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Comments: Please find attached scoping comments from Oregon Wild regarding the Blue Mountains Forest Plan Revision.

As requested, we are emailing a link to a folder with all the attachments to Christopher.Dennis2@usda.gov.

We will also be making another submission via the CARA system to incorporate previous comments.

LETTER TEXT:
Please accept the following scoping comments from Oregon Wild concerning the proposed revision of the Blue Mountains Forest Plans, https://www.fs.usda.gov/r06/umatilla/planning/blue-mountains-forest-plan-revision. Oregon Wild represents 20,000 members and supporters who share our mission to protect and restore Oregon[rsquo]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).We must start by saying that it is hard to take the agency and this planning process seriously when the relevant project websites are splashed with incendiary partisan nonsense like this:These forest plan are supposed to thoughtfully balance interests and last for decades, but the current (temporary) administration is so hell-bent on [ldquo]owning the libs[rdquo] and rejecting everything they stand for, that we have no faith in the agency[rsquo]s ability to find lasting balance and uphold the public interest.This proposal involves revision of the Land and Resources Management Plans for the Blue Mountains, including the Umatilla, Malheur, and Wallowa-Whitman National Forests. The revision will entirely replace the existing LRMPs, including the Eastside Screens and PACFISH/INFISH.Contents [hyperlinked, use CTRL]Incorporate by referenceThe sources of information for this plan revision should include the entire administrative record and scientific record for the Interior Columbia Basin Ecosystem Management Project (ICBEMP), including but not limited to PNW-GTRs 485, 406, 463, 399, 385, 382, 374, and 405. The agencies invested millions of dollars and many years developing important information that was intended to lead to improved, ecosystem-based forest plans. An example of such information is the ICBEMP data on wildlife sources and sinks, and the finding of Korol et al (2002) that estimated that even if the Forest Service applies 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. Now is the time to bring that information into the planning process. We incorporate ALL that information by reference.1We also incorporate by reference all the comments, rationale, and cited science in:[bull] The Eastside Screens, PACFISH, and INFISH, and subsequent interpretive memos related to those policies;[bull] The comments and science cited in our prior comments on Blue Mountains forest planning, including:o Conservation Coalition comments dated 5-28-2024 on the Blue Mountain Assessment Reportso Oregon Wild comments dated 11-6-2024 on draft Need for Change for the Blue Mountains Forest Plan Revision;o Conservation Coalition objection dated 8-28-2018 to the 2018 Blue Mountains Forest Plan Revision;o Conservation Coalition comments dated 8-15-2014 on the 2014 DEIS for the Blue Mountain Forest Plan Revision;[bull] Conservationist and Scientists comments on the Large Tree Amendment to the Eastside Screens, including but not limited to those dated 2-27-2020, 5-15-2020, 10-13-2020, and 11-24-2020.Make Plan Components meaningful and enforceableThroughout the draft plan we find the word [ldquo]Contribute[rdquo] used over and over. This is a worthless wiggle word, that provides no meaningful guidance. Contribute a little or a lot? We urge the Forest Service to provide more robust and meaningful guidance that actually instructs managers that they must meet the requirements of NFMA related to sustainability and ecological integrity.Land management decisions have long-term consequences. Once logged, large trees and mature forest stands do not regrow for hundreds of years. Once emitted, carbon does not leave the atmosphere for thousands of years. Once the public trust has been lost, it[rsquo]s hard to regain. For this reason, decisions must be very carefully planned and implemented. The planning process must NOT emphasize efficiency, but rather effectiveness. Decisions must be well informed. The public must be consulted. Trade-offs must be carefully weighed and balanced. Competing values1 See https://www.fs.usda.gov/r6/icbemp/ and related government sources.must be harmonized. Plan components must be designed to reflect this careful land management approach.Plan components must be clear and enforceable otherwise the Forest Service cannot show that the plan will meet legal requirements related to sustainability, ecological integrity, viable populations, recovery of threatened & endangered species, restoration of rare plant and animal communities, etc.Many aspects of the existing LRMPs and the Eastside Screens include quantitative standards that ensure that management stay within concrete sideboards. This includes soil standards, Habitat Effectiveness Index, diameter limits, road density, connectivity requirements, etc. The revised plan does away with most of these quantitative limits which raises concerns about how the revised plan will meet legal requirements, especially given the increased expectation of active management for fuels, fire, logging, etc.Preliminary Need for ChangeOregon Wild already provided detailed comments on the Preliminary Need for Change. We do not see our comments meaningfully reflected in the current iteration of the Need for Change. We hereby incorporate by reference our 11-6-2024 comments on the Preliminary Need for Change, AND our 5-28-24 comments on BMFP Assessment Reports.Time to challenge assumptionsAs highlighted in our previous comments, the agency needs to validate its assumptions and test the logical links between goals and proposed actions to reach them.We are compelled to challenge the agency to questions its assumptions:[bull] Assumptions about the need for commodity production when the need for carbon storage to mitigate climate change is so great. Land uses such as logging contribute to the cumulative excess of GHG in the atmosphere, and these emissions can be greatly reduced to help address the climate crisis22 [ldquo]LULUCF [land use, land use change, and forestry] is part of the problem (climate change), thus must be part of solution.[rdquo] http://www.jopp.or.jp/CDM/doc/Shlamadinger.pdf; (Climate stabilization [ldquo][w]edges can be achieved from energy efficiency, from the decarbonization of the supply of electricity and fuels (by means of fuel shifting, carbon capture and storage, nuclear energy, and renewable energy), and from biological storage in forests and agricultural soils.[rdquo]) Pacala and Socolow. 2004. Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies. Science 13 August 2004: Vol. 305. no. 5686, pp. 968 [ndash] 972.
http://web.archive.org/web/20070712193649/http://www.gpisd.net/documents/science13aug04v305pg968.pdf; ([ldquo]Our analysis found that a [lsquo]no timber harvest[rsquo] scenario eliminating harvests on public lands would result in an annual increase of 17[ndash]29 million metric tonnes of carbon (MMTC) per year between 2010 and 2050[mdash]as much as a 43% increase over current sequestration levels on public timberlands and would offset up to 1.5% of total U.S. GHG emissions.[rdquo]). Depro, B., Murray, B., Alig, R., Shanks, A. 2008. Public land, timber harvests, and climate mitigation: quantifying carbon sequestration potential on U.S. public

timberlands. Forest Ecology and Management. 255(3-4): 1122-1134. https://pubag.nal.usda.gov/download/21039/PDF.[bull] Assumptions about the need for fuel reduction when logging may just as easily increase fire hazard by making stands hotter-drier-windier, and whether thinning really reduces fire hazard.3[bull] Assumptions whether time-since-fire is an accurate measure of fire hazard. There is evidence that high biomass forests actually experience less severe fire, and logged forests experience more severe fire.4[bull] Assumptions about whether retaining only a few snags per acre will meet the needs of wildlife when current science indicates that there is a region wide deficit of dead wood habitat, and logging will exacerbate that deficit for decades, and wildlife need more snags than previously recognized.53 ([ldquo]Thinning opens stands to greater solar radiation and wind movement, resulting in warmer temperatures and drier fuels throughout the fire season. [T]his openness can encourage a surface fire to spread, [hellip][rdquo]) USDA Forest Service; Influence of Forest Structure on Wildfire Behavior and the Severity of Its Effects, November 2003. https://web.archive.org/web/20220709213153/https://www.fs.fed.us/projects/hfi/2003/november/documents/forest-structure-wildfire.pdf). ([ldquo]First, larger-diameter woody materials do not pose a significant threat for wildfire ignition or spread. It is largely the finer fuels (a few inches and less in diameter) that carry fire. More important, large, old trees actually provide protection from fire spread because they are resistant to fire and their shade maintains favorable moisture conditions in the understory fuels. Too much thinning of the forest canopy can produce more rapid drying of such fuels and, thereby, more frequent and severe wildfire risk. Furthermore, big, old trees provide critical habitat and maintain key ecosystem functions.[rdquo]) (pg 4) Statement of Norman L. Christensen, Jr., Ph.D. Before the Senate Committee on Agriculture, Nutrition and Forestry Regarding H.R. 1904[mdash]the Healthy Forests Restoration Act of 2003, 26 June 2003. https://web.archive.org/web/20041016021429/https://wwwpaztcn.wr.usgs.gov/fire/hr_1904_testimony_christensen.pdf; Simpson W.E. 2025. Report on the Ineffectiveness of Forest Wildfire Mitigation Measures: Insights from the Bootleg Fire and Scientific Principles. The Wildlife News 8-29-2025. https://www.thewildlifenews.com/2025/08/29/report-on-the-ineffectiveness-of-forest-wildfire-mitigation-measures-insights-from-the-bootleg-fire-and-scientific-principles/; [ldquo]High overstory density can be resilient[rdquo] 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. http://ecoshare.info/projects/central-cascade-adaptive- management-partnership/workshops/restoring-westside-dry-forests/; Ott, J.E., Kilkenny, F.F. & Jain, T.B. Fuel treatment effectiveness at the landscape scale: a systematic review of simulation studies comparing treatment scenarios in North America. fire ecol 19, 10 (2023). https://doi.org/10.1186/s42408-022-00163-2.https://fireecology.springeropen.com/counter/pdf/10.1186/s42408-022-00163-2.pdf citing Ex, S.A., J.P. Ziegler,W.T. Tinkham, and C.M. Hoffman. 2019. Long-term impacts of fuel treatment placement with respect to forest cover type on potential fire behavior across a mountainous landscape. Forests 10 (5): 438. https://doi.org/10.3390/f10050438; The Deschutes National Forest Boundary Road Fuel Reduction CE admits that [ldquo]the efficacy of those [past fuel] treatments on the landscape has decreased over time due to brush accumulation and lodgepole pine regeneration. The growth of understory shrub components and influx of lodgepole pine have created an undesirable level of fuels.[rdquo] https://usfs-public.app.box.com/s/zj8iqxq57qzbg1utczf8dhtto04fps9o/file/1892835909165; Jain, T. B., Abrahamson, I., Anderson, N., Hood, S., Hanberry, B., Kilkenny, F., ... & O'Brien, J. J. (2021). Effectiveness of fuel treatments at the landscape scale: State of understanding and key research gaps. JFSP PROJECT ID: 19-S-01-2. Boise, ID: Joint Fire Sciences Program. 65 p. https://www.fs.usda.gov/rm/pubs_journals/2021/rmrs_2021_jain_t001.pdf.4 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.5 See Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife- Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001) http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf; 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; Bruce G. Marcot , Janet L. Ohmann, Kim L. Mellen-McLean, and Karen L. Waddell. Synthesis of Regional Wildlife and Vegetation Field Studies to Guide Management of Standing and Down Dead Trees. Forest Science 56(4) 2010. http://www.fs.usda.gov/pnw/pubs/journals/pnw_2010_marcot002.pdf; Steve Zack, T. Luke George, and William F.[bull] Assumptions that thinning has a beneficial effect on recruitment of large trees, large snags, and large instream woody structures, when there is a significant unacknowledged trade-off between logging and large tree/wood recruitment. In reality thinning [ldquo]captures mortality,[rdquo] increases vigor which not only delays recruitment but in absolute terms reduces recruitment of large wood.6[bull] Assumptions that logging and grazing are the main economic benefits from public land management, when the best available science shows that forest and landscape conservation provide much greater economic benefits from both ecosystem services and quality of life that benefits all industries and job creators in the region. Key ecosystem services from conservation include: clean water, stable water flows, soil integrity, slope stability, nutrient storage and cycling, biodiversity, carbon storage that supports climate stability, diverse recreation opportunities, scenic splendor, climate change adaptation, natural fire regime, etc. The economic value of carbon storage alone vastly outweighs the economic value of logs and cattle.7[bull] Assumptions that GHG emissions logging is minimal, carbon neutral, or acceptable. Science shows that forests can be part of the climate solution if they are protected from logging and allowed to store closer to their biological potential for carbon storage. When forests are logged they emit GHG and are part of the climate problem, making things worse for the forest of the Blue Mountains and ecosystems around the world. See comments below;[bull] Assumptions that logging reduce drought stress by reducing competition for soil water, which ignores new science showing that logging removes protective canopy and makes the forest hotter and dryer which increases evaporative demand and increases vapor pressure deficit and increases drought stress. The adverse effects of thinning may outweigh the benefits, or at least raise the possibility that lighter thinning treatments that retain more trees will better balance the different ways that trees experience stress both above and below ground.8Laudenslayer, Jr. 2002. Are There Snags in the System? Comparing Cavity Use among Nesting Birds in [ldquo]Snag-rich[rdquo] and [ldquo]Snag-poor[rdquo] Eastside Pine Forests. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181. http://www.fs.usda.gov/psw/publications/documents/gtr-181/017_Zack.pdf; Vizcarra, Natasha 2017. Woodpecker Woes: The Right Tree Can Be Hard to Find. PNW Science Findings, Issue 199, August 2017. https://www.fs.usda.gov/pnw/sciencef/scifi199.pdf. citing Lorenz, T.J.; Vierling, K.T.; Johnson, T.R.; Fischer, P.C. 2015. The role of wood hardness in limiting nest site selection in avian cavity excavators. Ecological Applications. 25: 1 016[ndash]1033.https://web.archive.org/web/20190702185623/https://www.fs.fed.us/pnw/pubs/journals/pnw_2015_lorenz.pdf.6 ([ldquo]Under the no action alternative [the target] level of [large] snags would not be achieved for another two decades[hellip]. The action alternatives would delay reaching this level by an additional 10 to 30 years [hellip][rdquo]) 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. Heiken, D. Thinking About Dead Wood in Managed Landscapes. 2012. https://www.dropbox.com/s/5gofctjdglx5t3t/dead%20wood%20slides%202012.pdf.7 Rasker et al. (2004). Prosperity in the 21st Century West - The Role of Protected Public Lands. Sonoran Institute. http://web.archive.org/web/20070105005615/http://sonoran.org/pdfs/Prosperity%20Report.pdf; Thomas Power, The Economics of Wildland Preservation. 2000. https://web.archive.org/web/20071026045006/http://www.cas.umt.edu/econ/papers/Wildland%20Economics%20Report.htm; Rasker, Ray 2017. The Transition from Western Timber Dependence: Lessons for Counties. Headwaters Economics. https://headwaterseconomics.org/wp-content/uploads/Lessons_Timber_Transition.pdf; Niemi, Whitelaw, & Johnston 1999. The Sky Did NOT Fall. ECONorthwest. http://pages.uoregon.edu/whitelaw/432/articles/SkyDidNotFallFull.pdf; Headwaters Economic 2012, Annotated Bibliography: Studies on the Economic Value of Public lands and Protected Public Lands that have Appeared in the Peer-Reviewed Academic Literature: December 2012. http://headwaterseconomics.org/wphw/wp-content/uploads/Annotated_Bib_Value_Public_Lands.pdf.8 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/sciencef/scifi268.pdf. See also,[bull] Assumptions that special status fish & wildlife species remain viable, when we do not have statistically powerful monitoring data that would unambiguously tell us whether those species are doing well or not;[bull] Assumptions that best management practices are effective at preventing water quality violations during storm events, when we lack credible monitoring data;[bull] Assumptions that any standards & guidelines actually achieve intended objectives absent credible monitoring data;ASQ [ldquo]timber sale quantity[rdquo] must be harmonized with multiple use.Retired USFS Chiefs Vicki Christiansen, Tom Tidwell, Mike Dombeck and Dale Bosworth said [ldquo]We need to face reality. The easy to access timber has been cut. The primary role of the Forest Service should be in stewardship and restoration activities that protect human communities from fire and restore the health of the land.[rdquo] E&E News. 9-17-2025.Draft Plan (p 76) says that timber sale quantity (TSQ) is estimated without regard for other multiple uses. [ldquo]The sustained yield limit is the amount of timber that can be removed annually in perpetuity on a sustained yield basis from all lands that may be suitable for timber production. For this calculation the assumption is made that all lands are managed to produce timber without considering other multiple uses or fiscal or organizational capability.[rdquo] This is highly improper. TSQ must be harmonized with all other values- fish, watersheds, carbon, snag habitat recruitment, lack of social license to log MOG. The risk from failure to harmonize these goals is a plan that places too much emphasis on logging and destroys those other competing values, including: water, fish, wildlife, climate, recreation, soil, fire safety, etc.NFMA Sec 6(e) says:the Secretary shall assure that such plans- [hellip] (2) determine [hellip] harvesting levels [hellip] in the light of all of the uses set forth in subsection (c)(1), the definition of the terms 'multiple use' and 'sustained yield' as provided in the Multiple-Use, Sustained-Yield Act of 1960, and the availability of lands and their suitability for resource management.MUSYA says:The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple use and sustained yield of the several products and services obtained therefrom. In the administration of the national forests due consideration shall be given to the relative values of the various resources in particular areas.16 U.S.C. 529.The definitions of Multiple Use and Sustained Yield explicitly require renewable resources to be: utilized in the combination that will best meet the needs of the American people [and] harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, [hellip]16 U.S.C. 531.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.Also, the planning regs say [ldquo]Timber will be harvested from NFS lands only where such harvest would comply with the resource protections set out in sections 6(g)(3)(E) and (F) of the NFMA (16 U.S.C. 1604(g)(3)(E) and (F).[rdquo] 36 CFR 219.11.All the highlighted words above run directly counter to the Forest Service approach to calculate timber sale quantities without consideration of other competing resource values.Also, the calculation of TSQ needs to be transparent. How was climate uncertainty accounted for? In particular, sustained yield typically assumes periodic regen harvest, but climate change raises serious questions whether new stands of trees can be regenerated on climate stressed landscapes. Regen comes with huge risks that forests may be difficult to sustain in a warmer dryer world. Partial harvest may partially mitigate this risk, but how are sustained yield volumes calculated under a thinning-only regime?The forest plan should identify the Blue Mountains as unsuitable for regeneration logging given the uncertainty of global climate change.Regen harvest is no longer scientifically sound or sustainable.Regeneration logging that removes most of the trees in a stand is no longer scientifically supported. The science supporting regen harvest is outdated due to global climate change and increasing drought stress and fire hazard. It is no longer known whether forests can be successfully regenerated at scale under future climate regimes.Regen also makes everything worse:[bull] Regen increases risks associated with climate uncertainty. Regen creates harsh microclimate where it is difficult to establish a new cohort of trees, this is especially true in light of global climate change that is making the growing season both hotter and dryer, and hotter adds to the evaporative stress. Many areas of the Blue Mountains are on the cusp between forest and non-forest vegetation. Logging might shift them from one type to another, likely in favor of non-forest. Tree establishment is a vulnerable stage where trees are subject to significant mortality. Many areas that are logged may not grow a new forest. This is inconsistent with legal mandates under NFMA and the Organic Act.[bull] Regen causes GHG emissions that make global climate change worse. This effect of regen interacts unfavorably with global climate change.[bull] Regen opens the stand to warm dry air which degrades the microclimate buffer that many wildlife need to survive in a warmer world. This effect of regen interacts unfavorably with global climate change.[bull] Regen removes shade and increases sun exposure, which warms the air and increases evaporative demand and vapor pressure deficit, increasing the climate stress that trees must endure to survive. This effect of regen interacts unfavorably with global climate change.[bull] Regen opens the canopy, stimulates growth of surface and ladder fuels, shifting fuels from the high canopy closer to the ground where they are more available for combustion during fires. This increases fire hazard.[bull] Regen severely depletes the pool of green trees from which future mature and old-growth trees and snags are recruited. Regen also erases the stand legacies that normally carry over from one stand to another during natural disturbance events. This makes a badsituation worse with respect to the current deficit of mature and old-growth habitat, large trees, snag habitat.[bull] Regen causes unnatural peak stream flows in the years immediately after harvest and reduce seasonal low stream flows in the decades after establishment of dead conifers. These hydrologic effects likely violate the Forest Service Organic Act. This effect of regen interacts unfavorably with global climate change which is also predicted to modify weather patterns in a way that increases high flows and reduces low flows.If lands are no longer suitable for regeneration harvest, then they are no longer suitable for sustained yield timber production, because the FS does not have a credible way to predict future wood production from thinning, and there is tremendous uncertainty about forests[rsquo] continued sustainability under global climate change.Timber sales are not the best toolThe plan should include a full suite of vegetation management tools to achieve management objectives, and a rigorous process for choosing the appropriate tool during forest plan implementation. Tools like non-commercial thinning and prescribed fire should be the favored tools for fuel management, and silvicultural intervention. These tools are highly effective and have far fewer trade-offs compared to commercial logging.Commercial logging degrades soil, water quality, habitat, carbon storage, recreation, scenic values, exacerbates fire hazard, and spreads weeds. Timber sales also tend to cause greater tree mortality compared to the [ldquo]problems[rdquo] they are intended to prevent.The analysis of this plan revision must disclose the trade-offs of commercial logging and how those trade-offs undermine effectiveness of management efforts. The analysis must carefully weigh the trade-offs of commercial logging versus other management tools, and the plan should consider and adopt standards that mitigate the trade-offs associated with commercial logging (and other management tools).The revised plan must also require disclosure, weighing, and mitigation of trade-offs during analysis of projects implementing the plan.The agency often identifies some need for vegetation management such as thinning of small trees in fire-suppressed forests, but the Forest Service too often adopts proposed actions that are not well designed to meet the identified purpose and need. The FS often goes far beyond the purpose and need for small tree removal, and unnecessarily removes medium and large trees that serve valuable ecosystem services and that pose little or no fire hazard, or even help moderate fire hazard by providing a cool/moist microclimate, and suppressing growth of hazardous surface and ladder fuels. The plan must provide robust mechanisms to ensure that projects focus on the real need and mechanisms to restrain unnecessary removal of medium and large trees, and mechanisms to avoid and mitigate trade-offs from unnecessary commercial logging. Including these mechanisms as plan components and standards & guidelines is necessary to meet the requirements related to sustainability in the NFMA planning regulations. 36 CFR [sect] 219.8.Commercial logging can be a useful tool to achieve some restoration and fuel reduction objectives, but commercial logging is also a vastly overused tool that has significant trade-offs that often conflict with the underlying objectives of the project. NEPA analysis is needed tocarefully consider all these trade-offs, and alternatives that mitigate these trade-offs. It is often the case that non-commercial thinning can produce results that are as good or better than commercial logging, and with much fewer trade-offs, so the net benefits far exceed those from commercial logging.Trade-offs from commercial logging include:[bull] Reducing canopy cover makes fire hazard worse, not better. Logging makes the stand hotter, drier, and windier, which (i) dries fuels, (ii) creates more hazardous conditions for fire. Commercial logging of canopy trees not only creates more hazardous slash that must be treated, it also stimulates the growth of future hazardous surface and ladder fuels, and makes future retreatment more expensive.[bull] Logging makes the forest warmer, increases evaporative demand and vapor pressure deficit, which increases drought stress.[bull] Removing canopy also causes habitat fragmentation, exposes wildlife to greater risk of predation, increases barriers to safe movement across roads and fuel treatment areas, and degrades the microclimate refugia that diverse wildlife need to survive extreme weather during this climate emergency.[bull] Logging transfers carbon form the forest to the atmosphere and exacerbates global climate change.[bull] Commercial logging has far greater impact on soil and water and weeds due to greater use of roads and heavy equipment that disturbs soil, cause erosion, and expose mineral soil where weeds can establish.[bull] Commercial logging creates unnatural habitat conditions. Natural disturbance leaves the dead wood habitat behind, where many old-growth species can persist while the forest recovers, but logging exports that valuable habitat away. This causes long-term reduced recruitment of large trees and large snags and dead wood.[bull] Logging adversely affects hydrology, causing unnatural peak stream flows and unnatural low stream flows.[bull] Logging requires heavy equipment and road construction and/or road use that have significant effects on soil, water, habitat, fire ignition risk, etc.Non-commercial thinning of small trees and retention of higher canopy cover mitigates all these adverse effects and still achieves fuel reduction objectives. Most fires move along the ground, not through the canopy, so fuel reduction focused on surface and ladder fuels is most effective. Canopy fuels are rarely continuous. Virtually every road serves as a break in canopy continuity, and there is a dense road network on public lands. Retaining canopy also helps suppress the growth of future surface and ladder fuels, which means that future retreatment can be more affordable, with less frequent need for treatment and less accumulated fuels to deal with.Records from a 2023 meeting of the Federal Timber Purchasers Committee show that the agencies obsession with meeting timber production goals leads them to blend timber and fuel goals in ways that likely compromise fire hazard reduction goals and these are not disclosed in NEPA:Are you working with the fuels management staff to identify projects which can use timber harvest to achieve hazardous fuels reductions? [hellip] How well are you working with the fuels management staff in your region to identify and offer fuels reduction projects which also produce merchantable timber? [hellip] Yes, timber and fuels staff work together at the Regional and Forest level to develop [hellip] the Region and Forests recognize the importance of local infrastructure and build outyear plans that aim to meet needs on the ground while providing reliable quantities of timber to local industry [hellip] we have been creative in doing fuels reduction that produces volume and forest products. [hellip] IRA. Fuelsand Veg management are symbiotic in nature. [hellip] Natural Resources and Fire and Aviation Management in the Region are highly integrated and work together frequently on an integrated program of work that produces mutually beneficial outcomes for risk reduction and contribution to timber volume outputs [hellip] Fuels treatment is critical but shouldn't squeeze out the timber program. [hellip] Fuels funding also goes to forestry projects when they are designed as integrated which most are.9The agencies clearly use timber sales as a way to accomplish fuel objectives, and that would be fine if they limited timber sales to removing just the small fuels that need to be removed to reduce fire hazard, while leaving the medium and larger trees in the forest. But that is not what they do. The reality is that the agencies conduct timber sales that remove too many medium and large trees, and the effect of those timber sales is to make fire hazard worse, instead of better, and the agencies fail to conduct NEPA analysis that honestly discloses the conflict between timber production and fuel reduction, especially when medium and large trees are removed. The agencies pretend as if there is great harmony between timber objectives and fuel objectives, when in reality too much logging makes fire hazard worse, but this fact is hidden for the public and the decision-maker.Climate change - Meeting legal mandates requires mitigating climate change.The revised plan and the analysis supporting the revised plan must be prepared with a clear understanding that the Forest Service cannot meet its legal obligations unless it works to reduce climate change. Please consider a preferred alternative that manages toward biological potential for carbon storage in order to meets these legal obligations. Those legal obligations emanate from the Forest Service Organic Act, the National Forest Management Act, the Endangered Species Act, Multiple-Use Sustained-Yield Act, etc.For example, the Organic Act says [ldquo]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.[rdquo]10 Climate change is expected to disrupt forest ecosystems and hydrologic systems to an extent that threatens to violate the very foundations of the agency[rsquo]s Organic Act. The FS should make every effort to reduce GHG emissions that exacerbate global climate change.The National Forest Management Act and its implementing regulations require that plans achieve sustainability, ecological integrity, conservation of habitat for healthy wildlife populations, watershed health, and aquatic integrity. The Plan and supporting NEPA analysis must show how all of these goals are impeded by global climate change. Landscape scale logging and livestock grazing will exacerbate global climate change and make it even more difficult to meet legal mandates. For instance, as the climate warms forests, natural unlogged forests,9 USFS 2023. Fall Federal Timber Purchasers Committee Q&A. Erie, PA. Nov. 13-17, 2023, https://drive.google.com/file/d/1ZXnJXhLuBCIQalNRJBKkZR0ufoXrepFt/view.10 1897 FS Organic Act. https://winapps.umt.edu/winapps/media2/wilderness/NWPS/documents/publiclaws/ORGANIC-ACT-OF-1897.pdf.become an increasingly important refuge for North American mammals, and thinning dense forests may impair the forests function as climate refugia.11Carbon storage, air quality [ndash] avoid emissions. Manage toward biological potential.Powell (2017) found that eastside forests are carbon depleted.[R]esearch suggests that historic stands with a low density of large trees supported more biomass (and C) than contemporary, fully-stocked, fire-suppressed old growth forest (DeLuca and Aplet 2008). An explanation for this seemingly counterintuitive result is as follows: on a proportional basis, one large tree has a higher C content than many small trees [ndash] according to Fellows and Goulden (2008), a single large tree (> 90 cm; 35 in) contains the same amount of C as 60 small (10-30 cm; 4-12 in) trees.12This means that past logging has contributed to global climate change, and more logging will make a bad situation worse. This plan revision should strive to reverse that pattern, and strive to use the Blue Mountain Forests as a climate solution by managing to avoid carbon emissions and manage toward the biological potential for carbon storage.Trees themselves, as well as the carbon stored in soil and vegetation, provide a wide variety of ecosystem services, including climate regulation that supports the provision of multiple ecosystem services. Forests provide a variety of ecosystem services that will be increasingly important as the climate changes. Ellison et al. (2017) explain that -[F]orest, water and energy interactions provide the foundations for carbon storage, for cooling terrestrial surfaces and for distributing water resources. Forests and trees must be recognized as prime regulators within the water, energy and carbon cycles. [hellip][F]orests play important roles in producing and regulating the world[rsquo]s temperatures and fresh water flows. [hellip] By evapotranspiring, trees recharge atmospheric moisture, contributing to rainfall locally and in distant locations. Cooling is explicitly embedded in the capacity of trees to capture and redistribute the sun[rsquo]s energy (Pokorn[yacute] et al., 2010). Further, trees[rsquo] microbial flora and biogenic volatile organic compounds can directly promote rainfall. Trees enhance soil infiltration and, under suitable conditions, improve groundwater recharge. Precipitation filtered through forested catchments delivers purified ground and surface water (Calder, 2005; Neary et al., 2009). [hellip]Forests play a large role in regulating fluxes of atmospheric moisture and rainfall patterns over land. Earth[rsquo]s land and ocean surfaces release water vapor to the atmosphere. On continental surfaces, this process is aided by forests and other vegetation through evapotranspiration (ET) [ndash] evaporation from soil and plant surfaces and transpiration of water by plants. The resulting atmospheric moisture is circulated by winds across the Earth[rsquo]s continents and oceans. The upwind and cross-continental production and transport of atmospheric moisture [mdash] [ldquo]precipitation recycling[rdquo] [mdash] can, in11 Tourani et al 2023. Maximum temperatures determine the habitat affiliations of North American mammals. PNAS December 4, 2023. 120 (50) e2304411120 https://doi.org/10.1073/pnas.23044111,https://www.pnas.org/doi/pdf/10.1073/pnas.2304411120.12 David C. Powell 2017. Climate Change and Carbon Sequestration: Vegetation Management Considerations. WHITE PAPER F14-SO-WP-SILV-45. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd546902.pdf.the appropriate circumstances, promote and intensify the redistribution of water across terrestrial surfaces.On average, at least 40% of rainfall over land originates from ET. [hellip]Trees and forests contribute to the intensification of rainfall through the biological particles they release into the atmosphere, which include fungal spores, pollen, bacterial cells and biological debris. Atmospheric moisture condenses when air becomes sufficiently saturated with water and much more readily when suitable surfaces, provided by aerosol particles (condensation nuclei), are present (Morris et al., 2014; Sheil, 2014). Some volatile organic compounds, 90% of which are also biological in origin, become oxidized and sticky in sunlight and attach to any (mainly biological) particles, thereby growing to sizes that enhancecondensation [hellip]Forests influence local and global temperatures and the flow of heat. At the local scale, forests can remain much cooler during daytime due to shade and the role of evaporation and transpiration in reducing sensible heat [hellip] Additional regional and global cooling derives from the fact that, through emissions of reactive organic compounds (Spracklen et al., 2008), forests can increase low-level cloud cover and raise reflectivity [albedo]. [hellip]Using the sun[rsquo]s energy, individual trees can transpire hundreds of liters of water per day. This represents a cooling power equivalent to 70 kWh for every 100 L of water transpired (enough to power two average household central air-conditioning units per day). With deeper roots, trees can maintain their cooling function even during long- lasting heatwaves [hellip]Forests may be particularly important for the so-called [ldquo]water towers[rdquo] of larger regions (see e.g. Viviroli and Weingartner, 2004). High altitude forests have a special ability to intercept fog and cloud droplets. Condensation on plant surfaces, including on dense, epiphytic lichen and moss communities, provides additional moisture for tree growth, ET, infiltration, groundwater recharge, and, ultimately, runoff [hellip]Tree root architecture is also highly important for the hydraulic redistribution of water in soils, facilitating both upward and downward flows and thereby improving dry-season transpiration and photosynthesis while simultaneously transporting rainwater downward to levels where it cannot easily be evaporated (Neumann and Cardon, 2012; Prieto et al., 2012). Intermediate tree densities on degraded lands may in fact maximize groundwater recharge (Ilstedt et al., 2016). [hellip]Biodiversity enhances many ecosystem functions like water uptake, tree growth and pest resistance (Sullivan and O[rsquo]Keeffe, 2011; Vaughn, 2010). The perverse effects of current land management strategies require closer scrutiny. For example, the practice of plantation forestry can negatively impact species richness and related ecosystem services (Ordonez et al., 2014; Verheyen et al., 2015).Mixed species forests may lead to healthier, more productive forests, more resilient ecosystems and more reliable water related services, and often appear to perform better than monocultures regarding drought resistance and tree growth (Ordonez et al., 2014; Paquette and Messier, 2011; Pretzsch et al., 2014 Pretzsch et al., 2014). Through variation in rooting depth, strength and pattern, different species may aid each other through water uptake, water infiltration and erosion control (Reubens et al., 2007). [hellip]The climate-regulating functions of forests [ndash] atmospheric moisture production, rainfall and temperature control at local and regional scale [ndash] should be recognized as their principal contribution, with carbon storage, timber and non-timber forest products asco-benefits (Locatelli et al., 2015). [hellip]The multiple water and climate-related services provided by forests [ndash] precipitation recycling, cooling, water purification, infiltration and groundwater recharge, [hellip] represent powerful adaptation opportunities that can significantly reduce human vulnerability and simultaneously, through their carbon storage functions, provide mitigation (Pramova et al., 2012b). [hellip]Given sufficient scientific evidence on forest, water and energy interactions, decision- making must recognize that water and climate-related ecosystem services benefit and impact people well beyond the local or catchment scale, often far from where actual decisions on tree planting or removal are made. Tradeoffs, for example between local restoration costs and downstream or downwind benefits, must also be taken into account[hellip]Findings on forest and water interactions have important implications for environmental accounting. In addition to representing a potential loss for downstream water users, we likewise see ET as a potential gain for downwind users. Thus, the accounting and definition of plant water use as [ldquo]consumption[rdquo] is problematic and requires careful consideration (Launiainen et al., 2014; Maes et al., 2009). [hellip]The effects of forests on water and climate at local, regional and continental scales provide a powerful adaptation tool that, if wielded successfully, also has globally-relevant climate change mitigation potential.13Draft Plan (pp 15, 24, 64) recognizes carbon storage as an ecosystem service, but fails to articulate the full suite of benefits from a stable climate as required by 36 CFR 219.6 and 219.8. Missing plan components include:[bull] system drivers (e.g., Logging causes carbon emissions. Climate warming and drought increase uncertainty about sustained yield and other multiple uses),[bull] [ldquo]baseline assessment of carbon stocks[rdquo] based on existing information,[bull] [ldquo]benefits people obtain[rdquo] from climate regulation provided by forest carbon storage, (The plan must carefully document the benefits of keeping carbon in the forest, which can be thought of as [ldquo]avoided harms[rdquo] of logging related carbon emissions. See some of those harms and benefits below.),[bull] [ldquo]The plan must include plan components, including standards or guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds[rdquo] (how much carbon must be retained to meet this objective?)[bull] [ldquo]The plan must include plan components, including standards or guidelines, to guide the plan area[rsquo]s contribution to social and economic sustainability[rdquo] (This requires consideration of the social cost of carbon dioxide emissions.[bull] Air quality plan components and standards set forth in the draft plan are inadequate. The plan needs to include standards & guidelines to [ldquo]maintain or restore [hellip] air quality.[rdquo] 36 CFR 219.8(a). CO2 is long-lasting in the atmosphere, so meeting this requirement13 David Ellison et al 2017. Trees, forests and water: Cool insights for a hot world. Global Environmental Change 43 (2017) 51[ndash]61. http://ac.els-cdn.com/S0959378017300134/1-s2.0-S0959378017300134-main.pdf?_tid=38eca4a8- 081a-11e7-9f6d-00000aab0f02&acdnat=1489429617_9efb667c50b0b4b3a3a03214472ba08drequires avoiding carbon emissions in order to avoid adding to the cumulative excess of GHG in the global atmosphere, and avoid exacerbating global climate change.The plan needs to include components to maintain and increase long-term storage of carbon in the forest and keep carbon out of the atmosphere in order to optimize ecosystem services. Given the current global climate emergency caused by decades of delayed action on climate, the goal should be to minimize carbon emission and maximize long-term forest carbon storage. The plan should call for managing forests toward the biological potential for carbon storage. This will help meet legal requirements, including provision of diverse ecosystem services, such as climate regulation, and appropriate mitigation for global climate change which is necessary to meet legal requirements.The Blue Mountains Forest Plan Revision should implement the requirements of the 2012 NFMA planning regulations that recognize carbon storage and climate regulation as an "ecosystem service" provided by forests.The rules say:The plan must include plan components, including standards or guidelines, to guide the plan area[rsquo]s contribution to social and economic sustainability, taking intoaccount: ... (4) Ecosystem services; ...36 CFR [sect] 219.19- The definition of [ldquo]ecosystem services[rdquo] includes [ldquo]long term storage of carbon[rdquo].[sect] 219.5 the planning framework is intended to allow the FS to adapt to changing conditions, including climate change.[sect] 219.6 During plan revision, FS must prepare an assessment using [ldquo]existing information[rdquo] including: [ldquo]system drivers[rdquo] such as climate change; a [ldquo]baseline assessment of carbon stocks;[rdquo] an assessment of the [ldquo]benefits people obtain[rdquo] from ecosystem services, e.g. carbon storage.The 2012 regulations are focused on planning for sustainability, including plan components that guide provision of ecosystem services such as carbon storage.[ldquo]Sustainability - The plan must provide for social, economic, and ecological sustainability within Forest Service authority and consistent with the inherent capability of the plan area, as follows: (a) Ecological sustainability. (1) Ecosystem Integrity. The plan must include plan components, including standards or guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity, taking into account: [hellip] (iv) System drivers, including [hellip] stressors, such as [hellip] climate change; and the ability of terrestrial and aquatic ecosystems on the plan area to adapt to change. [hellip] (b) Social and economic sustainability. The plan must include plan components, including standards or guidelines, to guide the plan area[rsquo]s contribution to social and economic sustainability, taking into account: [hellip](4) ecosystem services [carbon storage] [hellip][rdquo] 36 CFR [sect] 219.8.[sect] 219.10 Ecosystem services seem to be added to the list of multiple uses. And plans must [ldquo]consider[rdquo] and [ldquo]provide for[rdquo] ecosystem services through [ldquo]integrated resource management[rdquo] and must consider [ldquo]system drivers[rdquo] including [ldquo]stressors[rdquo] such as climate change.FS Handbook 1909.12- 12.42 [ndash] Assessing the Plan Area Influences on Carbon Stocks - The Interdisciplinary Team should identify influences on carbon stocks. Influences onthe carbon or carbon-bearing compounds of the carbon pool may include disease, insects, growth, management, timber harvest, vegetation, and wildfire. Consider using information assessed according to section 12.3 of this Handbook, regarding system drivers and stressors. If information is available, the assessment may include the potential change over time (flux)of carbon stocks within those pools.Climate change (and logging related carbon emissions) will have significant effects on high- elevation ecosystems, many of which are managed by the Forest Service. Berwin et al. (2017) explain that -Most of the world[rsquo]s mountain regions are warming twice as fast as the global average, speeding up microbial activity. As a result, the ratio of two key nutrients [mdash]nitrogen and phosphorus[mdash] is shifting fast, according to University of Vermont researcher Nathan Sanders, one of an international team that studied soil chemistry in seven mountain regions around the world over the course of a growing season. The changes will likely displace some plants altogether and dramatically shift the range of others, he said.The results show how some climate change impacts will occur on a global scale. The scientists made the same findings at mountain plots in Japan, British Columbia, New Zealand, Patagonia, Colorado, Australia, and Europe: As temperatures warm, nitrogen increases, but phosphorus does not, decoupling a critical cycle for plants, Sanders said. The study, published last week in the journal Nature, suggests that future climate warming will substantially alter the way that these sensitive ecosystems function.14The Trump Administration rescinded CEQ[rsquo]s Guidance on consideration of greenhouse gases (including the social cost of GHG) effective May 28, 2025.15 This decision is based on Trump[rsquo]s Executive Order 14154, Unleashing American Energy which says [ldquo][t]he calculation of the [lsquo]social cost of carbon[rsquo] is marked by logical deficiencies, a poor basis in empirical science, politicization, and the absence of a foundation in legislation [hellip][rdquo] The Trump administration[rsquo]s assertions about the social cost of carbon dioxide emissions are not well founded, so agencies would be wise to follow the law and the best available science on this instead of following the baseless assertions of the Trump administration. The Trump administration cannot by itself do away with executive agencies[rsquo] duty to follow laws duly enacted by Congress, including NEPA (which requires accurate scientific analysis of proposed actions), and NFMA planning regulations (which require managing for [ldquo]social and economic sustainability[rdquo]) both of which credibly requires consideration of the social cost of carbon dioxide emissions.The IPCC has high confidence in the impacts of climate change:/ / // / // / /14 Bob Berwyn 2017. Climate Change Causes Fundamental Shifts in the Chemistry of Mountain Soil - New research says the changes will likely displace some plants altogether and dramatically shift the range of others. https://psmag.com/global-warming-is-changing-mountain-soils-8b527fe1b7ec#.3t0ybmrav.15 Federal Register 5/28/2025. https://www.federalregister.gov/documents/2025/05/28/2025-09569/withdrawal- of-national-environmental-policy-act-guidance-on-consideration-of-greenhouse-gas.16The US Dept of State testified about the diverse and profound impacts of global climate change. 1716 https://images.firstpost.com/wp-content/uploads/2018/10/IPCC_Infographic.jpg17 Schoonover, Rod 2019. Department of State testimony on the National Security Implications of Climate Change before the House Permanent Select Committee on Intelligence. June 5, 2019. https://games- cdn.washingtonpost.com/notes/prod/default/documents/23db9731-209c-44c2-ab0f-1db57d157f51/note/7acf47a1- 8ec4-4e76-a93e-2d4dba26cb28.pdf#page=1.Ecological Integrity requires fewer roadsManagement of the transportation system is an important aspect of creating a comprehensive integrated plan for management of the Blue Mountain National Forests. The Forest Service can[rsquo]t skip this important aspect of forest management with significant impacts on soil, water quality, watershed integrity, fish & wildlife habitat and connectivity, carbon storage, climate adaptation, fire ignition risk, recreation quality, etc.The Forest Service built too many roads before we fully understood the adverse impacts of those roads on soil, water, fish & wildlife, fire, recreation etc. Many of these adverse trade-offs will only get worse as the climate warms and the hydrologic cycle amplifies. There is a scientific consensus that road density needs to be reduced to minimize and mitigate the adverse effects on roads so the agency can meet legal requirements related to sustainability, ecological integrity, viable populations, recovery of threatened & endangered species, and restoration of rare plant and animal communities.The Forest Service lacks the resources to adequately maintain those roads, so the adverse effects are poorly controlled and accelerating. Given this context, it is irresponsible to keep building more roads.Road construction is often treated by the agency as a foregone conclusion when vegetation management is proposed. This has to stop. Roads have significant adverse trade-offs that often outweigh the allege benefits of the proposed vegetation management.Given the need to avoid increasing the footprint of the road system, the plan should require the agency to focus on managing areas that are accessible from existing roads, in order to avoid all the many adverse effects of roads. As part of this planning effort, the Forest Service should include plan components that call for appropriate road density reduction and road closure (especially those with the greatest adverse impacts on watershed conditions and habitat quality) to bring each subwatershed of the Blue Mountains into compliance with legal requirements related to sustainability, ecological integrity, viable populations, recovery of threatened & endangered species, and restoration of rare plant and animal communities.The analysis should carefully weigh all the trade-offs associated with roads/culverts including:[bull] Soil disturbance, erosion, compaction, loss of forest productivity[bull] Pollution: sedimentation, thermal loading[bull] Hydrologic modification: flow interception, accelerated run-off, peak flows[bull] Impaired floodplain function[bull] Barrier to movement of wood and spawning gravel[bull] Habitat removal[bull] Reduced recruitment of snags and down wood habitat[bull] Fragmentation: wildlife dispersal barrier[bull] Human disturbance, weed vector, hunting pressure, loss of snags, litter, marbled murrelet nest predation, human fire ignition, etc.[bull] Reduced carbon storage in the road prism and in adjacent and nearby forestsIn weighing the need for veg management, the adverse effects of roads must be accounted for. 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[hellip] no truly [ldquo]safe[rdquo] 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/mi[sup2]) or less.18Reed Noss said: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.19Especially 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 WatershedsII. Climate Change and Transportation Infrastructure Including the Value of Roadless Areas for Climate Change AdaptationIII. 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 terms18 Carnefix, G. and C.A. Frissell. [ldquo]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.[rdquo] Pacific Rivers Council Science Publication (2009) 09-001. Pacific Rivers Council, Portland, OR and Polson, MT. http://pacificrivers.org/science-research/resources-publications/road-density-as-indicator19 Noss, Reed; The Ecological Effects of Roads;
https://web.archive.org/web/20101226195455/http://www.wildlandscpr.org/ecological-effects-roads.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 sequestrationThe 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).20Science indicates that the erosion from roads is far worse than that from severe fire.21 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. [hellip] 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. [hellip] Subbasins having the highest forest integrity values were largely unroaded [hellip] Conversely, subbasins [hellip] that had been intensively roaded, typically had the lowest forest integrity [hellip][hellip]Major decreases in pool habitat have been caused by two factors: the loss of riparian vegetation, and road and highway construction accompanying human20 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. 2017. Locating spatial variation in the association between road network and forest biomass carbon accumulation. Ecol. Indic. 73, 214[ndash]223. https://www.sciencedirect.com/science/article/abs/pii/S1470160X16305738.21 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.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. [hellip] The amount of fine sediment (sediment less than6 mm) on channel beds is another important aspect of habitat quality that apparently is influenced by management. The results of our analysis indicateroad density significantly affects surface fines and corroborates the link between forest management practices and channel sediment characteristics. [hellip] [T]he proportion [of strong salmonid populations] declines with road density. [hellip]Roads and Associated ActivityRoads 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.[hellip]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.22We would be kidding ourselves to think that [ldquo]modern road practices[rdquo] avoid these problems, because the described effects seem to be mostly inherent and unavoidable outcomes of roads. The burden is on the agency to show otherwise.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. [hellip] [S]ilviculture sources contributed to impairment of 19,444 miles of rivers and streams [nationwide]. [hellip] 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).23NRDC issued a report that discusses the impacts of roads:1. Harm Wildlife2. Spread Tree Diseases and Bark Beetles3. Promote Insect Infestations4. Cause Invasion by Harmful Non-native Plant and Animal Species5. Damage Soil Resources and Tree Growth6. Adversely Impact Aquatic Ecosystems2422 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.pdf23 EPA 2012. Notice of Intent To Revise Stormwater Regulations [hellip] 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.24 NRDC 1999. [ldquo]End of the Road: The Adverse Ecological Impacts of Roads and Logging: A Compilation of Independently Reviewed Research[rdquo] (1999), https://web.archive.org/web/20081024112126/http://www.nrdc.org/land/forests/roads/eotrinx.asp. See also this annotated bibliography of road related research:The Forest Service has reported that forest roads have negative effects on water quality, fires, wildlife habitat, invasion by exotic species, and local economies.25 The plan should reflect this science as well as the science found in the Draft Review and Comment on: Forest Service Roads: A Synthesis of Scientific Information, 2nd Draft.26The agency lacks the funds to maintain existing roads, so it is arbitrary and capricious to build more. In Oregon alone, there are over 70,000 miles of national forest roads with more than a half billion dollars of deferred maintenance needs. Over 100 million dollars of that maintenance need is considered [ldquo]critical.[rdquo] From 1998 to 2002, the Forest Service subsidized road construction to the tune of almost $40,000,000.00.27Roads have a particularly negative influence on aquatic and riparian ecosystems and organisms. Roads interfere with movement of materials and organisms in three dimensions: upstream/downstream, channel/upland, and surface/subsurface.28 Roads are also a conveyor belt for delivering chronic sediment to streams.29 These effects cannot be adequately mitigated so it is best to just avoid building roads.As far as we know, the Forest Service still has a Roads Policy and they must follow it. See our related comments on the impacts of roads on big game.Riparian/AquaticsRiparian and aquatic ecosystems are degraded by decades of logging, roads, and grazing. The Plan must identify restoration needs and include plan components and [ldquo]standards or guidelines, to maintain or restore the ecological integrity of riparian areas in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity [hellip] taking into account [hellip] Aquatic and terrestrial habitats; [hellip] connectivity; Restoration needs[rdquo] 36 CFR 219.8(a).http://web.archive.org/web/20061008112434/http://www.wildlandscpr.org/resourcelibrary/rremresources/RoadR eferences.doc.25 USDA Forest Service, [ldquo]Forest Roads: A Synthesis of Scientific Information,[rdquo] Pacific Northwest Research Station, General Technical Report PNW-GTR-509. May, 2001. Page 4. https://www.fs.usda.gov/pnw/pubs/pnw_gtr509.pdf26 Draft Review and Comment on: Forest Service Roads: A Synthesis of Scientific Information, 2nd Draft, USDA FS:[bull] Ecological impacts - by Jack Wade (http://web.archive.org/web/20061008094731/http://www.wildlandscpr.org/resourcelibrary/reports/wade_report2.html).[bull] Socio-economic impacts - by Daniel Brister (http://web.archive.org/web/20061008094703/http://www.wildlandscpr.org/resourcelibrary/reports/brister_commnets.html).27 See PRC. Road Wrecked: Why the $10 Billion Forest Service Road Maintenance Backlog Is Bad for Taxpayers, Taxpayers for Common Sense. March 2004. http://pacificrivers.org/files/roads/RoadWreckedFINAL.pdf.28 Jim Doyle, Where the Water Meets the Road. http://web.archive.org/web/20070325061623/http://www.fsl.orst.edu/geowater/RRR/jim/aquahab/index.html.29 Michael Derrig. Road Improvements for Watershed Restoration. http://www.fsl.orst.edu/geowater/PEP/calfed/derrig/index.html.The draft plan includes Objectives (MA3A-RMA OBJ) which calls for more than 1,000 acres per year or [ldquo]silvicultural thinning[rdquo] in RMAs. This must be removed, because removing trees from RMAs is removing biophysical elements necessary to meet NFMA requirements related to sustainability and ecological integrity. Alternatively, the plan should specify that thinning be done non-commercially so the wood is left in the RMA to fulfill its biophysical functions.Dead wood in and near streams plays critical ecological roles in dissipating energy, capturing/storing/releasing water/sediment/wood, partitioning habitat, thermal buffering, providing substrate for biodiversity, travelways, etc.30 Functional wood is already in short supply in the Blue Mountains, and logging in streamside areas will capture mortality and make a bad situation worse. Logging medium and large trees in riparian areas should be prohibited.Thinning small trees also needs to be carefully considered because small wood can provide key ecological functions, especially in small streams which are the majority of the stream network.Riparian areas are also highly degraded by livestock grazing which destabilize streambanks and floodplains, adversely modifies width/depth, reduces vegetation diversity and all the functions that it plays in the streamside areas, raises stream temperature, adds harmful nutrients and bacteria, pollutes water, spoils recreation, etc. Control of livestock grazing must be identified as a restoration need and standards & guidelines must be adopted to prevent adverse effects.Riparian areas should be identified as unsuitable for grazing.31The desired condition states that NF lands will [ldquo]contribute to native assemblages of riparian- dependent plants and animals.[rdquo] This needs to be rewritten to include a desire for viable populations of native species. [ldquo]Contribute[rdquo] is a worthless wiggle word, that provides no meaningful guidance. Contribute a little or a lot?Desired conditions for RMAs include a long list of parameters followed by [ldquo]sufficient to sustain physical complexity and stability.[rdquo] This means nothing. A little complexity or a lot? A little stability or a lot? This is empty guidance. Plan components must be linked to NFMA requirements for sustainability and ecological integrity.RMAs capable of [ldquo]supporting self-sustaining populations of native and desired non-native aquatic and riparian-dependent plant and animal species[rdquo] needs to be amended to include NFMA requirements to maintain viable populations of species of conservation concern, recovery of threatened & endangered species, and restoration of rare plant and animal communities. 36 CFR 219.9.The draft plan calls for various activities in RMAs to [ldquo]minimize[rdquo] adverse effects. This weakens current standards. The plan should retain the [ldquo]do not retard stand from PACFISH/INFISH. The plan revision EIS should disclose the adverse consequences of this change. The baseline for comparing adverse effects is relative to the natural recovery rate, not relative to the existing degraded state. Our watersheds are in crisis after 100 years of grazing and logging and roads.Numerous fish populations are threatened with extinction. As reflected in PACFISH/INFISH30 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[rsquo]Neil. OSU Press. 2001) http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf.31 Heiken D., 1995. RIGHT PLACE -- WRONG ANIMAL: Determining Grazing Suitability Based on Desired Ecosystem Outcomes for the Interior Columbia River Basin. Association of Forest Service Employees for Environmental

Ethics. May 1995. https://www.dropbox.com/s/ucw50hhs8xsiz2k/AFSEEE%20Grazing%20Suitability%20Report.doc?dl=0.and the applicable biological opinions, making slow progress is not enough. We must let watersheds heal at a natural rate dictated by natural processes. This will require removing roads, removing livestock, and protecting RMAs from logging.The draft plan includes a standard that prohibits retarding recovery of federally listed species. This raises major concerns because it is a big back-track from PACFISH/INFISH which apply the [ldquo]do not retard[rdquo] standard across the landscape. NFMA requires conservation of habitat to support viable populations of fish & wildlife, which is a more robust standard than threatened & endangered. Given the degraded state of watersheds, and the tremendous need for restoration, the FS cannot meet legal requirements by weakening or limiting the [ldquo]do not retard[rdquo] standard.The Forest Service has done a poor job applying the do not retard standard over the last 3 decades. The do not retard standard must be interpreted to mean what it says. NOT slow incremental movement in the right direction, but rapid recovery at a pace dictated by natural processes.The draft plan says stream crossings should be designed to allow organisms to pass [ldquo]where connectivity has been identified as an issue.[rdquo] This qualifier must be removed in order to meet NFMA requirements related to sustainability and ecological integrity. When and where will this connectivity issue be identified? Who has the authority to make it?Draft Plan (p 115) says [ldquo]To protect water, aquatic, and riparian resources, new and existing special uses authorizations should include actions that result in maintenance or restoration of those conditions and processes.[rdquo] This is unclear. Does [ldquo]those conditions and processes[rdquo] refer to the [ldquo]water, aquatic and riparian resources,[rdquo] or to the special use authorizations? Please clarify.The draft plan (p 115) says that stubble height along the [ldquo]green line[rdquo] in RMAs can be taken down to 4-6[rdquo]. This is not adequate to meet NFMA requirements related to sustainability and ecological integrity.The draft plan document includes an Appendix with the ARCS, but it is not clear whether the ARCS is being adopted as plan components and standards & guidelines. For instance, are key watersheds and priority watersheds being identified? Will watershed analysis be required for activities in RMAs? Will watershed analyses be used to guide management activities? Will recommendations in updated watershed analyses be based on best available science or based on Trump admin priorities for resource exploitation?The [ldquo]watershed restoration action plan[rdquo] (p 160) recommended as part of the Watershed Analysis must not be used to justify aggressive logging and roads without considering less impactful alternatives such as non-commercial thinning and prescribed fire, and various mitigation actions that address trade-offs caused by logging and roads. Watershed Analysis is not a NEPA document, and recommendations that flow from watershed analyses do not have the force to violate NEPA[rsquo]s mandate to consider alternatives.Draft plan (p 53) calls for [ldquo]Reduc[ing] juniper canopy cover to less than 10 percent in sagebrush steppe habitat, mahogany, meadows, springs, seeps, or riparian areas.[rdquo] This is overly prescriptive and unnecessary. Science shows that:[bull] Native juniper plays important ecological roles and stores carbon.[bull] It provides wildlife food and habitat.[bull] It helps suppress weeds.[bull] It helps shade streams and provide bank stability.[bull] Juniper is not the [ldquo]water thief[rdquo] it is often accused of.The revised plan should retain the benefits of juniper in order to contribute to the diverse ecosystem services provided by this native species. If juniper control is required it should focus on hand felling of small trees in areas of recent encroachment, high priority sage grouse habitat, areas more than 100 feet from water features, and areas accessible from existing roads. Cut juniper should be retained on site to retain and recycle nutrients, and avoid the adverse effects juniper removal via heavy equipment.Juniper trees, along with their berries, provide food and shelter to over sixty species of birds. The Townsend's Solitaire is highly dependent on juniper berries for winter food. The scientific basis for juniper control is highly questionable. Juniper will take care of itself after you remove livestock and reintroduce fire.Juniper treatments tend to increase invasion by invasive plants. See Coop & Magee 2016: Treatments exhibited rapid, large, and persistent increases in the frequency, richness, and cover of 20 non-native plant species including cheatgrass (Bromus tectorum). Exotic plant expansion appears linked to the disturbance associated with treatment activities, reductions in tree canopy, and alterations to ground cover. [hellip] [I]ncreased herbaceous surface fuels including exotic annuals are expected to alter potential fire behavior via [hellip] increased surface fire intensity, flame length, and rate of spread. [hellip] We encourage managers carrying out P-J mastication projects to explicitly consider 1) potential trade- offs between desired treatment outcomes and potentially unwelcome impacts [hellip]32Kerns and Day (2014) foundthat areas with higher juniper abundance to begin with seemed to show a resistance to invasion by exotic annual grasses, perhaps because the exotics are intolerant to shade. Their work has important lessons for conservation efforts and land management goals, especially given the strong push from ranchers and sage grouse advocates to remove junipers. If a juniper woodland is already invaded by exotic grasses, thinning treatments and their associated disturbances such as slash pile burning and skid trail formation[mdash] even if followed by seeding[mdash]may not be enough to restore native grasslands in the short term.33Contrary to common misconceptions there is in fact often a positive relationship between juniper basal area and native grass/forb cover (e.g., bluebunch wheatgrass, Sandberg bluegrass, and richness of native perennial) relative to exotic grasses, while juniper removal tends to32 See Coop & Magee 2016. Integrating Fuels Treatments and Ecological Values in Pi[ntilde]on-Juniper Woodlands: Fuels, Vegetation, and Avifauna Final Report to the Joint Fire Science Program. Agreement number L13ACOO237. https://www.firescience.gov/projects/13-1-04-45/project/13-1-04-45_final_report.pdf33https://web.archive.org/web/20150504040528/http://www.fs.fed.us/pnw/research/2015/apr/index.shtml#thinning citing B. K. Kerns and M. A. Day. 2014. Fuel Reduction, Seeding, and Vegetation in a Juniper Woodland. Rangeland Ecology & Management 67(6):667-679. 2014; doi: http://dx.doi.org/10.2111/REM-D-13-00149.1.http://www.bioone.org/doi/abs/10.2111/REM-D-13-00149.1.increase exotic annual grasses relative to native plants. Even with follow-up seeding with native plants, the treated area was [ldquo]highly invaded by exotic grass![rdquo]34Removing juniper can increase cover of weeds such as cheatgrass at the expense of other native plants.35 In fact, juniper is associated with native vegetation cover, while removing juniper tends to spread and increase weeds.Contrary to common assumptions about trees and water yield, new science indicates that moderate tree cover might actually benefit hydrology. Ramsay (2016): [ldquo]In arid places where water is scarce, the planting of trees is often discouraged out of the belief that trees always reduce the availability of much-needed water. Yet scientists working in Burkina Faso found that when a certain number of trees are present, the amount of groundwater recharge is actually maximized. The study is a [ldquo]game changer[rdquo], according to one of the study[rsquo]s authors, [hellip] [lsquo]The most important point of our study is to show that a trade-off between water and tree cover doesn[rsquo]t always exist, and that more trees can actually improve groundwater recharge.[rdquo]36New science indicates that the alleged hydrologic impacts of juniper may be miscalculated. The water resources used by trees may be much more segregated than previously thought from the water resources discharged to streams. Once the root zone is recharged, which happens every winter, the trees have little impact on the annual discharge of water to streams.37Niemeyer (2016) found -Despite that many toute that pinyon and juniper removal will augment water yield, these assertions are often based on studies in humid forests or anecdotal evidence. Many studies in pinyon and juniper watersheds reveal negligible increase in streamflow (Clary et al. 1974; Baker Jr 1984; Dugas et al. 1998; Baker Jr and Ffolliott 2000; Owens and Moore 2007). In other cases woody plant expansion increased streamflow (Wilcox and Huang 2010) and in another case woody plant die-off decreased streamflow (Guardiola-Claramonte et al. 2011). As a result of this scientific literature, many scientists question whether pinyon and juniper removal actually results in appreciable gain in most34 Kerns, B.K., and M.A Day. 2013. Powerpoint: The Crooked River National Grassland Westside Wildland Urban Interface Fuel Reduction Project Effect of Juniper Cutting and Seeding on Vegetation. https://web.archive.org/web/20150530003509/http://www.firescience.gov/projects/05-2-1-05/project/05-2-1-05_Kerns_ppt_for_051513.pdf.35 Coultrap D, Fulgham K, Lancaster D, Gustafson J, Lile D, et al. (2008) Relationships Between Western Juniper (Juniperus Occidentalis) and Understory Vegetation. Invasive Plant Science and Management: Vol. 1, No. 1 pp. 3[ndash]11. https://bioone.org/journals/invasive-plant-science-and-management/volume-1/issue-1/IPSM-07- 008.1/Relationships-Between-Western-Juniper-Juniperus-Occidentalis-and-Understory-Vegetation/10.1614/IPSM- 07-008.1.pdf.36 Deanna Ramsay 2016. Finding water amid the trees - More trees in arid areas could lead to more water access[mdash] which is good news for hundreds of millions of the world[rsquo]s poorest people. https://forestsnews.cifor.org/40702/finding-water-amid-the-trees?fnl=en; citing Ilstedt, U.; Tobella, B.; Bazi[eacute], H.R.; Verbeeten, E.; Nyberg, G.; Benegas, S.L.; Murdiyarso, D.; Laudon, H.; Sheil, D.; Malmer, A. 2016. Intermediate tree cover can maximize groundwater recharge in the seasonally dry tropics. Scientific Reports 6: 21930. DOI: 10.1038/srep21930 http://www.cifor.org/publications/pdf_files/articles/AMurdiyarso1601.pdf.37 See Oregon State University (2010, January 23). Water hits and sticks: Findings challenge a century of assumptions about soil hydrology.

ScienceDaily. Retrieved March 15, 2010, from
http://www.sciencedaily.com/releases/2010/01/100121173452.htm. BROOKS, J., H. Barnard, R. COULOMBE, ANDJ. McDonnell. Ecohydrologic separation of water between trees and streams in a Mediterranean climate. Nature Geoscience. 3, 100 - 104 (2010).Published online: 20 December 2009| doi:10.1038/ngeo722.http://www.nature.com/ngeo/journal/v3/n2/abs/ngeo722.htmlhttps://andrewsforest.oregonstate.edu/sites/default/files/lter/pubs/pdf/pub4611.pdf.landscapes is highly contested (Huxman et al. 2005; Wilcox et al. 2006; Roundy and Vernon 1999; Ffolliott and Gottfried 2012).[hellip]Whether woody plant removal actually increases water yield depends on the physical traits of the plants (rooting depth, canopy size, etc.), climate (precipitation amount, seasonality, and intensities), soil type, and geomorphology (Thurow and Hester 1997; Huxman et al. 2005; Wilcox et al. 2006). Many researchers assert that based on previous water yield studies, only sites with more than 450 mm (18 inches) of precipitation will result in increased water yield if pinyon and juniper are removed (Hibbert 1983; Wilcox 2002; Kuhn et al. 2007).[hellip] Two empirical studies are underway in the northern pinyon and juniper cover range[hellip], the South Mountain paired-catchment study in southwestern Idaho by the USDA- ARS in Boise, Idaho and the Porter Canyon Experimental Forest administered by the USDA-ARS in Reno, Nevada in winter-dominated precipitation regimes. These studies could clarify if and where increases in streamflow would occur with PJ removal.38The agency should carefully consider the trade-offs associated with juniper removal. One of those trade-offs involves the lost opportunity to store carbon that mitigates global climate change. Landscape scale expansion of juniper woodlands is providing an ecosystem service (carbon storage via natural afforestation) and juniper removal erases that benefit. Campbell et al. (2012): [ldquo]unlike forest growth which is balanced by natural disturbance, timber harvest, and land conversion, woody encroachment is assumed to be largely one-directional with the potential result of a [significant] North American net carbon sink. [hellip] [T]he highest biomass shrubs with which juniper competes in Oregon (namely, Artemisia spp.) have an average biomass per unit crown cover of only 8% that of juniper (derived from juniper allometry of Sabin [2008], and sage allometry of Rittenhouse and Sneva [1977]). This means that even when juniper cover replaces sage cover on a one-to-one basis (as reported by Miller et al. 2005), aboveground biomass lost in shrubs is less than 8% that gained in aboveground juniper biomass. [hellip] This study illustrates the capacity of woody removal, over very small areas, to offset encroachment over very large areas [hellip][rdquo]39Ecological Integrity [ndash] Structure, function, composition, connectivity.The NMFA regulations require:[ldquo]The plan must include plan components, including standards or guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore structure, function,38 Ryan Niemeyer. 2016. Juniper Hydrology website - Streamflow Paradox. https://rniemeyer07.github.io/Juniper_Hydrology/streamflow/streamflow_paradox/.39 Campbell, J.L., R. Kennedy, W.B. Cohen, and R. Miller. 2012. Regional carbon consequences of Western Juniper encroachment in Oregon. Journal of Rangeland Ecology and Management. 65(3):223-231.
http://larse.forestry.oregonstate.edu/sites/larse/files/pub_pdfs/Campbell_etal_2012.pdf. See also Barger, N.N.,A.R. Archer, J.L. Campbell, C. Huang, J.A. Morton, and A.K. Knapp. 2011. Woody plant proliferation in North American drylands: A synthesis of impacts on ecosystem carbon balance. Journal of Geophysical Research. 116, G00K07,
doi:10.1029/2010JG001506.http://fes.forestry.oregonstate.edu/sites/fes.forestry.oregonstate.edu/files/PDFs/Barger_2011_JGR.pdf ([ldquo]The greatest tree biomass response occurred in Great Basin sagebrush steppe sites encroached upon by western juniper (J. occidentalis), sites strongly dominated by winter precipitation. [hellip] Changes in [above ground biomass] pools were greatest in systems experiencing Juniperus and Pinus spp. Encroachment [hellip][rdquo])composition, and Connectivity, taking into account [hellip] contributions of the plan area to ecological conditions within the broader landscape [hellip][rdquo]36 CFR 219.8(a).Retain more basal area when loggingThe revised plan should not use outdated agricultural models of forestry that try to suppress or eliminate natural mortality processes. Mortality is a natural and desired ecological process in our National Forests. There is currently a deficit of dead wood and large trees on the Blue Mountain National Forests and business-as-usual logging will only make them worse. It is necessary to recruit more large trees and dead wood which serves a wide variety of ecological functions.40In order to meet legal requirements related to sustainability, ecological integrity, viable populations, recovery of threatened & endangered species, and restoration of rare plant and animal communities, thinning prescriptions must retain enough basal area to perpetuate natural

processes, give natural processes something to act upon, and restore depleted populations of large trees and large dead wood.We urge the agency to retain greater basal area when logging. 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. Maintaining basal area is also necessary to restore populations of large trees and large snags, and can partially mitigate loss of carbon storage.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 treescan 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:[bull] 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.[bull] 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.40 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[rsquo]Neil. OSU Press. 2001) http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf.[bull] 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.[bull] 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[rsquo] stocking guides were created and intended to be used as a tool to avoid mortality which is clearly inconsistent with ecosystem management. The FS often relies on Powell (1999) who said: [ldquo]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[rdquo]41 Healthy forests require dead trees, sometimes in abundance, in order to meet the needs of diverse wildlife and provide full suite of ecosystem functions.42A 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 USFS Microsoft Teams public meeting held Feb 1, 2023 to discuss the draft report of the [ldquo]2nd Annual Adaptive Management Workgroup: Management Direction for Large Diameter Trees[rdquo] 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./ / // / // / /41 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_016

034.pdf.42 Rose et al. (2001).43Cutting 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.Conserve and restore mature and old-growth trees and forestsSee the information and analysis regarding management of and for mature and old-growth trees and forests previously provided by Oregon Wild and others in comments on the Assessment Reports and the Preliminary Need for Change.The revised plan redefines large trees to allow logging of grand fir trees 21-30[rdquo] dbh, AND significantly weakens protections for large trees, old trees, and legacy trees of all species by allowing removal of large trees to meet other purposes. [ldquo]05. To maintain, move toward, or achieve ecological desired conditions where removal of smaller trees alone is not effective, old trees and large trees may be felled or removed. This may include to provide complex instream large wood structure; to increase space and resources for aspen, cottonwood, whitebark pine, and old trees; and to meet desired conditions for forest species composition and density. See also FW-WTR-DC, FW- VEGNF-DC, FW-FOR-CMP-DC, and FW-FOR-DEN-DC.[rdquo] (draft plan pp47-48). This is a huge loophole and there are likely many more loopholes buried in [ldquo]except as provided in other plan components.[rdquo] All this will render the large tree protections in the revised plan virtually meaningless, and undermine any assurance that the revised plan will meet legal requirements related to sustainability, ecological integrity, viable populations, recovery of threatened & endangered species, and restoration of rare plant and animal communities.43 USFS 2023. USFS Microsoft Teams public meeting held Feb 1, 2023 to discuss the draft report of the [ldquo]2nd Annual Adaptive Management Workgroup: Management Direction for Large Diameter Trees[rdquo] https://usfs-public.app.box.com/v/PinyonPublic/file/935341953116These changes are not needed either, because: (1) species composition and stand density can almost always be met by removing smaller trees <16-20[rdquo] dbh. Any incremental gain from removing large trees is vastly outweighed by the loss of valuable and hard to replace large tree/snag habitat, which is gained by retaining large trees, and (2) it is fairly rare to find large grand fir and large Ponderosa pine growing together. The plan needs to require the Forest Service to carefully weigh trade-offs, e.g., the incremental gains related to species composition and stand density, versus the significant and long lasting adverse effects of removing large trees on soil, water, carbon, wildlife habitat, etc.The Eastside Screens recognized the profound ecological and social value of large trees, and the severe deficit of large trees due to decades of unsustainable logging, and called for remaining large trees to be retained, AND managing all stands toward mature and old-growth conditions. The draft plan guts that policy (p 48) [ldquo]For each project proposing the removal of large trees or old trees, demonstrate through project analysis that over time management actions move the landscape towards desired conditions and that large and old trees are distributed in a manner and are of enough abundance to sustain old forest conditions and wildlife habitat through time.[rdquo] There is no meaningful guidance here to ensure that projects implementing the plan will retain enough trees to meet legal requirements related to sustainability, ecological integrity, carbon storage as an ecosystem service, viable populations, recovery of threatened & endangered species, and restoration of rare plant and animal communities. There is a severe shortage of large trees on the eastside. Any removal of large trees will make a bad situation worse (same for regen harvest or heavy thinning that depletes the population of green trees needed for future recruitment of large trees).There is evidence that natural mortality processes are self-correcting the species composition, and getting the job done better than logging because natural processes kills the trees that are least fit to survive, and natural processes create and retain snags, and dead wood habitat. In 2022, forest scientists reported a [ldquo]Firmageddon[rdquo] event, where true firs such as white fir and grand fir and noble fir were dying across large areas of eastern Oregon, apparently from drought stress.44There is evidence indicating that Grand fir may be more fire resistant than assumed in the NEPA analysis supporting the Screens Amendment. Moris et al. (2022):The grand fir forest type had severity values at the same level of forest types dominated by fire-resister species despite grand fir was classified as a fire-avoider species. [hellip] In many ponderosa pine forests maintained historically by a high frequency, low-severity fire regime, the transition towards denser forests dominated by Douglas-fir and grand fir would explain why ponderosa pine and Douglas-fir still compose a significant proportion of basal area in the grand fir forest type, and many maintain large, old, fire-resistant ponderosa pine trees (Johnston et al. 2021; Merschel et al. 2021). Therefore, the particular structure and composition of these [ldquo]recent[rdquo] grand fir forests (e.g., Merschel et al. 2014), with an important presence of large-diameter trees of fire-resistant species, may provide latent fire resistance (Larson et al. 2013).4544 See Nathan Gilles 2022. Massive die-off hits fir trees across Pacific Northwest | Columbia Insight (AP) Updated: Nov 27, 2022. https://www.mailtribune.com/top-stories/2022/11/27/massive-die-off-hits-fir-trees-across-pacific- northwest/.45 Jose V. Moris, Matthew J. Reilly, Zhiqiang Yang, Warren B. Cohen, Renzo Motta, Davide Ascoli 2022. Using a trait-based approach to asses fire resistance in forest landscapes of the Inland Northwest, USA. Landsc Ecol (2022) 37:2149[ndash]2164. energyhttps://doi.org/10.1007/s10980-022-01478-w,https://www.fs.usda.gov/rm/pubs_journals/2022/rmrs_2022_moris_j001.pdf. See also, EFC (2025) In Defense ofSince the Eastside Screens were adopted new information has come to light on the value of old trees that are not very large. Franklin & Johnson (2013) explain why it is important to conserve small old trees:Box 8: Removal of Small Old Ponderosa Pine Trees in Dry Forest Restoration ProjectsRemoval of small (<21" dbh), older (>150 yr) ponderosa pine trees is sometimes proposed as a part of Dry Forest restoration projects. These older trees are important ecological components of Dry Forests, despite their smaller size, which is why we recommend their retention along with larger old trees. Ponderosa pine >150 years include older mature pines (150 to 200 years) that are beginning to develop old-growth attributes and will become fully developed old-growth trees after about 200 years.Small old trees fulfill many of the functions that larger old trees provide. These trees have:1. A significant percentage of heartwood, which exhibits different patterns of decay than sapwood (in live trees, snags, and logs). Young ponderosa pine have relatively little and poorly developed heartwood. Snags from old trees persist for a longer time than snags from younger trees of comparable (or even larger) diameter, and down wood (either bole or branches) decays differently than that of young trees.2. Distinctive complex crowns and large branches that differ from those found on younger pines and that often have developed various defects (e.g., forks, brooms, and cavities) not present in younger ponderosa pine.3. Greater value for wildlife than young trees of comparable or even larger diameter as a consequence of the preceding points [ndash] complex and distinctive crowns and significant heartwood content, which is reflected in quality wildlife habitat in both living and dead trees.4. Bark that is thicker and fire resistant relative to the tree[rsquo]s diameter, making the trees more resistant to fire than younger trees of comparable diameter. Since these smaller old trees exhibit many of the attributes of larger old trees, albeit it on a smaller scale, their retention is part of ecologically-focused restoration treatments.When clusters of old ponderosa pine trees that include small old trees are encountered, silviculturists sometimes assume that significant competition must be taking place within these clusters, particularly if they observe mortality of individual trees. This inference of significant competition is unwarranted, however, and may reflect the silviculturist[rsquo]s projection of the competitive processes of tightly spaced young trees. The old trees in these clusters have not only survived that period of youthful competition but almost certainly have established mutual relationships with each other, such as significant rootGrand Fir. https://www.canva.com/design/DAGyC3lKAzU/kof3GUh0LrGxd_-0hoOVXA/edit?utm_content=DAGyC3lKAzUk2.grafting and shared mycorrhizal masses. Thus, these clusters of old trees are more likely to be mutually supportive than competitive.Nevertheless, proposals for removal of removal of small older pine trees will arise and the following points should be considered:1. An ecological justification for the removal of small (<21" dbh), old (>150 yr) ponderosa pine trees has not been established.2. Proposals for removal of small old ponderosa pine trees would need to be based on economic necessity[mdash]that removal of some or all of these trees is necessary to create an economically viable or an economically more valuable restoration project.3. If a project is calculated to be non-viable economically, we recommend consideration of the following adjustments prior to planning removal of small old ponderosa pine trees:¦ Adjustment of the boundaries of the project area so as to include additional areas that will generate larger volumes of wood during restoration;¦ Increase in the amount of wood marked for removal in trees <150 years even if this requires modification of target restored stand basal areas or trees/acre;¦ Elimination of restoration activities included as costs in the calculation of sale economics that are not essential to accomplishing the stand-level restoration goal; and,¦ Consider the potential for collaborators and partners to find funds.4. If the restoration project remains non-viable after making the above adjustments, consider the alternative of whether or not to remove some small older ponderosa pine trees, including an assessment of how many such trees would have to be removed in order to achieve economic viability.5. Calculation of economic viability should be based on the appraisal or other formal analysis that includes actual cruise or inventory data.6. If a decision is made to proceed with cutting sufficient small older ponderosa pine trees to achieve viability, select only a sufficient number of such trees to achieve the economic break-even point.7. The older trees selected for removal should come from the mature (150 to 200 year) age class; removal of fully developed (>200 year old) ponderosa pine should be avoided.8. The decision process should be transparent, well documented to ensure that stakeholders and collaborative groups understand the basis for removing old trees.4646 Franklin, J.F., Johnson, K.N., et al 2013. Restoration of Dry Forests in Eastern Oregon [ndash] A Field Guide. The Nature Conservancy, Portland, OR. 202 pp. http://nature.ly/dryforests.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 [ldquo]maximize durability while minimizing [hellip] damage[rdquo].47Zust et al. (2011):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 differencebetween 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.48De la Mata et al (2017) studied the variable survival of Ponderosa pine during a mountain pine beetle (MPB) outbreak and found that slow growing trees had an advantage -Growth rates have fitness consequences and selection is expected (23). Indeed, we found significant genetic responses to selection on growth rates, but importantly, these responses changed in direction and strength over time (Fig. 2A). Fast growth was positively selected before the outbreak, but negatively selected during the outbreak, clearly showing that intense herbivory shifted selection patterns. Fast growth in trees under competitive environments is critical for light acquisition and resource capture, and slow growth is selected against and underrepresented at mature stages (27). Consistently, selection for fast growth was strongest during early seedling establishment when density- dependent mortality in trees typically occurs (38) and when the proportion of seeds that attain maturity is usually very small (6). The MPB outbreak, however, caused significant selection differentials in the opposite direction (positive selection for slow-growing phenotypes), which triggered a negative genetic response after the outbreak (Fig. 2A).Our results are consistent with studies showing that fast early growth within tree species correlates with decreased longevity (29) and increased herbivory at maturity (30), and provide strong empirical evidence of the conflicting effects of growth rates on fitness during ontogeny.47 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.48 Tobias Z[uuml]st, 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 citing Beth Roskilly, Eric Keeling, Sharon Hood, Arnaud Giuggiola, Anna Sala. 2019. 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. 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 ([ldquo]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 fastand 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.[rdquo]). 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.[hellip]Our results also have important management implications. Tree improvement programs supply seed resources for managed tree plantations, and for restoration purposes after natural and human-caused disturbances (e.g., fire, severe drought, and reclamation).These programs have traditionally focused on selection on growth-related traits (52), although efforts to breed for tree resistance against insects and pathogens are currently in place (53). Our results indicate that the traditional focus on fast-growth by tree breeding programs may reduce survival under intense, unpredictable stress (54).49In order to conserve forest values that have been severely degraded over many decades of forest mismanagement on the eastside, the Forest Service must protect all available large AND old trees, especially those that are naturally fire tolerant such as Ponderosa pine, larch, sugar pine, white pine, lodgepole pine, and Douglas fir. Large trees also contribute to the canopy that helps retain moisture and shade and thereby reduces fuel desiccation and fire danger. Large trees also perform hydraulic lift whereby deep roots of large trees bring water up from deep soil horizons and during the night and make it available to plant communities with shallower root systems.Protect large grand firThe revised plan intends to adopt a significant change in the last 30 years of policy to allow logging of large grand fir trees 21-30[rdquo] dbh. There is no compelling ecological rationale for removing large trees.As with any forest planning effort, the Forest Service is trying to advance multiple, potentially competing, objectives. This requires harmonizing goals that may be in conflict, rather than maximizing any particular goal. The existing requirements of the Eastside Screens already permit harmonizing of diverse goals.Adjusting species composition in areas that have been encroached by an uncharacteristic abundance of shade-tolerant conifers, is a laudable goal in some areas, but diversity of tree species has ecological value and shifting species composition should not be pursued to the detriment of large tree restoration. Species composition can be managed to a great degree by focusing on thinning the overabundant small trees, and will be further advanced when the disturbance regime is restored. The goal of restoring large trees and large snags requires conserving large trees and snags. The large tree restoration goal will be significantly delayed if this amendment is approved.There are many trade-offs associated with removing large trees. The purpose and need cannot be one-sided and ignore these trade-offs. The purpose and need for this proposal should include maintaining and restoring the full suite of values associated with large trees and relatively dense forest canopies, including: large green tree habitat, large snag habitat, accumulations of large down wood, carbon storage in the forest, cool-moist microclimate, inter-tree competition leading to natural selection of genotypes fit for survival, clumpy spatial patterns among trees, mitigation49 Raul de la Mata, Sharon Hood, and Anna Sala 2017. Insect outbreak shifts the direction of selection from fast to slow growth rates in the long-lived conifer Pinus ponderosa. PNAS. www.pnas.org/cgi/doi/10.1073/pnas.1700032114.for shortages of large tree values on-site and elsewhere on the landscape, meeting the objectives of the Eastside Screens, etc.In 2003, PNW Regional Forester Linda Goodman issued a memo saying [ndash] "science findings ... reinforce the importance of retaining and recruiting large, old trees in the eastside landscape.... The objective of increasing the number of large trees and LOS stands on the landscape remains.[rdquo] These science findings remain well-supported.The enclosure to the 2003 Goodman memo says "It is critical that silvicultural prescriptions provide for large snags in adequate numbers (as indicated by DecAID and other tools) through time to provide habitat for these species." Sadly, the existing snag standards are scientifically discredited and the Forest Service has not updated their snag standards to ensure that large snags are provided in adequate numbers. This [ldquo]critical[rdquo] policy cannot be followed until snag standards are brought into conformance with the best available science.In 2015, Regional Forester James Pe[ntilde]a[rsquo]s issued a memo saying to [ldquo]consider site-specific Forest plan amendments where this will better meet LOS objectives by moving the landscape towards HRV, and providing LOS for the habitat needs of associated wildlife species." This clearly indicates that restoring species composition should not trump conservation of LOS components and wildlife conservation. All these purposes of large tree conservation need to be explicitly considered and met.The NEPA analysis must also consider and disclose the fact that the agency can substantially meet ALL of its goals related to density reduction, fuel reduction, and species composition, and legacy tree culturing by focusing on removal of young trees less than 21[rdquo] dbh.The purpose and need, effects analysis, alternatives and mitigation need to address all the evidence both for and against removing large trees. The Forest Service must address reasonable opposing viewpoints. Likely effects of large tree removal, and sound reasons to conserve rather than remove large trees include:1. Killing and removing large trees will transfer carbon from the forest to the atmosphere and forego additional carbon sequestration in large trees that are allowed to keep growing. This will exacerbate global climate change and ocean acidification.2. Killing and removing large trees will reduce the population of large trees and the valuable habitat they provide, including and bark habitat (used by bats, birds and arboreal mammals), canopy habitat, etc.3. Killing and removing large trees will eliminate an important source of large snag and large wood recruitment. This is a significant long-term effect exacerbated by the fact that all the applicable LRMPs lack scientifically credible standards for maintaining and restoring depleted snag habitat and ensuring viable populations of wildlife associated with dead wood. Increase removal of large trees, combined with the ongoing effects of widespread density reduction on the eastside National Forests, will have significant, long- term effects on recruitment of large snags and large wood.4. Killing and removing large trees will increase fire hazard by stimulating growth of smaller trees and shrubs; increasing slash production and the risks that go along with leaving slash on the ground and/or disposing of it; altering the microclimate making stands hotter; dryer, windier; and eliminating canopy that helps suppress surface and ladder fuels.5. Killing and removing large trees will increase public distrust of the agency. Large trees are highly valued by the public as a resource that not only provides immediate scenic and recreational values, but the public also understands that large trees contribute to wildlife habitat, carbon storage, hydrology, etc.Jerry Franklin highlighted the importance of large trees. He said, [ldquo]Removal of legacies is most profound long-term impact[rdquo] because of the [ndash]Importance of Coarse Wood:[bull] Habitat for species[bull] Organic seedbeds (nurse logs)[bull] Modification of microclimate[bull] Protection of plants from ungulates[bull] Sediment traps[bull] Sources of energy & nutrients[bull] Sites of N-fixation[bull] Special source of soil organic matter[bull] Structural elements of aquatic ecosystems50Another important ecological function provided by conservation of large trees, and eventual natural mortality of large trees, is that it promotes evolutionary adaptation, which is critical right now in the face of climate change.[R]esearchers were surprised to find that the mortality of established trees considerably promotes the adaptation of forests to the changing environment. [hellip] Evolution is promoted by the mortality of established trees. The researchers assumed that demographic characteristics of the trees would have a notable impact on their adaptability. Tree species differ for example so that birch matures at a considerably younger age than pine, and birch seeds spread more effectively than pine seeds. However, the results showed that these differences had only minor impacts. Instead, the mortality of established trees played a large role in the evolutionary adaptation.5150 Jerry Franklin - What is a 'Good' Forest Opening? [ndash] Powerpoint http://courses.washington.edu/esrm315/Lectures/FranklinEarlySuccession.pdf. Each of these issues should be carefully considered and mitigated. See also Rose et al (2001) which provides a detailed description of the functional roles of large trees and large wood. 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[rsquo]Neil. OSU Press. 2001) http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf.51 Northern forests do not benefit from lengthening growing season. UNIVERSITY OF HELSINKI. PUBLIC RELEASE: 12-JAN-2010. http://www.eurekalert.org/pub_releases/2010-01/uoh-nfd011210.php.Importantly, for natural selection to occur, mortality must be caused by natural events like drought, insects, and fire, rather than through human choices about which trees will live and which will die.The recently proposed plan amendment for the Fremont-Winema would allow removal of large white-fir trees for wide variety of different reasons, e.g., [ldquo]where needed, to protect old-growth trees, restore species composition and stand structure, maintain diversity components, and improve forest resiliency to fire, drought, insects and disease.[rdquo] Each of these reasons needs its own rationale, but none have been provided, and none have been weighed against all the reasons to conserve large trees. This whole proposal would be easier to swallow if it were limited to a plausible ecological objective such as saving legacy pine trees by girdling some of the 21-25[rdquo] dbh white fir trees <120 years old within the drip-line of legacy pine trees.Conserve Unroaded Areas as part of the natural range of variabilitySee the information and analysis regarding management of and for roadless and unroaded areas previously provided by Oregon Wild in comments on the Assessment Reports and the Preliminary Need for Change.The plan and supporting analysis must review roadless and unroaded areas for their full suite of ecosystem services and values, not just their value as potential wilderness.Conserving roadless and unroaded areas >1,000 acres is critical for elk and other wildlife because these areas represent important aspects of the natural range of variability and they serve as refuge from human disturbance. Fish and wildlife evolved in landscapes without roads and logging. These conditions provided key structures, functions, processes and connectivity that fish and wildlife need to survive. We will obviously never return the entire landscape to that roadless condition, but we must retain and restore a significant subset of the landscape to a largely unmanaged, unroaded condition in order to meet legal requirements related to sustainability, ecological integrity, viable populations, recovery of threatened & endangered species, carbon storage as an ecosystem service, and restoration of rare plant and animal communities.Plan components that will help move the landscape toward the natural range for roadlessness, and more representative condition that wildlife evolved with, include:[bull] Protect inventoried roadless areas from logging and road construction;[bull] Protect other (uninventoried) roadless areas >1,000 acres from logging and road construction. New science indicates that these areas are ecologically significant and provide disproportionate ecosystem values, and logging and roads will have disproportionate adverse impacts;[bull] Reduce road density in watersheds with high intrinsic potential for restoring key resources like threatened & endangered fish, key wildlife, carbon storage, etc.[bull] Management of unroaded areas may allow careful non-commercial thinning of small trees and prescribed fire to help restore natural vegetation conditions and natural disturbance regimes;In a 1997 letter to President Clinton, 136 scientists said:There is a growing consensus among academic and agency scientists that existing roadless areas[ndash]irrespective of size[ndash]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[rsquo] 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[hellip]. 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[hellip]. 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.52There are tremendous co-benefits from conserving large blocks of unmanaged forests, such as climate mitigation and biodiversity conservation. Roberts et al. (2020):Based on the species[ndash]area relationship, regarded as one of ecology[rsquo]s few universal laws, protection of [too] little habitat will condemn thousands of species to extinction if habitat outside them is converted, degraded or lost. It is this logic that underpins calls for [lsquo]Nature Needs Half[rsquo] [26], together with an understanding that ecosystem processes and services of the scale needed to sustain the well-being of life on Earth require large wildlife populations and huge expanses of intact and restored habitat. Climate changeadds a new dimension to the question of how much protected area coverage is needed to assure conservation of wild nature. Climate change is already reducing wildlife population sizes and forcing range shifts as conditions alter [28,29]. Protected areas counter such stresses by building up populations, and connectivity of populations and habitats is emerging as a key property in securing species persistence and resilience to rapid change [5]. Hence networked protected areas, especially where embedded within well-managed land or seascapes, provide crucial stepping stones to accommodate range shifts and, where no further movements are possible, refuges of last resort [5]. Analyses suggest that adequate levels of population viability and connectivity can be achieved only with marine protected area coverages of 30% or more [27] [G]iven that manyecosystems are already degraded, ensuring continued provision of ecosystem services requires not only the precautionary protection of currently intact habitats, but also large- scale habitat restoration.Providing greater space for recovery of intact, vibrant nature is not altruistic conservation, but is, we argue, an indispensable act of self- preservation, producing a cascade of benefits that will help maintain the habitability of the biosphere as the climate changes, thereby securing the well-being of generations to come.5352 Letter to President Clinton from 136 scientists (Dec. 10, 1997). https://drive.google.com/file/d/0B4L_-RD-MJwrRzhFcm5QcFR0MHM/view?usp=sharing&resourcekey=0-2-sbGMN3bOUBQGGMDBQM1Q.53 Roberts CM, O[rsquo]Leary BC, Hawkins JP. 2020 Climate change mitigation and nature conservation both require higher protected area targets. Phil. Trans. R. Soc. B 375: 20190121. https://royalsocietypublishing.org/doi/pdf/10.1098/rstb.2019.0121. See also, Soto-Navarro C et al. 2020 Mapping co-benefits for carbon storage and biodiversity to inform conservation policy and action. Phil. Trans. R. Soc. B 375: 20190128. http://dx.doi.org/10.1098/rstb.2019.0128 showing the congruence of high carbon value and high biodiversity value in PNW forests.Law et al (2022) describe a strategic reserve approach to protect water, biodiversity, and carbon in Oregon[rsquo]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. [hellip] 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. [hellip] Meeting the forest preservation targets would substantially increase protection of tree carbon stocks, animal and tree species[rsquo] habitat, and surface drinking water source areas. [hellip] Meeting these forest preservation targets would substantially increase forest habitat protection for threatened and endangered (T&E) species and other species of interest [hellip] 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 (K[ouml]rner, 2017; Mackey et al., 2020). [hellip] 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). [hellip] 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). [hellip] Older forests in Oregon[rsquo]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). [hellip] 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.54Maintain and restore connectivityAs noted above, connectivity must be considered at multiple scales, both within the planning area and in the broader landscape context. The Plan must reflect the important role played by the Blue Mountains as a link between the Rockies, the Cascades, the Columbia Plateau, and the Great Basin.The Eastside Screens had an explicit method of ensuring that connectivity was provided:54 Law BE, Berner LT, Mildrexler DJ, Bloemers RO and Ripple WJ (2022) Strategic reserves in Oregon[rsquo]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.... 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 [ldquo]old growth/MR[rdquo] habitats by maintaining stands between them that serve the purpose of connection as described below:(1) Network pattern [ndash] 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 [ndash] 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 [ldquo]narrower stands[rdquo] 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 [ndash] 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.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:(l) 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 proposed plan revision does not have any meaningful requirements to analyze and habitat and provide for connectivity. In fact, the word connectivity only appears once in the draft plan (p 48) where it basically recites the NFMA regulations as a [ldquo]consideration.[rdquo] How can legal requirements be met if the connectivity requirements are not more clear and enforceable?Connectivity between mature and old-growth stands is just one dimension of connectivity. Other important connective functions that need consideration include:[bull] Upstream and downstream connections within stream networks;[bull] Wildlife passage across roads that can be barriers to wildlife movement. More roads, and more clearing along roads (for instance, for fuel breaks) can make those movement barriers much worse.[bull] Suitable habitat patch networks for species such as birds, butterflies, pollinators, etc.[bull] Animals with large ranges (e.g., wolves, wolverines, lynx) need networks of large suitable habitat patches with limited human presence so that such species move freely.[bull] Linkages across ridgetops so there are connection between drainage basins.55The Forest Service may also find it helpful to incorporate all or portions of the relevant policies developed by other agencies, such as:[bull] BLM IM 2023-005, Change 1. Instruction Memorandum [ndash] Habitat Connectivity on Public Lands. November 18, 2022 https://www.blm.gov/policy/im-2023-005-change-1;[bull] Mallory, B. 2023. CEQ Guidance for Federal Departments and Agencies on Ecological Connectivity and Wildlife Corridors. https://www.whitehouse.gov/wp- content/uploads/2023/03/230318-Corridors-connectivity-guidance-memo-final-draft- formatted.pdf.The agency[rsquo]s analysis of connectivity should consider the State of Oregon[rsquo]s Priority Wildlife Connectivity Areas (PWCAs) developed by ODFW[rsquo]s Oregon Connectivity Assessment and Mapping Project (OCAMP).56/ / // / // / /55 Olson, Deanna H.; Burnett, Kelly M. 2009. Design and management of linkage areas across headwater drainages to conserve biodiversity in forest ecosystems. Forest Ecology and Management. 258S: S117-S126. https://www.fs.usda.gov/pnw/pubs/journals/pnw_2009_olson004.pdf.56 OCAMP is described here: https://oregonconservationstrategy.org/success-story/priority-wildlife-connectivity-areas-pwcas/; and displayed here: https://experience.arcgis.com/experience/6979b6598f904951bd0af1821e1595f1/ (Note: the habitat thresholds in OCAMP are set to minimize the extent of connectivity areas. These thresholds should be adjusted, especially on federal lands, to recognize wildlife[rsquo]s broader use of the landscape for movement and connectivity.)Modernize management for snags & dead woodThe plan revision anticipates aggressive logging at landscape scales, as well as removal of large grand fir trees 21-30[rdquo] dbh. This will cause significant long term adverse effects on recruitment and maintenance of snags and dead wood. There is already a deficit of these critical ecosystem resources, so the revised plan will make a bad situation worse. The analysis needs to honestly disclose these adverse effects. The revised plan also needs to be adjusted to retain all large trees and more green trees to ensure future recruitment of large trees and snags to meet legal requirements related to sustainability, carbon storage, ecological integrity, viable populations, recovery of threatened & endangered species, and restoration of rare plant and animal communities.What[rsquo]s so important about snags and down logs?Snags provide homes to owls, woodpeckers, bats, squirrels, bluebirds, wood ducks, swallows, mergansers, weasels, raccoons and many other animals. More than 50 species of birds and mammals use snags for nesting, feeding and shelter. A lack of snag cavities for nesting can limit populations of some bird species. Snags larger than 20 inches DBH are in short supply on private lands. Snags can be created from live trees, and wildlife respond quickly to their availability.You can reduce the cost of leaving snags by selecting rotting or deformed trees. In eastern Oregon, down logs are used by 150 species of wildlife, including amphibians, reptiles, birds and mammals. Logs are also important to certain insects, fungi and plants.[hellip] [A] forest without down logs may have fewer species of plants and animals.57Dead wood serves important watershed functions, such as building healthy soil, capturing/storing/releasing energy, water, and sediment. Dead wood is also a limiting factor for57 Oregon Forest Resources Institute 2011. Oregon[rsquo] Forest Protection

Laws [ndash] An Illustrated Manual, Revised Second Edition. https://oregonforests.org/sites/default/files/2018-02/OFRI_IllusManual_full.pdf.many wildlife species.58 The aggressive removal of trees and fuels and the adverse effects on future wood recruitment will compromise watershed functions and wildlife habitat provided by dead wood in all its forms. The NEPA analysis needs to disclose this and consider mitigating alternatives.Snags are not just nice to have, they are an essential feature of old forests. A stand of big trees without snags is not a healthy forest. The ICBEMP Scientific Analysis Group (SAG) review of selected terrestrial vertebrate populations used [ldquo]large snag density as a proxy for the structural quality of old-forest habitats.[rdquo] and the SAG found thatKey model factors contributing most strongly to low environmental index values and low population outcomes[mdash]Families 1 and 2 (Old-forest families)[mdash][bull] Low recruitment of large snags composed of shade-intolerant tree species, such as ponderosa pine, western larch, and western white pine, as indexed by moderate and high HRV (Lewis[rsquo] woodpecker (migrant), pygmy nuthatch, flammulated owl), are the key factors contributing to low environmental index and low population outcomes.[bull] Low quality of old-forest structural conditions (lack of diversity of size and decadence of large trees, large snags, and large logs), as indexed by declining large snag and/or large log trends (northern goshawk [summer], American marten, hoary bat), are the key factors. [hellip]Long-eared myotis (Family 7)[mdash][bull] [hellip] decreasing snag trends (indexing low availability of roost sites) contribute to low environmental index and low population outcomes. [hellip]Western bluebird (Family 8)[mdash][bull] High HRV departure and declining large snag density (indexing a lack of shade- intolerant tree species recruited as snags) contribute to the low environmental index and low population outcomes.59In a dynamic ecosystem life may be fleeting but the snags and logs that survive disturbance provide very critical temporal links from one stand to the next. Under natural conditions, a forest hands down a large legacy of living and dead material from one stand to another even after an intense disturbance. Even non-stand-replacing disturbance creates pulses of dead material that are critical for forest ecosystems.One thing the plan gets correct is that [ldquo]Snags and down wood are essential ecological components[rdquo] (p 48). Unfortunately, the draft plan components for snag and down wood are severely inadequate. There is no quantitative standards to ensure adequate retention of green trees and recruitment and retention of snags and down wood adequate to meet legal requirements related to sustainability, ecological integrity, viable populations, recovery of threatened & endangered species, and restoration of rare plant and animal communities. There is a shortage of dead wood across the Blue Mountains and continued or increased logging, regardless of purpose, will make a bad situation worse.58 Thomas, Jack Ward [Technical Editor] 1979. Wildlife Habitats in Managed Forests the Blue Mountains of Oregon and Washington. Agriculture Handbook No. 553. U.S. Department of Agriculture, Forest Service. 512 p. https://www.srs.fs.usda.gov/pubs/misc/agh553.pdf.59 Martin G. Raphael, Richard S. Holthausen, Bruce G. Marcot, Terrell D. Rich, Mary M. Rowland, Barbara C. Wales, Michael J. Wisdom, 2000. DRAFT Effects of SDEIS Alternatives on Selected Terrestrial Vertebrates of Conservation Concern within the Interior Columbia River Basin Ecosystem Management Project, March 2000, revised June 23 , 2000 and November 14, 2000.The revised plan needs to adopt quantitative, science-based standards for snags and dead wood recruitment that reflect the full suite of ecosystem services provided by dead wood and address the regional shortage of dead wood on both public and private lands, and moves the landscape toward the natural range of variability, and mitigates for species most sensitive to the absence of abundant snags and dead wood habitat.The Plan needs to reflect best available science and conserve high levels of recruitment of snags and dead wood. Dead wood is import not just for wildlife habitat, but for a wide variety of ecosystem services. Current plan direction for protecting and providing snags and down wood tends to be focused on a small subset of the full spectrum of values provided by dead wood and does not ensure the continued operation of these ecosystem functions or meet the complete lifecycle needs of the many species associated with this unique and valuable habitat component. The revised plan needs to be brought up to current scientific standards, and consider all the many values of snags and down wood presented in Rose et al. (2001):IntroductionDecaying wood has become a major conservation issue in managed forest ecosystems.16, 64, 69a, 149, 201 Of particular interest to wildlife scientists, foresters, and managers are the roles of wood decay in the diversity and distribution of native fauna, and ecosystem processes.Numerous wildlife functions are attributed to decaying wood as a source of food, nutrients, and cover for organisms at numerous trophic levels.231, 232, 234, 346, 369 Principles of long- term productivity and sustainable forestry include decaying wood as a key feature of productive and resilient ecosystems.10, 229, 291, 293, 386 In addition to a growing appreciation of the aesthetic, spiritual, and recreational values of forests, society increasingly recognizes ecosystem services of forests as resource capital with tangible economic value to humans, such as air and water quality, flood control, and climate modification.15, 262, 290 The ecological importance of decaying wood is especially evident in coniferous forests of the Pacific Northwest. In this region, the abundance of large decaying wood is a defining feature of forest ecosystems, and a key factor in ecosystem diversity and productivity.127 [hellip] Large accumulations of decaying wood provide wildlife habitat and influence basic ecosystem processes such as soil development and productivity, nutrient immobilization and mineralization, and nitrogen fixation.85, 115, 218, 233 [hellip][hellip]Since the publication of Thomas et al.369 and Brown,48 new research has indicated that more snags and large down wood are needed to provide for the needs of fish, wildlife, and other ecosystem functions than was previously recommended by forest management guidelines in Washington and Oregon. For example, the density of cavity trees selected and used by cavity-nesters is higher than provided for in current management guidelines.53, 102 [hellip][hellip]Ecological Functions of Decaying Wood[hellip]Recent significant advancements have defined wildlife species-specific relationships with particular characteristics and components of decaying trees, both standing and fallen,56, 95, 185, 284, 351, 373, 386, 402 and implications for management.13, 68, 223, 226, 250, 327 [hellip][hellip]Hollow trees larger than 20 inches (51 cm) in diameter at breast height (dbh) are the most valuable for denning, shelter, roosting, and hunting by a wide range of animals.7, [hellip][hellip][hellip] In the Interior Columbia Basin, grand fir and western larch form the best hollow trees for wildlife uses. [hellip][hellip]Recent studies have provided valuable insight on wildlife uses of snags (dead trees).21, 56, 314, 402 Snags provide essential habitat features for many wildlife species (Figure 6). The abundance of cavity-using species is directly related to the presence or absence of suitable cavity trees. Habitat suitability for cavity-users is influenced by the size (diameter and height), abundance, density, distribution, species, and decay characteristics of snags.307 In addition, the structural condition of surrounding vegetation determines foraging opportunities.402The Habitat Elements matrix on the CD-ROM with this book lists a total of 96 wildlife species associated with snags in forest (93 species) or grassland /shrubland (47 species) environments. Most of these species use snags in both environments. In forests, this includes 4 amphibian, 63 bird, and 26 mammal species. Additionally, 51 wildlife species are associated with tree cavities, 45 with dead parts of live trees, 33 with remnant or legacy trees (which may have dead parts), 28 with hollow living trees, 21 with bark crevices, and 18 with trees having mistletoe or witch[rsquo]s brooms. Habitat uses include nesting, roosting, preening, foraging, perching, courtship, drumming, and hibernating (Figure 7).Of the 93 wildlife species associated with snags in forest environments, 21 are associated with hard snags (Stages 1 and 2), 20 with moderately decayed snags (Stage 3), and 6 with soft snags (Stages 4-5) in the five-stage classification system. According to the matrixes,188 most snag-using wildlife species are associated with snags >14.2 inches (36 cm) diameter at breast height (dbh), and about a third of these species use snags >29.1 inches (74 cm) dbh.This query of the Habitat Elements matrix illustrates the breadth of updated information about wildlife and snag habitat relations. Research results have expanded the number and variety of decaying wood categories over what was previously presented in Thomas366 and Brown.48[hellip]. Down Woody Material (logs). Down wood affords a diversity of habitat functions for wildlife, including foraging sites, hiding and thermal cover, denning, nesting, travel corridors, and vantage points for predator avoidance.56, 64, 230 Larger down wood (diameter and length) generally has more potential uses as wildlife habitat. Large diameter logs, especially hollow ones are used by vertebrates for hiding and denning structures.214, 230 [hellip][hellip]Long term Productivity[hellip] Processes that sustain the long- term productivity of ecosystems have become the centerpiece of new directives in ecosystem management and sustainable forestry.78, 229, 291, 320 Given the key role of decaying wood in long-term productivity of forest ecosystems in the Pacific Northwest,122, 169, 261, 302 the topic should remain of keen interest to scientists and managers during the coming decade.149 [hellip] functions of decaying wood directly linked to long-term productivity, include[e] influences on the frequency and severity of disturbances such as fire, disease, and insect outbreaks.5, 6, 133, 137Nutrient Cycling and Soil Fertility. Decaying wood has been likened to a savings account for nutrients and organic matter,376 and has also been described as a short-term sink, but a long-term source of nutrients in forest ecosystems.164 [hellip][hellip] Substantial amounts of nitrogen are returned to the soil from coarse wood inputs, yet even where annual rates of wood input are high, 4 to 15 times more nitrogen is returned to the forest floor from foliage than from large wood.164 [hellip][hellip] The low nutrient content in wood, small mass of tree boles relative to foliar litterfall, and slow rates of wood decay suggest that large wood plays a minor role in forest nutrition.18, 159, 162 After large scale disturbance such as fire and blowdown, however, thelarge nutrient pool stored in woody structures of trees (bole, branches, twigs, roots) becomes available to the regrowing forest. Large down wood may thus be an ample source of nutrients throughout secondary succession.281[hellip]Recent studies indicate that wood may release nutrients more rapidly than previously thought through a variety of decay mechanisms mediated by means other than microbial decomposers, i.e. fungal sporocarps, mycorrhizae and roots, leaching, fragmentation, and insects.107, 158, 159, 162, 339, 405 [hellip]Soil is the foundation of the forest ecosystem.68, 348 [hellip] On the H. J. Andrews Experimental Forest of western Oregon, 20-30% of the soil volume consists of decaying wood dispersed throughout a matrix of litter and duff.294 Because wood is a relatively inert substance, it may help to stabilize pools of organic matter in forests by slowing soil processes and buffering against rapid changes in soil chemistry. [hellip][hellip][hellip] Numerous studies have demonstrated that losses in soil productivity often are closely linked to losses in soil organic matter.298[hellip]Mass Wasting and Surface Erosion. [hellip] Large wood helps to anchor snowpacks, limit the extent of snow avalanches, and may even stabilize debris flows, depending on the depth of the unstable area.125, 356, 358 [hellip] By covering soil surfaces and dissipating energy in flowing and splashing water, logs and other forms of coarse wood significantly reduce erosion.357 Large trees lying along contours reduce erosion by forming a barrier to creeping and raveling soils, especially on steep terrain. Material deposited on the upslope side of fallen logs absorbs moisture and creates favorable substrates for plants that stabilize soil and reduce runoff.230Stand Regeneration and Ecosystem Succession. Decomposing wood serves as a superior seed bed for some plants because of accumulated nutrients and water, accelerated soil development, reduced erosion, and lower competition from mosses and herbs.160, 376 In the Pacific Northwest, decaying wood influences forest succession by serving as nursery sites for shade-tolerant species such as western hemlock, the climax species in moist Douglas- fir habitat.80, 123, 160, 163, 244 Wood that covers the forest floor also modifies plant establishment by inhibiting plant growth, and by altering physical, microclimatic, and biological properties of the underlying soil. For example, elevated levels of nitrogen fixation in Ceanothus velutinus and red alder35, 88 have been reported under old logs.Streams and Riparian Forests. Long-term productivity in streams and riparian areas is closely linked to nutrient inputs, to attributes of channel morphology, and to flow dynamics created by decaying wood.144, 233, 360 [hellip]Large wood is the principal factor determining the productivity of aquatic habitats in low- and mid-order forested streams.262 Large wood stabilizes small streams by dissipating energy, protecting streambanks, regulating the distribution and temporal stability of fast-water erosional areas and slow-water depositional sites, shaping channel morphology by routing sediment and water, and by providing substrate for biological activity.361 The influence of large wood on energy dissipation in streams influences virtually all aspects of ecological processes in aquatic environments, and is responsible for much of the habitat diversity in stream and riparian ecosystems.262, 376Key Ecological Functions of Wildlife Species Associated With Decaying Wood[hellip]Various symbiotic relations can be described for the 96 snag-associated species. Sixteen species are primary cavity excavators and 35 are secondary cavity users; 8 are primaryburrow excavators and 11 are secondary burrow users; 5 are primary terrestrial runway excavators and 6 are secondary runway users. Nine snag-associated species create nesting or denning structures and 8 use created structures. Sixteen species might influence vertebrate population dynamics and 22 might influence invertebrate population dynamics. Snag-associated species also contribute to dispersal of other organisms including seeds and fruits (21 snag-associated wildlife species perform this function), invertebrates (8 species), plants (8 species), fungi (2 species), and lichens (1 species). Six snag-associated species can improve soil structure and aeration through digging, 2 species fragment standing wood, and 2 species fragment down wood. One snag-associated species creates snags, and at least 1 can alter vegetation structure and succession through herbivory.[hellip][hellip] both snag- and down wood-associated wildlife more or less equally participate in dispersal of seeds and fruits (although the particular species they disperse may differ); however, snag- associated wildlife play a greater role in dispersal of invertebrates and plants, and down wood-associated wildlife play a greater role in dispersal of fungi and lichens. Down wood-associated species might contribute more to improving soil structure and aeration through digging, and to fragmenting wood. This is one example of the far greater differentiating power afforded by a well-constructed set of matrixes than was previously available in Thomas 366 and Brown.48 [hellip][hellip]Fire Suppression. In the eastern Cascades and through much of the intermountain area, extensive forest insect and disease problems have resulted from decades of fire suppression in combination with selective harvesting of pines.177, 194, 236, 401, 403 An analysis of landscape dynamics in the Interior Columbia River Basin302, 379 revealed that fire suppression resulted in a decreased abundance of large- diameter trees, and caused fuel accumulations that predisposed forests to stand-replacement fires. As mentioned previously, more intense fires not only consume more wood, but can inhibit wood decay by reducing nitrogen availability (and other elements) through volatilization and leaching, especially for wood in close association with the soil.245 Wood decay in post-fire regenerating forests also may be exacerbated by a decline in symbiotic nitrogen-fixing plant species in stands subject to prolonged fire suppression.169[hellip]Management Considerations Management Ramifications of Snag and Down Wood Abundance[hellip][hellip] The apparent dearth of large snags in Ponderosa pine may mean lower suitability for the 54 wildlife species associated with large snags (20+ in or 51+ cm dbh) in that wildlife habitat. Intensive forest management activities that have decreased the density of large snags in early forest successional stages (sapling/pole and small tree stages) may have had adverse impacts on the 61 associated wildlife species (Figure 12). Similarly, the lesser amount of large down wood in early forest successional stages may not provide as well for the 24 associated wildlife species. Such results suggest the continuing need for specific management guidelines to provide large standing and down dead wood in all successional stages.[hellip]Depletion of Large Wood. The loss of large wood structures has numerous potential impacts on ecological functions of forests, although available information is inadequate for a definitive assessment. The lack of large logs on steep slopes can decrease water percolation into soil, impair slope stability, accelerate soil erosion and sediment input to streams, and increase nutrient losses in litter.164, 358, 359, 360, 361 Some data support a linkagebetween intensive management (especially depletion of decaying wood) and reduced forest biomass productivity, particularly on less productive sites. Lower productivity is attributed to nutrient losses from managed forests, reduced nutrient availability in older stands, and decreased nutrient storage, particularly in the soil.272, 383, 384 Depletion of soil organic matter has been cited as a primary factor contributing to declining forest productivity and biodiversity in the Pacific Northwest and elsewhere.17, 137, 198, 199, 228, 292, 293, 298, 299[hellip]Riparian Forests. [hellip] Far-reaching effects of the absence of large wood structures in streams include: 1) simplification of channel morphology, 2) increased bank erosion, 3) increased sediment export and decreased nutrient retention, 4) loss of habitats associated with diversity in cover, hydrologic patterns, and sediment retention.33, 144, 262 In coastal environments and estuaries, the loss of large wood may disrupt trophic webs and alter coastal sediment dynamics.233[hellip]Lessons Learned During the Last Fifteen Years[hellip]Several major lessons have been learned in the period 1979-1999 that have tested critical assumptions of these earlier management advisory models:[bull] Calculations of numbers of snags required by woodpeckers based on assessing their biological potential. (that is, summing numbers of snags used per pair, accounting for unused snags, and extrapolating snag numbers based on population density) is a flawed technique. Empirical studies are suggesting that snag numbers in areas used and selected by some wildlife species are far higher than those calculated by this technique.226[bull] Setting a goal of 40% of habitat capability for primary excavators, mainly woodpeckers,369 is likely to be insufficient for maintaining viable populations.[bull] Numbers and sizes (dbh) of snags used and selected by secondary cavity-nesters often exceed those of primary cavity excavators.[bull] Clumping of snags and down wood may be a natural pattern, and clumps may be selected by some species, so that providing only even distributions may be insufficient to meet all species needs.[bull] Other forms of decaying wood, including hollow trees, natural tree cavities, peeling bark, and dead parts of live trees, as well as fungi and mistletoe associated with wood decay, all provide resources for wildlife, and should be considered along with snags and down wood in management guidelines.[bull] The ecological roles played by wildlife associated with decaying wood extend well beyond those structures per se, and can be significant factors influencing community diversity and ecosystem processes.We have also learned that managing forests with decay processes should be done as part of a broader management approach to stand development, with attention paid to retaining legacies of large trees and decaying wood from original or prior stands. Further lessons have been learned in the area of technical and operational developments; some of these are discussed below.[hellip][hellip] Studies suggest that wood habitat structures function best for wildlife when they are broadly distributed as well as occurring in locally- dense clumps, such as with scattered snag or down wood patches. [hellip][hellip][hellip] A new modeling tool named DecAID is available to assist with this task. DecAID (as in [ldquo]decayed[rdquo] or [ldquo]decay aid[rdquo]) is a new Decayed Wood Advisory Model being developed to address some of the recent lessons learned.226, 247 DecAID is based on a thoroughreview of literature, available research and inventory data, and expert judgment. It broadens the paradigm for wildlife species and habitat assessment by considering the key ecological functions of wildlife (see below) as well as the ecosystem context of wood decay in terms of secondary effects on forest productivity, fire, pest insects, and diseases.[hellip]The manager will be able to use DecAID for advice on the following topics by first specifying wildlife habitat, structural stage, and statistical (confidence) level: 1) wildlife species associated with particular sizes and densities of snags and down wood, or, conversely, the sizes and densities required to meet specified wildlife management objectives, at three levels of confidence; 2) the array of key ecological functions of wildlife associated with decaying wood; 3) the recent-historic and current range of natural conditions of snags and fallen trees; 4) advice on fire risk assessment and mitigation; 5) advice on the roles of insects and diseases associated with various amounts of decaying wood; 6) and the influence of the abundance of decaying wood on ecosystem processes and productivity.[hellip]Management Tools and Opportunities[hellip][hellip] In young stands, Franklin122 recommends that management should:1. Aggressively create stands of mixed composition to maintain habitat for a broad array of species (and to achieve diversity in quality and timing of nutrient inputs to streams).2. Delay the process of early canopy closure (wide spacings, pre-commercial thinning etc.).3. Provide for adequate amounts and a continuous supply of large wood, including snags and down logs, for maintaining structural diversity in forests and streams and maintaining all other ecosystem processes associated with wood.The basic theme of these revisions of intensive forestry practices is to retain the higher levels of complexity found in natural forests, and in so doing, to protect processes and structures that retain future options for ecosystem management. [hellip][hellip][hellip] Retention of snags provides numerous habitat benefits.154, 239, 402 However, safety and liability issues associated with snag retention have posed an operational barrier to management objectives for structural retention. Two approaches useful in reducing hazards associated with snags are: 1) to cluster snags in patches rather than wide dispersal, and 2) to create snags from green trees after cutting.122[hellip] Managers must also consider the temporal dimension to decaying wood, to ensure that sufficient snag and down wood densities are provided through time. [hellip]Live (Green) Tree Retention. Retention of living trees on cutover areas is one form of structural retention that can provide for future recruitment of snags and down wood [hellip]Green trees function as a refugium of biodiversity in forests. For example, many species of invertebrate fauna in soil, stem, and canopy habitats of old-growth forests do not disperse well, and thus, do not readily recolonize clear-cut areas.207, 326 The same concept holds for many mycorrhizae-forming fungal species.293 Added benefits of green tree retention include moderated microclimates of the cutover area, which may increase seedling survival, reduce additional losses of biodiversity on stressed sites,293 and facilitate movement of organisms through cutover patches of the landscape. Green trees retained across harvest cycles can also be used to grow very large trees for either ecologic or economic goals. [hellip]Green tree retention offers many benefits to wildlife. For example, the higher structural diversity in young stands that contain legacy trees from previous stands provides muchimproved habitat values to late successional species such as the northern spotted owl, as well as other vertebrates that use late-successional stands for some elements of their life history.69, 122, 314 Such stands may provide wildlife habitat as early as age 70-80 years rather than 200-300 years, the approximate time interval required for old-growth conditions to develop after secondary succession. [hellip][hellip]Summary of Management RecommendationsThe information presented in this chapter emphasizes several properties of decaying wood in forest ecosystems: (1) each structure formed by decaying wood helps support a different functional web in the ecosystem; (2) no one decaying wood structure supports all functions equally; and (3) all decaying wood habitats together support the widest array of ecological functions and associated wildlife species. The CD-ROM with this book in combination with the DecAid model provides managers with a powerful tool that makes it possible to assess the degree of [ldquo]full functionality[rdquo] of ecosystems as supported by the various decaying wood structures, and which functions are strengthened, diminished, or lost through alternative silvicultural management practices.Lessons for managers are:[hellip]2. Emphasize retention of wood legacies, and secondarily promote restoration where legacies are deficient to meet stated objectives. The decline of species associated with late-successional forest structures, as well as the prolonged time needed to produce wood legacies, suggests that it is both ecologically and economically advantageous to retain legacy structures across harvest cycles wherever possible, rather than attempt to restore structures that have been depleted. This is especially obvious for slow-growing tree species and very large wood structures. [hellip][hellip]Operational Considerations[hellip][hellip] OSHA revised the federal Logging Standard

(29 CFR 1910.266) in 1995, to clarify its intent that danger trees may be avoided, rather than being removed or felled.72a A danger tree is any standing tree (live or dead) that poses a hazard to workers, from unstable conditions such as deterioration, damage, or lean. The revised rule allows some discretion in determining the hazard area around a danger tree, by. allowing work tocommence within two tree lengths of a marked danger tree, provided that the employer demonstrates that a shorter distance will not create a hazard for an employee..(OSHA Logging Preamble, Section V). Determining a safe working distance requires a case-by- case evaluation of various factors such as, but not limited to, the size of the danger tree,how secure it is, its condition, the slope of the work area, and the presence of other employees in the area. [hellip][hellip]Concerns frequently arise where high public use creates a risk of third party liability. Considerations include the proximity of reserve trees to roads, trails, campgrounds, ski areas, and other recreation areas and public access points. Methods for addressing these concerns include signage and clear delineation of potential hazard areas, fencing and other barriers to discourage public access, snag height reduction and use of setbacks to minimize exposure.6060 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.Dynamic ecosystems historically included large-scale mortality events both pulsed and continuous. Mortality and biomass accumulation are natural and desirable ecological processes that forest management has been working for decades to capture, suppress, and avoid. Large snags are severely under-represented in our forests and logging will capture, reduce and delay recruitment of future large snags. Korol et al (2002) estimated that even if we 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.61 Wisdom et al (2008) found that snag abundance in the Pacific northwest forests is inversely related to past harvest and proximity to roads. Salem BLM[rsquo]s Bottleneck LSR Enhancement Project EA62 includes Table 9 which clearly shows that thinning will adversely affect mortality processes. Mortality would be 70 tpa without treatment, or 0.10 tpa with thinning, thus sacrificing 69.9 trees per acre averaging 20.3" dbh that would be recruited to the large snag and down wood pool over the next 30 years except that they will instead be cut and taken to the mill.Snags have been severely depleted across the eastside forests. On industrial forest lands [ldquo]The density of large snags [under an industrial forest regime] was projected to be less than 1% that found in unmanaged stands.[rdquo]63 The federal agencies need to compensate for the severe lack of snags on intensively managed forest lands, but unfortunately snags are lacking on federal lands as well. The ICBEMP Scientific Analysis Group which found that [ldquo]Across the [interior Columbia River] basin (all lands) large snags have declined more than 30 percent. This was most likely a reflection of the loss of late-seral forests, particularly in the dry and moist PVGs.[rdquo]64Bell et al (2021) confirm the long-term deficit of snag habitat, the critical role of federal lands in providing snag habitat, and note that federal management goals often conflict with efforts to reduce the snag deficit.Since the mid-20th century, anthropogenic stressors, such as timber harvesting, land conversion, and wildfire, have greatly reduced the extent of old-growth forests in Oregon and Washington (Bolsinger and Waddell 1993). Many wildlife species in this region rely entirely or in part on the availability of large live and dead trees [hellip][hellip] Other management goals can conflict with the aim to increase snag densities, such as thinning to accelerate old forest conditions in moister forests (northwestern OR, western61 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.62 Salem BLM. 2009. Bottleneck EA: https://web.archive.org/web/20150926133606/http://www.blm.gov/or/districts/salem/plans/files/sdo_080-07-16_eafonsi.pdf.63 Wilhere, G.F. 2003. Simulations of snag dynamics in an industrial Douglas-fir forest. Forest Ecology and Management. Volume 174, Issues 1-3, 17 February 2003, Pages 521-539. https://www.fs.usda.gov/sites/nfs/files/legacy-media/r06/11%20Wilhere-2003-Simulation-of-snag-dynamics-in-industrial-DF-forest.pdf.64 Miles A. Hemstrom, Wendel J. Hann, Rebecca A. Gravenmier, Jerome J. Korol. 2000. [SAG] Landscape Effects Analysis of the [ICBEMP] SDEIS Alternatives. USDA/USDI, draft March 2000. See also, 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, and see Tara Hudiburg, Beverly Law, David P. Turner, John Campbell, Dan Donato, And Maureen Duane 2009. Carbon dynamics of Oregon and Northern California forests and potential land-based carbon storage. Ecological Applications, 19(1), 2009, pp. 163[ndash]180. http://terraweb.forestry.oregonstate.edu/pubs2/Hudiburg2009EA.pdf.WA), and fuel reduction treatments in drier forests (southwestern OR, eastern OR and WA).[hellip]While we observed increases in areas supporting large live trees and snags during recent decades (Fig. 6), these changes in area were relatively small (Fig. 5) and are therefore unlikely to offset past losses for the region as a whole. We observed increases in area with large live trees and snags on federal lands, but not on nonfederal lands, indicating that those federal lands drive most of the regional changes. The reduction of forest area supporting high densities of large live trees and snags since historical times and the lack of substantial increases during recent decades on all lands highlights major challenges to maintaining quality habitat for some wildlife species.[hellip]ConclusionsIn part, the maintenance of forest biodiversity depends on the retention of existing and restoration of late-successional and older forest habitat for wildlife species to within natural or desired ranges. Our results indicate that the forests of Oregon and Washington have lost a substantial proportion of forests supporting large live trees and snags compared to reference conditions and that recruitment of these structural elements of wildlife habitat at regional scales is a slow process. [hellip] Large quantities and diversities of dead wood structures are needed to maintain biodiversity in forest ecosystems (Sandstr[ouml]m et al. 2019). Given that most forests supporting large live trees and snags are federally managed, these federal lands will be central to the conservation and management of large live trees and snags in the Pacific Northwest.65Dead wood is ecologically important, in short supply, and adversely affected by logging, roads, and fuel reduction, and the old standards are scientifically outdated, therefore rigorous new standards are required for dead wood and green trees that[rsquo]s serve as a recruitment for dead wood over time. The FS admits that the old standards are outdated, but the agency seems unwilling to adopt new quantitative, science-based standards. The recent Large Tree Amendment adopted a new standard that basically said retain [ldquo]some snags[rdquo] for [ldquo]some species.[rdquo] This does not meet legal requirements related to sustainability, ecological integrity, viable populations, recovery of threatened & endangered species, and restoration of rare plant and animal communities.The authors of DecAID, the Decayed Wood Advisor, describe some of the limitations of the old methods of managing snag habitat.Limitations of Existing Approaches for Assessing Wildlife-Dead Wood Relations.Models of relationships between wildlife species and snags in the Pacific Northwest typically are based on calculating potential densities of bird species and expected number of snags used per pair. This approach was first used by Thomas et al. (1979). Marcot expanded this approach in Neitro et al. (1985) and in the Snag Recruitment Simulator (Marcot 1992) by using published estimates of bird population densities instead of calculating population densities from pair home range sizes. This approach has been criticized because the numbers of snags suggested by the models seem far lower than are now being observed in field studies (Lundquist and Mariani 1991, Bull et al. 1997). In addition, the models provided only deterministic point values of snag sizes or65 David M. Bell et al 2021. Quantifying regional trends in large live tree and snag availability in support of forest management. Forest Ecology and Management 479 (2021). https://pdf.sciencedirectassets.com/271259/1-s2.0- S0378112720X0020X/1-s2.0-S0378112720313232/am.pdf.densities and of population response ("population potential") instead of probabilistic estimates that are more amenable to a risk analysis and risk management framework.In addition, existing models have focused on terrestrial vertebrate species that are primary cavity excavators. Thomas et al. (1979) and Marcot (1992) assumed that secondary snag-using species would be fully provided for if needs of primary snag-excavating species were met. However, McComb et al. (1992) and Schreiber (1987) suggested that secondary cavity nesting birds may be even more sensitive to snag density than are primary cavity excavators.Furthermore, existing models do not address relationships between wildlife and down wood, nor do they account for species that use different types of snags and partially dead trees, such as hollow live and dead trees used by bats (Ormsbee and McComb 1998, Vonhof and Gwilliam 2007), Vaux's swift (Chaetura vauxi) (Bull and Hohmann 1993), American marten (Martes americana) (Bull et al. 2005), and fisher (Martes pennanti) (Zielinski et al. 2004).66Additional problems with the old standards include:[bull] 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;[bull] 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;[bull] The old standard failed to account for the size height of snags favored by some species;[bull] In applying the old standards the agencies often fail to account for rates of snag fall and recruitment;[bull] 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;[bull] The old standards fail to account for the differential use of space and population density of different species;[bull] The old standards ignore other important habitat features of dead wood, e.g. loose bark, hollow trees, broken tops, etc.The new plan components must be informed by sound science, such as:1. Franklin, J.F., Lindenmayer, D., MacMahon, J.A., McKee, A., Magnuson, J., Perry, D.A., Waide, R., and Foster, D. 2000. Threads of Continuity. Conservation Biology in Practice. [Malden, MA] Blackwell Science, Inc. 1(1) pp9-16. https://andrewsforest.oregonstate.edu/sites/default/files/lter/pubs/pdf/pub2815.pdf;2. William F. Laudenslayer, Jr., Patrick J. Shea, Bradley E. Valentine, C. Phillip Weatherspoon, and Thomas E. Lisle Technical Coordinators. Proceedings of the Symposium on the Ecology and Management of Dead Wood in Western Forests. PSW- GTR-181.https://www.fs.usda.gov/psw/publications/documents/psw_gtr181/psw_gtr181.pdf.3. Lofroth, Eric. 1998. The dead wood cycle. In: Conservation biology principles for forested landscapes. Edited by J. Voller and S. Harrison. UBC Press, Vancouver, B.C. pp. 185-214. 243 p.https://web.archive.org/web/20110716234012/http://www.for.gov.bc.ca/hre/deadwood/DTrol.htm.4. 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 and66 Bruce G. Marcot , Janet L. Ohmann, Kim L. Mellen-McLean, and Karen L. Waddell. 2010. Synthesis of Regional Wildlife and Vegetation Field Studies to Guide Management of Standing and Down Dead Trees. Forest Science 56(4) 2010. http://www.fs.usda.gov/pnw/pubs/journals/pnw_2010_marcot002.pdf.Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001) https://apps.fs.usda.gov/r6_decaid/legacy/decaid/pages/documents/Rose-et-al-2001.pdf.5. Stevens, Victoria. 1997. The ecological role of coarse woody debris: an overview of the ecological importance of CWD in B.C. forests. Res. Br., B.C. Min. For., Victoria, B.C. Work. Pap. 30/1997. http://www.for.gov.bc.ca/hfd/pubs/docs/Wp/Wp30.pdf.6. Hagar, Joan, 2007, Assessment and management of dead-wood habitat: USGS Administrative Report 20071054, pp. 1-32. http://pubs.usgs.gov/of/2007/1054/pdf/ofr20071054.pdf7. Bruce G. Marcot; 2002. An Ecological Functional Basis for Managing Wood Decay Elements for Wildlife; USDA Forest Service Gen. Tech. Rep. PSW-GTR-181. https://web.archive.org/web/20121024180652/http://www.fs.fed.us/psw/publications/ documents/gtr-181/068_Marcot.pdf.8. Bruce G. Marcot 2017. Ecosystem Processes Related to Wood Decay. PNW Research Note 576. https://web.archive.org/web/20190701221558/https://www.fs.fed.us/pnw/pubs/pnw_ rn576.pdf;9. Jennie Sandstr[ouml]m et al. 2019. Impacts of dead wood manipulation on the biodiversity of temperate and boreal forests. A systematic review, Journal of Applied Ecology (2019). DOI: 10.1111/1365-2664.13395.https://besjournals.onlinelibrary.wiley.com/doi/pdf/10.1111/1365-2664.13395.10. Blue Mountain Native Forest Alliance. 199x. Problems Related to the Loss of Dead Wood. http://www.subtleenergies.com/ormus/bmnfa/DEADWOOD.HTM.An important and under-appreciated ecological process is the cycle of biomass accumulation (e.g., large snag and dead wood are vastly under-represented on the landscape because management is so focused on controlling and preventing mortality.) The full life-cycle of a tree starts with photosynthesis that captures carbon from the air to build a magnificent tree but it includes decades to centuries of "life" as a snag, down wood, and soil enhancement before it returns to the atmosphere to begin the cycle again. The dead wood portion of this cycle needs to be re-established to enhance biodiversity, hydrology, soil productivity, and carbon storage. The NEPA analysis needs to recognize the full life-cycle of forests including the ecological, hydrological and carbon-cycle value of both live and dead trees.Felling and removal of large trees, whether they are alive or dead, removes large material that is normally handed down from one stand to the next. The loss of this material has serious adverse consequences for wildlife, hydrology, soil, etc. These legacies are often described as [ldquo]lifeboats[rdquo] that allow species to persist in post-disturbance forests and/or return more rapidly to post- disturbance forests. Given cumulative loss of habitat and ecological functions over the last century, how many lifeboats can we take off the ship when threatened and endangered species and sensitive species are at stake? The NEPA analysis must account for all the values provided by snags and down wood and the effect of removing these legacy structures.The NEPA analysis must recognize that mechanical treatments unavoidably reduce snag habit, if for no other reason than the habitual removal of snags for safety reasons, but the most significant effect of commercial logging on snag habitat is the long-term reduction in the recruitment pool of green-trees available for future snags. Even restoration thinning intended toaccelerate development of large trees reduces mortality that is another key attribute of late successional forests.67The 2017 Science Synthesis for the NW Forest Plan says partial cutting in older forests will [ldquo]strongly impact dead wood amounts, and the accompanying road and harvest system will add additional impacts.[rdquo] At least six times more coarse wood carries over from old-growth forests after wildfire compared to timber harvest, and the CWD left after logging is smaller and decays faster (citing Spies & Cline 1988)68. Ohmann et al (1994) found that non-federal forestlands do not retain enough snags to support viable wildlife populations69, so federal managers likely need to retain more snags on federal lands to compensate. Even when snag removal is not an intentional design feature of a project, hazard tree felling normally occurs in all treatment areas, plus a safety buffer around all treatment areas, plus a safety corridor along roads, and other work areas. Furthermore, non-federal lands are not managed for snag habitat. These are some of the reasons why Korol et al (2002) found that large snag habitat is below the historic range of variability, and in the future would attain historic levels only in roadless and wilderness areas.Wisdom et al (2008) found that snag abundance in the Pacific northwest forests is inversely related to past harvest and proximity to roads. [ldquo]Our highest snag density [hellip] occurred in unharvested stands that had no adjacent roads. [hellip] Stands with no history of timber harvest had 3 times the density of snags as stands selectively harvested, and 19 times the density as stands having undergone complete harvest. Stands not adjacent to roads had almost 3 times the density of snags as stands adjacent to roads.[rdquo]70 Given the current extent of the road network and the historic extent of logging, the cumulative effects analysis must recognize the inherent conflict between [ldquo]forest management[rdquo] (past, present and future) and snags and all their values.Federal forest management also needs to mitigate for conditions on non-federal lands where dead wood is highly under-represented. PNW Research reported that [ldquo]Large snags and logs decreased on forest industry lands as legacy dead wood derived from historical natural disturbance events was not replaced through management. Conservation oriented policies designed to maintain or increase dead wood may have strong positive influence on large dead wood abundance and related biodiversity in parts of a region also under intensive management.[rdquo]7167 Mortality of Douglas-fir and hardwoods was higher in controls than in thinned units. Liane R. Davis, and Klaus J. Puettmann, Gabriel F. Tucker. 2007. Overstory Response to Alternative Thinning Treatments in Young Douglas-fir Forests of Western Oregon. Northwest Science 81(1). 2007. https://www.fs.usda.gov/pnw/pubs/journals/pnw_2007_tucker001.pdf.68 Spies, T. A., and S. P. Cline. 1988. Coarse woody debris in forests and plantations of coastal Oregon. Pp. 5-23 in: C. Maser, R. F. Tarrant, J. M. Trappe, and J. F. Franklin, ed. From the forest to the sea: a story of fallen trees. Gen. Tech. Rpt. PNW- GTR-229. USDA Forest Service, Portland OR. https://www.fs.usda.gov/pnw/pubs/229chpt1.pdf.69 Ohmann, McComb, & Zumrawi; 1994. SNAG ABUNDANCE FOR PRIMARY CAVITY-NESTING BIRDS ON NONFEDERAL FOREST LANDS IN OREGON AND WASHINGTON; Wildl. Soc. Bull. 22:607-620, 1994http://web.archive.org/web/20041107222037/http://www.fs.fed.us/pnw/pubs/journals/ohmann-snagabundance.pdf.70 Wisdom, M.J., and Bate, L.J. 2008. Snag density varies with intensity of timber harvest and human access. For. Ecol. Manage. 255: 2085[ndash]2093. doi:10.1016/j.foreco.2007.12.027.https://web.archive.org/web/20111024015158/http://www.fs.fed.us/pnw/pubs/journals/pnw_2008_wisdom001.pdf.71 Kennedy, R. 2010. Large dead wood in coastal forests projected to increase on federal land, decrease on private. InMazza, Rhonda 2010. 2010 Science Accomplishments Report of the Pacific Northwest Research Station. Portland,Not just woodpeckers, but a wide variety of wildlife depend on dead wood. For instance, [ldquo]woodland (Plethodontid) salamanders are the most abundant vertebrates in North American forests, functioning as predators on invertebrates and prey for higher trophic levels.[rdquo]72 Salamander[rsquo]s role in the ecosystem has cascading effects on important public values, such as increasing forest carbon storage. The agency should strive to retain not just minimum levels, but optimal levels of dead wood in order to support diverse wildlife and their ecological functions.Salvage logging is harmful and outdatedThe revised plan needs to reflect the fact that salvage of dead and dying trees after natural disturbance events is scientifically outdated. It exacerbates the [ldquo]snag gap[rdquo] that naturally occurs after disturbance and before the next stand grows large trees that can be recruited. It removes trees that are valuable for wildlife and a wide variety of other ecosystem services. It truncates the diverse early seral ecosystem that thrives after natural disturbance.In September 2015, over 260 scientists sent a joint letter to Congress and the President highlighting the ecological value of post-fire landscapes, the significant adverse effects of salvage logging, and opposing bills that would encourage post-fire logging.[hellip] numerous scientific studies tell us that even in the patches where forest fires burn most intensely, the resulting wildlife habitats are among the most ecologically diverse on western forestlands and are essential to support the full richness of forest biodiversity.Post-fire conditions also serve as a refuge for rare and imperiled wildlife species that depend upon the unique habitat features created by intense fire. These include anabundance of standing dead trees, or [ldquo]snags,[rdquo] which provide nesting and foraging habitat for woodpeckers and many other plant and wildlife species responsible for the rejuvenation of a forest after fire.The post-fire environment is rich in patches of native flowering shrubs that replenish soil nitrogen and attract a diverse bounty of beneficial insects that aid in pollination after fire.[hellip]This post-fire renewal, known as [ldquo]complex early seral forest,[rdquo] or [ldquo]snag forest,[rdquo] is quite simply some of the best wildlife habitat in forests, and is an essential stage of natural processes that eventually become old-growth forests over time. This unique habitat is not mimicked by clearcutting, as the legislation incorrectly suggests. Moreover, it is the least protected of all forest habitat types, and is often as rare, or rarer, than old-growth forest,[hellip]After a fire, the new forest is particularly vulnerable to logging disturbances that can set back the forest renewal process for decades. Post-fire logging has been shown to eliminate habitat for many bird species that depend on snags, compact soils, remove biological legacies (snags and downed logs) that are essential in supporting new forest growth, and spread invasive species that outcompete native vegetation and, in some cases, increase the flammability of the new forest.OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 88 p. http://www.treesearch.fs.usda.gov/pubs/37383.72 Best, M. L., and H. H. Welsh, Jr. 2014. The trophic role of a forest salamander: impacts on invertebrates, leaf litter retention, and the humification process. Ecosphere 5(2):16. http://dx.doi.org/10.1890/ES13-00302.1.While it is often claimed that such logging is needed to restore conifer growth and lower fuel hazards after a fire, many studies have shown that logging tractors often kill most conifer seedlings and other important re-establishing vegetation and actually increases flammable logging slash left on site. Increased chronic sedimentation to streams due to the extensive road network and runoff from logging on steep slopes degrades aquatic organisms and water quality.We urge you to consider what the science is telling us: that post-fire habitats created by fire, including patches of severe fire, are ecological treasures rather than ecological catastrophes, and that post-fire logging does far more harm than good to public forests.73The ICBEMP analysis showed that traditional salvage logging that removes large trees is not compatible with ecosystem management.Can salvage timber sales be compatible with ecosystem-based management?[hellip] Our findings suggest that this type of harvesting is not compatible with contemporary ecosystem-based management. Ecosystem-based management would emphasize removing smaller green trees with greater attention to prevention of mortality rather than removal of large dead trees.74Salvage logging and replanting will convert a structurally complex landscape into a simplified and biologically depraved landscape. Unsalvaged, naturally regenerated, young stands are one of the rarest forest types in the Pacific northwest, and their biodiversity rivals that of old-growth forests. Lindenmayer et al. (2002):Indeed, naturally developed early-successional forest habitats, with their rich array of snags and logs and nonarborescent vegetation, are probably the scarcest habitat in the current regional [Pacific Northwest] landscape.75The ICBEMP Scientific Assessment says that salvage logging should not focus on the removal of large trees but rather the removal of small green trees to the extent that they present a risk of insect outbreaks. The agency should consider this as a NEPA alternative, but also consider the important ecological value of native forest insects.Salvage[mdash]We found that salvage activities could contribute to achievement of long-term ecological integrity by emphasizing prevention of insect and disease outbreaks rather than focusing on the removal of large, recently dead trees. Such an approach would include removing smaller green trees as part of the overall management regime that emphasizes stand structure and composition at the watershed level (rather than the stand level). Low risks to ecological integrity would exist from treating areas currently roaded, where companion efforts might include reducing adverse effects associated with73 DellaSala, Hanson et al (2015) Open Letter to U.S. Senators and President Obama from Scientists Concerned about Post-fire Logging and Clearcutting on National Forests. https://johnmuirproject.org/wp- content/uploads/2015/09/Final2015ScientistLetterOpposingLoggingBills.pdf.74 Quigley, Thomas M., tech. ed. 1996; The Interior Columbia Basin Ecosystem Management Project: Scientific

Assessment.) Gen. Tech. Rep. PNW-GTR-382, https://www.fs.usda.gov/pnw/pubs/pnw_gtr382.pdf; Page 178.75 Lindenmayer, David B. and Jerry F. Franklin. 2002. Conserving Forest Biodiversity: A Comprehensive Multiscale Approach. Island Press. Washington, DC: 69. See also, DellaSala, D.A., J.E. Williams, C. Deacon-Williams, and J.F. Franklin. 2004. Beyond smoke and mirrors: a synthesis of fire policy and science. Conservation Biology, Pages 976[ndash] 986. Volume 18, No. 4, August 2004.
http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/17521/Beyond%20smoke%20and%20mirrors.pdf.ro ads. Such approaches can be consistent with attainment of economic objectives for salvage activities.76How will the agency utilize this in the NEPA analysis?The NEPA analysis of the revised plan should consider and disclose reasons NOT to remove snags. Science tells us that natural forests develop after disturbance with abundant structural legacies. These legacy features include snags and down wood which play a wide variety of valuable ecological services for the developing forest, including but not limited to:[bull] nutrient uptake, storage, and release[bull] water uptake, storage, and release[bull] mycorrhizal colonization[bull] wildlife habitat, in particular for primary cavity species which are recognized as a "keystone" element of healthy forests[bull] allowing some forest species to linger in burned forests after disturbance and to recolonize burned forests sooner after disturbance, thereby shortening the period during which burned stands are unsuitable for wildlife[bull] providing food for insects that in turn feed a wide variety of other wildlife such as birds and bats[bull] favorable sites for seed germination and establishment[bull] mechanical thinning of the regenerating stand due to the process of snag fall[bull] shade and cover for everything from seedlings to big game[bull] perches, nest, and den structures,In general, the larger the piece size, the longer they tend to last. But salvage logging removes those very elements that are most valuable for wildlife and most difficult to replace. An excellent description of the diverse ecosystem services provided by dead trees often removed by salvage logging is provided by Rose at al. (2001).77Since this project involves post-fire commodity extraction (also often referred to erroneously as [ldquo]salvage[rdquo] logging) please carefully disclose and weigh the economic and environmental trade- offs the associated with salvage logging. The NEPA analysis must include a site-specific analysis of the many reasons NOT to do post-fire commodity extraction, including but not limited to:[bull] adverse impacts to soil, such as erosion, compaction, displacement, litter disturbance, nutrient depletion; loss of chemical buffering; loss of soil organic matter; loss of burrowing wildlife that help aerate soils; reduction of nitrogen fixing plants that boost soil fertility; loss of slope and snow stabilizing effects which could lead to mass wasting or eliminate mechanisms that may mitigate mass wasting;[bull] loss of down wood functions s such as trapping sediment and aiding water infiltration, and creating microsites favorable for germination and establishment of diverse plants, and habitat for diverse wildlife;76 Quigley, Thomas M., tech. ed. 1996; The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment.) Gen. Tech. Rep. PNW-GTR-382, https://www.fs.usda.gov/pnw/pubs/pnw_gtr382.pdf; Page 184. ICBEMP also included Appendix 12 - "Requirements for Snags and Down Wood" March 2000 Supplemental DEIS for the Interior Columbia Basin Ecosystem Management Project.
http://www.icbemp.gov/pdfs/sdeis/sdeis.html.77 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.pdf78 79[bull] loss of decaying wood and depletion of the [ldquo]savings account for nutrients and organic matter[rdquo] which affects site productivity through the removal of dead trees which store nutrients and slowly release them to the next stand. Mara[ntilde][oacute]n-Jim[eacute]nez, S. et al. (2013): [ldquo]Partially charred wood represented a considerable pool of nutrients, due to both the78
https://www.yesmagazine.org/environment/2020/03/11/climate-change-montana-forest/79
https://www.nrfirescience.org/event/wildfire-effects-microclimate-conditions-and-seedling-regeneration- northern-rockies-mixed; https://youtu.be/wxRAOWiVGkYrelatively high concentrations and to the great amount of biomass still present after the fire. Potential contributions of the charred wood were particularly relevant for N and micronutrients Na, Mn, Fe, Zn and Cu, as wood contained 2[ndash]9 times more nutrients than the soil. Post-fire woody debris constitutes therefore a valuable natural element as a potential source of nutrients, which would be lost from ecosystems in cases where it is removed.[rdquo]80[bull] Recent studies indicate that wood may release nutrients more rapidly than previously thought through a variety of decay mechanisms mediated by means other than microbial decomposers, i.e. fungal sporocarps, mycorrhizae and roots, leaching, fragmentation, and

insects;[bull] Charred trees produce a pulse of charcoal delivered into long-term storage in the soil which offers numerous benefits related to nutrient retention, below-ground biological activity, and water holding capacity. [ldquo]Post-fire salvage logging [hellip] can impact soil charcoal levels. Removing burned trees removes a lot of char that would otherwise fall to the ground and become incorporated into soil over time.[rdquo]81[bull] loss of nutrients from live trees that are determined to be [ldquo]dying.[rdquo] Surviving trees produce serve as refugia for animals, facilitate tree regeneration, invertebrates, and mycorrhizae; produce litter fall; and help cycle nutrients which are all extremely valuable in the post-fire landscape;[bull] loss of wood that serves to buffer soil chemistry and prevent extreme changes in soil chemistry;[bull] water quality degradation;[bull] loss of water storage capacity in down logs;[bull] altered timing of storm run-off which could lead to peak flows that erode stream banks and scour fish eggs;[bull] delaying the pace of vegetative recovery and reducing the quality/diversity of the vegetation community;[bull] dead trees serve as a natural fence that protects young seedlings from browse by cattle and big game. This is one way that young aspen and other valuable species can get their start;80 Mara[ntilde][oacute]n-Jim[eacute]nez, S., Fern[aacute]ndez-Ondo[ntilde]o, E., and J. Castro. 2013. Charred wood remaining after a wildfire as a reservoir of macro- and micronutrients in a Mediterranean pine forest. International Journal of Wildland Fire. http://dx.doi.org/10.1071/WF12030.81 Wilson, Kelpie 2015. Biochar for Forest Restoration in the Western United States [ndash] September 18, 2015 https://web.archive.org/web/20210609181804/http://greenyourhead.typepad.com/files/biochar_for_forest_restoration_wba.pdf. See also Maestrini, B., E. C. Alvey, M. D. Hurteau, H. Safford, and J. R. Miesel (2017), Fire severity alters the distribution of pyrogenic carbon stocks across ecosystem pools in a Californian mixed-conifer forest, J. Geophys. Res. Biogeosci., 122, doi:10.1002/2017JG003832; Wei, X., Hayes, D. J., Fraver, S., & Chen, G. (2018).Global pyrogenic carbon production during recent decades has created the potential for a large, long-term sink of atmospheric CO2. Journal of Geophysical Research: Biogeosciences, 123. https://doi.org/10.1029/2018JG004490 ([ldquo]PyC [pyrogenic carbon] production from fires may represent approximately 0.2[ndash]0.6% of annual global net primary production (Huston & Wolverton, 2009). Though this percentage is relatively small, we emphasize that PyC is more recalcitrant than original biomass (Bird et al., 2017), meaning that it accumulates in terrestrial and marine ecosystems PyC from fires may be a significant sink of atmospheric CO2 when considered over longer time periods... [F]ires represent a large carbon source to the atmosphere by releasing CO2 and other gaseous carbon compounds; however, they also create PyC in the form of charred material that remains on site or small particles that are transported far from the site of origin (Bird et al., 2015; Cotrufo et al., 2016). Because PyC is more recalcitrant to decay than original biomass, the accumulated PyC may serve as a potentially growing, stable carbon sink that is distributed globally.[rdquo]) See also, Montes-Pulido, C. R., Bird, M. I., Carvalho, S., Serrano, J., Quesada, C. A., & Feldpausch, T. R. (2025). Climatic and Edaphic Drivers of Soil Organic Carbon and Pyrogenic Carbon Stocks Across Elevation and Disturbance Gradients in Colombian Andean Forests. Global Change Biology, 31(7), e70135. https://doi.org/10.1111/gcb.70135[bull] spread of invasive weeds through soil disturbance and extensive use of transportation systems;[bull] loss of legacy structures that can carry species, functions, and processes over from one stand to the next;[bull] loss of terrestrial and aquatic habitat (mostly snags and down logs) potentially harming at least 93 forest species (63 birds, 26 mammals, and 4 amphibians) that use snags for nesting, roosting, preening, foraging, perching, courtship, drumming, and hibernating, plus many more species that use down logs for foraging sites, hiding and thermal cover, denning, nesting, travel corridors, and vantage points for predator avoidance;[bull] Depletion of large wood structures in streams that can cause: 1) simplification of channel morphology, 2) increased bank erosion, 3) increased sediment export, 4) decreased nutrient retention, 5) loss of habitats associated with diversity in cover, hydrologic patterns, and sediment retention;[bull] commercial salvage usually removes the largest trees, but this will disproportionately harm wildlife because: (1) larger snags persist longer and therefore provide their valuable ecosystem services longer and then serve longer as down wood too, and (2) most snag-using wildlife species are associated with snags >14.2 inches diameter at breast height (dbh), and about a third of these species use snags >29.1 inches dbh.[bull] Truncation of symbiotic species relations and loss of biodiversity. Sixteen species are primary cavity excavators and 35 are secondary cavity users; 8 are primary burrow excavators and 11 are secondary burrow users; 5 are primary terrestrial runway excavators and 6 are secondary runway users. Nine snag-associated species create nesting or denning structures and 8 use created structures.[bull] Reduced avian and terrestrial species diversity which affects plant and invertebrate diversity. Since different wildlife help disperse different sets of seeds and invertebrates, reduced wildlife diversity can significantly affect pace of recovery and the diversity of the regenerating stand. Snag-associated wildlife play a greater role in dispersal of invertebrates and plants, while down wood-associated wildlife play a greater role in dispersal of fungi and lichens. Down wood-associated species might contribute more to improving soil structure and aeration through digging, and to fragmenting wood which increases surface area encouraging biological action that releases nutrients.[bull] loss of partial shade that helps protect the next generation of forest;[bull] loss of cover quality and fawning areas for big game;[bull] loss of future disturbance processes such as falling snags that help thin and diversify the next generation of forest;82[bull] increased human activity and human access that can increase fire risk;[bull] increased fine fuels on the forest floor that can cause an increase in fire hazard;[bull] loss of seed sources, and[bull] loss of diversity of vegetation and microsite conditions.82 JAMES A. LUTZ AND CHARLES B. HALPERN. 2006. TREE MORTALITY DURING EARLY FOREST DEVELOPMENT: A LONG-TERM STUDY OF RATES, CAUSES, AND CONSEQUENCES. Ecological Monographs,76(2), 2006, pp. 257[ndash]275. This study showed that mortality from mechanical damage ([ldquo]crushing disturbance[rdquo]) from falling limbs and trees and snow loads can be a more significant factor than suppression mortality. See also, Brown, Martin J.; Kertis, Jane; Huff, Mark H. 2013. Natural tree regeneration and coarse woody debris dynamics after a forest fire in the western Cascade Range. Res. Pap. PNW-RP-592. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 50 p. [ldquo]Snag fall and fragmentation added so much wood to the ground[mdash]thousands of meters of log length per hectare[mdash]that it probably constitutes a significant ecological disturbance in itself, a kind of rain of logs.[rdquo])[bull] The fact that regional standards for snags and down wood fail to incorporate the most recent science indicating that more snags and down wood (especially large snags and logs) are required in order to maintain species viability and sustain site productivity.[bull] Arguments in support of the [ldquo]reburn hypothesis[rdquo] are specious. (1) partial reburn may be completely natural and desirable in some cases to consume some fuel and diversify the regenerating forest, and (2) salvage logging will cause a pulse of fine fuels on the ground and actually increase the reburn risk/hazard above natural levels, and (3) fuels that fall to the ground over time will to some extent decay as they fall.[bull] Uncertainty calls for a cautious approach.Compare these adverse impacts of salvage logging to the few scant reasons to salvage (e.g., economic recovery of fiber).Prevention of reburn must not be used as a justification for post-fire logging, without carefully documenting the rationale and providing references to published scientific studies (not just hypotheses and speculation and anecdotes). Also, the Forest Service must explain whether logging will increase or decrease the risk of reburn in terms of fuels profiles over various time horizons, ignition sources, etc. Salvage logging increases fine and mid-size fuels in the short- term by leaving treetops, branches, and needles on site. Fine and mid-size surface fuels also occur in unsalvaged areas, but accumulate gradually over time. It is unlikely that fuels in an unsalvaged area would reach the same magnitude as in the post-salvage scenario because decomposition breaks down new material accumulates. As noted by scientists interviewed by the Oregonian, [ldquo]There would be less risk by leaving dead trees standing where they gradually would decay while keeping their tinder above the reach of flames.[rdquo] Michael Milstein. [ldquo]Scorched forests best left alone, study finds.[rdquo] The Oregonian, Jan 6, 2006.Please consider at least one non-commercial, restoration-only alternative that invests in restoration and recovery of the fire area by, for instance, eliminating livestock grazing, emphasizing native species recovery, not building any new roads, stabilizing soils disturbed by the fire suppression effort, decommissioning unneeded roads.Also, consider an alternative modeled on the recommendations of the Beschta report. Specifically:[bull] prohibit post-fire logging AND roadbuilding on all sensitive sites, including: severely burned areas (areas with litter destruction), on erosive soils, on fragile soils, in roadless/unroaded areas, in riparian areas, on steep slopes, and any site where accelerated erosion is possible. We would add: Late-Successional and Riparian Reserves, and protective land allocations or designations including Botanical and Scenic River Areas;[bull] protect all live trees;[bull] protect all old snags over 150 years old;[bull] protect all large snags over 20 inches dbh;[bull] protect at least 50% of each size class of dead trees less than 20 inches dbh.83It is simply not necessary to conduct salvage and replanting in order to regenerate conifers. Science shows that natural regeneration is adequate to restock conifers even in large high severity burn patches. Hanson & Chi (2021) [ldquo]In our analysis the percentage of plots lacking83 See Beschta RL, Frissell CA, Gresswell R, Hauer R, Karr JR, Minshall GW, Perry DA, and Rhodes JJ. 1995. Wildfire and Salvage Logging: recommendations for ecologically sound post-fire salvage logging and other post-fire treatments on Federal lands in the West. Corvallis, OR: Oregon State University. Available at: http://www.fire- ecology.org/science/Beschta_Report.pdf.conifer regeneration decreased significantly with larger plot sizes, a finding contrary to previous studies which assumed vast [ldquo]deforested[rdquo] areas in wildland fires, a bias created by small plot size. We found higher conifer regeneration closer to live-tree edges, but we consistently found natural post-fire conifer regeneration at all distances into interior spaces of large high-severity fire patches, including >300 m from the nearest live trees. Distance from live-tree edges did not affect pine dominance in post-fire regeneration. [hellip] Our results indicate that using small plots and reporting the proportion of these plots without conifer regeneration, or the median values (which will often be zero when plots are very small), has the potential to create a misleading impression that post-fire conifer regeneration in high-severity fire patches occurs almost exclusively near live-tree edges and is nearly absent far from surviving conifers[mdash]an assumption that is driving and misdirecting current forest management to perform widespread post-fire clearcutting and artificial tree planting in spotted owl territories (USFS, 2014, 2016).[rdquo]84The analysis for the revised plan should consider the recommendations of the Society for Conservation Biology (2006) which prepared a white paper summarizing the scientific approach to forest management after fire. This report was later peer-reviewed and published in Frontiers in Ecology and Environment 2006:Forest Management After WildfireForest landscapes that have been affected by a major natural disturbance[mdash]such as a severe wildfire or windstorm event[mdash]are commonly viewed as devastated and biologically impoverished. Such perspectives are usually far from ecological reality. Overall species diversity measured as number of species[mdash]at least of higher plants and vertebrates[mdash]is often highest following a natural stand-replacement disturbance and before re- development of closed-canopy forest. Important reasons for this include an abundance of biological legacies, such as living organisms and dead tree structures, the migration and establishment of additional organisms adapted to the disturbed, early-successional environment, and temporary release of other plants on the site from dominance by trees.Currently, natural, early-successional forest habitat[mdash]naturally disturbed areas with a full array of legacies (i.e., not subject to post-fire logging) and experiencing natural recovery processes (i.e., not seeded or planted)[mdash]are among the scarcest habitat condition in some regions, such as the Pacific Northwest.Key Findings:[bull] Research by both ecologists and foresters provides evidence that areas affected by large-scale natural disturbances often recover naturally. Post- burn landscapes have substantial capacity for natural recovery. Reestablishment of closed forest following stand-replacement fire characteristically occurs at widely varying rates, providing temporary, but ecologically important and now rare early-successional habitat for a variety of native species and key ecological processes.[bull] Post-fire logging does not contribute to ecological recovery; rather it negatively impacts recovery processes, with the intensity of such impacts84 Hanson CT and Chi TY (2021) Impacts of Postfire Management Are Unjustified in Spotted Owl Habitat. Front. Ecol. Evol. 9:596282. doi: 10.3389/fevo.2021.596282.https://californiachaparral.org/ static/4f78faa64c72d372738235ccd46dac10/hanson-and-chi-rim-fire-forest- 2021.pdf.depending upon the nature of the logging activity. Post-fire logging in naturally-disturbed forest landscapes generally has no direct ecological benefits and many potential negative impacts from an ecological standpoint. Trees that survive the fire for even a short period of time are critical as seed sources and as habitat that will sustain many elements of biodiversity both above and below ground. The dead wood, including large snags and logs, is second only to live trees in overall ecological importance.Removal of these structural legacies[mdash] living and dead[mdash]is inconsistent with our scientific understanding of natural disturbance regimes and short- and long-term recovery processes.[bull] Post-fire logging destroys much of whatever natural tree regeneration is occurring on a burned site. This is a fundamental concern since these tree seedlings are derived from local seed sources, which are most likely the best adapted to the site. Furthermore, environmental variables, such as moisture and temperature conditions, are major selective factors in determining which natural tree seedlings survive, which favors genotypes more tolerant of environmental stresses than are nursery- or greenhouse-grown seedlings.[bull] Evidence from empirical studies is that post-fire logging typically generates significant short- to mid-term increases in fine and medium fuels. In some cases this may result in increased reburn potential rather than a decreased reburn potential, as is often claimed. In any case, from an ecological perspective large wood is of demonstrated importance in ecological recovery; removing this wood in an attempt to influence the behavior of a potential reburn event has little scientific support.[bull] In forests subjected to severe fire and post-fire logging, streams and other aquatic ecosystems will take longer to return to historic conditions or may switch to a different (and often less desirable) state altogether. Following a severe fire the biggest impacts on aquatic ecosystems are often increased sedimentation caused by runoff from roads. High sediment loads from roads may continue for years, greatly increasing the time for recovery.[bull] Post-fire seeding of non-native plants generally damages natural ecological values, such as reducing the recovery of native plant cover and biodiversity, including tree regeneration. Non-native plants typically compete with native species, reducing both native plant diversity and cover. Reductions in natural tree regeneration as a result of seeding of non-native plants have also been reported in numerous studies.[bull] Post-fire seeding of non-native plants is often ineffective at reducing soil erosion. Aerial seeding of grasses (primarily non-native) is common on federal lands following moderate- to high-severity fire to reduce postfire erosion. The effectiveness of seeding in reducing erosion is mixed. Grass seeding generally does not mitigate erosion during the first winter following fire, when seeded grasses are not yet well established. Seeding may slow erosion during the second year following fire but is rarely effective during intense storms.[bull] There is no scientific or operational linkage between reforestation and post-fire logging; potential ecological impacts of reforestation are varied and may be either positive or negative depending upon the specifics of activity, site conditions, and management objectives. On the other hand, ecological impacts of post-fire logging appear to be consistently negative. Salvage and reforestation are often presented asthough they are interdependent activities, which they are not from either a scientific or operational perspective. From a scientific perspective, policy and practice should consider each activity separately. As noted above, post-fire logging is a consistently negative practice from the standpoint of ecological recovery. Natural tree regeneration is ecologically most appropriate, but intentional reforestation could also be designed to provide significant ecological benefits in some cases.[bull] Accelerated reestablishment of extensive closed forest conditions after fire is usually not an appropriate objective on sites managed with a major ecological focus. Wildfires have been viewed historically as events that destroy valuable standing forest and create undesirable expanses of deforested (i.e., unproductive) landscape. Reestablishment of fully stocked stands of commercially important tree species on burned sites has been a fundamental forest management objective on most private and public forestlands; hence the historic commitment to intensive reforestation. However, timber production is no longer the primary objective on many federal lands, where the focus on provision of biodiversity and ecosystem services equals or exceeds wood production objectives. The ecological importance of biological legacies and of uncommon, structurally complex early-successional stands argues against actions to achieve rapid and complete reforestation except where the primary goal is wood production. In addition, it is also inappropriate to re-establish fully stocked stands on sites characterized by low severity fire[mdash]the same sites where managers are trying to restore fuel loadings to their historical range of variability.[bull] Where timber production, other societal management goals, or special ecological needs are the focus, planting or seeding some native trees and other plants using local seed sources may be appropriate. Ecological assessments of the post-burn area and considerations of management objectives should be used to determine appropriate activity. Special ecological circumstances might include a need to restore an uncommon plant species or habitat for a threatened or endangered species. Innovative practices, such as low or variable density planting, will likely be more appropriate ecologically than traditional practices that involve dense tree plantations of one or a few commercial species. Dense uniform conifer plantations are always inappropriate on sites characterized by low-severity fire unless the intent is intensive management of such sites for wood production.85Fire kills vegetation and dramatically changes forage and cover quality for big game. Big game have also lived with fire for millennia. Deer are known to use areas affected by fire. The fire- created mosaic of forage and residual cover may be beneficial for big game. Forage will almost certainly improve following fire, but in order for the big game populations to take advantage of this new flush of forage, the agency must maintain an adequate amount of cover.85 Society for Conservation Biology, Scientific Panel on Fire in Western U.S. Forests, Reed F. Noss (editor), Jerry F. Franklin, William Baker, Tania Schoennagel, and Peter B. Moyle. Ecological Science Relevant to Management Policies for Fire-prone Forests of the Western United States. February 24, 2006. https://web.archive.org/web/20101213170745/http://conservationbiology.org/Sections/NAmerica/FireWhitepaper.pdf See also the published version, Reed F. Noss (editor), Jerry F. Franklin, William L. Baker, Tania Schoennagel, and Peter B. Moyle. 2006. Ecology and Management of Fire-prone Forests of the Western United States. Society for Conservation Biology Scientific Panel on Fire in Western U.S. Forests. August 2006. http://www.conbio.org/images/content_policy/2006-8_SCB_NA_Statement_Wildland_Fire.pdf.Fires provide two benefits for big game: improved forest and adequate hiding cover. Salvage logging will remove what little cover they have. Montana Fish & Game staff have observed big game using fire killed trees as security cover:The upside of fires is that they remove some of the blocking overstory and rejuvenate forage in the understory, Kolbe said. When a burn takes place it can improve forage for as long as 25 or 30 years.[ldquo]In most cases burns are, in the long term, really beneficial,[rdquo] he said.It depends on the scope and intensity of the fire to estimate when a herd may return. In some instances, especially if the area is more wet than average, elk are back as early as the year following a burn if green grass is growing abundantly in the rich soil. In other cases it can take several years for the soil to recover and plants to start growing again.Kolbe said he[rsquo]s witnessed an interesting trend in tight patches of lodgepole that are burned. A few years following those torchings, the lodgepoles start to fall over and create a thick patchwork covering the ground. That[rsquo]s difficult for people to walk through, but doesn[rsquo]t seem to affect elk travel.Kolbe said he[rsquo]s seen some bulls seek out those areas and hide among the thick downed trees where there[rsquo]s plenty of grass and less potential danger.[ldquo]The elk are going to go where the forage and habitat security is,[rdquo] he said.8686 ALEXANDER DEEDY 2015. Elk numbers at or above target in north-central Montana. Helena Independent Record. September 17, 2015. http://helenair.com/lifestyles/outdoors/elk-numbers-at-or-above-target-in-north- central-montana/article_941cf307-8cc1-5370-876b-01aa2f921039.html.A deer finds cover in a burned forest. Salvage logging will eliminate cover, thus reducing the utility of newly created forage.Although fire may have reduced big game habitat, salvage logging will make a bad situation worse by reducing cover and delaying recovery of vegetation species that are favorable for foraging and hiding cover. Even dead trees can provide hiding or thermal cover for a period of time. The NEPA analysis must assess the lost cover associated with salvage logging of dead trees, either those killed by the fire or that will die in the near term from fire-related damage.87Robichaud et al (2016) looked at the effects of salvage logging on run-off and erosion and found that salvage logging exacerbates fire effects.Runoff volume, runoff velocities, and sediment concentrations increased with increasing levels of disturbance. The burned only plots had lower runoff rates and sediment concentrations than any of the other disturbances. The salvage logged plots had greater responses than the burn only plots and the mitigation treatment had a marginal effect on runoff ratios, runoff velocities and sediment concentrations. These results suggest that additional disturbance after a wildfire can increase the erosional response [hellip]88Wagenbrenner et al. (2015): [ldquo]Highlights: Post-fire salvage logging increased soil compaction and decreased vegetative cover. Salvage logging greatly increased sediment production from more disturbed plots. Salvage logging delayed post-fire recovery of vegetation and sediment production.[rdquo]89Wagenbrenner et al (2016) found that salvage logging increases erosion and reduces vegetation cover.87 Grifantini (1990 and 1991) cited in McIver, James D.; Starr, Lynn, tech. eds. 2000. Environmental effects of postfire logging: literature review and annotated bibliography. Gen. Tech. Rep. PNW-GTR-486. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 72 p. https://web.archive.org/web/20170504124830/http://www.fs.fed.us/pnw/pubs/gtr486.pdf.88 Robichaud, Peter; Wagenbrenner, Joseph; Brown, Robert 2016. Rill Erosion in Post Wildfire Forests after Salvage Logging. Geophysical Research Abstracts. Vol. 18, EGU2016-17814, 2016. EGU General Assembly 2016, held 17-22 April, 2016 in Vienna Austria, p.17814. http://adsabs.harvard.edu/abs/2016EGUGA..1817814R;https://meetingorganizer.copernicus.org/EGU2016/EGU2016-17814.pdf.89 Joseph W. Wagenbrenner, Lee H. MacDonald, Robert N. Coats, Peter R. Robichaud, Robert E. Brown 2015. Effects of post-fire salvage logging and a skid trail treatment on ground cover, soils, and sediment production in the interior western United States. Forest Ecology and Management. Volume 335, 1 January 2015, Pages 176[ndash]193. http://www.fs.usda.gov/rm/pubs_journals/2015/rmrs_2015_wagenbrenner_j001.pdfWe found that ground-based logging using heavy equipment compacted soil, reduced soil water repellency, and reduced vegetation cover. Vegetation recovery rates were slower in most logged areas than the controls. Runoff rates were higher in the skidder and forwarder plots than their respective controls in the Montana and Washington sites in the year that logging occurred, and the difference in runoff between the skidder and control plots at the British Columbia site was nearly significant ($p = 0.089$). Most of the significant increases in runoff in the logged plots persisted for subsequent years. [hellip] [R]ill sediment fluxes were 5 to 1900% greater in logged plots than the controls in the year of logging [hellip] Our results indicate that salvage logging increases the risk of sedimentation regardless of

equipment type and amount of traffic, and that specific best management practices are needed to mitigate the hydrologic impacts of post-fire salvage logging.90Mara[ntilde][oacute]n-Jim[eacute]nez et al (2013) found that salvage logging harmed natural forest regeneration processes.salvage logging has a detrimental effect on the ecophysiological performance and growth of naturally regenerating pine seedlings, compared to alternative post-fire management practices in which burnt logs and branches are left in situ. Improved seedling growth and performance is associated with the amelioration of microsite/microclimate conditions by the presence of residual burnt wood, which alleviates seedling drought stress and improves nutrient availability through the decomposition of woody debris.91Leverkus et al (2014) also found that salvage logging sets back vegetation recovery after fire.Post-fire salvage logging was associated with reduced species richness, Shannon diversity, and total plant cover. Moreover, salvaged sites hosted different species assemblages and 25% lower cover of seeder species (but equal cover of resprouters) compared to the other treatments. Cover of trees and shrubs was also lowest in Salvage Logging, which could suggest a potential slow-down of forest regeneration.92Salvage logging will set back vegetative recovery that has already started and thereby retard attainment of riparian and aquatic management objectives. In research on post-fire logging on the Winema NF, Sexton (1998) found that salvage logged sites produced only about 38% of the understory biomass of that on the unlogged site; and one year later produced only about 27% of the understory biomass of that on the unlogged site. In fact, Sexton[rsquo]s (1998) study comparing salvaged and unsalvaged areas of a fire on the Winema NF one and two years after logging showed:90 Wagenbrenner, Robichaud & Brown 2016. Rill erosion in burned and salvage logged western montane forests: Effects of logging equipment type, traffic level, and slash treatment. Journal of Hydrology. DOI: 10.1016/j.jhydrol.2016.07.049.
https://www.fs.usda.gov/rm/pubs_journals/2016/rmrs_2016_wagenbrenner_j001.pdf.91 Sara Mara[ntilde][oacute]n-Jim[eacute]nez, Jorge Castro, Jos[eacute] Ignacio Querejeta, Emilia Fern[aacute]ndez-Ondo[ntilde]o, Craig D. Allen 2013. Post-fire wood management alters water stress, growth, and performance of pine regeneration in a Mediterranean ecosystem. Forest Ecology and Management 308 (2013) 231[ndash]239.
https://ecologia.ugr.es/sites/dpto/ecologia/public/inline-images/Post-fire-wood-management-alters-water-stress.pdf.92 Alexandro B. Leverkus, Juan Lorite, Francisco B. Navarro, Enrique P. S[aacute]nchez-Ca[ntilde]ete, Jorge Castro 2014. Post-fire salvage logging alters species composition and reduces cover, richness, and diversity in Mediterranean plant communities.
http://www.californiachaparral.com/images/Leverkus_et_al_Salvage_logging_Med_climates_2014.pdf.Salvage Areas Unsalvaged Areasreduced vegetation biomass greater vegetation biomassreduced species diversity greater species diversityreduced species richness greater species richnessreduced growth of planted seedlings greater growth of planted seedlings reduced survival of planted seedlings greater survival of planted seedlings93Maintaining and restoring mature and old-growth requires protecting burned forests from salvage. In a major agency-sponsored science synthesis surrounding the Northwest Forest Plan, Dr. Tom Spies explained the need to conserve legacy trees after fire, because they contribute to the complexity and diversity of the new forest for decades or centuries.The ecological influences of old growth do not end with the death of the tree layer in a high-severity fire, however. Biological legacies of old growth, including dead trees, surviving live trees, and other organisms and organic matter carry over into the young forests and can persist for many decades as the new younger forest develops (Harmon and others 1986). For example, significant amounts of dead wood from the previous stand can be found 100 years later in postfire stands, and trace amounts can be detected in some 200- year-old stands (Spies and others 1988). [hellip] The [ldquo]connected oldgrowth network[rdquo] is more than a spatial concept[mdash]it is also a temporal one, in which developmental stages are connected to each other through surviving and slow-decaying structural and compositional components of previous stages. [hellip] [R]emoving any large dead trees would diminish amounts of late-successional habitat elements in young forests. Second, these early-successional stages, with many large dead trees, contribute to an important but not often stated goal2 of the Plan, which is to maintain biological diversity. [hellip] [T]he ecological value of large dead trees in early-successional forests has been reaffirmed in several synthesis papers on the subject (Beschta and others 2004, Lindenmayer and others 2004, McIver and Starr 2000). In addition, no empirical evidence has emerged that salvage logging can improve the desired ecological diversity of young forest or the development of late-successional forests later in succession.94Salvage logging is often justified by alleged fuel reduction purposes. This is not supported by science. Post-disturbance fuels are not a significant fuel hazard. Salvage

increases fire hazard.A core purpose of forest planning is to balance the value of retaining snags and down wood spotted owls and other wildlife against the fire hazard caused by retaining snags and down wood. The revised plan must acknowledge that balance is best achieved if the agencies retain all large snags because they contribute greatly to habitat value and contribute little to fire hazard, while focusing fuel reduction only on small snags that contribute little to habitat values while contributing disproportionately to fire hazard.Contrary to popular belief, snags and large downed wood do not pose a high fire hazard. Research into fire behavior and fuel modeling has shown that large, downed wood and snags are not [ldquo]flashy[rdquo] fuels that carry fire. They are slow burning, producing slow- moving fire with short flame lengths.93 Sexton, Timothy O. 1998. Ecological effects of post wildfire activities (salvage-logging and grass-seeding) on vegetation composition, diversity, biomass, and growth and survival of Pinus ponderosa and Purshia tridentata. MS Thesis Oregon State University. Corvallis, OR. 121p.94 Spies, T.A. 2006. Maintaining old-growth forests. Chapter 6 in R.W. Haynes, B.T. Bormann, D.C. Lee, J.R. Martin, tech. eds. Northwest Forest Plan - The First 10 Years (1994-2003): Synthesis of Monitoring and Research Results.General Technical Report PNW-GTR-651. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR. https://www.fs.usda.gov/pnw/pubs/pnw_gtr651.pdf.[hellip]Snags are often removed simply because we don[rsquo]t like the way they look. But if we looked closely, we would see that snags contain even more life than live trees. Hundreds of species of fungi and insects, specialized only to feed on dead wood, inhabit these trees.These organisms in turn feed dozens of other animals who co-evolved with this dead wood resource that used to be abundant in our forests.95A large study of instances where reburn did occur found that past fire helps moderate future fire for up to 20 years, though there are a lot of complex variables. Tortorellis (xxxx) [ldquo]In forests that historically experienced frequent-fire regimes, high-severity fire exacerbates the severity of subsequent fires by increasing prevalence of shrubs and/or by creating drier understory conditions. Low- to moderate-severity fire, in contrast, can moderate future fire behavior by reducing fuel loads. [hellip] Previous fire moderated reburn severity in all ecoregions with the strongest effects occurring in the California Coast and Western Mountains and the average duration of moderating effects ranging from 13 years in the Western Mountains to >36 years in the California Coast. The strength and duration of moderating effects depended on climate and initial fire severity in some regions, reflecting differences in post-fire fuel accumulation. [hellip] Moderating effects were largely robust to fire weather, suggesting that previous fire can mediate future fire severity even under extreme conditions.[rdquo]96Recognizing that small fuels are the most hazardous and large fuels are the least hazardous, the best way to summarize the effects of salvage logging is to say that it increase fuel loads and fire hazard for several years, followed by a 40 year shortage of large woody habitat. Peterson et al. (21015):Relative to unlogged stands, post-fire logging initially increased surface woody fuel loads, increasing small diameter fuel loads by up to 2.1 Mg/ha during the first 5 years after fire and increasing medium diameter fuel loads by up to 5.8 Mg/ha during the first 7 years after fire. Logging subsequently reduced surface woody fuel loads, reducing large diameter fuel loads by up to 53 Mg/ha between 6 and 39 years after wildfire, reducing medium diameter fuel loads by up to 2.4 Mg/ha between 12 and 23 years after wildfire, and reducing small diameter fuel loads by up to 1.4 Mg/ha between 10 and 28 years after wildfire. Logging also reduced rotten, large diameter fuel loads by up to 24 Mg/ha between 20 and 39 years after wildfire.97The significant and long-term reduction of large woody habitat seems much more significant than the minor, short-term changes in small fuels.BLM created a model based on MTBS (Monitoring Trends in Burn Severity) data and they estimated that over a 50 year period only 10% of the area affected by wildfires will reburn.9895 Lyndia Hammer and Pepper Trail 2021. Snags have value as essential homes for wildlife. Medford Mail Tribune op- ed March 7, 2021. https://www.mailtribune.com/opinion/guest-opinions/snags-have-value-as-essential-homes-for- wildlife/96 Tortorelli, C. M., Latimer, A. M., & N. Young, D. J. Moderating effects of past wildfire on reburn severity depend on climate and initial severity in Western US forests. Ecological Applications, e3023. https://doi.org/10.1002/eap.3023,https://esajournals.onlinelibrary.wiley.com/doi/epdf/10.1002/eap.3023.97 Peterson, David W.; Dodson, Erich K.; Harrod, Richy J. 2015. Post-fire logging reduces surface woody fuels up to four decades following wildfire. Forest Ecology and Management. 338: 84-91. http://www.firescience.gov/projects/06-3-4-16/project/06-3-4-16_Peterson_et_al_-_2015_-_FEM_-_post-fire_logging_and_fuels.pdf.98 BLM 2015. RMP Revisions for Western Oregon DEIS. Appendix D [ndash] Modeling Wildfires and Fire Severity.

http://www.blm.gov/or/plans/rmpswesternoregon/files/draft/RMP_EIS_Volume3_appd.pdf.The best available science indicates that salvage logging increases small fuels that are most hazardous, and reduces large wood which is most valuable to wildlife.Our study examined fuel succession patterns by surveying downed woody fuels across a chronosequence of dry coniferous forest stands that burned with high fire severity (95[ndash] 100% overstory tree mortality) within mixed- and high-severity wildfires in eastern Washington and Oregon, USA, between 1970 and 2007. We sampled forests in which ponderosa pine (Pinus ponderosa) and Douglas-fir(Pseudotsuga menziesii) are the dominant early-seral tree species [hellip] Relative to unlogged stands, post-fire logging initially increased surface woody fuel loads, increasing small diameter fuel loads by up to 2.1 Mg/ha during the first 5 years after fire and increasing medium diameter fuel loads by up to 5.8 Mg/ha during the first 7 years after fire. Logging subsequently reduced surface woody fuel loads, reducing large diameter fuel loads by up to 53 Mg/ha between 6 and 39 years after wildfire [hellip] The initial pulse of elevated surface fuels in logged stands was expected under our first hypothesis. Post-fire logging transfers woody debris in tree branches and tops from the canopies of fire-killed trees to the forest floor, producing well-documented conditions of higher surface woody fuels in logged stands than in unlogged stands in the first 1[ndash]4 years following logging (Donatoet al., 2006, 2013; McIver and Ottmar, 2007; Monsanto and Agee, 2008; Keyser et al., 2009). Higher amounts of surface woody fuels [ndash] especially small and medium diameter woody fuels [ndash] can increase short-term fire hazards in logged stands by increasing potential rate of spread and fire-line intensity [hellip] Post-fire logging was most effective for reducing large diameter surface fuels, consistent with our second hypothesis. By removing tree boles, post-fire logging reduced maximum large diameter fuel loadings and produced a long period of reduced large diameter fuels, including both sound and rotten fuels. Although large diameter fuels may contribute little to fire spread rates (Hyde et al., 2011) and are typically disregarded in fire behavior modeling [hellip].99This study showed that salvage logging is most effective at reducing large fuels, which contribute least to fire hazard, but the study strangely failed to consider the effect on habitat. Reducing large wood for 40 years or more will have a significant adverse effect on wildlife habitat. It is also notable that this study focuses on fuels, but failed to note whether any of the numerous fire areas they looked at across Oregon and Washington had actually reburned. Studies that have looked at this issue, show that the risk of reburn (with or without salvage logging) is small, while the risk to wildlife from salvage logging is great.Similar results were found in a [ldquo]NecroDynamics[rdquo] model that looked at 7 fires in the eastern slopes of the Oregon Cascades.Salvage logging immediately increased surface fine woody fuel loadings by 160[ndash]237% above maximum loadings observed in unmanipulated stands, and were higher during the initial 18[ndash]22 years post-fire [hellip] [O]ur modeling results suggest salvage logging has mixed effects on reducing hazardous fuel conditions since it increases fine woody fuel loadings and decreases coarse woody fuel loadings. [hellip] [P]rescriptions can be altered. For example, [to] retain a higher abundance of snags which would reduce the magnitude of difference in fine woody fuels between salvaged and unmanipulated stands during early in post-fire succession [hellip]. Although salvage logging reduces coarse woody fuel loadings, alone it does not mitigate re-burn hazard because it increases fine woody fuel loadings [hellip]. Additionally, intensive reforestation typically substitutes conifer biomass for shrub99 David W. Peterson, Erich K. Dodson, Richy J. Harrod 2015. Post-fire logging reduces surface woody fuels up to four decades following wildfire. Forest Ecology and Management 338 (2015) 84[ndash] 91.http://www.firescience.gov/projects/06-3-4-16/project/06-3-4-16_Peterson_et_al_-_2015_-_FEM_-_post-fire_logging_and_fuels.pdf.biomass, limiting hazardous fuels reduction unless additional efforts are employed [hellip] Understory woody vegetation reestablishes rapidly in these dry-mixed conifer forests (Dunn and Bailey, in press) and can be a highly-flammable fuel layer (Weatherspoon and Skinner, 1995), as well as a source of post-fire fine woody fuels when shrub crowns die (Table 4). This suggests salvage logging alone will not mitigate contributions to re-burn hazard from dead biological legacies when the temporal dynamics of multiple fuelbeds (e.g. fine woody fuels, coarse woody fuels, and regenerating vegetation) are evaluated. R[hellip] Salvage logging to enhance ecosystem resilience may not be appropriate if multiple ecosystem functions and resources are considered, including; coarse wood use by wildlife (Cahall and Hayes, 2009; Hutto, 1995; Fontaine et al., 2009; Saab et al., 2005), functional attributes of early seral vegetation (Swanson et al., 2010), compounding effects on soil and nutrient pools (Brais et al., 2000; Triska and Cromack, 1980) and reduced water and carbon storage (Harmon et al., 1986).100The authors suggested modifying salvage logging prescriptions to retain more snags, which would help retain fine fuels in the canopy longer and reduce the amount of fine fuels that are moved from the canopy to the ground.Contrary to what many believe, she said, large dead trees are not a major fire hazard and the finer materials left behind after logging, like branches, are a bigger risk."It's fine materials that will carry a fire. When you want to start a fire, you don't put this big log in your fire pit, it has to start with smaller pieces. It's the same in the forest, so dead standing trees aren't that big of an issue."101A study of the portions of the Biscuit fire that were previously burned by wildfire, reveals that salvage logging did not reduce the severity of subsequent fires, and in fact salvage logging appeared to increase the severity of subsequent wildfires.102A scientific study of post-fire logging (McIver and Ottmar 2007) showed that salvage logging causes a four-fold increase in fine fuels and that increase can last for 15 years. Fine fuels tend to cause wildfires to rapidly spread which is more likely to kill young trees and set back forest recovery. Unlogged fire areas (the controls) had lower levels of fine fuels but had higher levels of large fuels. Large fuels do not tend to exacerbate the spread of fire but they can heat the soil.However, soil heating is a patchy phenomenon that forests have evolved with and can tolerate.100 Christopher J. Dunn, John D. Bailey 2015. Modeling the direct effects of salvage logging on long-term temporal fuel dynamics in dry-mixed conifer forests. Forest Ecology and Management 341 (2015) 93[ndash]109. http://www.sierraforestlegacy.org/Resources/Conservation/FireForestEcology/SalvageLoggingScience/Dunn&Baile y2015.pdf.101 Justin Dupuis 2019. Leaving more deadwood in forests enhances biodiversity, according to study. PHYSORG. SEPTEMBER 25, 2019. https://phys.org/news/2019-09-deadwood-forests-biodiversity.html citing Jennie Sandstr[ouml]m et al. Impacts of dead wood manipulation on the biodiversity of temperate and boreal forests. A systematic review, Journal of Applied Ecology (2019). DOI: 10.1111/1365-2664.13395. https://besjournals.onlinelibrary.wiley.com/doi/pdf/10.1111/1365-2664.13395.102 See Jonathan R. Thompson, Thomas A. Spies, and Lisa M. Ganio. 2007. Reburn severity in managed and unmanaged vegetation in a large wildfire. Proceedings of the National Academy of Sciences. PNAS published online Jun 11, 2007. http://www.fs.usda.gov/pnw/pubs/journals/pnw_2007_thompson001.pdf ([ldquo]In places that burned with high severity in the Silver Fire, areas that were salvage-logged and planted burned with even higher severity than comparable unmanaged areas.[rdquo]) https://web.archive.org/web/20090514083136/http://www.fs.fed.us/pnw/research/PNAS_Biscuit_Author_Comments_PNW.doc. This represents significant new information about salvage logging. ([ldquo]Some, including forest scientists, would have expected fire severity to be lower in the logged and planted sites, where large wood was removed, broadcast burning done to reduce fine surface fuels, and some vegetation management conducted possibly reducing the cover of flammable shrubs. That our findings were the opposite of this expectation indicates that the large diameter wood is not a major factor in flammability [hellip][rdquo]).Retaining the large wood is also important for wildlife habitat and soil conservation. The scientific consensus in the fuel management literature is that it is more important to control small fuels.103Donato et al (2006) looked at the effects of salvage logging after the Biscuit fire and found that[mdash] Postfire logging significantly increased both fine and coarse downed woody fuel loads (Fig. 1B). This pulse was comprised of unmerchantable material (e.g., branches), and far exceeded expectations for postfire logging-generated fuel loads (5, 6). In terms of short- term fire risk, a reburn in logged stands would likely exhibit elevated rates of fire spread, fireline intensity and soil heating impacts (7). Postfire logging alone was notably incongruent with fuel reduction goals. Fuel reduction treatments (prescribed burning or mechanical removal) are frequently intended following postfire logging, including in the Biscuit plan, but resources are often not allocated to complete them (8). Our study underscores that, after logging, mitigation of short-term fire risk is not possible without subsequent fuel reduction treatments.104The 1987 Bland Mountain fire burned east of Canyonville and was heavily salvage logged. The same area then reburned in 2004 with high fire intensity. Salvage logging did not appear to save these plantations from intense fire, in fact, the removal of large logs and dense replanting may have made the fire more intense. One fact is unquestionable, that is that fire hazard is high in young plantations even when they are salvaged. Salvage logging does nothing to address this fact, and may in fact lead to increased density of conifer vegetation types that are more flammable than the mixed conifer-broadleaf vegetation types that may be less flammable.The Forest Service often asserts that leaving large numbers of snags is unsafe and the agency typically anticipated undesirable scenario with respect to the no action and restoration alternatives, but the analysis must acknowledge the fire risks associated with salvage logging including: (a) salvage logging will remove most of the largest logs that least prone to burn (because large logs hold the most water the longest and they have relatively high ratios of volume to surface area), (b) salvage logging leave behind almost all of the smallest material which is most prone to drying and burning (e.g., relatively low ratio of volume to surface area),(c) the proposed action may lop and scatter the tops of large trees that are too big for the ground-based harvest machinery, (d) salvage logging equipment and workers could start fires,(e) increased human access increases the risk of human caused ignition, (f) the replanting will create a fuel load that is dense, uniform, extensive, volatile, and close to the ground (During an extreme weather conditions this is one of the most extreme fire hazards in the forest).There is little empirical support for the idea that salvage logging reduces the intensity or severity of subsequent fire. Recent data show an actual increase in fire severity where post-fire logging had occurred.105103 J.D. McIver, and R. Ottmar. 2007. Fuel mass and stand structure after post-fire logging of a severely burned ponderosa pine forest in northeastern Oregon. Forest Ecology and Management. Volume 238, Issues 1-3 , 30 January 2007, Pages 268-279.http://www.sierraforestlegacy.org/Resources/Conservation/FireForestEcology/SalvageLoggingScience/Salvage- McIver07.pdf104 D. C. Donato, J. B. Fontaine, J. L. Campbell, W. D. Robinson, J. B. Kauffman, B. E. Law. Post-Wildfire Logging Hinders Regeneration and Increases Fire Risk. www.sciencexpress.org. 5 January 2006.105 McIver, James D.; Starr, Lynn; [Technical Editors] 2000. Environmental effects of postfire logging: literature review and annotated bibliography Gen. Tech. Rep. PNW-GTR-486. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 72 p. http://www.fs.usda.gov/pnw/pubs/gtr486.pdf. Harma K., and P. Morrison. 2002. Analysis of Vegetation Mortality and Prior Landscape Condition, 2002 Biscuit Fire Complex. Pacific Biodiversity Institute.The agency also over-states the risk of leaving standing snags. Where large numbers of standing snags were present in bug killed areas burned by the Hayman fire in Colorado, fire was generally less severe compared to other areas where large numbers of dead trees were absent.In addition to wildfires, the Hayman Fire burned over another type of natural fuel modification: an area affected by a spruce budworm outbreak. Most Douglas-fir in the area between points 47 and 48 on figure 63 were killed by spruce budworm in the early 1990s with subsequent mortality in remaining trees from Douglas-fir beetle. Surface fuel loads were not excessive, since most of the Douglas-fir snags remained standing. The only live trees remaining prior to the Hayman fire were scattered ponderosa pine and the reduction in crown cover due to insect mortality seemed to affect fire behavior. The fire spread towards the southeast through this area during the relatively inactive period between the runs of June 9 and 17. The fire burned mostly as a surface fire on both sides of Westcreek, with small patches of crown fire activity. From the air, the burn appeared less severe than in areas outside the budworm affected area (fig. 70).106Salvage typically removes large logs that act as water [ldquo]reservoirs[rdquo] and are least prone to drying. Scientists recommend they be retained after fire.107The agencies[rsquo] NEPA analysis too often lumps all sizes of woody material together for purposes of estimating fire hazard. This leads to arbitrary and capricious decision-making because the availability of fuel to combustion is inversely related to size. Small fuels are hazardous, while large fuels pose little or no hazard. Fuel models do not generally consider fuels larger than 8[rdquo] in diameter. Commercial salvage logging removes primarily (sometimes exclusively) wood that does not contribute to fire hazard. Large amounts of fuels >8[rdquo] that can be retained on a given site without detrimental effect. Lumping fuel sizes together prevents the decision-maker from accurately understanding the actual magnitude of the risk from logging or not logging.If fuels must be removed, the agency should remove the smaller fuels that are most hazardous and leave the largest logs that are least flammable and most valuable for habitat and other ecological services. The Forest Service own research shows that pound-for-pound small fuels are far more hazardous than large fuels, and that if the agency would remove more small fuels they could safely leave more large logs that are beneficial to wildlife:http://web.archive.org/web/20060518211529/http://www.siskiyou.org/issues/pbivegetative.pdf; Dennis C. Odion, Evan J. Frost, James R. Strittholt, Hong Jiang, Dominick A. Dellasala[sect], And Max A. Moritz. 2004. Patterns of Fire Severity and Forest Conditions in the Western Klamath Mountains, California. Conservation Biology. Volume 18 Issue 4 Page 927 - August 2004. http://www.blackwell-synergy.com/links/doi/10.1111/j.1523-1739.2004.00493.x.106 Graham, Russell. 2003. Hayman Fire Case Study. Rocky Mountain Research Station Report RMRS-GTR-114. p144. http://www.fs.usda.gov/rm/pubs/rmrs_gtr114.html.107 See Amaranthus, M.P.; Parrish, D.S.; and D.A. Perry. 1989. Decaying Logs as Moisture Reservoirs After Drought and Wildfire. In: Alexander, E.B. (ed.) Proceedings of Watershed '89: Conference on the Stewardship of Soil, Air, and Water Resources. USDA-FS Alaska Region. RIO-MB-77. p. 191-194. Pdf. This study found that large down logs in a post-fire landscape contain 25 times more moisture than the surrounding soil. While the authors recommended preventing large accumulations of "woody residue" (which the author described as very small diameter material--branches, twigs, etc.), they also recommended leaving down logs after fires to PREVENT future fire severity. They concluded that, "When forest managers are analyzing for fire risk, they should take into account the high water content of fallen logs during the period in which wildfire potential is greatest... Fallen trees, in a range of decay classes, therefore provide a long-term reservoir of moisture. A continuous supply of woody material left on the forest floor, not only protects the productive potential of the forest soil, but also provides a sanctuary for ectomycorrhizae and a significant source of moisture in the event of prolonged drought or wildfire." The study was conducted in the Klamath region in an area with roughly 40 inches of annual rainfall. It was published in 1989 in Proceedings of Watershed '89: a conference on the stewardship of soil, air and water resources. USDA Forest Service, Alaska Region:pp. 191-194 (1989).Small and large downed woody fuels contribute differently to the various elements of fire hazard. [hellip] Large woody fuels have little influence on spread and intensity of the initiating surface fire in current fire behavior models[hellip] [T]he spatial distribution of snags was highly variable...[hellip]For cavity-nesting birds, up to 25 tons per acre may be desirable depending on species [hellip]. For small mammals, more than 30 tons per acre is best. [hellip]To summarize the negative values, fire hazard including resistance-to-control and fire behavior reach high ratings when large fuels exceed about 25 to 30 tons per acre in combination with small woody fuels of 5 tons per acre or less. Excessive soil heating is likely at approximately 40 tons per acre and higher. Thus, generally high to extreme fire hazard potential exists when downed CWD exceeds 30 to 40 tons per acre.Consideration of these positive and negative aspects indicates that the optimum quantity of CWD is about 5 to 20 tons per acre for warm dry ponderosa pine and Douglas-fir types and 10 to 30 tons per acre for cool Douglas-fir and lodgepole pine types and lower subalpine fir types. The recommended optimum ranges of CWD quantities (fig. 2) should be modified by consideration of other factors such as quantity of small woody fuel, diameter of CWD, landscape level needs, and ecosystem restoration objectives. [hellip]Higher loadings of CWD are acceptable where larger piece sizes predominate, for example in accumulated falldown of old growth trees. Larger piece sizes also are desirable because, faced with decomposition and fire, they persist longer to benefit wildlife and soil productivity. Unfortunately, the relationship between quantity and size of CWD and the various measures of fire hazard is largely undefined. Thus, it is a matter of judgment to consider that the larger the diameter of downed CWD the greater the loading that could be allowed without undesirable fire effects. [hellip] surface area This suggests that where CWD comprises predominately 3- to 6-inchmaterial, the optimum quantity is less, perhaps by 5 tons per acre or more, than for larger sized material....[hellip] The probability of a reburn occurrence, which is small for a particular site but high over a large area [hellip][hellip][S]ome general statements about the effects of a reburn during high to extreme burning conditions with low fuel moistures can be made:0 to 10 Years After First Fire[mdash]High severity fire is unlikely because duff and downed woody fuels that support prolonged burning would be absent. Large woody fuels would still be accumulating through falldown, and they would not have decayed enough to support smoldering combustion, which can extend the period of downward heating. If salvage operations leave concentrations of small woody fuels, high severity burning could occur where the fuels are concentrated. [hellip][hellip][hellip] The time interval chosen for predicting CWD should be long enough for a new immature or mature forest to develop.[hellip][S]alvage may be desirable in the wildland-urban interface zone [hellip][hellip]Salvage may be undesirable where large diameter snags needed by wildlife are in short supply in adjoining areas.[hellip] Many years elapse in high fire severity burns before newly grown large diameter snags can replace the fallen snags, so leaving an ample density of snags following fire can help maintain a minimal snag resource during the 20 to 40 year postfire period when many snags have already fallen. Leaving a high density of snags would require constraints on harvesting. [hellip][hellip][hellip] Salvage accompanied by fuel treatment lowered CWD into the optimum range (fig. 9). The simulations for salvage of all dead merchantable trees without fuel treatment and 50 percent salvage accompanied by fuel treatment produced nearly the same amount of CWD [hellip] [T]he level of salvage affected snag density significantly [hellip] In planning for retention of a given amount of CWD, treatment of fuel that reduces small-sized CWD (trees up to 6 inches d.b.h.) makes it possible to retain more large- diameter dead snags.108WildlifeSpecies of Conservation Concern & Focal SpeciesThe plan should identify species of conservation concern and focal species that are good indicators of important ecological structure/function/process, AND that are relatively sensitive to planned active management, e.g., logging, roads, and grazing.The definition of focal species is [ldquo]A small subset of species whose status permits inference to the integrity of the larger ecological system to which it belongs and provides meaningful information regarding the effectiveness of the plan in maintaining or restoring the ecological conditions to maintain the diversity of plant and animal communities in the plan area. Focal species would be commonly selected on the basis of their functional role in ecosystems.[rdquo] 36 CFR219.19. The key phrase here is [ldquo]meaningful information regarding the effectiveness of the plan in maintaining or restoring the ecological conditions.[rdquo] This means that focal species should include species sensitive to logging, roads, fuel reduction, grazing, such as species that need mature and old-growth conditions, abundant dead wood, habitat connectivity and cover (especially when crossing roads), lush wet meadows, unsalvaged fire areas, etc. Some of the species that may fit this description include: cold water fish, big game, goshawk, pileated woodpecker, bats, lamprey, mussels, mollusks, carnivores (lynx, wolf, fisher), invertebrates, pollinators, etc.ElkODFW and others recognize that habitat conditions "are not prime" for wildlife. Big game require reduced road density. Travel management is "our last line of defense" and without it wildlife will not thrive. Elk especially need security areas to "hold elk". Without Travel108 Brown, James K.; Reinhardt, Elizabeth D.; Kramer, Kylie A. 2003. Coarse woody debris: managing benefits and fire hazard in the recovering forest. Gen. Tech. Rep. RMRSGTR-105. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 16 p. http://www.fs.usda.gov/rm/pubs/rmrs_gtr105.html. This paper reveals a scientific controversy about how much wood and of what size to leave after a fire and this issue needs to be fully analyzed in an EIS.Management "wildlife will be impacted in a very negative way." ODFW has a 25-year old MOU with USFS that is enforceable. It was predicated on a promise that Travel Management would be part of Forest Planning.Elk security habitat is often over-estimated by the agency. 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. [hellip] ~ Distance to road- rather than road density- better predicts elk distribution.[hellip]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.SummaryElk have a negative response to human activity [hellip] 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.109Conserving roadless and unroaded areas >1,000 acres is critical for elk and other wildlife because these areas represent important aspects of the natural range of variability and they serve as refuge from human disturbance.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.110University of Alberta researchers discovered that elk are more frequently and more easily disturbed by human behavior such as ATV drivers than by their natural predators like bears and wolves.111The 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.109 USFS, ODFW 2017. Blue Mountain Forest Plan Elk Standards & Guidelines Discussion, powerpoint 7-20-2017.110 Deschutes NF 2025. Fuels Maintenance Environmental Assessment. MIS Specialist Report. https://usfs-public.app.box.com/v/PinyonPublic/file/1824767099212111 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.Commercial logging is not the answer to fire and fuelsFuel reduction should be designed to address fuels concerns with the best balance of effectiveness and minimal trade-offs on other multiple-use goals and to meet legal requirements related to meet legal requirements related to sustainability, ecological integrity, viable populations, recovery of threatened & endangered species, and restoration of rare plant and animal communities. This means that the focus should be on surface and ladder fuels, not canopy fuels.The forest plan and supporting analysis needs to recognize that retaining a relatively dense high forest canopy actually helps reduce fire hazard while removing canopy trees increases fire hazard. Canopy reduction via logging has competing effects on fuels and microclimate that need to be more carefully examined. (i) Logging removes fire resistant trees with thick bark and high canopies that help maintain a cool, moist microclimate and suppress growth of surface and ladder fuels; (ii) Logging opens the stand and makes the forest hotter, drier, and windier all of which exacerbate fire behavior; (iii) Logging moves significant amounts of fine canopy fuels from the canopy (where they are relatively unavailable for combustion by surface fires) to the ground, (where they are more available for combustion by surface fires), and such activity fuels often remain on the ground for extended periods before being treated; (iv) Logging opens the canopy which makes light, water, and nutrients available to stimulate the growth of future surface and ladder fuels; (v) A more open stand with more rapid growth of hazardous fuels requires more frequent and more expensive follow-up fuel treatments.Large areas of the Blue Mountains are a natural mosaic of forests and non-forest vegetation types. The forests in these landscapes are not a high priority for fuel reduction because fuels are already discontinuous, so fire will tend to carry along the ground as often desired.The revised plan and supporting analysis should reflect the best available science indicating that logging to reduce community fire hazard should focus on the structure ignition zone, within 100 feet of homes and buildings (which is primarily on private land, not National Forest land).The revised plan and supporting analysis should reflect the low probability that treatments will interact with wildfire. In evaluating the efficacy and utility of logging for fuel reduction, the agency must discount the alleged benefits of logging to account for the low probability that fire will be beneficially modified, while recognizing that the adverse trade-offs of fuel reduction logging and associated roads (on soil, water, carbon, and habitat) are largely unavoidable and should not be discounted.As noted in our previous (11-6-2024) comments on the Blue Mountains Plan Revision:[bull] 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 [ldquo]is like trying to scoop water out of the ocean to make it less wet.[rdquo] [ldquo]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. [hellip] 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[rsquo]t work that way, and fires are sparked in random places by lightning andhumans, and they are pushed by erratic winds and weather. [hellip] According to Tania Schoennagel, a forest landscape ecologist and fire researcher at the University of Colorado,[hellip] [lsquo]it[rsquo]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[rsquo]ve pre-treated is so low. It[rsquo]s not a very effective lever. We don[rsquo]t know where fires are going to happen.[rsquo][rdquo]112[bull] The effects of fuel reduction are modest. Even extensive fuel reduction reduces the extent of wildfire by less than 10 percent.113 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."114112 David Erickson (2017). Experts: More logging and thinning to battle wildfires might just burn taxpayer dollars. CREDIT: MISSOULIAN.COM. Oct 1, 2017. 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.http://www.mdpi.com/1999-

4907/7/10/237. See also, 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. http://api.ning.com/files/1kp0vDW*F1cqOeO4-GdXE1AHOATghmIAN2x9qLpH3aA_/FireandFuelTreatments.pdf; [ldquo]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.[rdquo] Pohl, Kelly 2019. [ldquo]For communities, land use planning is more effective than logging on federal lands to reduce future wildfire disasters.[rdquo] https://headwaterseconomics.org/wildfire/solutions/land-use-planning-is-more-effective/. Also, [ldquo]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), vegetationdeparture (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 successlevels increased suggesting that fuel management goals need to be tempered to consider the stochastic nature of wildfire.[rdquo] 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.fed.us/rm/pubs_journals/2019/rmrs_2019_barros_a001.pdf.113 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.114 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 [ldquo]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 effectsfrom fire are short-lived.[rdquo] 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.[bull] 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 [ldquo][hellip] decades of data show that intense logging creates more destructive fires than the ones that burn through roadless areas, parkland and wilderness.[rdquo]115[bull] 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.116115 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 http://www.firescience.gov/projects/09-2-01-16/project/09-2-01-16_09-2-01-16_rmrs_gtr292web.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[ndash]3703, 2013. https://www.biogeosciences.net/10/3691/2013/bg-10-3691-2013.pdf. ([ldquo]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)[rdquo]) 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.fed.us/pnw/pubs/pnw_gtr915.pdf. ([ldquo]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. [hellip][rdquo]). Montana Public Radio reported on Senator Daines statement that [ldquo][rsquo]radical environmentalists[rsquo] 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 [mdash] standing dead trees [mdash] 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.116 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[ndash]3703, 2013. https://www.biogeosciences.net/10/3691/2013/bg-10-3691-2013.pdf. ([ldquo]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)[rdquo]). [ldquo]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.[rdquo] 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. http://www.fs.fed.us/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. [ldquo][hellip]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 [plusmn] 18.67 [mean [plusmn] SE]) vs. BLM forests (398.87 [plusmn] 18.23) with a muchAn example of thick brush that can grow after thinning.[bull] Only a small fraction of needed density reduction can support an economically viable timber sale. See Rainville et al. (2008): [ldquo]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. [hellip] [W]e found that on lands where active forestry is allowable, thinning of most densely stocked stands would not be economically viable. [hellip] 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. [hellip] 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 ([plusmn] 4,600) acres, or less than 10 percent of the densely stocked acres (table 4-8). [hellip] [hellip] even when considered under the most favorable of assumptions, most densely stocked stands would not be treatable without significant investments.[rdquo]117[bull] The agencies are failing to treat the areas of highest hazard and choosing instead to treat areas that produce profitable timber sales. Vaillant & Reinhardt 2017: [ldquo][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 [hellip] 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. [hellip] Areas of very low hazard often are favored forgreater 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.[rdquo] 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.117 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.fed.us/pnw/pubs/pnw_gtr752.pdf.treatment because they are less complex to plan and implement, are more economical to treat, [hellip] [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.[rdquo]118Forest Insects and DiseaseThe presence of forest insects and disease is often used as a justification for silvicultural interventions, including commercial logging, that have limited effectiveness or benefits and significant adverse trade-offs. The revised plan must reflect current science showing that native insects and disease are part of the solution, not always a problem. These natural disturbance agents help add structural heterogeneity to forest stands and landscapes, which supports plant and animal diversity. Native insects and disease recruit dead and defective trees that provide valuable habitat. They adjust species composition toward species more adapted to current conditions. They reduce stand density and help remaining trees thrive.The plan must use best available science and account for the fact that logging to control native insects and disease is not only unneeded but also ineffective.Modern ecological forest management recognizes that natural processes, like native insects and disease, help regulate a healthy forest, and help increase desired diversity and heterogeneity in the forest. Insect and disease are part of the solution, not part of the problem. Logging is also not always an effective intervention to control insects and disease. Logging can actually increase insects and disease instead of reducing them.The agencies need to stop thinking about forests as an agricultural crop and start thinking about forests as complex, self-organizing systems. When forests become dense, natural mortality processes, like insects, disease, competitive mortality, and fire, are not a problem, rather they are part of the solution. Natural mortality increases the diversity and complexity of the forest.Mortality creates opportunities for new organisms, thus enhancing biodiversity. Romeo (2016) said forests[hellip] scarred by the spruce beetle outbreak, can elicit strong emotions in the nature lover. Several logging sales may be on the way, but new research suggests ravaged trees can create an ecologically vital habitat worth saving. [hellip] The Forest Service has long maintained such timber sales benefit the health of the ecosystem as it transitions from an old-growth to new-growth forest, but research from the University of Montana, as well as several conservation groups, challenges that idea. [hellip] After the beetle moves on, woodpeckers feed on the larvae left behind, which creates nest cavities in dead trees for other species [ndash] such as bluebirds, chickadees and even squirrels [ndash] who are unable to make the safe havens themselves. Then come the wildflowers, which thrive on the exposed understory of the forest, typically covered in shade. Flies and other insects arrive to feed on the flowers, and in turn bring birds, bats and other small mammals, which attract larger predators. [ldquo]What you end up with is a very rich and biodiverse ecosystem,[rdquo] Hanson said. Clark University associate professor Dominik Kulakowski agreed. He said the result, a [ldquo]snag forest,[rdquo] is a favorable habitat for many invertebrates and vertebrates because of the creation of canopy gaps and enhanced growth of118 Vaillant & Reinhardt 2017. An Evaluation of the Forest Service Hazardous Fuels Treatment Program[mdash]Are We Treating Enough to Promote Resiliency or Reduce Hazard? J. For. 115(4):300 [ndash]308. July 2017. https://doi.org/10.5849/jof.16-

067.https://www.fs.fed.us/pnw/pubs/journals/pnw_2017_vaillant001.pdf.understory plants. [ldquo]Outbreaks create snags that may be used by various birds and mammals, including woodpeckers, owls, hawks, wrens, warblers, bats, squirrels, American marten and lynx,[rdquo] Kulakowski said.[rdquo] By removing the trees, you remove this process, both Hanson and Kulakowski said.119In 2022, forest scientists reported a [ldquo]Firmageddon[rdquo] event, where true firs such as white fir and grand fir and noble fir were dying across large areas of eastern Oregon, apparently from drought stress.120 This is an example of natural processes readjusting the species composition toward pines and Douglas firs that tend to be more long-lived and resilient.Campbell (2017) explained -Failure to embrace natural disturbance as part of the solution rather than part of the problem. Throughout the CFCP, wildfire, insect mortality, and drought mortality are all described as undesirable carbon losses to be mitigated through preemptive thinning when it is generally understood that California forests are in need of more fire not less (Stephens et al., 2007; Marlon et al., 2012; Baker, 2015) and that insect mortality, and drought mortality function primarily to thin forests (Harvey et al., 2013; Meigs et al., 2016), much like that proposed through selective harvest.121Foresters are trained to control and limit tree mortality, but tree mortality from insects, disease, fire, etc. actually enhances stand heterogeneity and resilience to disturbance. Koontz et al. (2020):Resilience to wildfire may arise from feedback between fire behaviour and forest structure in dry forest systems. Frequent fire creates fine-scale variability in forest structure, which may then interrupt fuel continuity and prevent future fires from killing overstorey trees. Testing the generality and scale of this phenomenon is challenging for vast, long-lived forest ecosystems. We quantify forest structural variability and fire severity across >30 years and >1000 wildfires in California's Sierra Nevada. We find that greater variability in forest structure increases resilience by reducing rates of fire- induced tree mortality and that the scale of this effect is local, manifesting at the smallest spatial extent of forest structure tested (90 [times] 90 m).122Several recent studies suggest that beetles may in fact help forests adapt to changing climate conditions.123119 Jonathan Romeo 2016. Beetle-kill zones surprisingly rich in biodiversity. Durango Herald. March 2, 2016. http://www.durangoherald.com/article/20160302/NEWS06/160309880/0/SEARCH/Beetle-kill-zones- surprisingly-rich-in-biodiversity.120 Nathan Gilles 2022. Massive die-off hits fir trees across Pacific Northwest | Columbia Insight (AP) Updated: Nov 27, 2022. https://www.mailtribune.com/top-stories/2022/11/27/massive-die-off-hits-fir-trees-across-pacific- northwest/.121 Campbell, J.L. 2017, Comments on the Jan 2017 draft California Forest Carbon Plan. http://www.fire.ca.gov/fcat/downloads/FCAT_PublicComment/Campbell_CFCP_Review_Final-2nd.pdf.122 Koontz, M.J., North, M.P., Werner, C.M., Fick, S.E. and Latimer, A.M. (2020), Local forest structure variability increases resilience to wildfire in dry western U.S. coniferous forests. Ecol Lett. https://doi.org/10.1111/ele.13447.https://www.fs.usda.gov/psw/publications/north/psw_2020_north002_koontz.pdf.123 Peter T. Soul, Paul A. Knapp & Justin T. Maxwell (2013) "Mountain Pine Beetle Selectivity in Old-Growth Ponderosa Pine Forests, Montana, USA" Ecology and Evolution Volume 3 Issue 5 pp.1141-1148. https://libres.uncg.edu/ir/asu/f/Soule_Peter_2013_Mountain%20Pine%20Beetle_orig.pdf; Millar, C.I. et al. 2007. Response of high-elevation limber pine (Pinus flexilis) to multiyear droughts and 20th-century warming, Sierra Nevada, California, USA. Canadian Journal of Forest Research 37: 2508-2520. https://www.fs.usda.gov/psw/publications/millar/psw_2007_millar031.pdf; Millar, C.I. et al. 2012. Forest mortality in high-elevation whitebark pine (Pinus albicaulis) forests of eastern California, USA; influence of environmentalBeetles also help inoculate trees with diverse fungi which surprisingly reduces the rate that carbon is released from dead trees.In two new studies, James Skelton, along with a group of collaborators, investigated how the fungi associated with bark beetles and closely related ambrosia beetles influence how fast wood decays. As a postdoc in Jiri Hulcr[rsquo]s lab at the University of Florida, Skelton[rsquo]s work focused on describing the ways in which the beetles and their symbiotic fungi interact. And very soon he began to question a broadly accepted idea [ndash] that the fungi the beetles carry into the tree accelerate decay.[ldquo]It didn[rsquo]t make sense given these beetles are really better suited to a fast food lifestyle[rdquo] Skelton says. [ldquo]They [fungi] get into the tree and then have to be ready to get back out fast when the beetles leave. They are not in the tree that long.[rdquo] That means a grab-and-run lifestyle. [ldquo]If the beetles are your only bus out, why invest in expensive enzymes for decay which is way too slow?[rdquo]So, Skelton set off to see what really happens in beetle-infested trees. In two experiments, one set in the messy but natural conditions of the forest and the other in the tightly-controlled environment of the laboratory, he used a combination of high-tech molecular approaches and standard wood product testing methods to challenge the old supposition with actual data. The exposed pieces of trees he left in the forest were soon colonized by hundreds of beetles and with them came a diverse set of fungi [ndash] in fact, these logs were 400% higher in fungal diversity than the pieces of trees he protected from beetles. And the kicker [ndash] the more species of fungi that were brought in by beetles or introduced in the lab, the lower the rate of decay.This outcome was not completely surprising to Skelton. [ldquo]The majority of the fungi the beetles carry do not decay wood.[rdquo] But it wasn[rsquo]t just that. The diversity of fungi was key to lowering the rate of decay, irrespective of whether individual species could decay wood or not. This effect had been found in other studies in wood without beetles where researchers found that that as the number of fungal species increased, CO_2 release declined. And again, it wasn[rsquo]t so much who was there but how many.Early models of CO_2 release from beetle-killed forests were mostly tales of gloom and doom predicting a rapid mass release of carbon into the atmosphere. However, field- based studies have since helped define crucial factors affecting carbon release that were missing in the early models.In living forests it turns out, about half the CO_2 taken from the air by the tree for photosynthesis is converted to sugar and excreted into the soil via the roots where it is consumed by soil microbes that use it as energy resulting in its release back to the atmosphere as CO_2. When trees die, this process and release stops, offsetting much of the increase in CO_2 release that occurs due to decay. Matt Hansen, a scientist with the Forest Sciences Lab in Logan, UT comments [ldquo]The work I did on the ground began to add the information we needed for more accurate models. It showed beetle-affected forests become carbon neutral and slowly recover[rdquo] says Matt Hansen. Similarly, a study bycontext, bark beetles, climatic water deficit, and warming. Canadian Journal of Forest Research 41: 749-765. https://www.fs.usda.gov/psw/publications/millar/psw_2012_millar001.pdf;David Moore of Northern Arizona University found much lower rates of CO_2 release from beetle-kill in forests than expected.124NRDC (2023) provide a nice science summary of the resilience of mature and old-growth forests to insects and disease.Native insect outbreaks have been critical elements of cyclical forest ecology for millennia. Tree-mortality from these outbreaks creates natural gaps in the forest canopy to allow for heterogeneity of plants and tree age diversity, improving the resilience of forests to future disturbances. Snags and downed dead logs from stand-killing events provide important habitats for many species of birds and rodents and are critical components of old-growth forests. [hellip] While thinning can be effective in some cases when infestations are small, current science does not support the idea that thinning is a universally effective solution. In some cases, thinning can reduce competition between trees, thereby reducing the drought stress which can make stands vulnerable to bark beetle outbreaks. However, research suggests that once an epidemic has begun, logging will not alter the trajectory of the outbreak. Despite this extremely limited window of potential effectiveness, logging is often employed in an attempt to curb epidemics, leading to the removal of mature and old-growth trees and stands, doing more harm than benefit to the overall forest ecosystem. [hellip]125Beetle outbreaks also stimulate flowering plants and benefit pollinators. Puikkonen (2020): The team found that average floral abundance in spruce beetle-affected stands was 67 percent higher than in non-affected stands. The average number of bee species was also37 percent greater in beetle-affected stands, with more species present in June than later in the growing season. Davis said the relationship between these insects and their surrounding vegetation may be more complex.[ldquo]It appears there are different controls over bee abundance and diversity,[rdquo] Davis said. [ldquo]Bee abundance was correlated to the floral species, while the diversity is more related to the forest structure, both of which are affected by bark beetles.[rdquo]In other words, bark beetles directly changed the forest structure which indirectly improved wild bee populations by providing a more robust food source for the buzzing insects on the ground.Spruce beetle-affected forests offer a few advantages for understory plants and wild bees. Tree mortality typically opens up the forest canopy, allowing more light to reach plants and flowers on the forest floor. Dead trees also remain standing for up to 25 years after this disturbance. This offers more cavities for wild bees that nest in trees and dead wood.126The NEPA document needs to consider the beneficial effects of insects and disease, for example: the value of mistletoe brooms as wildlife structures; the value of root rot in creating pockets of124 Six, D. 2020. How tiny fungi may be slowing carbon release from bark beetle-killed trees. Blog post. https://web.archive.org/web/20210114234939/https://eddycovarianceblog.wpcomstaging.com/2020/06/11/how-tiny-fungi-may-be-slowing-carbon-release-from-bark-beetle-killed-trees/.125 NRDC 2023. https://www.climate-forests.org/post/native-insects-and-mature-forests126 Karina Puikkonen 2020. Bark beetle outbreaks benefit wild bee populations, habitat. CSU News, Published Oct. 14, 2020. https://web.archive.org/web/20201021055702/https://warnercnr.source.colostate.edu/bark-beetle- outbreaks-benefit-wild-bee-populations-habitat/.down woody debris, enhancing biodiversity, and creating gaps with complex canopy architecture; the value of bark beetles as food sources for diverse wildlife and as vectors of sapwood decay fungi rendering the tree more suitable for wildlife habitation.Hanson (2105):Rather than pests, both the bark beetle and wood-boring beetle species at issue are native species that fill essential roles in native forests. They evolved in these forests over many millennia; in many ways, they're a cornerstone of the biodiversity in forest ecosystems in California and the western U.S.Periods of drought are natural in the western U.S., and most dead trees result from occasional pulses of drought and fire. These native beetle species require recently dead trees to survive, since their larvae depend upon the unique microhabitat and food conditions found under the bark of recent snags. Woodpeckers depend upon these beetle larvae for their food, and the woodpeckers need snags, which are softer than live trees, so they can excavate nest cavities to raise their chicks.Every year these native woodpecker species, like the black-backed woodpecker, hairy woodpecker, and white-headed woodpecker, create a new nest cavity, allowing the previous cavities to be used by dozens of species that also require nest cavities but cannot create their own, such as bluebirds, nuthatches, wrens, and even small mammals like flying squirrels and pine martens. Raptors such as the northern goshawk and Cooper's hawk depend upon such birds for their food.Where pockets of dead trees occur, increased sunlight spurs the growth of native shrubs, which produce flowers and edible berries. These shrubs require high levels of sunlight, and cannot survive under the shade of a dense forest canopy. The flowers attract native flying insects -- bees, wasps, butterflies and moths -- which in turn provide food for flycatching birds and bats. The berries on these shrubs are essential food bears need to eat to fatten up before the long, cold winter, and the leaves on the shrubs provide forage for mule deer. The shrubs also create important nesting habitat for many shrub-nesting birds, many of which have become rare or are declining due to lack of habitat currently. Small mammals create dens in the shrubs and downed logs, providing a core food source for owls.The entire ecosystem and many of its inhabitants depend upon these native beetle species and an abundance of snags. No snags, no beetles. No beetles, no woodpeckers. No woodpeckers, no bluebirds, nuthatches, or other secondary cavity-nesters. No woodpeckers, bluebirds, etc., no hawks. Without an ample supply of snags, and healthy beetle populations, bears and deer also suffer.The fact is, an ecologically healthy forest has a lot of dead trees. Current science indicates that we have a deficit, not an overabundance, of dead trees in forests of California, relative to the needs of the dozens of cavity-nesting wildlife species that depend upon these snags for both food and homes.[hellip]Studies show that cavity-nesting wildlife species generally need at least four to eight snags per acre to have sufficient food and nest-cavity abundance. The rarest and most imperiled cavity-nesting species often require much higher levels.For example, the California spotted owl depends on dense, old forests with 8 to 12 snags per acre for nesting and roosting habitat, and generally even higher levels for foraging habitat, because snags and downed logs (after the snags fall to the ground) create excellent habitat for the owl's small mammal prey species. The rare black-backed woodpecker depends upon areas with at least several dozen snags per acre in order to have enough food to survive, since the birds feed on the larvae from native beetles found almost exclusively under the bark of dead trees.So, when you see a forested slope with some pockets of dead trees, don't lament it; rather, celebrate the sight as a positive sign for wildlife populations and the ecological resilience of the forest.127Meigs et al (2015) made a careful review of the evidence and found beetle-kill/fire interactions to be relatively rare and concluded that it is better to view insects as part of the solution, not part of the problem:Abstract. Although there is acute concern that insect-caused tree mortality increases the likelihood or severity of subsequent wildfire, previous studies have been mixed, with findings typically based on stand-scale simulations or individual events. This study investigates landscape- and regional-scale wildfire likelihood following outbreaks of the two most prevalent native insect pests in the US Pacific Northwest (PNW): mountain pine beetle (MPB; Dendroctonus ponderosae) and western spruce budworm (WSB; Choristoneura freemani). We leverage seamless census data across numerous insect and fire events to (1) summarize the interannual dynamics of insects (1970[ndash]2012) and wildfires (1984[ndash]2012) across forested ecoregions of the PNW; (2) identify potential linked disturbance interactions with an empirical wildfire likelihood index; (3) quantify this insect-fire likelihood across different insect agents, time lags, ecoregions, and fire sizes. All three disturbance agents have occurred primarily in the drier, interior conifer forests east of the Cascade Range. In general, WSB extent exceeds MPB extent, which in turn exceeds wildfire extent, and each disturbance typically affects less than 2% annually of a given ecoregion. In recent decades across the PNW, wildfire likelihood does not consistently increase or decrease following insect outbreaks. There is evidence, however, of linked interactions that vary across insect agent (MPB, WSB), space (ecoregion), and time (interval since insect onset). Specifically, in most cases following MPB activity, fire likelihood is neither higher nor lower than in non-MPB-affected forests. In contrast, fire likelihood is lower following WSB activity across multiple ecoregions and time lags. In addition, insect-fire likelihood is not consistently associated with interannual fire extent, suggesting that other factors (e.g., climate) control the disproportionately large fire years accounting for regional fire dynamics. Thus, although both bark beetles and defoliators alter fuels and associated fire potential, the windows of opportunity for increased or decreased fire likelihood are too narrow[mdash]or the phenomena themselves too rare[mdash]for a consistent signal to emerge across PNW conifer forests. These findings suggest that strategic plans should recognize (1) the relative rarity of insect-fire interactions and (2) the potential ecosystem restoration benefits of native insect outbreaks, when they do occur.128127 Chad Hanson 2015. COMMENTARY - In Defense of The Bark Beetle. October 14, 2015 http://www.kcet.org/news/redefine/rewild/commentary/in-defense-of-the-bark-beetle.html.128 Meigs, G. W., J. L. Campbell, H. S. J. Zald, J. D. Bailey, D. C. Shaw, and R. E. Kennedy. 2015. Does wildfire likelihood increase following insect outbreaks in conifer forests? Ecosphere 6(7):118. http://dx.doi.org/10.1890/ES15-00037.1;http://www.esajournals.org/doi/pdf/10.1890/ES15-00037.1 See also, Garrett W Meigs, Harold S J Zald, John L Campbell, William S Keeton, and Robert E Kennedy. 2016. Do insect outbreaks reduce the severity of subsequent forest fires? Environmental Research Letters, Volume 11, Number 4.Harball (2015):[hellip] researchers looked at three major fire years -- 2006, 2007 and 2012 -- and compared Forest Service-derived maps of where beetle outbreaks occurred with maps of where forest fires burned. They found that of the nearly 25 million acres hit by wildfire in those years, only 5 percent of the burned area overlapped with a recent mountain pine beetle infestation. [hellip] factors other than mountain pine beetles may be more powerful when it comes to forest fire risk.129/ / // / // / /http://iopscience.iop.org/article/10.1088/1748-9326/11/4/045008/metahttp://iopscience.iop.org/article/10.1088/1748-9326/11/4/045008/pdf ([ldquo]In contrast to common assumptions of positive feedbacks, we find that insects generally reduce the severity of subsequent wildfires. Specific effects vary with insect type and timing, but both insects decrease the abundance of live vegetation susceptible to wildfire at multiple time lags. By dampening subsequent burn severity, native insects could buffer rather than exacerbate fire regime changes expected due to land use and climate change. [hellip] In the case of [mountain pine beetle], this forest thinning effect results in a lasting reduction of fire impacts on residual vegetation (figure 3(a)). Moreover, the continuing decline in post-beetle burn severity indicates that the thinning effect may persist until vegetation and fuel distributions recover to pre-insect conditions. [hellip] Our core finding that insect outbreaks actually dampen wildfire severity across numerous large insect[ndash]fire events has direct applications to natural resources management.Specifically, policies based on the assumption that recent insect outbreaks increase the hazard of subsequent wildfires might be unjustified (Hart et al 2015). Furthermore, given that insects also can reduce wildfire likelihood (Lynch and Moorcroft 2008, Meigs et al 2015a), these findings illustrate the role that a biotic disturbance (i.e., insect outbreak) can play in limiting both the occurrence and impacts of an abiotic disturbance (i.e., wildfire).[rdquo])129 Elizabeth Harball, E&E reporter. RESOURCES: Mountain pine beetles don't cause more forest area to burn in wildfires [ndash] study. March 24, 2015, https://web.archive.org/web/20220120095343/https://spot.colorado.edu/~schoenna/images/ClimateWire_MPB_dont.pdf, citing Sarah J. Hart, Tania Schoennagel, Thomas T. Veblen, and Teresa B. Chapman 2015. Area burned in the western United States is unaffected by recent mountain pine beetle outbreaks. PNAS Early Edition. https://www.pnas.org/cgi/doi/10.1073/pnas.1424037112 (Abstract: [ldquo][hellip]we superimposed areas burned on areas infested by MPBs for the three peak years of wildfire activity since 2002 across the western United States. Here, we show that the observed effect of MPB infestation on the area burned in years of extreme fire appears negligible at broad spatial extents. Contrary to the expectation of increased wildfire activity in recently infested red-stage stands, we found no difference between observed area and expected area burned in red-stage or subsequent gray-stage stands during three peak years of wildfire activity, which account for 46% of area burned during the 2002[ndash]2013 period.Although MPB infestation and fire activity both independently increased in conjunction with recent warming, our results demonstrate that the annual area burned in the western

United States has not increased in direct response to bark beetle activity.[rdquo]) 130Six et al (2014) said [ldquo][T]here is a widespread belief in the policy arena that timber harvesting is an effective and necessary tool to address beetle infestations. [hellip] [I]n reality there has been a dearth of monitoring to assess outcomes, and failures are often not reported. Additionally, few studies have focused on how these treatments affect forest structure and function over the long term, [hellip][rdquo]131Shiffman (2016):e360: The U.S. Forest Service has been thinning forests as a response to this. Any evidence that this is helping with the beetle problem?Six: The idea behind thinning is that if you have an over-dense forest where trees are so close together that they are competing for soil nutrients and water, if you thin that forest out, you will relieve that competition, the trees will become healthy, and that will strengthen their defenses against beetles. It was also thought that, if you thin forests, it disrupts the chemical communication of the beetles, which are the pheromones that they use to mass-attack trees. Neither of those ideas totally pans out.Nobody has shown conclusively that pheromones get disrupted. Also, we know that thinned stands can go down as easily as un-thinned stands. In most of our forests, we have reached a situation where changes in temperature and drought have reached the point where thinning will no longer be effective. Under normal conditions it can help, perhaps. But the fact is we are just not there anymore. I visited one stand that had been thinned many years earlier as a demonstration of how thinning protects trees from bark130 DellaSala 2016. Forest Health: Perspectives & Consequences. webinar. https://web.archive.org/web/20161118190019/http://www.forestlegacies.org/images/projects/forest- health-dds-presentation-20160908.pdf.131 Six DL, Biber E, Long E. Management for Mountain Pine Beetle Outbreak Suppression: Does Relevant Science Support Current Policy? Forests. 2014; 5(1):103-133. http://www.mdpi.com/1999-4907/5/1/103http://www.mdpi.com/1999-4907/5/1/103/pdfbeetles and enhances growth. Yet when the insects came through, that was the first stand to go down!e360: So by trying to fix the problem, we sometimes only make it worse.Six: As humans, we have this feeling that if something goes awry, we need to fix it, and that somehow we can. I don[rsquo]t think that we necessarily always know what needs to be done, or that when we do apply management that we are always actually doing the right thing. Sometimes we just need to realize that nature can sort itself out perhaps better than we can.[hellip]models assume that the forest is genetically homogenous, that everything is the same. And they are not. I suspect that there is a lot more genetic variability out there that will allow for more adaptation and greater persistence than we currently anticipate.e360: You are suggesting that evolution will kick in and help to a degree?Six: If we let it. If we don[rsquo]t go out and replant with stock that may not be genetically correct, if we don[rsquo]t thin or cut down trees that may have been selected by beetles or drought to survive. We have to get smart about how we are treating our forest if we[rsquo]re going to help nature[rsquo]s process of adaptation to proceed.132In October 2005, the Xerces Society released an 88-page report that dispels many commonly held misconceptions about native forest insects and the efficacy of logging as a tool to control them. This analysis of over 150 relevant studies shows that industrial logging is not the solution to forest insect outbreaks. Former U.S. Forest Service Chief Mike Dombeck gives report his "highest recommendation" and calls it "the most useful publication on the topic of forests and forest pests that I have seen."Logging to Control Insects: The Science and Myths Behind Managing Forest Insect [ldquo]Pests.[rdquo] A Synthesis of Independently Reviewed Research includes a summary ofrelevant studies on the importance of insects to forest function and the methods used to control forest "pest" insects, and a compilation of summaries of over 150 scientific papers and Forest Service documents. Key findings in the report include:* Native forest pests have been part of our forests for millennia and function as nutrient recyclers; agents of disturbance; members of food chains; and regulators of productivity, diversity, and density.* Fire suppression and logging have led to simplified forests that may increase the risk of insect outbreaks.* Forests with diverse tree species and age classes are less likely to develop large insect outbreaks.* There is no evidence that logging can control bark beetles or forest defoliators once an outbreak has started.* Although thinning has been touted as a long-term solution to controlling bark beetles, the evidence is mixed as to its effectiveness.133132 Richard Shiffman interview with Diana Six. 04 JAN 2016: INTERVIEW- How Science Can Help to Halt The Western Bark Beetle Plague http://e360.yale.edu/content/feature.msp?id=2944.133 Scott Hoffman Black. 2005. Logging to Control Insects: The Science and Myths Behind Managing Forest Insect [ldquo]Pests.[rdquo] A Synthesis of Independently Reviewed Research. Xerces Society for Invertebrate Conservation. http://www.xerces.org/wp-content/uploads/2008/10/logging_to_control_insects1.pdf. The author has degrees in ecology, horticultural plant science, and entomology.The Xerces Society report also outlines general guidelines to follow when considering pest insects and forest management.[bull] Maintain and restore high-quality late successional and old-growth forestconditions. Diverse, old forests contain an array of natural predators and pathogens, and are more resilient to forest insect pests.[bull] Ensure structural and species diversity when logging, including the retention of large trees and snags, downed wood, and canopy closure. These practices can help minimize large outbreaks of insect pests.[bull] Minimize soil compaction and harm to trees and tree roots when doing any thinning or logging. Soil compaction and tree damage can increase the susceptibility of forest stands to insect attack.[bull] Utilize prescribed fire to promote more natural forest conditions. Insect pests are less of a problem under diverse natural conditions. [Note: Fire should be used carefully, as there is some evidence that fires that damage tree cambium can potentially exacerbate insect problems.][bull] Reduce current road densities, particularly in ecologically significant areas. Roads can serve as corridors for dispersal for nonnative invasive insect species.Since logging is likely to have lots of adverse impacts on soil water and wildlife habitat, and since is not likely to have much beneficial effects on insect pests, we urge the agency to reconsider logging to control insects.In 2010, the National Center for Conservation Science and Policy released a literature review about the effects of beetles and logging on forests with several significant findings:[bull] FINDING 1: Insect outbreaks and fires have been part of the ecology of these forests for millennia.[bull] FINDING 2: Ongoing outbreaks of insects are probably caused primarily by climate.[bull] FINDING 3: Insect outbreaks in roadless areas are not likely to heighten fire risk in adjacent communities.[bull] FINDING 4: Tree-cutting is not likely to control ongoing bark beetle outbreaks or other insect species common to Colorado.[bull] FINDING 5: Thinning in roadless areas is not likely to alleviate future large-scale epidemics of bark beetle.[bull] FINDING 6: Tree-cutting in roadless areas will not keep communities safe from wildfire.[bull] FINDING 7: Building the roads necessary to enter roadless areas affects their ecological values.[bull] FINDING 8: Green and familiar forests will eventually return following insect outbreaks in most locations.[bull] FINDING 9: The 2001 Roadless Area Conservation Rule allows sufficient flexibility to manage Colorado[rsquo]s roadless areas....Generally speaking, outbreaks of beetles can facilitate the development of a forest that is structurally, genetically and compositionally more diverse (Axelson et al., 2009) and therefore perhaps less prone to subsequent beetle attack (Amman, 1977). Thus, despite causing mortality of many individual trees, outbreaks can also play a critical role in ecosystem processes (Berryman, 1982).134134 Black, S. H., D. Kulakowski, B.R. Noon, and D. DellaSala. 2010. Insects and Roadless Forests: A Scientific Review of Causes, Consequences and Management Alternatives. National Center for Conservation Science & Policy, AshlandAnother relevant study compared beetle activity in thinned and unthinned stands found that thinning had the effect of increasing the number of pine engravers while decreasing the relative abundance of their predators (the predators being more abundant in unthinned stands).Simpson (2004):The largest effect of stand thinning was the 7-fold increase in the abundance of pine engravers relative to unthinned stands. We speculate, but did not show, that this increase in pine engraver abundance in thinned stands is due to the increased availability of habitat, decreased stand complexity and potential decline in predation pressure. Traits associated with host quality did not improve after thinning as we had expected and as other studies in the boreal forest have shown (Valinger 1992, 1993, Yang 1998). Pine engravers tended to settle on logs from thinned stands earlier and at higher densities than on logs from unthinned stands, yet ultimately experienced similar reproductive success in both log types. Thus, the costs of declining phloem quality after thinning appear to be offset by the direct effects of earlier settlement and of a more simplified stand structure, and the indirect effects of increased host availability or decreased predation pressure.These results contrast with previous work that indicates thinning is a good management strategy for preventing outbreaks of mountain pine beetle (see above). Thinning is thought to deter attack by mountain pine beetle because of enhanced stand temperature, interrupted pheromone signals and/or improved host defensive response (Waring and Pitman 1985, Amman et al. 1988, Bartos and Amman 1989, Schmid et al. 1991, 1992).We did not detect deleterious impact of increased temperature on pine engraver abundance. Furthermore, we found no difference in pheromone detection ability between thinned and unthinned stands. However, an improvement in host defensive capability may account for the pine engraver[rsquo]s poor performance in trees from thinned stands, though we were unable to address this specifically.The response of pine engravers seven years after thinning further contrasts with another species of secondary bark beetle, the striped ambrosia beetle, which was more abundant in unthinned stands. Previous work (Hindmarch and Reid 2001, Park 2002) found the striped ambrosia beetle to be more abundant in thinned stands up to two and three years after harvest. Logging slash and stumps may be better habitat than windfalls for striped ambrosia beetles, unlike pine engravers.135Increasing tree vigor through thinning also has complex effects. On the one hand it may help the tree [ldquo]pitch out[rdquo] the invading beetles, but on the other hand a vigorous trees can support higher rates of beetle reproduction. Hindmarch (1999).Thinning may also enhance reproductive success of pine engraver bark beetles asa result of increased tree vigour in the residual stand. Pine engraver reproductive success was significantly greater in trees that had been growing vigorously at the time of death: females laid more eggs and a higher proportion of their eggs developed resulting in more offspring produced per female than in less vigorous hosts. Consequently, trees that fall inOR. http://www.geosinstitute.org/images/stories/pdfs/Publications/RoadlessAreas/FireandBugReport.pdf.http://www.xerces.org/wp-content/uploads/2010/03/insects-and-roadless-forests1.pdf.135 Colleen Simpson and Mary Reid. Consequences of stand thinning for bark beetles: direct and indirect effects. University of Calgary. January 2004. http://web.archive.org/web/20050816034648/http://sfm-1.biology.ualberta.ca/english/pubs/PDF/PR_200304reidmcons6.pdf.thinned stands are superior hosts when compared to trees that fall in unthinned stands, and may lead to larger populations in thinned stands.[hellip]Reproductive success of pine engravers was examined as a function of tree vigourusing freshly felled jack pine (Pinus banksiana Lamb.) from a 77 year old stand (Reid and Robb 1999). The number of eggs laid, egg gallery length, proportion of eggs that successfully developed, and number of emerged offspring per female were higher on trees that had been growing most vigorously before death.Commercial thinning had a significant effect on bark beetles. Although diversitydid not change after thinning, the number of beetles in thinned stands was higher than in unthinned stands. Furthermore, beetles in thinned stands chose the biggest logs possible for breeding, and had higher reproductive success in the most vigorous hosts. Beetles could also fly on more days and do so more easily in thinned stands than in unthinned stands.136If the agency is concerned about tree mortality, they must recognize that logging kills trees and in fact likely causes greater mortality than the alleged [ldquo]problems[rdquo] logging is intended to prevent. For instance, logging to prevent beetle-kill often ends up killing more trees than the beetles, and those trees are removed from the forest, resulting in forgone benefits of snag habitat created through natural processes.The analysis for this plan revision must to explain why mortality from natural events like drought, beetles fire are unacceptable, while mortality from logging is acceptable. If the agency insists on intervening, only small subset of the [ldquo]problem[rdquo] area (e.g., [ldquo]hotspots[rdquo]) should be treated.137Berner et al. (2017) showed that in the western continental United States [ldquo][h]arvest accounted for the largest percentage of MORTH+B+F (~50%), followed by beetles (~32%), and fires (~18%). Tree mortality from harvest was concentrated in Washington and Oregon, where harvest accounted for ~80% of MORTH+B+F in each state. Tree mortality from beetles occurred widely at low levels across the region, [hellip][rdquo]. 138 The graph below shows the relative mortality from logging is particularly high in Oregon./ / // / // / /136 Trevor D. Hindmarch and Mary L. Reid. Effects of Commercial Thinning on Bark Beetle Diversity and Abundance. May 1999. http://web.archive.org/web/20040710190343/http://sfm-1.biology.ualberta.ca/english/pubs/PDF/PR_1999-13.pdf.137 Sims, Aadland, et al 2014. "Complementarity in the provision of ecosystem services reduces the cost of mitigating amplified natural disturbance events." PNAS 2014. DOI: 10.1073/pnas.1407381111 https://www.pnas.org/doi/pdf/10.1073/pnas.1407381111138 Berner, Law et al 2017. Tree mortality from fires, bark beetles, and timber harvest during a hot and dry decade in the western United States (2003[ndash]2012). Environ. Res. Lett. 12 065005. http://iopscience.iop.org/article/10.1088/1748-9326/aa6f94/meta.Hanson (2025) shows that the total cumulative tree mortality from thinning + wildfire fire is worse than tree mortality from wildfire alone.Commercial thinning is widely conducted on public and private forestlands as a fire management approach designed to reduce fire severity and associated tree mortality. However, tree mortality from thinning itself, prior to the occurrence of the wildfire, is generally not taken into account, which leaves a potentially important source of tree loss, with its associated forest carbon loss and carbon emissions, unreported. This study investigated the [ldquo]cumulative severity[rdquo] of commercially thinned and unthinned forests in a large 2021 wildfire, the Antelope fire, occurring within mixed-conifer forests on public lands in northern California, USA. Using satellite imagery to estimate pre-fire percent basal area mortality from thinning at each thinned location, combined with percent basal area mortality due to the fire itself from post-fire satellite imagery, it was found that commercial thinning was associated with significantly higher overall tree mortality levels (cumulative severity).[hellip]I defined cumulative severity as the percent basal area mortality from thinning (if any) for a particular location, plus the percent basal area mortality of the remaining (after thinning) live tree basal area due to the Antelope fire. For example, if the basal area mortality from commercial thinning was 38%, and the basal area mortality of the remaining 62% of live tree basal area was 18%, then the cumulative severity for such a location would be 38% + 11% = 49%. Thus, cumulative severity presents a more comprehensive assessment of live tree mortality.[hellip]Commercial thinning resulted in overall higher levels of tree mortality, as compared to unthinned forests, when tree mortality from both thinning and the Antelope fire was combined. Accounting for the tree mortality from commercial thinning, prior to the occurrence of the 2021 Antelope fire, provided a more contextualized and complete assessment of the cumulative effects of this type of forest management on tree mortality.139From an ecological standpoint, it is much better for a tree to die of natural causes and stay in the forest to serve diverse biophysical functions, rather than be cut and sent from the ecosystem on the back of a log truck. Retaining unlogged forests allows natural processes (such as disturbance139 Hanson, C. T. (2025). Correction: Hanson, C.T. Cumulative Severity of Thinned and Unthinned Forests in a Large California Wildfire. Land 2022, 11, 373. Land, 14(7), 1489. https://doi.org/10.3390/land14071489. pdf.and succession) to flourish. This typically results in higher-quality combination of habitat features with fewer trade-offs. For instance, allowing trees to grow unharvested, results in natural tree mortality which not only frees up resources (light, moisture, nutrients, growing space) for residual trees to be grow larger, but also creates valuable snags and down wood habitat, and opens small canopy gaps that stimulate understory development and new tree cohorts. The benefits of allowing natural succession to occur in older stands is summarized by Eugene BLM:As dominant trees continue to grow, they would gain late-successional habitat features like large diameters, deeply fissured bark, deep crowns, large branches, broken tops, and cavities. As individual dominant trees die, they would become large snags or down wood. As large trees or snags fall, they would knock over other trees and branches, creating growing space. This growing space would release understory conifers and hardwoods, allowing them to grow into dominant trees, and stimulate growth of shrubs and herbaceous vegetation. The overall effect of these successional processes would create a mosaic of tree ages, species composition, and late-successional habitat features in the stands. Additionally, patches of overstory trees would continue to suffer mortality from sporadic processes such as root rot or other disturbance such as windthrow. This would create larger areas of growing space for surviving overstory trees, hardwoods, conifer regeneration, shrubs, and herbs to occupy. Therefore, habitat in the project area would primarily develop late-successional characteristics, with patches of early- or mid- successional habitat throughout.140Livestock GrazingThe plan should include a credible and transparent analysis of grazing suitability.To meet legal requirements related to grazing suitability, sustainability, ecological integrity, viable populations, recovery of threatened & endangered species, and restoration of rare plant and animal communities., the plan should limit grazing to protect soil, water quality, riparian and watershed integrity, prevent weeds, vegetation functions and plant reproduction, conserve viable populations of fish & wildlife, retain and increase carbon both above and below ground, etc.The plan should allow for voluntary permit relinquishment, with dedication of allotments to multiple use purposes such as conservation of soil, water, fish & wildlife, carbon, recreation, etc.The plan should include quantitative riparian management standards.The plan should explicitly plan for co-existence with large carnivores, emphasizing non-lethal control of predators, and excluding livestock from areas of known predator activity.Consider the following in the plan revision and NEPA processes:[bull] The revised plan and NEPA analysis should provide careful analysis of known problem areas in terms of livestock management, and other areas have high ecological value and140 BLM 2013. McKenzie Landscape EA, No. DOI-BLM- OR060-2013-0005-EA.https://eplanning.blm.gov/public_projects/nepa/69610/103201/126296/2017_04_11_McKenzie_Landscape_EA_Final_PrintReady.pdf.potential adverse impact from livestock, such as wet meadows, floodplains, and key stream reaches.[bull] Bunch grasses evolved with different kinds of herbivory and are not suitable for livestock grazing. Grazing should be eliminated or grazing seasons should be very short in order to prevent irreversible damage to drought-stressed plants and it will significantly impact the ability of plants to set seeds.[bull] Please provide for long-term viability of native plants by allowing plants to fulfill their full lifecycle including flowering, seed set, and sexual or asexual reproduction without significant interference by livestock grazing.[bull] "Improving livestock distribution" is not necessarily a good thing because it spreads the effects of livestock to areas that are currently spared the adverse effects of livestock grazing. Improved distribution homogenizes grazing effects and expands the ecological stress caused by livestock grazing. It would be better to just limit livestock numbers.[bull] Fencing has ecological consequences that should be considered and minimized or avoided when possible. Fences can kill or harm birds and other wildlife. It many cases it may be preferable to just remove livestock from the area. Floyd Reed, retired FS Range staff, says that [ldquo]fencing is a sign of management failure.[rdquo] Fencing fragments the forest landscape adversely impacting landscape connectivity and is harmful to wildlife. Fencing is very expensive and difficult to impossible to maintain especially in forested terrain. Fencing is designed to facilitate more intensive commercial livestock management which surveys have shown is not among the values the wider American public holds for public lands. Fencing is for the convenience of a small number of private commercial livestock operators privileged to hold public land grazing privileges at little cost to themselves, but huge costs to other values. Fencing requires gates and cattleguards are often difficult to negotiate by both wildlife and the public. A study released in October 2009 shows that during a seven month period the Wyoming Game and Fish Department documented 146 instances of finding sage-grouse feathers or carcasses on or near a 4.7-mile section of barbed-wire fence.141 Also, the Colorado Division of Wildlife has prepared a report on the impacts of fences and how to mitigate them.142 This report asks the important question, [ldquo]Do you really need a fence?[rdquo] because [ldquo][hellip] the best fence for wildlife is no fence at all.[rdquo] Remember the option of removing livestock instead of building fences.143[bull] Fences can pose a high risk of sage-grouse collisions and other wildlife entanglement. Wildlife agencies typically recommended that they be designed to allow safe passage of big game and be marked with anti-strike reflectors to prevent avian collisions. The preferred alternative should include these mitigation actions.[bull] Consider and avoid adverse impacts of livestock grazing on biodiversity. Filazzola et al. (2020): [ldquo][hellip] here we address the potential multi-trophic effects on animal141 EDF 2009. http://world-wire.com/news/0912160001.html.142 Hanophy, W. 2009. Fencing with Wildlife in Mind. Colorado Division of Wildlife, Denver, CO. 36 pp http://web.archive.org/web/20110101134309/http://wildlife.state.co.us/NR/rdonlyres/20D5C775-55DD-4C6D-A5CF-C9B83FCEA69E/0/DOWFencingWithWildlifeInMind.pdf.143 See also, Bryan S. Stevens 2011. IMPACTS OF FENCES ON GREATER SAGE-GROUSE IN IDAHO: COLLISION,MITIGATION, AND SPATIAL ECOLOGY. University of Idaho Master[rsquo]s Thesis. May 2011. https://www.utahchukars.org/wordpress/wp-content/uploads/2019/02/B_Stevens_Thesis.pdf ([ldquo]Increasing terrain ruggedness reduced probability of collision presence, whereas increasing fence length per km2 increased probability of collision. Broad-scale modeling also suggested collision counts per km2 were influenced by distance to nearest active sage-grouse lek, where increasing distance reduced expected collision counts. These data suggest 2 km mitigation buffers around leks in high risk areas may be necessary[hellip] [rdquo])biodiversity(e.g. herbivores, pollinators and predators). We conducted a meta-analysis on 109 independent studies that tested the response of animals or plants to livestock grazing relative to livestock excluded. Across all animals, livestock exclusion increased abundance and diversity, but these effects were greatest for trophic levels directly dependent on plants, such as herbivores and pollinators. Detritivores were the only trophic level whose abundance decreased with livestock exclusion. We also found that the number of years since livestock was excluded in?uenced the community and that the effects of grazer exclusion on animal diversity were strongest in temper-ate climates.These ?ndings synthesise the effects of livestock grazing beyond plants and demonstrate the indirect impacts of livestock grazing on multiple trophic levels in the animal community. We identi?ed the potentially long-term impacts that livestock grazing can have on lower trophic levels and consequences for biological conservation.144[bull] Consider and avoid impacts to wildlife, including big game, ground nesting birds, uncommon plants, pollinators, and aquatic species. Ensure that livestock grazing is not impairing the maintenance of viable populations including well-distributed plant and animal communities with healthy age-class distributions. Focus on species that are sensitive to livestock grazing such as aspen and other highly palatable plants, and animals that live near the ground such as ground-nesting birds, amphibians, mollusks, etc... Grazing is known to have significant adverse impacts on ground nesting birds. Walsberg (2005): [ldquo]Our results suggest that moderate spring cattle grazing in dry-stony ecological sites reduced the amount of digestible nutrients available to mule deer during the year of grazing.[rdquo]145 Poessel et al. (2020): [ldquo]We analyzed changes in vegetation and bird abundance at a wildlife refuge in southeastern Oregon over 24 years, following cessation of 120 years of livestock grazing. Overall avian abundance increased 23%during the 12 years after removal and remained consistent from then through year 24. Three times as many species colonized the survey sites as dropped out. Of the focal species, most riparian woodland-tree or shrub dependent, sagebrush obligate, and grassland or meadow taxa increased in abundance or remained stable locally. Incontrast, most riparian woodland-cavity nester species decreased in abundance locally, reflecting disruption of aspen stand dynamics by decades of grazing. Avian nest parasites and competitors of native species declined in abundance locally, matching regional trends. Restoring riparian ecosystems by removing livestock appeared to be beneficial to the conservation of many of these declining populations of migratory birds.[rdquo]146[bull] Consider and minimize adverse impacts of livestock grazing on pollinators. On June 20, 2014, the White House released a [ldquo]Presidential Memorandum[mdash]Creating a Federal Strategy To Promote the Health of Honey Bees and Other Pollinators.[rdquo] which states144 Filazzola, A., Brown, C., Dettlaff, M.A., Batbaatar, A., Grenke, J., Bao, T., Peetoom Heida, I. and Cahill, J.F., Jr (2020), The effects of livestock grazing on biodiversity are multi-trophic: a meta-analysis. Ecol Lett. doi:10.1111/ele.13527;https://onlinelibrary.wiley.com/doi/pdfdirect/10.1111/ele.13527.145 Glenn E. Walsberg 2005. Cattle Grazing in a National Forest Greatly Reduces Nesting Success in a Ground-nesting Sparrow. The Condor Volume 107, No. 3. August, 2005. https://bioone.org/journals/the-condor/volume-107/issue- 3/0010-5422_2005_107_0714_CGIANF_2.0.CO_2/CATTLE-GRAZING-IN-A-NATIONAL-FOREST-GREATLY-REDUCES-NESTING-SUCCESS/10.1650/0010-5422(2005)107[0714:CGIANF]2.0.CO;2.short See also, Sara JaneWagoner 2011. The Effects Of Spring Cattle Grazing On The Nutritional Ecology Of Mule Deer (Odocoileus Hemionus) In Eastern Washington. Master[rsquo]s Thesis. Washington State University. May 2011. https://rex.libraries.wsu.edu/esploro/outputs/graduate/The-effects-of-spring-cattle-grazing/99900525083101842146 Sharon A. Poessel, Joan C. Hagar, Patricia K. Haggerty, Todd E. Katzner 2020. Removal of cattle grazing correlates with increases in vegetation productivity and in abundance of imperiled breeding birds. Biological Conservation.Volume 241, January 2020, 108378. https://www.sciencedirect.com/science/article/pii/S0006320719313540?via%3Dihub.[ldquo]Over the past few decades, there has been a significant loss of pollinators, including honey bees, native bees, birds, bats, and butterflies, from the environment. The problem is serious and requires immediate attention to ensure the sustainability of our food production systems, avoid additional economic impact on the agricultural sector, and protect the health of the environment. [hellip] Given the breadth, severity, and persistence of pollinator losses, it is critical to expand Federal efforts and take new steps to reverse pollinator losses and help restore populations to healthy levels.[rdquo]147 Further, Section 3 calls for [ldquo]Increasing and Improving Pollinator Habitat [hellip] (e) The Departments of Agriculture and the Interior shall[hellip] develop best management practices for executive departments and agencies to enhance pollinator habitat on Federal lands.[rdquo] With this direction, U.S. Department of Agriculture and U.S. Department of Interior, issue this timely and critically needed document, Pollinator-Friendly Best Management Practices for Federal Lands, May 11, 2015, with the following recommendations: [ldquo]Objective: To reduce the impact to pollinators from livestock grazing. Explanation: Livestock grazing alters the structure, diversity, and growth pattern of vegetation, which affects the associated insect community. Grazing during a time when flowers are already scarce may result in insufficient forage for pollinators. Grazing when butterfly larvae are active on host plants can result in larval mortality and high intensity grazing can cause local loss of forb abundance and diversity. Implementation: The following actions should be considered in rangelands when livestock grazing is present: [bull] Determine which types of pollinators and which pollinator habitat elements are affected by grazing livestock. [bull] Assess if grazing is compatible with the specific needs of target pollinator species on site, including targeted butterfly species. [bull] Prevent trampling ground-nesting sites by implementing practices to minimize hoof action of grazing animals, which causes soil compaction or erosion in pollinator nesting and shelter patches. [bull] Minimize livestock concentrations in one area by rotating livestock grazing timing and location to help maintain open, herbaceous plant communities that are capable of supporting a wide diversity of butterflies and other pollinators. [bull] Protect the current season[rsquo]s growth in grazed areas by striving to retain at least 50% of the annual vegetative growth on all plants. [bull] Enhance the growth of forbs to ensure their ability to reproduce and to provide nectar and pollen throughout the growing season by setting grazing levels to allow forbs to flower and set seed. [bull] Leave nearby ungrazed areas to provide reserves for pollinator populations. [bull] Prevent grazing during periods when flowers are already scarce (e.g., midsummer) to maintain forage for pollinators, especially for bumble bee species. [bull] In important butterfly areas, avoid grazing when butterfly eggs, larvae, and in some cases pupae are on host plants. [bull] Consider the needs of pollinators when placing range improvements and structures on the landscape. [bull] Ensure that fencing is adequate and well maintained. [bull] Include protection of pollinator species in grazing management plans.[rdquo]148[bull] Manage livestock to avoid conflicts with predators. Special attention should be given to facilitate recovery of ecologically functional populations of threatened gray wolves. Some allotments may need to be closed to give predator populations an opportunity to expand thrive while minimizing risks of human conflicts. Where grazing will continue in areas147 June 20, 2014, the White House released a [ldquo]Presidential Memorandum[mdash]Creating a Federal Strategy To Promote the Health of Honey Bees and Other Pollinators.[rdquo] https://web.archive.org/web/20170522105356/https://www.fs.fed.us/wildflowers/pollinators/documents/PresMemoJune2014/PresidentialMemo-PromoteHealthPollinators.pdf.148 USDA/USDI 2015. Pollinator-Friendly Best Management Practices for Federal Lands, May 11, 2015. https://web.archive.org/web/20170501061631/https://www.fs.fed.us/wildflowers/pollinators/BMPs/documents/PollinatorFriendlyBMPsFederalLands05152015.pdf.frequented by predators, permitees should be required to take all necessary steps to avoid conflicts and use non-lethal methods to prevent and limit depredation of livestock.149[bull] Livestock are naturally prone to cause adverse impacts because they spend a disproportionate amount of time in sensitive areas such as meadows, wetlands, and riparian areas. Livestock don[rsquo]t move when we want them to. It takes significant resources to ensure that range conditions are monitored and livestock are moved. This is evidence that the arid west is unsuitable for livestock grazing. If the agency and the permittee fail to commit necessary resources for range monitoring and moving animals, livestock grazing should be terminated.150[bull] Protect springs, streams, and wetlands from the impacts of livestock (and restoration of areas already degraded) are of utmost important because they represent a small subset of the landscape, they provide disproportionately important ecosystem services, and they suffer disproportionate adverse impact from livestock grazing. The adverse effects of livestock on water quality are well documented.151[bull] Take to heart the numerous science-based policies requiring agencies to avoid actions that would slow attainment of aquatic objectives (e.g. [ldquo]do not retard[rdquo] language in PACIFISH/INFISH and NWFP). Continued livestock grazing with only minor modifications is unlikely to avoid retarding recovery. Riparian vegetation that is ungrazed will provide better shade, better bank stability, better nutrient cycling. Riparian areas that are grazed will have more erosion, less bank stability, less shade, less tightly coupled nutrient cycles, lower water quality, more soil compaction and faster run- off. [ldquo][N]atural restorative processes should be used wherever possible; in fact, natural processes may be sufficient once the degrading influences have been removed. Because the process of restoration is progressive, the criteria of success are not easy to define. The most important point is that ecosystem development should be on an unrestricted upward path.[rdquo]152 Other important public policy objectives near streams include protection of beneficial uses of water, conserving ESA listed fish & wildlife, avoiding future listings by maintaining viable populations of native species, and meeting treaty obligations related to fish & wildlife. In most cases this will require excluding livestock from sensitive meadows and streamside areas. Livestock conflicts with water quality goals are highlighted by recent research showing that E. coli bacteria from livestock can survive in stream sediments for months.153149 ODFW Non-Lethal Measures to Minimize Wolf-Livestock Conflict, https://web.archive.org/web/20151010175850/http://dfw.state.or.us/Wolves/docs/ODFW_Non-lethal_Measures_130719.pdf.150 GAO 2016. UNAUTHORIZED GRAZING: Actions Needed to Improve Tracking and Deterrence Efforts. GAO-16- 559: Published: Jul 7, 2016. http://www.gao.gov/assets/680/678292.pdf151 Lindsey Myers, Brenda Whited. 2012. The Impact of Cattle Grazing in High Elevation Sierra Nevada Mountain Meadows over Widely Variable Annual Climatic Conditions. Journal of Environmental Protection, 2012, 3, 823-837. doi:10.4236/jep.2012.328097.https://www.scirp.org/pdf/JEP20122800004_43924817.pdf.152 A.D. Bradshaw 1996. Underlying principles of restoration.. Can. J. Fish. Aquat. Sci. 53(Suppl. 1): 3[ndash]9 (1996). http://www.globalrestorationnetwork.org/uploads/files/LiteratureAttachments/353_underlying-principles-of-restoration.pdf.153 Anne Perry 2011. E. coli: Alive and Well, Probably in a Streambed Near You. Agricultural Research l July 2011. http://www.ars.usda.gov/is/AR/archive/jul11/Ecoli0711.pdf.[bull] The agency has not prepared a legally adequate grazing suitability analysis based on economic and environmental considerations as required by NFMA.154[bull] Meeting legal requirements such as NFMA sustainability and ecological integrity and species viability is unachievable if climate change proceeds as expected. The Forest Service must do more to increase carbon storage to address global climate change and meet legal requirements. The Blue Mountains landscape will store more carbon and help mitigate climate change if they remain ungrazed. The agency needs to help mitigate climate change by managing all living systems to capture and storage optimal levels of carbon. Livestock grazing reduces carbon storage in vegetation and soil at an ecosystem scale and grazing must be reduced to help mitigate climate change.[bull] Climate change is a new and added stress on native ecosystems. Climate change is expected to increase winter storms, summer droughts, reduce snowpack and summer streamflows, and cause earlier spring snowmelt and run-off. This adds stress to plants, animals, and streams that are also stressed by grazing. To avoid cumulative impacts from the combination of climate stress and anthropogenic stresses such as grazing, the agency needs to reduce anthropogenic stress from livestock grazing. Here are a few concrete examples. First, livestock trample and destabilize streambanks and expose streambanks to erosion. Such streambanks are vulnerable to erosion during peak flows. Climate change is expected to bring bigger precipitation events which will increase the erosive power of peak flows resulting in adverse cumulative interactions between climate change and grazing. Second, plants are stressed by summer dry periods which limits their ability to set seed, set buds, and store nutrients in woody parts and roots. These life functions are directly related to their survival. Climate change is expected increase the intensity and duration of summer droughts resulting in another adverse cumulative interaction between grazing and climate change. In order to help ecosystems cope with climate stress, the agency should reduce or eliminate anthropogenic stresses such as livestock grazing. In the absence of livestock grazing streambanks will be better protected by plant roots and plants will be able to store more energy reserves which will help them be more resistant and resilient in the face of climate change.[bull] The plan should include triggers that require the removal of livestock during droughts, and after droughts the agency should provide for long periods of rest and recovery before livestock are allowed to return so that plants can rebuild soil cover, biomass, and energy stores both above and below ground.[bull] The plan should consider and avoid the effects of livestock grazing on the fire regime. Livestock grazing shifts the plant community composition from palatable grasses and forbs toward unpalatable conifers. This is contrary to current policy goals related to forest which urge us to avoid creating more ladder fuels. Livestock decrease the abundance of fine fuels which are necessary to carry periodic, low intensity surface fires. This reduces the frequency of fires, but increases their severity.155154 Heiken D., 1995. RIGHT PLACE -- WRONG ANIMAL: Determining Grazing Suitability Based on Desired Ecosystem Outcomes for the Interior Columbia River Basin. Association of Forest Service Employees for Environmental Ethics. May 1995. https://www.dropbox.com/s/ucw50hhs8xsiz2k/AFSEEE%20Grazing%20Suitability%20Report.doc?dl=0.155 See Kirsten Stade, MS, and Mark Salvo, JD. 2009. Ponderosa Pine in Peril: Assessing Public Lands Livestock Grazing in Ponderosa Pine Forests. Wild Earth Guardians. https://pdf.wildearthguardians.org/support_docs/report-ponderosa-pine-08-09.pdf; Belsky, A.J., Blumenthal, D.M., [ldquo]Effects of Livestock Grazing on Stand Dynamics and Soils in Upland Forest of the Interior West,[rdquo] Conservation Biology, 11(2), April 1997. http://web.archive.org/web/20030409094020/http://www.onda.org/library/papers/standdynamics.pdf. See also[bull] Nitrogen is a limiting nutrient in most rangeland ecosystems. Sending thousands of livestock to slaughter from public lands removes vast amounts of scarce nitrogen from the ecosystem. About 3% of livestock biomass is nitrogen that is mostly accumulated from eating plants grown with scarce nitrogen from public lands. Sending these livestock to market, exports the scarce and virtually irreplaceable nitrogen.[bull] The agency should protect and restore biotic soil crusts that help prevent erosion, fix nitrogen, cycle nutrients, and increase site productivity. Livestock grazing conflicts with the maintenance and recovery of biotic soil crusts. [ldquo]Comparison of grazed and long- ungrazed sites revealed lower cover of biotic crusts, nitrogen-fixing lichens, crust- dominated soil surface roughness, and lower species richness in the grazed transects. There was more bare ground in the grazed transects[hellip][rdquo]156[bull] Require Rest After Fire. The plan should require at least a full season (or two or three) of livestock rest after prescribed fire, and must disclose the environmental consequences of not providing such rest. Soils are far more sensitive to compaction and erosion after fire. Vegetation is also in a state of recovery. The new green shoots are essential to restoring plant vigor and biomass, but those same shoots are highly palatable to livestock. Failure to provide rest after fire is likely to lead to degrade range conditions. Plant communities are more vulnerable to invasion by non-native plants/weeds. Grazing is likely to exacerbate that problem.[bull] Grazing spreads weeds that alter vegetation structure, habitat, hydrology, and fire regimes. Weeds are a slow motion explosion that are adversely affecting native plant communities and entire ecosystems. By reducing the vigor of native plants, reducing soil cover, and exposing mineral soil, livestock grazing has a strong tendency to spread invasive weeds and exacerbate this problem. The agency should limit or exclude livestock in order to help prevent the spread of weeds.157Wuerthner, George. Livestock Grazing and Fire. January, 2003. http://web.archive.org/web/20040107135236/http://www.onda.org/library/papers/Livestock_Grazing_and_Fire.pdf; and Michael H. Madany, and Niel E. West. Livestock Grazing-Fire Regime Interactions within Montane Forests of Zion National Park, Utah. Ecology: Vol. 64, No. 4, pp. 661-667. Comparing grazed and ungrazed areas of Zion National Park this study found [ldquo][hellip] the increased understory density of plateau stands should not be attributed primarily to cessation of fires. Instead, heavy grazing by livestock and associated reduction of the herbaceous groundlayer promoted the establishment of less palatable tree and shrub seedlings[hellip][rdquo]156 Jeanne M. Ponzetti and Bruce P. McCune. 2001. Biotic Soil Crusts of Oregon's Shrub Steppe: Community Composition in Relation to Soil Chemistry, Climate, and Livestock Activity. The Bryologist 104(2):212-225. 2001. https://www.jstor.org/stable/3244886.157 Michael D. Reisner, James B. Grace, David A. Pyke and Paul S. Doesche 2013. Conditions favouring Bromus tectorum dominance of endangered sagebrush steppe ecosystems. Journal of Applied Ecology 2013 doi: 10.1111/1365- 2664.12097. http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/38539/jpe_12097_Rev_EV.pdf ([ldquo]Evidence suggests abundant bunchgrasses limit invasions by limiting the size and connectivity of gaps between vegetation, and [biological soil crusts] appear to limit invasions within gaps. Results also suggest that cattle grazing reduces invasion resistance by decreasing bunchgrass abundance, shifting bunchgrass composition, and thereby increasing connectivity of gaps between perennial plants while trampling further reduces resistance by reducing [biological soil crusts]. [hellip] Grazing exacerbates Bromus tectorum dominance in one of North America[rsquo]s most endangered ecosystems by adversely impacting key mechanisms mediating resistance to invasion. If the goal is to conserve and restore resistance of these systems, managers should consider maintaining or restoring: (i) high bunchgrass cover and structure characterized by spatially dispersed bunchgrasses and small gaps between them; (ii) a diverse assemblage of bunchgrass species to maximize competitive interactions with B. tectorum in time and space; and (iii) biological soil crusts to limit B. tectorum establishment. Passive restoration by reducing cumulative cattle grazing may be one of the most effective means of achieving these three goals.[rdquo]) Consider reducing grazing and restoring native grasses and forbs. Gucker & Shaw 2019. Western Forbs: Biology, Ecology, and Use in Restoration,[bull] Do not allow livestock grazing in existing ecosystems that are healthy and largely ungrazed. Let[rsquo]s not extend the harm to grazing to ecosystems that have been spared up to now. Similarly, please take steps to permanently terminate grazing authorizations in existing vacant or inactive allotments.[bull] Please mitigate all the significant ecological impacts of livestock grazing described in Fleischner, T.L. 2010; DuToit, et al.; and Fleischner, T. 1994.158[bull] The agency should not misunderstand their responsibilities under the multiple-use laws. The agency is not required to allow livestock grazing everywhere, nor everywhere they have historically or currently allowed grazing. The agency[rsquo]s highest priority is to meet the requirements of substantive requirements of the Clean Water Act and Endangered Species Act even if it means curtailing grazing. The agency should strongly weigh the moral imperative of mitigating climate change by storing more carbon in ungrazed ecosystems. People who choose to raise cattle should bear the full costs of their business operation. Grazing should occur primarily on private lands where the costs are internalized, rather than on public lands where the public is forced to bear the ecological costs and someone else gets to pocket the profits.[bull] Portions of these grazing allotments may occur in inventoried roadless area or unroaded areas larger than 1000 acres. Such areas are rare on the landscape and contribute disproportionately to ecological values and ecosystem services. Enhanced efforts toward conservation of ecological values are appropriate in such areas.[bull] George Wuerthner describes a variety of adverse effects from livestock grazing on public lands. The NEPA analysis should address each of these and propose alternative ways to avoid, minimize, and mitigate adverse effects.1. Dewatering of streams to the detriment of aquatic ecosystems.2. Conversion of native riparian habitat and sage brush steppe to hay pastures of exotic grasses.3. Trampling of biological crusts and contribution to soil erosion.4. Trampling of biocrusts which facilitate cheatgrass invasion.5. Soil compaction which decreases water infiltration.6. The trampling of riparian areas and springs reduces its ability to soak up water and store for late season flows. It also destroys habitat for native mollusks.7. Water troughs are breeding grounds for mosquitoes that carry West Nile virus (and harm sage grouse).8. Fences block migration and are a major source of mortality for sage grouse.https://web.archive.org/web/20200420203714/http://greatbasinfirescience.org/western-forbs-restoration/?_sf_s=western+forbs.158 Fleischner, T.L. 2010. Livestock grazing and wildlife conservation in the American West: historical, policy, and conservation biology perspectives. Pages 235-265 in J. DuToit, R. Kock, and J. Deutsch, eds. Wild Rangelands: Conserving Wildlife While Maintaining Livestock in Semi-Arid Ecosystems. Zoological Society of London/ Blackwell Publishing Ltd., Oxford, UK. https://pastoralismjournal.springeropen.com/articles/10.1186/2041-7136-1-15 and Fleischner, T. 1994. Ecological Costs of Livestock Grazing in Western North America. Conservation Biology. Volume 8 Issue 3, Pages 629 [ndash] 644. https://www.buffalofieldcampaign.org/images/get-involved/students-resource-about- bison/bison-conservation-papers/Fleischner-Ecological-Costs-of-Livestock-Grazing-in-Western-North-America- September-1994.pdf.9. We kill all kill all kinds of predators and other wildlife (like prairie dogs) as pests and [ldquo]varmints[rdquo].10. The eating of riparian vegetation eliminates hiding cover and habitat for many species from songbirds to sage grouse chicks.11. Forage competition. On many public lands, the vast majority of forage is allotted to domestic livestock. Many wet meadows, etc. are grazed to golf course height to the detriment of native wildlife.12. Disease transfer such as occurs with domestic sheep and wild bighorns.13. Weed invasion[ndash]grazing of native perennials and trampling and disturbance of soils favors weedy invasions.14. Even where grasses are meeting [ldquo]objectives[rdquo] like 4 inch stubble height that is not enough to hide ground nesting birds. For instance, grouse require at least 10 inches of stubble height which you seldom see where there is significant grazing.15. Effects on fire regimes. The invasion of cheatgrass, created by livestock disturbance, is a major factor in the burnout of sage brush habitat. Similarly, grazing can enhance conifer establishment in the ponderosa zone, including stand densities, again affecting fire regimes.16, Cows are a major source of methane and thus GHG emissions contributing to global warming. Worse than all the transportation put together.17. Most of the dams built-in the West are for water storage to provide for irrigation. These dams change the water characteristics of rivers and block migration (think of salmon). While you might say a few situations where dams have created trout habitat below them as [ldquo]good[rdquo], this doesn[rsquo]t account for the numerous losses imposed by dams.18. Grazing favors invasives and exotics over native plants. Grazing has dramatically altered many native plant communities.159[bull] Consider the grazing standards in Appendix 2 of AFSEEE[rsquo]s 1995 Grazing Suitability Report. We consider these to be minimum standards to meet the agency[rsquo]s legal requirements under NFMA, ESA, MBTA, NEPA, etc.160The plan and supporting analysis must recognize the role of livestock grazing that degrades forest health. The plan should minimize and mitigate the direct adverse effect of livestock grazing on vegetation structure. The agency must analyze the effect of past and future grazing which will tend to reduce palatable fine fuels like grasses and shift the plant community toward less palatable shrubs and trees which are more hazardous as ladder fuels. Livestock grazing probably contributed to the development of plant communities where grass and forbs are underrepresented and small conifers are over-represented. Grazing also likely contributes to the159 GEORGE WUERTHNER, Critique of Montana Outdoors proposed [ldquo]Green[rdquo] Grazing article. The Wildlife News. AUGUST 14, 2017 http://www.thewildlifenews.com/2017/08/14/critique-of-montana-outdoors-proposed-green- grazing-article/.160 Heiken D., 1995. RIGHT PLACE -- WRONG ANIMAL: Determining Grazing Suitability Based on Desired Ecosystem Outcomes for the Interior Columbia River Basin. Association of Forest Service Employees for Environmental Ethics. May 1995. https://www.dropbox.com/s/ucw50hhs8xsiz2k/AFSEEE%20Grazing%20Suitability%20Report.doc?dl=0.spread of juniper. Future livestock grazing will tend to cause these same trends, so the NEPA analysis must consider the connected and cumulative impacts of livestock grazing.This project should take steps to address the threat that livestock grazing causes to forest health. There is little point in the agency[rsquo]s efforts to mechanically reduce tree density unless other underlying causes of overstocking are dealt with, e.g. livestock grazing. The NEPA document describes the effects [ldquo]on[rdquo] range resources (e.g., fences and transitory range) but fails to disclose or analyze the effects [ldquo]of[rdquo] livestock on forest health and the desired future condition of vegetation composition. The Council on Environmental Quality directs agencies to analyze actions together when the actions are similar in timing or geography, when doing so is the best way to assess the combined impacts of the actions (40 CFR [sect]1508.25). As recognized by BLM, [ldquo]Evaluating both actions in the same EA allows BLM to better assess the combined effects and to consider complementary design features to reduce potential conflicts among potentially competing uses.[rdquo]161Grazing reduces the density and vigor of grasses which usually outcompete tree seedlings, leading to dense stands of fire-prone small trees. Cows also decrease the abundance of fine fuels which are necessary to carry periodic, low intensity surface fires. This reduces the frequency of fires, but increases their severity.162The NEPA document needs to address these issues and consider alternative ways of avoiding these impacts by not grazing. The combination of fire suppression, past high-grading, and livestock grazing together caused the overstocked condition of the stands in the analysis area. Logging and prescribed fire will only partially address the problem. To be effective, livestock grazing must also be eliminated. Grazing and logging cause cumulative effects that must be considered together in one NEPA document.The court[rsquo]s decision in League of Wilderness Defenders v. USFS, Civil No. 04--488[mdash]HA. 2004U.S. Dist. LEXIS 24413. November 19, 2004, makes clear that the agency has a duty to take a hard look at the effects of grazing in the context of making timber sale decisions. The agency must disclose cumulative impacts and cannot compartmentalize.Further evidence of the adverse forest health effects of livestock are presented in Madany et al (1983):Abstract. Major differences were found between the vegetation structure of ponderosa pine-dominated communities on the Horse Pasture Plateau and those on the nearby but isolated Church and Greatheart Mesas in Zion National Park. The Horse Pasture Plateau was heavily grazed by livestock in the late 19th and early 20th centuries, while the mesas were never grazed. Conditions on the mesas now approximate the pre-European situation of the region as described in the earliest written accounts. Pine, oak, and juniper sapling density and cover were much higher on the formerly grazed plateau than on the relict mesas. Herbaceous species dominated the groundlayer in mesa ponderosa161 BLM 2018. Thurston Hills Trails and Forest Management EA,https://eplanning.blm.gov/public_projects/nepa/75350/142227/174633/2018_04_23_THills_EA_Final_Print.pdf.162 See Belsky, A.J., Blumenthal, D.M., [ldquo]Effects of Livestock Grazing on Stand Dynamics and Soils in Upland Forest of the Interior West,[rdquo] Conservation Biology, 11(2), April 1997. http://web.archive.org/web/20030409094020/http://www.onda.org/library/papers/standdynamics.pdf. See also Wuerthner, George. Livestock Grazing and Fire. January, 2003. http://web.archive.org/web/20040107135236/http://www.onda.org/library/papers/Livestock_Grazing_and_Fire.pdf.pine savanna stands, while grass and forb cover was low on analogous sites of the plateau. Age-class distributions of major tree species further substantiated that major physiognomic changes have occurred on the plateau since the arrival of European man. Analysis of fire scars showed that prior to 1881, the mean fire-free interval for ponderosa pine stands on the plateau was 4 to 7 yr, while the interval for Church Mesa was 69 yr.Since there were no recorded fires on Church Mesa between 1892 and 1964, and yet no corresponding increase in sapling density, the increased understory density of plateau stands should not be attributed primarily to cessation of fires. Instead, heavy grazing by livestock and associated reduction of the herbaceous groundlayer promoted the establishment of less palatable tree and shrub seedlings, Fire, however, played an important secondary role in maintaining savanna and woodland communities.163Grazing is also known to have significant adverse impacts on ground nesting birds.164The agency often erroneously concludes that livestock grazing will not affect upland vegetation of fuel profiles because fire suppressed stands are too dense to allow livestock access, but this is a gross oversimplification. The agency is conducting so-called [ldquo]restoration[rdquo] projects to reduce fuels and vegetation density which has and will allow livestock use. The NEPA document must disclose how livestock grazing interacts with the so-called forest restoration projects. The goal of restoration is a more open stand, and the agency wants more grass and forbs and fewer conifers, but grazing in those [ldquo]restored[rdquo] stands will cause the opposite effect [ndash] more conifers and less grass and forbs [ndash] thereby conflicting with the restoration objectives.Tribal rights and interestsWe hope that this planning effort can enhance the cultural and environmental interests of native people, especially related to cultural use of native plants & wildlife, and cultural practices, such as seasonal burning, and gathering food and craft supplies. We hope there are opportunities for sharing and using traditional ecological knowledge (TEK) and we hope native people be involved in both planning and implementation of this project, where appropriate.We strongly support greater coordination and engagement between the federal land management agencies and tribal governments and tribal members. We also feel the agencies need to ensure the general public is informed and understands the importance of this coordination, and that it is happening. The general public is not always well informed about treaty rights or the importance of agencies like the Forest Service consulting and engaging with tribes on land management decisions, and failure to adequately inform the public can lead to unnecessary conflict. We urge that tribal consultation and application of TEK be done within a transparent NEPA framework, so that the general public can also be informed and involved in management of public lands.We encourage the federal land management agencies to work toward a meaningful harmonization of tribal interests and the interests of the public. Oregon Wild strongly supports tribal involvement in public land management, and the protection and restoration of fisheries, wildlife, native plants, wetlands, and clean water needed to sustain tribal treaty rights and interests. We also want to ensure continued public notice and public involvement, and163 Michael H. Madany, and Niel E. West. 1983. Livestock Grazing-Fire Regime Interactions within Montane Forests of Zion National Park, Utah. Ecology: Vol. 64, No. 4, pp. 661-667.164 Walsberg, G.E., 2005. Cattle Grazing in a National Forest Greatly Reduces Nesting Success in a Ground-nesting Sparrow. The Condor. Volume 107, No. 3. August, 2005.fulfillment of conservation goals reflected in forest plans, and other land management policies. We hope the agency can identify the significant overlap among these diverse interests and manage accordingly.Wild and Scenic River EligibilityIt does not appear that the Forest Service has done any work on Wild and Scenic River since the Assessments Report was written. We incorporate by reference our 5-28-2024 comments on the Assessment Reports.Wilderness RecommendationsThe plan revision must conduct a two-step process, to identify (1) lands suitable for wilderness, and (2) lands recommended for wilderness designation by Congress. 36 CFR 219.7 (c)(2). The inventory of potential wilderness must be [ldquo]broad and inclusive[rdquo] and transparent consistent with the 2012 Planning Rule Directives. FSH 1909.12- Chapter 70 [ndash] Wilderness.165 Notably, the inventory should include areas with roads (maintenance level 1), and previous logging (if it is substantially unnoticeable). See Oregon Wild[rsquo]s previous comments on the Assessment Reports, the Preliminary Need for Change, and the earlier attempts to amend the Blue Mountain Forest Plans.The Forest Service[rsquo]s refusal to recommend ANY wilderness at all flies in the face of the evidence supporting the need for more wilderness:Wilderness areas are acknowledged as a scarce and dwindling resource, requiring humility on behalf of humanity to retain the natural condition of wilderness areas, and to convey an understanding of human and natural history. Wilderness serves as a baseline, demonstrating the functions of healthy ecosystems that can be contrasted with human activities that change our world. Wilderness areas provide a variety of valuable ecosystem services including carbon sequestration, watershed protection and air quality and may contain habitat for numerous threatened and endangered species and other rare biological resources. Managing an area to protect its wilderness character provides unique opportunities and benefits for present and future generations that may otherwise be irreparably lost. 166This description of the value of wilderness begins to capture its importance, but there is even more. As the population grows, there is a growing demand for wilderness, but the FS is not doing what is needed to meet that demand.167The Forest Service refusal to recommend wilderness is even more arbitrary and capricious because numerous areas evaluated include ALL wilderness values and are reasonably manageable. This includes polygons: 2010, 1010, 1008, 1002, 1022, 4012, 4011, 6030, 4007,165 FSH 1909.12- Chapter 70. http://www.fs.usda.gov/detail/planningrule/home/?cid=stelprd3828310.166 USFS 2024. Blue Mountains Designated Areas Assessment Report, page 9.167 Kimberly A. Wade-Benzoni, 2002: A Golden Rule Over Time: Reciprocity in Intergenerational Allocation Decisions. AMJ, 45, 1011[ndash]1028, https://doi.org/10.5465/30693272016, 2021, 2015, 2025, 2032, 2031, 2030, and 4003.168 It[rsquo]s a shame the Forest Service does not use relevant place names that help the public recognize whether the analysis relates to places they know and love.It was also arbitrary and capricious to exclude areas from fine scale analysis of wilderness values.Notable roadless areas that should be recommended for wilderness include:[bull] Joseph Canyon[bull] Hellhole[bull] Beaver Creek[bull] Castle Ridge[bull] McLellan Mountain[bull] Skookum CreekIn several cases above, the Forest Service shrunk the boundary to include less than the IRA boundary but if the Forest Service had mapped it accurately without bias they would have mapped it larger than the IRA boundary.==Each substantive issue discussed in these comments should be (i) incorporated into the purpose and need for the plan amendment, (ii) used to develop NEPA alternatives that balance tradeoffs in different ways, (iii) carefully analyzed and documented as part of the effects analysis, and (iv) considered for mitigation.Please post to the project website, links to all relevant ESA and EFH consultation documents, RMPs, watershed analyses, science references, and other supporting documents relied on in the NEPA analysis.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/168 See orange polygons on this map: https://usfs-public.app.box.com/v/PinyonPublic/file/1921988572770 and further information in this report: https://usfs-public.app.box.com/v/PinyonPublic/file/1921987580927Sincerely,Doug Heiken (he/him) <REDACTED>