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TO: Pomeroy District Ranger, Susan Piper

VIA: https://cara.fs2c.usda.gov/Public//CommentInput?Project=61783

Subject: Pomeroy Danger Tree and Fire Salvage [mdash] scoping comments

Please accept the following scoping comments from Oregon Wild concerning the Pomeroy Danger Tree and Fire Salvage Project, https://www.fs.usda.gov/project/?project=61783. 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).

The public should be given a chance to comment on an informative NEPA document, not just scoping. To provide only scoping and no other opportunity to comment is not consistent with the spirit of NEPA.

Removing hazard trees along closed roads sounds like a really poor way to balance the need for public safety and conservation of wildlife trees. Roadside danger tree removal should focus on high use areas. Dead and dying trees are valuable habitat that should be retained unless they pose an imminent hazard to the public. Ecologically valuable snags should be retained along dead end spur roads, and low maintenance roads that receive little use.

This project appears to involve improper NEPA segmentation. The notice of proposed action specifically says that purpose of this project is to open roads for future actions that have not been approved. This is not allowed. NEPA analysis must consider [ldquo]connected actions[rdquo] in one NEPA document. Clearly, opening roads is connected to the future forest management actions, so they must be considered in one analysis. The NEPA analysis for those future actions should consider the cumulative environmental impacts of felling and removing valuable wildlife trees that may pose a hazard to people.

The FS says that tree planting is one of the future actions expected, but tree planting is not an explicit part of this decision. There is significant controversy whether replanting is necessary or desired, because it interferes with the development and persistence of complex early seral habitats. If roadside wildlife trees also need to be felled and removed to facilitate this potentially unneeded action, these two action need to be considered together, not segmented into two NEPA analyses.

The proposed action is based on unsupported and outdated views of forest ecology. The notice of proposed action says [ldquo]Severely burned areas unlikely to naturally regenerate to a forested state will need future land management interventions, primarily in the form of reforestation. Removing fire-killed and -injured trees would make room for future seedlings[rdquo] The FS provides no evidence that these forests will not regenerate. They have burned and regenerated many times since the glaciers retreated. Also, there is no evidence that it is necessary to [ldquo]make room[rdquo] for seedlings be removing large wood. In fact, retaining rather than removing large wood probably helps forest regeneration by moderating biophysical extremes (heat/cold, dry/wet), and when snags fall they perform natural thinning of the regenerating forest. Another service that is lost when trees are salvaged.

If some areas are far from seed sources, the FS can do strategic patches of tree planting without removing the snags. If they do it quickly. Putting tree planters under snags is no more dangerous than putting loggers under snags during salvage and hazard felling.

Large snags are especially valuable for wildlife because they can accommodate more use by larger suite of animals and they tend to persist longer on the landscape before falling. The FS should adopt a design criteria that retains all large trees that are [ldquo]dying[rdquo] and all snags over 21[rdquo] dbh. Dying trees are not dead. Dying trees are still alive (and may yet survive) and must be retained per the Screens. Large snags are also LOS components that should be retained in order to restore LOS conditions as required by the Eastside Screens.

Retaining felled hazard trees would slightly mitigate the adverse effects of felling snags. Commercial removal will exacerbates adverse effects by removing carbon, biomass, and structural complexity that adds to the vitality of current and future forest stands.

Cutting trees in RHCAs that have experienced wildfire must be kept to an absolute minimum. The snags and dead wood that exist now are all the stream is going to get for the next 100 years. Functional wood is a limited resource and tree removal will make a bad situation worse.

It is not necessary to remove tree 1 [frac12] tree lengths from the road. The goal should be to reduce risk, not eliminate risk. The probability of a tree hitting the road diminishes significantly beyond 100 feet form roads. Unless a tree is actually leaning toward the road, only a small fraction of the directions a tree could fall will actually reach the road.

The rationale supporting these brief comments are explained in detail below.

Salvage: Capturing commercial log value is a questionable purpose for this project.

Conducting destructive salvage operations in order to capturing commercial log value is inappropriate. The Forest Plan is so outdated that it is effectively invalid. The plan, like so many others in the Interior Columbia Basin, calls for the liquidation of most of the remaining old forest, so the ICBEMP process was initiated to deal with the loss of old forests and the species viability issues caused by such mismanagement. Just because this burned area is in a [ldquo]timber production zone[rdquo] in an outdated forest plan is not a reason to salvage this area.

This nation does not need to destroy public resources in order to supply its wood product needs. The local timber industry should get its raw materials from private lands. The highest and best use of the National Forests is for clean water, wildlife habitat, recreation, carbon sequestration, etc. NOT for fiber. Because of this, the recommendations of the Beschta report deserve much more careful consideration and should be followed.

Eastside Screens Prohibit Removal of Large Trees that are Dying
The 9th Circuit Court of Appeals which governs this region had occasion to consider the question of [ldquo] what is a dead tree[rdquo] in the School Fire Salvage case.

The Appeals Court reasoned that in the absence of an adopted technical definition of [ldquo]live trees,[rdquo] the common understanding of the word [ldquo]live[rdquo] from the Merriam Webster[rsquo]s Collegiate Dictionary (10th ed. 1993) meant [ldquo]to be alive,[rdquo] which meant [ldquo]not dead,[rdquo] and concluded [ldquo]the common meaning of the term [lsquo]all live trees[rsquo] is all trees that have not yet died.[rdquo] Opinion at 12. Thus, according to the Appeals Court, dying trees designated for harvest were not yet dead, and remained [ldquo]live[rdquo] for the purposes of the Eastside Screens.

The Appeals Court remanded the case to the District Court to issue an injunction consistent with its findings. The District Court issued an injunction on February 14, 2007, requiring that [ldquo]The Forest Service shall not harvest from the three timber sales areas any [ldquo]live tree[rdquo] > 21 inches dbh.[rdquo] This includes any tree of requisite size with green needles or that is not yet dead.[rdquo] District Court Order at 2.

Record of Decision for the School Fire Salvage Project, Umatilla National Forest. 6-11-07.
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5211932.pdf.

When attempting to predict the mortality of trees that are not yet dead, the Forest Service cannot predict with accuracy which trees will die and which trees will survive, so guessing will unavoidably cause the loss of live trees that would otherwise survive and jump-start to the recovery of the fire-affected forest.

ABSTRACT: Wild and prescribed fire-induced injury to forest trees can produce immediate or delayed tree mortality but fire-injured trees can also survive. ... We used data from 4024 ponderosa pine (Pinus ponderosa

Dougl. ex Laws.) and 3804 Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) trees from 23 fires across Oregon and Washington to assess the discriminatory ability of 21 existing logistic regression models and a polychotomous key (Scott guidelines). We used insights from the validation exercise to build new models for each tree species and to identify fire-injury variables which consistently produce accurate mortality predictions. Only 8% of Ponderosa pine and 14% of Douglas-fir died within 3 years after fire. The amount of crown volume consumed, the number of bole quadrants with dead cambium and the presence of beetles were variables that classified most accurately, but surviving trees in our sample displayed a wide range of fire injury making the accurate classification of dead trees difficult. For ponderosa pine, our new model correctly classified 99% of live trees and 12% of dead trees while the Malheur model (Thies et al., 2006) correctly classified 95% of live trees and 24% of dead trees. The Scott guidelines accurately predicted at least 98% of live ponderosa pine trees but less than 2% of dead ponderosa pine. For Douglas-fir the Scott guidelines accurately predicted at least 80% of live trees and generally less than 10% of dead trees.

...

We calculated the overall correct classification rate as the percent of correctly

classified live and dead trees out of all classified trees and the overall error rate as the percent of incorrectly classified trees. We calculated sensitivity (percent of dead trees correctly predicted to be dead) and specificity (percent of live trees correctly predicted to be alive). We also calculated the correct mortality prediction rate as the percent of truly dead trees out of the total number of trees predicted to be dead and the incorrect live prediction rate as the percent of dead trees incorrectly predicted to be alive. The two types of misclassification errors, dead trees predicted as live (1-Sensitivity) or live trees predict as dead (1-Specificity), are inversely related.

...

Ponderosa pine. Direct application of previously published models to trees from

wildfire or prescription fire resulted in a wide range of discriminatory ability for ponderosa pine, from 52% to 77%.

...

Douglas fir. ... Over all models, there was a wide range of average discriminatory ability (AUC), from slightly above 50% (Ryan and Amman, 1994) to over 80% (Hood et al., 2008). For some models (e.g., Kobziar et al., 2006; Ryan and Amman, 1994) the lower confidence limit indicates that the average discriminatory ability can be only slightly better than a coin toss.

...

Error rates. The error rates for the Scott guidelines and our logistic regression

models were similar. In general, a large proportion of our live trees demonstrated a wide range of fire injury and live trees had significant amounts of fire injury. This resulted in low error rates when classifying live trees but high error rates (>80%) when classifying dead trees.

... [I]n salvage operations, managers must assess the relative cost of predicting a

dead tree as live (resulting in a loss of revenue) versus predicting a live tree as dead (resulting in salvage logging of live trees).

... [T]he range of fire injury for trees which survive for 3 years is surprisingly

wide.

... The two types of errors that can occur (i.e., falsely predicting a dead tree will live and falsely predicting a live tree will die) come with different costs to land managers ...

Lisa M. Ganio, Robert A. Progar. 2017. Mortality predictions of fire-injured large Douglas-fir and ponderosa pine in Oregon and Washington, USA. Forest Ecology and Management. Volume 390, 15 April 2017, Pages 47-67. https://doi.org/10.1016/j.foreco.2017.01.008. Basically, these models are good for predicting which trees are going to live, but bad at predicting trees are going to die.

Minimize Replanting in Order to Promote Complex Early Seral

There is a growing recognition of the ecological importance of complex early seral habitat which typically exists after a disturbance and before young conifers re-establish dominance. Replanting therefore truncates succession to the detriment of complex early seral habitat. The agency should be willing to accept delayed conifer re-establishment. Slow progress toward conifer dominance is not a failure of forestry, but a benefit to biodiversity.

We urge the agency to carefully consider how replanting can be adjusted to minimize and mitigate adverse effects on complex early seral habitat, for instance:

* consider relying on natural regeneration;
* leave unplanted "skips" within planting areas;
* plant in a highly variable, clumpy, gappy pattern;
* plant at low density, so that future thinning entries are not needed;
* plant diverse species and diverse genetic stock (especially important considering climate change);
* minimize soil disturbance and avoid weeds;
* retaining complex dead wood structure (retain all snags, leave dead/down wood in patches, leave some fuel piles unburned, etc).

Science shows that natural regeneration is adequate to restock conifers even in large high severity burn patches. 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. ([ldquo]In our analysis the percentage of plots lacking 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.[rdquo]).

This project should be adjusted to reflect the growing recognition of the ecological and social value of complex early seral habitats which are promoted by delayed re-establishment and dominance of conifers after disturbance.

Complex early seral habitat, with diverse vegetation, as well as retaining some structure remaining after previous entries, often provides important ecological value to a wide variety of wildlife including big game, birds, insects, small animals, plants and wildflowers, butterflies, etc.

Complex early seral habitats are now relatively uncommon as a result of many decades of timber dominant forestry, with regeneration harvest, fire suppression, salvage logging, and conifer replanting.

This project could be made more beneficial to the creation of complex early seral habitat by dropping areas from planting entirely when they have a nice existing complement of diverse vegetation. Please minimize efforts to control competing native vegetation.

Another option is to replant at very low densities or in a very clumpy-patchy-gappy pattern to allow existing non-conifer vegetation more time in the sun. Try to avoid homogenizing tree densities.

The agency should be willing to accept delayed conifer re-establishment. Slow progress toward conifer dominance is not a failure of forestry, but a boon to biodiversity.

The diversity and complexity of naturally established early seral forests are both resilient to climate change and help store a lot of carbon. Bernard T. Bormann, Robyn L. Darbyshire, Peter S. Homann, Brett A. Morrissette, Susan N. Little. 2015. Managing early succession for biodiversity and long-term productivity of conifer forests in southwestern Oregon. Forest Ecology and Management 340 (2015) 114[ndash]125 https://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/55627/MorrissetteBrettForestryManagingEarlySuccession.pdf ([ldquo]Fifteen years of growth of shrubs and hardwood trees in the Early-seral plantation was remarkable, resulting in total aboveground biomass increment (18 Mg/ha/yr) double that of the Douglas-fir plantations.[rdquo])

To help get your creative juices flowing on this interesting and developing topic please review and consider the following resources:

Jerry Franklin - Early seral forest: a diminishing resource? http://www.slideshare.net/ecoshare/jerry-franklin-early-seral-forest-a-diminishing-resource.

K. Norman Johnson - Policies to Encourage Diverse, Early Seral Forest in Oregon: What Might We Do? http://www.slideshare.net/ecoshare/k-norman-johnson-policies-to-encourage-diverse-early-seral-forest-in-oregon-what-might-we-do.

Exploring What is a 'Good' Forest Opening and is the Future a concern? January 30, 2007. http://ecoshare.info/projects/central-cascade-adaptive-management-partnership/workshops/early-seral-forest-2007/. AND http://www.slideshare.net/ecoshare/presentations.

Daniel C. Donato, John L. Campbell & Jerry F. Franklin 2011. Multiple successional pathways and precocity in forest development: can some forests be born complex? Journal of Vegetation Science. (2011) http://onlinelibrary.wiley.com/doi/10.1111/j.1654-1103.2011.01362.x/pdf.

Churchill, D.J., M.C. Dalhgreen, A.J. Larson, and J.F. Franklin. 2013. The ICO approach to restoring spatial pattern in dry forests: Implementation guide. Version 1.0. Stewardship Forestry, Vashon, Washington, USA. https://web.archive.org/web/20130330181038/http://www.cfc.umt.edu/ForestEcology/files/ICO_Manager_Guide.pdf and

Derek J. Churchill, Andrew J. Larson, Matthew C. Dahlgreen, Jerry F. Franklin, Paul F. Hessburg, and James A. Lutz. 2013. Restoring forest resilience: From reference spatial patterns to silvicultural prescriptions and monitoring. Forest Ecology and Management 291 (2013) 442[ndash]457. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5428873.pdf

Replanting may not be necessary where birds and other wildlife serve essential roles in post-disturbance seed dispersal.

Seed dispersal mutualisms with scatter-hoarders play a crucial role in population dynamics of temperate large-seeded trees. These behaviors shape seed dispersal patterns, which can be applied to conservation of populations, communities, and even ecosystems dominated by large-seeded trees. We draw on a growing body of literature to describe the ecological context and consequences of scatter-hoarding as a seed dispersal mechanism. We synthesize the quantitative literature on the interaction between members of the avian family Corvidae (crows, ravens, jays, magpies, and nutcrackers) and nut-bearing trees such as pines (Pinus spp.) and oaks (Quercus spp.) to examine unique aspects of avian scatter-hoarders as seed dispersers. During the scatter-hoarding process, seed selectivity, transportation distance, hoarding frequency, and cache placement affect seed dispersal effectiveness, a measure of the quantity and quality of dispersal. Case studies from around the world highlight the role of corvid seed dispersal in population dynamics of trees, and how the birds' scatter-hoarding behavior can be facilitated for the restoration of oak- and pine-dominated habitats.

Mario B. Pesendorfer, T. Scott Sillett, Walter D. Koenig, and Scott A. Morrison (2016) Scatter-hoarding corvids as seed dispersers for oaks and pines: A review of a widely distributed mutualism and its utility to habitat restoration. The Condor: February 2016, Vol. 118, No. 2, pp. 215-237. http://dx.doi.org/10.1650/CONDOR-15-125.1

If reforestation of recently-burned areas remains an important goal, relatively cool/wet sites should be prioritized first because seedling survival in these areas is likely to be greatest, now and into the future. Within these wetter areas, planting units should be limited to locations where available seed sources are most distant (Stevens-Rumann and Morgan 2019). ... In addition, prioritizing plantings in wetter years would be likely to benefit treatment success ...

Veblen & Rodman 2019. Modeling the Influence of Climate and Local Site Factors on Post-Fire Regeneration in the Southern Rocky Mountains. JFSP PROJECT ID: 17-2-01-4

November 2019. https://www.firescience.gov/projects/17-2-01-4/project/17-2-01-4_final_report.pdf.

Plant at low density to extend the early seral community and avoid future stand management costs.

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.

[ldquo]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.[rdquo]

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. Beyond smoke and mirrors: a synthesis of fire policy and science. In review - Conservation Biology. [ldquo]There has been a loss of diverse young forests on all ownerships. [hellip] Conservation of diverse young forests has received little attention in forest policy.[rdquo] Janet Ohmann; Science Findings, Issue 56; Seeing the trees for the forest: mapping vegetation biodiversity in coastal Oregon forests; (September 2003). http://www.fs.fed.us/pnw/sciencef/scifi56.pdf.

If this project involves artificial planting, avoid dense replanting that creates dense homogeneous plantations. Such areas inhibit biodiversity and also represent dangerous fuel conditions. Please replant in patches and/or at a fairly low density and avoid the need for future thinning and other stand management costs. Let[rsquo]s be patient and allow these stands recover slowly as diverse early seral communities. Diverse early seral plant communities are becoming less common and we should encourage slow and easy regeneration of forest communities. This is consistent with the research being done by Nathan Poage which indicates that many stands developed over much longer time periods than we typically allow under the agricultural model of forest management. David Hibbs[rsquo] research is also showing that natural regeneration is sufficient to reforest most sites after disturbance. OSU Media Release, Slow but Reasonably Sure: Burned Forest Lands Regenerate Naturally, 4-03-07. http://web.archive.org/web/20071101041901/http://oregonstate.edu/dept/ncs/newsarch/2007/Apr07/forestrecovery.html ([ldquo]Some studies have argued that, in the absence of aggressive management, burned areas might turn into unproductive shrub fields that could persist for decades or centuries. [lsquo]In contrast to expectations, we found natural conifer regeneration to be generally abundant across a variety of settings,[rsquo] the scientists wrote in the new study. [lsquo]Management plans can benefit greatly from utilizing natural conifer regeneration, but managers must face the challenge of long regeneration periods, and be able to accommodate high levels of variation across the landscape of a fire.[rsquo][rdquo]).

Jerry Franklin points out that the more diverse forests that develop from natural regeneration are more resilient to climate change. In the 2007 Early Seral Forest Workshop, Jerry Franklin pointed out an important reason to rely on natural regeneration, saying [mdash]

Naturally-regenerated ESFCs are likely to be more resilient under climate change due to

- greater species diversity

- tree genotypes selected by nature (i.e., environmental stresses)

[hellip]

Reforestation will usually:

o Reduce the duration of ESFCs

o Reduce heterogeneity of the process by which closed forest canopy is re-established

o Alter genotype of planted species (less selection by environment)

o Homogenize composition of forest

http://www.reo.gov/ecoshare/ccamp/good_forest_opening/powerpoints/FranklinEarlySuccession.ppt

Brown and Kertis studied the seedlings that came up naturally after the Warner Creek fire, and found that [ldquo]seedling density can vary a lot within a plot. You might have a general density of 50 thousand per hectare, but locally those numbers could be anywhere from 0 to 300 per hectare. These seedlings are numerous, but not laid out in a grid![rdquo]

http://web.archive.org/web/20050428020846/http://www.brownandbrown.tv/warner-presentation-2002-05-14b.pdf.

Planting [ldquo]Improved[rdquo] Trees Undermines Genetic Diversity, Tree Fitness and Natural Selection

De 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. This means that replanting trees from tree breeding programs that have focused on tree growth rates may be creating forests that are less resilient to stress from insects and climate change.

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.

[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).

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.

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:

* nutrient uptake, storage, and release
* water uptake, storage, and release
* mycorrhizal colonization
* wildlife habitat, in particular for primary cavity species which are recognized as a "keystone" element of healthy forests
* 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
* providing food for insects that in turn feed a wide variety of other wildlife such as birds and bats
* favorable sites for seed germination and establishment
* mechanical thinning of the regenerating stand due to the process of snag fall
* shade and cover for everything from seedlings to big game
* 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.

Since 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:

* 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;
* 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;

https://www.yesmagazine.org/environment/2020/03/11/climate-change-montana-forest/

https://www.nrfirescience.org/event/wildfire-effects-microclimate-conditions-and-seedling-regeneration-northern-rockies-mixed

* 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., 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 ([ldquo]Partially charred wood represented a considerable pool of nutrients, due to both the relatively 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])
* 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;
* 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] Wilson, Kelpie 2015. Biochar for Forest Restoration in the Western United States [ndash] September 18, 2015 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]);

* 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;
* loss of wood that serves to buffer soil chemistry and prevent extreme changes in soil chemistry;
* water quality degradation;
* loss of water storage capacity in down logs;
* altered timing of storm run-off which could lead to peak flows that erode stream banks and scour fish eggs;
* delaying the pace of vegetative recovery and reducing the quality/diversity of the vegetation community;
* 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;
* spread of invasive weeds through soil disturbance and extensive use of transportation systems;
* loss of legacy structures that can carry species, functions, and processes over from one stand to the next;
* 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;
* 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;
* 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.
* 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.
* 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.
* loss of partial shade that helps protect the next generation of forest;
* loss of cover quality and fawning areas for big game;
* loss of future disturbance processes such as falling snags that help thin and diversify the next generation of forest;[1]
* increased human activity and human access that can increase fire risk;
* increased fine fuels on the forest floor that can cause an increase in fire hazard;
* loss of seed sources, and
* loss of diversity of vegetation and microsite conditions.
* 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.
* 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.
* 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:

* 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;
* protect all live trees;
* protect all old snags over 150 years old;
* protect all large snags over 20 inches dbh;
* protect at least 50% of each size class of dead trees less than 20 inches dbh.

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.

Consider the recommendations of the Society for Conservation Biology

The Society for Conservation Biology in 2006 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; 4(9): 481-487.

Forest Management After Wildfire

Forest 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 impacts 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 as though 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.

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.

Salvage is a Tax on Ecosystem Structure/Function/ Process.
The NEPA analysis should clearly disclose and carefully consider the adverse environmental effects of salvage

logging.

An article from respected scientists in one of the world[rsquo]s leading science journals said:
[hellip] [N]atural disturbances are key ecosystem processes rather than ecological disasters that require human repair. Recent ecological paradigms emphasize the dynamic, nonequilibrial nature of ecological systems in which disturbance is a normal feature and how natural disturbance regimes and the maintenance of biodiversity and productivity are interrelated [hellip] Salvage harvesting activities undermine many of the ecosystem benefits of major disturbances. [hellip] [R]emoval of large quantities of biological legacies can have negative impacts on many taxa. For example, salvage harvesting removes critical habitat for species, such as cavity-nesting mammals, [and] woodpeckers, [hellip] Large-scale salvage harvesting is often begun soon after a wildfire, when resource managers make decisions rapidly, with longlasting ecological consequences[hellip].Lindenmayer, Franklin, Hunter, Noss, et al., ECOLOGY: Salvage Harvesting Policies After Natural Disturbance, Science 2004 303: 1303. http://www.eebweb.arizona.edu/courses/ecol406r_506r/lindenmayer&noss-2005-effectslogging4.pdfIn a January 3, 2014 letter to the Forest Service following the Rim Fire, several scientists said:We are also concerned that your proposal under-estimates the cumulative impacts of postfire logging and its potential effects on ecological integrity and forest health. In particular, the proposal seems to violate the National Forest System Land Management Planning Rule of 2012 (36 CFR Part 219) that directs the Forest Service to maintain the ecological integrity of a planning area as it relates to [ldquo]the completeness of wholeness of an ecosystems composition, structure, function, and connectivity.[rdquo] Postfire logging is inconsistent with the intent of the planning rule as it would greatly diminish ecological integrity of important postfire wildlife habitat while removing habitat for at-risk species, as noted. [hellip]Current studies also have concluded that complex early seral habitat, created by higher-severity fire, has declined substantially since the era of fire suppression . Yet there are no forest plan provisions to protect this habitat. Thus, in closing, there is a consensus of scientific opinion that post-fire logging and artificial conifer plantation establishment is one of the most ecologically damaging activities that could occur after mixed-severity fire.DellaSala, Hanson, Bond, Hutto, Halsey. 1-3-2014 letter to the USFS regarding Rim Fire salvage.
http://www.californiachaparral.org/images/rimfirescientistsignonletter12_13_2013.pdfIn 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 an abundance 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.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.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.
http://www.geosinstitute.org/images/stories/pdfs/Publications/Fire/SciLetterOpposingPostfireLoggingBillsSept2015.pdf; http://www.geosinstitute.org/press-room-sp/press-releases/1228-260-scientists-oppose-post-fire-logging-bills.htmlThe 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.Quigley, Thomas M., tech. ed. 1996; The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment.) Gen. Tech. Rep. PNW-GTR-382; Page 178.Salvage 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. 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. 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. 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.pdfA post-fire study in the Klamath Region looked at forests 20 years after wildfire, salvage logging, replanting found -- [middot] Management had no impact on Douglas-fir regeneration, the main species of concern in the region.[middot] Managed sites had more homogeneous stand structure with fewer snags than unmanaged sites.[middot] Aspect overwhelmed management[rsquo]s ability to influence composition and conifer regeneration.Maria J. Lopez Ortiz, Terry Marcey, Melissa S.Lucash, David Hibbs, Jeffrey P.A. Shatford, Jonathan R.Thompson. 2019. Post-fire management affects species composition but not Douglas-fir regeneration in the Klamath Mountains. Forest Ecology and Management. Volume 432, 15 January 2019, Pages 1030-1040. https://doi.org/10.1016/j.foreco.2018.10.030[ldquo]There has been a loss of diverse young forests on all ownerships. [hellip] Conservation of diverse young forests has received little attention in forest policy.[rdquo] Janet Ohmann; Science Findings, Issue 56; Seeing the trees for the forest: mapping vegetation biodiversity in coastal Oregon forests; (September 2003). http://www.fs.fed.us/pnw/sciencef/scifi56.pdf.The agency should carefully review the post-fire science summary prepared by the World Wildlife Fund in 2006. In general traditional forestry has viewed fire as bad and dead trees as a waste. These views have skewed public policies about post-fire logging. However, current scientific understanding recognizes that disturbance and dead trees are in fact critical to forest health. Of the approximately thirty scientific papers on post-fire logging and additional government reports published to date, not a single one indicates that logging provides benefits to ecosystems regenerating post-disturbance. In general, post-fire logging impedes regeneration when it compacts soils, removes [ldquo]biological legacies[rdquo] (e.g., large dead standing and downed trees), introduces or spreads invasive species, causes soil erosion when logs are dragged across steep slopes, and delivers sediment to streams from logging roads. Further, a large body of science on disturbance ecology (e.g., recent books on Mt. St Helens and studies in the Yellowstone Ecosystem and elsewhere) indicate that when natural disturbance events are preceded and/or followed by land management activities they often impair the recovery of forest ecosystems.Dominick A. DellaSala 2006. POST-FIRE LOGGING SUMMARY OF KEY STUDIES AND FINDINGS. World Wildlife Fund, February 2006.https://forestlegacies.org/wp-content/uploads/2010/08/PostfireSummaryOfKeyFindings.pdf
The agency often cites Franklin and Agee. 2003 [ldquo]Forging a Science-Based National Forest Fire Policy,[rdquo] Issues in Science and Technology Online. Fall 2003.
http://web.archive.org/web/20071215154828/http://www.issues.org/issues/20.1/franklin.html to support

[ldquo]active management[rdquo] after fire. This paper simply does not support aggressive salvage logging. In fact, it has very short discussion of post fire logging that includes the following:

Management of postburn areas, including timber salvage, needs to incorporate the concept of biological legacies. Salvaging dead and damaged trees from burns involves the ecology of a place, not simply economics and fuels. In addition to effects on postfire wildlife habitat, there are also effects of salvage logging on soils, sediments, water quality, and aquatic organisms. Significant scientific information exists on this topic as well as on biological legacies.

Biological legacies differ by orders of magnitude in natural forests, a fact that should guide restoration programs. Where stand-replacement fires are characteristic, such as with lodgepole pine and Pacific Coast Douglas fir forests, massive areas of standing dead and down trees are usual; salvage operations generally are not needed and do not contribute to ecological recovery, even though they do provide economic return. On the other hand, uncharacteristic stand-replacement fires in dry forests can produce uncharacteristic levels of postfire fuels, including standing dead and down trees. Removing portions of that particular biological legacy may be appropriate as part of an intelligent ecological restoration program, and not simply as salvage. (emphasis added)

At most this paper supports removal of a portion of the uncharacteristic fuels. The only fuels that would be [ldquo]uncharacteristic[rdquo] and the small trees that grew up as a result of fire suppression. If the tree was there before fire suppression, than it should remain after a stand replacing fire. Only small fuels should be removed. This intent is clear from Jerry Franklin[rsquo]s work on The Klamath Tribes[rsquo] Forest Management Plan.

Specific principles to guide removal of trees, snags, and logs from burned sites are as follows:

[hellip]

2) Trees (live and dead) and down wood will be retained in sufficient quantities to provide for wildlife and ecological needs, including long-term structural enrichment of the site.

However, this goal does have to be evaluated in the context of whether the post-fire levels of snags and down wood are within the characteristic range for the plant association; i.e., where pre-burn stands had uncharacteristic stand densities for that plant association. General guidelines for retention of trees (live and dead) and down wood within the wildfire area are as follows: Retain amounts and distributions of trees as would be characteristic of the pre-burn (historical) landscape [hellip]

[hellip]

Large snags persist for the longest period, and are most difficult to replace. Consequently, snag and log retention will focus on the largest (21"+ DBH) pieces in the post-burn landscape.

[hellip]

The retention standards should be checked to make sure that they will provide amounts and distributions of snags and down wood that will meet requirements for species at risk, sensitive species, and other species of special interest to the Tribes (such as mule deer). If they will not meet the species requirements, adjust the retention standards accordingly. There is an important caveat: this may not be done if providing for a particular species requires maintaining uncharacteristic levels of post-fire fuels over a significant portion of the burned landscape.

As noted above, proposed levels of snag and down wood retention will be evaluated to determine that they will not result in fuel loadings that are above characteristic levels for the plant association. Where they do, the goal will be to adjust retention to characteristic levels. In such a case retention of the large snags and down wood will be the standard since these structures contribute less to fuels on a cubic foot basis, persist longer, and provide habitat for more species.

(emphasis added)

K. Norm Johnson, Jerry Franklin, Debora Johnson. The Klamath Tribes[rsquo] Forest Management Plan. Dec 2003. http://web.archive.org/web/20040103034821/http://www.klamathtribes.org/forestplan.htm pp 108-109.

The Franklin and Agee piece also makes clear that salvage logging must be considered in an ecological restoration framework and all adverse impacts of the logging must be considered. A truly ecological post-fire plan would involve:

* rehabilitating fire fighting impacts (e.g. minimize erosion and block OHV use, re-establish native plant communities),
* significant road closures to protect watershed values and avoid the knee-jerk removal of hazard trees,
* culvert removal or replacement to provide for passage of fish sediment and woody debris,
* a long-term plan for managing fuels in the future,
* plans to avoid as much as possible impacts from seeding (e.g. weeds and competition with native plant communities), planting (dense plantations), logging (e.g. loss of snag habitat, loss of cover, etc.)

Hutto (2005) says:

"Personally, I've come to think we need to change our thinking on salvage logging. There are other values in the forest. In fact, a burned area is probably the most sensitive place you could be working in. The public really hasn't caught on to this yet. People still want to get the cut, get the trees they see as wasting away. They want the economic value. We talk about forest restoration after a fire, but it just got restored. That's what fire does. We know that, but we can't seem to get the message out. Until you start thinking like a black-backed woodpecker, you just ain't going to get it."

Richard L. Hutto, Ph.D., Director of the Avian Science Center and Professor of Ornithology and Ecology at the University of Montana. richard.hutto@umontana.edu or 406.243.4292 from Birds in the black: Through following avian wildlife, a UM scientist has discovered that burned forests play a critical role in the health and diversity of the Western landscape By MICHAEL JAMISON of the Missoulian August 11, 2005.

Hutto and others have been surveying birds in the Black Mountain fire area and nearly 20 other 2003 fire sites from Glacier National Park down to the Bitterroot, some of which have been salvage-logged. Nearly all woodpeckers have proven absent from salvaged areas, Hutto says, and all other bird species are less abundant in those spots than in areas left unlogged following fires.

[ldquo]I can[rsquo]t think of any other land-use practice where it[rsquo]s uniformly negative, at least in terms of birds,[rdquo] Hutto says. [ldquo]That[rsquo]s why I end up thinking that a burned place should be lower on our priority list for logging[mdash]because it[rsquo]s so sensitive.[rdquo]

Hutto[rsquo]s research is some of the first post-fire work that[rsquo]s been done in areas broader than one forest or one salvage-logging job, which may help it yield insightful facts for policymakers as they struggle to find a balance for post-fire salvage logging nationwide.

Jessie McQuillan. 2006. Still life, with woodpeckers. Missoula Independent. 6/22/2006.
http://missoulanews.bigskypress.com/missoula/still-life-with-woodpeckers/Content?oid=1137343

"More than 10 years ago, and again two years ago, I joined eight other scientists to explore whether forests might be restored by logging soon after a fire. We had among us a wealth of knowledge across a wide range of fields. We pored over several decades of research but found nothing to show that fire-adapted forests might be improved by logging in the wake of a fire.

In fact, we found just the opposite: Most plants and animals in these forests are adapted to periodic fires; they have a remarkable way of recovering [ndash] literally rising from the ashes.

These forests have evolved with fire. Periodic fires have been part of a normal cycle lasting thousands of years. Logging a burned forest damages the soil, carrying away nutrients, robbing seedlings of moisture and clogging nearby streams. Trees in a burned landscape, both dead and alive, continue to provide homes for wildlife after a fire and form the building blocks of new forests."

Karr, James. 2005 Nature doesn[rsquo]t benefit from logging fire-damaged lands | The News Tribune, Tacoma, WA.
ftp://ftp2.fs.fed.us/incoming/r5/Klamath/Mt.HebronRestoration/MountHebron.Records/MtHebronRestoration.ProjectRecord/D.%20ScopingComments.Analysis/ArtleyAttachment9.FullArticles/Pub10.Karr2005.Tribune.pdf

[I]n the absence of research specifically addressing the impact of large-scale salvage, I believe there is sufficient evidence to suggest that the risk to nontimber values decreases as the amount of retention increases at either the stand or landscape level (or in some cases both).

Jim Snetsinger, Chief Forester. Guidance on Landscape- and Stand-level Structural Retention in Large-Scale Mountain Pine Beetle Salvage Operations. December 2005.
http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/stewardship/cf_retention_guidance_dec2005.pdf.

A review of 116 research articles, dating from 1960 to 2002, which examined bird-forestry relationships in managed forests across North America found that [mdash]

[hellip] The response of birds to forestry practices has been mixed and highly species-specific, but in general, net change in community richness following timber harvest was negligible. Among silvicultural practices, uneven-aged management (e.g., selection harvest) appears to be the most favorable for birds. In contrast, snag removal was highly deleterious, with >80 percent of studies reporting net species loss; net gain was never reported....

[hellip] What seems to be particularly detrimental to forest avifauna is removal of snags. When prescriptions involved manipulation of snag densities, either by removing (Kilgore 1971, Scott 1979, Dingledine and Haufler 1983, Scott and Oldemeyer 1983, Schreiber and deCalesta 1992), retaining (Dickson et al. 1983, Zarnowitz and Manuwal 1985, Stribling et al. 1990, Schreiber and deCalesta 1992, Welsh et al. 1992), or creating (McPeek et al. 1987) snags, bird numbers were typically found to be positively correlated with snag density. Unlike even-aged and unevenaged management practices, removal of snags never resulted in more species increasing in abundance than decreasing. The importance of snags to birds is wellknown (Davis et al. 1983 and references therein, Bull et al. 1997, references above), not only to cavity nesters, but also songbirds (Sallabanks et al. 2002) that may use snags for nesting, perching, foraging, singing, and scanning for predators.

[hellip] Since large remnant snags and [ldquo]defective[rdquo] residual green trees provide much of the snag habitat for cavity-nesters in early- to mid-successional stands, particularly on private lands (Ohmann et al. 1994), retention of these structures will be important for maintaining populations of cavity- and snag-using avian species in managed forests. Snag retention and/or creation were the most commonly listed management recommendations from studies included in our review. We concur that leaving snags wherever possible is another important way that foresters can improve or maintain avian habitat quality within managed forest

landscapes.

Rex Sallabanks and Edward B. Arnett. Accommodating Birds in Managed Forests of North America: A Review of Bird-Forestry Relationships. PSW-GTR-191.

http://www.fs.fed.us/psw/publications/documents/psw_gtr191/Asilomar/pdfs/345-372.pdf.

Part of the natural post-fire recovery process is that beetles eat some trees parts and excrete nutrient-rich frass which enhances the growth of surviving and newly established plants. New science indicates that salvage should be avoided or delayed and snags must be retained well-distributed in order to realize the nutrient-cycling benefits of beetle frass.

Beetle droppings[mdash]known in the scientific world as frass[mdash]are crucial to forests recovering from fire. The tiny piles of droppings, found at the bases of trees, resemble cones of sawdust, and they help nourish the forest floor by increasing microbial activity in the soil. This process can also determine which kinds of trees grow back.

"This means that rather than being considered a pest or a nuisance, these beetles are in fact very important to helping burned forests recover," Cobb said. He is concerned, though, because salvage logging is taking the beetles out of the forest before they can do their job; the insects lay their eggs in the dead trees, and the larvae are subsequently destroyed when the wood is processed at sawmills. "That population is being removed from the salvage site and that takes away the mechanism by which the nutrients are returned to the soil."

Salvage logging should be delayed after a fire to allow the beetles to complete their life cycle, Cobb said.

Betkowski, Bev. 2007. Beetle dung helps forests recover from fire. University of Alberta. Public release date: 3-Dec-2007. http://www.uofaweb.ualberta.ca/rso/news.cfm?story=69803citing Tyler Cobb. 2007. Boreal Mixed-wood Beetles and the Cumulative Ecological Consequences of Disturbance. PhD Dissertation. University of Alberta. Spring 2007.

Scientists raised concerns about salvage logging after fires in B.C.

"When trees are removed from a newly burned landscape, birds and mammals lose the last remnants of habitat," she adds. "Salvage logging decreases forest biodiversity and changes ecological processes of post-fire forest regeneration. Mosaics of regenerating forest are changed through the removal of standing and downed trees, which would naturally remain on the landscape following fire."

Hodges notes while BC's logging industry is heavily regulated, harvesting differs between normal harvests and post-fire logging. More frequent wildfires mean an increase in post-fire salvage logging.

"Salvage logging is often done urgently as harvesters attempt to get burned timber to market before the wood deteriorates," she says. "Salvage logging is also done at larger scales and intensities than a standard harvest. This post-fire harvest means wildlife species that can manage after a wildfire do not rebound as quickly from this second disturbance."

UBCO researchers concerned about prey and predator species in post-fire logging areas -

Salvage harvesting damages vital habitat for wildlife species. https://scienmag.com/ubco-researchers-concerned-about-prey-and-predator-species-in-post-fire-logging-areas/; https://news.ok.ubc.ca/2020/09/23/ubco-researchers-concerned-about-important-prey-and-predator-species-in-post-fire-logging-areas/

Simon Thorn et al 2020. Estimating retention benchmarks for salvage logging to protect biodiversity. NATURE COMMUNICATIONS | (2020) 11:4762 | https://doi.org/10.1038/s41467-020-18612-4, https://www.nature.com/articles/s41467-020-18612-4.pdf ([ldquo]Many naturally disturbed forests are subsequently subjected to post-disturbance salvage logging, particularly in the temperate and boreal zones. Salvage logging is commonly justified to recover economic capital, reduce the risk of insect outbreaks, and decrease fire hazard. It is sometimes also justified on the basis that it contributes to ecosystem recovery. Salvage logging is conducted in all forest types, and is common even in areas that are otherwise excluded from logging, such as national parks. By extracting timber and other tree biomass from large areas, salvage logging can impair ecosystem services6 and affect the biodiversity of deadwood-dependent species. Salvage logging can have more profound effects on biodiversity than natural disturbance or logging alone due to the additive and interacting effects of the two disturbances. This has been exemplified by studies on changes in communities of birds and vascular plants. Currently, unlogged early-successional forests following stand-replacing natural disturbances are among the most uncommon habitats in many regions of the world [hellip] The increasing frequency and extent of natural disturbances have generated intense debates about the appropriateness of widespread, high-intensity salvage logging. Hence, the retention of key structures in salvage logging operations (so-called biological legacies), and the partial exclusion of naturally disturbed forests from salvage logging, are increasingly discussed as measures to halt the loss of forest biodiversity. However, while benchmarks for a specific number of trees to be excluded from overall logging operations are common measures in modern retention forestry, such benchmarks are rare for salvage logging of naturally disturbed forests [hellip] We apply this statistical approach to a global dataset of studies with sampling units selected randomly from both naturally disturbed and salvage logged areas to estimate logging benchmarks for naturally disturbed forests, namely a) the portion of naturally disturbed forest that must be spared from salvage logging to maintain 90% of the species richness associated with naturally disturbed and not salvage logged forest; and conversely b) the portion of species richness associated with naturally disturbed forest that remains when 50% of the area of a disturbed forest is salvage logged [hellip] Using a global multi-taxa dataset, we estimate retention benchmarks needed for biodiversity conservation in naturally disturbed forests. We find that, across all investigated disturbance types, an average of 75% of the disturbed area needs to be unlogged to maintain 90% of the disturbed forest[rsquo]s unique species. [hellip] preservation of all species unique to unlogged naturally disturbed areas requires the retention of on average 100% of the disturbed area, [hellip] The benchmarks reported in our study are based on the number of species unique to unlogged, naturally disturbed forests. Hence, the overall increase or decrease in species richness with increasing extent of salvage logging depends both on the loss of species unique to unlogged naturally disturbed forests and on the simultaneous colonization of species typically found in salvage-logged forests.[rdquo]). Note: The Deschutes LRMP, M15-9 says [ldquo]Dead, down trees will be managed to maximized biological diversity.[rdquo]

11 Reasons Why Burned Forests are Beautiful

1. Severely burned forests provide rich habitats.

2. Severely burned forests are rich in bird life.

3. Severely burned forests support a wonderful variety of insects.

4. Severely burned forests still have lots of living trees, it just takes time for them to say hello.

5. Natural regeneration is everywhere.

6. If left alone, severely burned forests are fun to watch as they explode with new life over the years.

7. Shrubs and trees live together in harmony.

8. Severely burned forests provide habitat where it might be least expected! [e.g., bird nesting in root wads]

9. Severely burned forests still have patches of green.

10. The usual alternative to letting severely burned forests alone is an ecological disaster. [e.g. clearcut salvage and replanting and herbicides on private land]

11. Severe fire is a natural part of forest ecosystems.

California Chapparal Institute. 2014.
http://hosted.verticalresponse.com/652874/13cc17b39e/289104753/39addbbd1d/

Salvage and ICBEMP Science

The 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 with roads. Such approaches can be consistent with attainment of economic objectives for salvage activities.

Quigley, Thomas M., tech. ed. 1996; The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment.) Gen. Tech. Rep. PNW-GTR-382; 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. How has the agency utilized this information or described its relevance in the NEPA analysis?

Look at the [ldquo]Snag Gap[rdquo] with Open Eyes.

Large dead trees, often called snags or wildlife trees, are valuable habitat for a large number of species and they serve a variety of other ecosystem services, such as: carbon storage, soil conservation, creating microsites suitable for forest regeneration, and capture/storage/release of water, nutrients, and sediment, and when snags fall they have the capacity to do mechanical work such as thinning young seedlings and saplings. Once large snags are removed it takes more than 100 years to replace a population of large dead trees.

One of the most significant and lasting effects of stand replacing disturbance such as fire, wind, or regeneration logging is to bring the process of snag recruitment to a virtual standstill for many decades. It may seem counterintuitive but the apparent abundance of large snags after a stand replacing disturbance masks a severe shortage of large snags down the road. Even if snags are not removed by the disturbance, snags created by the disturbance will fall down over time and few if any snags are created. After those snags fall down, the snag population remains low for many decades because the pool of green trees available for snag recruitment is greatly reduced. This shortage of snags lasts at least until the new stand grows large trees again. This results in a [ldquo]snag gap[rdquo] that has serious adverse consequences for diverse wildlife and fish that depend on snags and many other ecological processes.

In a 2021 guest opinion in the Salem Statesman-Jouirnal, Jerry Franklin & Norm Johnson said:

The standing dead and down wood created by intense disturbances such as wildfire or wind is essential to the ecological recovery of disrupted forest and aquatic ecosystems. Where most trees are killed, such as the September 2020 wildfires, this pulse of dead wood represents all the large dead wood that will be available to the ecosystem for most of the next century.

These snags and logs are critical as habitat for an immense array of wildlife, including birds, insects, mammals, salamanders and reptiles, all of which are elements of larger food webs. This wood also represents an immense long-term source of energy and nutrients [ndash] and of sequestered carbon. In streams, the logs are critical structures important in maintaining stream productivity, water quality and fisheries.

Where management goals emphasize restoring diverse forest ecosystems with a full array of functional capabilities, natural recovery is the surest way for them to regain their ecological integrity. Salvage logging combined with dense commercial tree planting results in artificial ecosystems that lack most of the features that the public wants in our forests.

Jerry F. Franklin and K. Norman Johnson 2021. Salvage does not aid ecological recovery of forests. Salem Statesman-Journal, Guest Opinion. https://www.statesmanjournal.com/story/opinion/2021/04/23/guest-opinion-salvage-logging-wildfires-secondary-growth-forests/7289895002/?fbclid=IwAR3zuN-tA__dvGs7g3vrDzxhLchXZvHHxud16vVNturwzv-hmJ3tTIgsK1w (emphasis added).

In Congressional testimony in July 2004, Jerry Franklin said:

It is sometimes argued that following a stand-replacement fire in an old-growth forest that snags and logs are present in [ldquo]excess[rdquo] of the needs of the site, in terms of ecosystem recovery. In fact, the large pulse of dead wood created by the disturbance is the only significant input of woody debris that the site is going to get for the next 50 to 150 years[mdash]the ecosystem has to [ldquo]live[rdquo] off of this woody debris until the forest matures to the point where it has again produced the large trees that can become the source for new snags and logs (Maser et al. 1988).

Dr. Jerry F. Franklin, Professor of Ecosystem Studies, College of Forest Resources, University of Washington. July 15, 2004. TESTIMONY FOR THE RECORD ON OVERSIGHT HEARING ON [ldquo]RESTORING FORESTS AFTER CATASTROPHIC EVENTS[rdquo] BY HOUSE COMMITTEE ON RESOURCES, SUBCOMMITTEE ON FOREST AND FOREST HEALTH. https://www.govinfo.gov/content/pkg/CHRG-108hhrg94996/html/CHRG-108hhrg94996.htm.

In 2015 Jerry Franklin offered illuminating comments on the Klamath NF[rsquo]s Westside Fire Salvage DEIS:

The massive input of large dead wood is characteristic and critical to stand development processes and the ultimate provision of habitat for late-successional species following stand replacement fires (Maser et al. , 1988;

Franklin et al. 2002). As noted these wood structures may persist and play functional roles for several centuries, particularly in the case of decay resistant species. Large pines may also persist as snags for several decades and additional periods as logs on the forest floor. In fact, the entire recovering forest ecosystem will depend upon this pulse of CWD until it reaches a point in its development where the new stand begins to generate snags and logs of comparable size and heartwood content-generally between 100 and 200 years (Maser et al. 1988; Franklin et al., 2002). Consequently, basing snag and CWD retention following salvage on levels of these structures found in existing mature and old forests is not appropriate; all of this initial pulse of wood is needed to reach those levels one to two centuries from now! Indeed, the use of mature forests as a standard for CWD is particularly inappropriate since this is the period when CWD levels are at their lowest level during the entire natural developmental sequence from stand-replacement fire to old growth (see diagram in paper by Spies in Maser et al. 1988). It certainly does not appear to me that the approach taken in the DEIS reflects an appreciation of the fact that this one-time input of large and decay resistant CWO is all that the recovering forest ecosystem is going to get for the next 100 to 200 years.

Jerry Franklin. Comments on the Klamath NF, Westside Fire Salvage DEIS. 6 April 2015.

Similarly, Johnson & Franklin[rsquo]s 2008 Forest Plan for the Klamath Tribes says of large fires [mdash]

Such fires do generate a large pulse of dying, dead and down material. After a stand-replacement fire, that pulse of large wood is all of the large wood that the recovering ecosystem is going to get for the next century or more[mdash]i.e., until trees of large size are once again a part of the stand. Some of this dead wood legacy will persist and fulfill important functional roles in the recovering forest for many decades and, in the case of the largest and most decay resistant material, even for a century or more.

The shortage of snags in the decades following stand replacing fire is acknowledged by the Forest Service on page 136 of the Wallowa-Whitman National Forest[rsquo]s Trail Vegetation Management Project EA (October 2012). http://www.fs.usda.gov/project/?project=34482

1. The agency must recognize the asymmetric nature of snag dynamics after all types of stand replacing disturbance. High rates of snag fall would be expected in the decades following disturbance, while low rates of snag recruitment would be expected in the decades following a disturbance. This unavoidably results in a serious deficit of snags at some point in the future.
2. In order for the NEPA analysis to fully address the snag habitat issue it must look carefully at the snag gap from both ends.

1. The snag gap begins when too many of the current snags are gone. So the snag gap is exacerbated on the front end by salvage logging which removes too many large snags.
2. The snag gaps ends when the next stand grows to the point that it contains large trees and some of them die, so the snag gap is exacerbated on the back end if there is a significant delay in tree regeneration.

3. The agency has a tendency to focus on the back end of the snag gap which is allegedly mitigated by tree replanting, but this benefit is in the distant future and remains speculative. The agencies tend to ignore the effect of logging on the front end of the snag gap (which is concrete and unavoidable).
4. Logging which retains only enough snags to meet snag requirements after harvest will not meet snag requirements in a few years after those few retained snags fall.

5. Both the RMP and the Northwest Forest Plan (p C-13) require that snags be maintained through time, so our goal must be to manage snags to minimize the time period that there is a deficit of snags.
6. The NEPA analysis must account for snag fall rates and figure out how to minimize the snag gap. Every day that the [ldquo]snag gap[rdquo] is lengthened by salvage logging is a violation of the RMP. Models that may be used to analyze snag dynamics can be found here:
https://web.archive.org/web/20120907194130/http://www.for.gov.bc.ca/hre/deadwood/DTmod.htm.
7. There is a strong correlation between the size of the snags and the length of time it is likely to remain standing, so salvage must be designed to retain all the large snag and only remove trees from smaller size classes.
8. Consider this example: Assume that the stands currently have 30 large trees/acre and 24 of those will be removed via salvage logging while 6 trees/acre will be retained for snag habitat. Further assume that in 50 years 2 percent of the large snags will remain standing as snag habitat. Two percent of 6 trees/acre is FAR LESS than 2 percent of 30 trees/acre, so there is a virtual statistical certainty that salvage logging will exacerbate the snag gap.
9. The snag gap is really exacerbated by salvage logging in two ways [mdash] first by targeting removal of the large and most persistent component of the snag population, and second by accelerating the rate that remaining snags fall and are lost from the snag population. New science from Idaho reveals that Ponderosa pine snags persist longer in unlogged areas. See Russell, R.E., Saab, V.A., Dudley, J.G., and J.J. Rotella. 2006. Snag longevity in relation to wildfire and postfire salvage logging. Forest Ecology and Management 232 (2006) 179-187. http://www.fs.fed.us/rm/pubs_other/rmrs_2006_russell_r001.pdf ([ldquo]The predicted half-life of a ponderosa pine snag was 7-8 years in salvage logged plots and 9-10 years in unlogged plots.[rdquo])

These graphics show the huge wedge of dead wood [ldquo]added by disturbance[rdquo] that is missing in stands subject to salvage and other forms of regen logging.

The agency often compares their proposed snag retention levels to the average number of snags across the landscape, without recognizing that after a significant disturbance such as fire [ldquo]the rate of input [of snags] to the CWD pool is 100-1000x the rate expected for an unburned steady-state forest (Harmon et al 1986). Even afterwards, in the next 5 or 6 years, the rate of input is still 5 or 10 or even 100 times that steady-state rate.[rdquo] http://web.archive.org/web/20050428020846/http://www.brownandbrown.tv/warner-presentation-2002-05-14b.pdf

The BLM has previously admitted that a [ldquo]high proportion[rdquo] of snags [ldquo]are expected to persist for at least 50 years.[rdquo] Roseburg BLM 2009, Little Wolf 3 Density Mgt EA. http://www.blm.gov/or/districts/roseburg/plans/files/LittleWolf3EA.pdf. This means that salvage logging can exacerbate the snag gap the front end by at least 50 years.

The agency cannot take a hard look at the issues of snag habitat and complex young forests without considering the dynamics of snags and dead wood.

Spies et al. (1988) reported that amounts of CWD were high in the youngest successional stages, were lowest in 60-80-year-old forests, and were high in old stands (< 500 years). After 500 years CWD amounts declined to an intermediate level. Spies and Franklin (1988) reported that CWD input may be low in young stands because of the small size of dead and dying stems. Volumes in these stands are often high, however, due to residual CWD from the previous stand.

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.
http://www.for.gov.bc.ca/hre/deadwood/DTrol.htm.

An example of how regen and salvage logging would lengthen the period that a forest remains inhospitable to wildlife is provided by the following study, Payer, D.C., and D.J. Harrison. 2000. Structural differences between forests regenerating following spruce budworm defoliation and clear-cut harvesting: Implications for marten. Canadian Journal of Forest Research 30(12): 196572. ([ldquo]Summary: The authors looked at the use of clearcuts and areas where spruce budworm has caused mortality in relation to the American marten. When establishing new territories, martens avoid clearcuts but do not avoid stands with a history of extensive tree mortality caused by eastern spruce budworm. Although live tree basal area was similar between stand types, the results showed that the vertical structure provided by large snags can offset the limited availability of live trees for the marten, particularly where coarse woody debris and understory vegetation are plentiful.[rdquo])
http://www.umaine.edu/cfru/documents/payer.pdf

Salvage: Rationale for retaining large snags and 50% of small. The agency often claims that the Beschta report offered no rationale for the recommendation of retaining all large and old snags and 50% of smaller size classes. Let us offer some rationale:

1. retaining large quantities of legacy structures will more closely match the natural historic development of post-fire landscapes.
2. retaining large numbers of standing trees will preserve an important ecological process, that is falling snags over time that will help to thin and break up the continuity of brush and other reprod.[2]
3. retaining snags and dying trees will help provide some level of shade that will help suppress growth and break up the continuity of brush and other reprod
4. retaining large quantities of snags will help provide some hiding cover for Mule deer and elk
5. retaining large quantities of tree boles will help to retain water storage mechanisms on site.

Salvage logging violates the Eastside Screens.

The Eastside Screens require that any activities that occur outside of the old forest must help move the system toward, rather than away from, the historic range of variability, which included far more large trees, both live and dead, than occur today. The Eastside Screens say [ldquo]2) Outside of LOS, many types of timber sale activities are allowed. The intent is still to maintain and/or enhance LOS components in stands subject to timber harvest [hellip] Manipulate vegetative structure that does not meet late and old structural (LOS) conditions, [hellip] in a manner that moves it towards these conditions as appropriate to meet HRV. [hellip] Manipulate vegetation in a manner to encourage the development and maintenance of large diameter, open canopy structure.[rdquo] Large snags are an [ldquo]LOS component[rdquo] and a [ldquo]large diameter, open canopy structure[rdquo] that is under-represented and in need of conservation and retention.

Salvage logging converts a complex young forest, which Jerry Franklin says is one of the most rare forest types, into a simplified young forest which is all too common, so it move the ecosystem in the wrong direction.

Also, after stand replacing fire, green trees are in short supply and even if they are not yet large, they are desperately needed for future recruitment of large tree structure. Salvage logging here will likely remove [ldquo]dying[rdquo] trees, but no predictive system is perfect, and some of these trees will be misidentified as dying when they would in fact have survived. Removal of those misidentified dying trees (even if they are smaller than 21[rdquo] dbh) will move these stands away from the HRV in violation of the Eastside Screens.

Salvage: Provide for both clumped AND well-distributed snags and down wood.

Snag retention should be both clumped and well-distributed, not all clumped. Some of the functions provided by snags are best provided in clumps, but other functions are best provided by well-dispersed snags. These latter functions include:

* Cover for deer and elk and other wildlife;
* Shade and microclimate for germination and seedling survival;
* Young stand thinning functions provided by falling snags;[3]
* Soil functions such as nutrient input, nutrient cycling; erosion control and sediment trapping;
* Hydrologic effects such as water retention in both wood and soil, and dissipation of energy in surface flow, favorable effects on snow dynamics;
* Favorable microsites for seed germination and seedling survival;
* Habitat for small mammals and amphibians;
* Habitat connectivity corridors;

https://www.yesmagazine.org/environment/2020/03/11/climate-change-montana-forest/

There is a value to retaining more dead wood on every acre. We know that dead wood has important ecological values. Why would you plan for areas that are so dramatically deprived of an important resource? (Sure humans can go for days without food, and historically we did, but you try to provide three meals a day for your family.

Same for forests and snags.) Areas of extreme low snags abundance are already over-represented within logged areas on both federal and non-federal lands. We should not be creating any more of this over-represented snag-deprived forest type. Instead we should be relishing the fact that we have an opportunity to provide complex early seral habitat with abundant structural legacies, which is a significantly under-represented forest type, relative to the historic condition.

Soil development processes are the quintessential process that must be well-distributed. Roger Hungerford, writing in Effects of Fire or Fire Exclusion on Soil Sustainability New Perspectives a workshop given Nov. 18[shy]20, 1991, at Coeur d'Alene, said "Evidence does exist that much of the soil wood and organic components originated from fire killed trees." We are concerned that the salvage logging will continue the trend of loss of site productivity, depleting nutrients through biomass removal, and interfering with ecological and hydrological processes that should be well-distributed, not clumped.

Mark Harmon[rsquo]s long-term study of log decomposition on the HJ Andrews Experimental Forest has revealed significant findings that would indicate the value of well-dispersed down wood for nutrient storage and release.

A 200-year study of rotting logs in the Oregon Cascade Range is only 10 percent complete, but findings from this research have already helped save hundreds of millions of dollars, improved forest health and shattered conventional wisdom about the decay of woody debris.

It also has attracted the interest of forest managers from around the world.

This work was begun 20 years ago by scientists from the College of Forestry at Oregon State University with 530 logs at the H.J. Andrews Experimental Forest near Blue River, Ore. The research was seen as a way to more rigorously document the process of wood decay and the value it provides in nutrient release, soil enhancement and other issues.

Even though the study is far from complete, it has already achieved many of these goals and raised other important questions that will continue to affect modern silviculture and the understanding of forest ecology, said Mark E. Harmon, the Richardson Chair and Professor of Forest Science at OSU. The work has been funded by the National Science Foundation and the U.S.D.A. Forest Service.

"When this study began, we still assumed that most debris and logs decayed in more or less the same way, only releasing their stored-up nutrients after decades or centuries of decay," Harmon said. "It's now understood that there are large differences between the decay rate caused by different decomposers of different tree species, and that some nutrients from dead wood begin to enrich the forest almost immediately.

"That's a huge change in our thinking, and there are still a lot more changes to come," he said.

Among the other findings of the first 20 years of this work:

As much as one-third of the nitrogen in Pacific Northwest forests, one of the key nutrients that limit vegetation growth, appears to come from nitrogen fixation processes within rotting logs, in addition to that being slowly released from the wood itself.

Nutrient release begins far more quickly than ever anticipated, from both decaying fungi and the leaching effects of persistent rains.

The "brown rot" fungi that cannot break down lignin in trees leaves structural material behind to help form the next generations of forest floor and ultimately soil. White rot fungi, by contrast, degrade all parts of the wood, leaving almost nothing behind and decaying far more rapidly but only on some tree species.

Although some wood (such as Douglas-fir) resists decay, mechanisms such as mushroom growth on downed logs work to drain nitrogen from these logs, much more than had been understood.

There is a 10-fold difference in wood decay rates among dead trees. True firs such as silver fir will decay far more rapidly than other species, as much as 5-6 percent a year and may be gone in 60 years or less. Other species such as western red cedar or Douglas-fir may persist for hundreds of years.

Some parts of a log will decay and release nutrients much more quickly than other parts, leading to complex patterns that cannot be predicted by considering just the "average" condition of the wood.

Decay processes are dynamic and constantly changing, and they affect everything from nutrient release to soil changes, stream sedimentation, and plant, animal and fish habitat.

[hellip]

"In the past we just didn't pay much attention to what was decaying, and how, and what the ecological implications of that were," Harmon said. "We now know there are huge differences between tree species, that some fungi decay some species and not others, and that all of these factors will play a role in sustainable forestry and overall forest health."

In the future, Harmon said, trees increasingly will be planted that are never meant to be harvested - by design, they will be left to decay and play certain roles in forest ecology, for the health of plants, trees, microbes and wildlife. With large trees that have commercial value, it's still not certain exactly how many must be left for the complete range of forest benefits, he said, and findings on that issue will continue to emerge from studies such as this.

[hellip] Harmon said. "Now people from all over the world are watching these studies, and many experts think of nutrient release as one of the last frontiers in understanding the role of dead trees in forest ecology.

http://www.sciencedaily.com/releases/2005/08/050819123757.htm.

http://web.archive.org/web/20080324192217/http://oregonstate.edu/dept/ncs/newsarch/2005/Aug05/decay.htm

"[D]ispersed retention may be important for maintaining old trees distributed across a block, to serve as sources of inoculum (e.g., lichens aboveground, mycorrhizae below ground) for a new stand." Highlights of Coast Information Team. The Scientific Basis of Ecosystem-Based Management. March 2004. http://www.citbc.org/c-ebm-scibas-fin-04May04.pdf.

Ideally, retention will be spatially well-distributed within all harvested openings to provide vertical structure, a variety of wildlife habitats, and coarse woody debris over the long term.

Jim Snetsinger, Chief Forester. Guidance on Landscape- and Stand-level Structural Retention in Large-Scale Mountain Pine Beetle Salvage Operations. December 2005. http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/stewardship/cf_retention_guidance_dec2005.pdf.

Both clumped and scattered snag distributions are desirable. Rochelle, James A., 2002. Green trees, snags, logs, and wildlife in managed forests: An Overview. presented to The Wildlife Society, Oregon Chapter. Feb 11, 2002.

http://fw.oregonstate.edu/tws/workshop%20files/green%20trees.pdf.

Salvage logging will make a bad situation worse for big game.

Fire 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.

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.

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. 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. http://www.fs.fed.us/pnw/pubs/gtr486.pdf.

Following two wildfires in northern California that occurred 10 years apart, Grifantini et al compared vegetation response of areas that were unsalvaged and unplanted vs. areas that were clearcut salvaged, burned, and planted. They found that:

1. Unsalvaged sites had much more deerbrush cover, than did salvaged sites (measured 12 years after wildfire);
2. Unsalvaged sites had greater forb cover than did salvaged sites (measured 2 years after wildfire);
3. Unsalvaged sites supported more vascular plant diversity;
4. Unsalvaged sites had greater mean hiding cover values that salvages sites (measured both 2 and12 years after wildfire) [ldquo]suggesting that salvage logging and reforestation resulted in less screening cover than if the stands would have been left unsalvaged.[rdquo] (p 166)
5. [ldquo]Apparently postfire management influenced early seral stand development and the quantity and diversity of deer forage[rdquo] (p 166)
6. [ldquo][W]e hypothesize that lack of cover may limit deer use. Maintaining a mosaic of unsalvaged stands, located adjacent to water sources, meadows, traditional migration corridors and staging areas (locations having potential for heavy deer use) would likely be an important post-fire mitigation.[rdquo] (p 167)
7. They recommend maintaining all available screening cover near potentially high deer-use areas, keeping patch size to a fraction of deer[rsquo]s average home range size, using a variety of post-fire management options, and dispersing different management schemes across the landscape.

Grifantini, M.C., Stuart J.D., and L. Fox III, 1992. [ldquo]Deer Habitat Changes Following Wildfire, Salvage, Logging and Reforestation, Klamath Mountains, California,[rdquo] Proceedings of the Symposium on Biodiversity of Northwestern California, Oct 28-30, 1991, Santa Rosa, CA. UC Wildland Resource Center Report 29. December 1992.

Salvage logging is adverse to big game for two reasons [ndash] it removes hiding cover, and it increases adverse impacts related to construction and use of roads. M. Hebblewhite, R.H. Munro, E.H. Merrill. 2009. Trophic consequences of postfire logging in a wolf[ndash]ungulate system. Forest Ecology and Management 257 (2009) 1053[ndash]1062. http://www.cfc.umt.edu/heblab/PDFS/FORECO11394.pdf

The agency must address the adverse effects of salvage logging on big game habitat, especially in areas allocated for big game management in the applicable resource management plan.

According to the Fire Effects Information System (FEIS), dead and dying trees do provide cover value for big game, but the agency does not explain why they can just destroy so much of what little cover remains in this winter range. See USFS FEIS Elk narrative:Site preference studies show that elk usually prefer to graze on burned as opposed to unburned sites. [hellip] Fire in a Southwestern ponderosa pine forest increased forbs, grasses, and shrubs, created edge, and provided snags for cover. Elk increased in the burn, reaching a peak 7 years after fire when grasses were most abundant. [hellip] In Glacier National Park fires increased carrying capacity on winter range by creating a mosaic of thermal and hiding comver [sic] and forage areas. [hellip] Standing dead trees may provide adequate cover within burns.FIRE EFFECTS AND USE WILDLIFE SPECIES: Cervis elaphus | Elk. http://reference.allrefer.com/wildlife-plants-animals/animals/mammal/ceel/fire-effects-use.htmlAnd the FEIS narrative on Mule deer says:Deer seem to prefer foraging in burned compared to unburned areas [hellip] Small burns are more beneficial than large burns to mule deer because they tend to use burned areas close to cover.FIRE EFFECTS AND USE WILDLIFE SPECIES: Odocoileus hemionus | Mule Deer. http://web.archive.org/web/20060524192803/http://www.fs.fed.us/database/feis/wildlife/mammal/odhe/fire_effects_and_use.html, http://reference.allrefer.com/wildlife-plants-animals/animals/mammal/odhe/fire-effects-use.html.

Regardless of whether [ldquo]dying[rdquo] trees that currently provide cover will die as predicted by the tree mortality guidelines, those trees do presently provide cover. Thus, it is undisputed that logging imposes a near-term loss of cover. That near-term cover loss should be disclosed in the NEPA analysis. The tree mortality guidelines must also be based on sound science (based on multiple-regression analysis using real data) and must be field verified before being applied.

The NEPA analysis must address the ways that salvage logging will affect big game and compliance with applicable Standards & Guidelines.

Post-fire landscapes are not a high priority for fuel treatment.

Modeling done by the University of Washington scientists shows that post-fire landscapes are by far the least hazardous fuel profiles not just in the short-term but for several decades after wildfire. If the agency is following the National Fore Plan they will prioritize fuel reduction in areas that are suffering from fire suppression, not areas that have just burned.

C. Larry Mason, Kevin Ceder, Heather Rogers, Thomas Bloxton, Jeffrey Comnick, Bruce Lippke, James McCarter, Kevin Zobrist, Investigation of Alternative Strategies for Design, Layout and Administration of Fuel Removal Projects; Rural Technology Initiative; July 2003; http://www.ruraltech.org/pubs/reports/fuel_removal/. See especially Appendix B, pages 13 and 14.

Post-fire fuels are not a significant hazard. Salvage increases fire hazard. Risk of Reburn is Overblown.

A core purpose of NEPA analysis 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 FEIS fails to 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.

[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.

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/

Recognizing 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, 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.treesearch.fs.fed.us/pubs/48822 ([ldquo]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.[rdquo]) The 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. 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 (Donato

et 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].

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. This 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 shrub 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).

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&Bailey2015.pdf The 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."

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.htmlciting 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.

A 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. 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.fed.us/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]) 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]).

A 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 phenomena that forests have evolved with and can tolerate. 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. 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.pdf

Donato 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.

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.

The 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 NEPA analysis asserts that leaving large numbers of snags is unsafe and the NEPA document describes an undesirable scenario with respect to the no action and restoration alternatives, but the NEPA document 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. 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.fed.us/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.
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.

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).

Graham, Russell. 2003. Hayman Fire Case Study. Rocky Mountain Research Station Report RMRS-GTR-114. p 144. http://www.fs.fed.us/rm/pubs/rmrs_gtr114.html.

The NEPA document also fails to disclose that NOT salvage logging (e.g., natural recovery) may have some countervailing benefits in terms of fire risk and reburn potential, including: (a) large logs store water, (b) standing snags provide some shade, (c) regrowth tends to be more patchy and less dense and continuous, (d) fuels in the form of branches and dead trees fall to the ground slowly over time and have a chance to decay as they added, (e) falling snags over time ten to break up the continuity of fuels in the form of brush and reprod.

Salvage typically removes the largest logs that act as water [ldquo]reservoirs[rdquo] and are least prone to drying. 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. 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).

The 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:

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. Therecommended 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-inch material, 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.

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.fed.us/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.)

"There's no science that demonstrates re-burn potential in areas where there is downed wood or decayed wood."

Craig Bobzien, Bitterroot NF Acting Supervisor (Missoula Independent, July 19, 2001)

"We found no studies documenting a reduction in fire intensity in a stand that had previously burned and then been logged."

Environmental Effects of Postfire Logging (USDA Forest Service, 2000)

"[We] are aware of no evidence supporting the contention that leaving large dead wood material significantly increases the probability of reburn."

Wildfire and Salvage Logging (Beschta, et al., Oregon State University, 1995)

"The removal of large, merchantable trees from forests does not reduce fire risk and may, in fact, increase such risk."

Dept. of Agriculture and Interior, Report to the President (September 2000)

Bitterroot NF Burned Area Recovery DEIS, p.3-12: "The slash created by the harvest and fuels treatments that is left on the ground for site protection and future site productivity, would create a short term (zero - eight years) fire hazard. The fuel-bed created by these treatments would be, in large part, comprised of material in the smaller size classes. These fuels would contribute to the flammability and continuity of fuels on a local level, as well as across the landscape. Under good burning conditions, fires burning in these slash fuel types have the potential to spread rapidly and extensively."

A recent fuels modeling project for the Cerro Grande Fire area (Greenlee 2000) found that, without fuels treatment, fire risk in ponderosa pine stands bordering Los Alamos generally would be: 1) lower than the pre-fire risk during the first five years after the Cerro Grande Fire, 2) equal to the pre-fire risk during succession years six through twelve, and 3) lower than the pre-fire risk during succession years 13 through 23. Specifically, WUI fire risk would increase markedly by succession year six due to heavy fuel accretion in the moderately- to severely burned stands. Such fuel accretion occurs as a result of numerous fallen snags intermingled with the newly developing understory of grasses, shrubs, and trees.

Greenlee, Dawn. 2000. Predicted changes in fire danger in the Los Alamos Wildland-Urban Interface as a result of the Cerro Grande wildfire. Unpub. final rept. FEMA-1329-DR-NM, on file at Fire Research Institute, Missoula MT.

The agency often alleges that leaving large snags and logs will increase [ldquo]resistance-to-control[rdquo] during future fire fighting. Any discussion of [ldquo]resistance to control[rdquo] needs to be limited to areas where direct attack fire-fighting is likely to occur. Improving resistance to control does not justify salvage logging in areas that are not likely to be subject to direct attack, such as topographic chimneys, or steep mid-slope areas.

Resistance to control is defined as[mdash] the relative difficulty of constructing and holding a fire control line as affected by resistance to line construction and fire behavior. Resistance to line construction is the relative difficulty of constructing control lines as determined by the fuel, topography, and soil.

National Wildfire Coordinating Group. 1998. page G-16. While future fire in the next 50 years is by no means a certainty, large logs may increase the time and effort needed to construct fire lines in the event of a future fire. However, this is only a concern in specific locations where fire lines are likely to be built, not all across the landscape. The only place it makes sense to remove large wood to reduce resistance-to-control is in areas where the agency anticipates building fire lines, such as [ldquo]shaded fuel breaks.[rdquo] Furthermore, fire lines are often built along ridgelines, so the interest in reducing resistance-to-control must be balanced against the significant impacts of removing large snag and logs other ecological values associated with ridgetop locations. These unique ridgetop values include rare plants and bats roosts.

Large logs do not always have lengthy burn-out times or cause severe soil effects as sometimes assumed. Large logs in fact do not burn well.

[hellip] in most situations the consumption of large woody detritus is linked to consumption of the forest floor. The reason appears to be related to the extremely loose packing of woody detritus. To burn there must be a positive feedback of energy between pieces; and given the distance between large pieces of wood, this feedback is very low. Therefore, for coarse wood this positive feedback is with the underlying forest. This is important because it means that without deep forest floor layers, large pieces of woody detritus will not be completely consumed even when the moisture content is extremely low (similar to attempting to burn a single dry log in a fire place without another log or finer fuels).

Harmon, Mark E. Moving towards a New Paradigm for Woody Detritus Management. http://www.fs.fed.us/psw/publications/documents/gtr-181/071_Harm.pdfin 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. http://www.fs.fed.us/psw/publications/documents/gtr-181/.
Danger tree removal must not be used as an excuse to get timber volume.

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

protection and due to lack of funding, travel on classified roads may need to be restricted or closed.[rdquo] USFS Road Management Policy. https://www.fs.usda.gov/nfs/11558/www/nepa/115185_FSPLT3_5597368.pdf. The careful weighing of interests required to perform careful roads analysis means that it is not appropriate to categorically exclude danger tree removal projects from NEPA.
* The agency should consider alternative means of managing hazards from falling trees:
* Minimize human activities near hazard trees (e.g., closing roads). This may not work where a hazard trees is adjacent to a high traffic road, but some little used roads can be closed. Analyze whether spurs or overgrown roads truly receive public use that justifies hazard tree removal;
* Temporarily limit the use of roads that cannot be permanently closed until the risk of falling trees is naturally reduced;
* Top trees, rather than kill them, if shortening them would reduce the chance they would reach the road if they fell;
* Place signage warning people of post-fire hazards, particularly on roads that are infrequently used. This way people can evaluate the risks for themselves;
* Often the hazard is not from the tree falling directly on people, but from cars colliding with trees that have previously fallen. This hazard can be mitigated with signage and speed limits, while allowing valuable wildlife trees to persist;
* Prohibit cutting live, green trees, since all surviving trees are helping to rebuild the below-ground ecosystem, stabilize soils, and serve a valuable role as legacy structure and a recruitment pool for future large trees and snags;
* Focus tree removal on imminent danger or hazard trees located within striking distance of high use areas, such as developed sites, parking lots, and paved roads. Wherever possible, use hazard trees for restoration of streams and placement in nearby stands that lack large wood;
* Where they do not pose an immediate threat to safety, all trees presumed to be dying should be treated as live until they are dead, so as to not lose the ecological benefits of those trees that may survive;
* Take measures to stabilize impacted slopes in areas where roadside logging is unavoidable; and
* Analyze the cumulative impacts of all post-fire sales and roadside logging projects across agency jurisdictions.

* The agency should only fall trees that pose an imminent hazard to the public. There is little need to fell trees that lean away from the road. Trees more than 100 feet from the road have a low probability of falling on the road, even if they are taller than 100 feet. This is because of all the directions these trees could fall, only a small subset would reach the road. For instance, in the figure below, if a tree located at point (E) is close to a road (represented by line G-H) there is a much higher risk of it hitting the road compared to a tree at the location of point (C). The sum of the angles from the tree to the road (in the blue shaded areas) represent either broad or narrow risk of a tree falling and hitting the road depending on its distance from the road.

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

* There are several reasons that danger tree felling should be limited to 100 feet from roads. The chance of trees more than 100 feet from roads impacting the road are not very high because the tree would have to fall in precisely the right direction toward the road. And there is a much higher chance it will fall in numerous directions that do not threaten the road. In addition, many dead tree tops break off and fall close to the base of the tree, leaving a shorter snag with a more limited zone of hazard. Felling trees more than 100 feet from roads is unnecessarily risk averse, and unjustifiably sacrifices environmental values (such as snag habitat, dead wood habitat, and soil health).
* The agency should focus on roads that are heavily used by the public and workers. There is a trade-off between safety and habitat, and the agency should conserve defective trees and snag habitat in areas that

receive little public use.
* The agency should fell trees as absolutely necessary, but wherever possible leave the trees on-site to provide down wood habitat. When tree removal is necessary use the wood to restore stream habitat or to add down wood to previously clearcut plantations where down wood habitat is severely lacking.
* We object to commercial sale of hazard trees, because there are economic conflicts of interest that could lead to ecologically important large trees being removed for the wrong reasons. And the need for large trees for restoration purposes far outstrips the supply.
* The cumulative impact of hazard tree removal needs to be carefully considered. There is a dense road network across the federal/non-federal landscape and if all the hazard trees are removed a certain distance from all those roads, then the area of the forest that can support large snags become greatly diminished. See, for instance, these roadside danger tree removal plans from Eugene BLM[rsquo]s McKenzie watershed:

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

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

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

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

Under-represented snag habitat should be retained on along low standard roads because the PNW Region of the

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

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

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

[hellip]

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

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

Toupin, Filip, Erkert & Barger. 2008. Field Guide for Danger Tree Identification and Response. USDA FS, USDI BLM, Oregon OSHA. http://www.blm.gov/or/districts/medford/plans/files/fieldguidedangertree.pdf

Also, the Federal Tort Liability Act provides the government some degree of immunity in exercising their discretionary functions like hazard tree management. For instance, the National Park Service was found not liable for failing to remove a tree weakened by root rot that fell and killed a recreational motorist at Great Smokey Mountains National Park, even when the road involved was a high use paved road near a visitor center, and when the tree species at issue (Black Locust) was known by the Park Service to be prone to fall down. AUTERY v. UNITED STATES 992 F.2d 1523 (11th Cir. 1993). https://web.archive.org/web/20051203012108/http://classweb.gmu.edu/erodger1/prls560/content/autery.htm. The appeal court overturned the district court and held that the agency[rsquo]s balancing of public safety and preserving natural areas prevented judicial second guessing and gave them immunity from liability for the death of the motorist.

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

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

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

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

29 CFR [sect] 1910.266   (c) Danger tree. A standing tree that presents a hazard to employees due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stem or limbs, and the direction and lean of the tree.[hellip]   (d)(vi) Each danger tree shall be felled, removed or avoided. Each danger tree, including lodged trees and snags, shall be felled or removed using mechanical or other techniques that minimize employee exposure before work is commenced in the area of the danger tree. If the danger tree is not felled or removed, it shall be marked and no work shall be conducted within two tree lengths of the danger tree unless the employer demonstrates that a shorter distance will not create a hazard for an employee.   (vii) Each danger tree shall be carefully checked for signs of loose bark, broken branches and limbs or other damage before they are felled or removed. Accessible loose bark and other damage that may create a hazard for an employee shall be removed or held in place before felling or removing the tree.http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9862.

Preventing Injuries and Deaths of Loggers; NIOSH ALERT: May 1995; DHHS (NIOSH) Publication No. 95-101; http://web.archive.org/web/20090307144450/http://www.cdc.gov/niosh/logging.html.

The hazard posed by precarious trees is often overstated. This tree has been hanging by a proverbial thread for 130 years.

https://www.reddit.com/r/interestingasfuck/comments/hu32ty/left_a_painting_from_1892_right_the_same_spot_in/

Management of hazard trees is a matter of risk tolerance, and there is no reason that all hazards must be eliminated.

https://www.reddit.com/r/pics/comments/hhgk3a/respect/

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

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

Sincerely,

Doug Heiken

dh@oregonwild.org

[1] 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])

[2] 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])

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