logging and roads will make them all worse, with increased removal of habitat, accelerated GHG emissions, and increased road access that will be used by the Forest Service to suppress fires that might otherwise do good ecological work.

Provide public comment on a more informative NEPA document, e.g., the draft Environmental Assessment

We have been told that there will not be a comment period on the draft Environmental Assessment for this project. This is disappointing to say the least.

The scoping document is just a proposed action. It lacks important parts of a real NEPA document, especially the affected environment and the effects analysis, which the public will want to comment on to ensure that the decision-maker is fully informed before making a decision.

The Forest Service should provide for public comment on a draft environmental assessment so that any errors in the analysis can be day lighted and corrected so an informed decision can be made. 36 CFR 218 is still in effect and that regulation requires a 30-day comment period on Environmental Assessments.

We also urge the agency to understand that providing for public comments on a real NEPA effects analysis allows the public to more precisely target their comments, while failure to provide comments on an informative analysis means that we have to guess what the analysis might say and resulting in a firehose of comments designed to capture a wide range of possible analyses. This is a waste of time for both the agency and the public.

The Forest Service has official rules (36 CFR 218) governing notice-comment-objection on Forest Service projects implementing forest plans. These rules have not been enjoined or rescinded as far as we are aware. These rules unambiguously require a 30-day comment period after public notice of the availability of Environmental Assessments, 36 CFR 218.24(b)(4).

The Forest Service cannot extract from vague language in the Infrastructure bill or the USDA NEPA regulations some new authority to change those requirements.

First, the Infrastructure bill (Section 40807 B.1.B) waives the *objection* process for so-called “emergency” projects, but is completely silent on the *comment period* for EAs.

Second, the vague provisions of the USDA NEPA regulations at 7 CFR 1b 5 cannot be used to waive the clear requirement of the agency’s own notice-comment-objection regulations. Generally speaking, under the rules of legal interpretation, vague terms cannot override explicit terms.

Third, by exercising the alleged authority to waive the comment period on the EA, the Forest Service is violating two separate explicit requirements for a 30-day comment periods in its own rules, i.e., 36 CFR 218.24(b)(4), and 219.16(a)(2). “[A]n agency cannot exempt itself from duties plainly imposed by law; it cannot decide that only one of two statutes governs its activities when the laws themselves... clearly show that both apply.” *Seattle Audubon Soc’y v. Evans*, 952 F.2d 297, 302 (9th Cir. 1991).

As John Haber noted in a comment on [The SmokeyWire blog](#):

What we often hear about NEPA is that it has “twin aims,” one for the decision-maker, and the other for the public. The Supreme Court’s take (1981) on the latter is, “The second aim is to inform the public that the agency has considered environmental concerns in its decisionmaking process.” Public participation in the decisionmaking process is not statutorily required, but has been found to be a way of helping meet that second “aim.”

[citing *Weinberger v. Catholic Action of Hawaii/Peace Education Project*, 454 U.S. 139 (1981). <http://supreme.justia.com/cases/federal/us/454/139/>.]

The agency must provide an opportunity for public comment on real NEPA documents, not just scoping notices or “proposed actions.” Voluminous case law which requires all federal agencies to provide public comment on Environmental Assessments. The proposed action or scoping notice generally does not include any description of the affected environment or any analysis of environmental effects upon which the public can base their opinions and comments. Failure to provide information about the affected environment and failure to provide comment on the analysis of effects undermines a core purpose of NEPA which is to inform the public. Without an informed public, the decision-maker is denied the benefit of informed comments from the public, and the quality of final decisions will suffer.

Public participation works best when the public is well-informed and can have a meaningful influence on decisions. Public involvement is essential at all stages of decision-making but it is

most essential at the stage of commenting on well-developed NEPA documents. Scoping by itself is too early in the process, because the proposed action is not yet well-developed so the public does not know what they are commenting on. The objection process is too late, because the agency has already made up its mind and the public's views will likely be dismissed. Also, many members of the public may be willing to comment, but are unwilling to "object" so the agency should not discourage public involvement through intimidation.

To fulfill the purposes of NEPA, the decision-maker needs to have the benefit of public comment on the effects analysis. The CEQ regs may be rescinded, but they remain a clear description of the intent of NEPA. "Accurate scientific analysis, expert agency comments, and **public scrutiny are essential to implementing NEPA.**" 40 CFR 1500.1(b). and "Federal agencies shall to the fullest extent possible: ... (b) Implement procedures to **make the NEPA process more useful to decision-makers and the public;** ... (c) **Integrate the requirements of NEPA with other planning and environmental review procedures** required by law or by agency practice so that all such procedures run concurrently rather than consecutively. (d) **Encourage and facilitate public involvement** in decisions which affect the quality of the human environment." 40 CFR 1500.2. 40 CFR § 1501.2 states that: "Each agency shall:" ... "(b) Identify environmental effects and values in adequate detail so they can be compared to economic and technical analyses. Environmental documents and appropriate analyses shall be circulated and reviewed at the same time..." Environmental Document is defined at 40 CFR § 1508.10: "Environmental document" includes the documents specified in § 1508.9 (environmental assessment)..." 40 CFR § 1506.6(a) also requires the Forest Service to "Make diligent efforts to involve the public in preparing and implementing their NEPA procedures." CEQ's 40 Questions (Question 38) clarify this by stating, "Section 1506.6 requires agencies to involve the public in implementing their NEPA procedures, and this includes public involvement in the preparation of EAs and FONSI's."

National Park and Conservation Ass'n v. Federal Aviation Admin., 998 F.2d 1523, 1531 (10th Cir. 1993) ("Congress, through... NEPA, has determined that the public has a right to participate in actions affecting public lands."); Sierra Club v. Hodel, 848 F.2d 1068, 1093 (10th Cir. 1988) (NEPA "provides for broad-based participation" and requires "a cross-pollination of views.").

The 9th Circuit recently held that there are limits to the agencies' discretion to limit public involvement. Just last year the 9th Circuit Court of Appeals rejected comment periods less than 30 days:

Although we have not established a minimum level of public comment and participation required by the regulations governing the EA and [Finding of No Significant Impact] process, we clearly have held that the regulations at issue must mean something." *Citizens for Better Forestry v. U.S. Dept. of Agric.*, 341 F.3d 961, 970 (9th Cir. 2003). In *Bering Strait Citizens for Responsible Resource Development v. U.S. Army Corps of Engineers*, we were more concrete, holding that "[a]n agency, when preparing an EA, must provide the public with sufficient environmental information, considered in the totality of circumstances, to permit members of the public to weigh in with their views and thus inform the agency decision-making process." 524 F.3d 938, 953 (9th Cir. 2008). We concluded in *Bering Strait Citizens* that this standard was met where an agency "widely disseminated" information about a proposed mining project, "received a high level of public comment," and "made substantial efforts to provide additional information" explaining the permitting process. *Id.*

To meet [**58] the agency's responsibility "to permit members of the public to weigh in with their views and thus inform the agency decision-making process," the participation period offered for comment must be sufficiently long to permit members of

the public to weigh in on the decision in an informed manner. *Id.* The period must be long enough for participants to obtain and absorb the environmental information provided by the agency and then prepare their own analyses and critiques, including consultation with experts where appropriate. In *Fund for Animals v. Norton*, for example, a district court concluded that the agency's provision of a two-week comment period was insufficient, as the comments produced in such a short time period were likely to be inadequate to allow the agency to take a "hard look" at the proposed regulation. 281 F. Supp. 2d 209, 226-29 (D.D.C. 2003).

With respect to the parcels for which BLM offered a 30-day comment period for the Environmental Assessment (the June 2018 Wyoming and Nevada sales, and 124 of the parcels identified by Expressions of Interest in the September 2018 Wyoming sale), there was no NEPA violation. Those Assessments were conducted under the participation provisions of IM 2010-117, which Western ^{***59} Watersheds agrees were sufficient.

As to the parcels for which the comment or scoping period was less than 30 days (254 parcels offered in the September 2018 Wyoming sale, and all parcels offered in the September 2018 Utah sale), or for which the agency prepared a Determination of NEPA Adequacy (the September 2018 Nevada sale), we do not decide whether the participation offered was inconsistent with NEPA's requirements when considered in isolation. The statute itself does not impose any substantive measure of adequate participation. And the agency did ultimately receive comments on the Environmental Assessments prepared ^[*39] for each of the contested sales, as well as protests challenging the parcels included.

A change in policy or in a planned agency action may nevertheless be arbitrary and capricious if the agency fails to provide a "reasoned explanation" for the change. Applying the factors identified in *Fox Television*, we conclude that the Bureau displayed "awareness that it [was] changing position" on lease sale procedures, *Fox*, 556 U.S. at 515-16, by stating that IM 2018-034 "supersede[d] existing policy announced in IM 2010-117." The Bureau's given reason for adopting the new IM—"to simplify and streamline the leasing ^{***60} process to alleviate unnecessary impediments and burdens," and "to expedite the offering of lands for lease"—indicated that the agency "believe[d]" that the new policy was an improvement upon the old. *Id.*

As to whether simplification and streamlining of oil and gas leasing decisions are "good reasons" for reducing the overall opportunity for public participation, we have noted that "[e]lections have policy consequences," and that an agency may reevaluate the weight it gives to different priorities. *Organized Vill. of Kake v. U.S. Dep't of Agric.*, 795 F.3d at 968. For example, an agency's decision under a new administration to "value[] socioeconomic concerns more highly than environmental protection" may be an acceptable justification for a change of heart. *Id.*

At the same time, the justification offered for a change in policy or agency action cannot be inconsistent with the purpose of the requirement being implemented. Here, the agency's decision to prioritize administrative efficiency and expedition of oil and gas production over deliberative decision-making that takes into account informed public comments is in direct tension with NEPA. NEPA's "twin aims" are to ensure that the agency consider "every significant aspect of the environmental impact ^{***61} of a proposed action," and "inform the public that it has indeed considered environmental concerns in its decisionmaking process." *Baltimore Gas & Elec. Co. v. Nat. Res. Def. Council, Inc.*, 462 U.S. at 97. BLM failed entirely to acknowledge the potential costs of reducing public participation in leasing decisions, including that shortening the participation opportunity might lead to insufficient consideration of the environmental impacts of its actions. Individuals and groups are unlikely to learn of the decision, research the environmental impacts of each sale—here, numbering in the dozens to

hundreds—and compose a formal comment or protest marshalling facts and arguments in little over two weeks. By curtailing the opportunities available for public input in land management decisions for the sole purpose of more expeditious offerings of oil and gas leaseholds, the agency "entirely failed to consider an important aspect of the problem," one embedded in NEPA, the statute IM 2018-034 was implementing. *WildEarth Guardians v. U.S. E.P.A.*, 759 F.3d 1064, 1069-70 (9th Cir. 2014).

Whether the agency's new policy is "permissible under the statute"—as interpreted by the CEQ regulations—is also doubtful when considered in the context of its earlier policy. *Fox Television*, 556 U.S. at 515-16. The agency has provided no explanation as to how a 15-day comment or scoping period [**62] engages the public "to the extent practicable," 40 C.F.R. § 1501.4(b), or to "the fullest extent possible," *id.* § 1500.2(d), where the agency offered a comment period twice as long under IM 2010-117. Similarly, the government does not justify its decision to eliminate participation in the preparation of the Determinations of NEPA Adequacy, when [*40] it previously allowed 30 days for public comment.

Accordingly, we conclude that the Bureau violated NEPA when it eliminated in some instances and severely shortened in others the various public participation periods for NEPA review during the Phase One lease sales without providing a "reasoned explanation" for the change.

Mont. Wildlife Fedn v. Haaland, 127 F.4th 1, 38-40 (9th Circ 2025).

<https://cdn.ca9.uscourts.gov/datastore/opinions/2025/01/17/20-35609.pdf>

Killing large trees requires a plan amendment, and 30-day comment period.

The FS intends to cut large trees >21" dbh. This requires a plan amendment, because the Eastside Screens mandate retention of "live" trees. ("Scenario A ... Maintain all remnant late and old seral and/or structural live trees ≥ 21" dbh that currently exist within stands proposed for harvest activities") The FS says they intend to retain those killed trees, but they will kill them, which is not maintaining "live" trees. Any project requiring a plan amendment cannot rely on the emergency authorities, and the FS is required to provide a 30-day comment period on the EA.

Even if the Forest Service's takes the position that when they invoke Section 40807, they no longer have to comply with any of the provisions of 36 CFR Part **218**, that does not waive the requirements of the forest planning regulations, because this project involves a forest plan amendment, Part **219** applies. And 219.16(a)(2) requires a 30-day comment period:

"For an amendment that applies only to one project or activity for which a draft EIS is prepared, the comment period is at least 45 days unless a different time period is required by law or regulation or authorized pursuant to 40 CFR 1506.10(d). **For an amendment for which a draft EIS is not prepared, the comment period is at least 30 days[.]**"

The Forest Service should prepare an EIS

The Forest Service should prepare an EIS to fulfill the purposes of NEPA and to consider the potentially significant effects of logging and road building. Significant effects include:

- extensive logging and road building in a land allocation devoted to fish conservation;
- killing large trees that could provide large tree habitat and future large snag habitat;
- carbon emissions that amplify global climate change and ocean acidification, and forgone carbon storage increases that would mitigate global climate change and ocean acidification;
- Significant loss of snag habitat recruitment over the long term;
- Violations of the public involvement requirements in 36 CFR §§ 218 and 219.
- Violations of the LRMP as amended by the Eastside Screens (failing to maintain large live trees, failure to manage toward LOS due to regen and heavy thinning and loss of snag habitat recruitment), MA C7 (failure to maintain HEI, cover, and avoid impeding big game movement with heavy thinning and wide fuel breaks along roads), and PACFISH/INFISH (failure to prevent logging and road activities that will retard attainment of riparian management objectives).
- Cumulative adverse effects of logging, roads, fire, global climate change, OHVs, etc. The landscape will be better off dealing with the unavoidable effects of fire and climate change, than with those plus the added stress of logging and roads.

One of the purposes of an environmental assessment is to fulfill the purposes of NEPA when an EIS is not required. This EA does not fulfill those purposes, because there are inadequate alternatives, and there is no public comment to help refine the analysis and ensure a properly informed decision. If the Forest Service is not going to provide public comment on the effects analysis in the EA, then they should prepare an Environmental Impact Statement so that the public does have a chance to comment on the effects analysis.

“A threshold question in a NEPA case is whether a proposed project will ‘significantly affect’ the environment, thereby triggering the requirement for an EIS.” Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208, 1212 (9th Cir. 1998), citing 42 U.S.C. § 4332(2)(C). The Ninth Circuit has established a “relatively low threshold for preparation of an EIS,” and an EIS must be prepared if a plaintiff raises substantial questions about whether a project will have significant effects. NRDC v. Duvall, 777 F. Supp. 1533, 1537 (E.D. Cal. 1991); Blue Mountains, 161 F.3d at 1212. The NEPA regulations outline factors that an agency must consider in determining whether an action may significantly affect the environment. Sierra Club v. U.S. Forest Serv., 843 F.2d 1190, 1193 (9th Cir. 1988); 40 C.F.R. § 1508.27; see also Blue Mountains, 161 F.3d at 1212. Any of these factors may be sufficient to require preparation of an EIS. Public Citizen v. Dep’t of Transp., 316 F.3d 1002, 1023 (9th Cir. 2003) (holding that the presence of one NEPA significance factor required the preparation of an EIS); Anderson v. Evans, 314 F.3d 1006, 1021 (9th Cir. 2002) (same).

If the agency decides not to prepare an EIS, the agency must supply a “convincing statement of reasons” to explain why the action will not have a significant impact on the environment. Blue Mountains, 161 F.3d at 1212; see also 40 C.F.R. § 1501.4(e); 40 C.F.R. § 1508.13. “The statement of reasons is crucial to determining whether the agency took a hard look at the potential environmental impact of a project.” Blue Mountains, 161 F.3d at 1212 (internal quotations omitted). The Court is to defer to the agency’s decision not to prepare an EIS only when that

decision is “fully informed and well considered.” Jones v. Gordon, 792 F.2d 821, 828 (9th Cir. 1986).

The scale of this project is large and will cause significant effects including long-lasting detrimental changes to soil and water quality, degradation of the unique values represented by large unroaded areas or areas with low road density, killing of mature and old-growth forests, felling snags and reducing future snag recruitment, loss of wildlife habitat, exacerbating the project area’s deviation from the historic range of variability, etc.

This project also has many conflicting and competing objectives and outcomes that complicate the analysis and require an EIS. These include:

- The soil effects, water quality effects, and invasive weed effects of the combination of road decommissioning and road construction.
- The complex positive and negative effects of logging and roads and fire on soil, weeds, water, wildlife habitat, fire hazard, site productivity, and forest insects/disease/pathogens.
- Related activities such as off-road vehicles, livestock grazing and firewood poaching will also conflict with the proposed action and may be exacerbated by new roads which open access to poachers (reducing snag and down wood habitat) and off-road vehicles (causes erosion and spreads weeds), canopy removal which promotes growth of forage and modifies livestock use (modify fuel and fire behavior).

The leaders of the U.S. Forest Service, the U.S. Geological Survey and the National Oceanic and Atmospheric Administration, appeared at the annual meeting of the 8,000-member Ecological Society of America and admitted to the complexity of land management and the uncertainty of outcomes. These are indicators of NEPA significance:

Forest Service Chief Dale Bosworth said his agency no longer focuses on a particular tree or animal species as it did 40 years ago, but now takes a more complicated landscape-wide approach to managing federal forests.

"That ecological complexity has humbled us as land managers," he said. "It means that we're not going to be 100 percent sure about management prescriptions, and we're not going to be 100 percent sure about the outcomes of what we do on the land."

Bosworth, who was appointed the agency's chief in 2001, said mistakes will be made in managing forests. "But through science maybe we can do a much better job of learning through those mistakes and help us improve our future management."

The agencies have previously recognized the complexities and uncertainties of forest management:

The management of large forest landscapes is a complex and developing discipline. There is less than complete information about many of the relationships and conditions of fire ecology, wildlife and plant species, forest habitats, the economy, and conditions in rural communities.”

Medford BLM, South Deer EA, July 2005.

Similar complexities have been recognized in the peer-reviewed literature:

Climate change, fire policy, and fuel-treatment strategies are complex biosocial issues, and integrating them with wildlife conservation objectives is challenging. Conservation of taxa that live in late-seral forest and riparian habitat has been a dominant

management paradigm for the past two decades, but this emphasis is often incompatible with increased use of fire and mechanical thinning for ecosystem restoration (Cissel et al. 1999). For example, fuel treatments and natural fires that remove a portion of the overstory, understory, and surface fuels reduce the risk of subsequent crown fire but also preclude habitats required for some plant and animal species.

Donald McKenzie, Ze'ev Gedalof, David L. Peterson, and Philip Mote. Climatic Change, Wildfire, and Conservation. Conservation Biology 18(4), Aug 2004.

http://www.uoguelph.ca/cedar/Pubs/McKenzie_et_al_ConsBio.pdf. The complexity and uncertainty of modern forest management, especially multiple-objective projects like this, require careful consideration in an EIS.

This project proposes a wide variety of actions that can have both positive and negative effects over a variety of temporal and geographic scales. The NEPA document does not adequately consider these significant complexities and an EIS is needed to properly consider, analyze, and disclose these complex issues.

If this project were simplified to remove the commercial logging and road building, these conflicting and complicating factors would be greatly reduced and an EA might be more appropriate.

This project is also controversial which indicates its significance. Public Citizen v. Dept. of Transportation, 316 F.3d 1002, 1027 (9th Cir. 2003).

<http://bulk.resource.org/courts.gov/c/F3/316/316.F3d.1002.02-71249.02-70986.html>

This project will have significant effects because it will adversely affect listed species. The “no jeopardy” finding by FWS does not eliminate the probability that this projects will in fact be significant.

The ... “no jeopardy” opinion by FWS under the ESA is not equivalent to a finding of no potential impact under NEPA. The “no jeopardy” opinion says that routine training would not likely jeopardize the continued existence of endangered species, provided certain safeguards are implemented. A FONSI, by contrast, must be based on a review of the potential for significant impact, including impact short of extinction. Clearly, there can be a significant impact on a species even if its existence is not jeopardized. ...

Malama MAKUA v. Donald H. RUMSFELD, 163 F.Supp2d 1202. (D. Hawai'i). July 16, 2001.

Unresolved questions about forest restoration may require an EIS. Forest restoration is still a work-in-progress and the agencies need to approach every project as an opportunity to learn and improve practices and ensure achievement of restoration objectives. It is important to recognize that logging has complex effects some of which might be considered restorative and some detrimental to ecological values, so all the effects (both beneficial and adverse) must be carefully described and weighed. Over-simplification of the complexities of forest restoration treatments can lead to unintended consequences. NEPA's mandates for full-disclosure and informed-decision-making require that these unintended consequences be daylighted and avoided as much as possible.

“[F]uel-reduction activities may have undesirable environmental effects (e.g., the need for periodic treatments, introduction of weeds, soil disturbance, or maintenance of some roads).” Spies, Thomas A.; Hemstrom, Miles A.; Youngblood, Andrew; Hummel, Susan. 2006. Conserving old-growth forest diversity in disturbance-prone landscapes. Conservation Biology. 20(2): 351-362. http://www.fs.usda.gov/pnw/pubs/journals/pnw_2006_spies001.pdf.

The NEPA analysis should address the following unresolved questions that seem to come up again and again, especially when considering so-called “dry” forests:

1. Sharon Friedman questions several assumptions about historic range of variability and restoration of fire regimes:
 - (1) The idea that there is one past “historic fire regime” for millennia conceivably there were glaciers and warm periods, cool periods, and so on. Then there were humans* actively engaged, strangely absent from this narrative. Unless we know for sure that they were not burning forests.
 - (2) Then there is an idea that “ecosystems are adapted.” Adaptation is something that we usually consider to be a property of species. Exactly what is an “ecosystem” in this context, and how does it “adapt” since “an ecosystem” is an idea about real physical things, and not a thing in itself?
 - (3) That you need to reenact the past for things to be OK ...

Sharon Friedman 4-30-2019 commenting on The Missing (PNW) Fires at The Smokey Wire blog. <http://forestpolicypub.com/2019/04/30/the-missing-pnw-fires/#comment-453153>. See also, The scientific controversy described in Baker, William L., Chad T. Hanson, Mark A. Williams, and Dominick A. DellaSala. 2023. "Countering Omitted Evidence of Variable Historical Forests and Fire Regime in Western USA Dry Forests: The Low-Severity-Fire Model Rejected" *Fire* 6, no. 4: 146. <https://doi.org/10.3390/fire6040146>; <https://www.mdpi.com/2571-6255/6/4/146> citing Hagmann, R.K.; Hessburg, P.F.; Prichard, S.J.; Povak, N.A.; Brown, P.M.; Ful, P.Z.; Keane, R.E.; Knapp, E.E.; Lydersen, J.M.; Metlen, K.L. Evidence for widespread changes in the structure, composition, and fire regimes of western North American forests. *Ecol. Appl.* 2021, 31, e02431. And see Odion DC, Hanson CT, Arsenault A, Baker WL, DellaSala DA, et al. (2014) Examining Historical and Current Mixed-Severity Fire Regimes in Ponderosa Pine and Mixed-Conifer Forests of Western North America. *PLoS ONE* 9(2): e87852. doi:10.1371/journal.pone.0087852.

2. Firescience.Gov reported the management implications of Martinson & Omi (2013): “Until residual activity fuels are disposed, they largely offset much of the hazard reduction benefit achieved from opening the canopy. While follow-up slash treatment may be generally intended, untreated slash seems to be encountered by large wildfires with surprising frequency.” Firescience.Gov News. Fuel Treatments and Fire Severity: A Meta-Analysis. Issue 58 | June 7, 2013. <http://us2.campaign-archive1.com/?u=5f6de7b069a57255f980944b4&id=97915ceb5e&e=47edde4b58> citing Martinson, E.J.; Omi, P.N. 2013. Fuel treatments and fire severity: A meta-analysis. Res. Pap. RMRS-RP-103WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 35 pp https://www.firescience.gov/projects/08-2-1-09/project/08-2-1-09_RMRS-RP-103WWW.pdf. Martinson & Omi (2013) make the point that treatments are only effective for a short-time (5-15 years) and will require periodic retreatment, essentially in perpetuity. This raises a serious conundrum. If the initial fuel treatment in a stand is funded by removal of “excess” small trees, follow-up treatments are either (a) unlikely to occur because there are no more excess trees to pay for them, or (b) if follow-up treatments are funded with more tree-removals, such treatments will be removing ever more ecologically valuable trees and undermining any ecological benefit of the initial treatment. From an ecological perspective, the “excess” trees were removed in the first treatment. After that, all the

- trees *belong* and need to be retained so they can grow large and old in order to rebuild the severely depleted population of old growth.
3. There is a critical need to consider the trade-offs and cumulative effects of a fuel treatment *program*. Another important point that ties together several of the findings of Martinson & Omi (2013) (above):
 - Treating fuels in individual stands is unlikely to be effective in altering landscape fire behavior because stand-scale treatments are unlikely to encounter fire during the relatively brief period that treatments is "effective;"
 - In order to increase the probability that treatments will encounter fire and actually modify fire behavior, treatments must be implemented across the landscape;
 - The cumulative effects of landscape-scale treatments (plus the REQUIRED follow-up treatments) comes with significant trade-offs in terms of water quality, wildlife habitat, carbon, roads, soil, weeds, cost, etc.

Any attempt to reduce fuels should address these cumulative effects and unresolved trade-offs.
 4. Removing the understory across large areas may not be consistent with historic forest conditions. New evidence indicates that small trees were more common in dry forests than previously recognized. Historically, more than 60% of trees in the Blue Mountains and eastern Cascades were "small" (<40 cm or <16" dbh). William L. Baker and Mark A. Williams. 2015. Bet-hedging dry-forest resilience to climate-change threats in the western USA based on historical forest structure. *Front. Ecol. Evol.*, 13 January 2015 | doi: 10.3389/fevo.2014.00088.
<http://journal.frontiersin.org/Journal/10.3389/fevo.2014.00088/full>
 5. How can we balance the need to thin overly dense forests in order to grow more big trees and the need to provide habitat for species that depend on dead wood and dense canopy cover? This is a particular concern in terms of species associated with dead wood and those associated with complex riparian areas. There is evidence that capturing mortality has adverse consequences for these species that have not been fully integrated into our management approaches. Some might argue that our forests are suffering more from a lack of management, but we would strenuously argue that our forests are still more threatened by too much of the wrong forms of management, past, present and future (roading, logging, grazing, mining, fire suppression) and there is still too little recognition of this.
 6. How can we balance the competing effects of canopy removal that both reduces fire hazard by reducing canopy bulk density and increases fire hazard by making the stand hotter, drier, and windier? Canopy reduction has competing effects on fuels and microclimate that need to be more carefully examined. Recognizing that "The fire environment is thus an integration of the effects of all of its components" (Countryman 1972) the agencies lack a comprehensive model that integrates the effects of logging on both fuel structure (rearranging fuels, moving the canopy to the ground) and microclimate (making the stand hotter, drier, windier). "The evaluation of biomass removal alternatives on fire potential is complex and many-faceted. ... Treatments can alter many aspects of a stand and thus of fire potential. ... In fact, fuels and fire potential change dynamically and continuously— and not always consistently. The relative success of treatments in reducing fire potential may change as stands and fuels develop. ... In the long run, opening a stand and removing biomass alters stand dynamics and fuel dynamics. Effects on potential fire behavior may vary with time since treatment ..." Reinhardt, Elizabeth D.; Holsinger, Lisa; Keane, Robert 2010. Effects of biomass removal treatments on stand-level fire characteristics in major forest types of the northern Rocky Mountains. Western

- Journal of Applied Forestry. 25(1): 34-41.
http://www.fs.usda.gov/rm/pubs_other/rmrs_2010_reinhardt_e001.pdf.
7. How do we integrate and balance terrestrial and aquatic restoration objectives which can sometime be in conflict. Terrestrial restoration often involve manipulation of vegetation, while aquatic restoration more often benefits from minimal anthropogenic ground disturbance. Terrestrial restoration often requires road systems which are almost universally harmful to aquatic systems.
 8. Is fire-regime condition-class (FRCC) a sound basis for describing and prioritizing fuel treatments. FRCC is a widely used tool which assumes that “time since fire” is an accurate indicator of fire hazard, but there is conflicting evidence showing that closed canopy forests that develop in the absence of fire can help suppress the growth of surface and ladder fuels and maintain a cool, moist microclimate that helps reduce fire hazard. Dense canopy cover might actually help suppress fire rather than spread it. See Odion, D.C., E.J. Frost, J.R. Strittholt, H. Jiang, D.A. DellaSala and M.A. Moritz. 2004. Patterns of fire severity and forest conditions in the western Klamath Mountains, California. *Conservation Biology* 18(4): 927-936.
http://nature.berkeley.edu/moritzlab/docs/Odion_etal_2004.pdf.
 9. How much dead wood habitat should we be leaving, and how do we ensure that enough is provided through time? The current forest plan standards for snag-associated wildlife (based on “biological potential”) are scientifically outdated and need to be updated. DecAID is a start, but it has its own limitations and DecAID has not been officially adopted as a management standard with appropriate tolerance levels clearly specified for each land allocation. See
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<http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf>.
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10. Our understanding of mortality processes in eastside forests is still limited, so as we switch from human-dominated disturbance regimes back to more natural disturbance regimes, how many medium-sized trees do we need to retain in order to achieve desired levels of future old growth structure? The final recovery plan for the spotted owl recommends retention of large populations of medium-sized trees for recruitment as future large trees, both live and dead. See
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<http://www.fws.gov/pacific/ecoservices/endangered/recovery/NSORRecoveryplanning.htm>.
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http://www.iterations.com/protected/download_files/diversity_stability_debate.pdf.
 - USFWS. 2008 Final Recovery Plan for the Northern Spotted Owl.
<http://www.fws.gov/pacific/ecoservices/endangered/recovery/NSORecoveryplan.htm>
12. How can we balance the unavoidable adverse impacts of logging, roads, activity fuels, weeds, etc. versus the rather uncertain benefits of fuel reduction? Fuel reduction may have little or no beneficial effect on low severity fires (which are largely controlled by favorable weather conditions) or high severity fires (which are largely controlled by unfavorable weather conditions). What is the actual likelihood that favorable fire will occur any given stand during the relatively brief time period that fuel hazard is reduced by treatments? And, if fire does occur, will there be a good match between the actual forest type, the actual fuel treatment, and the actual weather conditions? See William L. Baker, Jonathan J. Rhodes. 2008. Fire Probability, Fuel Treatment Effectiveness and Ecological Tradeoffs in Western U.S. Public Forests. pp.1-7 (7). *The Open Forest Science Journal*, Volume 1. 2008.
<https://www.energyjustice.net/files/biomass/library/Rhodes-Baker.pdf>.
 13. How effective will restoration treatments be in the long run unless we address the underlying causes of forest health problems, such as fire suppression, livestock grazing, roads, as well as top-down influences such as CO₂ enrichment and climate change. For instance, “[s]hade-tolerant trees show greater growth responses to CO₂ than do shade-intolerant species because of more efficient use of light, water, and nutrients.” John Aber, Ronald P. Neilson, Steve McNulty, James M. Lenihan, Dominique Bachelet, And Raymond J. Drapek. 2001. *Forest Processes and Global Environmental Change: Predicting the Effects of Individual and Multiple Stressors*. *BioScience* vol 51, no. 9, pp735-751.
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This could account in part for the proliferation of shade tolerant ladder fuels in our forests.
 14. How do we determine the appropriate mix of park-like stands and denser stands? How do we merge limited snapshot views of historic conditions into an accurate picture of the full range of historic conditions? Could low density forest conditions be at least partially a lingering artifact of native American burning practices? Is the current densification of forests partly related to climate change and CO₂ enrichment? What is the “future range of variability” in light of climate change? How do we manage eastside forests to be both resilient to disturbance and to store lots of carbon in order to help mitigate climate change? See William T. Sommers, Stanley G. Coloff, Susan G. Conard 2011. *Synthesis of Knowledge: Fire History and Climate Change*. JFSP Project 09-02-1-09 *Fire History and Climate Change*, Chapter 6.
http://www.firescience.gov/JFSP_fire_history.cfm (“When researchers and managers talk about “historic” fire regimes, they are generally referring to fire regimes during the period before extensive European settlement. Because Native American populations were widespread in much of the western US for over 10,000 years, on a broad scale it is generally impossible to separate the effect that they had on vegetation and fire regimes from the effects of fire ignited by lightning and other

- sources.”) See also Baker, W.L., T.T. Veblen and R.L. Sherriff (2006). Fire, fuels, and restoration of ponderosa pine-Douglas-fir forests in the Rocky Mountains, USA. *Journal of Biogeography*. 2006.
<https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1307&context=barkbeetles>.
15. When commercial logging is used as a tool to accomplish restoration, how can we ensure that we don't remove the very building blocks of forest health? There is evidence that commercial logging objectives can conflict with the attainment of objectives for both habitat and fire hazard. Are there other ways to pay for restoration that relies less on removing structure from the forest? See USDA PNW Research. Science Findings, Issue 85.
<http://www.fs.usda.gov/pnw/science/scifi85.pdf>.
 16. What scales and pace of restoration is needed to maintain viable populations of native wildlife, or conversely, what do we have to do on federal lands to compensate for what is occurring on non-federal forest lands? What scales and pace of treatment can be tolerated across the landscape while still maintaining viable populations of native fish & wildlife?
 17. How to appropriately integrate management before, during, and after disturbance. Right now these efforts are very dis-integrated. We try to restore forests to be more fire adapted, while we continue to aggressively suppress fire and remove valuable structural legacies after fire. This makes no sense.
 18. The agency often claims that fuel reduction logging improves habitat for species dependent on old growth forests, such as pileated woodpeckers and goshawks. The claim is that by reducing fire hazard logging improves forest conditions over the long term, but recent research shows that fuel reduction logging has a significant cost in terms of reduced carbon storage. Even if logging reduces fire hazard there is less carbon stored in the logged forest than is stored in a burned forest. See 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_mitchello01.pdf. Although thinning can affect fire, the agencies are likely to remove more carbon by logging than will be saved by avoiding fire. Forest carbon biomass is a rough proxy for wildlife habitat, soil quality, and other forest values, maybe even water quality. This brings into question the agency's frequent claims that they are saving the forest by logging it. The agency especially must recognize that carbon biomass is a meaningful proxy for wildlife habitat, especially for species associated with structurally complex mature and old-growth forest, so the NEPA analysis needs to disclose the likely adverse consequences of logging in terms of loss of complex wood structure in these forests.
 19. “[T]reatments that create more open stands in areas where user-created trails already exist invite development of more user-created trails, even when the project design leaves buffers along trails.” This can have a significant effect on soil, water, wildlife, recreation, and weeds. Unfortunately, this problem is not well understood because “a proliferation of user-created trails that made the GIS layers an unreliable data source for tracking these metrics.” Deschutes Collaborative Forest Project 2022. A Decade of Learning 10-Year Monitoring Report. Mamut Consulting, 6-30-2020.
<http://deschutescollaborativeforest.org/> The NEPA analysis needs to carefully consider these issues.
 20. Modern forestry does not account for the complex effects of both competition and cooperation among the trees in a stand. Forest science tends to assume that

competition dominates, but in reality the trees in a stand often share resources and provides benefits to their neighbors. Logging interferes with natural forest community dynamics.

Wohlleben: We all learn in school that evolution advances by pitting each individual against every other in the struggle for survival. As a forester, I learned that trees are competitors that struggle against each other for light, for space. But we are now learning that individuals of a species are actually working together, they are cooperating with one another.

e360: How exactly do trees cooperate with one another?

Wohlleben: One thing is that mother trees suckle their children, they feed the young tree just enough sugars produced by its own photosynthesis to keep it from dying. Trees in a forest of the same species are connected by the roots, which grow together like a network. Their root tips have highly sensitive brain-like structures that can distinguish whether the root that it encounters in the soil is its own root, the root of another species, or the roots of its own species. If it encounters its own kind, I don't know if scientists yet know how this happens, but we have measured with radioactive-marked sugar molecules that there is a flow from healthy trees to sick trees so that they will have an equal measure of food and energy available.

e360: How do the healthy trees that feed their sick companions benefit? Parts of the forest that grew naturally were 3 degrees C cooler than those managed by humans."

Wohlleben: If sick trees die, they fall, which open gaps in the canopy. The climate becomes hotter and drier and the environment becomes worse for the trees that remain. In the forest I manage, students from Aachen University did a study that shows that the parts of the forest that grew naturally were 3 degrees C cooler than those that are managed and disturbed by humans.

The world is trying to limit warming from climate change to 2 degrees, but undisturbed forests can do even better than that. Forests create their own microclimate. When we thin forests, the temperature rises, the humidity goes down, evaporation increases, and all the trees begin to suffer. So trees have a stake in supporting one another to keep all members of the community healthy.

Richard Schiffman, e360 INTERVIEW: Are Trees Sentient Beings? Certainly, Says German Forester. In his bestselling book, *The Hidden Life of Trees*, Peter Wohlleben argues that to save the world's forests we must first recognize that trees are "wonderful beings" with innate adaptability, intelligence, and the capacity to communicate with — and heal — other trees. 16 NOV 2016.

http://e360.yale.edu/feature/are_trees_sentient_peter_wohlleben/3055/. (Another view, Henriksson, N., Marshall, J., Högborg, M.N., Högborg, P., Polle, A., Franklin, O. and Näsholm, T. (2023), Re-examining the evidence for the mother tree hypothesis – resource sharing among trees via ectomycorrhizal networks. *New Phytol.* <https://doi.org/10.1111/nph.18935> ("We conclude that evidence of a

significant net [tre-to-tree] C transfer via common mycorrhizal networks that benefits the recipients is still lacking. Furthermore, a role for fungi as a C pipeline between trees is difficult to reconcile with any adaptive advantages for the fungi.”)). Similarly, Forests with more mature trees and more fungal connections may be more resilient than forests with fewer trees and fewer connections. Betkowski, B. 2020. Soil fungi act like a support network for trees, study shows – [University of Alberta] research is first to show that growth rate of adult trees is linked to fungal networks colonizing their roots. Folio Oct 22, 2020. <https://www.folio.ca/soil-fungi-act-like-a-support-network-for-trees-study-shows/> citing Birch, JD, Simard, SW, Beiler, KJ, Karst, J. Beyond seedlings: Ectomycorrhizal fungal networks and growth of mature *Pseudotsuga menziesii*. J Ecol. 2020; 00: 1– 13. <https://doi.org/10.1111/1365-2745.13507>. See also, Marissa J Goodwin, Matthew D Hurteau. 2024. The effect of shrub cover on conifer water-use patterns, growth, and response to precipitation variability in the southern Sierra Nevada, Tree Physiology, tpae004, <https://doi.org/10.1093/treephys/tpae004> (“our results suggest that growing in the presence of shrubs does not alter the water uptake patterns of white fir and Jeffrey pine and instead may have a positive effect on the growth rates of these species during both wet and dry years.”)

These questions are not intended to doubt the need for restoration but rather to refine the focus of restoration and improve methods. Hand thinning of small trees might still makes sense but building roads and commercial removal of established trees may not. The NEPA analysis should consider a full range of NEPA alternatives to illuminate and explore these unresolved issues.

This project presents a number of trade-offs that must be considered in an EIS, such as:

- Commercial logging and road construction versus unroaded/undeveloped values. Large unroaded/unmanaged areas provide disproportionate ecosystem services such as clean abundant water, high quality habitat, carbon storage / climate change mitigation, soil conservation, scenic values, quality of life, intact plant communities with fewer weeds, etc. Unroaded areas are rare and under-represented across the landscape and need to be restored, not further degraded. Building more roads and treating such a large fraction of the landscape move this landscape in the wrong direction;
- Commercial logging and road construction versus carbon storage. Climate change is a significant issue facing humanity. Our forests are an important part of the global carbon cycle. Logging will make climate change worse, while forest conservation will help store more carbon across the landscape and over time. This project is part of the cumulative global problem of carbon emissions. The global carbon cycle is globally distributed. There is no single place, or single activity that can fix the climate problem. All agencies must take steps to reduce GHG emissions. We can't point the blame and solution elsewhere;
- Commercial logging and road construction versus long-term recruitment of snags and dead wood habitat. Snags and dead wood habitat are critically important to forest ecosystems. Dead wood serves a wide variety of ecosystem services, not just habitat. Snags and dead wood habitat has been significantly reduced and degraded by decades of forest management on public and private lands. Logging kills trees and exports the wood unavoidably reducing dead wood values. This is a particular concern when such a large fraction of the landscape will be treated. The RMP and Eastside Screens are based on

outdated “potential population” methodology. New science indicates that wildlife need more snags and dead wood for a wider variety of life functions and more green trees are needed to serve as a recruitment pool for continuous snag recruitment through the life of the stand. The agency has not (but needs to prepare an EIS and plan amendment to) adopt new standards to replace the outdated standards. The agency should use DecAID as the best available science but should use this tool appropriately: prepare a stand simulation that project snag recruitment under the action and no action alternatives, not just rely on the reference stand conditions, but instead compares future snag conditions to the DecAID tolerance levels for individual species whose viability depends on high snag abundance;

- Commercial logging and road construction versus habitat for wildlife that prefer complex forest and dense forest cover. Many wildlife, including goshawk, marten, pileated woodpecker, marten, three-toed woodpecker, black-backed woodpecker, and fish that need well-shaded streams and abundant dead wood, etc. Logging across such a large fraction of this landscape will remove and degrade habitat for these fish & wildlife. The NEPA analysis needs to carefully disclose and weigh these impacts and provide mitigation to ensure species viability;
- Commercial logging and road construction versus fire hazard. Logging has complex effects on fire and fuels with some effects tending to reduce hazard, and other effects tending to increase hazard. When forest “restoration” treatments involve significant reduction of canopy cover it can have complex effects on fire hazard with potential to increase fire hazard by making the stand hotter/drier/windier, generating more hazardous slash, stimulating the growth of future surface and ladder fuels, and additional roads increase human ignition risks. These trade-offs require an EIS.

The Purpose and Need Should Address The Unmet Need for Carbon Storage

The Forest Service cannot meet its legal obligations unless it works to reduce the worst effects of global climate change. Those legal obligations emanate from the Forest Service Organic Act, the National Forest Management Act, the Endangered Species Act, Multiple-Use Sustained-Yield Act, and the applicable Land and Resources Management Plan. “Public forest reservations are established to protect and improve the forests for the purpose of securing a permanent supply of timber for the people and insuring conditions favorable to continuous water flow.” 1897 FS Organic Act.

<https://winapps.umn.edu/winapps/media2/wilderness/NWPS/documents/publiclaws/ORGANIC-ACT-OF-1897.pdf>. Climate change is expected to disrupt forest ecosystems and hydrologic systems to an extent that threatens to violate the very foundations of the agency’s Organic Act. The FS should make every effort to reduce GHG emissions that exacerbate global climate change.

The agency is required by law to faithfully implement its Resource Management Plan. Meeting resource management objectives set forth in the RMP requires properly functioning ecosystems with biophysical conditions and disturbance regimes within the historic range of variability. Global climate change is a clear and present threat to forest ecosystems and watersheds and is preventing the agency from meeting the goals and standards & guidelines described in the applicable Resource Management Plan, and other core legal requirements for management of federal lands. The agency cannot meet the RMP without bringing climate change under control, which requires reducing emissions, including emissions from logging. The agency cannot say

that carbon storage is outside the scope of this project or not part of the purpose and need. The agency must include carbon storage as part of the purpose and need for this project.

The agency typically says one of the purposes of this project is to provide a supply of wood products to the public. The agency should reconsider timber targets in light of the fact that the public *needs* carbon storage to reduce global climate change much more than they *need* wood products. The NEPA analysis also needs to account for the fact that managing forests for water quality, water quantity, quality of life, and carbon storage for a stable climate will contribute far more to community stability than propping up the timber boom-bust industry with subsidized logging.

The agency must recognize that wood products are already underpriced and over-supplied due to “externalities” (costs that are not included in the price of wood, so those costs are shifted from wood product producers and consumers to the general public who suffer the consequences of climate change without compensation from those who receive artificially inflated profits from logging related externalities). Ecosystem carbon storage on the other hand is under-supplied because there is not a functioning market for carbon storage and climate services. The agency is in a position to address these market imperfections by focusing on unmet demand for carbon storage instead of offering wood products that are already oversupplied.

Land protection, both public and private, provides substantial ecological benefits by avoiding conversion of natural systems to intensive, developed uses. These benefits include carbon sequestration, watershed functioning, soil conservation, and the preservation of diverse habitat types (e.g., Daily 1997, Brauman et al. 2007, Kumar 2012, Watson et al. 2014). Land protection also solves a key market failure: private markets tend to underprovide socially beneficial land uses such as natural forests, agricultural lands, or managed timberlands. The reason for this failure is that many of the benefits of these lands go to the public in general, not individual landowners. When private values and market transactions determine land uses, less land will be devoted to socially beneficial uses than if citizens could collectively determine use on the basis of social values (e.g., Angelsen 2010, Tietenberg and Lewis 2016).

Katharine R.E. Sims, Jonathan R. Thompson, Spencer R. Meyer, Christoph Nolte, Joshua S. Plisinski. 2019. Assessing the local economic impacts of land protection. *Conservation Biology*. 26 March 2019 <https://doi.org/10.1111/cobi.13318>, https://harvardforest.fas.harvard.edu/sites/default/files/Sims_et_al-2019-Conservation_Biology.pdf.

Maintaining and increasing carbon storage in ecosystems on public lands is also required to meet LRMP desired future conditions and standards & guidelines. Carbon emissions from logging and other land management activities exacerbate global climate change and drive ecosystem changes that diverge from desired future conditions, such as uncharacteristic drought, fire, insect outbreaks, vegetation and wildlife mortality, species range shifts, low summer stream flows, unfavorable stream temperatures, extreme precipitation and peak flows and erosion, uncertainty related to vegetation recovery post-disturbance, uncertainty about the ability to provide a predictable, sustainable supply of forest products, etc. The agency should identify a purpose and need that recognizes the necessity of avoiding carbon emissions from logging and optimizing carbon storage to fulfill the promises in the LRMP.

Forest conservation is also needed to help forests, watersheds, and fish & wildlife adapt to global climate change:

- Mature forests serve as climate refugia where wildlife can find essential cool-moist conditions as the climate warms;
- Dense forests maintain cool-moist conditions and reduce stress (and mortality) on trees caused by vapor pressure deficit, which is exacerbated by clearcutting and thinning; and
- Dense forests with high canopies are more resistant and resilient to wildfire compared to forests that are clearcut or thinned.

Forest conservation to mitigate these effects should be considered as an alternative in the NEPA analysis.

MA C7- Special Fish Management Area + PACFISH

The NEPA analysis must clearly document compliance with the LRMP standards & guidelines for the Umatilla National Forest, as amended by PACFISH, and especially MA C7 which has clear standards, including:

- “In riparian areas, a natural to near natural setting and vegetation development will predominate with a variety of plant communities, sizes, and age classes. A high tree canopy layer will be present, and the forest will appear denser than surrounding areas. Forest canopy of conifers and hardwoods will provide desired levels of stream surface shading and long-term supply of large woody material for instream fish habitat and snags. Vegetation will contribute to stable streambanks and complex fish habitat along the banks.”
- “Dead and down tree habitat will be managed in the riparian areas to provide or maintain 100 percent of the potential population level and, in the upland areas, 60 percent of the potential population level for all primary cavity excavators, and maintained for other wildlife species.”
- “Elk habitat will be managed to achieve a habitat effectiveness index of no less than 45, including discounts for open roads (see Thomas and others 1979). A minimum of 10 percent of an area will be managed as satisfactory cover (15-20 percent is desirable). A minimum of 30 percent of an area will be managed as total cover. Management activities will not create barriers to impede movement of big game.”
- “Anadromous fish habitat (includes streams and associated riparian areas) will be managed to produce at least 90 percent of potential smolt habitat capability index (SHCI). The standard should be achieved by meeting the following:
 - • Riparian vegetation will be managed to promote floodplain, bank, and channel stability, resiliency to disturbance, and aquatic diversity.
 - • Where natural conditions permit, streamside vegetation along the entire length of perennial streams will be managed to maintain an average shading of 80 percent of the entire stream surface shaded. Where existing shading is already below this level, retain all vegetation contributing to stream surface shading.
 - • Lands adjacent to perennial streams will be managed to provide for a continuous, well distributed supply of naturally occurring large woody material for instream fish and riparian habitat. At a minimum, these lands will include a zone within one tree height of the stream channel but may be extended to upland areas when the additional areas are determined to be critical to the provision of future large wood to downstream fish-bearing reaches.

- • Streams will be managed to provide pools that are relatively large, frequent, well distributed, and persistent during low flows.
- • Forest-wide Standards and Guidelines for water temperature and instream flows will be met.
- • The sediment budget will fall well within the range and frequency adapted to by indigenous aquatic communities.”
- “In the riparian areas, salvage timber harvest may be permitted where anadromous fish habitat can be protected and improved. Other types of scheduled timber harvest will not be permitted.”
- “Silvicultural systems and harvest practices within 500 feet of Class I and II streams will emphasize prevention of induced sediment production.”
- “Within 250 feet of all streams and wet areas associated with streams, limit the mineral soil exposed by ground-disturbing activities to 10 percent of the project area.”
- “Road construction will rarely occur within 500 feet of Class I and II streams, within 250 feet of
- Class III and IV streams, or on slopes over 60 percent. Road location, design, construction, and maintenance techniques used will focus on minimizing soil loss impacts to water quality and fisheries habitat.”
- “Fuels management activities will be designed and executed to maintain or enhance anadromous fish habitat.”

1990 Umatilla LRMP pp 4-173 to 4-176. These requirements apply to all activities, including the proposed firewood cutting and post & poles which may be implemented by contractors with less experience following the rules for protection of soil, water, fish & wildlife.

We are concerned that logging and roads will violate MA C7 elk habitat requirements. The NEPA analysis must provide clear documentation of compliance with those requirements. Heavy thinning and regen may violate HEI and cover requirements. Roads alone are a partial barrier to big game movement. Adding several hundred feet of roadside fuel treatments are highly likely to create impediments to big game movement. These issues need a hard look in the EA.

MA C7 standards for aggressive logging outside riparian areas are outdated. Current science indicates that credible fish conservation requires both riparian conservation and watershed conservation.

The verbiage in the LRMP about “All timber management practices and intensities are permitted” is superseded by the Eastside Screens which mandate retention of all large trees, managing all standards toward LOS, maintaining connectivity, managing for high levels of snags, etc, as well as the PACFISH mandates to “not retard” attainment of riparian management objectives.

[T]he Forest Service violated the Forest Act [NFMA] by approving the implementation of Bandit II without first establishing that short-term adverse impacts of the project on redband trout and short-term retardation of RMOs set forth in INFISH would not be inconsistent with the Ochoco forest plan.

League of Wilderness Defenders v. USFS, D. Or. CV 03-1563-AS, June 6, 2005.

The biological opinion issued by the National Marine Fisheries Service for PACFISH2 (USDA Forest Service and USDI Bureau of Land Management 1995) identified roads as a primary cause of salmonid decline, and indicated that roads may have unavoidable effects on streams, regardless of how well they are located, designed, or maintained.

Big game impacts

The EA needs to carefully disclose the effects of logging, roads, and other activities on big game, including detailed documentation of compliance with legal requirements. In particular, we are concerned that the roadside fuel treatments will significantly increase the adverse effects of roads on big game movement patterns. Thinning corridors along roads will amplify the existing behavioral barrier due to the loss of hiding cover and increased visual and audible exposure to vehicles and humans. Fuel reduction expands the distance from which elk can detect vehicle activity. Clearing understory vegetation and thinning reduces the visual barriers elk rely on for security, forcing them to spend more time and energy hiding when they need to be moving or moving when they should be resting or foraging.

Elk use is strongly correlated with distance to roads. Even 2-4 vehicles per 12 hour period notably reduced elk use near those roads. The highest elk use is far from roads (in summer, 2.8 km from major roads, and in winter 1.2 km from major roads). McCorquodale 2013. A Brief Review of the Scientific Literature on Elk, Roads, & Traffic. Washington Department of Fish and Wildlife. <https://wdfw.wa.gov/sites/default/files/publications/01491/wdfwo1491.pdf>. The report concludes:

“Collectively, the published scientific reports on the influence of roads and traffic on elk is not a small body of literature. To the contrary, extensive research over decades has demonstrated that high road densities and traffic negatively affect elk use ... The scientific evidence is compelling that disturbance associated with traffic on open roads can strongly affect elk distribution and limit use of even highly preferred habitat near roads ... ”

Elk security habitat is often over-estimated in agency analyses. First, because the agency assumes that roads that are closed on paper are closed in fact on the ground, which is often not the case. Where road closures are ineffective elk do not enjoy the security habitat they are assumed to enjoy. Second, because the agency identifies elk security cover using a one-size-fits-all buffer along open roads. In reality, not all roads are the same, or rather the vegetation cover adjacent to all roads is not the same. Buffers should be much wider when roads traverse scabland and low density forests (either naturally or after treatment).

Rowland et al. (2005) at Starkey found a strong linear increase in selection ratios for elk as distance to roads increased. ... ~ Distance to road- rather than road density- better predicts elk distribution.

...

Elk Security Areas better metric than road density. Hillis Paradigm [Hillis et al. 1991] is a way to define security areas for elk, is a combination of distance to motorized route ≥ 0.5 miles [and] security block ≥ 250 acres.

Summary

Elk have a negative response to human activity ... may have a response up to 1800 m from a road. Elk may move off the forest. May be able to keep elk on the forest by having security areas.

USFS, ODFW 2017. Blue Mountain Forest Plan Elk Standards & Guidelines Discussion, powerpoint 7-20-2017.

Hunting is the main source of mortality for adult elk (Wisdom et al. 2000) outside of national parks (USDA Forest Service 2012) and in the absence of predator populations. Elk are more vulnerable to hunters in roaded areas than in unroaded areas. Roads also break large tracts of habitat into smaller chunks, reduce vegetative cover used by elk for security and act as a vector for exotic plant species. Elk exhibit higher stress levels and increased movement rates near roads.

Deschutes NF 2025. Fuels Maintenance Environmental Assessment. MIS Specialist Report. <https://usfs-public.app.box.com/v/PinyonPublic/file/1824767099212>

University of Alberta researchers discovered that elk are more frequently and more easily disturbed by human behaviour such as ATV drivers than by their natural predators like bears and wolves. Ciuti S, Northrup JM, Muhly TB, Simi S, Musiani M, et al. (2012) Effects of Humans on Behaviour of Wildlife Exceed Those of Natural Predators in a Landscape of Fear. PLoS ONE 7(11): e50611. doi:10.1371/journal.pone.0050611 <https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0050611&type=printable>.

The agency assumes that a lot of places have become forage limited as a result of fire exclusion and conifer encroachment, but if the agency conducted an accurate analysis of elk security cover, in many cases they would find that many areas are cover limited, not forage limited.

Rowland et al. (2004):

With regard to elk habitat, the primary effect of roads may be habitat fragmentation; heavily roaded areas may contain few patches of forest cover large enough to function effectively as habitat for elk, especially where elk are hunted (Leege 1984, Rowland et al. 2000). The total loss of elk habitat from road construction is unknown; a rough estimate of 5 acres per linear mile (1.4 ha/km) of road is often applied (Forman et al. 2003). Across the United States, the area occupied by public roads and associated corridors is estimated to be 27 million acres (10.9 million ha); these numbers do not include private roads or “unofficial” roads on public lands (Forman et al. 2003).

Rowland, M. M., M. J. Wisdom, B. K. Johnson, and M. A. Penninger. 2004. Effects of roads on elk: implications for management in forested ecosystems. Transactions of the North American Wildlife and Natural Resources Conference 69:491-508. https://www.fs.usda.gov/pnw/pubs/journals/pnw_2004_rowland001.pdf.

See also, Backcountry Hunters and Anglers 2014. Literature Review: The Impact of Roads on Elk. <https://www.backcountryhunters.org/media/literature-review-the-impact-of-roads-on-elk>.

Do not rely on the flawed boilerplate climate analyses

As explained below, the Forest Service’s standardized NEPA language handed down from the regional office regarding carbon and climate change fails to take a hard look that NEPA requires. The analysis makes several highly misleading statements about managing forests for carbon storage, climate resilience, and the effects on climate change. The analysis inappropriately mischaracterizes the role of individual logging projects in the cumulative problem of global GHG

emissions. The analysis misstates the effects of logging related carbon emissions that are not related to “deforestation.” The analysis grossly misstates the climate effects of logging intended to reduce disturbance. The analysis misleadingly implies that logging benefits the climate by increasing forest productivity.

The NEPA analysis should consider the adverse climate consequences of GHG emissions caused directly and indirectly by logging. The NEPA analysis should estimate the quantity of GHG emitted by logging and associated activities throughout the wood products supply chain, and describe the contribution of this project to cumulative impacts of excess GHG in the atmosphere. The NEPA analysis should use a proxy such as the social cost of carbon dioxide emissions to describe effects.

The Forest Service should not rely on the boilerplate NEPA language from the regional office which is flawed in many ways. A proper analysis of the effects of logging on carbon and climate change will reflect the following realities:

- Do not dismiss carbon and climate effects of this project as an issue “considered but eliminated” from detailed analysis. The climate crisis is the greatest challenge facing humanity. Our global carbon cycle is severely out-of-whack, and the agency is managing an important part of that carbon cycle, and agency decisions whether and how to log the forest can make the climate crisis better or make it worse.
- The agency cannot justify actions that may help ecosystems adapt to global climate change if those actions (e.g., logging) will cause significant GHG emissions that will exacerbate climate change globally. The agency must consider alternatives that *harmonize* climate change mitigation (avoid carbon emissions) and climate change adaptation by retaining large trees, avoiding logging in mature and old-growth forests, protect roadless areas and riparian areas, etc.
- The analysis must recognize the cumulative nature of the GHG emissions and climate problems. It does not matter that this project is small in the global scheme because all emissions matter when the causation (and effects) of climate change are global and cumulative. This project will cause GHG emissions and will unavoidably make the problem of global climate change worse, which is something that must be avoided and minimized;
- All forms of logging cause net GHG emissions and is part of the climate problem. The analysis cannot credibly assert that this project is harmless because it’s not causing “deforestation.” This is immaterial. All GHG emissions, regardless of the source or how it is labelled, are part of the problem and cause the same climate impacts.
- The analysis cannot credibly assert that thinning for forest health improves forest productivity or mitigates emissions from logging. Logging does not increase the capacity for growing trees. To the contrary, logging harms soil and reduces site productivity. The analysis cannot focus on the growth on trees that are retained while ignoring the forgone growth on trees that are removed.
- The analysis must reflect that if this forest is not logged, or if more green tree are retained *in situ*, the climate will benefit. The agency cannot complain that without logging natural mortality will be greater than logging mortality. In fact, it is quite easy to predict that logging causes significantly more mortality than natural processes.
- Stabilizing carbon at the stand scale is not a climate solution. The only scale that really matters for the climate is the global scale, because CO₂ is long-lived in the atmosphere

and the atmosphere is well-mixed. It is fine for the climate if the forest builds up “extra” carbon due to fire suppression. It is fine for the climate if the carbon in the forest booms and busts on long time scales. What matters most is avoiding carbon emissions in the short-term (1-3 decades, while we decarbonize our energy systems), and then we can think about how to optimize the time value of carbon stored in the forest over the long-term.

- The analysis must compare climate effects *with* and *without* logging, NOT *before and after* logging, which is an improper framework for NEPA analysis. The proper NEPA framework is to compare the effects of different alternatives (over time), so the agency must describe the carbon emissions and carbon storage in the forest over time *with* logging and *without* logging.
- Logging to reduce fire effects does not result in a net increase in forest carbon storage. The agency is unable to predict the location, timing, or severity of future wildfires, so most fuel treatments will cause carbon emissions without meaningful offsetting benefits from modified fire behavior. Studies clearly show that the total carbon emissions from logging (plus unavoidable wildfire) are greater than carbon emissions from wildfire alone.
- Storing carbon in wood products is not preferable to storing carbon in forests. Evidence shows that forests are a more secure way of storing carbon compared to wood products. The analysis cannot credibly assert that carbon storage in wood products is a useful climate strategy. Logging kills trees, stops photosynthesis, and initiates decay and combustion, with the end result being a significant transfer of carbon from the forest to the atmosphere. In stark contrast, an unlogged forest continues to grow and transfer more carbon from the atmosphere to the forest. Carbon emissions caused by logging will far exceed the small fraction of carbon transferred to wood products. Carbon accounting methods that attempt to account for *substitution* of wood for other high-carbon building materials are fraught with uncertainty and too often represent maximum potential substitution effects rather than lower realistic estimates.

The FS [website](#) links to a 2009 [document](#) explaining how to incorporate “Climate Change Considerations in Project Level NEPA Analysis.” Since then the agency has regressed to a misleading and incomplete non-quantitative analysis of how carbon emissions from logging contribute to global climate change. The FS should now be following the latest 2023 CEQ guidance on fulfilling NEPA requirements for projects that affect the carbon cycle and emit GHG.

Document Compliance with All Aspects of the Eastside Screens, and PACFISH.

The NEPA analysis must disclose how the project will comply with all the requirements of the Eastside Screens, including those related to protection of large live trees >21” dbh, managing toward LOS in all logging prescriptions, maintaining connectivity, etc., and PACFISH requirements to protect RHCAs and avoid actions that would retard Aquatic Conservation Strategy objectives.

The Eastside Screens say “2) Outside of LOS, many types of timber sale activities are allowed. The intent is still to 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. ... Manipulate vegetation in a manner to encourage the development and maintenance of large diameter, open canopy structure.” 1995 Regional Forester’s Forest Plan Amendment #2.
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5288660.pdf

Regen logging and heavy thinning will move stands away from LOS conditions in violation of the Eastside Screens mandate. Dense forest, and dead/decaying trees are defining features of LOS forest. Regen logging that removes most of the trees in a stand, or removing the dead and declining trees will directly remove LOS features and move stands away from, not toward LOS.

The scoping documents say "Regeneration harvests used in areas where young lodgepole pine and/or grand fir are growing in expansive, homogenous monocultures that preclude the development of a diversity of habitat types across the landscape" The NEPA analysis needs to reflect the fact that those patches of dense lodgepole already represent landscape diversity. Habitat patches naturally occur at many scales. Fragmenting a large patch of lodgepole with regen is not consistent with natural forest pattern and structure.

Looking at the old-growth definition from ICBEMP
<https://web.archive.org/web/20161221075704/http://www.icbemp.gov/pdfs/sdeis/Volume2/Appendix17a.pdf>:

“old growth is typically distinguished from younger growth by several of the following attributes: 1. Large trees for species and site. 2. **Wide variation in tree sizes and spacing.** 3. **Accumulations of large-size dead standing and fallen trees** that are high relative to earlier stages. 4. Decadence in the form of broken or deformed tops or bole and root decay. 5. **Multiple canopy layers.** 6. Canopy gaps and understory patchiness.”

(emphasis added) It is clear that LOS “components” such as abundant snags must be retained and recruited, and many small and medium sized trees are needed grow into large trees. Thinning dense understory trees might help move stands toward LOS, but any action that would remove snags or reduce recruitment of medium trees into large tree classes would not be consistent with the Eastside Screens.

Recognizing the fact that past logging practices have greatly reduced the abundance of large trees and snags, the Eastside Screens also require that projects use the best available science to meet the intent of 100% potential populations of primary cavity excavators. While the potential population methodology has been discredited the Forest Service must still meet the intent by not taking any action that could reduce populations of primary cavity excavators.

The Eastside Screens *Scenario A* requires “To reduce fragmentation of LOS stands, or at least not increase it from current levels, stands that do not currently meet LOS that are located within, or surrounded by, blocks of LOS stands should not be considered for even-aged regeneration, or group selection at this time.” Any action that would build roads or establish young even-aged stands would not meet the Eastside Screens. Heavy thinning for fuel reduction should also be evaluated under this connectivity standard.

Make sure that any treatments in wildlife corridors comply with the expectations of the Eastside Screens, i.e. "medium diameter or larger trees are common, and canopy closures are within the top one-third of site potential. Stand widths should be at least 400 ft. wide at their narrowest point.... some amount of understory (if any occurs) is left in patches or scattered to assist in

supporting stand density and cover." This requires careful mapping of existing LOS stands, and connective habitat between them.

The explicit intent of the Screens which is "to insure that blocks of habitat maintain a high degree of connectivity between them,..." 1995 Eastside Screens, Scenario A, INTENT STATEMENT for connectivity (emphasis added).

The connectivity requirements of the screens are detailed and mandatory. Connectivity corridors:

- Must link all late old structure stands in at least 2 directions;
- Must be at least 400 feet wide at their narrowest spot;
- 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;

The Eastside Screens provide ...

... it is important to insure that blocks of habitat maintain a high degree of connectivity between them, and that blocks of habitat do not become fragmented in the short-term.

a) Maintain or enhance the current level of connectivity between LOS stands and between all Forest Plan designated "old growth/MR" habitats by maintaining stands between them that serve the purpose of connection as described below:

(1) Network pattern – LOS stands and MR/Old Growth habitats need to be connected with each other inside the watershed as well as to like stands in adjacent watersheds in a contiguous network pattern by at least 2 different directions.

(2) Connectivity Corridor Stand Description – Stands in which medium diameter or larger trees are common, and canopy closures are within the top one-third of site potential. Stand widths should be at least 400 ft. wide at their narrowest point. The only exception to stand width is when it is impossible to meet 400 ft with current vegetative structure, AND these "narrower stands" are the only connections available (use them as last resorts). In the case of lodgepole pine, consider medium to large trees as appropriate diameters for this stand type.

If stands meeting this description are not available in order to provide at least 2 different connections for a particular LOS stand or MR/Old Growth habitat, leave the next best stands for connections. Again, each LOS and MR/Old Growth habitat must be connected at least 2 different ways.

(3) Length of Connection Corridors – The length of corridors between LOS stands and MR habitats depends on the distance between such stands. Length of corridors should be as short as possible.

(4) Harvesting within connectivity corridors is permitted if all the criteria in (2) above can be met, and if some amount of understory (if any occurs) is left in patches or scattered to assist in supporting stand density and cover. Some understory removal, stocking control, or salvage may be possible activities, depending on the site.

We would like to emphasize that the screens anticipated the possibility of logging in connectivity areas, but there are minimum requirements for that. The screens provide: “Harvesting within connectivity corridors is permitted if all the criteria in (2) above can be met ...” and some patches of understory are retained.

The 1995 EA for the Eastside Screens identifies the following process for analyzing connectivity:

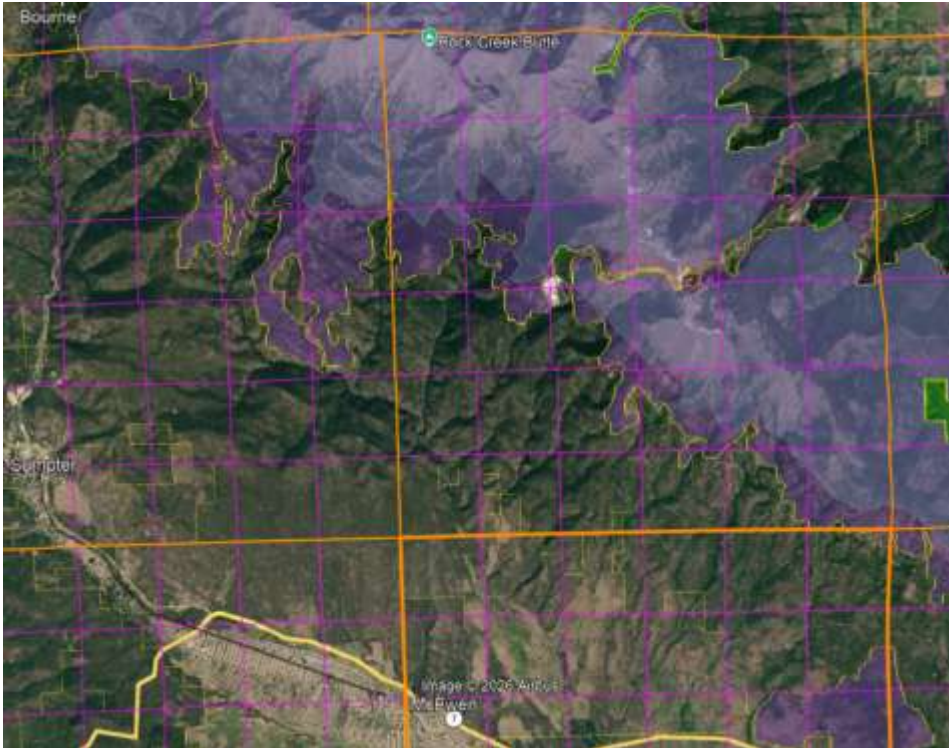
- c) To insure connectivity as described above is maintained, use the following process:
 - (1) Do suitable network linkages between old and late structural stands and MR-designated habitats occur, according to the previous description? If so, will the proposed project isolate any area or group of areas by reducing any one of the parameters below acceptable levels? If not, the project can continue. If so, the project must be deferred or re-designed to meet connectivity parameters described above.
 - (2) Do suitable network linkages between old and late structural stands and MR-designated habitats NOT OCCUR under current conditions, as described above? If areas are already isolated, or partially isolated by not meeting the connectivity description above, will the proposed prescription promote linkage sooner than if left alone? If so, the project should continue. If the project is designed in a manner that would further increase isolation, the project must be deferred or re-designed to enhance connectivity parameters.

The NEPA analysis must disclose how much of the project area will maintain >50% canopy closure (or in the top third of site potential) after this project is implemented. The 1995 EA supporting the Eastside Screens says “The intent is to maintain canopy closure as dense as possible.” The >50% canopy closure number comes from the 1995 EA for the Eastside Screens which included some clarifying text about connectivity on page 17 of Appendix C. Violation of the Eastside Screens, is a violation of NFMA which requires compliance with the LRMP as amended by the Screens.

Conserve Unroaded Areas

Large intact expanses of unfragmented habitat were once quite common but are now rare. Species evolved in the context of the large habitat patches that result from the natural disturbance regime. As just one important example, big game need large patches of security cover which is best provided by large unroaded areas. New science confirms that roads and logging tend to be contagious on the landscape (managed areas beget more management until little remains unmanaged), so to conserve the habitat values associated with wild places we have to prevent the first intrusions. The purpose and need for this project should include protecting and restoring large unroaded areas consistent with the natural range of variability. This goal is just as important as goals related to tree density or species composition that the agency too often relies on to justify logging and road building.

In the map below, the light purple polygons are inventoried roadless areas, and the darker purple polygons are uninventoried roadless area. They are contiguous so the analysis should start with the assumption that the uninventoried areas provide the same functions and values as the inventoried areas.



The Forest Service defines unroaded areas as any area without the presence of classified roads, and of a size and configuration sufficient to protect the inherent characteristics associated with its roadless condition.

<http://web.archive.org/web/20010729111100/http://roadless.fs.fed.us/documents/feis/glossary.shtml>. Unroaded areas greater than about 1,000 acres, whether they have been inventoried or not provide valuable natural resource attributes that must be protected. These include: water quality; healthy soils; fish and wildlife refugia; centers for dispersal, recolonization, and restoration of adjacent disturbed sites; reference sites for research; non-motorized, low-impact recreation; carbon sequestration; refugia that are relatively less at-risk from noxious weeds and other invasive non-native species, and many other significant values. See Forest Service Roadless Area Conservation FEIS, November 2000.

Before logging roadless areas the agency should consider the impacts to all the values of roadless areas, including:

- (1) High quality or undisturbed soil, water, and air;
- (2) Sources of public drinking water;
- (3) Diversity of plant and animal communities;
- (4) Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land;
- (5) Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation;
- (6) Reference landscapes;
- (7) Natural appearing landscapes with high scenic quality;
- (8) Traditional cultural properties and sacred sites; and
- (9) Other locally identified unique characteristics.

36 CFR §294.11 (2001).

http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5050459.pdf

The NEPA analysis should discuss whether the project will push the landscape toward or away from the natural range of variability for large-scale habitat patches. Landscape analysis based on historic disturbance patterns suggests that historically the majority of old forest occurred in large patches. See Wimberly, M. 2002. Spatial simulation of historical landscape patterns in coastal forests of the Pacific Northwest. *Can. J. For. Res.* 32:13-16-1328 (2002) [pdf](#). (72% of the total mature forest in the Oregon Coast Range was concentrated in patches >1,000 ha). These large patches of older forests that native fish and wildlife species evolved with are now severely underrepresented on the forest landscape and must be protected and restored.

Since this project area is largely designated to conserve fish habitat, the NEPA analysis should consider that unroaded areas are strongholds for at-risk fish -

The few areas that may meet RMOs [riparian management objectives] are typically found in wilderness, roadless areas, and undeveloped lands. ... Many authors have reported on the consequences of forest management and the attendant proliferation of roads across the landscape. DellaSala et al. (2011) state that “the roaded, intensively managed landscapes of the other national forest lands have been closely correlated with heavily sediment-laden streams and dramatic changes in flow regimes (Espinosa et al. 1997; Trombulak and Frissell 2000; Center for Biological Diversity et al. 2001; Coffin 2007; Frissell and Carnefix 2007).” The small roadless areas that have been left “unmanaged”, with a lack of logging and roads, play a critical role in maintaining high-quality water and protecting aquatic ecosystems. The clean water from remnant roadless areas is important to maintain healthy coldwater salmonid fisheries, sustain viable aquatic ecosystems, and help protect threatened species and ecosystems (Abell et al. 2000; Trout Unlimited 2004). Roadless areas are an important refugia for many salmon and trout populations, as well as for a diversity of endangered freshwater species (Henjum et al. 1994; Huntington 1998; Trombulak and Frissell 2000; Center for Biological Diversity et al. 2001; Strittholt and DellaSala 2001; Oechsli and Frissell 2002; Strittholt et al. 2004; Petersen 2005). DellaSala et al. (2011) state that “restoration of salmon and trout fisheries in places with high road densities will likely fail without the pivotal role provided by roadless areas as fishery strongholds.” Further, they state that “For many major drainages (entire watersheds of major rivers, such as the Columbia River Basin), roadless areas and other wilderness areas represent the last few percentages (typically 1% to 5%) of the landscape with a minimally disturbed, or near natural, hydrology.

Stuart, Amy 2022. Review and Comment on the “Forest Plans Amendment Forest Management Direction for Large Diameter Trees in Eastern Oregon and Southeastern Washington Environmental Assessment” and the Consequences and Impacts to Fish Habitat and Native Fish Populations in Riparian Areas. Expert Report for Oliver Stiefel, Crag Law Center. April 19, 2022.

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.

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.

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

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, USFS 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.

The NEPA analysis should consider Mildrexler et al. (2026) which does a great job highlighting the benefits of large and small roadless areas and the perils of more roads and logging.

A century of intensive logging resulted in over 386,000 miles of roads built on US national forests, enough to circle the globe about 15 times, with an estimated additional 60,000 miles of illegal unauthorized roads (USDA, 2001). This massive road system contributes to reductions in the quality and quantity of water, habitat fragmentation, spread of invasive plants, increased wildfire risk, and other problems that undermine ecological integrity (Aplet et al., 2026; Healey, 2020; Gucinski et al., 2001; Lindenmayer et al., 2025; Wisdom et al., 2018). In this context, remaining roadless areas have enormous ecological value, including roadless areas that are larger than 1000 acres but less than the 5000-acre minimum criteria for IRA designation (DellaSala et al., 2011; Henjum et al., 1994; Rhodes et al., 1994).

...

The high forest integrity scores for IRAs are underpinned by healthy ecosystem functions and the many valuable well-documented ecosystem services that IRAs provide (DellaSala et al., 2011; Dietz et al., 2021; Talty et al., 2020). If protected, IRAs can make important contributions toward achieving climate and biodiversity targets and safeguarding critical water resources (Crist et al., 2005; DellaSala et al., 2011; Law et al., 2021; Loucks et al., 2003).

...

Exceptional water values

IRAs are profoundly important for their role in preserving the natural hydrology of forest ecosystems, a quality that is now rare in temperate forests due to the long and intense history of resource extraction (Haddad et al., 2015; Usher, 1987; Wilcove et al., 1986). This includes above and belowground water movement and flow patterns which are highly vulnerable to human impacts such as road building and logging (Kastridis, 2020). Forests and water are an integrated system, and native forests and soils are particularly important for water flows and supplies (Creed et al., 2019). Because IRAs are predominantly located in mountainous terrain, they protect topographically complex headwater stream systems that feed into larger rivers (Fig. 2). These areas provide numerous valuable ecosystem services such as cold water refugia for fish like bull trout and salmon, habitat for sensitive plant species, resilience to climate change, and drinking water supplies to millions of Americans (DellaSala et al., 2011; Isaak and Luce, 2023; Liu et al., 2022). In the Western US, about 90% of people are served by public drinking water systems derived from NFS lands that include 71% of all IRAs in the nation (Liu et al., 2022).

...

Intact headwater streams that IRAs protect are superior at retaining, filtering, and slowly releasing water throughout the year (DellaSala et al., 2011; Furniss et al., 1991). This regulation of water quantity and quality is vital for supporting late-summer stream flows important to fisheries, cultural values, and recreational opportunities (Colvin et al., 2019). IRAs also contribute water supplies to downstream agricultural use. Through regulation of water flow, roadless areas help buffer species and services important to economies from climate impacts.

...

Strongholds for wildlife and wildlands

IRAs are among the most wild, undeveloped lands both in the nation and within their respective states (Talty et al., 2020). They provide habitat for hundreds of vulnerable wildlife species (Dietz et al., 2021), and they are key to the conservation of threatened, endangered, or imperiled species (Loucks et al., 2003). Large roadless areas serve as source populations for many species including wide-ranging carnivores like grizzly bear (*Ursus arctos*), wolverine (*Gulo gulo*), Canada lynx (*Lynx canadensis*) and fisher (*Martes pennanti*) (Carroll et al., 2001; Noss and Cooperrider, 1994; Sanderson et al., 2002). IRAs are strongholds for fish, including threatened salmonids and bull trout (Gucinski et al., 2001; Rhodes et al., 1994). They provide a safe haven for old and ancient trees that contribute unique evolutionary diversity having survived long cycles of environmental change (Cannon et al., 2022). Old-growth forests are a key component of IRAs and provide unique habitats for threatened species, and buffer sensitive species from warming (Betts et al., 2018; Piovesan et al., 2022).

IRAs are often located near existing reserves, thereby enhancing landscape connectivity of the larger reserve system. This proximity serves to increase the size of large intact habitats and reduce distance between core areas. Additionally, existing reserves tend to be at higher elevations than nearby IRAs that extend into adjacent lower elevation areas with unique wildlife habitats and ecosystem types (Aycrigg et al., 2016; Crist et al., 2005;

Talty et al., 2020). Roadless areas that physically link existing reserves together safeguard system functionality that is of existential importance to wide-ranging species and critical to climate adaptation. IRAs expand ecoregional and elevational representation of the reserve system and increase the number of areas large enough to provide refugia for species needing large tracts of land relatively undisturbed by people (Develice and Martin, 2001). ... Present and future ecological integrity of existing reserves is ultimately intertwined with and bolstered by the roadless lands near to them. ...

Forest carbon and climate mitigation values

Because IRAs have been protected from road building, they contain a significant amount of mature and old-growth forests that were often targeted for logging in roaded areas of national forests. Mature and old-growth forests with large trees play an outsized role in storing and accumulating carbon from the atmosphere, making them essential for climate change mitigation (Moomaw et al., 2019; Mildrexler et al., 2020; Law et al., 2022; Birdsey et al., 2025). A study of US forest carbon stocks found that IRAs hold 22% of the total mature forest carbon stock and 27% of the total old-growth carbon stock on national forest lands (Birdsey et al., 2025). In addition to their large, accumulated carbon stocks, mature and old forests provide co-benefits to biodiversity, water availability, and buffering climatic extremes linked to their ecological integrity and ecosystem functions (Frey et al., 2016; Perry and Jones, 2016; Moomaw et al., 2019; Mildrexler et al., 2023; DellaSala et al., 2025). IRAs are thus high-priority areas that could be strategically protected (GAP 1 or 2) to meet climate preservation targets of 30% protection by 2030, and 50% by 2050 (Law et al., 2021).

Medicine, food, and culture

Roadless areas play an important role in provisioning foods and medicines that support the nutritional, economic and cultural well-being of a large percentage of US citizens, especially among rural and Indigenous communities (Chamberlain et al., 2025).

...

Many IRAs are on the ancestral homelands of Tribes and hold spiritual, cultural, and ecological significance to Indigenous cultures (Vest, 1988).

...

Risks of rescinding the roadless rule

National forest roads - unmanageable and underfunded

With over 386,000 miles of roads on national forest lands, the USFS struggles to maintain a fraction of the existing road system. Deteriorating roads and road densities that exceed management standards degrade valuable ecosystem services, such as water quality and habitat security for wildlife (USDA, 2002; Wisdom et al., 2018).

...

Opening roadless areas to road building jeopardizes aquatic values

The exceptional aquatic values of IRAs are seriously threatened by road building. Negative consequences of roads include increased risk of sedimentation and debris slides, stream flow alterations, habitat fragmentation, invasion by exotic species, dispersal of pathogens, impacts on water quality such as chemical contamination, degradation of aquatic habitat, and other human actions (for example, trash dumping, illegal hunting, fires) (Gucinski et al., 2001; Wemple et al., 2018). Roads significantly elevate erosion and sediment delivery to streams (Gucinski et al., 2001; Kastridis, 2020). They disrupt subsurface flows essential to the maintenance of baseflows, and channel water into ditches and culverts, causing multiple negative impacts on water quality and hydrology of watersheds (Wemple and Jones, 2003; Wemple et al., 2018). Altogether,

roads are one of the greatest sources of aquatic degradation for fish and other species (Rhodes et al., 1994). Water quality impaired by road systems and forest cover loss may require expensive restoration or water treatment systems to accomplish what intact watersheds do free of cost (DellaSala et al., 2011; Gucinski et al., 2001; Warziniack et al., 2017).

...

More roads lead to more wildfires

Although the rationale for rescinding the Roadless Rule to permit road building in IRAs is given as reducing wildfire risk, in fact, a wide body of research shows that the opposite is true (Aplet et al., 2026; Balch et al., 2017; DellaSala and Frost, 2001; Yang et al., 2006). Human-started wildfires are an increasingly costly and dominant driver of fire regimes in the US, with human-related ignitions concentrated near forest roads (Calef et al., 2008; Faivre et al., 2014; Higuera et al., 2023; Narayanaraj and Wimberly, 2012; Syphard et al., 2025). A recent assessment of the impacts of roads on wildfire ignition density found that from 1992 to 2024, in all 8 contiguous-US Forest Service regions combined, the highest wildfire-ignition density was in lands within 50 m of roads (Aplet et al., 2026). The lowest wildfire ignitions were in designated Wilderness and IRAs (Aplet et al., 2026). Another study analyzed over 1.5 million fires across the US from 1992 to 2012 and found a significant increase in the frequency of human-caused wildfire ignitions, which accounted for 84% of all wildfires and 44% of total area burned (Balch et al., 2017). Human activities associated with roads alter fire regimes in three primary ways (Bowman et al., 2011). 1) Humans change the distribution and density of ignitions, with roads being a primary location where increased ignitions occur. 2) Humans shift the seasonality of burning by introducing ignitions into landscapes at times when natural starts from lightning are rare, but fuels are sufficiently dry enough to ignite and carry fire (Balch et al., 2017; Higuera et al., 2023). ... 3) Humans alter available fuels especially along roadsides. Roads are strongly associated with the spread of invasive plant species in national forests (Healey, 2020), and invasive plants provide highly flammable vegetation to dry roadsides, where human-ignitions most frequently occur. ...

...

Wilderness areas and IRAs are critical intact landscapes where natural fire regimes can function, which helps reduce fuel build-up, modulate future wildfire activity, and confer landscape resilience to climate change (Koch, 1935; Bradley et al., 2016; Johnston et al., 2021). Qualities that make these areas relatively good places to manage natural fire for resource benefit at relatively low risk, such as topographic complexity, and remote backcountry settings, also make them costly, difficult, and hazardous places for on-the-ground fire suppression activities (Dunn et al., 2020). Keeping IRAs intact and free from roads and emphasizing natural processes in these areas is an efficient, cost-effective, risk-reduction management strategy, particularly for an agency that is currently looking to reduce costs associated with land management and adapt ecosystems to a changing climate.

...

Logging in IRAs is damaging and uneconomic

Logging within IRAs runs counter to the urgent need to prevent forest degradation of intact forest ecosystems (Moomaw et al., 2019; Pan et al., 2024; Watson et al., 2016). The protection of Earth's remaining intact forests, including IRAs, is necessary to help humanity adapt to some of its greatest challenges – water security, climate change, and biodiversity loss. Moreover, directing limited agency resources toward costly and ecologically damaging backcountry logging takes resources away from areas where restoration is a higher priority, putting communities and ecosystems at greater risk. Logging activities in IRAs are far more costly to plan and implement compared with

roaded areas (DeVelice and Martin, 2001; Hjerpe et al., 2017). For operators, the high cost of transport from relatively remote locations contributes to tight economic margins which spur more aggressive logging to offset costs, such as logging large-diameter trees. Logging large trees rapidly releases decades to centuries of accumulated carbon to the atmosphere worsening climate change and degrading forests (Law et al., 2021; Mildrexler et al., 2020, Mildrexler et al., 2023). Timber harvest in IRAs is misguided economic policy because it degrades roadless areas and the valuable ecosystem services they provide, exacerbates climate change, and redirects resources away from protecting communities.

Mildrexler et al 2026. Roadless rule rescission threatens highest integrity forest ecosystems in the United States. Biological Conservation. Volume 321, September 2026, 111950.

<https://doi.org/10.1016/j.biocon.2026.111950>.

Faison (2026) showed that forest reserves (e.g., unroaded areas) generally produce as good or better outcomes for forest complexity and carbon storage compared to logged forests.

Abstract: Forests develop complex and carbon dense structures over time under moderate natural disturbance regimes. It has been posited that more extreme natural disturbances may simplify forest structure and reduce stand carbon. Alternative hypotheses were examined for forests in the western United States exposed to severe fires and insect outbreaks: forests protected from management (“reserved”) have (1) greater structural complexity and live carbon than unprotected forests (“nonreserved”) because of protection from cutting or (2) less complexity and live carbon because of reduced resilience in the absence of management. USDA Forest Inventory and Analysis data were used to compare the condition of reserved and nonreserved forests at regional and subsectional scales. The relative effects of tree cutting, crown fire and insects on forest condition were also assessed. At the regional scale, reserved forests had greater large live trees (+37 %), large snags (+39 %), coarse woody debris (+21.5 %), live aboveground carbon (+11 %), and overall structural complexity index (SCI; $P < 0.0001$). Tree cutting was the strongest negative predictor of differences in complexity and carbon, while crown fire was a negative predictor of live carbon and large trees, but had no effect on the SCI. At the subregional scale, three subsections had higher live carbon in nonreserved, and one had higher live carbon in reserved forests; complexity remained higher in reserved areas. Reserved forests were more effective at protecting live carbon at broad scales and structural complexity at all scales, while nonreserved forests retained more live carbon at smaller scales in some disturbance-prone forests.

Faison, E. 2026. Effects of reserve status and disturbance on structural complexity and carbon storage in western U.S. forests. Forest Ecology and Management 609. June 2026. DOI:

10.1016/j.foreco.2026.123641.

<https://www.sciencedirect.com/science/article/abs/pii/S0378112726001398?dgcid=author>.

Conserve Snag Habitat

The LRMP and the Eastside Screens also rely on outdated standards for managing snag habitat. New science shows that wildlife need more snags for a wider variety of life functions. The 2021 Amendment to the Screens adopted a standardless approach to managing snags and green replacement trees, calling for the provision of *some* snags and green trees to meet the needs of *some* species, but without any assurances that enough snags will be maintained and recruited over time to ensure population viability for the wide variety of species which are most sensitive to the absence of abundant snags found in natural forests.

“More recent empirical studies indicate that snag numbers and sizes selected by some wildlife species are far higher than those calculated using the maximum potential population method (Bull et al. 1997, Rose et al. 2001).” Deschutes NF 2025. Managed Stands Eastside Environmental Assessment. <https://usfs-public.app.box.com/v/PinyonPublic/file/1925647535091>

As explained on the DecAID website:

Why is DecAID needed?

National Forest LRMP standards and guidelines for management of snags and down wood in the Pacific Northwest were based on wildlife species models and tools that were developed in the 1970s and 1980s (Thomas et al. 1979, Neitro et al. 1985, Marcot 1992, Raphael 1983). New information about the ecology, dynamics, and management of decayed wood has been published since then, and the state of the knowledge continues to change. Rose et al. (2001) report that results of monitoring indicate that the biological potential models are a flawed technique (page 602). There has been an evolution from thinking of large woody material as habitat structures, to thinking of decaying wood as an integral part of complex ecosystems and ecological processes.

This paradigm shift has made the management of dead wood a much more complex task. We can no longer expect to go to our LRMPs or the biological potential model to get one number for the amount or size of snags and down wood that we can apply to all projects and to all acres. We are directed to use the best available science to manage ecosystems, and the best available science simply will not support business as usual for managing dead wood.

Region 6 - USDA Forest Service. A Guide to the Interpretation and Use of the DecAID Advisor. June, 2006.

<https://web.archive.org/web/20161212221748/http://www.fs.fed.us/r6/nr/wildlife/decaid-guide/>

A few of the problems with the old standards are:

- They failed to account for the fact that the number of snags needed for roosting, escape, and foraging can exceed the number of snags needed for nesting;
- They failed to recognize that the number of snags needed to support viable populations of secondary cavity users may exceed the needs of primary cavity excavators;
- The old standard failed to account for the size height of snags favored by some species;
- In applying the old standards the agencies often fail to account for rates of snag fall and recruitment;
- The old standards fail to recognize non-equilibrium conditions in our forests, i.e. some species rely on the natural large pulses of snags associated with large disturbances;
- The old standards fail to account for the differential use of space and population density of different species;
- The old standards ignore other important habitat features of dead wood, e.g. loose bark, hollow trees, broken tops, etc.

The Forest Service recognizes that

Forest Plan standards were based on a model that did not account for snags required for foraging (EA p. 68 and Appendix K p. 45). There is general consensus in the scientific and professional community that using the biological potential model (which was used in developing the Forest Plan standard) is flawed and does not provide adequate nesting, roosting, or foraging structure for cavity excavating birds ...

North Fork John Day RD, Umatilla NF. 2011. Mirage Vegetation Management Project DN. http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/53012_FSPLT2_055455.pdf.

“Two common consequences of conventional thinning practices have been increased uniformity of forest structure and composition, and removal or delay in the development of dead wood as snags or down wood to meet decadence and habitat functions. ... Over the past several decades our ecological understanding of decadence and its importance to habitat and biogeochemical processes has increased substantially, but translation of the fundamental knowledge into coherent goals is lagging.”

Paul D. Anderson 2013. Two Decades of Learning about Thinning in the Ecosystem Management Era. https://www.fs.usda.gov/pnw/pubs/pnw_gtr880/pnw_gtr880_001.pdf in Density Management in the 21st Century: West Side Story PNW-GTR-880. https://web.archive.org/web/20170524155257/https://www.fs.fed.us/pnw/pubs/pnw_gtr880.pdf

“Many species in the Pacific Northwest evolved to use large snags and logs that were historically abundant in the landscape. If snags and logs are lost, biodiversity can be affected and potentially cause a loss of some function in the landscape such as control of forest insects.”

Mt Hood NF 2011. Huckleberry Thin EA. <https://usfs-public.app.box.com/v/PinyonPublic/folder/158150413008>.

The NEPA analysis should help illuminate trade-off between snag quality (snag size) and snag quantity (number of snags) that follows from the choice between thinning and not thinning. This critically important trade-off may be amenable to quantitative analysis if the agency would conduct a stand simulation model. This is one of the key functions of NEPA to illuminate the consequences of alternative management approaches. With respect to dead wood habitat, what mix of treated and untreated areas will result in the best mix of thinned areas with later-fewer-larger snags, and unlogged areas where dead wood recruitment is more rapid, more abundant, only slightly smaller?

Thinning is often presumed to accelerate attainment of multiple attributes of mature and old-growth forests. This is partially true. Thinning does accelerate the growth rate of the trees that are retained, but thinning has limited effects on canopy structure¹ and generally has adverse effects on snags and dead wood. The NWFP ROD highlighted the importance of dead wood accumulation as young forests develop into mature & old-growth: “Desired late-successional and old-growth characteristics that will be created as younger stands change through successional development include: (1) multispecies and multilayered assemblages of trees, (2) **moderate-to-high accumulations of large logs and snags**, (3) moderate-to-high canopy closure, (4) moderate-to-high numbers of trees with physical imperfections such as cavities, broken tops, and large deformed limbs, and (5) moderate-to-high accumulations of fungi, lichens, and bryophytes.” 1994 ROD p B-5. Thinning will truncate this important ecological

¹ In young Douglas-fir stands “canopy structure did not differ dramatically between thinned and unthinned stands. ... There were no evident trends between understory cover and thinning history; both shrub and forb cover were fairly similar among the three thinning intensities [including the unthinned control stands]. The difference in mean shade-tolerant canopy cover was not significantly lower in LT [light thin] and HT [heavy thin] than in ND [undisturbed] stands ... We expected greater cover of understory vegetation in thinned than in unthinned stands but did not detect significant differences in this analysis.” McIntosh, Anne C.S.; Gray, Andrew N.; Garman, Steven L. 2009. Canopy structure on forest lands in western Oregon: differences among forest types and stand ages. Gen. Tech. Rep. PNW-GTR-794. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 35 p. http://www.fs.usda.gov/pnw/pubs/pnw_gtr794.pdf

process and degrade the quality of future late-successional habitat. When the logs are removed from the site, this adverse effect can be long-lasting.

There is a widely held belief that growing big trees faster by thinning, also benefits snag associated wildlife and fish because if there are bigger trees, there must also be bigger snags faster. This assumption does not hold up under scrutiny. Thinning captures mortality and removes it from the forest to the mill. It also increases the vigor of trees and delays mortality. BLM says “Thinning ‘captures’ much of the snag recruitment that results from inter-tree competition and very little density mortality ... is expected to occur for 25 years after treatment.” Salem BLM, South Scappoose EA.

http://www.blm.gov/or/districts/salem/plans/files/SSC_EA.pdf. See this online slideshow which shows the modeled effects of thinning on dead wood habitat.

<http://www.slideshare.net/dougoh/effects-of-logging-on-dead-wood-habitat>. Stand simulation models clearly show that we need to count the effects of thinning on dead wood as a “cost” instead of the “benefit”, so we need to consider appropriate methods to avoid and mitigate impacts. Avoidance is just to leave stands unthinned and let them naturally grow and recruit mortality over time. Mitigation can come in several forms. Here are a few ideas:

- a) truly mimic natural disturbance by thinning with prescribed fire that creates a pulse of dead trees and does not build roads. This could be combined with light thinning;
- b) retain abundant untreated areas such as riparian areas and other “skips” within thinning areas where natural mortality can proceed without interference, and make sure these areas do not get salvaged or thinned in subsequent entries so that mortality gets recruited to the stands, not to the mill;
- c) identify which portions of the landscape will remain unthinned in perpetuity and keep the loggers out. Use tools like DecAID determine the appropriate portion of the landscape must be managed to meet the each different tolerance levels in order to attain desired objectives over time for viable populations, carbon storage, soil stability/sediment storage and routing, nutrient cycling, site productivity, water storage, and other ecological services.

NOTE: simply protecting existing snags or artificially creating a few snags during logging has a very short-term effect that does not address the more fundamental issue of continuous snag recruitment over time.

Logging and roads will reduce recruitment of snags and dead wood and all the ecosystem services they provide. One of the most significant and lasting effects of stand replacing disturbance, including regeneration logging, is to bring the process of snag recruitment to a virtual standstill for many decades. Especially when trees are removed by logging, the snag population is directly reduced to ensure safe conditions for workers, and remains low for many decades because the pool of green trees available for snag recruitment is greatly reduced. This results in a multi-decade “snag gap” that has serious adverse consequences for habitat and many other ecological processes. See USDA Forest Service. 2007. Curran Junetta Thin EA. Cottage Grove Ranger District, Umpqua National Forest. June 2007. <https://usfs-public.app.box.com/v/PinyonPublic/folder/158152590920>; 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/c_hapter24.pdf. The agency should make snag habitat conservation and recruitment part of the purpose and need, consider alternatives that treat fewer acres and retain more green trees to mitigate for snag losses from logging; and fully and accurately disclose the long-term loss of snag recruitment caused by commercial logging;

The graph below from the Curran Junetta Thin EA (on the Cottage Grove Ranger District of the Umpqua NF) shows that typical thinning prescriptions 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). Note: for this fish-centric land allocation, the goal should be the top of the gray band representing 80% tolerance levels, which would mean that thinning virtually precludes attainment of snag habitat goals until a new cohort of understory trees grows large, e.g., 100+ years.

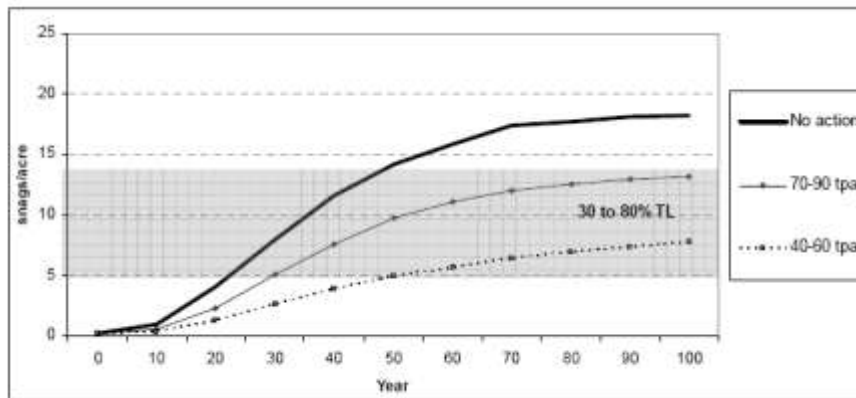


Figure 15. Short and long-term changes to ≥20" dbh snags.

<https://usfs-public.app.box.com/v/PinyonPublic/folder/158152590920>. The analysis needs to show that leaving 10% untreated skips will not adequately mitigate for the long-term effects of reduced snag recruitment. The agency cannot tier to the programmatic EIS for this issue because the PEIS does not show that leaving 10% skips will meet LSR objectives over the long-term. Analysis of this issue is important because so many late successional wildlife rely on dead wood and prefer abundant dead wood. Rose, et al. 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> And because widespread commercial thinning makes it almost impossible to attain abundant down wood for 5 decades or more. Taking care of dead wood habitat is particularly critical in this landscape because there are very few mature, unmanaged stands in the area to mitigate for the proposed widespread thinning.

The agency needs to consider an alternative that leaves much larger areas untreated, such as areas inaccessible from existing roads. Leaving inaccessible areas unthinned will provide several complementary benefits to LSR objectives. Less fragmentation, less edge effects, more optimal levels of snag recruitment over the long-term, more rapid attainment of LSR objectives. This alternative needs to be fully considered.

Conserving unroaded areas is a good way to mitigate for the existing shortage and continued loss of snag habitat due to logging. Korol et al (2002) found that large snag habitat is below the historic range of variability across the Interior Columbia Basin and they estimated that even if the agencies apply enlightened forest management on federal lands in the Interior Columbia Basin for the next 100 years, we will still reach only 75% of the historic large snag abundance, and most of the increase in large snags will occur in roadless and wilderness areas. Jerome J. Korol, Miles A. Hemstrom, Wendel J. Hann, and Rebecca A. Gravenmier. 2002. Snags and Down Wood in the Interior Columbia Basin Ecosystem Management Project. PNW-GTR-181. http://www.fs.usda.gov/psw/publications/documents/gtr-181/049_Korol.pdf.

Danger Tree Removal

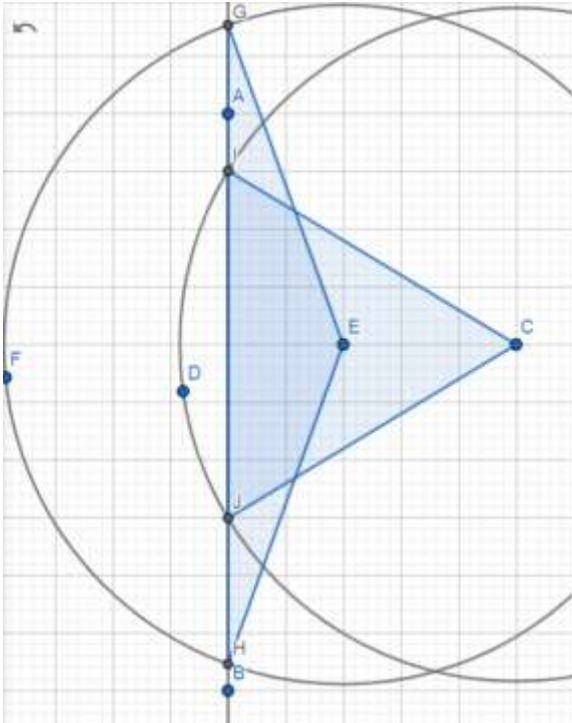
Some felling of large danger trees along high use roads and recreation sites can be expected, but off-site removal of danger trees is not warranted. Given the land allocation, removing large danger trees should not occur. The FS should not allow commercial incentives to undermine the need for retention of large wood to provide habitat benefits for fish & wildlife, store carbon, and meet a wide variety of ecosystem services.

Large dead or damaged trees have high ecological value (especially in this fish & wildlife centered land allocation) yet snags and dead wood are in short supply. Large wood provides many benefits to fish and wildlife. We question what methods will be used to determine whether large wood “not required to be retained for other resource needs.” This determination should include consideration of the current deficit of large wood, the diverse ecosystem services provided by large dead wood. See Rose, C.L., et al. 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>.

The decision whether to remove dead trees near roads agency needs to recognize that the public willingly accepts some level of hazard, especially when they visit wild lands.

- The objective of public safety is laudable, but there are gradations of risk based on characteristics of the site and the tree and the type and amount of public exposure, so felling of hazard trees must be balanced against other important objectives such as wildlife habitat, carbon storage, water quality/stream shade, etc.
- Clearing large areas along an extensive road system can have significant negative cumulative impacts such as: soil degradation from heavy equipment operating off roads and biomass removal, water quality degradation from heavy equipment affecting ditches that convey water to streams; cumulative loss of habitat associated with snags, down wood, and diverse early seral vegetation; accelerated carbon emissions; increased fire hazard associated with fire ignition risks, and plantation fuel structure; habitat fragmentation and loss of habitat connectivity caused by increasing the width of non-habitat associated with roads; etc.
- The agency should be more risk tolerant and retain more trees in sensitive areas, such as unroaded areas, riparian areas, and mature and old-growth stands and conservation areas.
- The agency can also be more risk tolerant because some agents of tree decay such as heart rot can coexist in living trees for hundreds of years. By Katherine Latham 2021. The Lost Generation of Ancient Trees. 8th September 2021. <https://www.bbc.com/future/article/20210908-the-lost-generation-of-ancient-trees>;
- To protect soil and water quality and vegetation diversity, heavy equipment should not be allowed off of roads.
- USFS Roads Policy requires the agency to use an open, public roads analysis process to balance competing interests involved in roads management including public safety and environmental values, and the policy urges the agency to focus maintenance work on the roads that get the most use, and emphasizes decommissioning of roads where environmental conservation should take priority, and “If necessary for environmental protection and due to lack of funding, travel on classified roads may need to be restricted or closed.” USFS Road Management Policy. https://www.fs.usda.gov/nfs/11558/www/nepa/115185_FSPLT3_5597368.pdf. The careful weighing of interests required to perform careful roads analysis means that it is not appropriate to categorically exclude danger tree removal projects from NEPA.

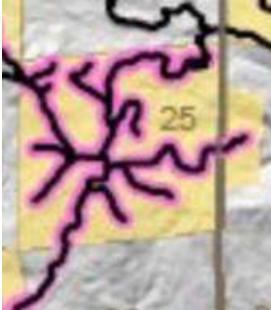
- The agency should consider alternative means of managing hazards from falling trees:
 - Minimize human activities near hazard trees (e.g., closing roads). This may not work where a hazard trees is adjacent to a high traffic road, but some little used roads can be closed. Analyze whether spurs or overgrown roads truly receive public use that justifies hazard tree removal;
 - Temporarily limit the use of roads that cannot be permanently closed until the risk of falling trees is naturally reduced;
 - Top trees, rather than kill them, if shortening them would reduce the chance they would reach the road if they fell;
 - Place signage warning people of post-fire hazards, particularly on roads that are infrequently used. This way people can evaluate the risks for themselves;
 - Often the hazard is not from the tree falling directly on people, but from cars colliding with trees that have previously fallen. This hazard can be mitigated with signage and speed limits, while allowing valuable wildlife trees to persist;
 - Prohibit cutting live, green trees, since all surviving trees are helping to rebuild the below-ground ecosystem, stabilize soils, and serve a valuable role as legacy structure and a recruitment pool for future large trees and snags;
 - Focus tree removal on imminent danger or hazard trees located within striking distance of high use areas, such as developed sites, parking lots, and paved roads. Wherever possible, use hazard trees for restoration of streams and placement in nearby stands that lack large wood;
 - Where they do not pose an immediate threat to safety, all trees presumed to be dying should be treated as live until they are dead, so as to not lose the ecological benefits of those trees that may survive;
 - Take measures to stabilize impacted slopes in areas where roadside logging is unavoidable; and
 - Analyze the cumulative impacts of all post-fire sales and roadside logging projects across agency jurisdictions.
- The agency should only fall trees that pose an imminent hazard to the public. There is little need to fell trees that lean away from the road. Even if a tree is directly on the edge of the road, a tree falling in a random direction has only a 50% chance of hitting the road, and the likelihood diminishes as the distance from the road increases. Trees more than 100 feet from the road have a low probability of falling on the road, even if they are taller than 100 feet. This is because of all the directions these trees could fall, only a small subset would reach the road. For instance, in the figure below, if a tree located at point (E) is close to a road (represented by line G-H) there is a much higher risk of it hitting the road compared to a tree at the location of point (C). The sum of the angles from the tree to the road (in the blue shaded areas) represent either broad or narrow risk of a tree falling and hitting the road depending on its distance from the road.



<https://www.geogebra.org/geometry?lang=en>

- There are several reasons that danger tree felling should be limited to 100 feet from roads. The chance of trees more than 100 feet from roads impacting the road are not very high because the tree would have to fall in precisely the right direction toward the road. And there is a much higher chance it will fall in numerous directions that do not threaten the road. In addition, many dead tree tops break off and fall close to the base of the tree, leaving a shorter snag with a more limited zone of hazard. Felling trees more than 100 feet from roads is unnecessarily risk averse, and unjustifiably sacrifices environmental values (such as snag habitat, dead wood habitat, and soil health).
- Removing trees more than 1 tree length is removing trees that have a zero percent chance of hitting the road. Those are not hazard trees. Removing hazards within 100 feet of the roads is usually sufficient. Trees farther than 100 feet from the road have a very low risk of hitting the road unless they are leaning toward the road. Going out 1 ½ tree lengths is unnecessarily risk averse. Removing trees more than 100 feet from roads is more about extracting timber volume and less about safety. Removing trees more than 100 feet from roads is inconsistent with authorities intended for hazard removal or emergency stabilization, and fails to provide a reasonable balance between safety and conservation. Removing large trees more than 100 feet from roads sacrifices relatively high ecosystem services (habitat, carbon storage, scenic values) for very small increases in safety.
- The agency should focus on roads that are heavily used by the public and workers. There is a trade-off between safety and habitat, and the agency should conserve defective trees and snag habitat in areas that receive little public use.
- The agency should fell trees as absolutely necessary, but wherever possible leave the trees on-site to provide down wood habitat. When tree removal is necessary use the wood to restore stream habitat or to add down wood to previously clearcut plantations where down wood habitat is severely lacking.
- We object to commercial sale of hazard trees, because there are economic conflicts of interest that could lead to ecologically important large trees being removed for the wrong reasons. And the need for large trees for restoration purposes far outstrips the supply.

- The cumulative impact of hazard tree removal needs to be carefully considered. There is a dense road network across the federal/non-federal landscape and if all the hazard trees are removed a certain distance from all those roads, then the area of the forest that can support large snags become greatly diminished. See, for instance, these roadside danger tree removal plans from Eugene BLM's McKenzie watershed:



<https://eplanning.blm.gov/eplanning-ui/project/2009923/570>. In their danger tree CX BLM said "Effects to potential spotted owl foraging in moderately and severely burned areas would not be significant because hazard tree removal would affect a linear corridor rather than entire forest stands" But they did not appear to account for these situations where is a dense road network and the linear corridors affect a large fraction of the stand. The cumulative effects analysis must also account for the lost potential for high quality large snag habitat caused by past regeneration harvest and salvage logging. The NEPA analysis should disclose how the forest can meet DecAID 50-80% tolerance objectives given the cumulative loss of large snag habitat.

The risk of a dead trees actually falling and hitting someone is extremely remote and must be put in perspective. For instance, the agency allows the public to use thousands of miles of roads where the risk of death or injury from collisions or other accidents is far far higher than the risk of being hit by a falling tree. The agency also allows boating and swimming in dangerous waterbodies, winter camping, mountain climbing, off-road vehicle use, and hunting with dangerous weapons. The agency also *promotes* dangerous occupations such as logging and firefighting, and piloting aircraft used for a variety of forest management activities. Furthermore, public use of public lands is skewed toward the summer months, while the extreme weather that tends to cause trees to fall is skewed toward the winter months. If the purpose of this project is to increase public safety please consider all the alternative ways that safety might be enhanced.

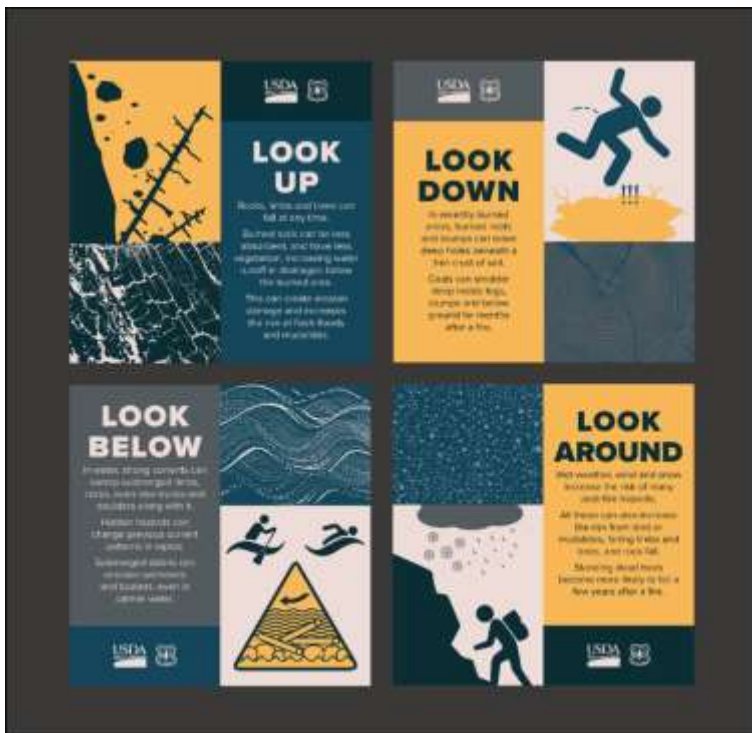
The hazards from trees falling is also mitigated by time. These are not high use roads. The chance that an employee or member of the public will be there when the tree falls is very low. To put things in perspective, there are almost 16 million seconds in a year. How many seconds are there vehicles on the road under these trees during the course of a year, and what fraction 16 million is that?

There are multiple options for managing safety, (a) manage the physical feature presenting the hazard, or (b) manage public use so that the public is less likely to be subject to the physical hazard. We strongly support retention of large snags while educating the public and managing public use to keep the public out of harm's way as much as possible. Truly hazardous trees (i.e., imminent risk of falling in very high use areas) may need to be felled (often leaving a high stump for wildlife) but the boles of such trees should generally be left to provide for wildlife and soil needs.

Here are some examples of signage that may improve safety awareness in burned landscapes:



Willamette NF 2025, Clark Butte Trail. If the Forest Service is willing to tolerate risk to people hiking on National Forest lands, why not tolerate a bit more risk for people driving on National Forest lands?



Situational awareness is critically important for staying safe in burned areas. Practice the Four Steps for Safety to improve your awareness of natural hazards: LOOK UP for upland burned areas, snags, and exposed rocks that may fall.

LOOK DOWN for debris from falling rocks, erosion – especially at road and trail edges, and ash pits (which may form from root pockets or stumps of burned trees),
LOOK AROUND Be situationally aware. Check the weather before you travel, including at higher elevations. Wind, rain, ice and snow can increase the risk of tree fall, rock fall, slides and other hazards. Flash floods and landslide risks are elevated below severely burned areas.

LOOK BELOW the surface of standing water and moving water for floating logs, submerged trees and other debris, which can strike or entangle swimmers and boaters and damage other infrastructure.

Willamette National Forest 2022. 2020 Fire Affected Road System Risk Reduction Project Storymap. <https://storymaps.arcgis.com/stories/841b9854be5346638c3c34291913fe31>

Under-represented snag habitat should be retained on along low standard roads because the PNW Region of the Forest Service already distributes an educational brochure titled “Getting Around on National Forest Roads” which says of low standard roads “If you choose to drive these roads, plan to encounter rocks and boulders, road washouts, downed trees and brush encroaching on the roadway. For safety, ... carry extra equipment such as axe, shovel, gloves ...” See “Getting Around on National Forest Roads” R6-ENG-RG-01-01. <https://babel.hathitrust.org/cgi/pt?id=umn.31951002920989g&view=1up&seq=2>. The public already expects some inconvenience when driving remote forest roads and would willingly trade some risk of inconvenience and small chance of encountering safety hazards for viable populations of native wildlife.

The agencies’ field guide for danger tree identification indicates that little-used logging roads are a low priority for danger tree removal because of intermittent and infrequent hazard exposure.

There are many miles of roads that may have danger trees adjacent to them. It is not possible to correct the danger tree problem immediately, so it is necessary to prioritize the danger tree treatment workload. The treatment priority should be highest where people are most likely to be impacted by danger trees. Consideration of exposure level and traffic frequency provides a way to prioritize the workload.

...

Another aspect of exposure along roads is traffic frequency. Roads that have a higher traffic frequency expose more people to a danger tree than roads with a lower traffic frequency.

The longer people are exposed to a tree, the more opportunity there is for the failed tree to impact them. If exposure duration and traffic frequency are reduced, the opportunity for the tree to impact people is also reduced. The qualified person should consider traffic frequency and exposure duration when determining whether a tree poses a danger to people.

Toupin, Filip, Erkert & Barger. 2008. Field Guide for Danger Tree Identification and Response. USDA FS, USDI BLM, Oregon OSHA.

<http://www.blm.gov/or/districts/medford/plans/files/fieldguidedangertree.pdf>

Sometimes the motivation for eliminating hazards is based on a misunderstanding of legal liabilities. The NEPA analysis needs to acknowledge that the public assumes certain risk when recreating on public lands, so not every hazardous tree on every dead end spur road needs to be felled and removed. See ORS §§ 105.672(3), 105.682(1) and Brewer v. ODFW, 2 P.3d 418, 167 Or.App. 173. <http://www.publications.ojd.state.or.us/A103245.htm>.

ORS 105.682(1) provides:

Except as provided by subsection (2) of this section [pertaining to intentional injuries], and subject to the provisions of ORS 105.688 [limiting immunity to those who do not charge for use of the land or who charge no more than \$20 per cord for woodcutting on the land], an owner of land is not liable in contract or tort for any personal injury, death or property damage that arises out of the use of the land for recreational purposes, woodcutting or the harvest of special forest products when the owner of land either directly or indirectly permits any person to use the land for recreational purposes, woodcutting or the harvest of special forest products. The limitation on liability provided by this section applies if the principal purpose for entry upon the land is for recreational purposes, woodcutting or the harvest of special forest products, and is not affected if the injury, death or damage occurs while the person entering land is engaging in activities other than the use of the land for recreational purposes, woodcutting or the harvest of special forest products.

ORS 105.676 provides:

The Legislative Assembly hereby declares it is the public policy of the State of Oregon to encourage owners of land to make their land available to the public for recreational purposes, for woodcutting and for the harvest of special forest products by limiting their liability toward persons entering thereon for such purposes...

"Land" is defined by ORS 105.672(3) as including "all real property, whether publicly or privately owned." "Owner" is defined by ORS 105.672(4) as "the possessor of any interest in any land, including but not limited to possession of a fee title. 'Owner' includes a tenant, lessee, occupant or other person in possession of the land."

The Oregon Court of Appeals in Brewer said,

The trade-off represented by this policy is manifest. The owner of land opened for recreational use in accordance with the Act gives up exclusive enjoyment of the land and, in return, is insulated from certain types of liability for injuries that may occur there. The users of recreational lands opened in accordance with the Act give up their rights to sue land owners for certain types of injuries but gain the benefit of using land for recreation that otherwise would not be available to them."

Brewer v. ODFW, 2 P.3d 418, 167 Or.App. 173.

<http://www.publications.ojd.state.or.us/A103245.htm>

Also, the Federal Tort Liability Act provides the government some degree of immunity in exercising their discretionary functions like hazard tree management. For instance, the National Park Service was found not liable for failing to remove a tree weakened by root rot that fell and killed a recreational motorist at Great Smokey Mountains National Park, even when the road involved was a high use paved road near a visitor center, and when the tree species at issue (Black Locust) was known by the Park Service to be prone to fall down. AUTERY v. UNITED STATES 992 F.2d 1523 (11th Cir. 1993).

<https://web.archive.org/web/20051203012108/http://classweb.gmu.edu/erodger1/prls560/content/autery.htm>. The appeal court overturned the district court and held that the agency's balancing of public safety and preserving natural areas prevented judicial second guessing and gave them immunity from liability for the death of the motorist.

Based upon the evidence in this case, the appeals court held that "the decisions made by GSMNP personnel in designing and implementing its unwritten tree inspection program fall within the ambit of the discretionary function exception."

Although the district court may have disagreed with the balance struck by the Park Service, or believed that some other policy would have been better, the discretionary function exception is designed to protect against just this type of "judicial 'second-guessing'..."

To decide on a method of inspecting potentially hazardous trees, and in carrying out the plan, **the Park Service likely had to determine and weigh the risk of harm from trees in various locations, the need for other safety programs, the extent to which the natural state of the forest should be preserved, and the limited financial and human resources available.** Indeed, the district court recognized this when it criticized the Park Service for elevating the overriding policy considerations of protecting the trees and the natural state of the area over the safety of humans using the park roadway.

This means that the agency is free to weigh the value of snags for wildlife and other ecosystem services and need not reflexively cut down every hazard tree. The agency's proposal in the present case is not consistent with applicable law or conservation principles.

Fuel breaks / PODs / PCLs

We are concerned that 4,693 acres of commercial logging to create shaded fuel breaks will make fire hazard worse instead of better. The NEPA analysis needs to reflect that likelihood that commercial logging will remove too much canopy, disturb too much soil, and stimulate the growth of more hazardous fuels. Shaded fuel breaks are best created non-commercially by thinning small diameter material <7-9" dbh and retaining greater canopy cover to reduce soil disturbance, reduce slash production, and retain canopy that helps suppress weed growth, fuel growth, and reduce the cost of future fuel maintenance efforts.

If used correctly, shaded fuel breaks can be a useful tool for fire management. Done incorrectly they can make the situation worse, and cause a lot of unintended adverse trade-offs. Shaded fuel breaks implemented non-commercially with significant canopy retention may be an effective fuel treatment, IF they are maintained over time. If fuel breaks remove too much canopy and are accomplished with heavy equipment that disturbs too much soil, fuel breaks can stimulate the growth of hazardous fuels and weeds, making fire hazard worse instead of better, while making long-term maintenance more difficult and more expensive.

Fuel breaks can have significant trade-offs, including: spreading weeds through soil and canopy disturbance, habitat fragmentation and edge effects, exacerbating barriers to wildlife movement, impaired wildlife connectivity, loss of wildlife cover, loss of snag and dead wood habitat, facilitating unauthorized OHVs, increased carbon emissions, etc. NEPA analysis is needed to disclose and consider these trade-offs and develop alternatives that avoid, minimize, and mitigate adverse effects.

Fuel breaks are largely untested with potentially uncertain ecological effects.

Shinneman *et al.* (2019) reported that there is little scientific information available regarding their [fuel breaks] ecological effects. They report that fuel breaks can: (1) directly alter ecosystems; (2) create edges and edge effects; (3) serve as vectors for wildlife movement and plant invasions; and (4) preemptively fragment otherwise contiguous sagebrush landscapes.

Kauffman, Beschta et al 2020. Comments on Boise BLM's Tri-State Fuel Break Project. 22 Dec 2020. https://drive.google.com/open?id=1AEA3PTs3iSv_-RZZnMsduhHCb1hniZ_e citing Shinneman, Douglas J.; Germino, Matthew J.; Pilliod, David S.; Aldridge, Cameron L.; Vaillant, Nicole M.; Coates, Peter S. 2019. The ecological uncertainty of wildfire fuel breaks: examples

from the sagebrush steppe. *Frontiers in Ecology and the Environment* 17(5):279-288. <https://doi.org/10.1002/fee.2045>. (“Fuel breaks are increasingly being implemented at broad scales (100s to 10,000s of square kilometers) in fire-prone landscapes globally, yet there is little scientific information available regarding their ecological effects (e.g. habitat fragmentation). ... Given uncertain outcomes, we examine how implementation of fuel breaks might (1) directly alter ecosystems, (2) create edges and edge effects, (3) serve as vectors for wildlife movement and plant invasions, (4) fragment otherwise contiguous sagebrush landscapes, and (5) benefit from scientific investigation intended to disentangle their ecological costs and benefits.”). See also Shinneman, D.J., Aldridge, C.L., Coates, P.S., Germino, M.J., Pilliod, D.S., and Vaillant, N.M., 2018, A conservation paradox in the Great Basin—Altering sagebrush landscapes with fuel breaks to reduce habitat loss from wildfire: U.S. Geological Survey Open-File Report 2018–1034, 70 p., <https://doi.org/10.3133/ofr20181034>.

PODs and fuel breaks should be explicitly planned and designed to facilitate the return of fire to the landscape, not to perpetuate the failed policy of continued suppression of wildfire. If the fuels breaks are intended for continued fire suppression, then the NEPA analysis should disclose the adverse environmental effects of that outdated policy. Timothy Ingalsbee 2005. Fuelbreaks for Wildland Fire Management: A Moat or a Drawbridge for Ecosystem Fire Restoration? *Journal of Fire Ecology*, Pages: 85-99. DOI:10.4996/fireecology.0101085. https://web.archive.org/web/20070818123112/http://www.fireecology.net/pdfs/7_ingalsbee.pdf.

We think some of the trade-offs of shaded fuel breaks and PODs can be minimized by following guidelines, such as:

- Well-shaded fuel breaks will be much more effective than linear clearings, or heavy thinning. Maintaining a reasonably dense canopy will mitigate habitat fragmentation effects, as well as lower maintenance costs by suppressing growth of surface and ladder fuels. Focus on small (<9” dbh) surface and ladder fuels within 150 feet of roads;
- Focus fuel break treatments near roads. Fire management goals can typically be met by focusing on small fuels within 150 feet from roads. In a survey of fuel breaks in California “average width of fuel breaks in this sample was 116.9 meters” which is ~59 meters each side of the road, or less than 200 feet from roads. Stephens, Collin, Omi, Johnson 2023. FINAL REPORT: Manager Perspectives on Fuel Break Effectiveness and Configurations. JFSP PROJECT ID: 19-2-01, March 2023. https://mcusercontent.com/5f6de7b069a57255f980944b4/files/68ab7c9b-a224-e68b-a3fa-97077e22b662/19_2_01_1.pdf.
- Focus on treating plantations and previously logged stands. Avoid/minimize treating mature & old-growth, riparian areas, and roadless/unroaded areas.
- Treatments in reserves and land allocations with an ecological mandate should be avoided where possible, and minimized/modified to retain more large wood and diverse vegetation to meet objectives for the RMP.
- Use manual treatments (hand felling, lop-and-scatter, burning small piles) instead of heavy equipment. This will protect soil, water quality, and fire resilient native plants;
- Retain dense, mid-to-high canopy to help maintain a cool, moist microclimate, retain fuel moisture, help suppress the growth of surface and ladder fuels (which also minimizes maintenance costs), and provide a bit more cover to mitigate for adverse effects on wildlife mobility;
- Where all trees are less than the minimum 7-9” dbh threshold, leave the healthiest trees at a variable spacing of 20-feet with a variance of 50% to allow for the best leave trees. Don’t thin to heavy and risk stimulating the growth of hazardous fuels. Retain

uncommon trees such as yew, mountain mahogany, aspen, hardwoods, whitebark pine, etc.

- Retain deciduous hardwoods which can serve as heat sinks during fires;
- Adjust prescriptions in response to different forest types, retaining a bit more density in moist forest types, and a bit less in dry forest types;
- Retain important elements of diversity where possible, such as Pacific yew, and some patches of shrubs that produce berries, nuts, nectar, etc. (food for wildlife), and to provide intermittent opportunities for wildlife crossing the road;
- Consider and minimize the effects on large and small wildlife that need to cross roads. Opening the forest reduces cover and increases barriers to safe movement of wildlife;
- Treat a well-planned network of roads that ideally create polygons with a high ratio of area/perimeter. Too much redundancy will create cumulative impacts. Larger PODs have a more favorable ratio of area/perimeter, which reduces cumulative effects. Possibly consider smaller PODs within the WUI, and larger PODs further out. Reduce cumulative effects by avoiding redundant fuel breaks, e.g. avoid treating nearby parallel roads.
- Plan and account for recurring maintenance costs, e.g., manual thinning, prescribed fire, weed control, etc. Avoid commercial logging in the first instance because log values will not be a recurring feature of POD maintenance. The fuels removed should be smaller over time, not larger.
- PODs planning must be truly interdisciplinary, not just in name only.
- NEPA analysis of PODs should be both programmatic and site-specific.

Please develop a NEPA alternative that follows these guidelines.

The NEPA analysis should consider the environmental effects of connected actions, including recurring maintenance and fire suppression activities. The NEPA analysis should disclose the essential connection between fuelbreaks and fire suppression, and disclose what kinds of potential suppression activities, such as fireline construction with hand crews or bulldozers, fire retardant chemical dumping, backfire and burnout operations, hazard tree felling could occur within the fuelbreaks, and disclose the general effects on soils, watersheds, and species of interest.

Weeds are a potential big problem with fuel breaks, especially the combination of frequent disturbance caused by recurring maintenance, and road use as a vector for weeds.

"[W]e found that 19 of the 24 fuel breaks had significantly higher relative nonnative cover than the adjacent wildland areas.... Time since construction was strongly associated with nonnative abundance when we evaluated all of the fuel breaks together.... A number of different species assumed dominance... suggesting that many nonnative species may be well adapted to take advantage of the conditions provided by fuel treatments.... [F]uel breaks with more canopy and ground cover may be less likely to be invaded.... We found that nonnative cover decreased with distance from the fuel break, suggesting that fuel breaks act as sources of nonnative plant seeds during the invasion of adjacent areas."

Merriam, K.E., Keeley, J.E., and Beyers, J.L., 2007, The role of fuel breaks in the invasion of nonnative plants: U.S. Geological Survey Scientific Investigations Report 2006-5185, 69 p. http://pubs.usgs.gov/sir/2006/5185/pdf/sir_2006-5185.pdf.

The Forest Service finds ...

in general, annual grasses that have invaded a lot of these locations along the roadside were the most ignitable.

While non-native annual invasive plants grow quickly, seed, dry out and die, native perennial plants retain moisture into the summer and early fall and will green back up in the spring. They need to retain that moisture to survive.

When it comes to ignitability the amount of moisture in plant leaves and stems is a major influencing factor. The lower the moisture the more easily ignitable.

Andrew Avitt 2026. The fire that never starts. Reducing roadside ignitions. USFS Office of Communication. March 9, 2026 <https://www.fs.usda.gov/about-agency/features/fire-never-starts>

In another publication, the authors warn that fuel breaks are of unproven effectiveness in the face of extreme fire weather, and suggest that an extensive system of fuel breaks would “create edges and edge effects, serve as vectors for wildlife movement and plant invasions (like cheatgrass), and fragment otherwise contiguous sagebrush landscapes.” Douglas J Shinneman, Matthew J Germino, David S Pilliod, Cameron L Aldridge, Nicole M Vaillant, Peter S Coates 2019. The ecological uncertainty of wildfire fuel breaks: examples from the sagebrush steppe. *Frontiers in Ecology and Management*. Vol 17, Issue 5, June 2019. Pages 279-288. <https://esajournals.onlinelibrary.wiley.com/doi/pdf/10.1002/fee.2045> (“Given uncertain outcomes, we examine how implementation of fuel breaks might (1) directly alter ecosystems, (2) create edges and edge effects, (3) serve as vectors for wildlife movement and plant invasions, (4) fragment otherwise contiguous sagebrush landscapes, and (5) benefit from scientific investigation intended to disentangle their ecological costs and benefits.”).

Fuel breaks can incrementally serve a variety of potential purposes during fire suppression efforts, however in a survey of fuel breaks in California “... only four first stopped at the fuel break without aid from suppression resources, while 29 either required the use of suppression resources or failed, which is in agreement with previous research ...” In testing various fuel break configurations, the authors found, “In the fuel break only scenario, all model runs showed a slight increase in burn probability in the near vicinity of the fuel break. ... likely due to the increase in light and flashy fuels in the fuel break area. ... The final modeling scenario of a simulated firing operation shows large decreases in burn probability on the lee side of all fuel breaks.” Stephens, Collin, Omi, Johnson 2023. FINAL REPORT: Manager Perspectives on Fuel Break Effectiveness and Configurations. JFSP PROJECT ID: 19-2-01, March 2023. https://mcusercontent.com/5f6de7b069a57255f980944b4/files/68ab7c9b-a224-e68b-a3fa-97077e22b662/19_2_01_1.pdf. The effectiveness of fuel breaks depends a lot on whether they are used as firing lines for burnout operations.

The efficacy of fuel breaks needs to be closely examined.

...fuel break performance and benefit is based on the questionable expectation that fire suppression will be capable of “stopping” fires after initial attack fails (see Expectations above). Large fires escape initial attack for many reasons that include resource scarcity due to high numbers of ignitions, and spotting and crown fire behaviors that make holding a pre-defined position by firefighters untenable and perhaps dangerous. Furthermore, the only firefighting tactics supported by fuel breaks are categorized as “indirect” (Brown and Davis 1973). This means that the rest of firefighting tactics (direct attack and parallel attack) are not enhanced regardless of the current fire behavior or fire position on the landscape relative to the location of the fuel break. A large fire that slows before reaching a fuel break (because of a change in weather conditions, nighttime, etc.) must be attacked (by direct or parallel tactics) with no benefit of the fuel break. Utilizing fuel breaks involves a large burnout operation, which may be of a size equal to the original wildfire, take place regardless of the fire behavior at its current location, and produce negative effects on wildland vegetation greater than the original wildfire.

Maintenance costs of fuel breaks are often ignored by proponents but maintenance is a perpetual burden that is likely to divert efforts from managing fuels and vegetation on the remaining majority of the landscape.

...

Evidence that fuel breaks surrounding urban zones are sufficient to reduce threats to urban values is lacking. Because of their location on the periphery of wildlands, fuel breaks cannot reduce losses of wildland values associated with a community. Although it is commonly argued that fuel breaks will reduce wildfire intensities adjacent to residential development and thereby allows firefighters to protect homes, wildland-urban fire disasters tend to occur during severe fire conditions when fire behavior characteristics often overwhelm fire protection resources.

Finney and Cohen. 2003. Expectation and Evaluation of Fuel Management Objectives. USDA Forest Service Proceedings RMRS-P-29.

http://www.fs.usda.gov/rm/pubs/rmrs_p029/rmrs_p029_351_366.pdf.

The agency should retain, not reduce, canopy fuels because canopy fuels actually help maintain a favorable microclimate and reduce surface and ladder fuels which are the greater hazard. If there is a perceived need to reduce the continuity of canopy fuels, the road itself serves that purpose.

It has been empirically demonstrated on the Umpqua that creating large gaps in the canopy during fuel break construction will lead to an undesired response of growth of smaller trees and brush. This would most likely contribute to undesired fire effects and fuel breaks that become inefficient in just a few years.

Umpqua NF 2025. Buckeye IRR Project, Comment Consideration Appendix (p 28). <https://usfs-public.app.box.com/s/7f9mgj386i60jwz01yxprgystxo5xth2/file/1958172230107>

Hakkenberg et al. (2024) showed that ladder fuels were the main driver of wildfire severity, whereas dense, high canopy fuels tend to reduce fire severity, even during extreme fire conditions.

Here we employed GEDI space-borne lidar to consistently assess how pre-fire forest fuel structure affected wildfire severity across 42 California wildfires between 2019–2021. Using a spatial-hierarchical modeling framework, we found a positive concave-down relationship between GEDI-derived fuel structure and wildfire severity, marked by increasing severity with greater fuel loads until a decline in severity in the tallest and most voluminous forest canopies. Critically, indicators of canopy fuel volumes (like biomass and height) became decoupled from severity patterns in extreme topographic and weather conditions (slopes >20°; winds > 9.3 m/s). On the other hand, vertical continuity metrics like layering and ladder fuels more consistently predicted severity in extreme conditions – especially ladder fuels, where sparse understories were uniformly associated with lower severity levels.

...

Vertical fuel continuity is especially important for lower stratum ladder fuels, where greater continuity may enable flames to transition from ground and surface fires to higher canopy strata, thereby increasing contagion ... [W]e observed that steep slopes, dry conditions and high winds overwhelmed most fuel structural conditions to constrain landscape severity patterns. Importantly, the sole exception to this pattern occurred with ladder fuels ...

... This finding suggests that high-intensity fuel treatments (which target entire forest canopies rather than focusing on lower stratum ladder fuels only) may have a limited effect on wildfire severity in extreme conditions. Conversely, sparse understories (<10 m) – even those that concurrently possess robust mid- strata (>10 m) – were associated

with reduced wildfire severity. This result has important management implications, especially for treatment interventions that focus on vertical fuel continuity such as understory thinning or cultural burns, which have been found to be effective in reducing high-severity burns². Understory treatments have also been found to lessen externalities associated with more intensive thinning operations⁷¹ and simultaneously promote culturally- and ecologically-beneficial wildfire outcomes across a wide variety of topographic, weather and climate contexts^{1,72}.

Hakkenberg, C. R., Clark, M. L., Bailey, T., Burns, P., & Goetz, S. J. (2024). Ladder fuels rather than canopy volumes consistently predict wildfire severity even in extreme topographic-weather conditions. *Communications Earth & Environment*, 5(1), 1-11. <https://doi.org/10.1038/s43247-024-01893-8>; pdf.

Let Fire and Other Natural Processes Do the Ecological Work, Rather Than Rely on Commercial Logging for Fuel Reduction

This project area is mostly set aside for fish conservation. This is a good place to exercise caution and use non-commercial thinning and prescribed fire to accomplish vegetation management and fuel objectives, rather than use 9,000 acres of commercial logging and 27 miles of temporary road construction with significant trade-offs that could conflict with objectives for fish conservation, LOS development, connectivity, snag habitat, etc.

We are concerned that projects like this are based on a false sense of control over nature when in reality fuel reduction has a low probability of encountering fire and has a modest/marginal effect on fire behavior, and wildfires continue to burn with a characteristic mix of low, moderate, and severe effects. The purpose and need for this project should be adjusted accordingly and the agency should consider alternatives that are based on working with, instead of against, natural processes. From this perspective, non-commercial thinning and prescribed fire make a lot of sense, while commercial logging is vastly over-used tool for restoration.

Oregon forests are fire-dependent. Even with increasing acres burned by wildfire in recent years, there is still a severe deficit of fire in all severity classes, including severe fire, a deficit which grows yearly. In eastern Oregon and Washington,

Contemporary years average well under historical rates for virtually all severity classes across dry and moist (but not cold) forests. Annualized fire deficits relative to historical rates are especially conspicuous for low-severity area in dry forests (on average missing 127,000–161,000 ha·yr⁻¹ regionally) and moderate-severity area in both dry (missing 34,000–44,000 ha·yr⁻¹) and moist (missing 9000–12,000 ha·yr⁻¹) forests. Ten-year moving averages in burn area are increasing in recent years, but remain below historical levels. Trends are similar across states and major land ownerships. ... As such, beneficial fire years may be those not with less, but rather more, area burned – with characteristic severity and patch distributions, minimal clearly-negative impacts (e.g. loss of life and property), and contribution to restoration/maintenance objectives.

...

Three key takeaways emerge: 1) historically, for all the forest types of the inland Pacific Northwest to have burned at published frequencies, a significant fraction of the land base – hundreds of thousands of hectares – would have burned each year, albeit with substantial year to year variation; 2) the contemporary era (1985–2020) has been much less fiery than the historical era – by nearly an order of magnitude when comparing averages of annual area burned; and 3) these burned-area rates demonstrate that successful forest restoration and maintenance will likely require both increasing active treatment rates and incorporating managed wildfire.

... Without significantly greater use of managed wildfire, in combination with major increases in prescribed fire or other treatments, it will be challenging to achieve wildfire risk reduction and landscape climate adaptation goals in a meaningful timeframe (North et al., 2012, North et al., 2021, Ager et al., 2022).

... A broader assessment of fire impacts could place fire seasons in a more meaningful context. Rather than a narrative centered simply on absolute area burned, a broader evaluation would consider both the impacts and the ‘work’ accomplished by wildfires. The ‘work’ of wildfire can be thought of as the degree to which stand- and landscape-scale fire effects are consistent with science-based objectives for [ecosystem resilience](#) or planned forest restoration/maintenance treatments. In essence, the question shifts from “how many hectares burned?” to “how many hectares burned that produced desired versus deleterious outcomes – ecologically and socially?” (See WA DNR, 2022a, WA DNR, 2022b).

Daniel C. Donato, Joshua S. Halofsky, Derek J. Churchill, Ryan D. Haugo, C. Alina Cansler, Annie Smith, Brian J. Harvey, 2023. Does large area burned mean a bad fire year? Comparing contemporary wildfire years to historical fire regimes informs the restoration task in fire-dependent forests, *Forest Ecology and Management*, Volume 546, 2023, 121372, ISSN 0378-1127, <https://doi.org/10.1016/j.foreco.2023.121372>. <https://www.sciencedirect.com/science/article/pii/S0378112723006060>. The authors recommend greater use of fire as a management tool. See also, Parks, S. A., et al. (2025). A fire deficit persists across diverse North American forests despite recent increases in area burned. *Nature Communications*, 16(1), 1-13. <https://doi.org/10.1038/s41467-025-56333-8> (“[O]ur results suggest that the area burned by wildfires during the last few decades remains relatively low considering the historical prevalence, an accumulating body of evidence indicates that the nature of the wildfires and fire regimes in forests and woodlands has changed substantially-- notably with respect to increased wildfire severity.”)

Faison et al (2023) say that natural processes are more likely to develop complexity and resilience-

North America's temperate forests evolved continuously in response to natural disturbances and changes in climate over the past 65 million years (Askins, 2014). Only in the past 10–15,000 years did humans arrive and manage forests with fire and tree removal for subsistence and safety near their settlements (Roos, 2020; Roos et al., 2021), and only in the past two centuries did humans manage forests intensively (including the suppression of natural disturbances like fire) for industry and other values at the regional scale (Williams, 1992).

... Forest health and resilience are important tenets of adaptation. Yet definitions of forest health focus on the ability of forests to provide direct resources and services to people (Millar & Stephenson, 2015), rather than the ability of ecosystems to persist and adapt per se in the face of changing disturbances. Hence, forest adaptation projects are portrayed as necessary for protecting forest ecosystems from climate change, when these initiatives are often more about resisting and directing change to promote a particular set of natural resource values and objectives, including economic gain.

... Here we argue that a resist and direct approach to managing forests (e.g., mechanical thinning, prescribed burns, species selection, pre- and postdisturbance salvage/planting, and other fire suppression tactics) is appropriate in some forests intended for resource production, experiments, and human safety in the “wildland–urban interface.” However, accepting the capacity of natural systems to adapt and be self-sustaining with natural stewardship is a critical and cost-effective approach in other forest contexts.

...

Although improved resilience and protection of biodiversity are goals of proposed adaptation management, active management may, in some cases, have little effect on future stand resistance (Morris et al., 2022), is often unnecessary for natural forest resilience (e.g., Cansler et al., 2022; Hart et al., 2015) and biodiversity (Thom & Seidl, 2016; Viljur et al., 2022), and is generally counterproductive to carbon storage, structural complexity, tree diversity, and resistance to invasive species. (Donato et al., 2013; Miller et al., 2018; Patton et al., 2022; Schwilk et al., 2009; Young et al., 2017; Table 1). Moreover, conservation evidence for the effectiveness of management interventions is often lacking or has mixed results (Sutherland et al., 2021), resources for interventions are limited, and management incurs substantial financial and other costs to society (Houtman et al., 2013). Depending on local considerations, and based on multiple values, natural or near natural forest stewardship is an effective approach to developing and sustaining forest complexity, diversity, and functionality and traditional/aesthetic values (Franklin et al. 2002; Miller et al., 2016; Miller et al., 2018; Sze et al., 2022; Waller & Reo, 2018). It is also an insurance policy as we face an uncertain future.

...

From an ecological perspective, it is questionable whether it is even desirable or necessary to reduce the frequency and intensity of fire and other disturbances away from human settlements and forests managed for sustained wood production (e.g., Bradley et al., 2016; Kulakowski, 2016). Even moderate to severe natural disturbances promote structural heterogeneity, create biological legacies and unique habitats, and can increase biodiversity (Carbone et al., 2019; Klaus et al., 2010; Santoro & D'Amato, 2019; Shive et al., 2013; Swanson et al., 2011). And while mechanical thinning may mimic some of the habitat benefits of low to moderate severity fires, it does not emulate the important habitat characteristics of high severity fires (Stephens et al., 2012).

...

A common rationale for forest adaptation management is preventing future tree mortality, species compositional shifts, and carbon loss from natural disturbances. In some cases, thinning has been shown to reduce subsequent tree death from insects and drought compared to untreated areas, thereby promoting stand resistance and maintaining an existing species composition, while procuring sound timber (Hood et al., 2016; Knapp et al., 2021). However, in other cases prescribed burn treatments increased subsequent tree mortality (Knapp et al., 2021; Stark et al., 2013; Youngblood et al., 2009), and thinning and burn treatments generally promote the spread of invasive plants relative to controls (Schwilk et al., 2009; Willms et al., 2017). Additionally, loss of tree basal area and carbon storage from thinning and prescribed burning is often equal to or considerably greater than tree mortality and carbon loss from the disturbances themselves (Campbell et al., 2012; Hood et al., 2016; Knapp et al., 2021; Powers et al., 2010; Yocom-Kent et al., 2015). As a result, treated stands are not objectively more resistant or resilient to tree mortality or carbon loss—and in many cases are less so—if losses from the management itself are taken into account. Not surprisingly, natural forests in strictly protected areas store greater amounts of carbon, on average, than managed and unprotected areas (Collins & Mitchard, 2017; Moomaw et al., 2019).

...

[M]ost forests still regenerate without interventions, even after severe natural disturbances (Donato et al., 2016; Pielou, 1991; Santoro & D'Amato, 2019; Shive et al., 2013). In fact, natural regeneration often exceeds active restoration efforts (Cook-Patton et al., 2020; Donato et al., 2006), provides greater genetic diversity than planted

seedlings (Swanson et al., 2011), and greater stand-level carbon storage in coarse woody debris (Donato et al., 2013).

...

Perceived regeneration failures from severe fire, intensive ungulate browsing, or seed source limitations may, in many cases, be patchy or delayed tree regeneration that has other benefits when seedling densities, growth rates, and particular tree species are not primary concerns. As one example, low density regeneration reduces the severity of reburns, facilitating forest recovery (Cansler et al., 2022; Harvey et al., 2016). Heterogeneity of natural regeneration also avoids structural uniformity that occurs with planting and can extend the duration of early successional patches and gaps, thereby accelerating the development of spatial and structural complexity (Donato et al., 2012; Reed et al., 2022; Swanson et al., 2011).

...

[A]ccepting change with natural stewardship and exposure to natural disturbances and processes generally increases structural complexity, carbon storage, and tree species and other diversity. These accruing benefits, in turn, make forests more resistant and resilient to many future natural challenges and provide mitigation against climate change. Given the limited resources for actively managing forests, the mixed evidence of management promoting young trees and reducing fire and other risks, and little evidence that we can actively resist or direct change in unknown future conditions better than nature can, protecting more forests with natural stewardship is a cost effective way to harness the inherent adaptation and mitigation powers in forests and ensure that they are at their most functional to regulate planetary processes.

Faison, E. K., Masino, S. A., & Moomaw, W. R. (2023). The importance of natural forest stewardship in adaptation planning in the United States. *Conservation Science and Practice*, e12935. <https://doi.org/10.1111/csp2.12935>.
<https://conbio.onlinelibrary.wiley.com/doi/pdf/10.1111/csp2.12935>.

The agencies are starting to turn the page and see wildfires as doing good work on ecosystems and fuels. Themes discussed at a workshop include:

Recognizing the role of high-severity wildfire in restoring landscape mosaics that include non-forest patches: To change the landscape ecology of fire at very large spatial and temporal scales will require considering emergent properties of non-forest (e.g., wetlands, prairies, savanna) in driving climate adaptation, and deliberate focus on cultivating vegetation structure and composition that both reflects historical landscape patterns and supports desirable future fire effects. Widespread replanting and relegating non-forest to unsuitable sites may not provide adequate heterogeneity or reflect prior conditions.

...

Institutional and policy factors: Green restoration and post-fire actions are typically planned separately and with different policy and management requirements, making it challenging to integrate them through longer-term, holistic, adaptive management approaches. Replanting requirements for sites “suitable” for timber cultivation can drive reforestation versus potentially more climate-adaptive, landscape-scale approaches such as leaving and enhancing non-forest for heterogeneity.

...

Big box fire management: The 2021 Bulldog Mountain Fire was managed with a fire suppression objective but the big box approach allowed for the accomplishment of about 6,000 acres of previously planned prescribed fire and thinning work. Many conditions need to align for this approach to be possible, yet it is the primary way to achieve the amount of burning that is needed.

...

We need to better define and articulate the positive work of high-severity fire, especially related to restoring non-forest patches.

Northwest Fire Science Consortium 2024. Workshop Summary: Leveraging the Work of Wildfire Before, During, and After Fires.

https://www.nwfirescience.org/sites/default/files/2024-08/WOW_Summary_Final.pdf.

After the extreme 2020 wildfires in Oregon's western Cascades, Bev Law testified before Congress saying:

The takeaway from the 2020 fires in Oregon is that we will always have available fuel in the forests that can burn. Grasslands and shrublands can burn too. We are not going to be able to cut our way to less fire, nor are we going to be able to suppress all fire. We need to be prepared for the large fire events by hardening our homes and protecting our communities. We may need to improve forest management, and that discussion needs to include how we manage industrial forestlands so they do not pose increased risks to communities.

...

Increasing the use of prescribed fires and managing wildland fires may promote resilience to more frequent fire (Schoennagel et al. 2017)." However, the scope and scale of this work is very expensive, and thinning vast landscapes has not been shown to have a high-probability of success in encountering fire or altering fire behavior. In Oregon, we have millions of acres of dry forests, and just addressing a portion of this landscape will costs billions of dollars. Because of the short period of treatment effectiveness (10-20 yr), the treatments will need to be repeated into the future. It is important for policymakers to know that there are ecological and carbon costs from landscape scale thinning, and that it is not an effective tool to ensure community safety. Rather, as Dr. Jack Cohen has demonstrating, working from the home outward is the best approach to ensuring fire safe communities.

...

It is highly unlikely that attempt to manage the flammability of vast landscapes by cutting will be effective or achievable over time. See responses to (#5a, 16c). State and federal agencies need to support individuals and communities to be fire wise, create and maintain defensible space and protect critical infrastructure. Home hardening works. Emergency planning and early warning systems are the most effective ways to save lives and livelihoods in extreme fire weather.

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://web.archive.org/web/20210501190104/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 agencies are moving across the landscape often using commercial logging as a tool to aggressively manage fuels and reducing stand density which causes significant cumulative impacts on soil, water, wildlife habitat, carbon storage, and other values. These public resources are now exposed to the unprecedented compound effects of both logging and fire. The agency thinks it has found great alignment between its desire for timber production, risk reduction, and other restoration goals, but this view is just too convenient. It requires constant validation and

reassessment. The view that everything aligns may be hiding significant trade-offs and causing the agency to overlook other viable options, such as decreasing reliance on logging and increasing reliance on fire as tools to achieve more optimal forest management outcomes. The accumulation of evidence does not support logging for fuel reduction as a sound strategy to manage fuel and fire.

- *Most fires are climate-driven, rather than fuel-driven*, and the warming climate is likely to make this effect even more pronounced, so the benefits of fuel reduction are insignificant. Schoennagel et al 2017. Adapt to more wildfire in western North American forests as climate changes. PNAS 2017; published ahead of print April 17, 2017. www.pnas.org/cgi/doi/10.1073/pnas.1617464114; https://headwaterseconomics.org/wp-content/uploads/Adapt_To_More_Wildfire.pdf; Odion, D.C. et al 2014. Examining Historical and Current Mixed-Severity Fire Regimes in Ponderosa Pine and Mixed-Conifer Forests of Western North America. PLOS One. February 2014 | Volume 9 | Issue 2 http://www.californiachaparral.org/images/Odion_et_al_Historical_Current_Fire_Regimes_mixed_conifer_2014.pdf; See also, Alisa Keyser and Anthony Westerling, 2017. Climate drives inter-annual variability in probability of high severity fire occurrence in the western United States, Environmental Research Letters. Accepted Manuscript online 4 April 2017 <https://iopscience.iop.org/article/10.1088/1748-9326/aa6b10/pdf>.
- *Our forests are still suffering from a deficit of fire, including high severity fire. Any trend toward more severe fires in the west is very recent and driven by climate change, not fuels.* Many institutions (timber industry, counties, land management agencies, some academics) have been advocating for aggressive fuel reduction for years, based on a counterfactual assertion that recent fires are uncharacteristic and driven by excessive fuels. Neither of these is well-supported by evidence (except for some very recent fire seasons driven to extremes by global climate change).
 - Schwind, B. (compiler). 2008. MTBS: Monitoring Trends in Burn Severity: Report on the PNW & PSW Fires — 1984 to 2005. https://web.archive.org/web/20130214220819/http://www.mtbs.gov/reports/MTBS_PNW-PSW_final.pdf (“MTBS data does not support the assumption that wildfires [in the PNW] are burning more severely in recent years. ... The majority of area burned falls within the unburned to low severity range, with relatively low annual variation in these severity classes. The high and moderate severity classes show higher relative variation between years, suggesting that these classes may be most influenced by variation in climate, weather, and seasonal fuel conditions.”)
 - Vaillant & Reinhardt 2017. An Evaluation of the Forest Service Hazardous Fuels Treatment Program—Are We Treating Enough to Promote Resiliency or Reduce Hazard? J. For. 115(4):300–308. July 2017. <https://doi.org/10.5849/jof.16-067>; https://web.archive.org/web/20190702062754/http://www.fs.fed.us/pnw/pubs/journals/pnw_2017_vaillant001.pdf (Nationwide, only 11% of fires burn uncharacteristically.)
 - 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> (This study reported no significant trend in area burned, number of fires, or fire severity for the state of Oregon.)
 - Ray Davis et al 2015. RMP Revisions for Western Oregon BLM DEIS. Appendix D – Modeling Wildfires and Fire Severity. https://web.archive.org/web/20160519103327/http://www.blm.gov/or/plans/rmps/westernoregon/files/draft/RMP_EIS_Volume3_appd.pdf. (“... examined the MTBS data for any obvious temporal trends in wildfire severity [within the range of the spotted owl], but did not detect a strong signal (Figure D-6). Over the course of 25

- years, there appears to be a slight increase in the percentage of area burned by low and moderate severity wildfire, and a slight decrease in the percent of area burned in high severity wildfire, although these trends are not statistically significant. ...”)
- Alisa Keyser and Anthony Westerling, 2017. Climate drives inter-annual variability in probability of high severity fire occurrence in the western United States, *Environmental Research Letters*. Accepted Manuscript online 4 April 2017 <https://iopscience.iop.org/article/10.1088/1748-9326/aa6b10/pdf>. (“We tested trends for WUS [western United States], each state, and each month. We found no significant trend in WUS high severity fire occurrence over 1984-2014, except for Colorado (table S1). While some studies have shown increasing fire season length, we saw no significant increase in high severity fire occurrence by month, May through October (figure S1). We found no correlation between fraction of high severity fire and total fire size, meaning increasing large fires does not necessarily increase fractional high severity fire area.”)
 - Brendan P. Murphy, Larissa L. Yocom, Patrick Belmont. 2018. Beyond the 1984 perspective: narrow focus on modern wildfire trends underestimates future risks to water security. *Earth's Future*, 2018; DOI: 10.1029/2018EF001006 <https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2018EF001006> (“Compiling several datasets, we illustrate a comprehensive history of western wildfire, demonstrate that the majority of western settlement occurred during an artificially and anomalously low period of wildfire in the 20th century, ... A crucial first step toward realigning public perspectives will require scientists and journalists to present recent increases in wildfire area within the context and scale of longer term trends. ... A review of *Science*, *Nature*, and *PNAS* reveals that 77% of wildfire-related articles published about the western U.S. since 2000 (n=52) only address fire trends from the past few decades. In many of these studies, as well as in principal wildfire databases (Eidenshink et al., 2007; NIFC, 2017), ca. 1984 is frequently the first year presented, because this marks the beginning of consistent, satellite-derived records (Short, 2015). Wildfire area has rapidly increased since 1984, as ecosystems realize their potential to burn in an era of lengthening fire seasons and warming temperatures (Abatzoglou & Williams, 2016). However, this “1984 perspective” of wildfire is problematic. First and foremost, the 1980s represent the end of an anomalously low period for wildfire during the mid-20th century, and western U.S. landscapes remain well below historical wildfire activity (Barrett, et al., 1997; Leenhouts, 1998; Stephens et al., 2007; Littell et al., 2009; Swetnam et al., 2016). ... Historical reconstructions of annual area burned demonstrate that wildfire area in the pre-settlement western U.S. was many times greater than the supposed ‘record highs’ of today (Barrett, et al., 1997; Leenhouts, 1998; Stephens et al., 2007) (Fig. 1A&C). Borne out by hundreds of fire-history studies, research consistently shows that dry western forests frequently burned by wildfire over the past few centuries (Falk et al., 2010). Although wildfire activity naturally oscillates over millennial timescales (Marlon et al., 2012), area burned across the West began to rapidly decline in the late 19th century with the introduction of railroads and livestock (Swetnam et al., 2016). This was especially true in dry forest ecosystems, where livestock ate the fine fuel necessary to carry widespread surface fires. By the mid-20th century (ca. 1950s to mid-1980s), the area burning annually across all western ecosystems had plummeted from 7-18 Mha to less than 0.5 Mha due to fire suppression activities (Leenhouts, 1998; Littell et al., 2009) (Figure 1A). This West-wide decline in area burned is corroborated by subregional records (Figure 1C) and is consistent with the 20th century “fire deficit” observed in fire scar and charcoal influx records Marlon et al., 2012). ... The annual area burned, as well as burn severity, are

- projected to continue increasing across the western U.S. through the 21st century due to climate change and, in some ecosystems, excess fuel loading from fire suppression (Brown et al., 2004; Westerling et al., 2011; Hawbaker & Zhu, 2012; Abatzoglou & Williams, 2016; Abatzoglou et al., 2017).”)
- Baker, W. L. 2015. Are high-severity fires burning at much higher rates recently than historically in dry-forest landscapes of the Western USA? PLoS ONE 10(9): e0136147.
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0136147>;
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 - *There is a relatively low probability that fuel treatments will interact with wildfire before fuels regrow and render the fuel reduction effort ineffective.* Tania Schoennagel highlights the problem of removing fuels from a vast forest landscape that has a low annual probability of burning by saying that forest fuel reduction “is like trying to scoop water out of the ocean to make it less wet.” “A recent study conducted by researchers at the University of Montana found that only about 7 percent of fuel-reduction treatment areas in the entire United States were subsequently hit by wildfires since 1999. ... If someone had the magical ability to predict, within the past decade, that a major fire was going to strike that particular portion of the 240,000-acre Scapegoat Wilderness, then thinning and logging theoretically could have helped. But it doesn’t work that way, and fires are sparked in random places by lightning and humans, and they are pushed by erratic winds and weather. ... According to Tania Schoennagel, a forest landscape ecologist and fire researcher at the University of Colorado, ... ‘it’s little bit of a crapshoot probability game whether the treatment you put in is going to encounter wildfire in the 10 to 15 years it remains effective in reducing fire severity. Simply because forests in the West are so vast, the chance of burning in a place we’ve pre-treated is so low. It’s not a very effective lever. We don’t know where fires are going to happen.” David Erickson (2017). Experts: More logging and thinning to battle wildfires might just burn taxpayer dollars. CREDIT: MISSOULIAN.COM. Oct 1, 2017.
<https://web.archive.org/web/20171006080820/http://www.america.easybranches.com/montana/Experts--More-logging-and-thinning-to-battle-wildfires-might-just-burn-taxpayer-dollars-152776> citing Kevin Barnett, Sean A. Parks, Carol Miller, and Helen T. Naughton. 2016. Beyond Fuel Treatment Effectiveness: Characterizing Interactions between Fire and Treatments in the US. Forests [open access] 2016, 7, 237; doi:10.3390/f7100237.
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“According to a recent analysis, annually less than one percent of U.S. Forest Service fuel reduction treatments in forested areas subsequently burned, on average. From 2000 to 2015, almost 17 million acres of federal land were treated for fuels reduction, equating to approximately four percent of U.S. Forest Service and Bureau of Land Management lands. During the same time period, more than 93 million acres burned. The odds of putting fuel treatments in the wrong place are extremely high.” Pohl, Kelly 2019. “For communities, land use planning is more effective than logging on federal lands to reduce future wildfire disasters.”

<https://headwaterseconomics.org/wildfire/solutions/land-use-planning-is-more-effective/>.

Also, “In real landscapes treatments are static, restricted to a small portion of the landscape and against a background of stochastic fire and dynamic vegetation, thus the likelihood of fire encountering a treatment during the period treatments remain effective is small. ... Allocating priorities to treat based on merchantable timber (THIN), vegetation departure (VDEP), area suitable for prescribed fire and restoration wildfire (FIRE) and conditional flame length (CFL) had similar or lower success odds than random allocation ... [S]uccess odds declined sharply as desired success levels increased suggesting that fuel management goals need to be tempered to consider the stochastic nature of wildfire.” Barros, Ana M. G.; Ager, A. A.; Day, M. A.; Palaiologou, P. 2019. Improving long-term fuel treatment effectiveness in the National Forest System through quantitative prioritization. *Forest Ecology and Management*. 433: 514-527.

https://www.fs.usda.gov/rm/pubs_journals/2019/rmrs_2019_barros_a001.pdf.

- *The effects of fuel reduction are modest.* Even extensive fuel reduction reduces the extent of wildfire by less than 10 percent. See M. A. Cochrane, C. J. Moran, M. C. Wimberly, A. D. Baer, M. A. Finney, K. L. Beckendorf, J. Eidenshink, and Z. Zhu. 2012. Estimation of wildfire size and risk changes due to fuels treatments. *International Journal of Wildland Fire*. <http://dx.doi.org/10.1071/WF11079>. http://www.publish.csiro.au/?act=view_file&file_id=WF11079.pdf. Andrew Larson, a forest ecologist from the University of Montana said "Even after you go and thin a forest, when it's dry like it is now, it's still going to carry a fire, it's still going to generate smoke. So, in terms of day to day life, the experience we have during the fire season, we need to not get our hopes up," Larson says. "You can anticipate more smoke. Even if we were to double, triple, increase the amount of area logged or thinned by a factor of ten or 20, we're still going have smoke, we're not going to stop the fires. We may change how they burn, and that's an important outcome, it's something that a lot of my research is directed at. But we need to make sure people don't get their hopes up and expect something that the forestry profession, that managers in the Forest Service, the Department of Interior, can't deliver on." ERIC WHITNEY 2017. Forest Ecologist Comments On Senator Daines' Fire Call. Montana Public Radio. Sept 14, 2017. <http://mtpr.org/post/forest-ecologist-comments-senator-daines-fire-call>. Also, Hurteau et al (2019) found that “fuel availability and flammability only reduced the cumulative area burned in the Sierra by about 7.5 percent over the course of the century ... because vegetation re-growth happens with sufficient speed that the fuel limitation effects from fire are short-lived.” Matthew D. Hurteau, Shuang Liang, A. LeRoy Westerling & Christine Wiedinmyer 2019. Vegetation-fire feedback reduces projected area burned under climate change. *Scientific Reports*, volume 9, Article number: 2838 (2019), <https://www.nature.com/articles/s41598-019-39284-1>; <https://doi.org/10.1038/s41598-019-39284-1>; <https://news.ucmerced.edu/news/2019/scientists-simulate-forest-fire-dynamics-understand-area-burn-future-wildfires>
- *Commercial logging will often make fire hazard worse, not better.* Reducing the forest canopy will make the stand hotter, drier, and windier, produce more activity fuels, and stimulate the growth of ladder fuels. Professor Char Miller said “... decades of data show that

intense logging creates more destructive fires than the ones that burn through roadless areas, parkland and wilderness.” Char Miller. 2017. Op-Ed: What the Trump administration doesn't understand about wildfires. LA Times. Oct 1, 2017.

<http://www.latimes.com/opinion/op-ed/la-oe-miller-zinke-fire-memo-20171001-story.html>. See also, Jain, Theresa B.; Battaglia, Mike A.; Han, Han-Sup; Graham, Russell T.; Keyes, Christopher R.; Fried, Jeremy S.; Sandquist, Jonathan E. 2012. A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-292. 2012

https://www.fs.usda.gov/rm/pubs/rmrs_gtr292.pdf. 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)”) Removing commercial sized logs as part of fuel reduction degrades habitat while doing little to modify fire behavior. If conducted at large scales, the effects of commercial logging for fuel reduction will be socially and ecologically unacceptable. Lehmkuhl, John; Gaines, William; Peterson, Dave W.; Bailey, John; Youngblood, Andrew, tech. eds. 2015. Silviculture and monitoring guidelines for integrating restoration of dry mixed-conifer forest and spotted owl habitat management in the eastern Cascade Range. Gen. Tech. Rep. PNW-GTR-915.

Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 158 p. http://www.fs.usda.gov/pnw/pubs/pnw_gtr915.pdf. (“Tradeoffs between fire resistance and NSO habitat quality are real. Our results demonstrate that balancing the goals of increasing fire resilience while maintaining habitat function, especially nesting and roosting, for the NSO in the same individual stand is a difficult, if not an impossible, task. Even lighter thinning treatments typically reduce canopy cover below 40 percent. The reality is that nesting and roosting NSO habitat is by definition very susceptible to high-severity fire; owl habitat value and fire risk are in direct conflict on any given acre. ...”). Montana Public Radio reported on Senator Daines statement that “radical environmentalists’ would try to stop efforts to remove dead trees from Montana forests. [Ecologist Andrew Larson said] “That’s an attitude that I’m always kind of disappointed to encounter,” Larson said, “because a healthy forest has dead trees and dead wood. The snags — standing dead trees — and dead logs are some of the most important habitat features for biodiversity. You can’t have an intact, healthy wildlife community without dead wood in your forest.” ERIC

WHITNEY 2017. Forest Ecologist Comments On Senator Daines’ Fire Call. Montana Public Radio. Sept 14, 2017. <http://mtpr.org/post/forest-ecologist-comments-senator-daines-fire-call>;

- *Retaining mature forest canopy is more fire resilient than most logged sites.* Canopy removal via thinning not only makes the forest hotter, drier, and windier, it also stimulates the growth of shrubs and create the very conditions that favor more severe crown damage during fire. This 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)”). “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. Zald & Dunn (2018) looked at fire severity in a mixed ownership landscape and found that stand age was inversely related to fire severity suggesting that older forests are more resistant and resilient to fire and that time-since-fire has the opposite of the assumed effect on fire hazard. “**...we found daily fire weather was the most important predictor of fire severity, followed by stand age and ownership, followed by topographic features. Estimates of pre-fire forest biomass were not an important predictor of fire severity.** Adjusting for all other predictor variables in a general least squares model incorporating spatial autocorrelation, mean predicted RdNBR was higher on private industrial forests (RdNBR 521.85 ± 18.67 [mean $\pm$ SE]) vs. BLM forests (398.87 ± 18.23) with a much greater proportion of older forests. **Our findings suggest intensive plantation forestry characterized by young forests and spatially homogenized fuels, rather than pre-fire biomass, were significant drivers of wildfire severity.** This has implications for perceptions of wildfire risk, shared fire management responsibilities, and developing fire resilience for multiple objectives in multi-owner landscapes.” Harold S. J. Zald, Christopher J. Dunn. 2018. Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. Ecological Applications. *Online Version of Record before inclusion in an issue*. 26 April 2018. <https://doi.org/10.1002/eap.1710>. Also, <https://phys.org/news/2018-04-high-wildfire-severity-young-plantation.html>.



An example of thick brush that can grow after thinning.

- *Only a small fraction of needed density reduction can support an economically viable timber sale.* Focusing on fuel reduction economically viable stands (while neglecting dense stands of small trees) will fail to meet goals for both fire hazard reduction, carbon & climate, and ecological conservation. See Rainville, Robert; White, Rachel; Barbour, Jamie, tech. eds. 2008. Assessment of timber availability from forest restoration within the Blue Mountains of Oregon. Gen. Tech. Rep. PNW-GTR-752. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 65 p. http://www.fs.usda.gov/pnw/pubs/pnw_gtr752.pdf (“Hoping to boost their economies and

also restore these forests, local leaders are interested in the economic value of timber that might be available from thinning treatments on these lands. ... [W]e found that on lands where active forestry is allowable, thinning of most densely stocked stands would not be economically viable. ... In the 46 percent of the three Blue Mountains national forests that is forested, thinning with timber removal is an unlikely treatment method. This does not mean that other vegetative management options (prescribed fire, wildland fire use, or thinning without commercial timber removal) could not be used to reduce fire hazard, but it is doubtful that these areas would produce much commercial timber. ... Commercial thinning would only be possible where the value of the timber harvested exceeds the cost of the harvesting, hauling, road maintenance, and contractual requirements (i.e., a positive net revenue exists). Because most simulated thinnings harvested low volumes of small trees, commercial removal was possible on only 39,900 ($\pm$ 4,600) acres, or less than 10 percent of the densely stocked acres (table 4-8). ... even when considered under the most favorable of assumptions, most densely stocked stands would not be treatable without significant investments.”)

- *The agencies are failing to treat the areas of highest hazard and choosing instead to treat areas that produce profitable timber sales.* Fuel logging is a distraction from higher priority activities such as home hardening and treating fuels in the structure ignition zone. Vaillant & Reinhardt 2017. An Evaluation of the Forest Service Hazardous Fuels Treatment Program—Are We Treating Enough to Promote Resiliency or Reduce Hazard? J. For. 115(4):300 –308. July 2017. <https://doi.org/10.5849/jof.16-067>. https://web.archive.org/web/20190702062754/https://www.fs.fed.us/pnw/pubs/journals/pnw_2017_vaillant001.pdf (“[W]e evaluated the [nationwide] extent of fuel treatments and wildfire occurrence within lands managed by the National Forest System (NFS) between 2008 and 2012 ... The very high hazard class had the lowest treatment percentage and the highest incidence of uncharacteristically high-severity wildfire out of all the hazard classes. ... Areas of very low hazard often are favored for treatment because they are less complex to plan and implement, are more economical to treat, ... [T]reatments may be placed where they can accomplish multiple objectives, including production of wood products. This may result in selection of locations that are less important for hazard mitigation.”)
- *Building codes and land use planning are more effective than logging to reduce community wildfire hazard.* Pohl, Kelly 2019. “For communities, land use planning is more effective than logging on federal lands to reduce future wildfire disasters.” <https://headwaterseconomics.org/wildfire/solutions/land-use-planning-is-more-effective/>. (“[W]e have the knowledge and tools to reduce risk posed by homes in wildfire-prone areas. ... [T]here are many land use planning tools available that can mean the difference between home survival and loss.”). The fire threat to communities is caused by, and may be best addressed by, land use practices, not forest fuels. Forest fuels policy needs to recognize that structures themselves represent hazardous fuels that can carry fire from structure-to-structure, or from structure-to-forest. There are already too many homes in the wildland urban interface, and more are being built every day. Radeloff, Helmers, Kramer et al 2018. Rapid growth of the US wildland-urban interface raises wildfire risk. Proceedings of the National Academy of Sciences. Mar 2018, 2017. <https://www.pnas.org/cgi/doi/10.1073/pnas.1718850115>. (“Abstract: ... Here we report that the WUI in the United States grew rapidly from 1990 to 2010 in terms of both number of new houses (from 30.8 to 43.4 million; 41% growth) and land area (from 581,000 to 770,000 km²; 33% growth), making it the fastest-growing land use type in the conterminous United States. The vast majority of new WUI areas were the result of new housing (97%), not related to an increase in wildland vegetation. Within the perimeter of recent wildfires (1990–2015), there were 286,000 houses in 2010, compared with 177,000 in 1990. Furthermore, WUI growth often results in more wildfire ignitions, putting more lives and

houses at risk. Wildfire problems will not abate if recent housing growth trends continue.”). This also shows that people are quite willing to tolerate fire hazard in order to enjoy the quality of life associated with living near the forest.

- *Unlogged areas provide many benefits such as wildlife cover, snag & wood recruitment, carbon storage, soil/watershed quality, microclimate buffering, etc.* Forests are naturally adaptive and natural processes will accomplish many of the benefits attributed to thinning. “Counter to many regional studies, our results indicated that treated and long-unaltered, untreated areas may be moving in a similar direction. Treated and untreated areas experienced declines in tree density, increases in the size of the average individual, and losses of surface fuels in most size classes. The number of large trees increased in untreated areas, but decreased in treated areas. Our results suggested that untreated areas may be naturally recovering from the large disturbances associated with resource extraction and development in the late 1800s, and that natural recovery processes, including self thinning, are taking hold. ... In a study of forest restoration need across eastern Washington and Oregon, over 25% of required restoration could be achieved through transition to later stages of forest stand development through successional processes as western landscapes recover from widespread historic degradation (Haugo et al., 2015).” Zachmann, L. J., D. W. Shaw, and B. G. Dickson. 2018. Prescribed fire and natural recovery produce similar long-term patterns of change in forest structure in the Lake Tahoe basin, California. *Forest Ecology and Management* 409:276–287. http://www.csp-inc.org/wp-content/uploads/2017/11/Zachmann_et_al_2017.pdf
- *Wildfire effects are more ecologically beneficial than logging.* The 2017 Fuels Report for the 130,000 acre East Hills Project on this Fremont-Winema NF admits that wildfires are expected to have beneficial effects even under the no action alternative - “Overall expected value of fire effects is moderately beneficial. This assumes that fires burn throughout the range of conditions – actual current practice is to suppress fires that are most likely to be beneficial.” <https://usfs-public.app.box.com/v/PinyonPublic/file/933489880976>. This would indicate a need to modify fire suppression practices and work *with* fire when weather conditions are favorable.

Considering all of this, forest managers need to recognize that they cannot log their way out of the fuel predicament they are in. Forest managers will eventually come to realize that the vast majority of the ecological work will be accomplished by wild and prescribed fire.

Oregon Wild supports the objective to prepare the landscape for wildfire, and many logging projects are based on this as part of the purpose and need, but the agency still has a policy of aggressive fire suppression, so this rationale is suspect. Fear of fire is being used as an excuse for logging, without a sincere intent to reintroduce fire. Also, preparing the landscape for fire does not mean that extensive commercial logging is required. Preparing for fire can often be done best by doing non-commercial pre-treatment followed by prescribed fire at the appropriate time, when the weather and fuels are relatively cool and moist. Fire is preferable because it has a lighter ecological footprint on soil, water, and large wood habitat.

Schoennagel et al (2017) make a compelling case for a new approach to managing fire and fuel with a greater emphasis on using wild and prescribed fire instead of mechanical fuel reduction.

Key aspects of an adaptive resilience approach are (i) recognizing that fuels reduction cannot alter regional wildfire trends; (ii) targeting fuels reduction to increase adaptation by some ecosystems and residential communities to more frequent fire; (iii) actively managing more wild and prescribed fires with a range of severities; and (iv) incentivizing and planning residential development to withstand inevitable wildfire. ... Managing ecosystems, people, and wildfire in a changing climate is a complex but critical challenge

that requires effective and innovative policy strategies. Our key message is that wildfire policy and management require a new paradigm that hinges on the critical need to adapt to inevitably more fire in the West in the coming decades. ... Three primary factors have produced gradual but significant change across western North American landscapes in recent decades: the warming and drying climate, the build-up of fuels, and the expansion of the wildland–urban interface. ... Increasing the use of prescribed fires and managing rather than aggressively suppressing wildland fires can promote adaptive resilience as the climate continues to warm. ... Strategic planning for more managed and uncontrolled wild fires on the landscape today may help decrease the proportion of large and severe wildfires in the coming decades and may enhance adaptive resilience to changing climate. Prescribed fires, ignited under cooler and moister conditions than are typical of most wildfires, can reduce fuels and minimize the risk of uncontrolled forest wildfire near communities. In contrast to wildfires, prescribed fire risks are relatively low, and more than 99% of prescribed fires are held within planned perimeters successfully. ... We need to develop a new fire culture. Despite these and various legal and operational challenges, the benefits of prescribed fire and managed wildfires to ecosystems and communities are high. Promoting more wildfire away from people and prescribed fires near people and the WUI are important steps toward augmenting the adaptive resilience of ecosystems and society to increasing wildfire. ... [T]he effectiveness of this [fuel reduction] approach at broad scales is limited. Mechanical fuels treatments on US federal lands over the last 15 y (2001–2015) totaled almost 7 million ha (Forests and Rangelands, <https://www.forestsandrangelands.gov/>), but the annual area burned has continued to set records. Regionally, the area treated has little relationship to trends in the area burned, which is influenced primarily by patterns of drought and warming. Forested areas considerably exceed the area treated, so it is relatively rare that treatments encounter wildfire. ... [R]oughly 1% of US Forest Service forest treatments experience wildfire each year, on average. The effectiveness of forest treatments lasts about 10–20 y, suggesting that most treatments have little influence on wildfire. ... [T]he prospects for forest fuels treatments to promote adaptive resilience to wildfire at broad scales, by regionally reducing trends in area burned or burn severity, are fairly limited. ... Home loss to wildfire is a local event, dependent on structural fuels (e.g., building material) and nearby vegetative fuels. Therefore, fuels management for home and community protection will be most effective closest to homes, which usually are on private land in the WUI where ignition probabilities are likely to be high. ... The majority of home building on fire-prone lands occurs in large part because incentives are misaligned, where risks are taken by homeowners and communities but others bear much of the cost if things go wrong. Therefore, getting incentives right is essential, with negative financial consequences for land-management decisions that increase risk and positive financial rewards for decisions that reduce risk. ...

Schoennagel et al 2017. Adapt to more wildfire in western North American forests as climate changes. PNAS 2017; published ahead of print April 17, 2017. www.pnas.org/cgi/doi/10.1073/pnas.1617464114; https://headwaterseconomics.org/wp-content/uploads/Adapt_To_More_Wildfire.pdf. Others seem to agree that fire is the preferred tool for management of fire-dependent forests that are suffering from fire exclusion and climate stress. MP North, RA York, BM Collins, MD Hurteau, GM Jones, EE Knapp, L Kobziar, H McCann, MD Meyer, SL Stephens, RE Tompkins, CL Tubbesing. 2021. Pyrosilviculture Needed for Landscape Resilience of Dry Western United States Forests, Journal of Forestry; https://www.fs.usda.gov/psw/publications/north/psw_2021_north004.pdf (“A management paradigm shift in fire use is needed to restore western forest landscape resilience. We propose a “pyrosilviculture” approach with the goals of directly increasing prescribed fire and managed wildfire and modifying thinning treatments to optimize more managed fire.”) We would caution

adoption of this paper's recommendation of using "revenue thinning" to pay for prescribed fire treatments, as large-scale commercial logging will have unacceptable trade-offs such as wildlife habitat, snag habitat, water quality, and carbon storage.

Here's the straightforward logic of Zinke's scapegoating: Environmentalists block the Forest Service from lowering the fuel load on the land, land catches on fire, and now it's harder to put out. Thanks, tree-huggers.

But fire scientists say it's more complicated than that. Many question the ecological (and economic) value of thinning forests out, for three big reasons. One, the evidence for its efficacy is both scant and at times contradictory. Two, probabilistic risk assessments show that the thinning doesn't really help much because the likelihood of a fire starting close enough to interact with thinned areas is negligibly small. And three, in the worst weather conditions — dry, hot, and most importantly, windy — no amount of thinning or selective logging is going to make much difference.

Megan Molteni 2017. THE SCIENCE OF FIGHTING WILDFIRES GETS A SATELLITE BOOST. Wired. Sept 11, 2017. <https://www.wired.com/story/the-science-of-fighting-wildfires-gets-a-satellite-boost/>

Wildfire policy is costly and complex. In an effort to provide context and promote effective and comprehensive policy discussions, ten wildfire experts from across the West came together to help link relevant science to ongoing debates about why so much of the West has been burning, and what policies and solutions may help deter the rising costs and risks of wildfire.

The paper presents seven key insights from wildfire science that should inform future fire policy:

- 1) Fire size and frequency will increase under a warmer and drier climate
- 2) Fuel reduction on federal lands will do little to reduce acreage burned and homes lost
- 3) Not all forests need restoration
- 4) High-severity fires often have ecological benefits
- 5) Insect outbreaks do not necessarily make fires worse
- 6) Land-use planning can reduce wildfire risk
- 7) Managing more fires to burn safely can reduce risk and increase ecological benefit

...

Because fire is a mechanism of ecological renewal and diversity, allowing space and time for fire-adapted forests and shrublands to burn and recover from fire is important to maintain the landscapes we and other species depend on. Given the natural role of fire in the West, managing prescribed and naturally ignited fires to burn will help reduce future wildfire threats and increase ecological benefits in many systems. Better fire and forest management is part of the solution, but the most effective changes in terms of protection of people and property, will be near homes and on private property. Fire-smart land-use planning, building, and landscaping are essential to creating fire-adapted communities that can survive and thrive despite inevitable wildfire.

Tania Schoennagel, Penny Morgan, Jennifer Balch, Philip Dennison, Brian Harvey, Richard Hutto, Meg Krawchuk, Max Moritz, Ray Rasker, and Cathy Whitlock. 2016. Insights from wildfire science: A resource for fire policy discussions. January 2016. <http://headwaterseconomics.org/wphw/wp-content/uploads/wildfire-insights-paper.pdf>

Higuera said that since the 1980s, the area consumed each year by wildfires is 10 times larger than the area that the Forest Service can log, thin, burn or restore.

“It forces you to recognize that you’re not going to get out of this problem simply by doing more treatment to the landscape,” Higuera said. “It’s unlikely that we would be able to eliminate years like 2017. So we need to expect and plan for more years like 2017.”

Whitlock and Higuera agreed that because wildfires are going to happen with increasing regularity as summers get hotter and drier, the Forest Service should use them as a tool to restore forest health. As long as they don’t threaten lives, wildfires can burn out all the dead wood and excess vegetation, setting the stage for a more healthy ecosystem. Treatment projects tend to be small due to funding limits. So they should be focused on areas around people’s homes where they can make a difference, Higuera said.

...

Since 1990, 2 million new homes have been built in the wildland-urban interface – mostly in fire-prone low-elevation forests. Already 900,000 homes are in zones of high fire risk. By 2040, it is projected that 40 percent of the WUI will have an increased risk of burning, according to a 2015 University of Colorado study.

“I think that’s where the conversation needs to focus,” Whitlock said.

Education is needed to make people aware of the threats so they don’t build in risk-prone areas, but also so they understand the positive aspects of wildfire. Americans need to accept the inevitability of fire like they accept the inevitability of earthquakes or tornadoes, Higuera said.

“The forests are continually adapting to climate change and one way is by burning. I think what we’re seeing is the forests are equilibrating to climate change. The trouble is the climate is still changing. But these fires really should be thought of as a natural ecological process of adjusting to a new climate,” Whitlock said.

LAURA LUNDQUIST 2018. UM ecologists: Forest Service should use wildfires to thin, restore forests. Missoula Current, SEPTEMBER 5, 2018. <https://missoulacurrent.com/wildfires-climate-change-montana/>

Max A. Moritz, Enric Batllori, Ross A. Bradstock, A. Malcolm Gill, John Handmer, Paul F. Hessburg, Justin Leonard, Sarah McCaffrey, Dennis C. Odion, Tania Schoennagel & Alexandra D. Syphard. 2014. REVIEW: **Learning to coexist with wildfire**. NATURE | VOL 515 | 6 NOVEMBER 2014. doi:10.1038/nature13946

See also, Dominick A. DellaSala, Richard L. Hutto, Chad T. Hanson, Monica L. Bond, Timothy Ingalsbee, Dennis Odion, and William L. Baker. 2017. Accommodating Mixed-Severity Fire to Restore and Maintain Ecosystem Integrity With a Focus on the Sierra Nevada of California, USA. *Fire Ecology in press*. (“We discuss a fire management approach in the mid-elevations of the Sierra Nevada that may exemplify similar challenges in fire-adapted regions of the western USA. We also discuss how managing for pyrodiversity through mixed-severity fires can promote ecosystem integrity ... At the coarse-filter level, pyrodiverse mixed-severity fires provide landscape heterogeneity. Species and ecosystem characteristics associated with pyrodiversity can be maintained or enhanced by accommodating moderately severe fires, which hasten restoration by recreating a complex vegetation mosaic otherwise at risk from suppression ... Managers face substantial political and public pressure to suppress fires through the use of aggressive firefighting tactics, but such tactics do little to contain fires under extreme fire weather conditions (Lydersen et al. 2014, Moritz et al. 2014, Ingalsbee and Raja 2015, Carey et al. 2016). Instead, managers could be encouraged to use prescribed and naturally ignited fires that yield both cost savings and ecosystem benefits. ... The ecosystem benefits of accommodating mixed-severity fires for ecosystem benefits pertain to both ends of the fire continuum: large fires with high-severity effects that generate unique biological pulses (e.g., complex structures) and lower-severity systems that may have been homogenized through

management and suppression. This suggests an important opportunity for expanding fire management beyond traditional kinds of prescribed burning to include prescriptions that benefit a broader suite of species associated with pyrodiverse landscapes (Moritz et al. 2014, DellaSala and Hanson 2015, Moritz and Knowles 2016). ... We argue that expanding natural fire ignitions for ecosystem benefits in combination with strategic use of defensible space, directed suppression, and active fuels management in appropriate areas provide untapped potential to enhance ecosystem integrity while protecting people and infrastructure with the potential for lower financial costs. Our approach is based on an ecological understanding of the importance of mixed-severity fires (DellaSala and Hanson 2015), and the need to reconsider “catastrophe” biases regarding natural disturbance processes (Lindenmayer et al. 2017).”

A study of wildfires that burned in a wilderness area in northern Arizona showed that wildfires burned mostly low severity, killing mostly smaller trees (shifting size distribution toward larger tree sizes), and stimulated regeneration of hardwoods. And, these benefits were realized without negative effects such as soil compaction and weeds that are normally associated with fuel reduction via commercial logging. Roccaforte, J.P., Huffman, D.W., Rodman, K.C. *et al.* Resource objective wildfires shifted forest structure and fuels toward pre-fire-exclusion conditions in a remote Arizona wilderness. *fire ecol* **21**, 60 (2025).
<https://doi.org/10.1186/s42408-025-00415-x>.

Another benefit of increasing efforts to reintroduce fire in fire-dependent dry forests is that it may help stabilize carbon storage. Krofcheck, D. J., M. D. Hurteau, R. M. Scheller, and E. L. Loudermilk. 2017. Restoring surface fire stabilizes forest carbon under extreme fire weather in the Sierra Nevada. *Ecosphere* 8(1):e01663. 10.1002/ecs2.1663.
<http://onlinelibrary.wiley.com/doi/10.1002/ecs2.1663/pdf>.

There are many benefits that flow from restoration of fire regimes. Wildfire is positively associated with plant diversity and the ecoregional scale. “Fire regime is a primary factor explaining plant diversity around the globe, even after accounting for [site] productivity. Fires delay competitive exclusion, increase landscape heterogeneity and generate new niches; thus, they provide opportunities for a large variety of species.” Pausas JG, Ribeiro E. 2017. Fire and plant diversity at the global scale. *Global Ecol Biogeogr.* 2017;00:1–9. <https://doi.org/10.1111/geb.12596>. pdf. See also, Chad T. Hanson. 2018. Landscape heterogeneity following high-severity fire in California's forests. *Wildlife Society Bulletin*. 12 April 2018 <https://doi.org/10.1002/wsb.871> (“I investigated postfire patterns in high-severity fire patches within yellow pine (*Pinus ponderosa* and *Pinus jeffreyi*) and mixed-conifer forests in California, USA, using field plots evenly spaced along random transects into the interior of patches within fires that occurred from 1999 to 2013. I found natural conifer regeneration in ≥80% of plots, even >300 m into patches. Conifer regeneration was greater closer to low–moderate-severity areas. Areas with lower conifer regeneration, where CESF would have the greatest longevity—comprised only 4.6% of these fire areas. Pine species dominated regeneration deeper into the interior of large high-severity patches, and fir–cedar-dominated at patch edges. Shrubs did not impede conifer regeneration, but greater densities of conifer saplings reduced shrubs, and sapling growth increased with time-since-fire. My findings suggest heterogeneous land-cover patterns are resulting from natural succession in high-severity fire patches.”)

Norm Johnson ... is professor emeritus at the OSU College of Forestry. ... Johnson agrees there's a need to remove excess growth caused by decades of fire suppression in dry forests that historically were cleaned up by frequent, low-intensity fires. But, he says, that's going to mean setting more controlled burns.

“Restoring these natural processes would be putting fire back on the landscape to a much more significant degree than we’re now doing,” he says.

...

But as for fires in moist forests like the Cascades ...

“That’s just nature at work,” he says. “And the fires historically were severe. And the notion that we ought to go in there and reduce fuels to restore natural processes is wrongheaded.”

LIAM MORIARTY 2017. Are Environmentalists To Blame For All These Fires? Jefferson Public Radio. Sept 13, 2017. <http://ijpr.org/post/are-environmentalists-blame-all-these-fires#stream/o>

Thompson, Riley, Loeffler & Haas 2017. Evaluating spatiotemporal tradeoffs under alternative fuel management and suppression policies: measuring returns on investment. JFSP PROJECT ID: 13-1-03-12. FINAL REPORT. SEPTEMBER 2017.

https://www.firescience.gov/projects/13-1-03-12/project/13-1-03-12_final_report.pdf.

(“The scientists modeled alternative fuel treatment strategies as well as alternative fire suppression strategies, with a specific focus on the rates at which possible future fires would encounter previously treated or previously burned areas. Modeling results generally confirmed that fire-treatment encounters are rare (such that median suppression cost savings are zero), that treatment effects are most pronounced within their boundaries and decay rapidly with distance ...”)

Baker (2018) discusses forest management in light of committed warming and the transition of dry western forests as they re-equilibrate to the changing climate:

Historical evidence suggests natural disturbances could allow more forest persistence, than expected from models, over 40 yr of transition to the net-zero emissions needed to limit warming to <2.0°C (e.g., Paris Agreement). Forests must ultimately equilibrate with committed warming from accumulated emissions. Historical dry-forest landscapes were heterogeneous from large, infrequent disturbances (LIDs) that reduced tree density and basal area, followed by slow, variable tree regeneration and recovery for 1–3 centuries. These together effectively provided bet-hedging through stand- and landscape-level heterogeneity that enhanced resistance and resilience to a diversity of unpredictable subsequent disturbances. ... our limited ability to prevent LIDs, I suggest (1) refocusing restoration to increase bet-hedging resilience to droughts and beetle outbreaks by retaining small trees and diverse tree species, (2) expanding development of fire-safe landscapes to protect people and infrastructure from unavoidable increased fire, (3) enabling more managed fire to restore and enhance stand-and-landscape-scale bet-hedging, and (4) accepting that LIDs will revise resistance, resilience, and adaptation, which enhance forest persistence, particularly if post-disturbance survivors are not logged and trees are not planted. Natural disturbance and slow recovery, if bet-hedged to increase resistance and resilience, could enable substantial forest persistence.

Baker, W. L. 2018. Transitioning western U.S. dry forests to limited committed warming with bet-hedging and natural disturbances. *Ecosphere* 9(6):e02288. 10.1002/ecs2.2288.

<https://esajournals.onlinelibrary.wiley.com/doi/pdf/10.1002/ecs2.2288>.

Natural disturbances like fire produce better results than logging in terms of restoring resilience and adaptive capacity.

[F]ailing command-and-control approaches (CACA) are leading to calls for new approaches in dry forests.

Working with natural processes is the premise of nature-based approaches. We recognize widespread concern that disturbances in dry forest are outside historical

variability, so they are damaging. However, we found they are not; instead, they are effectively restoring and adapting dry forests to climate change.

The central constraint on using natural disturbances is an insufficiently protected nearby built environment, which can be remedied by redirecting CACAs to focus on protecting the built environment.

... we have shown that high-severity fire is recently operating at rates and patterns within the range of historical variability.

...

Why are nature-based disturbances more restorative and adaptive to climate change than CACAs are? Wildfires provide strong selective pressure for trees to survive the fire itself, so they restore historical forest resistance, and select for adaptation to hotter and drier post-fire environments as climate changes. ... In contrast, CACAs select tree winners and losers without any knowledge of their genetic adaptations to future disturbances or climate change. ... Ecological heterogeneity from natural disturbances is also essential for species to adapt to climate change. Nature-based disturbances best provide essential natural selection, genetic adaptation, and spatial heterogeneity needed for forest resistance, resilience, and adaptation to future climate change.

...

We also think it is sensible to work with droughts/beetles as they are more consistently low- to moderate in severity and do not threaten the built environment as wildfires can.

Recent rates suggest natural disturbances alone could accomplish restoration and adaptation within ~40 years. However, if prescribed burning and managed fire for resource benefit were enhanced to be more natural, full restoration and adaptation could feasibly be met in ~30 years, by mid-century, a significant achievement.

William L. Baker, Chad T. Hanson, and Dominick A. DellaSala 2023. A nature-based solution to restore and adapt western US dry forests to climate change. *Physorg* Jan 19, 2024.

<https://phys.org/news/2024-01-nature-based-solution-western-dry.html> citing William L. Baker et al, Harnessing natural disturbances: A nature-based solution for restoring and adapting dry forests in the Western USA to climate change, *Fire* (2023). DOI: 10.3390/fire6110428. <https://www.mdpi.com/2571-6255/6/11/428>

Many restoration goals can be met by simply letting forests grow, or by working with fire and then letting forests grow. Haugo et al (2017) looked at forest restoration needs across the dry forests of Oregon and Washington and found -

that approximately 41% (4,742,000 ha) of all coniferous forest in eastern Washington and eastern and southwestern Oregon was in need of a transition to a different s-class [successional/structural stages] in order to restore forest structure to a NRV reference condition. Across these regions Disturbance then Succession was the most common restoration need category (20% of all forests, 5,678,000 ha) followed by Disturbance Only (14%, 3,920,000 ha) and Succession Only (7%, 2,120,000 ha; [Table 3](#)). On the largest individual ownership, the US Forest Service, approximately 38% (2,412,000 ha) of coniferous forests was in need of transition to a different s-class. ... Overall restoration need was higher on Bureau of Land Management, State, and Private forests (52%, 45%, and 45% of forests per respective ownership) with Disturbance then Succession, the most common restoration need category on these ownerships ([Table 3](#)).

...

Within the vast majority of the watersheds we evaluated, disturbance alone cannot restore NRV forest structure. Deficits in late development forest structure were clearly evident; succession into later development s-classes was required in over half (66%) of the total restoration needs across the region.

...

We found that time to transition into later development structural classes through successional processes was required on approximately 3.2 million ha (over 25% of all coniferous forests). On an estimated 2.3 million ha we identified that disturbance followed by succession was required to restore NRV forest structure.

Haugo, R., Zanger, C., DeMeo, T., Ringo, C., Shlisky, A., Blankenship, K., Simpson, M., Mellen-McLean, K., Kertis, J., Stern, M., 2015. A new approach to evaluate forest structure restoration needs across Oregon and Washington, USA. *For. Ecol. Manage.* 335, 37–50.
<https://doi.org/10.1016/j.foreco.2014.09.014>.

It is often asserted that we must perpetuate the timber industry and their infrastructure in order to ensure their continued availability for restoration. The NEPA analysis needs to accurately reflect the serious mismatch between the actual restoration needs in our forests, and existing timber industry infrastructure. The most critically needed restoration activities in our forests can be best achieved with non-commercial thinning, prescribed fire, and road rationalization, weed removal, often implemented with tribal input. Commercial logging is an imperfect, clumsy tool that has significant trade-offs that undermine restoration goals, such as habitat degradation, carbon emissions, and perpetuation of an extensive road system. The NEPA analysis needs to reflect the fact that alternatives with more logging perpetuate this mismatch, while alternatives with less logging could facilitate a shift to infrastructure better aligned with legitimate restoration needs, such as low-impact equipment, capacity to implement prescribed fire, trained personnel for hand implementation, etc.

Basal Area Retention

Maintaining a relatively high basal area is also necessary to meet the Eastside Screens requirement to manage for LOS conditions, which includes abundant large trees and abundant snags.

The analysis of stand vigor and resilience should avoid reliance on “stand density index” which focuses exclusively on the basal area and density of trees and the presumed inter-tree competition for light and moisture. However, SDI vastly oversimplifies the relationship between trees, and fails to account for (i) the fact that trees are not always in direct competition because they share resources via root grafting, fungal networks, and “hydrologic lift” whereby large trees with deep roots bring water up from deep soil layers and make some of it available to other plants whose roots occupy shallow soil layers, and (ii) the microclimate benefits of maintaining dense forest conditions that moderate drought stress, described below.

With a more nuanced view of the relationship between trees, the agency can safely retain greater basal area, which will provide many important ecological benefits. This will help mitigate several adverse trade-offs caused by commercial logging, including greenhouse gas emissions, wildlife cover and connectivity, long-term snag recruitment, blowdown risk, and slash production and disposal.

Basal Area retention is an important ecological consideration that must be disclosed *quantitatively* in the NEPA analysis. The NEPA analysis should consider alternative levels of basal area retention that resolve trade-offs in different ways. The NEPA document should disclose how recommended basal area retention levels will provide assurance that enough trees

are being retained to meet ecological needs for live and dead trees now and in the future. Use stand modelling to show this.

Where there are lots of small trees we recommend variable density thinning to 60-80 sq ft/acre basal area, retaining the largest trees that will become the next generation of old growth. Since larger trees have a higher ratio of basal area to leaf area, sites with abundant large trees can sustain higher basal areas, and we recommend retaining 100-140+ sq ft/acre.

Basal area retention should be variable but not be too low in any one unit. Enough trees need to be retained to retain and recruit large and old trees (AND snags) now and in the future. Basal area targets should be adjusted higher to account for the following actors:

- Prescribed basal area retention should be weighted to accommodate relatively greater retention in stands with large trees and desirable clumps of trees that contribute to LOS structural conditions.
- All things being equal, large and old trees are more sustainable and resilient than small trees, so where large and old trees are abundant, the site can sustain higher basal area and the mature and old trees do not need to be thinned.
- Retention patches should be excluded from the basal area calculation. Basal area should not be averaged across the stand, but rather across the treated portion of the stand. We recommended 3-4 clumps per acre of 2-10 individual trees as well as the skips to emulate natural historic stand structures.
- Basal area can be higher in riparian areas, area with higher water table, north slopes, etc...

The agency should avoid reducing stand density lower than is appropriate to meet the full suite of ecological objectives, including wildlife cover, perpetuating mortality processes that create and sustain valuable habitat features, etc. The goals should include creating a wide diversity of niches for different species, including those that thrive in dense, complex, forests with abundant snags and dead wood, instead of thinning to low basal area that tends to create one ideal niche for healthy, vigorous conifer trees.

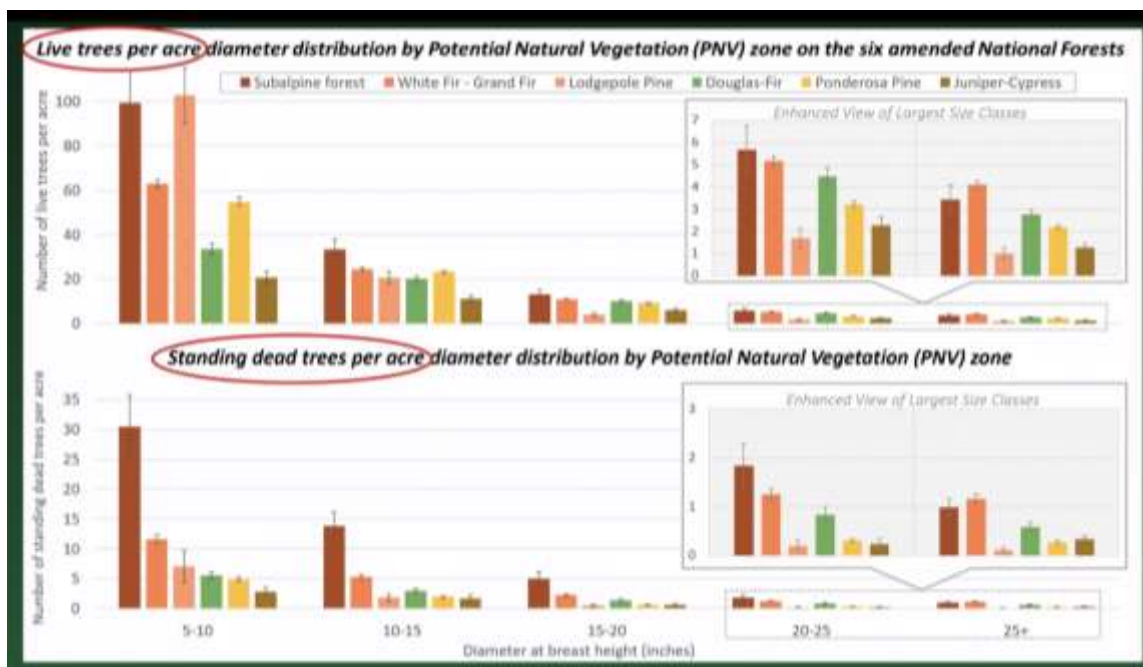
We are concerned that the agencies' stocking guides were created and intended to be used as a tool to avoid mortality which is clearly inconsistent with ecosystem management. ("To preclude serious tree mortality from mountain pine beetle, western dwarf mistletoe and perhaps western pine beetle, stand densities should be maintained below the upper limit of the management zone" Powell 1999, Suggested Stocking Levels for Forest Stands in NE Oregon. Umatilla National Forest F14-SO-TP-03-99, April 1999.

https://web.archive.org/web/20220121011438/https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev7_016034.pdf) Healthy forests require dead trees, sometimes in abundance, in order to meet the needs of diverse wildlife and provide full suite of ecosystem functions. 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>

A comprehensive restoration approach requires focusing not just on live trees, but also on the full suite of ecological processes including density dependent mortality processes that create and recruit snags and dead trees as a valuable feature of eastside forests. We urge the agency not to manage for tree vigor and minimum stocking levels because it will not provide enough green

trees for recruitment of snags through time. This is a critical issue given that the current standards for snag habitat are outdated and fail to provide adequate levels of snags and dead wood, and adequate levels of green trees needed to recruit those snags through time.

This graphic from the Microsoft Teams public meeting held Feb 1, 2023 to discuss the draft report of the “2nd Annual Adaptive Management Workgroup: Management Direction for Large Diameter Trees” clearly shows the close association between the abundance of large live trees and large snags. This makes perfect sense because all snags are a product of large live trees. The NEPA analysis must provide an honest and accurate disclosure of the adverse effects of thinning to low basal area through commercial removal of medium and large trees on the future recruitment of large snags.



<https://www.fs.usda.gov/project/?project=58050>

Cutting basal area down to 30-40 ft²/acre is too low. We urge the agency to retain at least 60-120 ft²/acre of basal area. 30-40 ft²/acre might be OK in small patches within units as part of a variable prescription, but the average over a unit must be much higher than that in order to ensure adequate cover for wildlife, and adequate dead wood recruitment through time.

Logging May Do More to Reduce Resilience Than Increase It

Logging to make the forest more resilient needs greater scrutiny in the NEPA analysis. Logging can just as easily reduce resilience as increase it.

Wildlife evolved in a landscape with lots of disturbance, and many species thrive on the results of natural disturbance. Most of the logging that is done in the name of resilience actually alters the landscape in a way that deprives wildlife of the benefits of natural disturbance, with many valuable trees removed from the forest so they can never serve to benefit that many species that need dead wood. Logging thus reduces resilience, rather than increasing it.

Proposed commercial logging is known to decrease resilience because:

- Logging slash greatly increases fire risk;
- Logging replaces large fire resistant larger trees with fire prone small trees;
- Logging causes “shock” to residual trees and increases the risk of blowdown of residual large trees;
- Logging increases the risk of disease such as root disease;
- Logging make fish and other aquatic organisms more vulnerable to increased sediment;
- Logging increases distribution of harmful invasive plants and reduces the prevalence of native plants;
- Logging reduces forest productivity through soil loss and damage (erosion, compaction, displacement), reduced soil carbon, and damage to the tightly coupled below ground ecosystem that captures/stores/transport water and nutrients;
- Logging causes long lasting reduction in snag densities needed by diverse wildlife that need abundant snags and dead wood, and cavity nesting birds that prey on forest “pest” insects;
- Logging interferes with evolutionary processes that ensure that the most fit trees survive and reproduce. Logging makes forests less resilient by removing trees that may be more genetically adapted to survive in a dynamic environment;
- Logging attracts OHV users that damage soils, spread weeds, and disturb wildlife;
- Logging and logging roads increases risk of human caused fire ignitions;
- Logging allows greater penetration of warm dry air into the forest which increases evaporative demand and increase drought stress, compared to a more dense canopy that maintains cooler, moister conditions with reduced drought stress.

Studies show that slower growing Ponderosa pine trees may be better adapted to survive drought. This might mean that logging prescriptions that favor removal of smaller trees might be making Ponderosa pine forests less resilient. 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.

Evidence Shows a Weak Relationship Between Low Stand Density and Forest Health or Resilience

The NEPA analysis needs to take a hard look at new evidence that thinning may make the stand less resilient instead of more resilient to drought. Thinning will increase penetration of warm dry air into the stand and expose trees to greater vapor pressure deficit. There is new evidence that drought stress and mortality risk experienced by Douglas-fir trees is less a function of soil water availability, but is rather strongly related to atmospheric water availability, specifically vapor pressure deficit. Tree density and thinning may have some minor effect on soil water, but will have no beneficial effect on atmospheric water availability, so thinning is much less likely to provide beneficial effects on tree stress than previously believed. In fact, thinning likely increases drought stress on trees by increasing penetration of warm dry air within thinned forest

stands. Lighter thinning would partially mitigate the effect compared to heavy thinning. The agency should consider and disclose these effects and consider a mitigating alternative with light non-commercial thinning of the understory.

Atmospheric water demand, not soil moisture availability, appears to be the primary cause of tree water stress in the late summer. Temperature-driven increases in vapor pressure deficit from climate change are likely to reduce forest productivity regardless of soil moisture availability.

...

“How in the world can the trees be water stressed if they haven’t used all the water available in the soil?” Wondzell recalls pondering. “We spent a lot of time at the whiteboard asking ourselves, ‘Is this data actually correct?’” recalls Bladon.

...

In 2018, Jarecke read up on other studies that researched why trees might experience drought stress. What she learned was that the drought stress could be coming from aboveground. “New studies were emphasizing the impact of increasing vapor pressure deficit on tree water stress,” she explains. “And there’s a misconception in forest management on how we’ve been thinking about water stress being all about the belowground drought stress.”

Jarecke describes vapor pressure deficit (VPD) as the “drying power of the atmosphere” or phrased another way, how much water vapor or humidity is needed to saturate the air at a given temperature. Hot air can hold more moisture than cold air, which means as temperatures increase without a corresponding increase in humidity, VPD increases. So, how does VPD affect trees? “You can think of a tree as a cluster of tiny straws,” explains Wondzell. “As the soil dries out, the tree finds it harder and harder to pull soil water into the bottom of these straws. Conversely, aboveground it is the dryness of the air that does the pulling. And as the air gets drier, it pulls harder and harder on the water at the top of the straws.”

...

Latewood carbon isotope composition was most strongly correlated to mean daytime VPD between May and September and total rainfall between May and August. The researchers noticed that increased VPD during June, when there was still plenty of soil moisture, decreased the latewood growth, which lent weight to the hypothesis that VPD limits growth even when soil moisture is plentiful.

... Karla’s research strongly suggests that at her study site, these trees are highly sensitive to vapor pressure deficit,” Wondzell says. “Of course, they’re also sensitive to rainfall, but it’s actually vapor pressure deficit that is by far and away the bigger driver.”

...

If vapor pressure deficit is a primary cause of water stress and a primary limitation to tree growth during the long, dry summers typical of western Oregon, thinning could prove ineffective, or even counterproductive, for increasing drought resilience. Thinning a stand could allow penetration of hot, dry air deeper into the canopy, potentially increasing tree water stress.

Watts, Andrea; Wondzell, Steve; Jarecke, Karla; Bladon, Kevin. 2024. Hot air or dry dirt: Investigating the greater drought risk to forests in the Pacific Northwest. *Science Findings* 268. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 6 p. <https://www.fs.usda.gov/pnw/science/scifi268.pdf>. See also, Karla M. Jarecke, Linnia R. Hawkins, Kevin D. Bladon, Steven M. Wondzell 2023. Carbon uptake by Douglas-fir is more sensitive to increased temperature and vapor pressure deficit than reduced rainfall in the western Cascade Mountains, Oregon, USA. *Agricultural and Forest Meteorology*, Volume 329, 15 February 2023, 109267. <https://www.sciencedirect.com/science/article/abs/pii/S0168192322004543>.

The airmass warming and drying effect caused by logging adds cumulatively to the already significant increase in AED (atmospheric evaporative demand) caused by global warming. Gebrechorkos, S. H., Sheffield, J., M., S., Funk, C., Miralles, D. G., Peng, J., Dyer, E., Talib, J., Beck, H. E., Singer, M. B., & Dadson, S. J. (2025). Warming accelerates global drought severity. *Nature*, 1-8. <https://doi.org/10.1038/s41586-025-09047-2>, pdf. (“... by developing an ensemble of high-resolution global drought datasets for 1901–2022, we find an increasing trend in drought severity worldwide. Our findings suggest that AED has increased drought severity by an average of 40% globally. Not only are typically dry regions becoming drier but also wet areas are experiencing drying trends.”)

There is evidence that tree mortality is controlled more by low humidity than soil water availability, so thinning to increase soil water availability won't do much good. Karla M. Jarecke, Linnia R. Hawkins, Kevin D. Bladon, Steven M. Wondzell 2023. Carbon uptake by Douglas-fir is more sensitive to increased temperature and vapor pressure deficit than reduced rainfall in the western Cascade Mountains, Oregon, USA. *Agricultural and Forest Meteorology*, Volume 329, 15 February 2023, 109267. <https://www.sciencedirect.com/science/article/abs/pii/S0168192322004543>.

High air temperatures caused by thinning can even cause plants to lose water through their cuticle, even when their stomata are closed. Garen, J. C., & Michaletz, S. T. (2025). Temperature governs the relative contributions of cuticle and stomata to leaf minimum conductance. *New Phytologist*, 245(5), 1911-1923. <https://doi.org/10.1111/nph.20346>; <https://nph.onlinelibrary.wiley.com/doi/epdf/10.1111/nph.20346>. (“We found that the pathway of water loss varied with temperature, such that the cuticular pathway increasingly dominated at higher temperatures. ... We further found that as temperature increased, the proportion of water escaping the leaf via the cuticle typically increased ... Such high-temperature increases in gcw may be due to phase transitions in the cuticular wax, or thermal expansion of the cuticular matrix resulting in the opening of additional pathways for diffusion in the cuticle surface, ...”). See also, Jain, P. et al. (2025). Loss of conductance between mesophyll symplasm and intercellular air spaces explains nonstomatal control of transpiration. *Proceedings of the National Academy of Sciences*, 122(47), e2504862122. <https://doi.org/10.1073/pnas.2504862122>.

Similarly, thinning often also transitions stands from being sun limited to water limited. It may be counter-intuitive, but even in a dry landscape, a stand that is "overstocked" may not be limited by moisture. The competition for sunlight slows growth before it's limited by water, but solar limits are not lethal. Silviculturists often suggest "opening up the stand" to reduce competition for resources including water. However, they might "release" the trees from the solar limitation to the point that they bump into the water limitation, which is in fact lethal, and also likely exacerbated by increased solar radiation and wind heating and drying soils faster.

Thinning is also not a great way to reduce mortality from wildfire. High quality habitat is often relatively dense, but science shows that such forests are also relatively fire resistant and resilient.

Pre-fire nesting/roosting habitat had lower probability of burning at moderate or high severity compared to other forest types under high burning conditions. Our results indicate that northern spotted owl habitat can buffer the negative effects of climate change by enhancing biodiversity and resistance to high-severity fires, which are predicted to increase in frequency and extent with climate change. Within this region, protecting large blocks of old forests could be an integral component of management

plans that successfully maintain variability of forests in this mixed-ownership and mixed-severity fire regime landscape and enhance conservation of many species. Lesmeister, D. B., S. G. Sovern, R. J. Davis, D. M. Bell, M. J. Gregory, and J. C. Vogeler. 2019. Mixed-severity wildfire and habitat of an old-forest obligate. *Ecosphere* 10(4):e02696. 10.1002/ecs2.2696. <https://esajournals.onlinelibrary.wiley.com/doi/pdf/10.1002/ecs2.2696>.

Lesmeister et al (2021)--

We examined the relationship between fire severity and suitable nesting forest in 472 large wildfires (> 200 ha) that occurred in the northern spotted owl range during 1987–2017. ... Averaged over all fires, the interior nesting forest burned at lower severity than edge or non-nesting forest. These relationships were consistent within the low severity, very frequent, and mixed severity, frequent fire regime areas. ... Over the 30-year study, we found a strong positive trend in the proportion of wildfires that burned at high severity in the non-nesting forests, but not in the suitable nesting forest types.

Conclusions: Under most wildfire conditions, the microclimate of interior patches of suitable nesting forests likely mitigated fire severity and thus functioned as fire refugia (i.e., burning at lower severity than the surrounding landscape). With changing climate, the future of interior forest as fire refugia is unknown, but trends suggest older forests can dampen the effect of increased wildfire activity and be an important component of landscapes with fire resiliency.

Lesmeister, D.B., Davis, R.J., Sovern, S.G. et al. Northern spotted owl nesting forests as fire refugia: a 30-year synthesis of large wildfires. *fire ecol* 17, 32 (2021).

<https://doi.org/10.1186/s42408-021-00118-z>;

<https://fireecology.springeropen.com/counter/pdf/10.1186/s42408-021-00118-z.pdf>.

The relationship between stand density and mortality may be intuitively appealing but is not well-supported by the evidence. Recent comments from the Center for Biological Diversity to the California Department of Forestry explained --

A study in the Douglas fir forests of northeastern Washington found that competition [i.e., higher density] did not affect tree responses to extreme drought. Importantly, trees with more competition from neighbors appeared to have higher drought resistance (i.e., a significantly higher proportion of sapwood area in latewood, which is a trait associated with drought resistance). The authors suggested that “a tree’s ability to cope with environmental variability is driven not just by the proximate effects of neighbours on resource availability, but also by phenotypic plasticity and long-term adaptations to competitive stress.”

A study that directly investigated the lack of fire on the physiological status of oldgrowth ponderosa pine trees in unlogged forests in Idaho found that, contrary to predictions, oldgrowth trees in stands that were unburned for at least 70 years showed no significant differences in multiple stress indicators compared to non-fire-suppressed stands, indicating that these trees may be “more resilient to increased stand density associated with the lack of fire than previously thought.”

Center for Biological Diversity et al., March 17, 2017 comments on the California Forest Carbon Plan (January 20, 2017 Draft).

http://www.biologicaldiversity.org/campaigns/debunking_the_biomass_myth/pdfs/Forest_Carbon_Plan_Comments.pdf citing Carnwath, G.C. and C.R. Nelson. 2016. The effect of

competition on response to drought and interannual climate variability of a dominant conifer tree of western North America. *Journal of Ecology* 104: 1421-1431, and Keeling, E.G. et al. 2011.

Lack of fire has limited physiological impact on old-growth ponderosa pine in dry montane

forests of north-central Idaho. *Ecological Applications* 21: 3227-3237.
<https://besjournals.onlinelibrary.wiley.com/doi/pdfdirect/10.1111/1365-2745.12604>.

The CBD comments cited above provided several useful excerpts from the literature--

Recent studies of epidemic forest mortality events have not found stand density to be a significant contributor to tree death and instead, have attributed forest declines to the effects of top-down drivers such as moisture stress and drought, and associated spread and proliferation of bark beetle populations (Ganey and Vojta, 2011; Lines et al., 2010; Sánchez-Martínez and Wagner, 2002; van Mantgem and Stephenson, 2007). During episodic forest mortality events, the role of site environment, spatial proximity and landscape configuration can become more important than stand characteristics for predicting mortality patterns (MacQuarrie and Cooke, 2011; Powers et al., 1999; Simard et al., 2012). Differences in the importance of tree vigor and spatial aggregation may help explain why hazard ratings based on stand characteristics have little predictive power when applied to landscapes (Logan et al., 1998; Nelson et al., 2007). A comprehensive understanding of the role of density dependence during both epidemic and non-epidemic ("background") mortality periods remains elusive (Stamp, 2003).

Van Gunst, K.J. et al. 2016. Do denser forests have greater risk of tree mortality: a remote sensing analysis of density-dependent forest mortality. *Forest Ecology and Management* 359: 19-32. <https://www.sciencedirect.com/science/article/abs/pii/S0378112715005277>.

Recent findings that stands with higher density do not necessarily exhibit greater physiological stress (Keeling, Sala & DeLuca 2011) or experience lower tree mortality in extreme drought events (e.g. Floyd et al. 2009; van Mantgem et al. 2009; Ganey & Vojita 2011) lend support to this idea but other studies have shown the opposite relationship between density and mortality (Negron et al. 2009; Kane & Kolb 2014) or that this relationship is inconsistent and context dependent (Meddens et al. 2015; Van Gunst et al. 2016).

Carnwath, G.C. and C.R. Nelson. 2016. The effect of competition on response to drought and interannual climate variability of a dominant conifer tree of western North America. *Journal of Ecology* 104: 1421-1431.
<https://besjournals.onlinelibrary.wiley.com/doi/pdfdirect/10.1111/1365-2745.12604>.

However, the available evidence suggests that density-dependent mortality is not as typical of old and large tree subpopulations in conifer forests (Acker et al., 1996; Das et al., 2011; Aakala et al., 2012; Silver et al., 2013; Larson et al., 2015) as it is in the smaller size classes (Das et al., 2011; Lutz et al., 2014).

Clyatt, K.A. et al. 2016. Historical spatial patterns and contemporary tree mortality in dry mixed-conifer forests. *Forest Ecology and Management* 361: 23-37.

Competitive interactions are complex. Shrub competition does not appear to have a negative effect on nearby conifers. Marissa J Goodwin, Matthew D Hurteau, The effect of shrub cover on conifer water-use patterns, growth, and response to precipitation variability in the southern Sierra Nevada, *Tree Physiology*, 2024; tpae004, <https://doi.org/10.1093/treephys/tpae004>. ("Overall, our results suggest that growing in the presence of shrubs does not alter the water uptake patterns of white fir and Jeffrey pine and instead may have a positive effect on the growth rates of these species during both wet and dry years").

New evidence indicates that forests continue to grow vigorously even when they have some signs indicating otherwise. Allan Baumann (2018) looked closely at the well-researched old growth

stand on the Umpqua National Forest and found that many trees with poor form and fungal infections were still growing well, so logging to increase tree vigor may not be needed.

Conventional young-growth thinking is that key crown structural form is important for adequate tree development; e.g. having crown ratios greater than 40% for Douglas-fir and not having a one-sided form. In testing these hypothesis against the Lynx old-growth some interesting results were found. These might influence future forest management for improving the resilience, health and sustainability of these valued genetic-legacy trees of the forest.

An in-depth look at one-sided crown trees found that while 24% did have poor growth rates, 76% had moderate or fast growth rates. Testing trees with less than 20% crown form found only 13% growing poorly, while 87% grew moderate-fast over the 40-year period. Testing trees with both poor crowns and one-sided structure, found that 23% had poor growth and 77% had moderate-fast growth rates.

Further analysis was done on trees with visible conk indicators. Fifty-one (51) trees with *Phellinus pini* were measured and while 26% had poor growth rates, 74% had moderate-fast growth rates. Six (6) trees with *Phaeolus Schweinitzii* were measured and 33% had poor growth rates and 66% were unexpectedly growing moderate-fast. Implications for this additional growth are not normally considered.

Baumann, A. 2018. Lynx #1 White paper.

Sohn et al (2016) conducted a meta-analysis which showed that thinning conifers does have an effect on trees' resistance and resilience to drought, but that effect is not large and diminishes over time:

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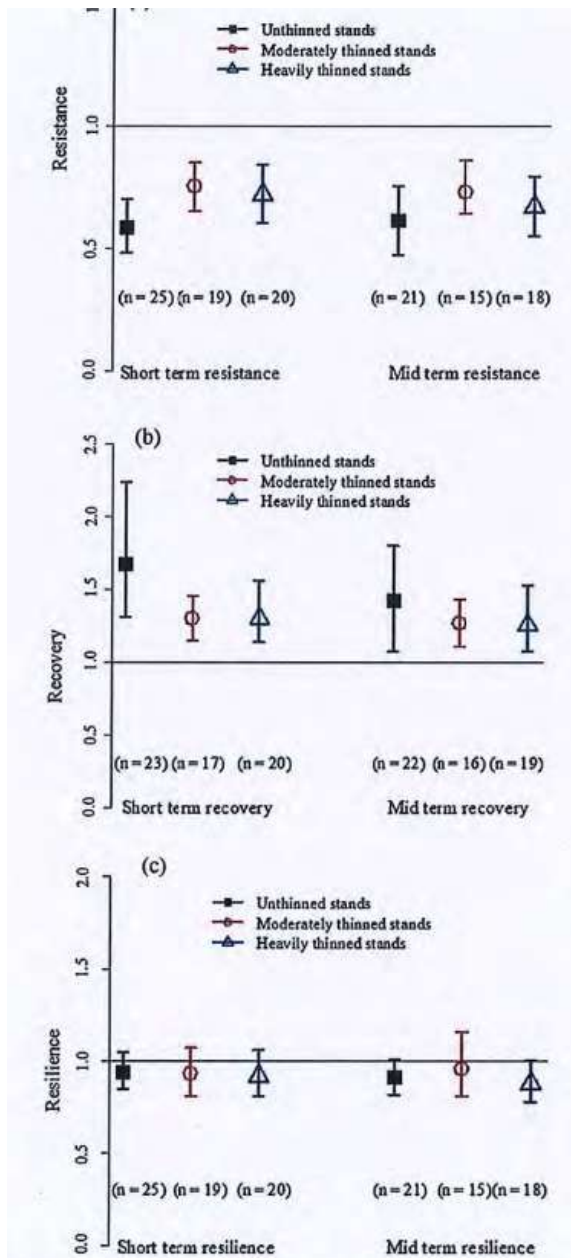


Fig. 3. (a–c) Global cumulative effect sizes as well as associated confidence intervals for the resistance (a), recovery (b), and resilience (c) in relation to drought among differently thinned stands. For each of the 3 *Lloret-indices*, we calculated (left) a short-term index using the value referring to 1 year before (for resistance and resilience) or after the drought (recovery and resilience) and (right) a medium-term index using the mean of the 3 years before or after the drought event (see Lloret et al., 2011; Kohler et al., 2010). Values of 1 mean for resistance that no growth reduction has taken place, at 0.5 a 50% reduction occurred. For recovery, a value of 1 means that growth after drought stayed at the level of the drought year. For resilience, a value of 1 indicates that growth after the drought returned to the pre-drought level. Sample size was $n = 15–25$.

Sohn, J. A., S. Saha, and J. Bauhus. 2016. Potential of forest thinning to mitigate drought stress: a meta-analysis. *Forest Ecology and Management* 380:261–273.
https://www.researchgate.net/profile/Somidh_Saha/publication/308097759_Potential_of_for_est_thinning_to_mitigate_drought_stress_A_meta-analysis/links/59cc0becaca272bbo50c64ea/Potential-of-forest-thinning-to-mitigate-drought-stress-A-meta-analysis.pdf?origin=publication_detail. This analysis also showed that heavy

thinning was less effective on more arid sites. Thinning in water-limited sites that exposes individual large trees to more sunlight may actually increase certain stress factors, causing “greater vulnerability to hydraulic stress and to higher radiation and evaporative demand of the more exposed crowns” when compared to smaller trees in crowded stands.

Forest scientists in Europe found that fungal relationships may have more to do with tree growth than previously understood, suggesting that other resource constraints, e.g., from competition, are less important:

Studying five species of the most common European forest trees, the researchers show that differences in fungal communities are linked to even greater variation in tree growth than local climate conditions and anthropogenic nitrogen inputs.

‘Differences in ectomycorrhizal fungal communities correspond to a three-fold increase in tree growth rates. These fungi also provide a clearer ecological explanation for differences in tree growth compared to other factors such as temperature and rainfall,’ says Mark Anthony, a postdoc at ETH Zurich and lead author of the new study in the journal ISME.

...

There was slower growth in forest trees where local ectomycorrhizal fungal communities are adapted to supply trees with nitrogen from organic sources. This type of nitrogen is found in dead, decaying biomass in the ground. To release it, the fungi must first generate special enzymes to depolymerize and break down the biomass. Doing this costs the fungi more energy than directly tapping inorganic nitrogen from the soil and in turn it also costs trees more. Since fungi that tap organic nitrogen draw their required energy from tree partners, the trees themselves are left with less energy to devote to their own growth.

...

‘In the future, fungal communities that utilize organic nitrogen could be advantageous for many species of tree,’ Anthony says. This is because rising temperatures and CO₂ concentrations promote plant growth. To grow faster, trees draw on easily obtainable inorganic nitrogen. In doing so, they deplete stores of this kind of nitrogen more quickly, which in turn could slow long-term growth. This is in contrast to the fungal communities that utilize organic nitrogen, which is more abundant in the soil albeit harder to access. The right fungi could ensure that their tree partner grow steadily into the future by capturing this organic nitrogen over the long term.

Peter Rüegg-Eth Zurich 2022. Fungi, Not Weather, May Explain Tree Growth Secrets. Futurity. January 11th, 2022. <https://www.futurity.org/trees-growth-fungi-symbiosis-2681232-2/> citing Anthony, M.A., Crowther, T.W., van der Linde, S. et al. Forest tree growth is linked to mycorrhizal fungal composition and function across Europe. ISME J (2022). <https://doi.org/10.1038/s41396-021-01159-7>.

Well-intentioned logging has impacts that make ecosystems less resilient to climate change. For instance, roads and soil degradation make watershed less resilient to the expected effects of the amplified hydrologic cycle; reduction of complex forest structure and dense forest conditions makes certain species populations less resilient to climate change, including species associated with relatively dense forests and species associated with snags and dead wood. These species are already stressed by the cumulative effects of non-federal land management and fragmentation caused by past and ongoing management on federal lands.

Also, “High overstory density can be resilient” when ladder fuel are absent and there is a gap between surface and canopy fuels. Terrie Jain (2009) Logic Paths for Approaching Restoration:

A Scientist's Perspective, *from* Workshop: Restoring Westside Dry Forests - Planning and Analysis for Restoring Westside Cascade Dry Forest Ecosystems: A focus on Systems Dominated by Douglas-fir, Ponderosa Pine, Incense Cedar, and so on. May 28, 2009. <https://www.fs.usda.gov/media/252748>.

A bet-hedging strategy should retain trees of all sizes and stands of various densities. "Removal of most small trees to reduce wildfire risk may compromise the bet-hedging resilience, provided by small trees and diverse tree sizes and species, against a broad array of unpredictable future disturbances." William L. Baker and Mark A. Williams. 2015. Bet-hedging dry-forest resilience to climate-change threats in the western USA based on historical forest structure. *Front. Ecol. Evol.*, 13 January 2015 | doi: 10.3389/fevo.2014.00088. <http://journal.frontiersin.org/Journal/10.3389/fevo.2014.00088/full>

Avoid road construction, including temporary roads

In an area set aside for fish conservation, there is no safe threshold for road construction.

The agency should focus on treating areas that are accessible from existing roads, in order to avoid all the many adverse effects of roads. As part of this project, the agency should also close roads (especially those with the greatest adverse impacts on watershed conditions and habitat quality) to bring the project area into compliance with plan standards for road density.

Problems with roads/culverts include:

- Soil disturbance, erosion, compaction, loss of forest productivity
- Pollution: sedimentation, thermal loading
- Hydrologic modification: flow interception, accelerated run-off, peak flows
- Impaired floodplain function
- Barrier to movement of wood and spawning gravel
- Habitat removal
- Reduced recruitment of snags and down wood habitat
- Fragmentation: wildlife dispersal barrier
- Human disturbance, weed vector, hunting pressure, loss of snags, litter, marbled murrelet nest predation, human fire ignition, etc.
- Reduced carbon storage in the road prism and in adjacent and nearby forests

Road building, often associated with logging, always has unavoidable adverse impacts on soil, water, weeds, and wildlife, and carbon stores. In order to support the assertion that logging is really restoration and not just timber production under a new name, these adverse impacts must be mitigated with clear conservation benefits. Road building has many adverse and long-lasting impacts on soil, water, weeds, wildlife and carbon. When roads building is a part of a restoration logging project, it becomes much more difficult for the benefits to clearly off-set the additional adverse impacts.

Science tells us that

... no truly "safe" threshold road density exists, but rather negative impacts begin to accrue and be expressed with incursion of the very first road segment; and 2) highly significant impacts (e.g., threat of extirpation of sensitive species) are already apparent at road densities on the order of 0.6 km/km² (1.0 mi/mi²) or less.

Carnefix, G. and C.A. Frissell. "Aquatic and Other Environmental Impacts of Roads: The Case for Road Density as Indicator of Human Disturbance and Road-Density Reduction as

Restoration Target; A Concise Review.” Pacific Rivers Council Science Publication (2009) 09-001. Pacific Rivers Council, Portland, OR and Polson, MT.
https://web.archive.org/web/20220121010955/http://www.fs.usda.gov/nfs/11558/www/nepa/107699_FSPLT3_4866267.pdf.

Nothing is worse for sensitive wildlife than a road. Over the last few decades, studies in a variety of terrestrial and aquatic ecosystems have demonstrated that many of the most pervasive threats to biological diversity - habitat destruction and fragmentation, edge effects, exotic species invasions, pollution, and overhunting - are aggravated by roads. Roads have been implicated as mortality sinks for animals ranging from snakes to wolves; as displacement factors affecting animal distribution and movement patterns; as population fragmenting factors; as sources of sediments that clog streams and destroy fisheries; as sources of deleterious edge effects; and as access corridors that encourage development, logging and poaching of rare plants and animals. Road-building in National Forests and other public lands threatens the existence of de facto wilderness and the species that depend on wilderness.

Noss, Reed; The Ecological Effects of Roads;
<https://web.archive.org/web/20101226195455/http://www.wildlandscpr.org/ecological-effects-roads>.

Especially in light of climate change and its interactions with the transportation system, the NEPA analysis should review and consider the information and recommendations made in the scientific literature.

The following literature review summarizes the most recent thinking related to the environmental impacts of forest roads and motorized routes and ways to address them. The literature review is divided into three sections that address the environmental effects of transportation infrastructure on forests, climate change and infrastructure, and creating sustainable forest transportation systems.

- I. Impacts of Transportation Infrastructure and Access to the Ecological Integrity of Terrestrial and Aquatic Ecosystems and Watersheds
- II. Climate Change and Transportation Infrastructure Including the Value of Roadless Areas for Climate Change Adaptation
- III. Sustainable Transportation Management in National Forests as Part of Ecological Restoration

...

As climate change impacts grow more profound, forest managers must consider the impacts on the transportation system as well as from the transportation system. In terms of the former, changes in precipitation and hydrologic patterns will strain infrastructure at times to the breaking point resulting in damage to streams, fish habitat, and water quality as well as threats to public safety. In terms of the latter, the fragmenting effect of roads on habitat will impede the movement of species which is a fundamental element of adaptation.

...

Transportation infrastructure and carbon sequestration

The topic of the relationship of road restoration and carbon has only recently been explored. There is the potential for large amounts of carbon (C) to be sequestered by reclaiming roads. When roads are decompacted during reclamation, vegetation and soils can develop more rapidly and sequester large amounts of carbon. A recent study estimated total soil C storage increased 6 fold to 6.5 x 10⁷g C/km (to 25 cm depth) in the northwestern US compared to untreated abandoned roads (Lloyd et al. 2013). Another recent study concluded that reclaiming 425 km of logging roads over the last 30 years in

Redwood National Park in Northern California resulted in net carbon savings of 49,000 Mg carbon to date (Madej et al. 2013, Table 5).

The Wilderness Society. 2014. Transportation Infrastructure and Access on National Forests and Grasslands - A Literature Review. May 2014.

https://www.fs.usda.gov/nfs/11558/www/nepa/96158_FSPLT3_3989888.pdf,

<https://www.sierraforestlegacy.org/Resources/Conservation/ProjectsPlans/ForestPlanRevisions/SFL%20et%20al.%20FPR%20comments%20part%205%20of%205.pdf>. Road networks are

also associated with reduced carbon storage in adjacent and nearby forests. Hu, X., Zhang, L., Ye, L., Lin, Y. & Qiu, R. Locating spatial variation in the association between road network and forest biomass carbon accumulation. *Ecol. Indic.* 73, 214–223 (2017).

<https://www.sciencedirect.com/science/article/abs/pii/S1470160X16305738>.

Science indicates that the erosion from roads is far worse than that from severe fire.

Colombaroli, D. and D.G. Gavin. 2010. Highly episodic fire and erosion regime over the past 2000 years in the Siskiyou Mountains, Oregon. *Proceedings of the National Academy of Sciences of the United States of America* 107: 18909-18914.

<http://www.pnas.org/content/early/2010/10/13/1007692107.full.pdf>. This should be part of the NEPA analysis weighing the relative risks from fire vs the effects of logging and roads.

The ICBEMP analysis found that roads have a disproportionate impacts on aquatic and terrestrial systems.

A good example of combined departures [from historic range of variability] is roads on BLM- and FS-administered lands. Road surface area in itself only accounts for 2 percent of the BLM- and FS-administered lands. However, because of the linear pattern across the contour and connected effects on aquatic and terrestrial systems the affected area is approximately 65 percent. ... Road density was found to be indirectly correlated with: (1) the distribution and spread of exotic plants, (2) many forest composition and structural changes, (3) efficacy of fire suppression activities, and (4) the probability of fire occurrence due to human caused ignitions. In forest systems, roads were associated with timber-management practices and thus correlated with the transition of shade-intolerant to shade-tolerant species, the loss of late-seral structures, reduced densities of large trees and snags, and increased fuel loadings. In rangeland systems, roads appear to function as vectors for dispersing exotic species. Regardless of the biophysical setting, roads appear to increase the efficacy of fire-suppression activities. ... Subbasins having the highest forest integrity values were largely unroaded ... Conversely, subbasins ... that had been intensively roaded, typically had the lowest forest integrity ...

...

Major decreases in pool habitat have been caused by two factors: the loss of riparian vegetation, and road and highway construction accompanying human activities (such as timber harvest, grazing, and farming). Most notably, pool frequency (large pools and all pools) is inversely correlated with road density and management intensity. ... The amount of fine sediment (sediment less than 6 mm) on channel beds is another important aspect of habitat quality that apparently is influenced by management. The results of our analysis indicate road density significantly affects surface fines and corroborates the link between forest management practices and channel sediment characteristics. ... [T]he proportion [of strong salmonid populations] declines with road density. ...

Roads and Associated Activity

Roads contribute to the disruption of hydrologic function and increase sediment delivery to streams. Roads also provide access, and the activities that accompany access

magnify their negative effects on aquatic habitats. Activities associated with roads include fishing, recreation, timber harvest, livestock grazing, and agriculture. Roads also provide avenues for stocking non-native fishes. Unfortunately, we do not have adequate broad-scale information on many of these attendant effects to accurately identify their component contributions. Thus we are forced to use roads as a catch-all indicator of human disturbance.

The discussion of the relationship of roads to fishes often centers around three themes: 1) the belief that road-building practices have improved enough in the last decade that we should not worry about their effects on aquatic systems; 2) the legacy of past road building is so vast and road maintenance budgets so low that the problems will be with us for a long time; and 3) the belief that there is not a strong correlation between road density and fish habitat and population.

From an intensive review of the literature, we conclude that increases in sedimentation are unavoidable even using the most cautious reading methods. Roads combined with wildfires accentuate the risk from sedimentation. The amount of sediment or hydrologic alteration from roads that streams can tolerate before there is a negative response is not well known. It is not fully known which causes greater risk to aquatic systems: building roads to reduce fire risk or realizing the potential risk of fire. More research is needed in this area.

The ability of the Forest Service and Bureau of Land Management to conduct road maintenance has been sharply reduced because of declining budgets. This is resulting in progressive degradation of road drainage structures and a potential increase in erosion. Most problems are with older roads that are located in sensitive terrain and roads that have been essentially abandoned, but are not adequately configured for long-term drainage. Given the magnitude of the area of federal forests with moderate to high road densities, the job of road maintenance will be expensive. Most road networks have not been inventoried to determine influence on riparian or aquatic resource goals and objectives.

We conducted two analyses examining the correlation of roads to habitat and fish population status. Each of these **analyses support the general conclusion that increasing road density correlates with declining aquatic habitat conditions and aquatic integrity**. Our results clearly show that increasing road densities (combined with the activities associated with roads) and their attendant effects are associated with declines in the status of four nonanadromous salmonid species. Those species are less likely to use moderate to highly roaded areas for spawning and rearing, and if found are less likely to be at strong population levels. There is a consistent and unmistakable pattern based on empirical analysis of thousands of combinations of known species status and subwatershed conditions. The analysis is limited primarily to forested lands managed by the Forest Service and Bureau of Land Management.

...

Designated wilderness and potentially unroaded areas are important anchors for [salmonid] strongholds throughout the Basin. More than 8 million hectares (27%) of Forest Service and BLM lands in the Basin contain strongholds (40% of Forest Service and 4% of BLM). These stronghold subwatersheds contain large areas of unroaded land (about 4.7 million hectares), averaging 58 percent of the area of an individual subwatershed.

Quigley, Thomas M.; Arbelbide, Sylvia J., tech. eds. 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins: volume 1. Gen. Tech. Rep. PNW-GTR-405. Portland, OR. <https://doi.org/10.2737/PNW-GTR-405>. https://www.fs.usda.gov/pnw/pubs/pnw_gtr405.pdf We would be kidding ourselves to

think that “modern road practices” avoid these problems, because the described effects seem to be mostly inherent and unavoidable outcomes of roads.

EPA describes the impacts of roads as follows:

Stormwater discharges from logging roads, especially improperly constructed or maintained roads, may introduce significant amounts of sediment and other pollutants into surface waters and, consequently, cause a variety of water quality impacts. ... [S]ilviculture sources contributed to impairment of 19,444 miles of rivers and streams [nationwide]. ... forest roads can degrade aquatic ecosystems by increasing levels of fine sediment input to streams and by altering natural streamflow patterns. Forest road runoff from improperly designed or maintained forest roads can detrimentally affect stream health and aquatic habitat by increasing sediment delivery and stream turbidity. This can adversely affect the survival of dozens of sensitive aquatic biota (salmon, trout, other native fishes, amphibians and macroinvertebrates) where these species are located. Increased fine sediment deposition in streams and altered streamflows and channel morphology can result in increased adult and juvenile salmonid mortality where present (e.g., in the Northwest and parts of the East), a decrease in aquatic amphibian and invertebrate abundance or diversity, and decreased habitat complexity.

The physical impacts of forest roads on streams, rivers, downstream water bodies and watershed integrity have been well documented but vary depending on site-specific factors. Improperly designed or maintained forest roads can affect watershed integrity through three primary mechanisms: they can intercept, concentrate, and divert water (Williams, 1999).

EPA 2012. Notice of Intent To Revise Stormwater Regulations ... Federal Register. May 23, 2012. <https://web.archive.org/web/20150911070239/http://www.gpo.gov/fdsys/pkg/FR-2012-05-23/pdf/2012-12524.pdf>.

NRDC issued a report that discusses the impacts of roads:

1. Harm Wildlife
2. Spread Tree Diseases and Bark Beetles
3. Promote Insect Infestations
4. Cause Invasion by Harmful Non-native Plant and Animal Species
5. Damage Soil Resources and Tree Growth
6. Adversely Impact Aquatic Ecosystems

NRDC 1999. “End of the Road: The Adverse Ecological Impacts of Roads and Logging: A Compilation of Independently Reviewed Research” (1999), <https://web.archive.org/web/20081024112126/http://www.nrdc.org/land/forests/roads/eotrx.asp>

Temporary roads still cause serious, long-term, adverse impacts to soil, water, wildlife, fire ignition risk, carbon, and spread weeds. Typically, temporary roads are not obliterated after use, rather they are “stored” for later use. The [Transportation Report for the Crater Lake National Monument](#) on the Deschutes NF admits “there is the expectation that closed roads are needed for future management activities, therefore, they are stored between uses.”

Even where road decommissioning is attempted, it is not entirely successful and the soil compaction effects can last for decades. The agency should consider avoiding building spurs by treating some areas non-commercially (e.g. thin lightly, create lots of snags, and leave the material on site).

We urge the agency to avoid road construction, including temporary road construction wherever possible. The ecological costs of road construction almost always outweigh any benefits of the associated commercial logging activity. Since an optimal landscape restoration plan includes a mix of treated and untreated areas, the agency can easily avoid road construction by co-locating untreated areas and inaccessible areas.

Temporary roads have many of the same impacts as permanent roads, including complete vegetation removal, severe soil disturbance and compaction, severe modification of the flow of water and air through the soil, impairment of soil biological activity, wildlife habitat fragmentation (especially for microfauna), and wildlife cover loss. In spite of the fact that some roads may only be used by heavy equipment on a temporary basis, the biophysical effects of temporary roads can be long-lasting. The FS may even come back and use these temporary roads for future vegetation management or fire management. The temporal effects of temporary roads can also be extended by legal or illegal use by off highway vehicles, woodcutters, hunters, mushroom collectors, etc.

The November 2000 National Forest Roadless Area Conservation FEIS p 3-30 says that temporary roads are not designed and constructed to the same standard as classified roads and therefore result in a “higher risk of environmental impacts.” The NEPA analysis must account for this increased risk of temporary roads compared to permanent roads.

The Roadless FEIS also says:

Temporary roads present most of the same risks posed by permanent roads, although some may be of shorter duration. Many of these roads are designed to lower standards than permanent roads, are typically not maintained to the same standards, and are associated with additional ground disturbance during their removal. Also, use of temporary roads in a watershed to support timber harvest or other activities often involves construction of multiple roads over time, providing a more continuous disturbance to the watershed than a single, well-designed, maintained, and use-regulated road. While temporary roads may be used temporarily, for periods ranging up to 10 years before decommissioning, their short- and long-term effects on aquatic species and habitats can be extensive. [The FEIS has similar disclosures citing extensive impacts to terrestrial species and habitats, and rare plant populations.]

Roadless Area Conservation FEIS — Specialist Report for Terrestrial and Aquatic Habitats and Species prepared by Seona Brown and Ron Archuleta, EIS Team Biologists
http://web.archive.org/web/20040515020554/http://roadless.fs.fed.us/documents/feis/specrpt/xbio_spec_rpt.pdf.

"Temporary roads are constructed with no engineering specifications since they are targeted to be used for a short time (ideally a single season), and then obliterated. This lack of construction design makes it particularly important to follow Project Design Criteria for avoiding potentially unstable slopes, even with potentially short time frame of use. That is because even temporary roads which are constructed with road cuts in steep, unstable terrain can trigger debris avalanches and slope failures by removing downslope support and interfering with surface and subsurface water flows that can weaken slopes."

USDA 2020. Stella Landscape Restoration Project Draft Environmental Impact Statement. Page III-30. Rogue River Siskiyou National Forest. <https://www.fs.usda.gov/project/?project=53241>.

For the semi-permanent roads that will be tilled, BLM's own soils scientist has little faith in the restorative value of this technique. He says: "What I have seen so far have been nothing more

than modified rock rippers and little lateral fracture of the soil occurs and the extent of de-compacting is very limited.” Coos Bay BLM, Big Creek Analysis file, section F, Soils Report. page 4.

Please consider George Wuerthner’s summary of the many problems with so-called temporary roads. George Wuerthner 2009. Temporary Roads Are Like Low Fat Ice Cream, NewWest. 3-17-09.

http://www.newwest.net/topic/article/temporary_roads_are_like_low_fat_ice_cream/C564/L564/ (“The problem is that temporary roads have most of the same environmental impacts as regular roads.”). See also, Wuerthner’s April 2020 blog post showing the persistent impacts of temporary roads. <http://www.thewildlifeneeds.com/2020/04/22/are-temporarily-roads-ecologically-invisible/>.

The agency typically assumes that temporary roads will have little or no effect because they are temporary. The agency has shown no scientific evidence to support this assumption. In fact, scientific research has shown exactly the opposite. Research results, published in *Restoration Ecology*, shows there is nothing temporary about temporary roads, and that ripping out a road is NOT equal to never building a road to begin with.

The saturated hydraulic conductivity of a ripped road following three rainfall events was significantly greater than that of the road surface before ripping... most saturated hydraulic conductivities after the third rainfall event on a ripped road were in the range of 22 to 35 mm/hr for the belt series and 7 to 25 mm/hr for the granitics. These conductivities are modest compared to the saturated hydraulic conductivity of a lightly disturbed forest soil of 60 to 80 mm/hr.” id. Even this poor showing of restoring pre-road hydrologic effects worsened with repeated rainfall. “Hydraulic conductivity values for the ripped treatment on the granitic soil decreased about 50% with added rainfall ($p(K1=K2)=0.0015$). This corresponded to field observations of soil settlement and large clods of soil created by the fracture of the road surface dissolving under the rainfall... The saturated hydraulic conductivity of the ripped belt series soils also dropped from its initial value. Initially, and for much of the first event, the ripped plots on the belt series soil showed no runoff. During these periods, run-off from higher areas flowed to low areas and into macropores.... Erosion of fine sediment and small gravel eventually clogged these macropores... Anecdotal observations of roads ripped in earlier years revealed that after one winter, the surfaces were nearly as solid and dense as the original road surfaces.” Id. Even though ripped roads increase water infiltration over un-ripped roads, it does not restore the forest to a pre-road condition. “These increases do not represent ‘hydrologic recovery’ for the treated areas, however, and a risk of erosion and concentration of water into unstable areas still exists.

Luce, C.H., 1997. Effectiveness of Road Ripping in Restoring Infiltration Capacity of Forest Roads, *Restoration Ecology*; 5(3):265-270. https://www.fs.usda.gov/t-d/programs/im/road_decommission/forms/luce_ripping_97_preprint.pdf.

The Rogue River-Siskiyou National Forest’s Rustler EA (2010) says:

Temporary roads are also expected to have an irretrievable reduction in soil productivity since they are bladed (soil is mixed and displaced) and compacted. Even once rehabilitated, the soil profile is modified to a degree that may take many years to return to the productive state of the undisturbed forest soils adjacent to it.

<https://www.fs.usda.gov/project/rogue-siskiyou/?project=26575>

To help weigh trade-offs, the agency should do an analysis that illuminates how many acres of of vegetation treatment are accessed by each road segment so that we can distinguish between short segments of spur that allow access to large areas (large accomplishment of goals, with small cost/trade-off) and long spurs that access small areas (small accomplishment, large cost/trade-off). This can help inform the decision-maker's balancing of the costs and benefits of logging and roading.

The 1994 NWFP ROD (p 68) says "Standards and guidelines for Alternative 9 require that new road construction be substantially limited. Any road construction associated with silvicultural treatments inside late-successional reserve would be subject to the overall 'beneficial' requirement for such activities. That is, if the value of a thinning was negated by the habitat lost through road construction to the thinning, the activity should not proceed."

The Coos Bay BLM's Brummit Creek Density Management EA (2005) includes a useful table showing the length of each road (new, renovated, improved), the unit acres that are accessed by each road, and the acres of unit per mile of road. This is a useful way to evaluate and prioritize road work relative the expected benefits of thinning.

Whitebark Pine

The NEPA analysis must consider the significant chance of incidental take of Threatened whitebark pine which is likely growing at low density in a significant portion of this project area due to the proximity of seed sources and the dispersal distances facilitated by birds that cache whitebark pine seeds. Diana F. Tomback 2012. Whitebark pine: Ecology, Threats, and Why We Care. Whitebark Pine Ecosystem Foundation, Science and Management Workshop 14 September 2012, Kimberley, B.C.
<https://whitebarkfound.org/wp-content/uploads/2013/09/Diana-Tomback-Ecology-Threats-Why-We-Care.pdf>; Keane, R. E., D. F. Tomback, C. A. Aubry, A. D. Bower, E. M. Campbell, C. L. Cripps, M. B. Jenkins, M. F. Mahalovich, M. Manning, S. T. McKinney, M. P. Murray, D. L. Perkins, D. P. Reinhart, C. Ryan, A. W. Schoettle, and C. M. Smith. 2012. A range-wide restoration strategy for whitebark pine forests. General Technical Report RMRS-GTR-279, USDA Forest Service Rocky Mountain Research Station, Fort Collins, Colorado.
<https://www.fs.usda.gov/rmrs/publications/range-wide-restoration-strategy-whitebark-pine-pinus-albicaulis>.

General recommendations for dry forest thinning/restoration

Please consider the following recommendations to improve the ecological benefits of restoring dry forests and to mitigate the adverse impacts.

1. Oregon Wild will do its best to maintain the torch that was carried for so long by the late Tim Lillebo who worked to protect and restore eastside forests for almost four decades. In Tim's office, we found the following concise summary of his recommendations for thinning dry forests containing old growth trees.

Old Growth stand thinning

My recommendation for thinning in OG stands is the same prescription we used for the Glaze Project where we thinned OG stands.

Basically,

- retain all OG trees of all species
- retain historic mix of species
- retain all snags and down logs, with safety exceptions

- retain 15-20% in wildlife leave patches from 1/4 - 5 acres
- In small trees thin in variable density 60-80 sq ft basal area, retaining the largest trees that will become the next generation of old growth. Larger trees carry higher basal areas of 100-140+.
- thin leaving clumps of 2-10 trees with 3-4 clumps per acre
- doughnut thin around old growth trees, but if available retain 1-2 good sized trees in the doughnut to become replacement old growth

A more detailed description of Tim's *restoration concepts, vision, priorities, recommended prescriptions* for eastside forests can be found in Oregon Wild's "Practical Guide for Ecological Restoration of Eastern Oregon's Dry Forests,"

[http://www.oregonwild.org/sites/default/files/pdf-](http://www.oregonwild.org/sites/default/files/pdf-files/Eastside_Restoration_Handbook.pdf)

[files/Eastside_Restoration_Handbook.pdf](http://www.oregonwild.org/sites/default/files/pdf-files/Eastside_Restoration_Handbook.pdf). In appropriate dry forest type please consider applying Tim's recommendations, including *lessons for successful restoration*, and *recommendations for minimizing unintended consequences*.

2. Additional dry forest restoration concepts can be found here: Franklin, J.F., Johnson, K.N., et al 2013. Restoration of Dry Forests in Eastern Oregon – A Field Guide. The Nature Conservancy, Portland, OR. 202 pp. <http://nature.ly/dryforests> (We have not had a chance to carefully review all of the recommendations in this field guide, but it does appear to have some good ideas. We are concerned about the proposed allowance to remove some old trees to make restoration economically viable. There are no clear criteria to ensure that the ecological benefits exceed the ecological costs.)
3. Use an integrated multi-objective planning process. "An integrated planning process focuses on multiple-objective planning rather than single-objective planning from the beginning of the project. It favors a transparent and interactive process that offers opportunities for understanding ecosystem complexity, stakeholder positions, and clear articulation of decision trade-offs and benefits." Jain, Theresa B.; Battaglia, Mike A.; Han, Han-Sup; Graham, Russell T.; Keyes, Christopher R.; Fried, Jeremy S.; Sandquist, Jonathan E. 2012. A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-292. 2012. https://www.fs.usda.gov/rm/pubs/rmrs_gtr292.pdf.

For example, the agencies too often assume that ecological restoration and fuel reduction are perfectly aligned. The analysis needs to recognize that fuel reduction and ecological restoration are often in conflict (e.g. thinning reduces habitat for wildlife that prefer dense, snag-rich forests). While it may be acceptable to sacrifice ecological goals INSIDE the structure ignition zone, there is no compelling rationale to sacrifice ecological restoration goals OUTSIDE the structure ignition zone. This conclusion becomes apparent when the analysis fully accounts for (i) the fact that only a small fraction of fuel treatments can be expected to interact with wildfire, (ii) the complex effects of logging as a tool for fuel management (e.g. removing canopy stimulates growth of surface ladder fuel and makes fire hazard worse) and (iii) logging for fuel reduction has many trade-offs (ecological, climate, and economic).

4. Be sure to treat moist forests different than dry forests. Many dry forests are mixed with moist/mixed forests. These stands do not typically need to be commercially logged. Moist stands naturally have dense, multi-layered canopies, and greater abundance of dead wood, and a more mixed fire regime, including patches of stand replacing fire. Natural processes will continue to operate in these stands and create desired conditions. Non-commercial thinning of some small trees may be appropriate if there is significant in-growth of small conifers that threaten legacy trees.

5. When conducting commercial thinning projects take the opportunity to implement other critical aspects of watershed restoration especially reducing the impacts of the road system and livestock grazing and establishing the ecological processes that foster recovery of hydrologic systems and fire regimes. See FEMAT 1993. Appendix V-J: Guidelines for Restoration Projects (unnumbered pages between V-96 and VI-1). Bradbury, Nehlsen et al 1995. Handbook for Prioritizing Salmon & Watershed Restoration.
<http://pacificrivers.org/science-research/resources-publications/handbook-for-prioritizing-watershed-protection-and-restoration-to-aid-recovery-of-native-salmon>.

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Most interviewees perceived that noncommercial treatments were not keeping pace with commercial treatments as accelerated restoration strategies have been implemented. Interviewees described how some treatments, especially non-commercial or very low-value treatments, were sometimes not completed as planned during project implementation. As one interviewee observed,

“[Accelerated restoration] has been pretty effective in getting a constant supply of timber and saw logs off the national forest, which is doing good work for restoration, but the other, maybe more extensive and detailed work of restoration that should be going on alongside that is not always happening.”

Some of the noncommercial elements of accelerated restoration cited as being left incomplete included:

- Noncommercial thinning and fuels reduction
- Applying prescribed fire
- Reinstalling large wood in streams
- Culvert replacement to improve fish passage
- Water quality improvements
- Improving recreation resources, such as trails and interpretive signage
- Rangeland grazing improvements, such as ensuring appropriate water sources
- Native species planting
- Invasive species removal
- Habitat restoration for Endangered Species Act-listed species
- Aspen stand restoration
- Decommissioning of roads

Many stakeholders acknowledged that the disparity between what is planned and what is implemented had become a source of conflict and/or frustration, especially for environmental constituents. Some interviewees said that incompletion of non-commercial treatments was causing tension between partners. One interviewee explained,

Anna Santo, Emily Jane Davis, Heidi Huber-Stearns, and Autumn Ellison 2018. Successes, Challenges, and Opportunities for Collaborative Accelerated Restoration in Oregon’s Blue Mountains. ECOSYSTEM WORKFORCE PROGRAM WORKING PAPER NUMBER 88, SUMMER 2018. <http://ewp.uoregon.edu/>

6. Don’t waste too much effort restoring forest *structure* when doing so will require continuous expenditure of money and effort to maintain. Use scarce resources efficiently by striving to restore ecological *processes* that can be self-sustaining. Recognize that insects and disease are natural ecological processes that actually help improve landscape diversity. Recognize that tree mortality recruits valuable habitat structures and makes resources available which increase the vigor of surviving trees, thus accomplishing many of the objectives of mechanical density reduction projects. Don’t focus too much on *tree health*, but think instead about *forest ecosystem health*. Use natural processes where it makes sense to do so. Fettig et al 2013 *review draft*. The Ecology and Management of Moist Mixed-Conifer Forests

in Eastern Oregon and Washington; a Synthesis of the Relevant Science and Implications for Future Management (“[R]estoration should aim to re-establish the self-organizing, self-maintaining, and adaptive capacities of ecosystems. This is done by restoring ecological patterns and processes. In doing so, we can address the goal of ‘healthier, more resistant, more resilient ecosystems, even if they are not exactly the same systems as before (USDA Forest Service).’ The application of ad hoc, narrowly focused ‘engineering’ solutions (e.g., managing forest structure and composition to recover a specific stable state) is expensive, logistically challenging, and often incapable of achieving restoration goals. Engineered solutions can still have limited roles for particular sites, but creating healthy and resilient landscapes requires a more dynamic and process-based perspective.”)

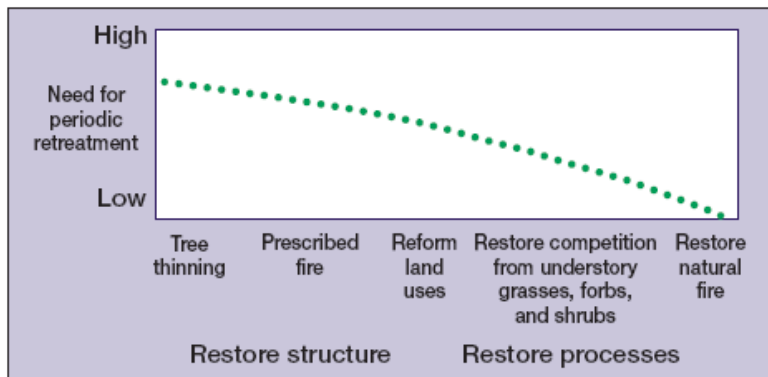


Figure 4. Forest restoration varies along a continuum from restoring structure (which requires periodic retreatment) to restoring potentially self-sustaining processes.

www.frontiersinecology.org

Reed F Noss, Jerry F Franklin, William L Baker, Tania Schoennagel, and Peter B Moyle. 2006. Managing fire-prone forests in the western United States. *Front Ecol Environ* 2006; 4(9): 481–487. <http://spot.colorado.edu/~schoenna/images/Nossetal2006Frontiers.pdf>. Crist, M.R., T.H. DeLuca, B. Wilmer, and G.H. Aplet. 2009 Restoration of Low-Elevation Dry Forests of the Northern Rocky Mountains: A Holistic Approach. Washington, D.C.: The Wilderness Society. http://fedgycc.org/documents/WldrnsSociety_Restoration-Low-Elev-Dry-Forests-Rocky-Mtns.pdf.

7. Use projects as an opportunity to conduct monitoring and research on the effects of thinning. There are many information gaps that need filling. Every project should generate useful information to inform future projects.
8. There are a lot of people calling for an increase in the “pace and scale” of restoration of eastside forests. The large size of recent projects raises concerns about cumulative effects. Also, if the agency moves too fast, then the “restoration” task may be complete, but the agency will still have a timber target. If the agency proceeds at a more measured and sustainable pace, they can continue to harmonize restoration and timber goals for longer. This should be considered in the NEPA analysis.
9. Treated stands do not exist in isolation, so be sure to consider the effects of thinning on adjacent areas which may provide habitat for species of concern. Prepare a “risk map” based on proximity to different habitat types from high quality to non-habitat. Agencies have a duty to consider habitat connectivity in their NEPA analyses. CEQ issued guidance saying “... agencies should consider and be transparent about the positive or negative impacts of proposed actions and alternatives on connectivity and corridors. Through the NEPA review process, Federal agencies can consider measures to advance corridors and connectivity as

components of proposed actions, alternatives to proposed actions, or mitigation for proposed actions' effects." Mallory, B. 2023. CEQ Guidance for Federal Departments and Agencies on Ecological Connectivity and Wildlife Corridors. March 21, 2023. <https://www.whitehouse.gov/wp-content/uploads/2023/03/230318-Corridors-connectivity-guidance-memo-final-draft-formatted.pdf>.

10. Only a small subset of needed restoration activities are “profitable,” so we can’t let logging economics determine restoration priorities. If we restore primarily those areas that have commercial-sized logs and fail to treat the thousands of acres of areas that need restoration but lack economic return, we will not be accomplishing real restoration which requires carefully and strategically choosing the subset of the landscape that can be treated to provide the greatest gain (both ecological and fire hazard reduction) for the least ecological “cost” in terms of soil, water, wildlife, carbon, and weeds. “Hoping to boost their economies and also restore these forests, local leaders are interested in the economic value of timber that might be available from thinning treatments on these lands. ... [W]e found that on lands where active forestry is allowable, thinning of most densely stocked stands would not be economically viable.” Rainville, Robert; White, Rachel; Barbour, Jamie, tech. eds. 2008. Assessment of timber availability from forest restoration within the Blue Mountains of Oregon. Gen. Tech. Rep. PNW-GTR-752. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 65 p. http://www.fs.usda.gov/pnw/pubs/pnw_gtr752.pdf. Allowing economics to drive these choices will result in greater ecological impacts and lower ecological gains. The NEPA analysis must honestly disclose what optimum restoration treatments would look like versus what is actually being proposed, so the public can see what’s being sacrificed.
11. Protect soil and water quality by avoiding ground-based logging and log hauling during the wet season.
12. Thinning should focus on areas accessible from existing roads. Building new roads will cause degradation that typically erases any alleged benefit of treatments. Inaccessible areas can be treated non-commercially or become part of the landscape mosaic that is untreated and serve important ecological values such as dense forest cover, carbon storage, and natural rates of snag recruitment.
13. Where road building is necessary, ensure that the realized restoration benefits far outweigh the adverse impacts of the road. Carefully consider the effects of roads on connectivity, especially at road/stream crossings, across ridge tops, and midslope hydrological processes (such as large wood delivery routes). The NEPA analysis should rank new road segments according to their relative costs (e.g. length, slope position, soil type, ease of rehabilitation, weed risk, native vegetation impacts, etc.) and benefits (e.g. acres of restoration facilitated), then use that ranking to consider dropping the roads with the lowest ratio of benefits to costs. Once the relative acres accessed per mile of road is determined, take the analysis one step further and determine the “effective road density” of each segment. In other words, extrapolate as if that much road were required to reach each acre of the planning area, then compare the resulting road density to RMP objectives for big game, fish conservation, cumulative hydrological impact, etc.? For example, if a new spur road accesses thinning opportunities at a rate of 200 acres of forest per mile of road, then divide 640 acres per section by 200 acres per mile to determine the effective road density of 3.2 mi/mi².
14. Use the historic range of variability as a guide, but don’t just focus on seral stage. The NEPA description of historic “forest stand structure” is often generalized as stand initiation, stem exclusion, understory reinitiation, etc. These are not very good generalizations because after natural disturbance stand conditions would include abundant legacies that are created by natural disturbance and often persist for long periods after disturbance. However, these

same terms are used to describe stand structures created by timber harvest that are NOT like natural stand structures, because logged stands lack the abundant legacy structures. The NEPA analysis should adjust the analytical methods to describe the historic abundance (and current shortage) of live and dead legacy structures. Restoring and maintaining legacies should be a major focus of restoration. Consider also the historic abundance of ecological attributes like large trees, large snags, the scale and distribution of patches of dense forest, low road density, roadless areas, etc., all of which have been severely reduced from historic norms. Also, consider the *natural* range of variability, which is the historic range of variability as modified by future climate change and fire suppression. James A. Harris, Richard J. Hobbs, Eric Higgs, and James Aronson. 2006. Ecological Restoration and Global Climate Change. *Restoration Ecology* Vol. 14, No. 2, pp. 170–176 JUNE 2006. http://www.globalrestorationnetwork.org/uploads/files/LiteratureAttachments/353_underlying-principles-of-restoration.pdf.

15. Develop restoration treatments appropriate to each forest type or plant association group (PAG). Dry Ponderosa pine forests that have significant ingrowth due to fire exclusion are good candidates for thinning. Mixed-conifer forest types often included some dense forest patches, so they should be retained at appropriate scales. Lodgepole pine and subalpine forests have stand replacing fire regimes and generally do not need to be thinned or regenerated.
16. Prioritize treating stands that are already degraded by past logging, and place less priority on treating previously unlogged forests. See Naficy, Cameron, Anna Sala, Eric G. Keeling, Jon Hagmann, and Thomas H. DeLuca. 2010. Interactive effects of historical logging and fire exclusion on ponderosa pine forest structure in the northern Rockies. *Ecological Applications* 20:1851-1864. http://rintintin.colorado.edu/~cana4848/papers/Naficy_et_al_2010_Ecol_App.pdf (“We document that fire-excluded ponderosa pine forests of the northern Rocky Mountains logged prior to 1960 have much higher average stand density, greater homogeneity of stand structure, more standing dead trees and increased abundance of fire-intolerant trees than paired fire-excluded, unlogged counterparts. Notably, the magnitude of the interactive effect of fire exclusion and historical logging substantially exceeds the effects of fire exclusion alone. These differences suggest that historically logged sites are more prone to severe wildfires and insect outbreaks than unlogged, fire-excluded forests and should be considered a high priority for fuels reduction treatments.”)
17. Recognize the value of untreated areas to provide benefits like dense forest cover, snags recruitment, soil/water quality, etc. Untreated areas might include: RHCA, unroaded areas, steep slopes, LOS forests, high quality wildlife habitat, and areas inaccessible from existing roads. Recognize that forests are naturally adaptive and natural processes will accomplish many of the benefits attributed to thinning. “Counter to many regional studies, our results indicated that treated and long-unaltered, untreated areas may be moving in a similar direction. Treated and untreated areas experienced declines in tree density, increases in the size of the average individual, and losses of surface fuels in most size classes. The number of large trees increased in untreated areas, but decreased in treated areas. Our results suggested that untreated areas may be naturally recovering from the large disturbances associated with resource extraction and development in the late 1800s, and that natural recovery processes, including self thinning, are taking hold. ... In a study of forest restoration need across eastern Washington and Oregon, over 25% of required restoration could be achieved through transition to later stages of forest stand development through successional processes as western landscapes recover from widespread historic degradation (Haugo et al., 2015).” Zachmann, L. J., D. W. Shaw, and B. G. Dickson. 2018. Prescribed fire and natural recovery produce similar long-term patterns of change in forest structure in the Lake Tahoe

basin, California. Forest Ecology and Management 409:276–287. http://www.csp-inc.org/wp-content/uploads/2017/11/Zachmann_et_al_2017.pdf.

18. Experts makes the following recommendation for wildlife friendly fuel reduction:

An evenly spaced stand, with much of the understory shrubs and small diameter trees removed, results in reduced cover and available forage. Habitat complexity elements in the mid to understory are critical for many forest wildlife species. For example, small clumps of trees provide a place for deer and elk to hide from predators, and provide shelter from inclement weather. Shrub clumps provide nesting and hiding cover for ground nesting birds and many small mammals that rely on that shrub layer. Deer and elk forage routinely on these same shrubs and hide their fawns in dense shrub thickets.

...

Remember, you don't need to eradicate all fuels on your property to reduce your risk of high intensity fire; you do need to break up the continuity of fuels ...

Summary of Recommendations:

Snags and Logs: Strive for 6 foraging snags/acre and 1 - 2 cavity nesting snags/acre. Strive for snags and logs greater than 15 ft. long/tall and greater than 12" in diameter.

Legacy: Keep any old growth trees, including defective trees. Strive for 2 - 3 per acre.

Openings: Openings can vary from 1/10 to 5 acres in size. They can comprise 5 - 15% of the landscape and aim for irregular shapes.

Patches: Patches can be 30 - 50 ft. across and preferably 100 - 300 ft. in length. Aim for 10 - 20% of the landscape.

Piles: Build habitat piles of 5 layers with larger material on bottom. Piles should be 20 ft. in diameter, 6 ft. high and 1 - 3 per acre.

Shrubs: Maintain the best species on the site, keep them in clumps, and beyond any adjacent tree's overhanging limbs (dripline).

Nicole Strong, Ken Bevis, Gretchen Bracher 2016. Wildlife-Friendly Fuels Reduction in Dry Forests of the Pacific Northwest. Woodland Fish & Wildlife Project of the Western Forestry and Conservation Association. https://woodlandfishandwildlife.com/wp-content/uploads/2019/12/Wildlife-Friendly-Fuels-Reduction-in-Dry-Forests-of-the-Pacific-Northwest_reduced.pdf.

19. Some people describe dry forest thinning as "cutting trees that would likely not be there." But don't forget the biomass in those trees we are removing would likely have accumulated on other trees in the stand, (e.g., the idealized park like stand of low density very large trees) so thinning might get back to the right number of stems per acre but not the right amount of biomass per acre. Removing trees deprives the stand of live and dead biomass over the long term.
20. Prioritize treating dry forest types at low elevation and on south slopes. Treatments in forests with naturally mixed-severity fire regimes should be carefully scrutinized to ensure those areas (i) are in fact outside of the HRV, and (ii) treatment will not remove scarce habitat for focal species that depend on dense forests, and (iii) treatments are in fact needed and (iv) proposed treatments will be effective. Treatments in mixed severity fire regimes should be more patchy and leave behind more structure, more snags and large dead wood.
21. Removing large numbers of small trees and forest understory across large areas may not be consistent with historic forest conditions. New evidence indicates that small trees were more common in dry forests than previously recognized. Historically, more than 60% of trees in the Blue Mountains and eastern Cascades were "small" (<40 cm or <16" dbh). William L. Baker and Mark A. Williams. 2015. Bet-hedging dry-forest resilience to climate-change threats in the western USA based on historical forest structure. Front. Ecol. Evol., 13

22. New evidence indicates that far more of the “dry” forests, rather than being typified low severity fire regimes, were in fact dominated by mixed severity fire regimes (including significant areas of stand replacing fire), so mixed severity fire is an important part of the historic range of variability that should be restored. The goal should not be a uniform low severity fire regime, but rather a wide mix of tree densities in patches of varying sizes. This objective can often be met by allowing natural fire regimes to operate, or by leaving significant areas untreated when planning fuel reduction projects. Hessburg, Paul. Evidence for the Extent of Mixed Severity Fires in Pre-Management Era Dry Forests of the Inland Northwest. Proceedings: Mixed Severity Fire Regimes: Ecology and Management. November 17–19, 2004. Spokane, Washington.
http://web.archive.org/web/20100713232718/http://www.sustainablenorthwest.org/bmfp/hessburg_salter_james_paper_11.pdf; Baker, W.L., T.T. Veblen and R.L. Sherriff (2006). Fire, fuels, and restoration of ponderosa pine-Douglas-fir forests in the Rocky Mountains, USA. *Journal of Biogeography*. 2006.
http://www.humboldt.edu/geography/documents/BakerEtAl_FireFuelsPipo_JBiog2007.pdf; Odion, D.C. et al 2014. Examining Historical and Current Mixed-Severity Fire Regimes in Ponderosa Pine and Mixed-Conifer Forests of Western North America. *PLOS One*. February 2014 | Volume 9 | Issue 2
http://www.californiachaparral.org/images/Odion_et_al_Historical_Current_Fire_Regimes_mixed_conifer_2014.pdf. (“We compiled landscape-scale evidence of historical fire severity patterns in the ponderosa pine and mixed-conifer forests from published literature sources and stand ages available from the Forest Inventory and Analysis program in the USA. The consensus from this evidence is that the traditional reference conditions of low-severity fire regimes are inaccurate for most forests of western North America. Instead, most forests appear to have been characterized by mixed-severity fire that included ecologically significant amounts of weather-driven, high-severity fire.”). William L. Baker 2017. Restoring and managing low-severity fire in dry-forest landscapes of the western USA.
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0172288> (“Frequent fire (PMFI/FR < 25 years) was found across only about 14% of historical dry-forest area, with 86% having multidecadal rates of low-severity fire. Historical fuels (e.g., understory shrubs and small trees) could fully recover between multidecadal fires, allowing some denser forests and some ecosystem processes and wildlife habitat to be less limited by fire. Lower historical rates mean less restoration treatment is needed before beginning managed fire for resource benefits, where feasible.”)
23. “The wildfire crisis generally and structure loss specifically are largely driven by extreme events, highlighted clearly in recent years ... The overwhelming majority of wildfires that result in structure loss are started by human-related ignitions, and they are occurring in regions with increasingly high structure density within flammable vegetation. Consequently, the number of structures destroyed by wildfire in the West in any single year was well explained by the total area burned from human-related ignitions; and, total structure loss in a state over the past two decades was well explained by the number of structures in flammable vegetation” Philip E Higuera, Maxwell C Cook, Jennifer K Balch, E Natasha Stavros, Adam L Mahood, Lise A St. Denis, Shifting social-ecological fire regimes explain increasing structure loss from Western wildfires, *PNAS Nexus*, 2023;
<https://doi.org/10.1093/pnasnexus/pgad005>. “We have learned that forest thinning is rarely effective under extreme burning conditions, and the severity of fire in adjacent forests has little to do with whether a home burns,” said Tania Schoennagel, who is affiliated with CU-Boulder's geography department. “Solely relying on public forest management to

prevent homes burning by wildfire is simply barking up the wrong tree. We need more integrated solutions that cross the public-private land boundary to help us coexist with inevitable wildfire." CU Boulder Press Release, New global wildfire analysis indicates humans need to coexist and adapt. November 5, 2014.

<http://www.colorado.edu/news/releases/2014/11/05/new-global-wildfire-analysis-indicates-humans-need-coexist-and-adapt>. And Coexist or perish, new wildfire analysis says (2014, November 5) retrieved 6 November 2014 <http://phys.org/news/2014-11-coexist-perish-wildfire-analysis.html>

Fuel treatments in the WUI should be coupled with efforts to make communities fire resilient, not just to facilitate fire suppression. We urge the agency to bifurcate the landscape along the area defining the "structure ignition zone" within 100 feet of homes and built structures. Inside the structure ignition zone, ecological restoration goals can be compromised so that vegetation treatments can focus on modifying fuels to protect infrastructure. Outside the structure ignition zone, treatments should focus on ecological restoration, while expecting some fuel reduction benefits as a byproduct. Do not define the wildland urban interface too broadly, because fire hazard can be reduced by treating the area immediately adjacent to structures and this "structure ignition zone" is usually on non-federal lands. Fire is an important ecological process that needs to be restored on public lands, so the WUI fire problem should be framed as a structure-ignition problem and the solution for that generally lies with the private property owners. Joe H. Scott, Matthew P. Thompson, Julie W. Gilbertson-Day 2016. Examining alternative fuel management strategies and the relative contribution of National Forest System land to wildfire risk to adjacent homes – A pilot assessment on the Sierra National Forest, California, USA. *Forest Ecology and Management* 362 (2016) 29–37.

http://www.fs.usda.gov/rm/pubs_journals/2016/rmrs_2016_scott_j001.pdf ("A treatment scenario that focused on treating defensible space near homes was by far the most efficient at reducing WUI exposure, including exposure transmitted from USFS lands. ... [T]he Defensible Space fuelscape was by far the most efficient at reducing home exposure. ... In terms of feasible treatment scenarios, treating USFS land near where people live (Five-percent Solution) was not nearly as effective as treating the same amount of area where people live with a focus on land closest to the national forest (Defensible Space). ... [T]he analysis suggests that mitigation of wildfire risk to homes through fuel treatment on some landscapes could be best accomplished by treating where the homes are, not on federal land further away. ") Cohen 2008. The Wildland-Urban Interface Fire Problem – A Consequence Of The Fire Exclusion Paradigm. *Forest History Today*. Fall 2008.

<http://www.foresthistory.org/Publications/FHT/FHTFall2008/Cohen.pdf>. Much more info here: <http://www.fusee.org/community-fire-preparedness>. See also, Gibbons P, van Bommel L, Gill AM, Cary GJ, Driscoll DA, et al. (2012) Land Management Practices Associated with House Loss in Wildfires. *PLoS ONE* 7(1): e29212.

doi:10.1371/journal.pone.0029212.

http://nature.berkeley.edu/moritzlab/docs/Gibbons_etal_2012_PLoS.pdf ("The typical response to destructive wildfires is to increase the total area of land that is fuel-reduced [10,13]. Our results instead indicate that a shift in emphasis from broad-scale fuel-reduction treatments to intensive fuel treatments close to houses will more effectively mitigate impacts from wildfires on houses. This result is consistent with observations that the density of airborne embers and amount of radiant heat (the principal causes of house loss during wildfires) are greatest closer to the fuel source. This suggests that the actions of private landholders, who manage fuel close to houses, are extremely important when reducing risks to houses posed by fuel."). Alexandra D. Syphard, Teresa J. Brennan, and Jon E. Keeley. 2014. The role of defensible space for residential structure protection during wildfires. *International Journal of Wildland Fire* - <http://dx.doi.org/10.1071/WF13158>, https://d2k78bk4kdhbpr.cloudfront.net/media/publications/files/Syphard_defensibleSpac

[e.pdf](#) (“Structures were more likely to survive a fire with defensible space immediately adjacent to them. The most effective treatment distance varied between 5 and 20 m (16–58 ft) from the structure, but distances larger than 30 m (100 ft) did not provide additional protection, even for structures located on steep slopes. The most effective actions were reducing woody cover up to 40% immediately adjacent to structures and ensuring that vegetation does not overhang or touch the structure.”) The need for density reduction treatment in the immediate vicinity of homes complements WUI homeowners preferences. See Factsheet: Forest Density Preferences of WUI Homebuyers.

https://docs.wixstatic.com/ugd/5fc209_6f3c53750fb84fbfb6d86a40625f3d1f.pdf; and https://docs.wixstatic.com/ugd/5fc209_57cff23959e24668a1863dda2aa3b2b2.pdf (“In the more immediate forest surrounding WUI houses (100-meter (109-yard) radius level), WUI homebuyers have a preference for lower forest density. In the larger surrounding vicinity of WUI houses (500-meter (547-yard) radius level), higher forest density was preferred.”)

24. Prioritize treatment of the dense young stands that are most "plastic" and amenable to restoration. Another priority is to carefully plan and narrowly target treatments to protect specific groves of fire-resistant, old-growth trees that are threatened by ingrowth of small fuels, but don't focus on rigid density reduction targets. Leave all medium and large trees that show old-growth characteristics.
25. Thin from below, retaining the largest trees, or use “free thinning” with a diameter cap so that some trees of all size classes are retained. Retain all large trees and most medium sized trees so they can recruit into the larger classes of trees and snags. In the face of uncertainty that is exacerbated by climate change, a bet-hedging strategy should retain trees of all sizes and stands of various densities. “Removal of most small trees to reduce wildfire risk may compromise the bet-hedging resilience, provided by small trees and diverse tree sizes and species, against a broad array of unpredictable future disturbances.” William L. Baker and Mark A. Williams. 2015. Bet-hedging dry-forest resilience to climate-change threats in the western USA based on historical forest structure. *Front. Ecol. Evol.*, 13 January 2015 | doi: 10.3389/fevo.2014.00088.
<http://journal.frontiersin.org/Journal/10.3389/fevo.2014.00088/full>
26. Identify and retain all trees with old-growth characteristics even if they are less than 21" dbh. Some refer to these small-old trees as "Tillebo trees" because the late Tim Lillebo was a big advocate for protection of old trees regardless of size. Old growth characteristics include thick bark, colored bark, flat top, asymmetric crown, broken top, forked top, relatively large branches, etc. These trees have important habitat value and human values regardless whether they are 21" dbh. Allow natural processes of succession and mortality to turn some of these medium and large trees into ecologically valuable snags and down wood. The agencies often use this technique to identify and retain old-growth juniper trees and the same can be used to protect old growth pine, larch, Douglas fir and other species. Van Pelt, R. 2008. Identifying Old Trees and Forests In Eastern Washington. Washington DNR. http://www.dnr.wa.gov/Publications/lm_hcp_east_old_growth_hires_part01.pdf. We are generally comfortable with the use of the Van Pelt guidelines to identify tree age, but as science improves, we urge the agency to use the best available information and err on the side of caution to ensure that trees older than 150 years (regardless of size) are not inadvertently cut. A recent study supports the retention of slow growing old trees because they are relatively more resilient. The study found that slower-growing older trees tend to channel their energy into structural support and defense compounds to “maximize durability while minimizing ... damage”. Black, 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. Box 8 of Franklin, J.F., Johnson, K.N., et al 2013. Restoration of Dry Forests in Eastern Oregon – A Field Guide. The Nature Conservancy, Portland, OR. 202 pp.

<http://nature.ly/dryforests>; and Tobias Züst, Bindu Joseph, Kentaro K. Shimizu, Daniel J. Kliebenstein and Lindsay A. Turnbull, Using knockout mutants to reveal the growth costs of defensive traits, in: Proceedings of the Royal Society B, 2011, Jan. 26,

doi:10.1098/rspb.2010.2475. 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.

27. Use diameter limits as a management tool because it provides a useful means to prevent economic values from trumping ecological values. The public supports the use of diameter limits because it provides a means to prevent economic values from trumping ecological values. It is often appropriate to use smaller diameter limits for fire tolerant species like Ponderosa pine and Douglas fir, while using somewhat larger limits for fire intolerant species like grand fir/white fir. The exceptional circumstances in which diameter limits allegedly don't work, are more rare than the circumstances in which refusing to use diameter limits will lead to unintended consequences, including removal of ecologically valuable trees and lack of public trust.²
28. While the agency embarks on an ambitious effort to reduce fuels and reduce forest density, the agency must also conserve habitat for diverse wildlife that depend on dense forest canopy cover, complex understories, and dead wood. Carbon storage and watershed values are also enhanced when forest cover is maintained. We urge the agency to carefully consider whether there is enough habitat provided for these species, including goshawk, marten, fisher, and pileated woodpecker. The current distribution of recognized and protected habitat areas may be inadequate, especially considering the need for redundancy to account for expected habitat loss from fire, logging, fuel reduction, and natural forest succession. The fact that big game cover requirements need to be amended to accommodate many projects like this raises concerns not just for big game, but for the wide variety of other species that depend on canopy cover, complex understory, and dead wood. Before conducting large-scale density reduction efforts or amending big game cover standards, the agency should carefully consider all the other wildlife that were intended to be sheltered by the "umbrella" of big game cover standards in the RMP. The cover and forage requirements of big game is another lens through which to think about optimizing the mix of treated and untreated stands, as well as the scale and extent of skips and heavily-thinned "gaps" within treated stands. The NEPA analysis should consider alternatives with different mixes of treated and untreated areas for this purpose. The agency should use a state-and-transition

² The Deschutes National Forest used a sensible approach on the Lava Cast Project using a 21" diameter cap for lodgepole, 18" diameter cap for white fir, a 16" diameter cap for Ponderosa pine where the average diameter is the stand is below 12", and 18" diameter cap for Ponderosa pine where the average diameter of the stand is larger than 12 inches. Lava Cast DN. Feb 2007.

model to project future dense forest habitat recruitment under a reasonable set of assumptions about disturbance and succession.

29. Recognize that thinning affects fire hazard in complex ways, including some tendencies to make fire hazard worse. The agency must address the fact that thinning creates slash; moves fine fuels from the canopy to the ground (increasing their availability for combustion); thinning increases ignition risk (by increasing human access and human activities, including spark-generating machinery); thinning makes the forest hotter-drier-windier; and makes site resources available to stimulate the growth of future surface and ladder fuels. Amy E.M. Waltz, Peter Z. Fulé, W. Wallace Covington, and Margaret M. Moore. 2003. Diversity in Ponderosa Pine Forest Structure Following Ecological Restoration Treatments. *Forest Science* 49(6) 2003.
https://web.archive.org/web/20170810220240/http://www.globalrestorationnetwork.org/uploads/files/LiteratureAttachments/91_diversity-in-ponderosa-pine-forest-structure-following-ecological-restoration-treatments.pdf (Kaufmann M.R., et al. 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. 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)”). Fuel reduction must find the “sweet spot,” by removing enough of the small surface and ladder fuels while retaining enough of the medium and large trees to maintain canopy cover for purposes of microclimate, habitat, hydrology, suppression of ingrowth, etc. The agency should consider alternative canopy treatments that are small and patchy, instead of extensive and continuous. Selective pruning of lower branches should also be considered as a viable canopy treatment.
30. Not all ladder fuels are hazardous. Studies after the Biscuit fire showed that “Mid-story hardwoods dampened fire and reduced mortality of dominant conifers—consider leaving them when thinning. ... Why did controls burn less intensely than thinned stands as predicted by fire models? Evidence to consider: ... * Controls retained mid-story hardwoods (madrone, tanoak, chinkapin) and they did not act as fuel ladder as predicted, and rather appeared to dampen the fire (much lower char heights). * Still much to be learned about fire behavior.” Bernard Bormann 2009. From B&B to Biscuit: What We Have Learned from Recent Westside Dry Forest Fires, *from Workshop: Restoring Westside Dry Forests - Planning and Analysis for Restoring Westside Cascade Dry Forest Ecosystems: A focus on Systems Dominated by Douglas-fir, Ponderosa Pine, Incense Cedar, and so on.* May 28, 2009. <https://www.fs.usda.gov/media/252764>.
31. Fire-regime condition-class may not be an accurate predictor of fire hazard, because it assumes incorrectly that time-since-fire is an accurate indicator of fire hazard. There is compelling evidence that time-since-fire has exactly the opposite of the assumed effect, that is, fires may burn more severely in early seral vegetation, and burn less severely in closed canopy forests. This may be related to the fact that closed canopy forests maintain a cool-moist microclimate that helps retain higher fuel moisture and more favorable fire behavior. Odion, D.C., E.J. Frost, J.R. Stritholt, H. Jiang, D.A. DellaSala and M.A. Moritz. 2004. Patterns of fire severity and forest conditions in the western Klamath Mountains, California. *Conservation Biology* 18(4): 927-936.

http://nature.berkeley.edu/moritzlab/docs/Odion_etal_2004.pdf. Canopy cover also helps suppress the growth of ladder fuels. The practical significance of this is that thinning projects should retain more canopy variability across the stand, and need not focus on treatment of canopy fuels except to provide some well-distributed “escape hatches” for hot gases generated by surface fires. Credible models of post-thinning fire behavior, must account for both fuel structure and microclimate effects of thinning.

32. There is growing evidence that in order to be effective, mechanical treatments must be followed by prescribed fire. But the effects of such fires (or lack thereof) must also be carefully considered. Fuel treatments without regular follow-up treatments might be worse than doing nothing at all because thinning can be expected to stimulate the growth of future surface and ladder fuels. Crystal L. Raymond. 2004. The Effects of Fuel Treatments on Fire Severity in a Mixed-Evergreen Forest of Southwestern Oregon. MS Thesis. http://depts.washington.edu/nwfire/publication/Raymond_2004.pdf; Jonathan R. Thompson, Thomas A. Spies 2009. Vegetation and weather explain variation in crown damage within a large mixed-severity wildfire. *Forest Ecology and Management* 258 (2009) 1684–1694. Therefore retain plenty of canopy cover to suppress the growth of those future fuels and as insurance against the very real possibility that follow-up fuel treatments may not be adequately funded and implemented.
33. Don't thin to uniform spacing. Use variable density thinning techniques to establish a variety of microhabitats, break up fuel continuity, create discontinuities to disrupt the spread of other contagious disturbances such as disease, bugs, weeds, fire, etc. Retain patchy clumps of trees which is the natural pattern for many species.
34. Be creative in establishing diversity and complexity both within and between stands. “Patchy, gappy, and clumpy” is often use to describe the distribution of trees in dry forests. Use skips and gaps within units to help achieve diversity. Gaps should be small, while skips should be a little larger. Landings do not make good gaps because they are clearcut, highly compacted and disturbed, more likely subject to repeated disturbance, and directly associated with roads. Gaps should be located away from roads and should not be clearcut but rather should retain some residual structure in the form of live or dead trees. Methods of implementing spatial variability in restoration treatments are described by Churchill, D.J., M.C. Dalhgreen, A.J. Larson, and J.F. Franklin. 2013. The ICO approach to restoring spatial pattern in dry forests: Implementation guide. Version 1.0. Stewardship Forestry, Vashon, Washington, USA. https://web.archive.org/web/20130330181038/http://www.cfc.umt.edu/ForestEcology/files/ICO_Manager_Guide.pdf and Derek J. Churchill, Andrew J. Larson, Matthew C. Dahlgreen, Jerry F. Franklin, Paul F. Hessburg, and James A. Lutz. 2013. Restoring forest resilience: From reference spatial patterns to silvicultural prescriptions and monitoring. *Forest Ecology and Management* 291 (2013) 442–457. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5428873.pdf



Figure 1. An example of naturally clumped large pines.

A historical reconstruction of forests in the Blue Mountains of Oregon, showed that more than 2/3 of plots had large clumps of between 10-30 trees and 50-90% of individual trees were within 6 meters of other trees (i.e., few were isolated individuals). Churchill, Derek J.; Carnwath, Gunnar C.; Larson, Andrew J.; Jeronimo, Sean A. 2017. Historical forest structure, composition, and spatial pattern in dry conifer forests of the western Blue Mountains, Oregon. Gen. Tech. Rep. PNWGTR-956. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 93 p.

https://www.fs.usda.gov/pnw/pubs/pnw_gtr956.pdf. See also Churchill, D.J., S T. Seager, A.J. Larson, E.E. Schneider, K.B. Kemp and C. Bienz. Ecological Functions of Spatial Patterns in Dry Forests: Implications for Forest Restoration. The Nature Conservancy, Portland, OR. 7 p.

https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/oregon/forests/Documents/WOC_9_ICO.pdf.

35. Thin heavy enough to stimulate development of some patches of understory vegetation, but don't thin so heavy that future development of a uniform understory of ladder fuels becomes a more significant problem than the one being addressed by the current project. 15-20 years after thinning and prescribed fire, the Umpqua NF found "considerable development of less fire tolerant understory vegetation Continued stand development ... will result in increased understory density and fuel laddering into the dominant fire tolerant overstory..." Umpqua NF, Diamond Lake RD, Lemolo Pine Health Maintenance Burn Project, June 1, 2010 scoping notice.
36. The scale of patches in variable density thinning regimes is important. Ideally variability should be implemented at numerous scales ranging from small to large, including: the scale of tree fall events; pockets of variably contagious disturbance from insects, disease, and mixed-severity fire; soil-property heterogeneity; topographic discontinuities; the imprint of natural historical events; etc.
37. Retain and protect under-represented species of conifer and non-conifer trees and shrubs. Retain patches of dense young stands as wildlife cover and pools for recruitment of future forests.

38. View native insects and disease in an ecological context. They are part of the natural processes that diversify and enrich our forests. They are best viewed as solutions, rather than problems. In particular, mistletoe brooms and seeds (and the large trees that mistletoe often live on) provide many ecological benefits, and treatment efforts are typically ineffective. So mistletoe, insect, and disease treatments have many costs and few benefits.
39. Recognize that thinning captures mortality and that most stands (especially plantations) are already lacking critical values from dead wood due to the unnatural stand history of logging, planting, and disrupted natural processes.³ To inform the decision, please conduct a stand simulation model showing that long term snag recruitment (after logging) will still meet DecAID 50-80% tolerance levels.
40. We are concerned that the agencies' stocking guides were created and intended to be used as a tool to avoid mortality which is clearly inconsistent with ecosystem management. ("To preclude serious tree mortality from mountain pine beetle, western dwarf mistletoe and perhaps western pine beetle, stand densities should be maintained below the upper limit of the management zone" Powell 1999, Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington: An Implementation Guide for the Umatilla National Forest, F14-SO-TP-03-99, https://web.archive.org/web/20220121011438/https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev7_016034.pdf) Healthy forests require dead trees, sometimes in abundance, in order to meet the needs of diverse wildlife and provide full suite of ecosystem functions. A comprehensive restoration approach requires focusing not just on live trees, but also on the full suite of ecological processes including density dependent mortality processes that create and recruit snags and dead trees as a valuable feature of eastside forests. We urge the agency not to manage for tree vigor and minimum stocking levels because it will not provide enough green trees for recruitment of snags through time. This is a critical issue given that the current standards for snag habitat are outdated and fail to provide adequate levels of snags and dead wood, and adequate levels of green trees needed to recruit those snags through time.
41. Retain abundant snags and coarse wood and green trees for future recruitment of snags and wood. Retention should be both distributed and in clumps so that thinning mimics natural disturbance. Retention of dead wood should generally be proportional to the intensity of the thinning, e.g., heavy thinning should leave behind more snags not less. Retain wildlife trees such as hollows, forked tops, broken tops, leaning trees, etc. Think not only about existing snags but more importantly about the processes the recruit snags, including: a large pool of green trees from which to recruit snags and the existence of competition and other mortality processes. Logging will significantly harm both of these snag recruitment factors. Recognize that thinning captures mortality. To inform the NEPA decision, please conduct a stand simulation model to fully disclose the adverse effects of logging on dead wood, especially long-term recruitment of large snags >20" dbh, and then mitigate for these adverse effects by identifying areas within treated stands and across the landscape that will remain

³ Tom Spies made some useful observations in the Northwest Forest Plan Monitoring Synthesis Report: "Certainly, the growth of trees into larger diameter classes will increase as stand density declines (Tappeiner and others 1997). At some point, however, the effect of thinning on tree diameter growth levels off and, if thinning is too heavy, the density of large trees later in succession may be eventually be lower than what is observed in current old-growth stands. In some cases, opening the stand up too much can also create a dense layer of regeneration that could become a relatively homogenous and dominating stratum in the stand. Furthermore, if residual densities are too low, the production of dead trees may be reduced (Garman and others 2003). Thinning should allow for future mortality in the canopy trees." <http://web.archive.org/web/20070808101639/http://www.reo.gov/monitoring/10yr-report/documents/synthesis-reports/index.html>

permanently untreated so they can recruit adequate large snags and dead wood to meet DecAID 50-80% tolerance levels as soon as possible and over the long-term.

42. “Biomass contains nutrients stored within the tree and when removed those nutrients are also removed as future nutrient input.” Deschutes NF 2025. [Fuels Maintenance EA](#). If using techniques such as whole-tree yarding or yarding with tops attached to control fuels, the agency should top a portion of the trees and leave the greens in the forest in order to retain nutrients on site. Achat, Deleuze, et al 2015. Quantifying consequences of removing harvesting residues on forest soils and tree growth – A meta-analysis. *Forest Ecology and Management* Volume 348, 15 July 2015, Pages 124–141. <http://www.sciencedirect.com/science/article/pii/S0378112715001814> (“Our study showed that, compared with conventional stem-only harvest, removing the stem plus the harvesting residues generally increases nutrient outputs thereby leading to reduced amounts of total and available nutrients in soils and soil acidification, particularly when foliage is harvested along with the branches. ... Soil fertility losses were shown to have consequences for the subsequent forest ecosystem: tree growth was reduced by 3-7% in the short or medium term (up to 33 years after harvest) in the most intensive harvests (e.g. when branches are exported with foliage). Combining all the results showed that, overall, whole-tree harvesting has negative impacts on soil properties and trees that may have an impact on the functioning of forest ecosystems.”) See also, NSF 2015. Morticulture: Forests of the living dead. Scientists unearth importance of dead wood to forest ecosystems. NSF News October 19, 2015. <https://www.nsf.gov/news/morticulture-forests-living-dead> (“Scientists now know that some of the nutrients from a rotting log are returned to the forest floor to replenish the soil almost immediately. Before Harmon's study, foresters often spent considerable expense and effort on removing dead trees and log debris. ... [L]eav[ing] downed trees in the forest ... creates a more diverse landscape, leaves nutrients on site, and provides habitat for species like bluebirds and woodpeckers that nest in tree cavities. ... Dead wood was long considered a wasted resource and a hazard in forest landscapes. But it performs a range of ecological functions: as habitat and food sources for many terrestrial and aquatic species; seedbeds for plants, including new trees; a source of water, energy, carbon and nutrients for the entire forest; and an agent that controls stream structure and function ...”).
43. Thinning creates activity fuels that can be treated (or not treated) in a variety of ways. Strive to treat fuels in ways that provide public benefits such as wildlife habitat (e.g., complex woody structure) and charcoal production (e.g., enhanced soil carbon storage), and reduce detrimental soil impacts from machine piling and hot burn piles. Deborah S. Page-Dumroese et al. 2017. Methods to Reduce Forest Residue Volume after Timber Harvesting and Produce Black Carbon. *Scientifica*. Volume 2017 (2017), Article ID 2745764, <https://doi.org/10.1155/2017/2745764>; <https://www.hindawi.com/journals/scientifica/2017/2745764/>; Jon Cox, Ken Bevis, Fran Cafferata, and Susan Barnes 2023. Habitat Piles Tools for Family Forestland Owners. Woodland Fish & Wildlife Project of the Western Forestry and Conservation Association. https://woodlandfishandwildlife.com/wp-content/uploads/2023/05/WFW-2023-Habitat-Piles-final_reduced.pdf. Use burn piles as an opportunity to produce biochar that helps improve soil and store carbon. <https://www.fs.usda.gov/research/rmrs/understory/making-biochar-hand-built-piles>.
44. Avoid impacts to raptor nests and enhance habitat for diverse prey species. Train marking crews and cutting crews to look up and avoid cutting trees with nests of any sort and trees with defects.
45. Take proactive steps to avoid the spread of weeds. Avoid and minimize soil disturbance. Retain canopy cover and native ground cover to suppress weeds.

46. Buffer streams from the effects of heavy equipment and loss of bank trees and trees that shade streams. Mitigate for the loss of LWD input by retaining extra snags and wood in riparian areas. Recognize that thinning captures mortality that is not necessarily compensated by future growth.⁴
47. Protect soils by avoiding road construction, minimizing ground-based logging, and avoiding numerous large burn piles. Mitigate the adverse soil impacts from burn piles by inoculating affected sites after burning (with living soil and native plant seeds, Julie E. Korb, Nancy C. Johnson, and W. W. Covington. 2004. *Slash Pile Burning Effects on Soil Biotic and Chemical Properties and Plant Establishment: Recommendations for Amelioration*. *Restoration Ecology* Vol. 12 No. 1, pp. 52-62 March 2004). Where road building is deemed necessary, ensure that the realized restoration benefits far outweigh the adverse impacts of the road, build the roads to the absolute minimum standard necessary to accomplish the job, and remove the road as soon as possible to avoid firewood theft, OHV trespass, and certainly before the next rainy season to avoid stormwater pollution. Do not allow log hauling during the wet season.
48. Adopt a purpose and need (and develop NEPA alternatives) that maintains and increases carbon storage in forest ecosystems. There is a carbon cost associated with thinning that must be disclosed and considered. As stands develop from young to mature to old, they continuously recruit carbon-rich material from the live tree pool to the dead wood pool. Some of that wood gets incorporated into the soil or falls in fire refugia where it can accumulate. Logging, even thinning, can dramatically affect the accumulation of carbon in the dead wood pool by capturing mortality, diverting it from the forest, and accelerating the transfer of carbon to the atmosphere. Carbon stays out of the atmosphere much longer if it remains in the forest as live and/or dead trees, instead of being converted to wood products and industrial and consumer waste.
49. If this project involves biomass utilization, the impacts need to be clearly disclosed. How will the biomass be moved from the remote corners of the treatment areas to the landings? Will there be extra passes made by heavy equipment? Will the landings be enlarged to make room for grinders, chip vans, and other equipment? Can the local forest roads accommodate chip vans? Will the roads be modified to make them passable by chip vans? What are the impacts of that? What are the direct, indirect, and cumulative impacts on soil, water, wildlife, and weeds?
50. Provide clear and detailed rationale that connects proposed actions to desired conditions. Test the rationale for actions and effects analysis against the scientific evidence, including the full range of evidence, reasonable opposing viewpoints, and the evidence presented in these comments. For each treatment unit, provide clear descriptions of silvicultural prescriptions and marking guides in the NEPA document.
51. Recognize that federal fuel reduction efforts likely have adverse unintended effects on human behavior and land use and fire hazard. "This project has explored the hypothesis that public fire suppression in fire-prone areas acts as a subsidy to landowners, incentivizing conversion of land to residential and commercial development. Landowners do not bear the full cost of their choice to build on land in fire-prone areas, since they do not pay for suppression, though they reap all of the benefits, potentially resulting in economically inefficient levels of development. ... Results suggest that when federal suppression efforts

⁴ "[T]he data have not supported early expectations of 'bonus' volume from thinned stands compared with unthinned. ... [T]hinnings that are late or heavy can actually decrease harvest volume considerably." Talbert and Marshall. 2005. *Plantation Productivity in the Douglas-fir Region Under Intensive Silvicultural Practices: Results From Research And Operations*. *Journal of Forestry*. March 2005, pp 65-70. *citing* Curtis and Marshall. 1997. *LOGS: A Pioneering Example of Silvicultural Research in Coastal Douglas-fir*. *Journal of Forestry* 95(7):19-25.

intensify on public lands, private development accelerates nearby. The main paper produced by the funded research thus shows that public investment in reducing the damages from fire in the short run causes unintended long-run behavioral responses, which may increase future hazard exposure.” Sheila Olmstead (PI), Carolyn Kousky (co-PI), Roger Sedjo (co-PI) 2013. Final Report to the Joint Fire Science Program Wildland Fire Suppression and Land Development in the Wildland/Urban Interface. http://www.firescience.gov/projects/10-3-01-33/project/10-3-01-33_final_report.pdf. Rasker, R. 2016. Why do we keep putting people in the way of wildfire? The wrong carrots and sticks. LA Times Op-Ed. <http://www.latimes.com/opinion/op-ed/la-oe-rasker-wildfire-preparation-incentives-20160901-snap-story.html>. (“Wildfire presents a classic case of a moral hazard, which is what occurs when someone takes a risk knowing someone else will bear a great deal of the cost if things go wrong. Typically, the wildfire version plays out in the West like this: Local governments, eager to reap increased property taxes, willingly approve new home construction, even on or near the most flammable of lands. When fire comes, federal and state agencies send in crews and air tankers to defend private homes. Most of the cost is borne by taxpayers... [T]he hard and unpleasant reality is that we will never solve the wildfire problem unless local governments are forced to bear a higher proportion of the firefighting costs. Keeping more of the costs local would create a strong incentive for continually improving land-use planning and other wildfire preparation policies. It may also provide elected officials the political cover they need to require stricter fire-safe standards for existing as well as new developments because it would make land-use planning a fiscal necessity.”)

52. Acknowledge and consider the following potentially significant issues in the NEPA analysis:

- a. Removing commercial sized logs, and associated roads and slash disposal, often conflicts with other resource values such as soil, water, weeds, wildlife habitat, fire hazard, and carbon storage;
- b. Removal of commercial sized logs can make the stand hotter, drier, and windier, making fire hazard worse instead of better;
- c. Commercial logging tends to present significant risks of weed infestations because of soil disturbance and canopy reduction;
- d. Removal of commercial logs necessitates road related impacts on soil and water resources. Machine piling and pile burning tend to cause significant adverse impacts on soil and water, especially when combined with road impacts and other logging disturbances.
- e. “Capturing mortality” reduces future snag habitat that is already deficient. Increasing vigor via thinning delays recruitment of snag habitat that is already deficient;
- f. The unavoidable adverse impacts of logging and roads must be balanced against the rather uncertain benefits of fuel reduction. Fuel reduction has little or no beneficial effect on low severity fires (controlled by favorable weather conditions) or on high severity fires (controlled by unfavorable weather conditions). There is actually a very low probability that moderate intensity fire will affect any given stand during the relatively brief time period that fuel hazard is alleged to be reduced. Please disclose the realistic probability that desired outcomes will occur based on (1) whether fire is likely to occur when the fuel treatments are likely to be effective, and (2) if fire does occur, whether there will be a good match between (A) the actual forest type and fuel treatment type, and (B) the actual probability of favorable weather conditions and fire conditions for that forest type and treatment type. Depending on these variables, fuel treatments may have little influence on both low intensity fire and extreme high intensity fire, leaving only a small subset of well-matched fuel treatments and fires, and a low probability that the proposed treatments will have ecological benefits that exceed ecological impacts.

- g. The effects of forest health thinning are very complex with many feedback loops. There is still a fair amount of scientific uncertainty about several critical factors relevant to a decision about fuel reduction, including: (A) uncertain rates of tree mortality and how many young trees need to be retained to ensure proper recruitment of future stands of old trees and large snags; (B) uncertainty about how much the canopy can be reduced without making the stand hotter, drier, and windier (and exacerbating fire hazard); (C) uncertainty whether logging has any significant beneficial effect on controlling insects and diseases like mistletoe.
- h. The agency must test the assumption that fire (and insect) risk reduction is compatible with ecological restoration objectives. This test must be spatial, probabilistic, and use reasonable assumptions about weather, fire frequency, fire suppression, and historic conditions in areas with variable-severity fire regimes. Sensitivity analysis should test the robustness of assumptions and conclusions. Example analyses can be found in the literature, e.g. 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%20Mitigatnion_AnAAG_2006.PDF, and 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 (“The results point toward several ways to guide current management practices in the study area. First, prioritizing land at the lowest elevations leads to the selection of the most land where both wildfire mitigation and restoration of historical forest conditions are needed. When thinning is restricted to Forest Service land, less land is selected where both goals are needed under all parameter scenarios. This is because Forest Service land tends to be at higher elevations and comprises forest types that are within the HRV. ... Prioritizing the stands with the highest canopy cover decreases the percentage of selected land where both outcomes are needed.... 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.”)
- i. Focus the analysis on “trade-offs” related to logging. All logging, including thinning, includes some adverse impacts and trade-offs. Some impacts of logging are unavoidable, so there is no such thing as a logging operation that is 100% beneficial. Depending on how thinning is done, it can have adverse impacts such as soil disturbance, habitat disturbance, carbon removal, spreading weeds, reduced recruitment of snags; road-related impacts on soil, water, site productivity, and habitat; moving fuels from the canopy to the ground, hotter-drier-windier microclimate that is favorable to greater flame lengths and rate of fire spread, etc. Some of these negative effects are fundamentally unavoidable, therefore all thinning has negative effects that must be compensated by beneficial effects such as reducing competition between trees so that some can grow larger faster, increased resistance drought stress and insects, possible increasing species and structural diversity, possible fire hazard reduction, etc. The NEPA analysis should elucidate and weigh these trade-offs and attempt to display net ecological effects.

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Each substantive issue discussed in these comments should be (i) incorporated into the purpose and need for the project, (ii) used to develop NEPA alternatives, including mitigation alternatives, that balance tradeoffs in different ways, (iii) carefully analyzed and documented as part of the effects analysis, and (iv) used to inform the finding of significance.

Please post to the project website, links to all relevant ESA and EFH consultation documents, RMPs, watershed analyses, and other supporting documents relied on in the NEPA analysis.

The NEPA analysis should clearly document how proposed activities will comply with substantive requirements including applicable laws and the LRMP as amended.

Please post to the project website before the public comment period, georeferenced maps of the proposed activity units that can be used to navigate in the field using apps such as Avenza.

Please provide Oregon Wild with timely notice of any forthcoming comment opportunities, and any draft and final decisions on this project. If the agency discovers new information or changed circumstance or modifies the project or the analysis after the decision, Oregon Wild requests to be notified and provided an opportunity to comment.

Note: If any of these web links in these comments are dead, they may be resurrected using the Wayback Machine at Archive.org. <http://wayback.archive.org/web/>

Sincerely,

A handwritten signature in black ink that reads "Doug Heiken". The signature is written in a cursive, slightly slanted style.

Doug Heiken (he/him)
dh@oregonwild.org